The Korean Society of Community Nutrition

KJCN Korean Journal of Community Nutrition

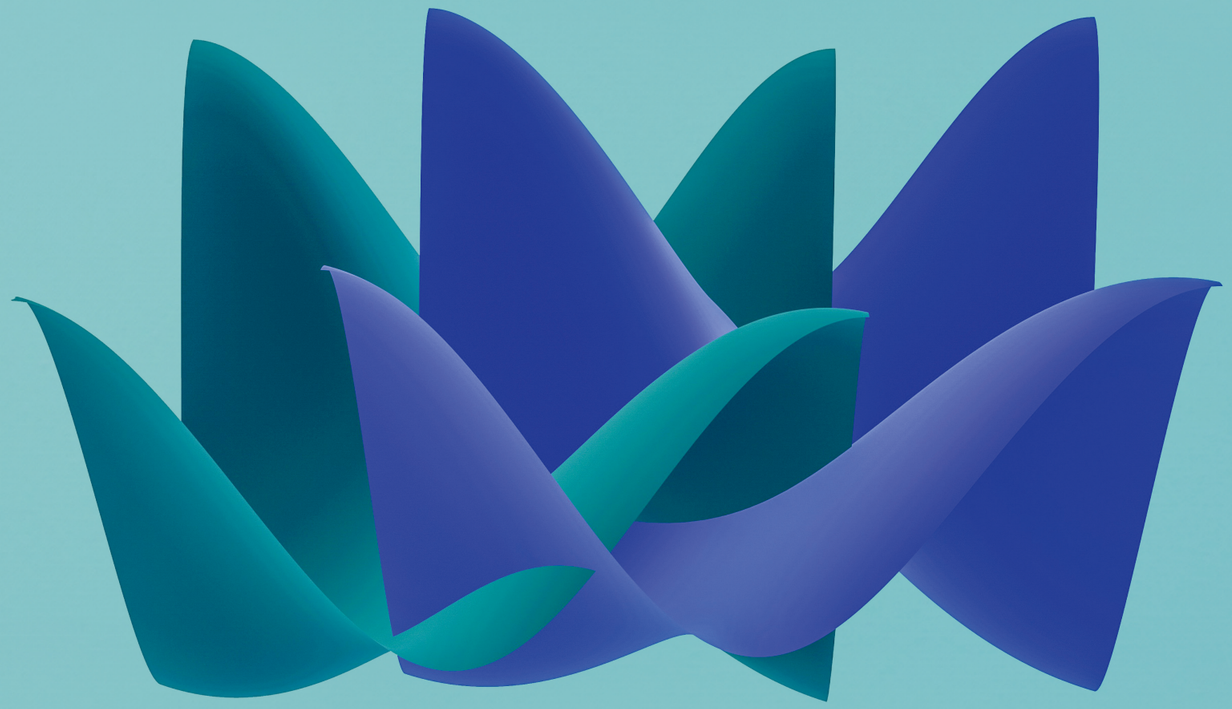
Vol. 31 • No. 1 • February 2026

The Korean Society of Community Nutrition

KJCN

Korean Journal of Community Nutrition

eISSN 2951-3146



Vol. 31 • No. 1 • February 2026
https://kjcn.or.kr

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Vol. 31 · No. 1 · February 2026

AIMS AND SCOPE

The *Korean Journal of Community Nutrition* is the official peer-reviewed journal of the Korean Society of Community Nutrition. It was launched in 1996. The previous primary titles were Jiyeog sahoe yeong-yang hag-hoeji (pISSN 1226-0983) from vol. 1, no. 1 to vol 3. no. 5, and Daehan Jiyeok sahoe yeong-yang hakoeji (pISSN 1226-0983, eISSN 2287-1624) from vol. 4, no. 1 to vol. 27 no. 4. The English title (parallel title) was Korean Journal of Community Nutrition from vol. 4, no. 1 to vol. 27 no. 4. The *Korean Journal of Community Nutrition* has been the current primary title since October, 2022 (eISSN 2951-3146). The abbreviated title of the journal is *Korean J Community Nutr.* It is published bimonthly in February, April, June, August, October and December. It began to be published only as an e-journal from 2022.

BACKGROUND

KJCN was first published in March, 1996. Three issues were published in 1996, and then five issues per year was published from 1997 to 2001. Since 2002, KJCN has become a bimonthly journal. It is published in February, April, June, August, October and December. This work was supported by the Korean Federation of Science and Technology Societies(KOFST) grant funded by the Korean government. The abbreviated title of the journal is 'Korean J Community Nutr'.

DISTRIBUTION

KJCN is distributed to the members of Korean Society of Community Nutrition. This journal is open access and full text PDF files are available at the official website (https://kjcn.or.kr/). The membership fee including subscription fee and postal charges is 50,000 Won for regular members, 20,000 Won for students, and 500,000 Won for institutional members.

ABSTRACTING AND INDEXING

KJCN is abstracted and indexed in the following databases: KoreaScience (1996-), KoMCi (2000-2020.2), Korea Citation Index (2002-), KoreaMed Synapse (2011-2020.2, 2024.8-), KoreaMed (2011-), Science Central (2014-), Google Scholar (2017-), CrossRef, Chemical Abstracts Service (CAS), CAB Abstracts, Directory of Open Access Journals (DOAJ, 2022-), SCOPUS (2022-), PubMed and PubMed Central (2023-).

Published on February 28, 2026

Published by

Publisher Korean Society of Community Nutrition

Editor in Chief Ji-Myung Kim, PhD

Korean Society of Community Nutrition

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Tel +82-2-6966-4930 **Fax** +82-2-6966-4945 **E-mail** support@m2-pi.com

KJCN
Korean Journal of Community Nutrition

eISSN 2951-3146

https://kjcn.or.kr

Editorial Board

KJCN
Korean Journal of Community Nutrition

eISSN 2951-3146

https://kjcn.or.kr

Vol. 31, No. 1, February 2026

Contents

Review

Research Articles

KJCN
Korean Journal of Community Nutrition

eISSN 2951-3146

https://kjcn.or.kr

Vol. 31, No. 1, February 2026

목차

종설

연구논문

Korean J Community Nutr. 2026 Feb;31(1):1-20
https://doi.org/10.5720/kjcn.2025.00374
eISSN 2951-3146

KJCN
Korean Journal of Community Nutrition

Review

국내 발달장애인 식생활 및 영양교육 연구동향: 주제범위 문헌고찰(2015–2025)

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Research trends in dietary behaviors and nutrition education among individuals with developmental disabilities in Korea: a scoping review (2015–2025)

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Received: December 31, 2025
Revised: February 1, 2026
Accepted: February 23, 2026

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Objectives: We mapped trends in studies on dietary behaviors, nutritional status, and nutrition-related education among individuals with developmental disabilities in Korea over the past decade to identify research gaps and inform future research and policy development.

Methods: A scoping review was conducted using three major Korean academic databases (RISS, KISS, and DBpia). Studies published between 2015 and September 2025 were identified using combinations of keywords related to developmental disabilities, dietary behavior, nutrition, and health-related interventions. Eligible studies included empirical studies and secondary research (e.g., systematic or scoping reviews) conducted in Korea that focused on dietary behaviors, nutrition, health promotion, or nutrition-related education for individuals with developmental disabilities. Thirty-six studies met our inclusion criteria and were analyzed based on study design, study population, disability type, research topic, and publication period.

Results: Observational quantitative, qualitative, intervention-based experimental, and evidence synthesis accounted for 27.8%, 13.9%, 22.2%, and 36.1% of all included studies, respectively. Children and adolescents (27.8%) and adults (25.0%) were the most frequently studied populations, with limited studies focusing on professionals or teachers. Most studies targeted individuals with developmental disabilities as a combined group (61.1%), followed by those specifically targeting autism spectrum disorder. Research topics included dietary behaviors and nutritional status, nutrition-related education and interventions, health promotion, and medical or clinical issues, with many small-scale and short-term intervention studies.

Conclusion: Although research on dietary and nutrition-related issues among individuals with developmental disabilities in Korea has expanded in scope and methodology, significant limitations remain. Future research should adopt longitudinal and community-based approaches, incorporate diverse populations, and strengthen policy-oriented nutrition support systems to promote sustainable health and quality of life for individuals with developmental disabilities.

Keywords: developmental disabilities; feeding behavior; nutritional status; health behavior; health promotion

INTRODUCTION

발달장애는 「장애인복지법」에서 지적장애와 자폐성장애를 포함하는 장애군으로 정의되며, 인지적·의사소통적·감각적 특성으로 인해 일상생활 전반에서 지속적인 지원을 필요로 한다. 2024년 기준 국내 등록 장애인은 2,631,356명이며, 이 중 발달장애인은 280,672명(지적장애 233,322명, 자폐성장애 47,350명)으로 전체의 약 10.6%를 차지한다[1]. 특히 발달장애인의 규모는 지속적으로 증가하고 있으며, 29세 이하 연령층에서는 발달장애인이 전체 장애인의 과반수를 차지하는 것으로 보고되는 등 저연령층에서의 비중이 높아지고 있다[2]. 해외에서도 자폐스펙트럼장애(autism spectrum disorder, ASD)의 진단률은 지속적으로 증가하는 경향을 보여[3], 발달장애인의 건강 및 일상생활 지원의 필요성은 전 세계적으로 확대되고 있다.

발달장애인의 식생활은 감각민감성, 음식선호의 제한, 섭식문제, 낮은 식품 다양성 등 장애 특성과 환경적 제약이 복합적으로 작용하여 취약한 패턴을 보이는 것으로 보고되고 있다[4-6]. 이러한 특성으로 인해 발달장애인은 일반인에 비해 과체중·비만 유병률이 높고, 채소 및 유제품 섭취 부족, 미량영양소 섭취 불균형과 같은 영양 문제 및 다양한 식행동 문제가 반복적으로 관찰된다[7, 8]. 이러한 식생활 문제는 신체적·정신적 건강뿐 아니라 가족관계와 사회적 참여를 포함한 삶의 질 전반에 영향을 끼칠 수 있다.

이처럼 식생활 취약성이 지속적으로 제기되고 있으나, 국내의 영양·식생활 교육은 제도적 기반이 충분히 마련되어 있지 않다. 2014년 「발달장애인 권리보장 및 지원에 관한 법률」 제정 이후 평생케어 종합대책, 활동서비스, 주간활동서비스 등 다양한 지원 정책이 도입되었으나[9-11] 영양·식생활 교육 영역은 여전히 제한적이다. 사회복지급식관리지원센터가 일부 복지시설을 중심으로 급식 및 영양관리 지원을 수행하고 있으나, 이는 시설 이용자에 국한된 서비스로 지역사회 혹은 재가 발달장애인을 포괄하는 영양지원 체계는 매우 부족한 실정이다[12, 13]. 특히 국내 영양교육 관련 연구는 장애인사회복지시설 입소·이용자를 대상으로 한 프로그램 개발 및 적용 연구에 집중되어 있어, 지역사회 기반으로의 확장성이 제한적이라는 구조적 한계가 제기되고 있다[12].

반면, 주요 국가에서는 장애 관련 공식 지원 범주에 영양서비스, 식사보조 및 건강관리 지원을 포함하여 제도적으로 보장하고 있으며, 예를 들어 미국의 Individuals with Disabilities Education Act, 영국의 National Health Service의 Learning Disability Programme, 호주의 National Disability Insurance Scheme 등이 이에 해당한다[14-16]. 또한 Autism MEAL Plan과 같은 ASD feeding program, 감각기반 modified Sequential Oral Sensory (M-SOS) 접근 및 응용행동분석(applied behavior analysis; ABA) 기반 feeding 중재를 비교한 연구 등 구조화된 섭식중재 연구가 지속적으로 수행되고 있다[17, 18]. 감각기반 M-SOS 접근은 음식의 맛·냄새·질감 등 감각 자극에 대한 민감성이 섭식거부로 이어질 수 있다는 관점에서, 감각 탐색과 점진적 음식 노출(food exposure)을 통해 음식 수용 범위를 확장하는 중재 전략이다. 여기서 점진적 음식 노출은 기피 음식에 대한 반복적·단계적 노출을 통해 수용성을 높이는 접근으로 감각기반 섭식중재 연구에서 핵심적으로 활용된다. 한편 ABA 기반 섭식중재는 섭식 회피 행동을 감소시키고 적절한 섭식 행동을 강화하는 행동분석 이론에 근거한 접근으로, 해외에서는 다양한 감각·행동 중재와의 비교 연구가 이루어지고 있다. 국내에서도 응용행동분석 이론을 적용하여 섭식 또는 삼킴 문제를 중재한 연구와, ASD 아동·청소년의 섭식 문제를 대상으로 ABA 기반 중재 연구의 설계와 효과를 종합적으로 고찰한 연구가 보고된 바 있으나, 대부분 국내 연구는 단기 중재나 소규모 실태조사 중심으로 이루어져 장기적 효과, 일반화 가능성, 중재 충실도 등을 충분히 검증하지 못하고 있으며, 생애주기별·장애유형별 특성을 체계적으로 파악하기에는 여전히 한계가 있다[19].

따라서 발달장애인의 건강한 식생활 형성과 자립역량 강화를 위해서는, 최근 10년간 국내에서 수행된 관련 연구의 흐름을 종합적으로 분석하여 정책적 공백을 확인할 필요가 있다. 이에 본 연구는 2015년부터 2025년까지 국내에서 발표된 발달장애인의 식생활 및 식생활 교육 관련 연구를 검토하여, 연구유형·대상·장애유형·연구주제·시기별 동향을 분석하고 향후 연구 및 정책 발전 방향을 제시하고자 한다.

METHODS

Ethics statement

This study was conducted as a scoping review and did not involve human participants or the collection of personal data. Therefore, Institutional Review Board (IRB) approval and informed consent were not required.

1. 연구설계

본 연구는 발달장애인의 식생활 및 영양교육과 관련하여 국내에서 수행된 연구의 범위와 특성을 체계적으로 파악하기 위한 주제범위 문헌고찰(scoping review) 연구이다.

2. 문헌 검색 절차

본 연구는 2015년부터 2025년까지 국내에서 발표된 발달장애인의 식생활 및 영양 관련 학술연구를 대상으로 하였다. 본 문헌고찰은 주제범위 문헌고찰의 목적과 절차에 따라 수행되었으며, 기존 연구의 범위와 특성을 포괄적으로 파악하는 데 중점을 두었다. 문헌 검색은 2015년부터 2025년 9월까지 RISS, KISS, DBpia 등 주요 국내 학술데이터베이스를 활용하여 수행하였으

https://doi.org/10.5720/kjcn.2025.00374

Table 1. Literature search strategy and keyword combinations

Category	Content
Databases	RISS, KISS, DBpia
Search period	January 2015–September 2025
Population-related keywords	developmental disabilities, intellectual disability, autism spectrum disorder
Diet and nutrition-related keywords	dietary habits, nutrition, nutritional status, diet, dietary patterns, intake, eating behavior, food preference, obesity, chronic diseases, weight management, health promotion
Nutrition education and intervention-related keywords	nutrition education programs, nutrition intervention, caregiver perception
Search strategy	Population-related keywords were combined with diet and nutrition or nutrition education and intervention-related keywords using the AND operator
Example search formula	(developmental disabilities OR intellectual disability OR autism spectrum disorder) AND (dietary habits OR nutritional status OR dietary patterns OR health promotion)

며, 최종 문헌 검색은 2025년 9월 30일에 완료되었다.

검색 전략은 발달장애인의 식생활 전반과 식생활 교육 및 영양중재 관련 문헌을 포괄적으로 탐색하기 위하여 다음 두 범주의 키워드를 중심으로 구성하였다. 첫째, 식생활 관련 키워드는 발달장애인의 식행동, 영양섭취, 건강 및 생활습관 등 식생활 전반을 포함하도록 설정하였으며, “영양”, “영양상태”, “식생활”, “식품”, “섭취”, “식사태도”, “건강문제”, “비만”, “만성질환”, “음식기호”, “식이패턴”, “식이”, “체중관리”, “건강증진” 등의 용어를 사용하였다. 둘째, 식생활 교육 및 영양중재 관련 키워드는 교육·중재 프로그램 및 건강증진 활동을 포함하도록 구성하였으며, “영양중재”, “영양교육프로그램”, “보호자 인식” 등의 용어를 사용하였다.

각 범주의 키워드는 발달장애 관련 진단명인 “발달장애”, “지적장애”, “자폐스펙트럼”과 AND 연산으로 결합하여 검색하였다. 대표적으로 사용된 검색식은 다음과 같다: (발달장애 OR 지적장애 OR 자폐스펙트럼) AND (식생활 OR 영양상태 OR 식이패턴 OR 건강증진), (발달장애 OR 지적장애 OR 자폐스펙트럼) AND (영양중재OR 영양교육프로그램 OR 보호자 인식). 문헌 검색에 사용된 데이터베이스, 키워드 범주 및 키워드 조합에 따른 검색 전략은 Table 1에 제시하였다.

검색된 문헌은 제목, 초록, 본문 순으로 단계적으로 검토하였다. 초기 검색을 통해 확보된 문헌 중 중복 문헌을 제외한 후, 제목과 초록 검토를 통해 연구 주제와의 관련성을 1차적으로 판단하였으며, 이후 원문 검토를 통해 최종 분석 대상 논문을 선정하였다. 검색 누락을 최소화하기 위해 다양한 키워드 조합을 적용하여 문헌을 폭넓게 탐색하였다. 문헌 선정 과정은 주제범위 문헌고찰의 일반적인 절차에 따라 수행되었으며, Joanna Briggs Institute에서 제시한 주제범위 문헌고찰 방법론을 참고하여 Fig. 1로 제시하였다[20].

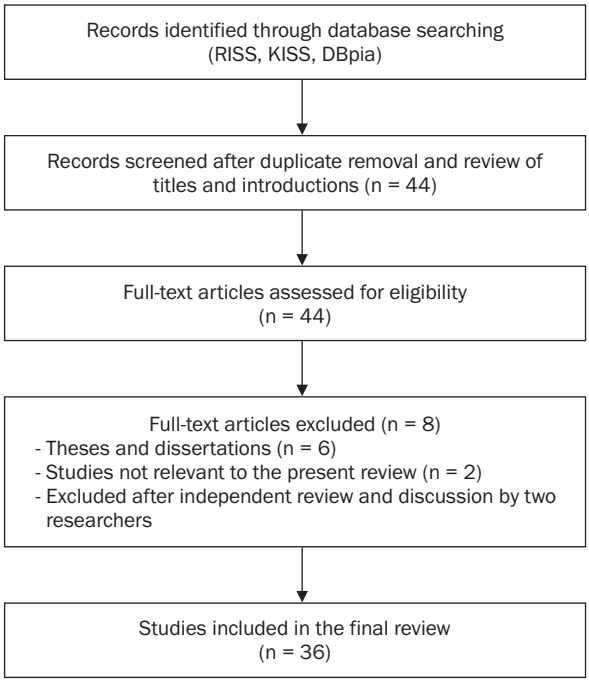

Fig. 1. Flow diagram of the literature selection process (adapted from the Joanna Briggs Institute scoping review methodology).

3. 연구 선정 기준

본 연구의 논문 선정 기준은 다음과 같다. 첫째, 발달장애(지적장애·ASD 등)를 주요 연구대상으로 한 연구를 포함하였다. 둘째, 식행동, 식습관, 영양섭취, 영양교육, 건강행동, 중재 등 식생활 및 영양 관련 변인을 하나 이상 포함한 연구를 선정하였다. 셋째, 국내에서 수행된 실증연구 또는 문헌연구를 대상으로 하였다. 이러한 기준에 따라 문헌을 검토한 결과, 최종적으로 36편의 논문이 분석 대상에 포함되었으며, 각 연구의 주요 특성은 Table 2 [19, 21–55]에 제시하였다.

4. 자료 추출 및 분석 틀

본 연구에서 사용한 연구유형, 연구대상, 장애유형, 주요 주

Table 2. Characteristics of included studies

Study ID	Reference	Population	Disability type	Study design	Main topic	Key findings
S1	Kim *et al.* [19] (2025)	Adults with developmental disabilities	Developmental disabilities (overall)	Evidence synthesis studies (systematic review)	Physical activity and health promotion	Included studies primarily targeted adults with mild to moderate intellectual disabilities and most frequently used single-group pre–post designs. Interventions reported overall positive changes in anthropometric measures, physical fitness, physical activity levels, dietary behaviors, health knowledge, self-efficacy, and quality of life. Few studies assessed maintenance/generalization, intervention fidelity, or social validity. Programs mainly focused on nutrition education, physical activity information, and exercise participation, frequently using visual supports and reinforcement strategies
S2	Kim [21] (2024)	Mixed (overlapping)	Developmental disabilities (overall)	Evidence synthesis studies (systematic review)	Dietary habits and nutritional status	Domestic studies have increased since 2012, with most employing literature reviews or survey designs. Qualitative and intervention studies were relatively scarce, and study populations were concentrated on children and individuals with multiple disabilities. Common dietary behavior issues included food selectivity, texture sensitivity, fear of new foods, pica, and atypical eating patterns
S3	Ahn *et al.* [22] (2015)	Adults with developmental disabilities	Mixed disability groups	Observational quantitative studies (cross-sectional survey)	Dietary habits and nutritional status	Mean BMI indicated overweight in the intellectual disability group and obesity in the mental disability group. Intake frequencies of vegetables and dairy products were generally low. Both groups showed vitamin B1, B2, and calcium intakes below recommended levels. Carotenoid intake, particularly lycopene, was lower than that of the general population, and cryptoxanthin intake was also low in the mental disability group
S4	Lee *et al.* [23] (2018)	Mixed (overlapping)	Developmental disabilities (overall)	Exploratory qualitative studies (in-depth interviews and focus groups; constant comparative analysis)	Medical, health and clinical topics	Key findings included difficulties in expressing and recognizing illness and symptoms, practical challenges in health management, barriers in access and communication during medical encounters, and limited self-determination in healthcare. Individuals with developmental disabilities experienced restricted access to information and decision-making due to communication difficulties and reliance on caregivers, with lack of disability awareness, inadequate facilities, and financial burden identified as major barriers
S5	Kim *et al.* [24] (2021)	Professionals and teachers	Autism spectrum disorder	Exploratory qualitative studies (in-depth interviews and focus groups; constant comparative analysis)	Dietary habits and nutritional status	Major themes included types of eating behaviors, eating-related problems, influencing factors (individual, environmental, medical), coping and instructional strategies, instructional difficulties, and support needs. Common eating behavior problems among students with ASD included food selectivity, texture sensitivity, food refusal, and pica, with gastrointestinal symptoms, sensory and behavioral characteristics, and home–school environments interacting to influence eating behaviors
S6	Lee *et al.* [25] (2022)	Children and adolescents with developmental disabilities	Developmental disabilities (overall)	Intervention-based experimental studies (single-group pre–post)	Nutrition and dietary education or interventions	Following the health education intervention, students' health knowledge and health-promoting behavior scores significantly increased compared with baseline. Ninety-three percent of participants achieved health management goals at or above the expected level. Self-determination significantly increased in student self-ratings, whereas no significant changes were observed in parent or teacher ratings
S7	Kang & Lee [26] (2015)	Adults with developmental disabilities	Developmental disabilities (overall)	Intervention-based experimental studies (randomized controlled pre–post design)	Physical activity and health promotion	Muscle mass increased most in the APA + Wii group, whereas body fat mass decreased most in the APA group. Muscular endurance, strength, flexibility, and cardiorespiratory fitness improved more in groups including APA than in the Wii-only group, while balance improved most in the Wii group. Step counts and caloric expenditure increased in all intervention groups compared with controls

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Table 2. Continued

Study ID	Reference	Population	Disability type	Study design	Main topic	Key findings
S8	Lee & Kim [27] (2024)	Parents and caregivers	Developmental disabilities (overall)	Evidence synthesis studies (systematic review)	Medical, health and clinical topics	Depression intervention programs for families of individuals with developmental disabilities showed overall significant reductions in depressive symptoms. Most programs were short-term (fewer than 10 sessions) group-based interventions, with reported effect sizes in the moderate to large range
S9	Shin *et al.* [28] (2024)	Mixed (overlapping)	Developmental disabilities (overall)	Evidence synthesis studies (scoping review)	Medical, health and clinical topics	Regular health checkups were identified as the most highly needed healthcare service. Across the life course, early diagnosis and early intervention were prioritized in infancy, whereas prevention of early aging and medical support were emphasized in middle and older adulthood. Individuals with developmental disabilities exhibited higher prevalence of chronic diseases, increased risk of premature mortality, and lower access to healthcare services, indicating substantial health vulnerability
S10	Kim & Song [29] (2018)	Children and adolescents with developmental disabilities	Autism spectrum disorder	Evidence synthesis studies (meta-analysis)	Nutrition and dietary education or interventions	The overall intervention effect size was Tau-U = 0.876, indicating moderate to high effectiveness. Larger effects were observed at younger ages and during follow-up phases compared with intervention phases. Multicomponent interventions were more effective than single-technique approaches, with the greatest effects reported for interventions lasting less than 20 sessions and approximately 2 months (5–8 weeks)
S11	Min & Kim [30] (2024)	Children and adolescents with developmental disabilities	Autism spectrum disorder	Evidence synthesis studies (narrative review)	Dietary habits and nutritional status	Feeding disorders in children with ASD were reported to be highly diverse, highlighting the need for comprehensive assessment. Available assessment tools were limited, and the inclusion of additional domains such as oral-motor and digestive function was recommended
S12	Park *et al.* [31] (2020)	Mixed (overlapping)	Autism spectrum disorder	Observational quantitative studies (cross-sectional survey)	Dietary habits and nutritional status	BMI distribution differed by age, with higher rates of underweight among children aged ≤ 10 years and higher rates of overweight and obesity among adolescents aged 11–19 years. Most participants consumed snacks at least once daily. Food preferences differed across age groups for grains, vegetables, fruits, dairy products, fats, and sugars. Parents reported high needs and willingness to participate in nutrition education
S13	Lee *et al.* [32] (2016)	Children and adolescents with developmental disabilities	Autism spectrum disorder	Observational quantitative studies (retrospective medical record review)	Medical, health and clinical topics	At the first visit, children with ASD had a higher proportion of males, fewer obstetric complications, and lower receptive and expressive language scores than children with intellectual disabilities. Children whose diagnosis changed from intellectual disability to ASD were all male, had more frequent family histories of developmental delay, and showed significantly lower initial receptive language scores. Sex, language characteristics, and obstetric information were associated with early ASD identification
S14	Jeon & Cho [33] (2018)	Children and adolescents with developmental disabilities	Developmental disabilities (overall)	Intervention-based experimental studies (single-case design)	Medical, health and clinical topics	After intervention, meal intake increased to approximately 700–800 g, with reductions in frequent small meals and shorter mealtime duration. Feeding patterns shifted from predominantly formula-based intake (≥ 80%) to mixed feeding after one week and to 100% solid food intake after two weeks. Applied behavior analysis intervention was associated with reductions in food refusal behaviors

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Table 2. Continued

Study ID	Reference	Population	Disability type	Study design	Main topic	Key findings
S15	Kim [34] (2022)	Adults with developmental disabilities	Developmental disabilities (overall)	Observational quantitative studies (cross-sectional survey with mediated regression analysis)	Dietary habits and nutritional status	Higher levels of perceived obesity were associated with poorer dietary habits and lower life satisfaction. Regular meals and balanced nutrition were positively correlated with both dietary habit scores and life satisfaction. Dietary habits showed a significant mediating effect in the relationship between perceived obesity and life satisfaction
S16	Oh & Hong [35] (2025)	Adults with developmental disabilities	Developmental disabilities (overall)	Evidence synthesis studies (narrative review)	Medical, health and clinical topics	Individuals with developmental disabilities showed reduced gut microbiota diversity, increased harmful bacteria, and decreased beneficial bacteria, which were associated with neurotransmitter dysregulation, immune and inflammatory responses, and metabolic imbalance. Dietary modification, probiotic supplementation, and physical activity interventions were reported to improve gut microbiota balance and related metabolic pathways
S17	Kim [36] (2018)	Adults with developmental disabilities	Intellectual disability	Evidence synthesis studies (single-group pre–post)	Physical activity and health promotion	After 16 weeks of intervention, no significant changes were observed in body composition indicators (BMI, body fat percentage). However, flexibility, muscular strength, and power significantly improved. Dietary habit scores increased, with higher intake frequencies of protein, green-yellow vegetables, and seaweed, and reduced intake of salty foods, sweets, and late-night snacks
S18	Choi & Kang [37] (2019)	Adults with developmental disabilities	Intellectual disability	Intervention-based experimental studies (multiple-baseline single-subject design)	Physical activity and health promotion	All participants showed increased numbers of appropriate eating behaviors during intervention and maintenance phases compared with baseline. Mean performance increased from 3.2 of 13 behaviors at baseline to 7 during intervention and 11 during maintenance. VR-based social story music therapy was associated with improvements in eating behavior performance and social skill acquisition
S19	Kang & Kim [38] (2020)	Parents and caregivers	Developmental disabilities (overall)	Observational quantitative studies (cross-sectional survey with hierarchical multiple regression)	Dietary habits and nutritional status	Poorer health status and higher levels of challenging behaviors in adults with developmental disabilities were significantly associated with increased caregiver burden. Health status and challenging behaviors were identified as significant predictors of caregiver burden
S20	Kim *et al.* [39] (2020)	Parents and caregivers	Autism spectrum disorder	Exploratory qualitative studies (thematic analysis of in-depth interviews)	Dietary habits and nutritional status	Mothers' experiences were categorized into themes related to children's eating characteristics (clear food preferences, atypical eating behaviors, influence of past experiences), family interactions, efforts to improve dietary behaviors, and support needs. Children's eating behavior problems imposed burdens on family meals, dining out, and mealtime atmosphere, with coping strategies involving environmental modification, consistent guidance, and program participation
S21	Kim [40] (2016)	Parents and caregivers	Developmental disabilities (overall)	Intervention-based experimental studies (non-equivalent control group pre–post–follow-up design)	Nutrition and dietary education or interventions	Compared with the control group, the intervention group showed significantly greater improvements in children's health management behaviors over time. Parenting stress scores in the intervention group significantly decreased at post-test and follow-up, with larger reductions than those observed in the control group
S22	Kim & Jeon [41] (2024)	Professionals and teachers	Developmental disabilities (overall)	Exploratory qualitative studies (one-on-one in-depth interviews)	Nutrition and dietary education or interventions	The most frequently requested nutrition education topics were diet education for obesity prevention and management and basic nutrition knowledge. Education at kindergarten to lower elementary school level was considered appropriate given cognitive functioning. Activity-based, face-to-face education using real foods, cooking activities, and visual materials, delivered in sessions of approximately 30 minutes, was perceived as effective

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Table 2. Continued

Study ID	Reference	Population	Disability type	Study design	Main topic	Key findings
S23	Ham & Sohn [42] (2023)	Mixed (overlapping)	Developmental disabilities (overall)	Observational quantitative studies (secondary data analysis with two-way ANOVA)	Dietary habits and nutritional status	Smoking, alcohol consumption, and stress showed significant main effects across both life stage and sex. Overweight showed a significant main effect by life stage, whereas sexual health issues differed by sex. Significant interaction effects between life stage and sex were observed for all five health behaviors, with higher levels reported for specific subgroups such as adolescent males' sexual health issues and older adults' alcohol use or overweight
S24	Park *et al.* [43] (2019)	Children and adolescents with developmental disabilities	Autism spectrum disorder	Evidence synthesis studies (narrative review)	Dietary habits and nutritional status	Many studies reported that children with ASD exhibited atypical eating behaviors such as food selectivity, binge eating, and pica compared with typically developing children. Data collection relied mainly on parent reports and observations. Associations between eating behaviors and individual characteristics were frequently reported, whereas evidence regarding family factors and nutritional intake or status was limited and inconsistent
S25	Choi & Lee [44] (2020)	Adults with developmental disabilities	Developmental disabilities (overall)	Intervention-based experimental studies (single-group pre–post quasi-experimental design)	Nutrition and dietary education or interventions	Following the health management education program, participants showed significant increases in overall health knowledge and all subdomain scores. Total health-promoting behavior scores also increased significantly, although changes in specific subdomains were not statistically significant
S26	Cho & Park [45] (2025)	Children and adolescents with developmental disabilities	Autism spectrum disorder	Evidence synthesis studies (systematic review)	Nutrition and dietary education or interventions	Common intervention techniques included high-probability request sequences, simultaneous or sequential presentation of preferred and non-preferred foods, peer modeling, and differential reinforcement. Most studies reported significant increases in food intake along with reductions in problem behaviors, although effect sizes and maintenance patterns varied by intervention setting
S27	Ha & Yoo [46] (2022)	Children and adolescents with developmental disabilities	Autism spectrum disorder	Evidence synthesis studies (systematic review)	Nutrition and dietary education or interventions	Gradual, repetitive, and systematic food exposure interventions for children with ASD were associated with overall improvements in food intake, food variety, food acceptance, amount consumed, and food contact behaviors. Included studies summarized clinically applicable exposure strategies and assessment tools
S28	Hong & Hong [47] (2025)	Mixed (overlapping)	Developmental disabilities (overall)	Evidence synthesis studies (systematic review)	Nutrition and dietary education or interventions	Most included studies focused on mental health–oriented programs for family caregivers. Interventions were associated with significant reductions in depression, anxiety, and stress, and improvements in quality of life and psychological well-being. Some studies also reported improvements in physical health behaviors such as exercise, self-care, and dietary behaviors
S29	Park *et al.* [48] (2023)	Mixed (overlapping)	Developmental disabilities (overall)	Evidence synthesis studies (narrative review)	Physical activity and health promotion	Individuals with developmental disabilities demonstrated lower levels of physical activity and exercise participation than those without disabilities, along with poorer physical fitness and cardiovascular health indicators. Moderate-intensity aerobic and resistance exercise, as well as high-intensity interval training following prolonged aerobic exercise, were associated with improvements in fitness and arterial stiffness

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Table 2. Continued

Study ID	Reference	Population	Disability type	Study design	Main topic	Key findings
S30	Kim *et al.* [49] (2015)	Children and adolescents with developmental disabilities	Mixed disability groups	Observational quantitative studies (cross-sectional comparative study)	Dietary habits and nutritional status	Rates of overweight and obesity were higher in the ASD group (44%) than in the intellectual disability group (26%), and the use of appetite-stimulating medications was also more frequent in the ASD group. Functional eating difficulties such as opening beverage containers were more common in the intellectual disability group, whereas color-based food selectivity was more prevalent in the ASD group. Adolescents with intellectual disabilities consumed meat, seaweed, fats, and sugars more frequently and in larger amounts than those with ASD
S31	Lee *et al.* [50] (2021)	Mixed (overlapping)	Mixed disability groups	Exploratory qualitative studies (focus groups and in-depth interviews; constant comparative analysis)	Nutrition and dietary education or interventions	Key themes included experiences with health problems and coping, practices of health management and education, support needs related to health management and education, and needs for school–home linked health self-advocacy programs. Teachers and parents perceived students with developmental disabilities as having physical and mental health problems, low health knowledge, and difficulties accessing healthcare services
S32	Lee *et al.* [51] (2021)	Mixed (overlapping)	Developmental disabilities (overall)	Evidence synthesis studies (systematic review)	Medical, health and clinical topics	Research topics were categorized into health status and related factors, health education and dual diagnosis issues and support, and effectiveness of exercise-centered health promotion programs. Studies were most frequently conducted in 2014, with experimental designs predominating. Most studies targeted individuals with developmental disabilities, and intervention studies primarily focused on physical activity programs
S33	Cho [52] (2018)	Adults with developmental disabilities	Developmental disabilities (overall)	Observational quantitative studies (cross-sectional SEM analysis)	Dietary habits and nutritional status	A greater number of health problems in adulthood was significantly associated with lower mental functioning and activities of daily living. Medical, community, and informal support services contributed to higher activity levels and social participation. Community services moderated the negative relationship between adult health problems and social participation
S34	Whang *et al.* [53] (2023)	Children and adolescents with developmental disabilities	Developmental disabilities (overall)	Observational quantitative studies (cross-sectional comparative and logistic regression analysis)	Dietary habits and nutritional status	Infants from multicultural families were significantly more likely than those from Korean families to receive abnormal results on initial developmental screening and to be diagnosed with developmental disabilities. After controlling for sex, income, and residential area, multicultural family background (foreign-born mother) remained significantly associated with developmental disability risk
S35	Choi [54] (2025)	Mixed (overlapping)	Developmental disabilities (overall)	Observational quantitative studies (cross-sectional SEM analysis)	Dietary habits and nutritional status	Family healthiness showed significant positive effects on both disability acceptance and life satisfaction. Disability acceptance was positively associated with life satisfaction and partially mediated the relationship between family healthiness and life satisfaction. Among control variables, age showed a negative association, whereas sex, disability type, education level, and presence of multiple disabilities were not significant
S36	Yang *et al.* [55] (2019)	Mixed (overlapping)	Developmental disabilities (overall)	Intervention-based experimental studies (small-sample single-group program development and implementation)	Nutrition and dietary education or interventions	Participants demonstrated relatively high basic nutrition knowledge regarding major nutrient groups and healthy food choices. The intervention, using photo records and food models, was associated with enhanced ability to independently compose healthy meals. The program was implemented through a living-lab–based community network involving local residents, university students, and independent living support centers

BMI, body mass index; ASD, autism spectrum disorder; APA, adapted physical activity; VR, virtual reality; ANOVA, analysis of variance.

https://doi.org/10.5720/kjcn.2025.00374

제, 연구시기 분류 기준은 발달장애 및 재활·특수교육 분야에서 수행된 선행 국내 리뷰연구들의 분류 체계를 토대로, 본 연구의 목적에 맞게 재구성한 것이다[21]. 특히 발달장애인의 식생활·건강 관련 연구는 연구설계와 개입 형태, 대상자 특성, 장애 진단 범주, 다루는 주요 내용 영역에 따라 연구의 성격이 비교적 명확하게 구분되므로, 다음과 같은 원칙에 따라 코딩을 실시하였다. 자료 정리와 코딩은 Microsoft Excel 2019 (Microsoft Corp.)를 활용하여 수행하였다. 자료 추출과 분류는 2인의 연구자가 독립적으로 수행하였으며, 분류 결과가 일치하지 않는 경우에는 상호 논의를 통해 합의에 도달하는 방식으로 조정하였다.

연구유형은 각 논문의 연구설계와 분석방법을 기준으로 분류하였다. 이 분류 기준은 발달장애인 식행동과 영양섭취 관련 국내 연구동향을 분석한 선행연구의 연구유형 분류 체계를 참고하여 설정하였다[21].

설문조사, 신체계측, 영양섭취량 분석 등 양적 자료를 수집하여 통계적으로 분석한 연구는 '관찰 기반 양적연구'로 분류하였다. 연구자가 교육, 운동, 행동, 심리 프로그램 등을 설계하여 사전·사후 비교 또는 실험군-대조군 비교를 통해 효과를 검증한 경우는 '개입 기반 실험연구'로 분류하였다. 심층면담, 포커스그룹 인터뷰, 자문화기술지 등 질적 자료를 활용하여 보호자, 교사, 전문가 또는 발달장애인의 경험과 인식을 탐색한 연구는 '탐색적 질적연구'로 분류하였다. 선행연구를 체계적으로 수집·정리·분석한 문헌고찰, 체계적 문헌고찰, 메타분석 및 주제범위 문헌고찰은 '근거통합 연구'로 구분하였다.

연구대상은 각 논문에서 명시한 주요 참여자의 특성을 기준으로 '아동·청소년 발달장애인', '성인 발달장애인', '부모·보호자', '전문가·교사'로 분류하였다. 연구에 발달장애인과 부모, 교사, 전문가 등이 함께 포함된 경우에는 복수 코딩을 허용하되, 분석 시에는 '기타(중복)' 범주로 별도 표시하였다.

장애유형은 원 논문에서 사용한 진단명과 연구대상 설명을 토대로 분류하였다. 자폐범주성장애, ASD 등으로 명시된 경우는 '자폐'로, 정신지체, 지적장애로 제시된 경우는 '지적'으로 코딩하였다. 두 진단이 포괄된 '발달장애' 또는 '발달장애인'으로 기술된 연구는 '발달장애(통합)'으로 분류하였으며, 자폐·지적장애·정신장애 등 둘 이상의 진단 범주가 동시에 포함된 연구는 '혼합(자폐+지적+정신장애 등)'으로 구분하였다.

주요 주제는 제목, 초록, 연구목적, 주요 변수 및 결과 영역을 중심으로 1차 개방코딩(open coding)을 실시한 뒤, 반복적 비교과정을 통해 유사한 내용끼리 묶는 축코딩 과정을 거쳐 네 가지 대분류로 정리하였다. 이러한 코딩 및 분류 과정은 컴퓨터 기반 자동 분류가 아닌 연구자 중심의 질적 분석 절차에 따라 수행되었으며, 2인의 연구자가 독립적으로 코딩과 주제 분류를 실시하였다. 이후 분류 결과를 상호 비교하여 일치 여부를 확인하였고, 분류가 일치하지 않는 경우에는 충분한 논의를 통해 합의에 도달하는 방식으로 최종 주제를 확정하였다. 분류된 주제는 식생활 및 영양실태 연구, 영양·식생활 교육 및 중재 연구, 신체활동·건강증진 관련 연구, 의학·보건·임상 관련 연구였다. 하나의 연구가 두 개 이상의 주제를 포함하는 경우에는 연구목적과 논의에서 가장 비중 있게 다루는 영역을 중심으로 1차 주제를 결정하였다.

연구시기는 분석 대상 기간인 2015부터 2025년까지를 연구동향 변화 양상을 비교하기에 적절한 세 시기로 구분하였다. 즉, 초기 실태 중심 연구가 수행된 2015–2018년, 중재 및 질적 연구가 본격적으로 확산된 2019–2021년, 체계적 문헌고찰과 주제범위 문헌고찰을 포함한 통합·정책연구가 증가한 2022–2025년으로 나누어 분석하였다. 이러한 시기 구분을 통해 연구량의 변화뿐 아니라 연구유형과 주제의 질적 변화를 함께 살펴보고자 하였다.

최종적으로 연구유형은 '관찰 기반 양적연구', '개입 기반 실험연구', '탐색적 질적연구', '근거통합 연구'로 연구대상은 '아동·청소년 발달장애인', '성인 발달장애인', '부모·보호자', '전문가·교사', '기타(중복)'로, 장애유형은 '자폐', '지적', '발달장애(통합)', '혼합(자폐+지적+정신장애)'으로 분류하였다. 주요 주제는 '식생활 및 영양실태연구', '영양,식생활 교육 및 중재연구', '신체활동·건강증진 관련 연구', '의학·보건·임상 관련 연구'로 연구시기는 '2015–2018년', '2019–2021년', '2022–2025년'으로 구분하였다.

RESULTS

1. 연구 설계별 연구 동향

본 연구에 포함된 36편의 논문에 대한 연구유형별 분포는 Table 3과 같다. 전체 연구 중 관찰 기반 양적연구는 27.8%, 탐색적 질적연구는 13.9%, 개입 기반 실험연구는 22.2%, 근거통합 연구는 36.1%로 분류되었으며, 최근에는 근거통합 연구의 비중이 가장 높게 나타났다. 시기별로 살펴보면, 2015년–2017년에는 관찰 기반 양적연구를 중심으로 발달장애인의 식습관, 영양섭취량, 체중상태 및 건강문제를 객관적 지표를 통해 파악하는 실태 중심 연구가 주로 수행되었으며, 이들 연구에서는 지적·자폐성 장애인을 대상으로 과체중·비만 비율이 72%에 이른다는 점과 함께 칼슘·비타민 B군을 포함한 미량영양소 섭취 부족, 채소 및 유제품 섭취 저조와 같은 문제가 반복적으로 보고되었다[22]. 또한 사회경제적 요인, 식습관 특성, 시설생활 여부, 보호자 지원 수준에 따른 식행동 차이를 분석한 연구들도 포함되어, 발달장애인의 식생활과 관련된 다양한 개인적·환경적 요인이 함께 다루어졌다. 2018년 이후에는 이러한 양적 실태 연구를 보완하기 위해 탐색적 질적연구와 개입 기반 실험연구의 비중이 점차 증가하였다. 탐색적 질적연구에서는 발달장애인, 부모, 교사, 복지시설 종사자 등을 대상으로 한 심층면담과 포커스그

Table 3. Distribution of study types (2015–2025)

Research type	Number (n)	Percentage (%)	Key characteristics
Observational quantitative studies	10	27.8	Assessment of dietary habits, nutrient intake, obesity status, and nutritional imbalances based on cross-sectional or comparative data
Exploratory qualitative studies	5	13.9	In-depth exploration of dietary experiences, self-determination, and perceived support needs of individuals with developmental disabilities and caregivers
Intervention-based experimental studies	8	22.2	Education-, exercise-, and behavior-based short-term participatory programs evaluating changes in health behaviors and dietary outcomes
Evidence synthesis studies	13	36.1	Systematic reviews, scoping reviews, and meta-analyses synthesizing intervention effects, research trends, and policy or service accessibility
Total	36	100.0	

룹 인터뷰를 통해 식생활 경험과 건강관리 과정에서의 어려움을 보다 입체적으로 탐색하였다. 예를 들어, 발달장애인의 의료서비스 이용과 자기결정 경험을 다룬 연구에서는 당사자–보호자 짝 면담을 통해 질병에 대한 의사표현의 어려움, 건강관리 및 진료 과정에서의 제약, 의료서비스 이용과 관련된 자기결정의 한계가 주요 주제로 도출되었으며, 자기결정 증진과 의료서비스 개선에 대한 지원 요구가 제시되었다[23]. 또한, 자폐범주성장애 학생을 대상으로 한 연구에서는 특수교사, 영양교사, 전문의를 대상으로 한 면담을 통해 편식과 이식 행동, 특이한 식사 패턴과 같은 식행동 유형과 함께 비만·변비 등 건강 문제, 식행동 지도 과정에서의 어려움과 다학문적 협업의 필요성이 보고되었다[24]. 이러한 질적연구들에서는 자기결정성, 자기옹호, 가정·학교·지역사회 연계와 같은 개념들이 반복적으로 언급되었다. 개입 기반 실험연구는 영양교육, 운동 및 행동중재 프로그램을 통해 발달장애인의 식습관과 건강행동 변화를 실험적으로 검증한 연구들로 구성되었으며, 대표적으로 학교 기반 건강자기옹호 프로그램[25]과, 가상현실(virtual reality, VR) 기반 운동중재 연구[26]가 포함되었다. 이들 연구는 대부분 4–30회기의 단기 프로그램과 사전·사후 설계, 소규모 실험군–대조군 비교 형태로 이루어졌고, 체중 감소, 영양섭취 개선, 자기결정성 향상, 건강관리 행동 증가 등 긍정적인 효과가 보고되었으며, 단순 정보전달형 교육보다 체험·참여형 중재가 더 효과적이고 가정–학교–교사 연계형 접근이 중재 효과의 지속성 측면에서 우수한 것으로 나타났다. 한편 2021년 이후에는 개입 기반 실험연구 결과를 포함한 체계적 문헌고찰, 메타분석 및 주제범위 문헌고찰 등 근거통합 연구가 증가하였다. 가족 대상 정신건강(우울) 중재 프로그램을 분석한 메타분석 연구에서는 cognitive behavioral therapy와 긍정양육 중재의 평균 효과크기가 d = 0.81–0.87로 보고되었으며[27], 의료·건강서비스 관련 주제범위 문헌고찰에서는 건강검진 미충족률, 의료 접근성 저조, 만성질환 위험 등을 체계적으로 정리하며 향후 정책적 개선과 실무자 교육의 필요성을 강조하였다[28].

2. 연구 대상별 연구 동향

본 연구에 포함된 36편의 논문은 연구대상에 따라 다섯 가지 범주로 분류되었으며, 그 분포는 Table 4에 제시하였다. 연구대상별로는 아동·청소년 발달장애인을 대상으로 한 연구가 27.8%로 가장 많았고, 성인 발달장애인 대상 연구는 25.0%, 부모·보호자 대상 연구는 11.1%, 전문가·교사 대상 연구는 5.6%를 차지하였으며, 기타 또는 중복대상을 포함한 연구는 30.6%로 나타났다. 아동·청소년 발달장애인을 단일 대상으로 한 연구는 총 10편으로, 근거통합 연구 5편, 관찰 기반 양적연구 4편, 개입 기반 실험연구 1편으로 구성되었다. 근거통합 연구에는 아동·청소년 발달장애인을 대상으로 한 식습관 및 섭식 관련 주제를 다룬 문헌고찰 연구가 포함되었다[29, 30]. 관찰 기반 양적연구에서는 발달장애 청소년의 편식 요인을 포함한 식습관과 식이섭취, 식품 기호도 및 영양교육 요구도를 조사한 연구가 수행되었으며[31], 발달장애 아동의 부모를 대상으로 한 산과적 합병증과 삼킴장애의 식이·영양관리와 같은 임상적 주제를 다룬 연구도 포함되었다[32, 33]. 개입 기반 실험연구로는 학교–가정 연계 건강 자기옹호 프로그램을 적용한 연구가 포함되었으며, 위생, 운동, 식사·영양 등 6개 건강관리 영역으로 구성된 15회기 프로그램을 통해 발달장애 학생의 건강지식과 건강증진 행동 점수가 유의하게 향상되고, 참여 학생의 93%가 기대 수준 이상의 건강관리 목표를 달성한 것으로 보고되었다[25]. 성인 발달장애인을 단일 대상으로 한 연구는 총 9편으로, 관찰 기반 양적연구 4편, 개입 기반 실험연구 4편, 근거통합 연구 1편으로 구성되었다. 관찰 기반 양적연구에서는 발달장애 성인의 비만 정도가 생활만족도에 미치는 영향, 카로티노이드 및 미량영양소 섭취 수준, 건강상태와 문제행동 간의 상관성을 분석한 연구와 함께, 장내미생물 대사특성을 중심으로 생리·대사적 특성과 영양 관련 지표 간의 관련성을 분석한 임상적 연구도 포함되었다[22, 34, 35]. 개입 기반 실험연구는 아동·청소년 대상 연구와 달리 성인 발달장애인에서 가장 높은 비중을 차지하였으며, 운동 중심 중재와 영양교육 중심 중재로 구분되었다. 운동 중심 중재 연구에서는 체육 프로그램과 비디오게임 기반 VR 운동 프로그램을 통

https://doi.org/10.5720/kjcn.2025.00374

Table 4. Distribution and key characteristics of study participants

Research subject	Number (n)	Main study types	Key characteristics	Research focus
Children and adolescents	10	Observational quantitative, intervention-based experimental, evidence synthesis	Multidimensional approaches addressing feeding problems and sensory sensitivity	School- and family-based dietary education and interventions integrating sensory and emotional factors
Adults	9	Intervention-based experimental, observational quantitative, evidence synthesis	Integrated approaches combining exercise and nutrition education	Development of behavior-change–focused and context-sensitive intervention models
Parents and caregivers	4	Observational quantitative, intervention-based experimental, evidence synthesis	Care burden, parenting stress, and parent-focused education	Family-based health promotion and nutrition education programs
Professionals and teachers	2	Exploratory qualitative	Exploration of field experiences and educational needs	Practice-based insights and needs for multidisciplinary collaboration
Mixed or multiple groups	11	Observational quantitative, exploratory qualitative, evidence synthesis	Collaborative approaches involving parents, teachers, and professionals	Expansion of coordinated and integrated nutrition and health education models

해 유연성($P < 0.001$), 근력($P = 0.045$), 순발력($P = 0.013$) 등의 체력 지표에서 유의한 향상이 나타났고[36], 근육량 증가, 체지방 감소, 심폐지구력 향상 효과도 보고되었다[26]. 한편 영양교육 중심 중재 연구로는 VR을 활용한 음악치료 중재 연구가 포함되었으며, 실제 식사 상황을 기반으로 한 VR 프로그램을 적용한 결과 지적장애인의 식사태도 목표행동 수행 항목 수가 기초선 대비 중재 및 유지 단계에서 뚜렷하게 증가하여 중재 효과가 유지되는 것으로 보고되었다[37]. 근거통합 연구는 발달장애 성인을 대상으로 한 건강증진 프로그램의 효과를 분석한 문헌고찰 연구로 구성되었다[19]. 부모·보호자를 단일 대상으로 한 연구는 총 4편으로, 관찰 기반 양적연구 2편, 개입 기반 실험연구 1편, 근거통합 연구 1편으로 이루어졌다. 관찰 기반 양적연구에서는 자폐아동의 식생활에 대한 어머니의 인식과 경험, 자녀의 건강상태 및 도전적 행동이 부모의 돌봄 부담에 미치는 영향을 중심으로 조사하여 부모가 영양관리 과정에서 영양지식 부족, 시간 제약, 정서적 어려움 등을 경험하고 있음을 보고하였다[38, 39]. 개입 기반 실험연구에서는 발달장애 아동 어머니를 대상으로 한 건강·영양교육 프로그램으로, 프로그램 참여 후 양육 스트레스 감소와 건강관리 행위 증가 등 긍정적인 변화가 보고되었다[40]. 근거통합 연구는 발달장애 가족을 대상으로 한 정신건강 증진 프로그램의 효과를 분석한 문헌고찰 연구로 구성되었다[27]. 전문가·교사를 단일 대상으로 한 연구는 총 2편으로, 모두 탐색적 질적연구에 해당하였다. 한 연구에서는 자폐학생의 식행동 특성에 대한 영양교사, 특수교사 및 의료전문인의 경험과 지원 요구를 심층적으로 탐색하여 식사 지도 과정에서 감각민감성, 섭식거부, 독특한 식행동 등으로 인한 실제적 어려움을 보고하였고[24], 다른 연구에서는 장애인 복지시설의 영양교육 프로그램 운영 경험을 주제로, 시설 영양사와 실무자 인터뷰를 통해 현장의 교육 요구와 한계를 탐색하였다. 해당 연구에서는 입소 장애인의 편식과 비만이 주요 문제로 지적되었으며, 편식 예방, 비만 관리 및 위생 교육에 대한 요구와 함께 평균 6–9세 아동 수준의 난이도, 시각적 자료 및 체험활동 중심 교육 매체의 필요성이 제시되었고, 거동이 불편한 장애인뿐 아니라 돌봄 종사자를 대상으로 한 영양교육 병행과 입소자–종사자 공동 교육 방식에 대한 의견도 함께 제시되었다[41]. 또한 일부 연구에서는 부모, 교사, 전문가 등 복합대상을 포함하여 가정·학교·시설 등 여러 환경에서의 식생활 교육 요구와 경험을 함께 보고하였다.

3. 장애 유형별 연구 동향

본 연구에 포함된 36편의 논문은 장애유형에 따라 네 가지 범주로 분류되었으며, 그 분포는 Table 5에 제시하였다. 분석 결과, 연구는 발달장애(통합) 22편(61.1%), 자폐성장애 8편(22.2%), 지적장애 2편(5.6%), 혼합(자폐+지적+정신장애 등) 4편(11.1%)으로 분류되었다. 가장 많은 비중을 차지한 발달장애 통합 연구는 근거통합 연구 8편, 개입 기반 실험연구 6편, 관찰 기반 양적연구 6편, 탐색적 질적연구 2편으로 구성되었으며, 연구 주제가 가장 다양하게 분포하였다. 근거통합 연구는 발달장애인을 대상으로 한 건강 및 식생활 관련 주제를 종합적으로 분석한 문헌고찰 연구로 구성되었다. 개입 기반 실험연구의 대표적 사례로, 발달장애 아동 어머니를 대상으로 한 건강교육 프로그램에서는 영양, 수면, 개인위생 등을 포함한 신체적 건강교육과 사회심리 교육을 병행한 결과, 실험군에서 자녀의 건강관리행위가 유의하게 증가($F = 9.21$, $P < 0.001$)되고 양육 스트레스가 유의하

게 감소(F = 15.32, $P < 0.001$)한 결과가 보고되었다[40]. 관찰 기반 양적연구에서는 발달장애인의 건강상태, 생활만족도, 영양섭취 및 식생활 특성을 중심으로 분석이 이루어졌으며, 일부 연구에서는 삼킴장애와 장내미생물 등 생리적 요인을 중심으로 건강위험요인을 분석하거나[35] 의료 접근성, 건강권 인식, 보건의료 서비스 이용 만족도 등을 다루었다[23]. 탐색적 질적연구는 발달장애인의 건강관리 및 식생활과 관련한 경험과 지원 요구를 면담과 질적 분석을 통해 심층적으로 탐색한 연구로 구성되었다. 자폐성장애를 단일 대상으로 한 연구는 근거통합 연구 5편, 탐색적 질적연구 2편, 관찰 기반 양적연구 1편으로 이루어졌으며, 근거통합 연구에서는 자폐성장애를 대상으로 한 식행동 및 섭식 관련 연구를 종합적으로 분석한 문헌고찰 연구가 포함되었다. 탐색적 질적연구에서는 자폐성장애 아동을 대상으로 한 식행동 지도 경험을 중심으로, 감각 민감성, 섭식거부, 특이한 식사 패턴으로 인한 지도상의 어려움과 함께 교사·전문의 간 협력 및 맞춤형 지원의 필요성이 공통적으로 제시되었다[24, 39]. 관찰 기반 양적연구에서는 자폐아동의 연령에 따른 식행동, 음식 기호도 및 영양교육 요구도를 분석한 결과, 연령이 증가할수록 체질량지수와 과체중·비만 비율이 높아지고, 11–19세 아동이 10세 이하 아동보다 대부분의 식품군에서 기호도가 높게 나타났다는 점이 보고되었다[31]. 지적장애인을 대상으로 한 연구는 모두 2편으로, 두 연구 모두 개입 기반 실험연구에 해당하였으며, 한 연구에서는 운동 및 영양교육 프로그램을 적용 후 지적장애인의 체력과 신체 계측 변화를 분석한 결과, 신체계측에서는 유의한 변화가 없었으나 체력 중 유연성($P < 0.001$), 근력($P = 0.045$), 순발력($P = 0.013$)에서 유의한 향상이 나타났고, 식습관 총점은 73.0점에서 76.1점으로 증가($P = 0.038$)하였다[36]. 다른 연구에서는 실제 식사 상황을 기반으로 한 VR 음악치료 중재를 적용한 결과, 지적장애인의 식사태도 목표행동 수행이 중재 및 유지 단계까지 지속적으로 향상되는 효과가 보고되었다[37]. 혼합대상 연구는 총 4편으로, 관찰 기반 양적연구 3편과 탐색적 질적연구 1편으로 구성되었다. 관찰 기반 양적연구에서는 지적장애인과 자폐 청소년의 식행동 및 식습관, 식이섭취 실태, 장애유형 간 산과적 합병증 및 임상 특성 비교, 성인 지적장애인의 영양소 및 카로티노이드 섭취수준과 식습관 분석 등이 포함되었다[22, 32]. 이러한 연구는 장애유형 간 생리적·행동적 차이를 규명하였으며, 특히 지적장애인의 미량영양소 섭취 부족과 ASD인의 산과적 합병증 위험 증가를 보고하였다. 탐색적 질적연구에서는 발달장애 학생의 건강관리 및 교육에 대한 특수교사와 부모의 경험과 지원 요구를 탐색하였고, 코로나

Table 5. Study types and key topic trends by disability category

Disability category	Number of studies [n (%)]	Composition of study types	Main research topics	Summary of findings
Developmental disabilities (overall)	22 (61.1)	Observational quantitative (6), intervention-based experimental (6), exploratory qualitative (2), evidence synthesis (8)	Eating behaviors and nutrient intake; health management and health promotion programs; obesity, physical activity, and quality of life; caregiver health education; dysphagia, gut microbiota, and healthcare services	Studies addressed a wide range of health-related topics, with intervention studies focusing on health behaviors and quality of life outcomes
Autism spectrum disorder	8 (22.2)	Exploratory qualitative (2), observational quantitative (1), evidence synthesis (5)	Sensory sensitivity; food refusal; feeding guidance; experiences of parents and teachers; age-related eating behaviors and food preferences; exposure-based and applied behavior analysis-informed feeding approaches	Research primarily focused on feeding-related problems and behavioral characteristics
Intellectual disability	2 (5.6)	Intervention-based experimental (2)	Exercise and nutrition education programs; virtual reality- or music-based interventions	Limited number of intervention studies addressing physical fitness and lifestyle-related outcomes
Mixed disability groups	4 (11.1)	Observational quantitative (3), exploratory qualitative (1)	Health management and educational experiences of students with disabilities; dietary intake patterns; obstetric complications; nutrient and carotenoid intake	Studies examined diverse health and nutrition issues across heterogeneous disability groups

https://doi.org/10.5720/kjcn.2025.00374

19 이후 위생·영양·정신건강 문제가 주요 쟁점으로 부각되면서 교사·부모 모두 학교–가정 연계형 건강 자기옹호 프로그램 구축과 맞춤형 교육자료·지원체계 마련의 필요성 요구가 보고되었다[25].

4. 주제별 연구 동향

발달장애인의 식생활 및 영양교육 관련 국내 연구는 네 가지 주제 범주로 분류되었으며, 해당 범주는 '식생활 실태 및 영양실태 조사 연구', '영양, 식생활 교육 및 중재 연구', '신체활동, 건강증진 관련 연구', '의학, 보건, 임상관련연구'로 구성되었고, 이러한 분류 기준은 Table 6에 제시하였다. 각 연구주제별 연구 분포 및 주요 내용은 Table 7에 정리하였다. '식생활 실태 및 영양실태 조사 연구'는 총 14편으로 관찰 기반 양적연구 9편과 근거통합연구 3편, 탐색적 질적연구 2편으로 구성되었다. 이 주제군은 발달장애인의 식습관, 식품섭취빈도, 영양섭취 수준, 건강행태 및 체중상태를 중심으로 실태를 파악하거나, 보호자·전문가의 인식과 경험을 탐색한 연구로 구성되었다. 관찰 기반 양적연구에서는 발달장애 청소년 및 성인을 대상으로 식행동과 식습관, 비만정도, 영양소 섭취수준, 건강행태의 차이를 분석하였으며, 국내 지적장애인과 자폐 청소년을 대상으로 한 식행동 및 식이섭취 실태조사에서는 채소와 유제품 섭취 부족, 미량영양소 섭취 부족이 공통적으로 보고되었다[22]. 또한 발달장애 성인의 생애주기 및 성별에 따른 건강행태를 분석한 연구에서는 노년기 발달장애인 여성에서 과체중이 관찰되었다[42]. 근거통합 연구로는 ASD 아동의 식행동 및 영양섭취 특성을 종합적으로 고찰한 문헌연구와 발달장애인의 식행동 및 영양섭취 관련 국내 연구동향을 분석한 문헌고찰 연구가 포함되어 개별 실태연구 결과를 종합적 관점에서 정리하였다[21, 43]. 탐색적 질적연구에서는 자폐성장애 자녀를 둔 어머니 면담을 통해 명확한 음식 선호와 특정 식행동, 식생활이 가족과 외식에 미치는 영향, 식생활 개선을 위한 환경 조성 노력, 그리고 정보 제공과 식생활 지도에 대한 지원 요구가 주요 주제로 도출되었고[39], ASD 학생의 식행동을 지도한 특수교사·영양교사·의료전문의 면담 연구에서는 감각민감성과 섭식거부, 특이한 식사행동으로 인해 지도에 어려움이 크며, 직종 간 협력과 맞춤형 지원체계가 필요하다고 보고하였다[24]. '영양, 식생활 교육 및 중재 연구'는 총 10편으로 개입 기반 실험연구 4편과 근거통합 연구 4편, 탐색적 질적연구 2편으로 구성되었다. 이 주제군은 발달장애인의 식생활 교육, 건강증진, 행동 변화 촉진을 위한 중재 및 프로그램 개발 연구로 구성되었다. 개입 기반 실험연구는 주로 학교·가정·시설 기반에서 이루어졌으며, 교육 프로그램, 운동·명상 등 다양한 접근을 통해 건강관리행동, 자기결정성, 식습관 개선 효과를 검증하였다. 발달장애 청년 대상 건강관리 교육 프로그램에서는 건강지식 향상이 보고되었으며[44], 학교–가정 연계형 건강 자기옹호 프로그램에서는 자기결정성 향상이 확인되었다[25]. 근거통합 연구로는 자폐성장애 학생의 식습관 개선 프로그램을 다룬 체계적 고찰과 섭식중재를 주제로 한 문헌고찰 연구들이 포함되어, 식생활 및 섭식행동 중재의 효과와 적용 가능성에 대한 근거를 종합적으로 제시하였다[29, 45–47]. 탐색적 질적연구는 교육 프로그램 운영 경험을 탐색하는 데 초점을 두었으며, 장애인 사회복지시설의 영양교육 프로그램 운영 모델을 분석한 연구에서는 현장 중심의 프로그램 설계와 실무자 교육 체계와 관련된 요구가 제시되었다[41]. '신체활동, 건강증진 관련 연구'는 총 5편으로, 개입 기반 실험연구 3편과 근거통합 연구 2편으로 구성되었다. 이 주제군은 운동, VR, 음악치료 등 신체활동 중심의 중재를 통해 발달장애인의 체력·건강행동·식사행동 변화를 검증한 연구들로 이루어져 있다. 개입 기반 실험연구에서는 지적장애인을 대상으로 한 운동 및 영양교육 프

Table 6. Topic-based study trend classification criteria

Category	Examples of subtopics	Corresponding research methods
Dietary habits and nutritional status	Dietary patterns, food frequency, nutrient intake, obesity and weight status, eating behaviors, meal attitudes	Observational quantitative studies; qualitative studies (exploration of caregiver, student, or professional perspectives); evidence synthesis studies (review of dietary and nutritional status)
Nutrition and dietary education or interventions	Nutrition education programs, dietary behavior interventions, feeding interventions, family- and teacher-involved programs	Intervention-based experimental studies; quasi-experimental designs; qualitative studies (program implementation and participation experiences); evidence synthesis studies (systematic or narrative reviews of interventions)
Physical activity and health promotion	Exercise interventions, physical fitness, cardiovascular health, physical activity levels, obesity prevention, health management behaviors	Intervention-based experimental studies (exercise-based or combined approaches); evidence synthesis studies (reviews of physical activity and health promotion programs)
Medical, physiological, and clinical topics	Gut microbiota, feeding disorders, nutritional metabolism, physiological indicators, health screening, disease-related factors, healthcare access	Clinical and observational studies; comparative studies; qualitative studies (healthcare experiences); evidence synthesis studies (scoping or systematic reviews of medical and healthcare topics)

Table 7. Distribution and key contents by study topic (2015–2025)

Research topic category	Number of studies (n)	Main study populations	Predominant study types	Examples of subtopics	Summary of research focus
Dietary habits and nutritional status	14	Children/ adolescents, adults	Primarily observational quantitative; some qualitative	Dietary patterns, food frequency, nutrient intake, obesity and weight status, eating behaviors, meal attitudes	Studies examined imbalances in nutrient intake (e.g., calcium and B vitamins), selective eating, and obesity patterns, as well as caregiver and professional perspectives on dietary practices
Nutrition and dietary education or interventions	10	Adults, children, parents, teachers	Predominantly intervention-based; some qualitative and evidence synthesis	Nutrition education, dietary behavior interventions, feeding interventions, family- and teacher-involved programs	Research focused on changes in dietary behaviors, self-determination, meal-related attitudes, and caregiver practices following educational or behavioral interventions
Physical activity and health promotion	5	Mainly adults	Predominantly intervention-based; some evidence synthesis	Exercise interventions, physical fitness, cardiovascular health, physical activity levels, obesity prevention, health management behaviors	Studies investigated physical health outcomes, body composition, and fitness improvements associated with structured physical activity or combined intervention programs
Medical, physiological, and clinical topics	7	Adults, children, older adult women with developmental disabilities	Clinical, observational, and evidence synthesis	Gut microbiota, dysphagia, nutritional metabolism, physiological indicators, health screening, healthcare access	Research explored medical and physiological characteristics, feeding and swallowing disorders, and healthcare access issues related to nutrition and health among individuals with developmental disabilities

로그램을 적용한 결과, 유연성($P < 0.001$), 근력($P = 0.045$), 순발력($P = 0.013$) 등 신체적 체력 지표를 유의하게 향상시켰고, 식습관 점수 또한 73.0점에서 76.1점으로 개선되었으며[36], VR을 활용한 음악치료 프로그램에서는 지적장애인의 식사행동 수정과 식습관 개선 효과가 보고되었다[37]. 비디오게임 기반 VR 운동 프로그램은 발달장애 성인을 대상으로 체력, 평형성, 근육량, 유연성의 유의한 향상을 보여주었다[26]. 근거통합 연구에서는 운동 중재와 발달장애인의 건강 및 신체활동 관련 연구를 종합적으로 분석하여 신체활동 기반 중재의 효과와 적용 가능성에 대한 근거를 제시하였다[48]. '의학, 보건, 임상관련연구'는 총 7편으로 근거통합 연구 4편, 개입 기반 실험연구 1편, 관찰 기반 양적연구 1편, 탐색적 질적연구 1편으로 구성되었다. 해당연구들은 발달장애인의 생리적 특성, 임상적 건강문제 및 의료서비스 접근 경험과 관련된 주제를 다루었다. 근거통합 연구로는 발달장애와 장내미생물의 관계를 주제로 한 문헌고찰 연구[35]와 발달장애인의 보건의료서비스 연구동향을 종합적으로 정리한 주제범위 문헌고찰이 포함되어 의료 접근성, 서비스 이용 경험 및 제도적 개선 필요성을 제시하였다[28]. 개입 기반 실험연구에서는 삼킴장애를 가진 발달장애 아동을 대상으로 한 ABA 기반 중재가 수행되어 음식 거부 행동이 감소하고 섭식시간 단축 및 섭취량 증가가 보고되었으며[33], 관찰 기반 양적연구에서는 ASD와 지적장애 간 산과적 합병증 및 임상적 특성 차이가 분석되어 ASD 아동에서 남아 비율이 높고($P < 0.01$), 산후기 의학적 문제는 적으며($P < 0.01$), 언어발달지수는 낮고 운동발달지수는 높게 나타났다[32]. 탐색적 질적연구에서는 발달장애인 당사자와 보호자를 대상으로 한 인터뷰를 통해 의료서비스 이용 과정에서의 의사표현 어려움과 자기결정의 제약, 그리고 의료서비스 개선에 대한 지원 요구가 주요 주제로 도출되었다[23].

5. 출판 시기별 연구 동향

연도별 연구유형의 분포는 Table 8에 제시하였다. 2015년부터 2023년까지는 관찰 기반 양적연구, 개입 기반 실험연구 및 탐색적 질적연구가 비교적 고르게 분포하였으며, 개별 식행동 및 영

https://doi.org/10.5720/kjcn.2025.00374

Table 8. Distribution of study types by year (2015–2025)

Research type	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total
Intervention-based experimental studies	1	1		2	2	1		1				8
Exploratory qualitative studies				1		1	1	1		1		5
Observational quantitative studies	2	1		1		2		1	2		1	10
Evidence synthesis studies				1	1		1	1	1	4	4	13
Total	3	2	0	5	3	4	2	4	3	5	5	36

n.

양섭취 실태를 분석한 연구나 단기 중재 프로그램을 중심으로 수행되었다. 반면 2024년 이후에는 근거통합 연구의 비중이 증가하여, 체계적 문헌고찰과 주제범위 문헌고찰을 중심으로 연구 결과를 종합·정리한 연구가 다수 발표되었다.

DISCUSSION

본 고찰은 주제범위 문헌고찰로서 국내 발달장애인의 식생활 및 영양교육 관련 연구 동향을 연구유형, 연구대상, 장애유형 및 연구주제별로 분류·정리하고, 각 연구 영역에서 나타난 연구 분포와 특성을 제시하는 데 목적이 있다. 이를 통해 향후 연구 설계와 현장 적용을 위한 과제를 도출하고자 하였다.

최근 10년간 발달장애인의 식생활 관련 연구는 관찰 기반 양적연구를 중심으로 한 실태 파악에서 출발하여, 개입 기반 실험연구, 탐색적 질적연구, 그리고 근거통합 연구가 병행되는 방향으로 점차 확장되어 왔다. 관찰 기반 양적연구는 발달장애인의 식습관과 영양섭취 문제를 체계적으로 파악하는 기초자료로 기능하였으며, 탐색적 질적연구는 식생활 관리 과정에서의 환경적·제도적 요인과 실제적 어려움을 드러내는 데 기여하였다.

개입 기반 실험연구는 영양교육, 운동 및 행동중재를 중심으로 수행되어 식습관 개선과 건강행동 변화의 가능성을 제시하였으나, 다수의 연구가 소규모 표본과 단기 중재 설계로 수행되어 중재 효과의 지속성을 검증한 연구는 제한적이었다. 한편 근거통합 연구는 개별 연구의 단편적 결과를 종합하여 연구 흐름과 공백을 체계적으로 정리하고, 향후 연구 방향 설정과 정책적·실무적 논의를 위한 근거를 제시하였다. 전반적으로 연구유형의 다양화와 함께 연구대상과 접근방법의 확장이 이루어졌으나, 중재 효과의 장기적 유지와 생애주기별 적용 가능성을 검증하는 연구는 여전히 부족한 실정이다.

연구대상별로 살펴보면, 국내 발달장애인의 식생활 관련 연구는 단순한 식습관이나 영양섭취 실태 분석을 넘어, 섭식장애, 감각민감성, 삼킴장애, 산과적 합병증 등 임상적 문제를 포괄하는 다층적 접근으로 확장되고 있다. 그러나 아동·청소년기 발달장애인을 대상으로 한 연구는 관찰 기반 양적연구와 이론적 고찰이 주를 이루었으며, 실제 현장 적용을 검증한 개입 기반 실험연구는 상대적으로 낮았다. 이러한 연구 분포를 고려할 때, 학교–가정 연계형 중재를 기반으로 감각 특성, 정서 요인, 자기결정성을 통합한 맞춤형 식생활 교육 프로그램의 개발과 효과검증이 향후 연구 과제로 제시된다. 반면 발달장애 성인 대상 연구는 실태 중심 연구에서 벗어나 행동 변화와 자기관리 능력 향상을 검증하는 개입 기반 실험연구가 비교적 활발하게 수행되고 있었으며, 운동·영양교육을 통합한 다학제적 접근이 주요 특징으로 나타났다. 다만 장기추적 기반의 맞춤형 중재모델과 생활환경·심리요인을 반영한 지속가능한 건강관리체계를 다룬 연구는 제한적인 수준에 머물러 있었다. 한편 전문가·교사 대상 연구는 현장 실무자의 경험을 중심으로 식생활 교육이 직면한 현실적 제약과 개선 요구를 구체적으로 제시하였으며, 이는 향후 발달장애인의 식생활 교육이 단순한 영양정보 전달을 넘어, 실무자 전문성 강화와 다직종 협력체계를 기반으로 설계될 필요성이 제기되었다.

발달장애(통합) 대상 연구는 영양·행동·가족·임상·서비스를 포괄하는 다층적 구조로 구성되어 있으며, 생애주기별·생활환경별 요인을 함께 고려한 연구들이 다수 포함되어 있었다. 자폐성장애 대상 연구는 감각민감성 기반 섭식문제를 중심으로 수행되었으며, 섭식행동이 감각적·행동적 요인에 의해 복합적으로 영향을 받는 특성이 보고되었다. 또한 부모–교사–전문가 연계형 행동중재와 맞춤형 영양교육의 결합이 효과적인 접근으로 제시되고 있었다. 한편 지적장애 및 혼합대상 연구는 아직 소수에 그치나, 신체활동과 감각·정서 요인을 결합한 융합적 중재와 장애유형 간 비교 분석을 통해 발달장애인의 건강관리 문제를 통합적으로 다룬 초기 단계 연구로 분류할 수 있다.

식생활 및 영양실태 연구는 발달장애인의 식습관 문제를 기초적으로 규명함과 동시에 사회·심리적 맥락을 함께 제시해왔으나, 대부분 단면연구에 머물러 인과관계 및 장기 변화 분석에는 한계가 있다. 이에 따라 향후에서는 표준화된 영양평가 도구 개발, 생애주기별 실태 모형화, 보호자·전문가를 포함한 다층적 분석을 결합한 통합 연구로의 발전이 요구된다. 한편, 의학·보건·임상 연구는 삼킴장애, 장내미생물, 의료서비스 접근성 등 생리·의학적 특성을 중심으로 수행되었으며, 일부 연구에서는 장–뇌 축(gut–brain axis) 이론에 근거하여 발달장애인의 식이,

면역, 행동 간 상호작용을 설명하고자 하였다. 이러한 연구들은 향후 생리적 요인과 행동·심리적 요인을 함께 고려한 다학제적 임상 접근의 가능성을 제시하고 있었다. 아울러 근거통합 연구는 각 주제 영역에서 개별 연구 결과를 종합·정리함으로써 연구 흐름과 공백을 체계적으로 제시하는 역할을 수행하였다. 식생활 및 영양실태 영역에서는 발달장애 아동·청소년의 섭식 문제 특성과 식습관 형성 요인을 반복적으로 정리하였으며[29, 30], 자폐성장애를 대상으로 한 연구에서는 ABA 기반 접근과 행동중재 전략이 주요 연구 주제로 제시되고 있다[45-47]. 또한 발달장애 성인을 대상으로 한 근거통합 연구에서는 영양교육, 신체활동, 의료정보 제공, 심리·정서적 지원을 포함한 다요인적 건강증진 프로그램이 중심적으로 검토되고 있다[19, 27]. 이와 함께 보건의료서비스 및 임상 영역의 리뷰연구에서는 장내미생물, 삼킴장애 등 생리적 요인과 의료 접근성, 의사소통 지원 문제를 함께 다루는 경향이 나타나고 있다[23, 28, 35].

2015년부터 2023년까지는 실태연구, 중재연구, 질적연구 및 리뷰연구가 비교적 고르게 분포하며, 개별 식행동과 영양섭취 실태를 파악하거나 단기 중재 효과를 검증하는 연구가 중심을 이루었다. 반면 2024년 이후에는 체계적 문헌고찰과 주제범위 문헌고찰 등 근거통합 연구의 비중이 증가하면서, 개별 사례 분석을 넘어 발달장애인의 건강, 영양 및 행동 전반을 통합적으로 조망하는 연구로 확장되는 양상을 보였다.

국내 발달장애인의 식생활 및 영양지원은 주로 특수학교와 복지시설 등 시설 기반 환경을 중심으로 이루어지고 있으며, 이로 인해 지역사회 및 재가 환경에서 생활하는 발달장애인을 포괄하는 체계적인 영양지원 서비스는 상대적으로 제한적으로 운영되고 있다. 또한 영양·식생활 교육은 단기적 프로그램이나 개인 대상 중재 중심으로 운영되어, 생애주기 전반을 고려한 지속적인 관리 체계로 확장되기에는 한계가 있는 것으로 나타났다.

반면 해외에서는 발달장애인의 식생활 및 영양지원을 공공건강관리와 장애 서비스의 필수 구성요소로 인식하고 있다. 미국 영양 및 식단 학회(Academy of Nutrition and Dietetics)는 지적 및 발달 장애성인과 특별 건강 관리 요구가 있는 아동·청소년 발달장애인에게 영양사의 전문적 개입이 필수적임을 공식 입장문을 통해 명시하였다[56]. 이러한 접근은 탈시설화 이후 지역사회 기반 서비스로의 전환과 함께, 다학제적 건강관리 체계 내에서 영양서비스의 역할을 제도적으로 강화하는 방향으로 이어지고 있다. 해외의 체계적 문헌고찰에 따르면, 기존 영양 및 건강증진 중재는 개인 대상 교육에 편중되어 있으며, 물리적 환경이나 정책 수준의 개입은 제한적인 것으로 보고되었다[57]. 또한 발달장애 성인을 대상으로 한 중재 연구는 소규모·단기·비무작위 설계가 많아 장기적 효과와 정책적 확장 가능성을 검증하기에는 근거가 충분하지 않다는 한계가 지적되었다[58]. 그럼에도 불구하고 이들 연구는 개인 단위 중재를 넘어 공중보건 정책 및 기관 차원의 구조적 개입이 필요함을 공통적으로 제안하고 있다.

이러한 해외 연구 및 정책 동향과 비교할 때, 국내 발달장애인의 식생활·영양지원은 여전히 시설 중심 및 개인 단위 개입에 머무르는 경향이 강하다. 특히 현재 사회복지급식관리지원센터의 관리 대상은 주로 집단급식소를 운영하는 장애인 이용 시설에 한정되어 있어, 기관에 소속되지 않은 재가 발달장애인과 그 가족을 대상으로 한 식생활 및 영양관리 지원은 제도적으로 충분히 포함되지 못하고 있다. 이는 사회복지급식관리지원센터의 역할이 시설 관리 중심에서 나아가, 지역사회 내 재가 발달장애인과 보호자를 포괄하는 영양상담, 식생활 교육, 식사 지원 연계 기능으로 확장될 필요성을 시사한다. 따라서 향후 국내 연구는 개인 대상 중재 효과 검증을 넘어, 지역사회 및 재가 발달장애인을 포괄하는 영양지원 모델의 구조적 설계와 정책적 실행 가능성을 함께 검토하는 방향으로 확장되어야 한다. 나아가 발달장애인의 식생활 및 영양관리를 공공 서비스 영역으로 명확히 위치시키고, 다직종 협력체계를 기반으로 한 지속가능한 지원체계 구축이 요구된다.

Limitations

국내 발달장애인의 식생활 및 영양교육 관련 연구는 지난 10년간 양적·질적 성장을 이루었으나, 여전히 연구대상, 연구설계, 교육·지원체계의 미비 등 여러 측면에서 구조적인 한계를 지닌다. 이에 선행연구의 경향을 토대로 주요 문제점을 도출하고, 향후 연구 및 정책적 발전 방향을 제시하고자 한다.

대부분의 연구가 특수학교 재학생, 복지시설 이용자, 성인 소규모 집단을 중심으로 수행되어 발달장애인 전체 인구의 특성을 반영하지 못한다. 특히 노년층을 대상으로 한 연구는 극히 제한적이며, 실태조사 또한 지역적 편중이 심해 대도시 중심으로 이루어져 있다. 또한 보호자·전문가·의료인 등 다층적 참여자 간의 상호작용을 통합적으로 분석한 연구는 매우 드물다. 따라서 향후 연구에서는 대규모 표본과 전국 단위 데이터를 활용하고, 장애유형·연령·성별을 세분화하여 분석하는 접근이 필요하다.

기존 연구의 상당수는 단면조사(cross-sectional) 중심으로 이루어져, 장기적인 효과나 지속가능성을 검증하지 못했다. 특히 영양교육·운동·행동중재 연구는 중재 직후의 성취에 초점을 맞추어, 이후의 행동 유지나 자기결정성 변화, 재발 예방 등의 과정을 충분히 추적하지 못했다. 향후에는 장기추적(longitudinal) 연구와 혼합방법(mixed-methods) 접근을 도입하여, 양적 결과뿐 아니라 정서·환경적 요인까지 통합적으로 분석할 필요가 있다.

많은 프로그램 개발 연구가 높은 만족도와 교육 효과를 보고하였으나, 대부분 일회성 또는 단기적 연구 프로젝트로 그쳐 실제 현장 적용이 제한적이었다. 학교·가정·복지시설 간의 협력체계가 미비하여 교육 프로그램이 지속되거나 제도화되지 못하는 사례가 많았으며, 영양사·특수교사·보호자 등 교육자 대상의 역량 강화 연구도 부족하다. 이러한 한계는 프로그램의 실

https://doi.org/10.5720/kjcn.2025.00374

행력과 전문성 확보를 어렵게 하며, 중재의 지속가능성을 저해한다. 향후에는 '현장–연구–정책'을 연계하는 실천기반 연구(practice-based research)를 활성화하고, 교육자 훈련체계 및 표준화된 매뉴얼 개발이 병행되어야 한다.

정책·서비스 연구는 건강권 보장, 의료접근성, 사회참여를 논의하고 있으나, 아직 영양·식생활 중심의 국가정책이나 제도적 지원체계는 부재한 실정이다. 발달장애인은 여전히 정기 건강검진 미수검, 영양상담 서비스 미흡, 식사지원 인력 및 교육자료 부족 등의 문제를 겪고 있다. 특히 가족의 돌봄 부담이 장기적으로 누적되며, 성인기 이후의 건강관리 공백이 심각하다. 따라서 향후 연구는 단순한 프로그램 효과 검증을 넘어 정책·법제화 연구, 지역사회 기반 영양관리모델 구축으로 확장되어야 한다.

Conclusion

본 연구는 최근 10년간 국내 발달장애인의 식생활 및 영양교육 관련 연구 동향을 연구유형, 연구대상, 장애유형, 연구주제 및 연구시기별로 종합적으로 고찰함으로써, 연구의 흐름과 한계를 체계적으로 정리하고 향후 연구 및 실천 방향에 대한 시사점을 도출하고자 하였다. 분석 결과, 국내 연구는 실태조사와 단기 중재 중심에서 점차 질적연구, 통합·리뷰 연구 등으로 확장되고 있으나, 여전히 장기적 효과 검증과 생애주기별 연계, 지역사회 기반 적용에는 한계가 존재하는 것으로 나타났다.

향후 연구에서는 대규모·전국 단위 자료를 활용하여 연령, 성별, 장애유형별 특성을 보다 정밀하게 분석하고, 시설 이용 여부와 관계없이 학교–가정–지역사회를 포괄하는 대표성 있는 데이터 구축이 필요하다. 또한 단면 연구에 머무르기보다 종단적 연구와 혼합방법 연구를 통해 영양교육 및 중재 효과의 지속성과 생애주기 전반에 미치는 영향을 검증할 필요가 있다. 아울러 실천기반연구를 활성화하여 영양사, 교사, 보호자, 지원인력의 전문역량 강화를 도모하고, 표준화된 교육 및 중재 체계 개발이 병행되어야 할 것이다.

특히 해외에서는 발달장애인의 식생활 및 영양지원을 개인의 선택이나 단기 프로그램이 아닌, 지역사회 기반의 공공 서비스로 제도화하려는 정책적 논의가 지속되고 있는 반면, 국내는 여전히 시설 중심의 지원체계에 머무르는 경향이 강하다. 이에 향후 국내 정책은 해외 사례를 참고하여, 시설 소속 여부와 무관하게 모든 발달장애인을 포괄하는 지역사회 기반 영양지원 모델로 전환될 필요가 있다. 이는 사회복지급식관리지원센터를 포함한 기존 제도의 역할을 재정립하고, 발달장애인의 건강권 보장과 삶의 질 향상을 위한 공공 영양서비스 체계를 강화하는 방향으로 이어져야 할 것이다.

결론적으로, 국내 발달장애인의 식생활 및 영양교육 관련 연구는 개인 중심의 실태조사와 단기 중재를 넘어, 연구–실천–정책이 연계된 통합적 지원모델로 전환되어야 하며, 이는 발달장애인의 지속가능한 건강관리와 사회적 참여를 촉진하기 위한 핵심 과제로 제시된다.

CONFLICT OF INTEREST

The authors declare no financial or other issues that might lead to conflict of interest.

FUNDING

This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2025S1A5A2A03016997).

DATA AVAILABILITY

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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https://doi.org/10.5720/kjcn.2025.00374

Korean J Community Nutr. 2026 Feb;31(1):21-35
https://doi.org/10.5720/kjcn.2026.00024
eISSN 2951-3146

KJCN
Korean Journal of Community Nutrition

Research Article

Psychosocial factors related to the stages of change in reducing sugar intake among adults in Seoul, Korea: a cross-sectional study

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Received: January 15, 2026
Revised: January 30, 2026
Accepted: February 5, 2026

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Objectives: This study examined the factors associated with stages of change (SOC) in reducing sugar intake among adults, applying the theory of planned behavior.
Methods: An online survey was conducted among adults aged 19–49 years residing in Seoul, Korea. Based on their SOC in reducing sugar intake, participants (n = 380) were categorized into a pre-action group (45.3%) and an action group (54.7%). Statistical analysis was performed using χ^2-test, analysis of covariance, and one-way analysis of variance with linear contrast.
Results: The consumption frequency of sugary foods was significantly higher in the pre-action group than in the action group ($P < 0.001$). Compared with the action group, participants in the pre-action group perceived the advantages of sugar intake more favorably ($P < 0.001$), perceived the disadvantages less strongly ($P = 0.002$), and reported greater influence from significant others ($P = 0.004$). In contrast, participants in the action group agreed less with insufficient knowledge/skills ($P < 0.001$), had greater control over the facilitating factors of sugar intake ($P < 0.001$), and had stronger control beliefs in situations promoting sugar intake ($P < 0.001$). Behavioral beliefs ($P < 0.001$) and control beliefs ($P < 0.001$) showed a significant linear trend across the five SOC, whereas subjective norms did not ($P = 0.275$).
Conclusion: Psychosocial factors related to sugar intake reduction clearly differed between the SOC groups. In the pre-action group, nutrition education should emphasize lowering the perceived benefits of sugar intake while increasing awareness of its adverse consequences. Strengthening the perception of control over sugar intake is important, despite the factors or situations promoting sugar intake. This can be achieved by providing practical tips and developing skills to reduce sugar intake. For the action group, it is necessary to maintain the reduced sugar intake through continual support and encouragement.

Keywords: adult; sugars; factor; theory of planned behavior; stages of change

INTRODUCTION

Sugars serve as an energy source and contribute to sensory satisfaction. They are widely used as sweeteners in food processing and preparation to enhance the sensory appeal and functional properties of food products. However, excessive sugar intake has been linked to an increased risk of chronic diseases, including dental caries, obesity, type 2 diabetes mellitus, metabolic syndrome, and car-

diovascular diseases, and negatively affects overall diet quality [1, 2]. The Korean Dietary Reference Intakes recommend that total sugar intake be limited to 10%–20% of total energy intake, with emphasis on limiting added sugars that are incorporated during food processing or preparation to less than 10% of total energy intake [3]. However, the recent Korea National Health and Nutrition Examination Survey (KNHANES) showed that the average daily sugar intake among adults aged 19 years and older in 2022 was 58.0 g, with males consuming 61.6 g and females consuming 54.4 g [4]. In addition, an analysis of the 2019–2021 KNHANES data reported that 34.0% of adults aged 19–34 years and 23.7% of those aged 35–49 years consumed more than 10% of their energy from sugars derived from processed foods [5].

Eating behaviors are shaped by various factors such as nutrition knowledge, personal beliefs, attitudes, and the eating environment. Theory-based research provides a framework for examining factors that influence eating behaviors. The stages of change (SOC), a key construct within the transtheoretical model, views behavior changes as a process moving from the precontemplation to maintenance stages. As individuals progress through these stages, different strategies or interventions need to be applied to match each stage [6]. The theory of planned behavior (TPB) is also used to explain or predict health behaviors and describes how factors are related to behaviors. The TPB states that the intention to perform a behavior is the key predictor of that behavior, and that intention is determined by attitudes, subjective norms, and perceived behavioral control. Each of these three factors is determined by salient beliefs: behavioral, normative, and control beliefs [7]. Attitudes are shaped by behavioral beliefs and evaluations of these beliefs. Subjective norms are formed by perceptions of significant others' expectations (i.e., normative beliefs) and motivations to comply with their expectations. Perceived behavioral control is influenced by control beliefs and the perceived power of each condition, reflecting how easy or difficult it is to perform [7]. The TPB has been applied to a variety of nutrition and eating behaviors, such as beverage consumption [8, 9], nutrition label use [10], maternal feeding decisions for toddlers [11], healthy eating intentions [12], and evaluation of nutrition interventions [13, 14].

Previous studies on sugar intake in Korea have mainly focused on sugar consumption patterns and the relationship between sugar intake and factors such as nutrition knowledge, attitudes, and eating behaviors among parents of young children, high school students, university students, and adults [15-18]. Only a few studies have examined SOC for sugar intake reduction or psychosocial factors related to sugar intake among Korean adults [19, 20]. There is a lack of research applying the TPB or SOC models to examine sugar consumption and related psychosocial factors in Korean adults.

This study aimed to explore the differences in psychosocial factors associated with the SOC in reducing sugar intake among adults residing in Seoul using the constructs of the TPB (i.e., behavioral beliefs, subjective norms, and control beliefs regarding sugar intake reduction). This study does not test the TPB itself, but rather applies the constructs of the TPB to examine differences according to the SOC in reducing sugar intake. The findings of this study will provide basic data for developing targeted nutrition education and counseling programs to help adults reduce their sugar intake.

METHODS

Ethics statement

The Institutional Review Board of Seoul Women's University (approval number: SWU IRB-2024A-04) approved the study protocol. Online informed consent describing the purpose and content of the study was obtained from each participant prior to participating in the online survey.

1. Study design

This study used a cross-sectional design. Data were collected through an online survey conducted between May and October 2024. This study was performed in accordance with the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) statement (https://www.strobe-statement.org).

2. Study participants

The study participants were adults aged 19–49 years residing in Seoul, Korea. The participants were recruited through six online communities in Seoul: an office worker community, a parenting community, and four

https://doi.org/10.5720/kjcn.2026.00024

regionally verified communities across the eastern, western, southern, and northern areas of Seoul. All the included online communities were open to both males and females.

Recruitment was conducted by posting a notice containing the survey link, and participation was voluntary. Before accessing the questionnaire, potential participants completed an eligibility screening that assessed age (19–49 years) and residence (Seoul). Those who did not meet these criteria were automatically excluded from participating. Eligible participants were presented with an online information sheet detailing the purpose, content, and procedures of the study. Only those who provided informed consent were allowed to respond to the self-administered online questionnaire. To prevent duplicate participation, the survey platform restricted repeated access. Participants who attempted to re-enter the survey after completion received a notification indicating that they had already participated and further access was blocked.

The minimum sample size was estimated as 318 based on a previous study of population proportion [19], assuming a 95% confidence level, 5% margin of error, and 10% loss. A total of 391 participants completed an online survey. After excluding 11 respondents with missing data on major study variables (i.e., subjective norms), 380 participants (97.2%) were included in the statistical analysis.

3. Study content and methods

1) Survey questionnaire

The questionnaire was developed based on the previous literature on sugar intake and its associated factors [20-23]. It comprised sections assessing general information, SOC in reducing sugar intake, consumption frequency of sugary foods, and factors related to sugar intake, including behavioral beliefs, subjective norms, and control beliefs. In this study, sugar intake was examined as the consumption of sugary beverages and snacks based on the KNHANES findings that these foods constitute a major proportion of sugar intake in adults [5, 24].

General information included participants' age, sex, height, weight, occupation, and primary meal preparer. Body mass index (BMI) was calculated using self-reported height and weight. The SOC in reducing sugar intake were assessed by asking whether participants were currently reducing their consumption of sugary beverages/snacks and, if not, whether they intended to do so, based on the SOC definitions. The participants were classified into one of five stages. The precontemplation stage included those not reducing sugar intake and with no intention to do so within the next six months. The contemplation and preparation stages included those not currently reducing sugar intake but intending to do so within the next six months or the next month, respectively. The action stage included participants who had been reducing sugar intake for less than six months, and the maintenance stage included those who had been doing so for six months or longer [6]. To provide an overall description of the participants, general characteristics were examined across all five SOC. For the major analyses, the participants were subsequently regrouped into two categories: a pre-action group (pre-contemplation, contemplation, and preparation stages) and an action group (action and maintenance stages). This regrouping was performed to reflect differences in behavioral performance and examine the psychosocial factors associated with the initiation and action of sugar intake reduction behaviors.

To assess the participants' sugar consumption status, they were asked the consumption frequency of sugary foods over the past three months. A list of 23 food items was developed based on major sources of sugar intake among adults aged 19–49 years, identified from the 2021 KNHANES and previous studies [17, 20, 25, 26]. The food list included beverages (7 items), milk and dairy products (6 items), frozen desserts and snacks (3 items), breads and rice cakes (3 items), sugars and sweets (3 items), and sauces (1 item). Participants reported how often they consumed each food based on a serving size provided, using response categories ranging from "never" to "more than three times per day."

Behavioral beliefs regarding the outcomes of consuming sugary beverages/snacks were developed based on literature, with a total of 15 items [20-23]. Factor analysis identified two subscales: beliefs about the advantages (nine items) and beliefs about the disadvantages (six items) of consuming sugary beverages/snacks. The advantages included items such as "taste," "quenching

thirst," "convenience," and "relieving anxiety or stress." Disadvantages included "tooth decay," "weight gain," and "risk of developing diseases." The Cronbach's alpha was 0.83 for the total behavioral beliefs, 0.85 for the advantages subscale, and 0.83 for the disadvantages subscale.

Subjective norms were assessed based on normative beliefs and motivation to comply. Significant others were identified as parents, siblings, spouse/partner, children, friends/co-workers, professionals (e.g., doctors, nutritionists), and mass media [10, 21-23]. Normative beliefs were assessed using seven items by asking whether significant others thought that participants should reduce sugar intake, and motivation to comply (seven items) was assessed by asking how much participants intended to follow significant others' recommendations. The factor analysis did not identify distinct subscales; thus, subjective norms were treated as a single construct. Cronbach's alpha for subjective norms was 0.94.

Control beliefs were measured using 15 items assessing how difficult or easy participants perceived controlling their sugar intake under various factors and situations [20-23]. Factor analysis categorized control beliefs related to reduce sugar intake (Cronbach's α = 0.91) into three subscales: lack of knowledge/skills for reducing sugary intake (six items, Cronbach's α = 0.86), facilitating factors of sugar intake (five items, Cronbach's α = 0.88), and situations promoting sugar intake (four items, Cronbach's α = 0.79).

2) Measurement and scoring of items

The items were measured using a 5-point Likert scale. For behavioral beliefs and normative beliefs, the responses ranged from "strongly disagree" (1) to "strongly agree" (5). The motivation to comply items was rated from "not at all" (1) to "very much" (5). For normative belief and motivation to comply items, participants were asked to select "not applicable" if there were not relevant others. Control belief items were assessed using either "very difficult" (1) to "very easy" (5) or "strongly disagree" (1) to "strongly agree" (5).

The total score for behavioral beliefs or control beliefs was calculated by reversing the scores for disadvantages, or negatively worded items reflecting barriers, and summing the scores of all items. Higher total behavioral beliefs and advantages subscale scores, along with lower disadvantages subscale scores, indicated more favorable perceptions toward consuming sugary beverages/snacks. Higher total control beliefs score and higher subscale score for "situations promoting sugar intake," and lower subscale scores for "lack of knowledge/skills in reducing sugar intake" and "facilitating factors of sugar intake" were indicative of stronger control beliefs toward reducing sugar intake. For subjective norms, the influence of each referent was calculated as the product of the normative belief score and corresponding motivation to comply score. Responses marked as "not applicable" were excluded from item-level calculations. To assess the overall influence of significant others while accounting for variation in applicable referents across participants, the mean subjective norms score was calculated by dividing the sum of item scores by the number of completed items, excluding "not applicable" referents. Higher scores indicate greater perceived support and influence from significant others regarding one's reducing sugar intake.

4. Statistical analysis

Statistical analyses (n = 380) were performed using SPSS Statistics version 29.0 (IBM Corp.). General characteristics across the five SOC were compared using χ^2-tests for categorical variables and one-way analysis of variance (ANOVA) for continuous variables. Comparisons of psychosocial factors, including behavioral beliefs, subjective norms, and control beliefs, were conducted between the pre-action group (pre-contemplation, contemplation, and preparation stages) and the action group (action and maintenance stages). Descriptive statistics, including means, standard deviations, and frequencies of the variables, were calculated.

Differences in variables such as consumption frequency of sugary foods, behavioral beliefs, subjective norms, and control beliefs between the pre-action and action groups were examined using analysis of covariance (ANCOVA), adjusting for general characteristics (e.g., age, sex, BMI, and occupation). Spearman's correlation analysis was performed as a secondary analysis to examine the association between the consumption frequency of sugary foods and the five SOC. Factor analysis was performed to identify the subscales of be-

https://doi.org/10.5720/kjcn.2026.00024

havioral beliefs, subjective norms, and control beliefs. To examine the linear trend of the study variables across the five SOC in reducing sugar intake, one-way analysis of variance (ANOVA) with linear contrasts was performed at both the total and subscale levels of the study variables. The results of the linear trend analyses were evaluated as *P* for trend. The statistical significance level was set at $P < 0.05$.

RESULTS

1. General characteristics of participants by the five stages of change in reducing sugar intake

With respect to SOC in reducing sugar intake, the largest proportion was in the maintenance stage (n = 112, 29.5%), followed by the action (n = 96, 25.2%), contemplation (n = 72, 18.9%), preparation (n = 61, 16.1%), and pre-contemplation stages (n = 39, 10.3%). Females accounted for 73.9% of participants. The most prevalent age group was 30–39 years (45.0%), followed by 19–29 years (33.7%) and 40–49 years (21.3%). No significant differences were observed among the five SOC in terms of sex or age. Similarly, there were no significant differences among the five SOC in terms of height, weight, and BMI (Table 1).

Regarding occupation, 63.7% of participants were professionals/office workers, 24.7% were housewives/unemployed/others, and 11.6% were students. The majority of participants reported that they prepared their own meals (67.6%), followed by parents (22.9%)

Table 1. General characteristics of participants by the stages of change in reducing sugar intake

Variables	Total (n = 380)	Stages of change					*P*-value[1)]
		Precontemplation (n = 39)	Contemplation (n = 72)	Preparation (n = 61)	Action (n = 96)	Maintenance (n = 112)	
Sex							
Male	99 (26.1)	15 (38.5)	16 (22.2)	16 (26.2)	23 (24.0)	29 (25.9)	0.422
Female	281 (73.9)	24 (61.5)	56 (77.8)	45 (73.8)	73 (76.0)	83 (74.1)	
Age (year)							
19–29	128 (33.7)	18 (46.2)	23 (31.9)	19 (31.1)	29 (30.2)	39 (34.8)	0.686
30–39	171 (45.0)	12 (30.8)	35 (48.6)	29 (47.5)	48 (50.0)	47 (42.0)	
40–49	81 (21.3)	9 (23.1)	14 (19.4)	13 (21.3)	19 (19.8)	26 (23.2)	
Height (cm)							
Male	175.6 ± 4.8	173.5 ± 4.8	177.2 ± 4.0	176.9 ± 4.2	174.3 ± 5.2	176.3 ± 4.8	0.078
Female	162.8 ± 4.5	162.5 ± 3.4	163.1 ± 5.0	163.9 ± 3.9	162.9 ± 4.5	162.1 ± 4.6	0.312
Weight (kg)							
Male	76.1 ± 9.9	76.2 ± 11.3	77.6 ± 10.4	74.7 ± 7.8	75.9 ± 11.3	76.3 ± 9.2	0.952
Female	57.2 ± 10.7	54.2 ± 6.5	57.6 ± 8.8	57.4 ± 8.6	58.9 ± 15.2	56.2 ± 8.7	0.335
Body mass index (kg/m^2)							
Male	24.7 ± 3.0	25.3 ± 3.8	24.7 ± 3.1	23.8 ± 2.0	24.9 ± 3.0	24.6 ± 3.0	0.715
Female	21.6 ± 3.9	20.5 ± 2.4	21.7 ± 3.3	21.4 ± 3.0	22.2 ± 5.5	21.4 ± 3.2	0.425
Occupation							
Students	44 (11.6)	7 (17.9)	7 (9.7)	9 (14.8)	10 (10.4)	11 (9.8)	0.084
Professionals/office workers	242 (63.7)	17 (43.6)	41 (56.9)	39 (63.9)	66 (68.8)	79 (70.5)	
Housewives/unemployed/others	94 (24.7)	15 (38.5)	24 (33.3)	13 (21.3)	20 (20.8)	22 (19.6)	
Meal preparer							
Self	257 (67.6)	27 (69.2)	51 (70.8)	41 (67.2)	62 (64.6)	76 (67.9)	0.731
Parents	87 (22.9)	9 (23.1)	15 (20.8)	13 (21.3)	28 (29.2)	22 (19.6)	
Spouse/friend/others	36 (9.5)	3 (7.7)	6 (8.3)	7 (11.5)	6 (6.3)	14 (12.5)	

n (%) or Mean ± SD.
[1)]By χ^2-test or analysis of variance (ANOVA).

and spouse/friend/others (9.5%). Occupation and the person primarily responsible for meal preparation did not differ significantly among the five SOC. As shown in Table 1, no significant differences in general characteristics were observed across the five SOC. Based on this distribution and the conceptual framework of the SOC, the subsequent results focused on the differences in psychosocial factors between the pre-action and action groups.

2. Consumption frequency of sugary foods by stages of change groups

The consumption frequency of sugary foods, assessed using 23 items with reference serving sizes, over the past three months was converted into weekly consumption frequency (Table 2). Participants reported an average consumption frequency of 25.4 times per week of the 23 sugary foods. Among the food categories, beverages were consumed most frequently (8.5 times/week), followed by milk and dairy products (6.3 times/week), and frozen desserts and snacks (3.9 times/week).

When analyzed by SOC groups, the total weekly consumption frequency of 23 sugary foods was significantly higher in the pre-action group (36.7 times/week) than in the action group (16.1 times/week, $P < 0.001$). The pre-action group also reported significantly higher consumption frequencies across all food categories, including beverages ($P < 0.001$), frozen desserts and snacks ($P < 0.001$), sugars and sweets ($P < 0.001$), milk and dairy products ($P < 0.001$), breads and rice cakes ($P < 0.001$), and sauce ($P = 0.031$, Table 2). Spearman correlation analysis showed significant inverse correlations between the five SOC (from precontemplation to maintenance stage) in reducing sugar intake and the weekly consumption frequency of 23 sugary foods ($\rho = -0.455$, $P < 0.001$). Significant negative correlations with the five SOC were also observed across food categories including beverages ($\rho = -0.429$, $P < 0.001$), frozen desserts and snacks ($\rho = -0.356$, $P < 0.001$), breads and rice cakes ($\rho = -0.308$, $P < 0.001$), sugar and sweets ($\rho = -0.296$, $P < 0.001$), and milk and dairy products ($\rho = -0.237$, $P < 0.001$, not shown in Table).

3. Behavioral beliefs by stages of change groups

The ANCOVA results accounting for general characteristics showed that the total score for behavioral beliefs regarding the outcomes of sugar intake (15 items, possible score: 15–75) had a mean of 39.5, corresponding to 52.7 out of 100 (Table 3). The pre-action group had a significantly higher total behavioral beliefs score (mean: 42.2) than the action group (mean: 37.2), indicating more favorable perceptions toward sugary beverages/snacks consumption in the pre-action group ($P < 0.001$). At the subscale level, scores for beliefs regarding advantages of consuming sugary beverages/snacks (nine items, possible score: 9–45) were significantly higher in the pre-action group (mean: 30.6) than in the action group (mean: 26.9, $P < 0.001$). In contrast, the action group agreed more on the disadvantages of consuming sugary beverages/snacks (six items, possible score: 6–30)

Table 2. Consumption frequency of sugary foods by the stages of change in reducing sugar intake

Variables	Total (n = 380)	Stages of change		*P*-value[1]
		Pre-action group (n = 172)	Action group (n = 208)	
Beverages (7 items)[2]	8.5 ± 9.5[3]	12.2 ± 10.7	5.4 ± 7.1	< 0.001
Milk and dairy products (6 items)	6.3 ± 7.9	8.9 ± 10.3	4.2 ± 4.2	< 0.001
Frozen desserts and snacks (3 items)	3.9 ± 5.1	5.9 ± 6.1	2.2 ± 3.4	< 0.001
Breads and rice cakes (3 items)	2.7 ± 5.5	3.9 ± 6.0	1.8 ± 5.0	< 0.001
Sugars and sweets (3 items)	2.7 ± 4.1	4.2 ± 5.3	1.5 ± 1.9	< 0.001
Sauce (1 item)	1.4 ± 2.0	1.6 ± 2.3	1.2 ± 1.7	0.031
Total (23 items)	25.4 ± 25.8	36.7 ± 30.4	16.1 ± 16.1	< 0.001

Mean ± SD.
[1]By analysis of covariance (ANCOVA), adjusted for sex, age, BMI, and occupation.
[2]The consumption frequency of each food item was measured using nine response categories from "never" to "more than three times per day."
[3]Summated consumption frequency of sugary foods in each food group per week.

https://doi.org/10.5720/kjcn.2026.00024

Table 3. Behavioral beliefs regarding sugar intake of participants by the stages of change in reducing sugar intake

Variables	Total (n = 380)	Stages of change		*P*-value[1]
		Pre-action group (n = 172)	Action group (n = 208)	
If I consume sugary beverages/snacks				
1. It will taste good[2]	3.5 ± 1.1	3.8 ± 1.0	3.3 ± 1.1	< 0.001
2. It will quench my thirst (e.g., carbonated beverages, sports drinks, fruit juices, etc.)	2.5 ± 1.3	2.8 ± 1.2	2.3 ± 1.2	< 0.001
3. It will be convenient to eat	3.3 ± 1.2	3.7 ± 1.0	2.9 ± 1.2	< 0.001
4. It will help relieve my anxiety and stress	3.4 ± 1.1	3.6 ± 1.1	3.3 ± 1.1	0.007
5. It will make me feel better	3.6 ± 1.1	3.7 ± 1.1	3.5 ± 1.0	0.018
6. It will increase my efficiency when I study or work	3.3 ± 1.1	3.5 ± 1.0	3.1 ± 1.1	< 0.001
7. It will cost less than other beverages and snacks	2.7 ± 1.3	3.0 ± 1.3	2.4 ± 1.2	< 0.001
8. It will provide carbohydrates and energy	3.2 ± 1.2	3.3 ± 1.2	3.2 ± 1.2	0.418
9. Variety of menu options will be available	3.1 ± 1.2	3.4 ± 1.2	3.0 ± 1.2	0.002
10. Tooth decay will occur	4.1 ± 1.0	4.0 ± 1.0	4.1 ± 1.1	0.235
11. I will gain weight	4.5 ± 0.8	4.4 ± 0.9	4.6 ± 0.8	0.005
12. The risk of developing diseases (e.g., diabetes mellitus, heart disease) will increase	4.5 ± 0.8	4.4 ± 0.8	4.6 ± 0.7	0.005
13. My skin condition will deteriorate	4.1 ± 0.9	3.9 ± 1.0	4.2 ± 0.9	0.003
14. My meal patterns will become irregular	3.9 ± 1.0	3.8 ± 1.0	4.0 ± 1.0	0.065
15. My nutrient intakes will become imbalanced	4.1 ± 0.8	4.0 ± 0.9	4.2 ± 0.8	0.014
Beliefs regarding advantages of consuming sugary beverages/snacks[3]	28.6 ± 7.0	30.6 ± 6.9	26.9 ± 6.6	< 0.001
Beliefs regarding disadvantages of consuming sugary beverages/snacks[4]	25.1 ± 4.0	24.4 ± 4.2	25.7 ± 3.7	0.002
Total behavioral beliefs score[5]	39.5 ± 7.4	42.2 ± 6.5	37.2 ± 7.4	< 0.001

Mean ± SD.
[1]By ANCOVA, adjusted for sex, age, BMI, and occupation.
[2]Each item was measured by five-point scale from "strongly disagree" (1) to "strongly agree" (5).
[3]Subscale score for nine items (Items 1–9), possible score: 9–45. Higher scores indicated stronger agreement with the advantages of consuming sugary beverages/snacks.
[4]Subscale score for six items (Items 10–15), possible score: 6–30. Higher scores indicated stronger agreement with the disadvantages of consuming sugary beverages/snacks.
[5]Total score for 15 items, possible score: 15–75. The items assessing disadvantages were scored in reverse. Higher scores indicated more favorable beliefs about consuming sugary beverages/snacks.

than the pre-action group ($P = 0.002$).

Specifically, compared with the action group, the pre-action group agreed significantly more with the advantage items, such as "convenience" ($P < 0.001$), "cost less than other beverages and snacks" ($P < 0.001$), "quenching thirst" ($P < 0.001$), "taste" ($P < 0.001$), "increasing efficiency in study/work" ($P < 0.001$), "variety of menu options" ($P = 0.002$), "relieving anxiety and stress" ($P = 0.007$), and "feeling better" ($P = 0.018$). Conversely, the action group agreed significantly more with the disadvantage items, including "deteriorating skin condition" ($P = 0.003$), "gaining weight" ($P = 0.005$), "risk of developing diseases" ($P = 0.005$), and "imbalanced nutrient intakes" ($P = 0.014$).

4. Subjective norms by stages of change groups

The mean subjective norms score, accounting for differences in the number of applicable referents across participants (possible score: 1–25), was 10.4, on average (Table 4). After accounting for general characteristics, the pre-action group reported a significantly higher mean subjective norms score (11.1) than the action group (9.9), indicating stronger perceived social influence from significant others to reduce sugar intake ($P = 0.004$). At each item level, significant differences between the pre-action and action groups were found for

Table 4. Subjective norms regarding sugar intake of participants by the stages of change in reducing sugar intake

Variables	Total		Stages of change				*P*-value[1]
			Pre-action group		Action group		
Normative belief X motivation to comply[2]							
1. Parents	363[3]	10.8 ± 5.7	169	11.8 ± 6.0	194	10.0 ± 5.4	0.001
2. Siblings	337	9.4 ± 5.8	152	10.0 ± 5.5	185	8.9 ± 5.9	0.055
3. Spouse/partner	285	9.8 ± 5.9	118	10.7 ± 6.2	167	9.1 ± 5.6	0.007
4. Children	169	9.0 ± 5.8	78	10.7 ± 6.4	91	7.6 ± 4.8	< 0.001
5. Friends/co-workers	353	8.8 ± 5.2	162	9.5 ± 5.3	191	8.3 ± 5.1	0.010
6. Experts (doctors, nutritionists, etc.)	333	11.6 ± 6.3	144	12.5 ± 6.4	189	10.9 ± 6.1	0.012
7. Mass media (television, social media, internet articles, etc.)	354	11.7 ± 6.3	160	12.3 ± 6.4	194	11.2 ± 6.2	0.079
Mean subjective norms score[4]	380	10.4 ± 4.9	172	11.1 ± 5.1	208	9.9 ± 4.7	0.004

Mean ± SD.
[1]By ANCOVA, adjusted for sex, age, BMI, and occupation.
[2]Possible score per item: 1–25. Scores were calculated by multiplying each normative belief score (from "strongly disagree" (1) to "strongly agree" (5)) by corresponding motivation to comply score (from "not at all" (1) to "very much" (5)). Responses marked as "not applicable" were excluded from item-level calculations.
[3]Number of participants included in the analysis for each item, excluding responses marked as "not applicable" for either normative belief or motivation to comply.
[4]Possible score: 1–25. The mean subjective norms score reflect the overall influence of significant others, accounting for the differences in the number of applicable items across participants. For each participant, the sum of item scores was divided by the number of completed items, excluding "not applicable" referents from both numerator and denominator. Higher scores indicated greater perceived influence from significant others.

children ($P < 0.001$), parents ($P = 0.001$), spouse/partner ($P = 0.007$), friends/co-workers ($P = 0.010$), and experts ($P = 0.012$). The pre-action group scored significantly higher on these items than did the action group, suggesting a greater influence of these significant others on reducing sugar intake.

5. Control beliefs by stages of change group

The mean total score for control beliefs related to reducing sugar intake (15 items, possible score: 15–75) was 48.2, equivalent to 64.3 out of 100 after adjusting for general characteristics (Table 5). The action group had a significantly higher total control beliefs score than the pre-action group (51.8 vs. 43.9, $P < 0.001$). Regarding the subscales, the action group scored significantly higher on the subscale about situations promoting sugar intake (mean: 12.7 vs. 11.1, $P < 0.001$) and lower on the subscale related to lack of knowledge and skills ($P < 0.001$) and the subscale regarding facilitating factors for sugar intake ($P < 0.001$). These results indicated that participants in the action group perceived greater confidence in their ability to control sugar intake across all three subscales.

Significant differences were found between the two groups for all 15 control belief items. Specifically, the action group agreed significantly less with items reflecting barriers such as "lack of nutrition knowledge" (i.e., sugar content in food, reading nutrition labels, $P < 0.001$), "lack of cooking skills for making tasty low-sugar snacks" ($P = 0.003$), and "lack of information on places that sell low-sugar beverages/snacks" ($P = 0.011$), suggesting stronger control beliefs in knowledge and skills reducing sugar intake in the action group. Compared with the pre-action group, the action group showed less agreement with difficulty in reducing sugar intake because of facilitating factors, such as "convenience" ($P < 0.001$), "tasting good" ($P < 0.001$), "easy availability" ($P < 0.001$), "relatively inexpensive" ($P < 0.001$), and "lack of time for grocery shopping or cooking" ($P < 0.001$), indicating stronger control beliefs over facilitating factors of sugar intake in the action group. Consistently, in situations promoting sugar intake, such as "choosing beverages/snacks at cafes or restaurants" ($P < 0.001$), "exposure to advertisements for sugary beverages/snacks in the media" ($P < 0.001$), "when others consume sugary beverages/snacks" ($P < 0.001$), and "when I feel anxious or stressed" ($P = 0.011$), the action group showed significantly higher control beliefs than the

https://doi.org/10.5720/kjcn.2026.00024

Table 5. Control beliefs regarding sugar intake of participants by the stages of change in reducing sugar intake

Variables	Total (n = 380)	Stages of change		*P*-value[1]
		Pre-action group (n = 172)	Action group (n = 208)	
It is difficult to reduce the intake of sugary beverages/snacks because of...				
1. Lack of nutrition knowledge, such as the sugar content in foods[2]	2.3 ± 1.1	2.6 ± 1.2	2.0 ± 1.0	< 0.001
2. Lack of knowledge in reading and interpreting nutrition labels when purchasing processed foods	2.2 ± 1.2	2.6 ± 1.3	2.0 ± 1.1	< 0.001
3. Lack of cooking skills for making tasty low-sugar snacks	2.7 ± 1.3	2.9 ± 1.3	2.5 ± 1.3	0.003
4. The size of beverages (sweetened coffee, carbonated drinks, etc.) is large	2.5 ± 1.3	2.8 ± 1.3	2.2 ± 1.1	< 0.001
5. Lack of information on places that sell low-sugar beverages/snacks	2.5 ± 1.3	2.6 ± 1.3	2.3 ± 1.3	0.011
6. There are many sugary beverages/snacks at home	2.6 ± 1.3	3.0 ± 1.3	2.3 ± 1.2	< 0.001
7. Sugary beverages/snacks taste good	3.2 ± 1.3	3.6 ± 1.2	2.9 ± 1.2	< 0.001
8. Sugary beverages/snacks are easily available	3.2 ± 1.3	3.5 ± 1.2	2.9 ± 1.3	< 0.001
9. Convenience (easy to prepare, carry and consume on the go)	3.1 ± 1.3	3.5 ± 1.2	2.7 ± 1.3	< 0.001
10. Sugary beverages/snacks are relatively inexpensive	2.7 ± 1.2	3.0 ± 1.2	2.5 ± 1.2	< 0.001
11. Lack of time for grocery shopping or cooking	2.8 ± 1.3	3.1 ± 1.3	2.6 ± 1.3	< 0.001
12. Exposure to advertisements for sugary beverages/snacks in the media	2.7 ± 1.3	3.0 ± 1.3	2.5 ± 1.2	< 0.001
How difficult or easy is it to refrain from consuming sugary beverages/snacks in the following situations?				
13. When I feel anxious or stressed	2.8 ± 1.1	2.7 ± 1.1	2.9 ± 1.1	0.011
14. When others (family members, friends) consume sugary beverages/snacks	2.9 ± 1.2	2.7 ± 1.2	3.1 ± 1.2	< 0.001
15. When I choose beverages/snacks at cafes or restaurants	3.0 ± 1.2	2.7 ± 1.2	3.2 ± 1.2	< 0.001
Control beliefs about lack of knowledge and skills[3]	14.8 ± 5.8	16.5 ± 6.1	13.4 ± 5.0	< 0.001
Control beliefs about facilitating factors of sugar intake[4]	14.9 ± 5.2	16.6 ± 4.8	13.5 ± 5.2	< 0.001
Control beliefs about situations promoting sugar intake[5]	12.0 ± 3.7	11.1 ± 3.8	12.7 ± 3.5	< 0.001
Total control beliefs score[6]	48.2 ± 12.6	43.9 ± 12.6	51.8 ± 11.4	< 0.001

Mean ± SD.
[1]By ANCOVA, adjusted for sex, age, BMI, and occupation.
[2]Items were measured by five-point scales from "strongly disagree" (1) to "strongly agree" (5), or from "very difficult" (1) to "very easy" (5).
[3]Subscale score for six items (Items 1–6), possible score: 6–30. Higher scores indicated greater agreement with insufficient knowledge and skills regarding sugar intake.
[4]Subscale score for five items (Items 7–11), possible score: 5–25. Higher scores indicated lower control beliefs regarding factors facilitating sugar intake.
[5]Subscale score for four items (Items 12–15), possible score: 4–20. Item 12 was scored in reverse to calculate the subscale score. Higher scores indicated stronger control beliefs in situations promoting sugar intake.
[6]Total score for 15 items; possible score: 15–75. Items 1–12 were scored in reverse. Higher scores indicated stronger control beliefs regarding sugar intake.

pre-action group (Table 5).

6. Relationship between the five stages of change in reducing sugar intake and study variables

The relationship between SOC in reducing sugar intake and the variables at the total score level is presented in Table 6. ANCOVA showed that the five SOC in reducing sugar intake were significantly related to behavioral beliefs ($P < 0.001$), control beliefs ($P < 0.001$), and the mean of subjective norms ($P < 0.001$). A significant linear trend was observed between SOC and behavioral beliefs (P for trend < 0.001), with behavioral beliefs score decreasing from the contemplation to the maintenance stages, indicating progressively less favorable beliefs about sugar consumption according to SOC. The SOC in reducing sugar intake also revealed a significant linear trend with control beliefs (P for trend < 0.001), with control beliefs score increasing from the contem-

Table 6. Factors related to the stages of change in reducing sugar intake at the total score level of variables

Variables	Stages of change					*P*-value[1]	*P* for trend[2]
	Precontemplation (n = 39)	Contemplation (n = 72)	Preparation (n = 61)	Action (n = 96)	Maintenance (n = 112)		
Behavioral beliefs[3]	41.8 ± 6.9	42.4 ± 6.9	42.3 ± 5.9	38.1 ± 7.1	36.5 ± 7.6	< 0.001	< 0.001
Mean of subjective norms[4]	7.8 ± 3.9	11.3 ± 4.5	13.1 ± 5.3	10.8 ± 4.1	9.1 ± 5.0	< 0.001	0.275
Control beliefs[5]	48.6 ± 14.9	40.5 ± 11.4	45.0 ± 11.5	49.1 ± 9.8	54.1 ± 12.1	< 0.001	< 0.001

Mean ± SD.
[1]By ANCOVA, adjusted for sex, age, BMI, and occupation.
[2]By one-way ANOVA with linear contrast.
[3]Total score for 15 items; possible score: 15–75. The items assessing disadvantages were scored in reverse. Higher scores indicated more favorable beliefs about consuming sugary beverages/snacks.
[4]Possible score: 1–25. The mean subjective norms score reflect the overall influence of significant others, accounting for the differences in the number of applicable items across participants. For each participant, the sum of item scores was divided by the number of completed items, excluding "not applicable" referents from both numerator and denominator. Higher scores indicated greater perceived influence from significant others.
[5]Total score for 15 items; possible score: 15–75. Items 1–12 were scored in reverse. Higher scores indicated stronger control beliefs regarding sugar intake.

Table 7. Factors related to the stages of change in reducing sugar intake at the subscale score level of variables

Variables	Stages of change					*P*-value[1]	*P* for trend[2]
	Precontemplation (n = 39)	Contemplation (n = 72)	Preparation (n = 61)	Action (n = 96)	Maintenance (n = 112)		
Beliefs regarding advantages of consuming sugary beverages/snacks[3]	28.6 ± 7.7	31.6 ± 6.5	30.9 ± 6.6	27.6 ± 6.0	26.3 ± 7.0	< 0.001	0.001
Beliefs regarding disadvantages of consuming sugary beverages/snacks[4]	22.7 ± 5.1	25.2 ± 3.7	24.5 ± 3.7	25.5 ± 3.0	25.8 ± 4.3	< 0.001	< 0.001
Mean of subjective norms[5]	7.8 ± 3.9	11.3 ± 4.5	13.1 ± 5.3	10.8 ± 4.1	9.1 ± 5.0	< 0.001	0.275
Control beliefs about lack of knowledge and skills[6]	14.8 ± 6.1	17.7 ± 6.1	16.2 ± 6.0	14.8 ± 4.6	12.2 ± 5.1	< 0.001	< 0.001
Control beliefs about facilitating factors of sugar intake[7]	15.2 ± 5.8	17.8 ± 4.2	16.2 ± 4.6	14.5 ± 4.6	12.7 ± 5.5	< 0.001	< 0.001
Control beliefs about situations promoting sugar intake[8]	12.6 ± 4.5	9.9 ± 3.6	11.4 ± 3.1	12.4 ± 3.4	13.0 ± 3.6	< 0.001	0.031

Mean ± SD.
[1]By ANCOVA, adjusted for sex, age, BMI, and occupation.
[2]By one-way ANOVA with linear contrast.
[3]Subscale score for nine items, possible score: 9–45. Higher scores indicated stronger agreement with the advantages of consuming sugary beverages/snacks.
[4]Subscale score for six items, possible score: 6–30. Higher scores indicated stronger agreement with the disadvantages of consuming sugary beverages/snacks.
[5]Possible score: 1–25. The mean subjective norms score reflect the overall influence of significant others, accounting for the differences in the number of applicable items across participants. For each participant, the sum of item scores was divided by the number of completed items, excluding "not applicable" referents from both numerator and denominator. Higher scores indicated greater perceived influence from significant others.
[6]Subscale score for six items, possible score: 6–30. Higher scores indicated greater agreement with insufficient knowledge and skills regarding sugar intake.
[7]Subscale score for five items, possible score: 5–25. Higher scores indicated lower control beliefs regarding factors facilitating sugar intake.
[8]Subscale score for four items, possible score: 4–20. Item 12 was scored in reverse to calculate the subscale score. Higher scores indicated stronger control beliefs in situations promoting sugar intake.

https://doi.org/10.5720/kjcn.2026.00024

plation to the maintenance stage, suggesting greater perceived control over reducing sugar intake across the SOC. However, no significant linear trend was observed between the five SOC and the mean of subjective norms (P for trend = 0.275, Table 6).

At the subscale level (Table 7), the ANCOVA results indicated that the five SOC in reducing sugar intake were significantly associated with all subscales examined, including two subscales of behavioral beliefs, one subscale of subjective norms, and three subscales of control beliefs ($P < 0.001$, respectively). A significant linear trend was identified between the SOC in reducing sugar intake and beliefs regarding advantages (P for trend = 0.001) and disadvantages of consuming sugary beverages/snacks (P for trend < 0.001), control beliefs about lack of knowledge and skills (P for trend < 0.001), control beliefs about facilitating factors of sugar intake (P for trend < 0.001), and control beliefs about situations promoting sugar intake (P for trend = 0.031).

DISCUSSION

In this study, 73.9% of participants were females. Although recruitment was conducted through online communities open to both males and females and sites restricted to females were excluded, the higher proportion of females may reflect their greater use of regional online communities. Approximately 54.7% of the participants were classified into the action group, including those in the action and maintenance stages. A similar pattern was observed in a study examining sugar-sweetened beverage (SSB) consumption among college students, in which the maintenance stage (35.1%) accounted for the largest proportion and the pre-contemplation stage (13.0%) represented the smallest proportion [27]. In contrast, a study of female college students reported that the pre-contemplation stage for sugar intake reduction (44.1%) was the most prevalent [19]. This finding differs from that of the present study, in which only 10.3% of participants were classified in the pre-contemplation stage. Such differences might be partly attributable to differences in participant characteristics (e.g., age distribution) or the timing of data collection. For example, increased public awareness of health and nutrition in recent years may have contributed to greater motivation and readiness to reduce sugar intake among the participants in the present study.

Participants in the action group reported a significantly lower consumption frequency of sugary foods across all examined food categories than those in the pre-action group. In addition, a higher SOC for reducing sugar intake was inversely correlated with the reported consumption frequency of sugary foods. These findings suggest the validity of the SOC-based classification in reflecting differences in actual sugar intake behaviors. However, no significant differences in body weight or BMI were observed between the two groups. This may be partly attributable to the assessment of sugar intake based on consumption frequency rather than the actual intake amount (e.g., grams or kcal). Despite the use of reference serving sizes, frequency-based measures may not fully reflect the total sugar or energy intake. However, this finding should not be interpreted to indicate that reducing the frequency of sugar-containing food consumption lacks health benefits. Body weight and BMI are influenced by multiple factors (e.g., energy intake, physical activity, and dietary patterns), and a reduction in sugar intake alone may not produce detectable anthropometric changes, particularly in a cross-sectional study.

Both the pre-action and action groups exhibited relatively high consumption frequency of beverages and dairy products, indicating that these food categories are major contributors to sugar intake regardless of SOC group. These results are consistent with those of previous studies [5, 24, 28]. Analysis of the 2019–2021 KNHANES data reported that beverages accounted for approximately 30% of the total sugar intake among adults aged 19–34 years and 24% among those aged 35–49 years [5]. Similarly, an analysis of the 2016–2018 KNHANES data found that nearly half of the daily sugar intake among adults aged 19–49 years was derived from ultra-processed foods, including SSB, sweetened milk products, cookies and snacks [24]. These findings suggest that nutrition education focusing on reducing the consumption of SSB, sweet bakery products, and snacks may be effective in lowering sugar intake in adults.

There were clear differences between the SOC groups in terms of their perceptions of outcomes associated with sugar intake. Compared to the action group, par-

ticipants in the pre-action group viewed the advantages of sugar consumption, such as convenience, low cost, quenching thirst, and taste, more favorably. In contrast, the pre-action group agreed less with the perceived disadvantages of sugar intake such as skin deterioration, weight gain, increased risk of diseases, and nutritional imbalance. Trend analysis further demonstrated a significant linear trend in behavioral beliefs across the five SOC regarding reducing sugar intake, suggesting an association between SOC and individual beliefs about the outcomes of sugar consumption.

Consistent with our study, commonly cited advantages of consuming SSB included taste, energy provision, low cost, and hydration, whereas perceived disadvantages included high sugar content, excessive intake of caffeine, and disease risk in focus group interviews with U.S. adults [22]. However, a study with adults reported some differences in perceptions (e.g., lack of palatability when reducing sugar intake) across sugary food consumption groups, whereas some perceptions (e.g., disease prevention, such as obesity and diabetes mellitus) did not differ significantly between the groups [20], partly supporting the present results. In addition, a study among college students identified perceptions of behavioral outcomes as a key factor in distinguishing SOC groups in adequate sodium intake [29]. Taken together, these findings indicate that behavioral beliefs play an important role in distinguishing the SOC in sugar reduction. Accordingly, nutrition education for the pre-action group may aim to attenuate favorable perceptions of sugar intake by introducing healthy food and beverage alternatives that fulfill similar functions, such as ease of consumption, quenching thirst, and taste. It is also necessary to emphasize both the short- and long-term negative consequences of excessive sugar intake, such as tooth decay, deterioration of diet quality, and increased risk of chronic diseases.

With respect to subjective norms, the pre-action group perceived more pressure to reduce sugar intake from significant others, including children, parents, spouse/partner, friends/co-workers, and experts, than the action group. This finding may reflect greater concern among the surrounding individuals who perceive the participant's sugar consumption to be relatively high or problematic. Similarly, Kassem *et al.* [21] identified parents and friends as key social referents influencing carbonated beverage consumption among female adolescents, with parents exerting a strong influence on adolescent behavior. Riebl *et al.* [9] reported that subjective norms play a substantial role in adolescent SSB intake. In addition, a previous study reported that individuals in the pre-action stage experienced greater pressure from others to consume adequate levels of sodium [29]. However, the linear trend analysis in the present study did not reveal a significant progression in subjective norms score across the five SOC. Thus, the influence of subjective norms on reducing sugar intake was relatively limited.

The findings regarding control beliefs indicate that those in the action group perceived greater confidence in their ability to control sugar intake. These results are consistent with those of previous studies that emphasized perceived behavioral control as a key determinant of SSB consumption and other nutrition behavior [8, 9, 30]. Lima *et al.* [31] also reported that higher self-efficacy for healthy dietary behaviors was related to lower odds of SSB consumption, supporting the importance of self-efficacy in sugar intake behaviors.

More specifically, the action group agreed significantly less on items addressing the perceived lack of knowledge and skills for reducing sugar intake, compared with the pre-action group. This finding suggests that sufficient nutrition knowledge and practical skills may help overcome the perceived barriers to reducing sugar intake. Thus, nutrition education that focuses on building concrete skills related to sugar intake reduction and increasing nutrition knowledge may be relevant in supporting one's perception of control over reducing sugar intake. Similarly, Choi & Kim [19] showed that individuals in the pre-contemplation stage of sugar intake reduction exhibited lower nutrition knowledge and poorer sugar-related eating behaviors than those in the action or maintenance stages. Following the mobile-based intervention, significant improvements in nutrition knowledge and favorable behavior changes regarding sugar intake reduction were noted across all SOC groups [19].

Factors facilitating sugar intake, including convenience, taste, ease of access, low cost, and limited time for grocery shopping or cooking, were also identified

https://doi.org/10.5720/kjcn.2026.00024

as important barriers to reducing sugar intake. In addition, participants in the action group reported greater control in situations that promoted sugar intake such as eating out, exposure to advertisements for sugary foods, social contexts, and emotional stress. Similarly, another study found that adults with higher sugar intake exhibited lower self-efficacy for avoiding sweet foods in high-risk situations [20], whereas those in the action stage demonstrated greater confidence in adopting alternative behaviors and managing recommended dietary behaviors across various situations than those in the pre-action stage [29]. Therefore, nutrition education may benefit from focusing on coping methods to deal with the factors or situations that promote sugar intake. Nutrition education might include guidance on choosing or preparing tasty low-sugar snacks, providing information on affordable low-sugar beverages/snacks, and skill building for preparing snacks through hands-on training or online program. An individualized approach can help identify barriers that lead to excessive sugar intake and develop strategies to address these factors.

Although a significant linear trend was observed for behavioral beliefs and control beliefs across the SOC, the precontemplation stage did not follow the same pattern observed from the contemplation to maintenance stages. This finding differs from that of a previous study that reported a clear and consistent linear trend across TPB constructs according to food literacy levels [12]. In the present study, scores for behavioral beliefs or control beliefs in the pre-contemplation stage were positioned between those in the preparation and action stages. This finding suggests that psychosocial changes related to sugar intake reduction may become more apparent after individuals begin to consider behavior changes.

Limitations

This study had some limitations. The participants were adults aged 19–49 years residing in Seoul, and 73.9% of them were females. Thus, the findings may not be generalizable to populations with different age and sex distributions, or to those with distinct geographic or sociodemographic characteristics. Although the consumption frequency questionnaire included a reference serving size to assist with more accurate responses, the extent to which the participants correctly recognized the serving size could not be confirmed. In addition, the cross-sectional design precludes causal inferences between SOC and study variables. Therefore, future studies need to include more diverse demographics, incorporate visual aids (e.g., portion size images) into food frequency questionnaires, quantify sugar intake, if possible, and employ longitudinal study designs to better examine the factors related to sugar reduction behaviors.

Conclusion

This study indicated that participants differed meaningfully in behavioral beliefs, control beliefs, and subjective norms related to sugar intake reduction across SOC, highlighting the necessity for nutrition education and counseling tailored to SOC. For the pre-action group, educational approaches should emphasize weakening favorable perceptions of sugar intake by offering healthy alternatives and practical recipes while strengthening awareness of the negative consequences of excessive sugar intake. Improving knowledge and practical skills, along with training on how to cope with factors or situations that promote sugar intake, are essential for enhancing the perception of control over sugar intake reduction. Support from family members and significant others may further facilitate the motivation for change. Strategies for the action group should focus on reinforcing and sustaining healthy behaviors related to sugar intake.

CONFLICT OF INTEREST

There are no financial or other issues that might lead to conflict of interest.

FUNDING

This work was supported by a research grant from Seoul Women's University (2025-0250).

ACKNOWLEDGEMENTS

We are grateful to the participants of this study.

DATA AVAILABILITY

The study participants did not provide written consent for their data to be shared publicly. Due to the sensitive nature of this research, supporting data are not available.

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Korean J Community Nutr. 2026 Feb;31(1):36-49
https://doi.org/10.5720/kjcn.2025.00332
eISSN 2951-3146

KJCN
Korean Journal of Community Nutrition

Research Article

Impact of a foodservice establishment manager's willingness to perform duties on hygiene management levels and the mediating effects of extrinsic motivations: a cross-sectional study

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Received: November 5, 2025
Revised: December 11, 2025
Accepted: January 21, 2026

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Objectives: Consumer demand is growing for more rigorous hygiene management within foodservice establishments. The aim of this study was to provide customized data specific to each foodservice establishment, thereby informing policy formulation to improve hygiene management levels.

Methods: We surveyed 310 managers of directly managed foodservice establishments (excluding franchises) that were subject to hygiene inspections by the Chungbuk Provincial Office in Korea between September 1 and 27, 2023. Additionally, 30 investigators trained in methods for evaluating the hygiene management levels of foodservice establishments objectively assessed 310 establishments using evaluation sheets. All 310 managers provided consent and personally completed the questionnaires. Data from 277 managers were included in the analysis. General characteristics were analyzed with descriptive statistics in IBM SPSS Statistics 28 (IBM Corp.). Univariate normality verification, measurement model verification, structural model verification, and mediation effect significance analysis were conducted using R's lavaan package (version 4.3.2.).

Results: Managers' willingness to perform duties had a positive influence on hygiene management level (0.224), enthusiasm for hygiene (0.661), awareness of hygiene compliance (0.616), mandatory perception of the system (0.568), trust in local governments (0.406), and attention to consumers (0.558). In the relationship between managers' willingness to perform duties and hygiene management level, mandatory perception of the system had a negative mediating effect (–0.223), while trust in local governments had a positive mediating effect (0.264).

Conclusion: Structural equation modeling was used to identify the complex pathways by which foodservice establishment managers' willingness to perform duties, mediated by their human factors, influences their hygiene management level. Accordingly, policy implications were presented, suggesting that the hygiene management level of foodservice establishments could be enhanced by increasing managers' willingness to perform their duties, and that a shift from mandatory regulations by local governments to support-oriented systems that foster trust in local governments is necessary.

Keywords: foodservice; willingness to perform duties; trust in local governments; hygiene management levels; mediating effects

INTRODUCTION

The daily dining-out rate among Korean adults (once or more per day), which reached its highest level at 33.5% in 2018, decreased to 23.8% in 2021 owing to the impact of the COVID-19 pandemic, before rising again to 24.8% in 2023. Consequently, the number of food poisoning incidents in restaurants increased from 119 cases in 2021 to 200 cases in 2023, leading to growing consumer demand for more rigorous hygiene management in these establishments [1-3].

Local governments, which are responsible for the hygiene management of restaurants within their jurisdiction, conduct hygiene inspections and provide hygiene education for restaurant managers in accordance with the Food Sanitation Act [4, 5]. Furthermore, since 2017, a hygiene grade certification system has been implemented to objectively evaluate the hygiene management levels of restaurants [6]. Although these local government policies have contributed to enhancing hygiene management in restaurants [7], food poisoning incidents have continued to rise alongside increasing dining-out rates. Therefore, a clear need has arisen for adaptable and customized policies that consider managers' human factors to ensure effective on-site restaurant hygiene management [8].

Motivation, a human factor, can be intrinsic or extrinsic, and restaurant hygiene management levels are known to vary depending on how these motivations—individually or interactively—influence managers [9-15]. Intrinsic motivation refers to the willingness to perform duties, defined as a manager's willingness to diligently carry out duties even in the absence of external rewards or punishments [9-12].

On the other hand, extrinsic motivation encompasses enthusiasm for hygiene, awareness of hygiene compliance, mandatory perception of the system, trust in local governments, and attention to consumers. Enthusiasm for hygiene signifies a manager's belief that hygiene is an important factor that should be proactively managed [16]. Awareness of hygiene compliance refers to managers' efforts to prevent food poisoning by adhering to hygiene-related laws and guidelines, such as the Food Sanitation Act [17, 18]. Mandatory perception of the system involves managers recognizing and striving to fulfill their responsibilities and obligations under hygiene-related guidelines [19]. Trust in local governments implies transparent and fair communication between authorities and managers, fostering positive acceptance of local government policies [20-22]. Attention to consumers refers to managers' efforts to meet the hygiene standards expected by customers [23-29].

Previous research, rather than specifically considering these human factors of managers, mostly focused on control-oriented policies to elevate hygiene management levels, or involved analyzing the importance and performance of kitchen hygiene management, the knowledge and attitudes of food handlers, managers' leadership, and employees' job engagement as determinants of hygiene management levels [7, 15, 19, 29-31]. Consequently, there is a shortage of research on how managers' human factors interact to determine the level of hygiene management in restaurants.

Furthermore, previous surveys of restaurants managers or employees often evaluated the hygiene management level of restaurants through self-reporting [30]. As it is difficult to ensure objectivity in a self-reported evaluation of hygiene management levels, overestimation or underestimation by managers or employees may occur. The shortcomings of self-reported data can be compensated for by using trained investigators to objectively assess the hygiene management level of restaurants on-site [31].

Verification of the complex multiple mediating effects involving managers' human factors and hygiene management levels assessed by trained investigators can be effectively analyzed using structural equation modeling (SEM), thereby enhancing the reliability of research findings [32]. Accordingly, this study was conducted using SEM to examine how restaurant managers' willingness to perform duties is linked with their enthusiasm for hygiene, awareness of hygiene compliance, mandatory perception of the system, trust in local governments, and attention to consumers, in order to determine hygiene management levels. Through this analysis, we aimed to clarify the multiple mediating effects and provide applicable data to each foodservice establishment, thereby informing policy formulation to improve hygiene management levels.

METHODS

Ethics statement

Written informed consent was obtained from each participant. The study protocol was approved by the Institutional Review Board (IRB) of Chungbuk National University (IRB No. CBNU-202307-HR-0169).

1. Study design

This cross-sectional study was conducted and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement, available at https://www.strobe-statement.org/.

2. Participants

Considering average total daily revenue and seating capacity, we surveyed 310 managers of directly managed foodservice establishments (excluding franchises) that were registered as general restaurants and were subject to hygiene inspections by the Chungbuk, Korea Provincial Office from September 1 to 27, 2023. The sample size for this study exceeded 200, meeting the minimum requirement for SEM [33]. Prior to the survey, the study's purpose was explained to the foodservice establishment managers to obtain their consent. Among them, 310 managers provided consent and personally completed the questionnaires.

Additionally, 30 trained investigators, trained in methods for evaluating hygiene management in foodservice establishments, objectively assessed 310 foodservice establishments using evaluation sheets. Data from 277 managers (analysis rate: 89.35%) were included in the analysis, while 33 responses were excluded owing to inadequacy.

3. Variables and measurement

The questionnaires used in this study were supplemented and revised with reference to previous studies [34-36]. They were divided into (1) a questionnaire to be completed directly by a foodservice establishment manager and (2) a hygiene management level evaluation sheet to be completed by a trained investigator. The manager questionnaire comprised items on general characteristics (9 items), willingness to perform duties (8 items), enthusiasm for hygiene (5 items), awareness of hygiene compliance (4 items), mandatory perception of the system (6 items), trust in local governments (5 items), and attention to consumers (5 items). Responses in the latter six categories were measured using a 5-point Likert scale (1 = Not at all, 2 = Not really, 3 = Average, 4 = Somewhat, 5 = Very much so). The hygiene management level evaluation sheet, completed by trained investigators, comprised 64 items: basic hygiene management (9 items), dining area hygiene management (7 items), kitchen hygiene management (45 items), and culinary employees hygiene management (3 items). These were assessed using a binary scale (0 = No, 1 = Yes).

Item parceling was conducted through factor analysis (Table 1). Willingness to perform duties, enthusiasm for hygiene, awareness of hygiene compliance, mandatory perception of the system, trust in local governments, and attention to consumers were configured as latent variables, while hygiene management level was treated as an observed variable. Item parceling followed the item-to-construct balance method [37], which equitably allocates observed variables across latent variables, such that each latent variable comprised three observed variables. Specifically, item parceling was performed by sequentially grouping observed variables with high and low factor loadings within each item, resulting in each latent variable being newly composed of three observed variables. Individual items measuring the same latent variable were grouped into three balanced observed variables through item parceling, based on their respective factor loadings [38, 39]. All factor loadings met the threshold of 0.3 or higher, thereby confirming that the latent variable was unidimensional and adequate [37, 40]. Through item parceling, model complexity was reduced and the stability of parameter estimates was secured.

For each latent variable, three observed variables were constructed: *willingness to perform duties* consisted of willingness to perform duties 1–3; *enthusiasm for hygiene* consisted of enthusiasm for hygiene 1–3; *awareness of hygiene compliance* consisted of awareness of hygiene compliance 1–3; *mandatory perception of the system* consisted of mandatory perception of the system 1–3; *trust in local governments* consisted of trust in local governments 1–3; and *attention to consumers* consisted of attention to consumers 1–3. In each case, observed

https://doi.org/10.5720/kjcn.2025.00332

Table 1. Factor analysis on the willingness to perform duties and extrinsic motivation variables

Item (item parceling)	Factor loading	Cronbach's alpha
Willingness to perform duties		0.914
Willingness to perform duties 1		
Foodservice establishments operation and management tasks energize me	0.86	
I believe foodservice establishments operation and management tasks are challenging	0.65	
Willingness to perform duties 2		
When performing foodservice establishments operation and management tasks, I feel mentally strong	0.84	
I am confident in foodservice establishments operation and management tasks	0.70	
When performing foodservice establishments operation and management tasks, I have the ability to solve problems	0.77	
Willingness to perform duties 3		
When performing foodservice establishments operation and management tasks, I pour all my energy into it	0.80	
When performing foodservice establishments operation and management tasks, time passes quickly for me	0.72	
When performing foodservice establishments operation and management tasks, I forget everything except the work	0.74	
Enthusiasm for hygiene		0.816
Enthusiasm for hygiene 1		
I well understand the purpose and necessity of hygiene management	0.86	
I am participating in or intend to participate in the hygiene grade certification system	0.38	
Enthusiasm for hygiene 2		
I strive to adhere to hygiene-related guidelines	0.85	
I know the purpose and qualifications of the hygiene grade certification system	0.63	
Enthusiasm for hygiene 3		
I am confident in hygiene management	0.73	
Awareness of hygiene compliance		0.920
Awareness of hygiene compliance 1		
I strive to comply with recommended, not just mandatory, hygiene-related rules	0.90	
I well understand the purpose and guidelines of food hygiene-related laws	0.79	
Awareness of hygiene compliance 2		
I comply with the relevant laws not only during inspection periods but also on a regular basis	0.88	
Awareness of hygiene compliance 3		
I comply with hygiene-related laws	0.87	
Mandatory perception of the system		0.914
Mandatory perception of the system 1		
I adhere better to hygiene-related guidelines due to the reward and punishment system (certification system or administrative disposition)	0.86	
I adhere better to hygiene-related guidelines due to consumer evaluations via SNS	0.74	
Mandatory perception of the system 2		
I adhere better to hygiene-related guidelines due to complaint reports to local governments	0.84	
I adhere better to hygiene-related guidelines due to local governments' hygiene inspection system.	0.74	
Mandatory perception of the system 3		
I adhere better to hygiene-related guidelines due to the introduction of the hygiene grade certification system	0.83	
I adhere better to hygiene-related guidelines due to hygiene education by the local government	0.77	
Trust in local governments		0.917
Trust in local governments 1		
I believe local governments' hygiene-related policies are useful	0.90	

(Continued to the next page)

Table 1. Continued

Item (item parceling)	Factor loading	Cronbach's alpha
When hygiene issues arise between consumers and establishments, local governments provide neutral and objective resolutions	0.77	
Trust in local governments 2		
Local governments propose appropriate solutions for hygiene-related problems	0.85	
I believe hygiene-related support provided by local governments helps with foodservice establishments hygiene management	0.79	
Trust in local governments 3		
Local governments provide the necessary information (changes in hygiene-related laws, guidelines, etc.).	0.84	
Attention to consumers		0.910
Attention to consumers 1		
I believe consumers will provide positive and active feedback if food is hygienic	0.87	
I believe consumers will feel assured about foodservice establishments hygiene due to participation of the foodservice establishments in the hygiene grade certification system	0.72	
Attention to consumers 2		
I believe consumer satisfaction will improve if food is hygienic	0.86	
I believe loyal consumers will increase and sales will improve if food is hygienic	0.82	
Attention to consumers 3		
I believe consumers will revisit through immediate and satisfactory resolution of hygiene-related complaints	0.83	

variables classified as Group 1 consisted of the survey items.

An analysis was conducted to determine whether the three constructed observed variables effectively assessed each latent variable. The resulting Cronbach's alpha coefficients for internal consistency reliability were 0.914 for willingness to perform duties, 0.816 for enthusiasm for hygiene, 0.920 for awareness of hygiene compliance, 0.914 for mandatory perception of the system, 0.917 for trust in local governments, and 0.910 for attention to consumers. All coefficients met the threshold of 0.7 or higher, thereby securing internal consistency.

4. Univariate normality verification

Because parameters were estimated using the maximum likelihood estimation method, the skewness and kurtosis of the variables measuring foodservice establishment managers' human factors were examined to confirm the assumption of a normal distribution for the observed variables [41]. The three observed variables for willingness to perform duties (skewness –0.035, –0.246, –0.279; kurtosis –0.607, –0.658, –0.221), enthusiasm for hygiene (skewness –0.276, –0.587, –0.477; kurtosis –0.210, 0.516, 0.412), awareness of hygiene compliance (skewness –0.265, –0.193, –0.382; kurtosis –0.191, –0.256, 0.106), mandatory perception of the system (skewness –0.120, –0.274, –0.188; kurtosis –0.035, 0.426, –0.238), trust in local governments (skewness –0.430, –0.436, –0.566; kurtosis 0.312, 0.216, 0.578), and attention to consumers (skewness –0.148, 0.235, –0.075; kurtosis –0.483, –0.487, –0.227) were all measured on a 5-point Likert scale. The skewness and kurtosis of each observed variable fell within the standard ranges [33] of –3 < skewness < 3 and –10 < kurtosis < 10, indicating univariate normality.

5. Statistical analysis

Statistical analyses were conducted using IBM SPSS Statistics 28 (IBM Corp.) and the lavaan package in R (version 4.3.2.). General characteristics were analyzed using descriptive statistics in SPSS. Univariate normality verification, measurement model verification, structural model verification, and mediation effect significance analysis were conducted using R's lavaan package [38].

Maximum likelihood estimation was used for parameter estimation. Univariate normality was confirmed by calculating the skewness and kurtosis for each observed variable created through item parceling [42]. Subsequently, a two-step approach was applied, involving measurement model verification followed by structural

https://doi.org/10.5720/kjcn.2025.00332

model verification [43]. The fit of the measurement model and structural model was confirmed using the comparative fit index (CFI), Tucker-Lewis index (TLI), and root mean square error of approximation (RMSEA). The criteria for fit indices were set at CFI and TLI ≥ 0.9 and RMSEA ≤ 0.08 [44]. The significance of the mediating effects of mandatory perception of the system and trust in local governments was verified using a bootstrap analysis. The significance level for all analyses was set at $P < 0.05$.

RESULTS

1. General characteristics

As shown in Table 2, of the 277 participants, 102 (36.80%) were male and 175 (63.20%) were female. Regarding age distribution, respondents in their 50s accounted for the largest group (32.50%, n = 90), followed by those aged 60 years or older (28.20%, n = 78), those in their 40s (25.20%, n = 70), those in their 30s (11.20%, n = 31), and those in their 20s (2.90%, n = 8). The average number of employees was 2.25, the average number of customers per day was 41.02, and the average total daily revenue was 586,928 KRW.

2. Dependence of foodservice establishment manager's human factor scores hygiene management levels

Table 3 presents a comparison of the results of comparing the scores of foodservice establishment managers' human factor scores across two groups categorized by hygiene management level. Human factors can be divided into intrinsic, such as willingness to perform duties, and extrinsic motivation, such as enthusiasm for hygiene, awareness of hygiene compliance, mandatory perception of the system, trust in local governments, and attention to consumers. Hygiene management level assessment comprised 64 items: basic hygiene management (9 items), dining area hygiene management (7 items), kitchen hygiene management (45 items), and culinary employees hygiene management (3 items). The maximum score was 64 points and an average of 55.85 points. Group 1 consisted of establishments with hygiene management levels below the average, while Group 2 comprised establishments with levels above the average.

Group 1 scored significantly higher than Group 2 on the following observed variables: willingness to perform duties 1 ($P < 0.001$), enthusiasm for hygiene 1 ($P < 0.001$), awareness of hygiene compliance 1 ($P = 0.004$), mandatory perception of the system 1 ($P < 0.001$), trust in local governments 1 ($P = 0.007$), and attention to consumers 1 ($P < 0.001$). The group with higher hygiene management levels generally had higher scores for most of the foodservice establishment managers' human factors.

3. Measurement model verification

Table 4 presents the factor loadings, average variance extracted (AVE), and composite reliability (CR) for each observed variable related to foodservice establishment managers' human factors. Table 5 lists the square root of the AVE values and correlation coefficients for each latent variable. As a two-step approach involving verification of the measurement model before using the structural model, the fit of the measurement model was first confirmed. Subsequently, the factor loadings of each observed variable were examined to ascertain the degree to which they accurately measured their respective latent variables.

Additionally, AVE was evaluated to confirm whether the observed variables constituting each latent variable

Table 2. General characteristics of the respondents (n = 277)

Characteristics	Value
Sex	
Male	102 (36.80)
Female	175 (63.20)
Age (year)	
20–29	8 (2.90)
30–39	31 (11.20)
40–49	70 (25.20)
50–59	90 (32.50)
≥ 60	78 (28.20)
No. of employees	2.25 ± 1.34
No. of customers (daily)	41.02 ± 30.52
Total revenue per seat (KRW/day)	
< 20	465,794 ± 270,726
20–49	566,496 ± 451,758
≥ 50	916,170 ± 614,794
Total revenue per seat (KRW/day)	586,928 ± 453,530

n (%) or Mean ± SD.

Table 3. Dependence of foodservice establishment manager's human factor scores hygiene management levels

Observed variables	Group 1 (n = 123)[1)]	Group 2 (n = 154)[2)]	*P*-value
Willingness to perform duties 1	3.32 ± 0.70	3.83 ± 0.76	< 0.001
Willingness to perform duties 2	3.50 ± 0.82	3.95 ± 0.77	< 0.001
Willingness to perform duties 3	3.66 ± 0.81	3.99 ± 0.78	< 0.001
Enthusiasm for hygiene 1	3.64 ± 0.69	3.96 ± 0.70	< 0.001
Enthusiasm for hygiene 2	3.71 ± 0.79	3.97 ± 0.75	0.004
Enthusiasm for hygiene 3	3.72 ± 0.69	3.99 ± 0.79	0.004
Awareness of hygiene compliance 1	3.28 ± 0.79	3.50 ± 0.93	0.035
Awareness of hygiene compliance 2	3.41 ± 0.77	3.61 ± 0.85	0.053
Awareness of hygiene compliance 3	3.23 ± 0.83	3.61 ± 0.94	< 0.001
Mandatory perception of the system 1	3.27 ± 0.71	3.64 ± 0.82	< 0.001
Mandatory perception of the system 2	3.40 ± 0.72	3.75 ± 0.81	< 0.001
Mandatory perception of the system 3	3.33 ± 0.83	3.73 ± 0.83	< 0.001
Trust in local governments 1	3.65 ± 0.67	3.89 ± 0.81	0.007
Trust in local governments 2	3.74 ± 0.65	3.94 ± 0.81	0.020
Trust in local governments 3	3.74 ± 0.70	3.91 ± 0.86	0.078
Attention to consumers 1	3.26 ± 0.84	3.73 ± 0.82	< 0.001
Attention to consumers 2	3.50 ± 0.64	3.90 ± 0.70	< 0.001
Attention to consumers 3	3.56 ± 0.66	3.89 ± 0.73	< 0.001

Mean ± SD.
The 5-point Likert scale (1 = not at all, 2 = not really, 3 = average, 4 = somewhat, 5 = very much so).
[1)]Group 1, group with lower than average score of the hygiene management levels.
[2)]Group 2, group with upper than average score of the hygiene management levels.

Table 4. Measurement model verification on the willingness to perform duties and extrinsic motivation variables

Latent variables	Observed variables	B	SE	β	AVE	CR
Willingness to perform duties	Willingness to perform duties 1	1.000		0.829	0.750	0.899
	Willingness to perform duties 2	0.923***	0.048	0.934		
	Willingness to perform duties 3	0.861***	0.050	0.850		
Enthusiasm for hygiene	Enthusiasm for hygiene 1	1.000		0.822	0.669	0.867
	Enthusiasm for hygiene 2	1.150***	0.068	0.886		
	Enthusiasm for hygiene 3	0.938***	0.070	0.737		
Awareness of hygiene compliance	Awareness of hygiene compliance 1	1.000		0.951	0.792	0.918
	Awareness of hygiene compliance 2	0.973***	0.045	0.849		
	Awareness of hygiene compliance 3	0.982***	0.042	0.875		
Mandatory perception of the system	Mandatory perception of the system 1	1.000		0.917	0.794	0.923
	Mandatory perception of the system 2	0.953***	0.038	0.933		
	Mandatory perception of the system 3	0.940***	0.048	0.830		
Trust in local governments	Trust in local governments 1	1.000		0.878	0.752	0.900
	Trust in local governments 2	1.005***	0.052	0.888		
	Trust in local governments 3	1.029***	0.058	0.841		
Attention to consumers	Attention to consumers 1	1.000		0.866	0.777	0.915
	Attention to consumers 2	1.078***	0.049	0.951		
	Attention to consumers 3	1.002***	0.056	0.830		
Conformance criteria analysis result		χ^2/df = 309.166/120, *P* < 0.001 , CFI = 0.956, TLI = 0.944, RMSEA = 0.075				

B, unstandardized coefficient; SE, standard error; β, standardized coefficient; AVE, average variance extracted; CR, composite reliability; df, degrees of freedom; CFI, comparative fit index; TLI, Tucker-Lewis index; RMSEA, root mean square error of approximation.
***$P < 0.001$.

https://doi.org/10.5720/kjcn.2025.00332

Table 5. Results of discriminant validity on the extrinsic motivation variables

Latent variables	Latent variable correlations				
	Enthusiasm for hygiene	Awareness of hygiene compliance	Mandatory perception of the system	Trust in local governments	Attention to consumers
Enthusiasm for hygiene	0.818[1)]				
Awareness of hygiene compliance	0.668	0.89			
Mandatory perception of the system	0.369	0.401	0.891		
Trust in local governments	0.424	0.444	0.451	0.867	
Attention to consumers	0.436	0.395	0.404	0.455	0.881

[1)]The square root of the average variance extracted for each latent variable was confirmed to verify whether the latent variables were distinct from each other.

Table 6. Structural coefficient and significance of structural model on the willingness to perform duties, extrinsic motivation variables, and hygiene management levels

Path	B	SE	β	t
Willingness to perform duties → Hygiene management levels	1.834	0.653	0.244	2.808**
Willingness to perform duties → Enthusiasm for hygiene	0.591	0.058	0.661	10.145***
Willingness to perform duties → Awareness of hygiene compliance	0.586	0.056	0.616	10.453***
Willingness to perform duties → Mandatory perception of the system	0.642	0.069	0.568	9.324***
Willingness to perform duties → Trust in local governments	0.397	0.063	0.406	6.307***
Willingness to perform duties → Attention to consumers	0.516	0.058	0.558	8.910***
Enthusiasm for hygiene → Hygiene management levels	1.674	1.087	0.199	1.540
Awareness of hygiene compliance → Hygiene management levels	0.332	0.901	0.042	0.369
Mandatory perception of the system → Hygiene management levels	−1.485	0.569	−0.223	−2.607**
Trust in local governments → Hygiene management levels	2.031	0.632	0.264	3.212**
Attention to consumers → Hygiene management levels	−0.743	0.702	−0.091	−1.058
Conformance criteria analysis result	χ^2/df = 314.025/132, P < 0.001, CFI = 0.958, TLI = 0.945, RMSEA = 0.071			

B, unstandardized coefficient; SE, standard error; β, standardized coefficient; t, t-statistic; df, degrees of freedom; CFI, comparative fit index; TLI, Tucker-Lewis index; RMSEA, root mean square error of approximation.
**P < 0.01, ***P < 0.001.

were significantly correlated [45]. CR was examined to confirm the reliability of the observed variables [46]. The square root of the AVE for each latent variable was confirmed to verify whether the latent variables were distinct from each other [47].

The fit of the measurement model was appropriate, with χ^2 = 309.166, df = 120, P < 0.001, CFI = 0.956, TLI = 0.944 (both CFI and TLI ≥ 0.9), and RMSEA = 0.075 (≤ 0.08). The factor loadings of the observed variables ranged from 0.737 to 0.951, all exceeding 0.7 and being statistically significant (P < 0.001), indicating that the observed variables adequately captured their respective latent variables [48].

The AVE values for the latent variables ranged from 0.669 to 0.794, all exceeding the 0.5 threshold and demonstrating convergent validity [48]. CR values ranged from 0.867 to 0.923, exceeding the 0.7 threshold and ensuring internal consistency [49]. The square root of the AVE for the latent variables (willingness to perform duties, enthusiasm for hygiene, awareness of hygiene compliance, mandatory perception of the system, trust in local governments, and attention to consumers) ranged from 0.818 to 0.891. These values exceeded the inter-construct correlation coefficients (0.369–0.668), indicating discriminant validity [49].

4. Structural model verification

Table 6 presents the structural coefficients and significance of the structural model, which examined the relationships among foodservice establishment manag-

ers' willingness to perform their duties, enthusiasm for hygiene, awareness of hygiene compliance, mandatory perception of the system, trust in local governments, attention to consumers, and hygiene management level.

The structural model demonstrated a good fit, with $\chi^2 = 314.025$, df = 132, $P < 0.001$, CFI = 0.958, TLI = 0.945 (both CFI and TLI ≥ 0.9), and RMSEA = 0.071 (≤ 0.08). An increase of 1 point in willingness to perform duties was associated with an increase of 0.244 points in hygiene management level, 0.661 points in enthusiasm for hygiene, 0.616 points in awareness of hygiene compliance, 0.568 points in mandatory perception of the system, 0.406 points in trust in local governments, and 0.558 points in attention to consumers. These results confirmed that higher willingness to perform duties led to higher hygiene management levels, enthusiasm for hygiene, awareness of hygiene compliance, mandatory perception of the system, trust in local governments, and attention to consumers.

When enthusiasm for hygiene, awareness of hygiene compliance, trust in local governments, and attention to consumers were controlled, a 1-point increase in mandatory perception of the system was associated with a 0.223-point decrease in hygiene management level. Thus, a higher mandatory perception of the system was associated with a lower hygiene management level.

When enthusiasm for hygiene, awareness of hygiene compliance, mandatory perception of the system, and attention to consumers were controlled, a 1-point increase in trust in local governments was associated with a 0.264-point increase in hygiene management level. Thus, a greater degree of trust in local governments led to a higher hygiene management level.

5. Significance of mediating effect of structural model

Table 7 presents the results of the mediation analysis between foodservice establishment managers' human factors and hygiene management level. Fig. 1 illustrates the mediation model, allowing for an intuitive understanding of both the direction and strength of the mediating effects. To verify the mediating effects of mandatory perception of the system and trust in local governments in the relationship between foodservice establishment managers' willingness to perform duties and hygiene management level, a bootstrap analysis with 1,000 resamples was conducted.

In this relationship, the mediating effect of mandatory perception of the system was statistically significant, as the 95% confidence interval did not include zero (B = –0.953, 95% CI = –1.696 to –0.148). Mandatory perception of the system had a negative (–) mediating effect in the relationship between willingness to perform duties and hygiene management level. For managers with high willingness to perform duties, a lower mandatory perception of the system can further enhance hygiene management levels.

Furthermore, the mediating effect of trust in local governments was statistically significant, as the 95% confidence interval excluded zero (B = 0.807, 95% CI = 0.372–1.435). Trust in local governments had a positive mediating effect in the relationship between willingness to perform duties and hygiene management level. For managers with high willingness to perform duties, enhancing their trust in local governments can further improve hygiene management levels.

DISCUSSION

In this study, SEM was used to identify the complex

Table 7. Significance of the mediating effect of structural model on willingness to perform duties, extrinsic motivation variables, and hygiene management levels

Path	B	SE	95% Confidence interval (bias-corrected bootstrap)	
			Lower	Upper
Willingness to perform duties → Mandatory perception of the system → Hygiene management levels	–0.953	0.386	–1.696	–0.148
Willingness to perform duties → Trust in local governments → Hygiene management levels	0.807	0.269	0.372	1.435

B, unstandardized coefficient; SE, standard error.

https://doi.org/10.5720/kjcn.2025.00332

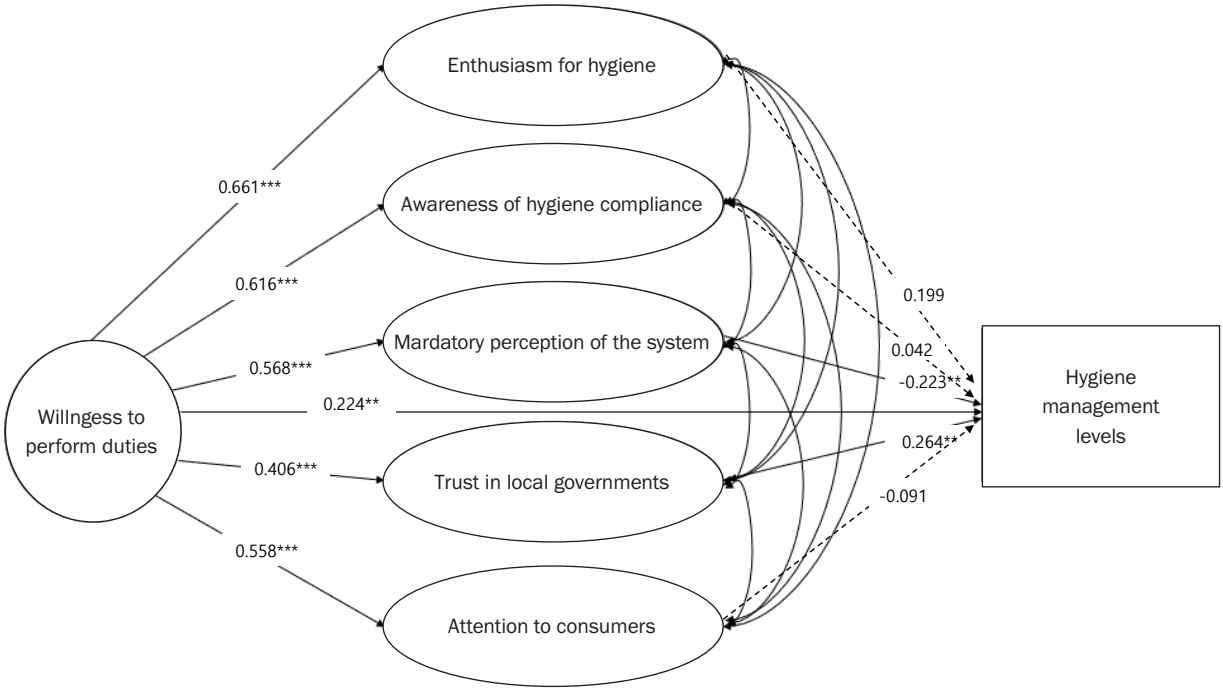

Fig. 1. Mediating model of enthusiasm for hygiene, awareness of hygiene compliance, mandatory perception of the system, trust in local governments, attention to consumers in a relation to willingness to perform duties and hygiene management levels. $^{**}P < 0.01$, $^{***}P < 0.001$.

pathways by which foodservice establishment managers' willingness to perform duties—mediated by their enthusiasm for hygiene, awareness of hygiene compliance, mandatory perception of the system, trust in local governments, and attention to consumers—translates into actual behavior in hygiene management levels. The study was conducted with the aim of providing customized data for individual foodservice establishments to inform policy development for improving hygiene management levels. To enhance research objectivity, assessment of hygiene management was carried out by trained investigators. The significance of this study lies in its approach to managers' human factors through motivation theory, distinguishing between intrinsic and extrinsic motivations, and systematically verifying the multiple mediating effects of extrinsic motivations on the relationship between intrinsic motivation and hygiene management level using SEM.

The results indicated that managers' willingness to perform duties had a positive influence on hygiene management level (0.224), enthusiasm for hygiene (0.661), awareness of hygiene compliance (0.616), mandatory perception of the system (0.568), trust in local governments (0.406), and attention to consumers (0.558). In the relationship between managers' willingness to perform duties and hygiene management level, mandatory perception of the system had a negative mediating effect (–0.223), while trust in local governments had a positive (+) mediating effect (0.264). Although not statistically significant, enthusiasm for hygiene (0.042) and awareness of hygiene compliance (0.091) had positive effects.

The finding that managers' willingness to perform duties directly and positively influences hygiene management levels is consistent with previous studies showing that managers' willingness to perform their duties affects their performance [50, 51]. It also aligns with prior research indicating that managers' human factors influence the operational methods or performance of foodservice establishments [13, 14]. Therefore, our study verified that managers' willingness to perform duties plays a crucial role in enhancing hygiene management levels. Hygiene management levels can be improved by implementing educational programs designed to en-

hance willingness to perform duties.

The finding that mandatory perception of the system negatively mediates the relationship between managers' willingness to perform duties and hygiene management level is similar to that of previous research, which suggested that policies that provide information on technology, rather than those that impose administrative regulations on businesses, are more beneficial for business development [52]. These results indicate that excessive legal regulations or administrative coercion by local governments on foodservice establishments may lower their hygiene management levels.

Conversely, the finding that trust in local governments positively mediates the relationship between managers' willingness to perform duties and hygiene management level is consistent with that of previous studies, which indicated that transparent and fair communication from local governments encourages managers to positively accept local government policies [20-22]. Our findings are also similar to those of prior research that the quality of administrative services contributes to increasing managers' trust in local governments [53]. Therefore, increasing trust in local governments may contribute to improved hygiene management levels in foodservice establishments.

The finding that managers' enthusiasm for hygiene and awareness of hygiene compliance did not significantly influence hygiene management levels is consistent with that of prior research [50]. On the other hand, the result indicating that managers' enthusiasm for hygiene and awareness of hygiene compliance had a positive effect on hygiene management levels was similar to those of previous studies [7, 17].

The present study showed that hygiene management compliance rates in foodservice establishments exceeded 80%, similar to a previous finding of 70% or higher [8]. This suggests that hygiene management levels in Korean foodservice establishments are relatively high. However, considering the increasing number of food poisoning incidents in restaurants [2], it is necessary to seek policy measures to genuinely improve hygiene management levels, rather than simply making absolute comparisons based solely on compliance rates.

Local governments should shift their policy direction from mandatory regulations and rules concerning hygiene in foodservice establishments to providing customized administrative services. These services can be centered on training specialized personnel for hygiene management, offering budget support, administrative guidance, and consulting [53-58].

Moreover, when hygiene-related issues arise in foodservice establishments, local governments should offer neutral and objective solutions to managers. Changes to hygiene-related laws and guidelines should be communicated promptly, as this increase managers' trust in local governments and ultimately enhance hygiene management levels [57, 58]. Providing individualized, customized hygiene education that considers managers' human factors, rather than implementing generalized and unilateral hygiene education, may be a more practical and effective approach to improving hygiene management levels of foodservice establishments [59].

Limitations

The limitations of this study are as follows. First, this study included individuals from Chungbuk, Korea; thus, an in-depth analysis that can be generalized nationwide may be more meaningful. Second, although various personal traits of foodservice establishment managers were analyzed, it would be more appropriate to include in future studies factors such as managers' foodservice establishment operation experience or educational background.

Conclusion

This study was conducted using SEM to identify the complex pathways by which foodservice establishment managers' willingness to perform duties—mediated by their enthusiasm for hygiene, awareness of hygiene compliance, mandatory perception of the system, trust in local governments, and attention to consumers—influences their hygiene management level. Accordingly, policy implications were presented, suggesting that the hygiene management level of foodservice establishments could be enhanced by increasing managers' willingness to perform their duties, and that a shift from mandatory regulations by local governments to support-oriented systems that foster trust in local governments is necessary. Future research focused on developing administrative service models related to hygiene

https://doi.org/10.5720/kjcn.2025.00332

for foodservice establishment managers by local governments and evaluates the effectiveness of customized hygiene education would contribute more practically to improving the hygiene management level of foodservice establishments and promoting public health.

CONFLICT OF INTEREST

There are no financial or other issues that might lead to conflicts of interest.

FUNDING

None.

DATA AVAILABILITY

Research data is available upon request to the corresponding author.

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Korean J Community Nutr. 2026 Feb;31(1):50-63
https://doi.org/10.5720/kjcn.2026.00017
eISSN 2951-3146

KJCN
Korean Journal of Community Nutrition

Research Article

Understanding the drivers of continuance intention in online grocery shopping using technology continuance theory: a cross-national comparison

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Received: January 13, 2026
Revised: February 12, 2026
Accepted: February 24, 2026

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Objectives: This study examined the determinants of consumers' continuance intention (CI) toward online grocery shopping (OGS) across different country markets. Drawing on technology continuance theory (TCT), this study compared key drivers of CI in a different countries market.

Methods: Data were collected via online surveys from 638 OGS users in China (n = 338) and South Korea (n = 300) between November and December 2023. A TCT-based model incorporating satisfaction, attitude, perceived usefulness (PU), perceived ease of use, confirmation, and CI was tested using partial least squares structural equation modeling. Partial measurement invariance testing was conducted to ensure valid cross-national comparison.

Results: In South Korea, both satisfaction and attitude significantly predicted CI, with satisfaction exerting a particularly strong effect. In China, attitude was the primary determinant of CI, whereas satisfaction had minimal impact. Across both countries, PU consistently and positively influenced satisfaction and attitude, thereby indirectly enhancing CI. Partial measurement invariance was confirmed, validating comparisons of the model across contexts.

Conclusion: The findings suggest that the drivers of online grocery continuance differ by cross-national market. In Korean markets, strategies must enhance customer satisfaction (and its influence on attitude) to sustain OGS usage. In Chinese markets, fostering favorable consumer attitudes toward OGS is essential for promoting continued use. This cross-national analysis advances the theoretical understanding of continuance behavior while providing practical guidance for designing market-specific strategies to sustain online grocery engagement.

Keywords: online systems; intention; cross-cultural comparison

INTRODUCTION

Amid the ongoing digital transformation of retail, online grocery shopping (OGS) is rapidly growing worldwide [1]. For example, the global online retail market has surpassed USD 6 trillion in annual sales, with OGS accounting for approximately USD 145 billion globally [2, 3]. However, OGS adoption still lags in many regions. In China, approximately 10% of grocery sales occur online, whereas in

South Korea the figure is about 25%, despite strong digital infrastructure [4, 5]. Notably, initial adoption of OGS does not guarantee continued use or sustained business success [6]. Prior research suggests that factors such as the lack of tactile product information—particularly for fresh and perishable foods—can undermine decision-making in online grocery environments and drive some consumers back to physical stores [7, 8]. These issues underscore the need to identify what motivates consumers to continue shopping for groceries online after their initial experience. Given that groceries constitute essential components of daily diets, understanding continuance in OGS is not only a retail concern but also relevant to how consumers secure regular access to fresh and perishable foods through digital channels. In this sense, OGS functions not only as a digital retail channel, but also as a mediated food environment that shapes consumers' access to food, especially fresh and perishable products central to daily diets.

Beyond its retail implications, the role of OGS must also be understood within the broader literature on food security and diet quality. Food security is closely associated with consistent access to nutritious foods, particularly fresh and perishable items that form the basis of healthy dietary patterns. Prior research demonstrates that food insecurity is linked to poorer diet quality, lower fruit and vegetable intake, and constrained food purchasing strategies driven by perceived risk and resource limitations [9, 10]. As digital food retail platforms expand, online grocery services increasingly function as alternative access points within the food environment, with the potential to either mitigate or exacerbate disparities in food access depending on infrastructure, affordability, and digital literacy [11, 12]. In this context, continuance intention (CI) in OGS becomes particularly salient: sustained platform use may contribute to stable and routine access to diverse food products, whereas discontinuance may reinforce reliance on geographically constrained physical outlets. Thus, examining the drivers of OGS continuance is not only important for technology adoption theory but also relevant to understanding how digital channels become embedded in everyday food provisioning systems and potentially influence dietary stability across different market contexts.

Furthermore, continuance behavior may vary significantly by market context, yet most prior studies have focused on single-country settings, overlooking cross-market differences [13-15]. In grocery retail, such contextual variation is particularly salient, as repeat use decisions are closely tied to consumers' accumulated experience in everyday consumption. Because food acquisition is a routine and necessity-driven behavior, differences in digital food infrastructure and consumer confidence may shape how online platforms are integrated into household food provisioning practices. In China, consumers have historically been cautious about purchasing perishable groceries online due to perceived quality risks, which may discourage repeat use [16, 17]. In contrast, the South Korean market adopted OGS technology earlier, with continuance driven by factors such as technological adaptability, user experience, and service quality, alongside challenges related to system complexity and usability [18-23]. These contrasts suggest that the drivers of OGS continuance are unlikely to be universal, underscoring the value of cross-national investigation [24, 25].

In light of these differences, this study compares OGS continuance in China and South Korea to examine how post-adoption mechanisms operate across different market contexts. While the two countries differ in multiple systemic aspects, including cultural and institutional settings, they provide a meaningful contrast in terms of consumers' experience accumulation and the routinization of OGS use. Such routinization is particularly important in the food domain, where stable purchasing channels contribute to consistent food access and potentially influence dietary patterns. Focusing on key post-adoption factors such as satisfaction and attitude, this study investigates whether their roles in shaping CI differ across contexts, thereby offering insights for sustaining long-term consumer engagement in OGS.

To guide our analysis, we adopted the technology continuance theory (TCT) as the theoretical framework. Research on technology-related behaviors has traditionally drawn on the technology acceptance model (TAM), which explains users' initial adoption decisions based on perceived usefulness (PU) and perceived ease of use (PEOU). Although TAM has been widely validated across information systems contexts [14], its primary focus on pre-adoption beliefs limits its ability to explain

post-adoption behavior and CI [24].

To address this limitation, expectation–confirmation–based models, particularly the expectation-confirmation model (ECM), were developed to explain continuance behavior by emphasizing users' post-use evaluations [25]. ECM identifies confirmation of expectations and satisfaction as central determinants of continued use. While this perspective effectively captures short-term evaluative responses, it tends to underemphasize the role of more stable attitudinal judgments that may guide repeated and habitual usage over time [14].

Building on these two theoretical traditions, TCT, originally proposed by Liao *et al.* [26], integrates the cognitive belief structure of TAM with the post-adoption evaluation mechanisms of ECM. By jointly considering PU, confirmation, satisfaction, and attitude, TCT provides a more comprehensive explanation of CI that captures both transient affective responses and more enduring attitudinal evaluations.

This integrative perspective is particularly well suited to the context of OGS. Unlike many technology usage settings, OGS involves technology-mediated interaction embedded in high-frequency, low-involvement, and risk-sensitive consumption decisions, especially for perishable products. Because food purchases are recurrent and essential, post-adoption evaluations may determine whether digital platforms become stable components of consumers' everyday food acquisition systems. In such contexts, CI is shaped not only by immediate post-use satisfaction, but also by stable attitudinal evaluations that guide habitual and routine purchasing behavior [27]. By explicitly distinguishing and jointly modeling satisfaction and attitude, TCT enables a theoretically grounded examination of the mechanisms underlying continued OGS use. However, despite the widespread application of TCT in contexts such as online payments and mobile applications [28-30], its application to online food consumption remains limited, highlighting the need for further empirical investigation.

In summary, this study aims to examine CI in OGS by clarifying the relative roles of satisfaction and attitude across different market contexts and by considering how the inherent "sensory deficit" of online grocery (i.e., the lack of tactile product experience) may influence post-adoption evaluations. The study further seeks to position OGS within the broader digital transformation of food environments by investigating whether sustained platform use is associated with stable access to diverse food products and routine food procurement channels. Through a cross-national comparison between China and South Korea, this research is designed to identify how continuance mechanisms vary across markets and to provide a theoretical basis for understanding long-term engagement in digital grocery services.

METHODS

Ethics statement

This study was approved by the Institutional Review Board (IRB) of Korea National University of Transport (KNUT IRB 2023-07). All participants were required to read a description of the content and purpose of the study prior to the start of the survey and to provide an online consent form.

1. Study design

This study employed a cross-sectional survey design. The STROBE (Strengthening the Reporting of Observational studies in Epidemiology) guidelines were consulted solely as a reporting reference to ensure clarity and transparency in describing the sampling, data collection, and analysis procedures, without implying an epidemiological study design.

2. Sample collection

Data were collected through an online survey conducted between mid-November and early December 2023. In South Korea, respondents were recruited through a market research panel (embrain.com), and quota sampling based on age and gender was applied to ensure basic demographic balance. In China, respondents were recruited via an online questionnaire platform (Tencent questionnaire.com). Given the more dispersed nature of this recruitment approach, strict quota sampling was not imposed; instead, age and gender distributions similar to those of the Korean sample were targeted during data collection to enhance the comparability of cross-national analyses. The survey was conducted in Beijing, Shanghai, and Seoul. These cities are interna-

https://doi.org/10.5720/kjcn.2026.00017

tional megacities with well-developed digital infrastructure and high penetration of OGS services. They also feature diverse consumer populations, which helps to mitigate the potential influence of cultural differences and better reflects leading market conditions in the digital retail sector of each country. In both countries, eligibility criteria required respondents to have purchased groceries online at least once within the past month to ensure recent and relevant usage experience. All questionnaires were screened prior to analysis. Responses were considered invalid and excluded if they were incomplete or if response patterns indicated inattentive or inconsistent answering. After data screening, a total of 338 valid responses from China (response rate 80.29%) and 300 valid responses from South Korea (response rate 100%) were retained for subsequent analysis. A priori power analysis using G*Power ($f^2 = 0.15$, $\alpha = 0.05$, power = 0.80, three predictors) indicated a minimum required sample size of 77, confirming that the final sample (n = 638) was adequate for model testing and multigroup analysis.

3. Hypothesis development and measures

As illustrated in Fig. 1, the proposed model operationalizes TCT by integrating cognitive beliefs and post-adoption evaluations into a unified framework. Rather than relying on a single theoretical perspective, the model simultaneously incorporates belief-based evaluations (e.g., PU and PEOU) and post-use assessments (e.g., confirmation and satisfaction), enabling a comprehensive explanation of CI.

This integrative structure is particularly appropriate for OGS, where repeated, necessity-driven purchasing decisions require both immediate experiential evaluation and more stable attitudinal judgment. In such contexts, continuance behavior may not be sufficiently explained by either short-term satisfaction or pre-adoption beliefs alone.

Consistent with TCT, attitude, satisfaction, and PU are specified as direct antecedents of CI. Attitude reflects an individual's overall evaluative orientation toward OGS and is a recognized driver of continuance [25, 31]. Satisfaction captures users' affective responses to prior usage experiences and is critical for sustained use. Prior research has shown that satisfaction enhances both attitude and CI [26, 32-34], leading to H1–H3.

PU represents users' cognitive evaluation of the extent to which OGS improves shopping efficiency and effectiveness. When users perceive OGS as useful in meeting their shopping needs, they are more likely to form favorable attitudes and experience higher satisfaction, thereby reinforcing continuance [35-37]. Hence, higher PU is expected to promote CI (H4) as well as enhance attitude (H5) and satisfaction (H6).

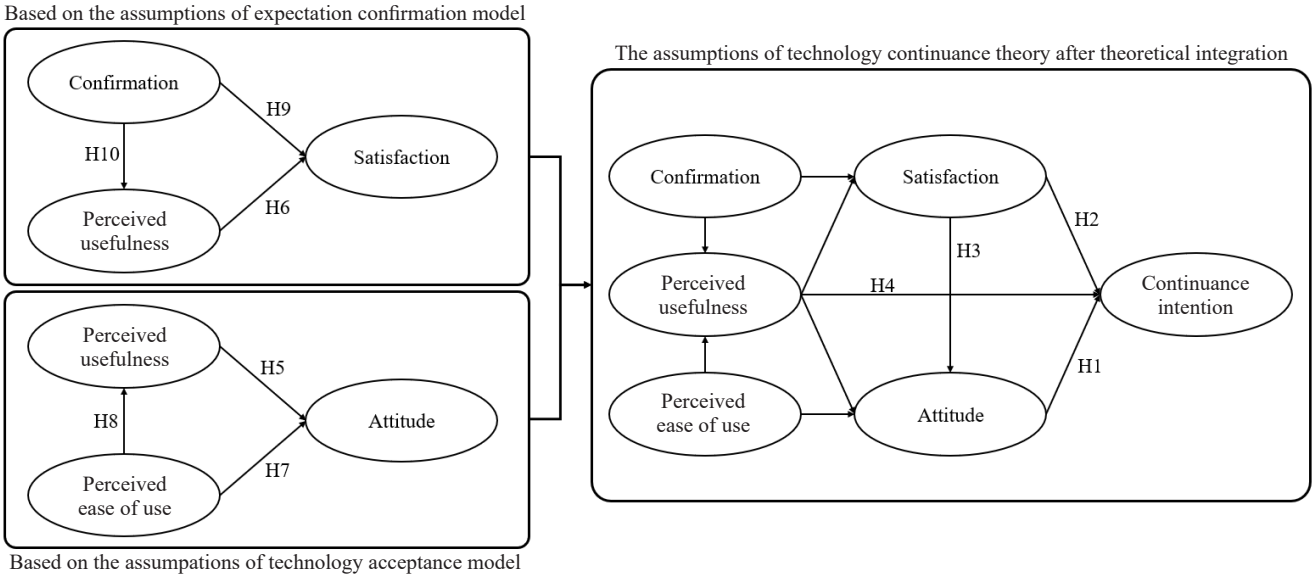

Fig. 1. Research model based on technology continuance theory.

PEOU reflects the effort required to use OGS. Within the integrated framework, PEOU indirectly influences continuance by strengthening PU and shaping evaluative responses. When platforms are intuitive and convenient, users are more likely to perceive them as useful and develop favorable attitudes [38], supporting H7–H8.

Finally, confirmation reflects the degree to which actual usage experiences align with prior expectations and serves as a key post-adoption evaluation mechanism. Confirmation reinforces perceptions of system performance and strengthens both satisfaction and PU [32, 35]. Therefore, higher confirmation is expected to increase satisfaction (H9) and strengthen PU (H10).

To examine the proposed model, we designed a two-part questionnaire. The first part measured continuous OGS behavior, and the second collected demographic information. Following Liao *et al.* [26], the measurement items were adapted to the OGS context. Furthermore, PU and PEOU were assessed with scales from Venkatesh & Davis [39], while confirmation, satisfaction, and CI were measured using items from Bhattacherjee [32]. Attitude was evaluated with four items from Taylor & Todd [40]. All items used a five-point Likert scale. To ensure cross-cultural equivalence, the questionnaire was translated into Chinese and Korean, with back-translation and expert review procedures applied [41]. The reliability of all constructs was assessed using Cronbach's alpha, and the results indicated satisfactory internal consistency for both the Chinese and South Korean samples, with all alpha values exceeding the recommended threshold of 0.70. The full list of measurement items used in the questionnaire is provided in the Appendix for reference.

4. Data analysis

We used IBM SPSS 25.0 (IBM Corp.) for descriptive analysis of demographics and Smart PLS 4.0 (SmartPLS GmbH) to validate the model and hypotheses. partial least squares structural equation modeling (PLS-SEM) supports theory extension and boundary testing by emphasizing explanatory power, the relative importance of structural relationships, and the modeling of complex relationships, and has been widely applied in business and management research [42]. The analysis proceeded in three steps. First, we tested common method bias and measurement invariance to ensure survey validity and cross-national comparability [43, 44]. Second, we evaluated the measurement and structural models following Hair *et al.* [45]. Finally, we applied partial least squares multigroup analysis to examine whether path coefficients differed significantly between China and South Korea [46].

RESULTS

1. Profile of respondents

Table 1 shows the demographic composition of the two samples was largely similar. In China, women were slightly more represented (52.4%), whereas in Korea the gender distribution was exactly balanced. For age, the

Table 1. Sample characteristics

Variables	Chinese sample (n = 338)	South Korean sample (n = 300)	χ^2
Gender			
Men	161 (47.6)	150 (50.0)	0.268
Women	177 (52.4)	150 (50.0)	
Age (year)			
20–29	71 (21.0)	60 (20.0)	7.919
30–39	71 (21.0)	60 (20.0)	
40–49	86 (25.4)	60 (20.0)	
50–59	68 (20.1)	60 (20.0)	
≥ 60	42 (12.4)	60 (20.0)	
Education level			
Junior high school	17 (5.0)	1 (0.3)	13.311***
High school	63 (18.6)	52 (17.3)	
Bachelor's	212 (62.7)	202 (67.3)	
Master's or above	46 (13.6)	45 (15.0)	
Occupation			
Student	13 (3.8)	18 (6.0)	44.671***
Homemaker	10 (3.0)	44 (14.7)	
Office worker	166 (49.1)	134 (44.7)	
Public official	18 (5.3)	9 (3.0)	
Self-employed	23 (6.8)	27 (9.0)	
Specialized worker	23 (6.8)	26 (8.7)	
Service industry	30 (8.9)	22 (7.3)	
Production worker	7 (2.1)	2 (0.7)	
Other	48 (14.2)	18 (6.0)	

n (%).
***$P < 0.001$.

https://doi.org/10.5720/kjcn.2026.00017

Chinese sample showed natural variation across groups, while the Korean sample displayed equal proportions by design, as quota sampling was applied. In both countries, most respondents held a bachelor's degree (64.9% in Korea, 62.7% in China). Regarding occupation, office workers were the largest group in both samples, with homemakers accounting for a higher proportion in Korea (14.7%) than in China (3.0%) (Table 1).

2. Common method bias

To minimize measurement bias, we applied procedural and statistical controls [45]. Procedural controls included adapting and testing questionnaire items, refining ambiguous terms, and considering respondent characteristics. Additionally, Harman's single-factor test showed the first factor explained less than 50% of variance, indicating no significant common method bias. Following Kock's [47] guideline, full collinearity tests yielded variance inflation factor (VIF) values ranging from 1.531 to 2.520 in the Chinese sample and from 1.366 to 2.901 in the South Korean sample, all below the 3.3 threshold. Thus, common method bias was unlikely to affect this study.

3. Measurement invariance analysis

In this study, all samples were measured using identical items and processed following the same analytical procedures, thereby establishing configural invariance. A permutation-based approach was employed to assess compositional invariance by comparing composite score correlations with the 5% quantile of the empirical distribution. The results consistently showed that, for all constructs, the original correlations exceeded the corresponding threshold values, supporting compositional invariance across the Chinese and South Korean samples. Further permutation tests of equality of means and variances did not provide support for full measurement invariance; however, partial measurement invariance was established, which is sufficient for meaningful cross-national comparison of structural path differences. Given that the primary objective of this study lies in comparative analysis rather than pooled estimation, the absence of full invariance does not undermine the validity of the subsequent analyses.

4. Measurement model analysis

Table 2 shows the assessment of measurement quality involved examining internal consistency via Cronbach's alpha and composite reliability, both of which surpassed the 0.70 guideline. In addition, evidence of convergent validity was provided, as the extracted variance for each construct exceeded 0.50, and all indicators loaded strongly on their intended factors.

To assess discriminant validity, we applied the heterotrait–monotrait (HTMT) ratio and the Fornell–Larcker criterion. As shown in Table 3, the square roots of average variance extracted exceeded inter-construct correlations. Table 4 indicates that most HTMTs met the 0.85 and 0.90 criteria, except for satisfaction–confirmation in the Chinese sample and satisfaction–confirmation and satisfaction–attitude in the South Korean sample.

Following the recommendations of Henseler *et al*. [46] and Rippé *et al*. [48], we did not rely solely on fixed HTMT thresholds. Instead, we conducted a bootstrap-based HTMT inference test to statistically assess discriminant validity in Table 5. The confidence intervals of the HTMT values did not include the value of 1, allowing rejection of the null hypothesis of a lack of discriminant validity. Taken together, these results indicate that adequate discriminant validity was established.

5. Structural model analysis

Herein, VIF for both the Chinese and South Korean samples were below 3, signifying the absence of multicollinearity. Subsequently, we used the PLS algorithm to derive the path coefficients and applied the bootstrapping method with 5,000 resampling iterations to obtain their significance. Table 6 and Fig. 2 summarize the path validation results for the Chinese and South Korean samples. In the Chinese sample, the hypothesized link between satisfaction and CI (H2) was not supported, whereas in the South Korean sample, all hypotheses (H1–H10) were validated.

Table 7 presents the results concerning the model's predictive capability. In both the Chinese (56.6%) and South Korean (51.7%) samples, over 50% of the variance in OGS's CI was validated. Furthermore, the results of the blindfolding procedure indicated that Q^2 was greater than 0 for each group. Consequently, the model exhibited predictive relevance for the Chinese and South Ko-

Table 2. Reliability and convergent validity of measurement model

Item	Chinese sample				South Korean sample			
	Outer loading	Cronbach's α	CR	AVE	Outer loading	Cronbach's α	CR	AVE
ATT								
ATT1	0.823	0.848	0.898	0.687	0.843	0.822	0.882	0.653
ATT2	0.868				0.842			
ATT3	0.815				0.750			
ATT4	0.809				0.792			
CI								
CI1	0.847	0.749	0.879	0.709	0.869	0.833	0.900	0.750
CI2	0.836				0.823			
CI3	0.842				0.904			
CON								
CON1	0.830	0.801	0.883	0.715	0.912	0.875	0.923	0.800
CON2	0.855				0.883			
CON3	0.852				0.888			
PEOU								
PEOU1	0.758	0.757	0.846	0.578	0.740	0.739	0.836	0.562
PEOU2	0.749				0.659			
PEOU3	0.755				0.805			
PEOU4	0.778				0.787			
PU								
PU1	0.755	0.790	0.864	0.615	0.728	0.774	0.856	0.602
PU2	0.712				0.610			
PU3	0.840				0.870			
PU4	0.824				0.864			
SAT								
SAT1	0.826	0.875	0.914	0.727	0.881	0.893	0.925	0.756
SAT2	0.849				0.864			
SAT3	0.881				0.878			
SAT4	0.854				0.856			

CR, composite reliability; AVE, average variance extracted; ATT, attitude; CI, continuance intention; CON, confirmation; PEOU, perceived ease of use; PU, perceived usefulness; SAT, satisfaction.

rean samples. Moreover, the f^2 for each group surpassed the minimum threshold of 0.02.

6. Multi-group analysis

The MGA results (Table 8) revealed significant cross-national variations between Chinese and South Korean consumers. Specifically, Chinese consumers exhibited a significantly stronger path coefficient for the relationship between PEOU and PU, suggesting they are more sensitive to functional ease of use. In contrast, South Korean consumers demonstrated significantly stronger effects in the affective and evaluative stages, the impact of Confirmation on Satisfaction and Satisfaction on CI were both notably higher than those of their Chinese counterparts. No statistically significant differences were observed for the remaining structural paths.

DISCUSSION

This study examined CI in OGS, a context characterized by frequent consumption, product perishability, and limited sensory cues in the online environment. Beyond these retail characteristics, OGS also plays an increasingly important role in household food provisioning and digital food distribution systems. Drawing on the TCT, we compared consumers in China and South Korea and

https://doi.org/10.5720/kjcn.2026.00017

found that, while the overall model exhibited strong explanatory power, notable cross-national differences emerged in the relative importance of key post-adoption mechanisms.

These differences should be interpreted in light of broader market contexts rather than attributed to any single factor. Although China and South Korea differ in multiple macro-level aspects, including cultural and institutional settings, the use of a unified theoretical framework and partial measurement invariance testing allows this study to focus on how post-adoption mech-

Table 3. Fornell–Larcker criterion results

Construct	ATT	CI	CON	PEOU	PU	SAT
Chinese sample						
ATT	0.829					
CI	0.722	0.842				
CON	0.678	0.601	0.845			
PEOU	0.640	0.557	0.639	0.760		
PU	0.665	0.633	0.589	0.666	0.784	
South Korean sample						
ATT	0.808					
CI	0.666	0.866				
CON	0.711	0.623	0.895			
PEOU	0.562	0.452	0.517	0.750		
PU	0.644	0.588	0.562	0.508	0.776	
SAT	0.782	0.656	0.856	0.511	0.612	0.870

The diagonal is the square root of AVE.
ATT, attitude; CI, continuance intention; CON, confirmation; PEOU, perceived ease of use; PU, perceived usefulness; SAT, satisfaction.

Table 4. Heterotrait–Monotrait ratio results

Construct	ATT	CI	CON	PEOU	PU	SAT
Chinese sample						
ATT						
CI	0.879					
CON	0.819	0.751				
PEOU	0.795	0.715	0.821			
PU	0.810	0.798	0.735	0.852		
SAT	0.840	0.719	0.940	0.772	0.741	
South Korean sample						
ATT						
CI	0.795					
CON	0.832	0.721				
PEOU	0.716	0.568	0.644			
PU	0.788	0.714	0.671	0.674		
SAT	0.907	0.754	0.966	0.630	0.725	
SAT	0.782	0.656	0.856	0.511	0.612	0.870

ATT, attitude; CI, continuance intention; CON, confirmation; PEOU, perceived ease of use; PU, perceived usefulness; SAT, satisfaction.

Table 5. HTMT inference based on bootstrapped confidence intervals

	Ratio	Lower limit	Upper limit	H1
Chinese sample				
SAT ↔ CON	0.940	0.887	0.991	Accepted
South Korean sample				
SAT ↔ ATT	0.907	0.856	0.959	Accepted
SAT ↔ CON	0.966	0.931	0.998	Accepted

H0, HTMT ≥ 1; H1, HTMT < 1. If H0 holds indicates a lack of discriminant validity.
ATT, attitude; CON, confirmation; SAT, satisfaction.

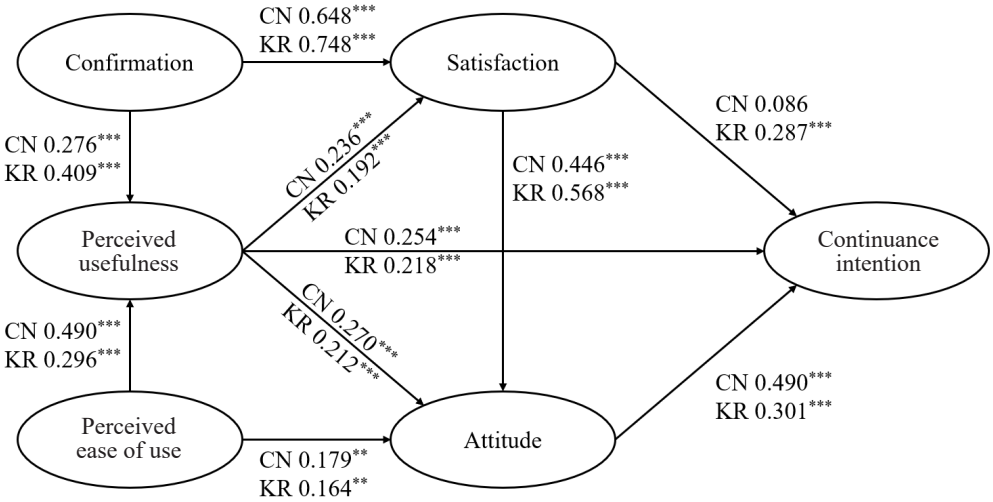

Fig. 2. Path coefficients by country. CN, Chinese sample; KR, South Korean sample. $^{**}P < 0.01$, $^{***}P < 0.001$.

Table 6. Hypothesis testing of structural model

Hypothesis	Chinese sample				South Korean sample			
	β	t-value	f^2	Remark	β	t-value	f^2	Remark
H1 ATT → CI	0.490	7.773***	0.220	S	0.301	3.727***	0.065	S
H2 SAT → CI	0.086	1.464	0.008	NS	0.287	3.524***	0.063	S
H3 SAT → ATT	0.446	9.233***	0.278	S	0.568	12.781***	0.565	S
H4 PU → CI	0.254	4.853***	0.077	S	0.218	3.721***	0.055	S
H5 PU → ATT	0.270	3.947***	0.094	S	0.212	4.629***	0.079	S
H6 PU → SAT	0.236	5.462***	0.105	S	0.192	4.967***	0.104	S
H7 PEOU → ATT	0.179	2.763**	0.040	S	0.164	3.370***	0.056	S
H8 PEOU → PU	0.490	8.799***	0.277	S	0.296	4.228***	0.104	S
H9 CON → SAT	0.648	17.174***	0.797	S	0.748	23.207***	1.578	S
H10 CON → PU	0.276	4.474***	0.088	S	0.409	6.258***	0.197	S

ATT, attitude; CI, continuance intention; CON, confirmation; PEOU, perceived ease of use; PU, perceived usefulness; SAT, satisfaction; S, significant; NS, not significant.
**$P < 0.01$. ***$P < 0.001$.

Table 7. Predictive ability of structural model

Construct	Chinese sample		South Korean sample	
	R^2	Q^2	R^2	Q^2
ATT	0.619	0.524	0.673	0.550
CI	0.566	0.400	0.517	0.402
PU	0.488	0.479	0.380	0.367
SAT	0.656	0.637	0.758	0.737

ATT, attitude; CI, continuance intention; PU, perceived usefulness; SAT, satisfaction.

Table 8. Path differences of structural model

Hypothesis	Path coefficients-diff (CN−KR)	*P*-value of difference
H1 ATT → CI	0.189	0.063
H2 SAT → CI	−0.201	0.046
H3 SAT → ATT	−0.122	0.062
H4 PU → CI	0.036	0.643
H5 PU → ATT	0.058	0.481
H6 PU → SAT	0.044	0.449
H7 PEOU → ATT	0.016	0.842
H8 PEOU → PU	0.193	0.024
H9 CON → SAT	−0.100	0.047
H10 CON → PU	−0.133	0.140

CN, Chinese sample; KR, South Korean sample; ATT, attitude; CI, continuance intention; CON, confirmation; PEOU, perceived ease of use; PU, perceived usefulness; SAT, satisfaction.

anisms such as satisfaction and attitude vary in salience across contexts. In the context of food acquisition, such mechanisms influence whether digital grocery platforms become embedded in consumers' routine food procurement practices.

For the South Korean consumers, CI was strongly influenced by PU, satisfaction, and attitude. Shoppers who perceived OGS as useful, felt satisfied with prior experiences, and held positive attitudes were more likely to continue using it, confirming the central role of satisfaction in maintaining CI [19, 49, 50]. In the context of food provisioning, satisfaction reflects whether consumers successfully obtain fresh and diverse products within expected timeframes, which is critical for maintaining stable food access through online channels. In China, however, satisfaction from a single transaction showed little impact on continuance. Instead, enduring attitudes toward OGS proved to be the strongest predictor, suggesting that Chinese shoppers place greater weight on stable beliefs and accumulated confidence than on short-term satisfaction. This is consistent with Fishbein & Ajzen's [51] view that intentions rely on beliefs and feelings that remain consistent over time. Such stable attitudes may facilitate the habitual incorporation of online grocery platforms into long-term household food procurement strategies.

Attitude was consistently shaped by PEOU, PU, and satisfaction across both countries. PEOU reduced cognitive effort and time costs [52], reinforcing positive attitudes. Lower cognitive and time burdens may also enable consumers to secure daily food supplies more efficiently, particularly under time or mobility constraints.

https://doi.org/10.5720/kjcn.2026.00017

Similarly, Mirhoseini *et al.* [53] showed that when consumers perceive OGS as less demanding, they are more willing to adopt it. Furthermore, our data confirmed that satisfaction played a substantial role; repeated positive experiences fostered more favorable overall evaluations [54]. Satisfaction was largely driven by consumers' needs being met and expectations being confirmed [55]. Confirmation of expectations proved even more influential than usefulness [26], with a stronger effect in South Korea than in China. Because confirmation reflected the most recent experience, satisfaction tended to be transient. In contexts where satisfaction strongly drives CI, like in Korea, consumer CI may be unstable unless expectations are continuously fulfilled. From a food system perspective, such instability may affect the reliability of digital food access if performance expectations are not consistently met. PU was shaped by both PEOU and confirmation and emerged as the most important determinant of attitude and continuance. Additionally, when OGS provided benefits such as convenience, variety, and competitive prices, consumers were willing to tolerate minor usability issues, echoing Bridges & Florsheim [56]. Greater product variety available through online platforms may expand consumers' access to diverse food categories, which has potential implications for dietary diversity and food accessibility. Notably, PEOU had a greater effect on PU in China, highlighting the importance of simplicity and intuitive design.

These findings offer several theoretical contributions. By examining OGS, a product category heavily reliant on sensory input, this study extends the scope of continuance research [57]. Despite increased attention to online shopping, the specific case of groceries has received limited focus. Our results showed that TCT is well suited to this domain. Moreover, we contribute to ongoing debates about the relationship between satisfaction and attitude [54, 58], providing evidence that satisfaction in the post-adoption stage primarily reinforces attitude. Cross-national comparisons further reveal that market context moderates TCT pathways: South Korea OGS market depends on immediate satisfaction, whereas China market relies more on long-term attitudes [34, 59]. Importantly, by situating OGS within the broader digital transformation of food systems, this study links CI to the stability of food acquisition channels. Sustained engagement with OGS may reduce spatial and temporal barriers to food access and therefore represents a behavioral prerequisite for stable digital food availability at the household level.

From a practical perspective, strategies should reflect market conditions. In South Korea, where CI is highly satisfaction-driven, firms should focus on consistently meeting expectations through reliable delivery, responsive service, and active customer engagement. Ensuring product freshness, delivery punctuality, and transparent food information is particularly critical to maintaining trust in digital food supply channels. Conversely, in China, where attitudes are more decisive, retailers should emphasize user-friendly platforms, intuitive navigation, and support services to strengthen consumer confidence. Across markets, improving PU remains essential. Investments in features such as high-quality visuals, efficient search tools, and broad product assortments are likely to enhance perceptions of value and encourage long-term engagement [60]. In the longer term, strengthening these mechanisms may contribute to more inclusive and resilient digital food environments, particularly as online grocery channels become integrated into national food distribution systems. Additionally, enhancing efficiency and usefulness may be especially critical to sustain global OGS adoption for cross-border e-commerce.

Limitations

Consideration of certain limitations is necessary when interpreting the findings. First, almost everyone can be seen as potential consumers of grocery products such as food, which are considered consumer staples. Although our sample size is much larger than the minimum threshold recommended, future research should utilize larger-scale surveys. Second, this research does not explore structures other than technological factors. It overlooks some of the impact of intrinsic motivational factors that may extend beyond technical features. Accordingly, future research should apply more theoretical structures to enhance the understanding of CI. Finally, our sample primarily includes consumers in China and South Korea. Although market maturity provides a useful contextual lens for comparison, future

research should further disentangle its effects from other country-level characteristics by incorporating additional countries or longitudinal research designs. Future research should explore regions with greater cultural differences, such as comparing developed countries in Europe or America with the Asian market, to enhance our discussion.

Conclusion

Our analysis shows that PU and attitude significantly predicted CI in both South Korea and China, whereas the effect of satisfaction differed across the two contexts. Satisfaction and usefulness reflect consumers' evaluations of service performance, while attitude captures a more enduring favorability toward OGS. Among these factors, attitude exhibited the strongest association with CI, indicating its central role in sustaining continued use. Overall, these findings provide support for the applicability of the TCT in explaining OGS behavior across different market contexts, while also highlighting context-specific variation in the role of satisfaction. From a practical perspective, retailers may benefit from strategies that strengthen positive consumer attitudes, such as improving convenience, service reliability, and platform compatibility, to support sustained engagement with OGS.

CONFLICT OF INTEREST

There are no financial or other issues that might lead to a conflict of interest.

FUNDING

None.

DATA AVAILABILITY

Due to privacy and ethical considerations, the dataset is not publicly available, as participants did not provide consent for unrestricted data sharing. However, anonymized data supporting the findings of this study are available from the corresponding author upon reasonable request for research purposes.

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https://doi.org/10.5720/kjcn.2026.00017

APPENDIX

Construct and indicators
Attitude
OGS would be a good idea
OGS would be a wise idea
I like the idea of using OGS
Satisfaction
My overall experience with OGS was: very satisfied
My overall experience with OGS was: very pleased
My overall experience with OGS was: very contented
My overall experience with OGS was: absolutely delighted
Continuance intention
I intend to continue using OGS rather than discontinue its use
My intentions are to continue using OGS than use any alternative means
If I could, I would like to continue using OGS as much as possible
Usefulness
Using the OGS improves my performance in my shopping
Using the OGS improves my productivity in my shopping
Using the OGS enhances my effectiveness in my shopping
I find the OGS to be useful in my shopping
Ease of use
My interaction with the OGS is clear and understandable
Interaction with the OGS does not require a lot of my mental effort
I find it easy to get the OGS to do what I want it to do
I find the OGS to be easy to use
Confirmation
My experience with using OGS was better than what I expected.
The service level provide by OGS was better than what I expected.
Overall, most of my expectations from using OGS were confirmed

OGS, online grocery shopping.

Korean J Community Nutr. 2026 Feb;31(1):64-74
https://doi.org/10.5720/kjcn.2025.00325
eISSN 2951-3146

KJCN
Korean Journal of Community Nutrition

Research Article

Association between number of teeth and oxidative balance score in Korean adults: a population-based study

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Received: October 31, 2025
Revised: December 5, 2025
Accepted: January 28, 2026

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Objectives: This study aimed to evaluate the relationship between oxidative balance score (OBS), a metric indicating an individual's oxidative balance status, and the number of teeth in a sample of Korean adults.
Methods: This cross-sectional study included 13,199 adults aged 19 and older who participated in a health survey and oral examination. Subsequent to the adjustment for confounding factors, a logistic regression analysis was employed to evaluate the probability of a subject belonging to a number of teeth category based on OBS level.
Results: In the group with OBS level T2, the likelihood of having NT1 (0–10 teeth) was found to be significant adjusted for all variables (odds ratios: 1.51, 95% confidence intervals: 1.195–1.908). In the multinomial model, a significant association was observed for the NT1 category, whereas no significant association was found for the NT2 (11–20 teeth) category after adjustment.
Conclusion: In the group with OBS level T2, the likelihood of having NT1 (0–10 teeth) was found to be significant. As this study examines cross-sectional associations, the necessity of conducting longitudinal research as subsequent studies is evident to ascertain the existence of causality.

Keywords: oxidative balance score; oral health; Korea National Health and Nutrition Examination Survey; tooth loss

INTRODUCTION

The oxidative balance score (OBS) is a comprehensive indicator of an individual's oxidative balance status, and it is evaluated based on various dietary and lifestyle factors [1-3]. An individual's diet, physical activity, and health-related behaviors collectively influence their level of oxidative stress. Many studies have reported an association between systemic diseases and OBS, including dietary intake and lifestyle behaviors, in various conditions such as periodontitis [4, 5], hearing loss and tinnitus [3], gastrointestinal cancers [6], and cardiovascular diseases [7].

An examination of the effects on oral tissues during the oxidation process, when molecular oxygen is reduced to water, reveals the release of a large amount of free energy. This free energy has the potential to induce free radicals and reactive oxygen species (ROS). In this instance, oxidative stress, stemming from an imbalance between free radicals and ROS, is identified as a primary contributor to oral inflammatory diseases and dental caries [8]. In particular, related system-

atic literature reviews and meta-analysis studies have indicated a significant association between periodontitis and local oxidative stress. These results suggest that oxidative stress may be involved in the development and progression of chronic periodontitis [9]. Furthermore, oxidative stress has been reported to be involved in the onset and progression of diseases mediated by dental biofilm, such as dental caries [10].

Consequently, oxidative stress can serve as a risk factor for major oral diseases and potentially contribute to tooth loss, depending on the condition and prognosis of the oral disease.

Research on the relationship between OBS and periodontitis has been conducted both nationally and internationally [4, 5]. However, to the best of our knowledge, no study has yet demonstrated a relationship between number of teeth and OBS using large-scale national data. The number of remaining teeth is an objective indicator of the oral condition of an individual and a factor that can reflect the deterioration of oral health or cumulative exposure to systemic diseases over time [11, 12]. Therefore, determining the OBS of individuals, as well as the number of teeth, which is a cumulative oral indicator is essential.

This study aimed to evaluate the relationship between number of teeth and OBS among Korean adults using nationally representative data from the Korea National Health and Nutrition Examination Survey (KNHANES 7th, 2016–2018). We hypothesized that a correlation would exist between the number of teeth and OBS even after controlling for major confounding factors.

METHODS

Ethics statement

The first and second years (2016–2017) of the 7th KNHANES were exempted from review by the Institutional Review Board (IRB) of the Korea Disease Control and Prevention Agency, as they constitute research directly conducted by the state for public welfare under the Bioethics and Safety Act. The third year (2018) was subject to IRB review considering the collection of human-derived materials and the provision of raw data to third parties (IRB No. 2018-01-03-P-A).

1. Study design

This study was conducted as a cross-sectional study using data from the 7th KNHANES (2016–2018) [13] and, reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement (https://www.strobe-statement.org/).

2. Study participants

The data used in this study were obtained from the 7th KNHANES, a nationally representative cross-sectional survey conducted between 2016 and 2018. KNHANES data are publicly available [13], and the study participants were selected using a complex sample design with proportional allocation and systematic sampling applied in stages. The requirement for informed consent was waived because the study utilized data were already accessible to the public. The oral examination data of the study participants collected during the health screening survey were utilized. The total number of individuals selected for the study was 13,199, out of a total sample of 16,489 individuals. The discrepancy in overall frequency of the research results was due to missing values.

3. Number of teeth

The standardized oral examination in the KNHANES was performed by dentists with extensive training. The methods used to ensure the reliability of the oral examination included training using dental models, education for calibration, web-based photo instruction, simulation of oral health examination with human participants, field instruction, and reproducing examinations. The number of remaining teeth was calculated by summing the number of teeth in the anterior region—comprising the central incisor, lateral incisor, and canine, each with four surfaces (buccal, distal, mesial, and lingual)—and the posterior region—comprising the first premolar, second premolar, first molar, and second molar, each with five surfaces (buccal, distal, occlusal, mesial, and lingual). Missing teeth and wisdom teeth were excluded from the calculation. The number of teeth in the study participants was categorized into three groups: NT1 (0–10 teeth), NT2 (11–20 teeth), and NT3 (21–28 teeth) [14].

4. Oxidative balance score

OBS components were categorized as follows based on previous research: five types of antioxidants (physical activity, n-3 fatty acids, vitamin C, retinol, β-carotene) and five types of pro-oxidants (obesity, alcohol, smoking, n-6 fatty acids, and polyunsaturated fatty acids [PUFAs]) [4, 5, 15, 16]. Dietary intake was assessed using the 24-hour recall method, wherein trained interviewers documented dietary information. Furthermore, data concerning lifestyle habits were collected via questionnaires completed by the study participants.

Physical activity scores were calculated using the metabolic equivalent of task (MET; MET-min/week). The scores for high-intensity physical activities, exercises, sports, and leisure activities (8.0 × min × day); moderate-intensity physical activities, exercises, sports, and leisure activities (4.0 × min × day); and walking (3.3 × min × day) were summed and categorized into tertiles [17]. The nutrient intake scores for the six nutrients were categorized into tertiles based on the minimum and maximum values. Alcohol consumption data were classified as < 1 drink per month (3), 1–4 drinks per month (2), or ≥ 2 drinks per week (1). Smoking data were classified as non-smoker (3), occasional smoker (2), or daily smokers (1). Body mass index (BMI) data were classified as normal weight (18.5–22.9 kg/m^2) (3), overweight (23–24.9 kg/m^2) (2), or obese (≥ 25 kg/m^2) (1). Each antioxidant and pro-oxidant was scored from 1 to 3 points, ranging from the lowest tertile to the highest tertile, with 30 points being the maximum score. Higher scores indicated greater antioxidant effects. This study categorized the OBS into tertiles based on the lowest and highest scores.

5. Covariates

Covariates were reclassified as follows for the purpose of analysis. The demographic factors considered included gender, age, household income, and education. The covariates applied in this study were selected based on prior research as key factors associated with oral health and OBS levels [5].

Age was categorized into 19–29, 30–39, 40–49, 50–59, and ≥ 60 years. Household income was classified as < 25% (the lowest quartile group), 25%–49%, 50%–74%, and 75%–100% (the highest quartile group). It was subsequently categorized into upper, middle (upper-middle, lower-middle), and lower levels. Education was categorized as primary school or below, middle school, high school, and college or above.

The general health variables considered included hypertension, diabetes, and tooth brushing frequency per day. Hypertension was classified as hypertension, pre-hypertension, or normal [18]. Hypertension was defined as a systolic blood pressure of 140 mmHg or higher, diastolic blood pressure of 90 mmHg or higher, or taking antihypertensive medication. Pre-hypertension was defined as a systolic blood pressure of 120 mmHg or higher but lower than 140 mmHg and diastolic blood pressure of 80 mmHg or higher but lower than 90 mmHg. The rest were defined as normal.

Diabetes was classified into diabetes, pre-diabetes, and normal [19]. Diabetes was defined as having a fasting blood glucose level of 126 mg/dL or higher, having received a diagnosis from a physician, or being on oral hypoglycemic agents or insulin injections. Pre-diabetes was defined as a fasting blood glucose level of 100 mg/dL or higher but lower than 126 mg/dL, with the rest classified as normal.

Finally, tooth brushing frequency per day was categorized as once or less, or twice or more.

6. Statistical analysis

KNHANES data were collected using a complex sample design method. A complex sample analysis was performed after applying weights, stratification variables (kstrata), and survey units (psu). The number of teeth according to the general characteristics of the study participants was subjected to a chi-squared test. The mean scores for each OBS item according to the categories of the number of teeth were analyzed using analysis of variance in a complex sampling general linear model. To determine the relationship between OBS and number of teeth, the multivariate logistic regression model was adjusted stepwise for confounding variables. Model 1 was an unadjusted model, while Model 2 was adjusted for demographic factors including gender, age, household income, and education. Model 3 was additionally adjusted for hypertension, diabetes, and tooth brushing frequency per day from Model 2.

The analysis results are presented as odds ratios (OR)

https://doi.org/10.5720/kjcn.2025.00325

and 95% confidence intervals (CI). All statistical analyses conducted in this study were performed using IBM SPSS Statistics for Windows, version 28.0 (IBM Corp.), and significance testing was based on a Type I error level of 0.05.

RESULTS

1. Number of teeth by general characteristics

Table 1 shows the number of teeth by the general characteristics of the study participants. In the NT1 (0–10 teeth) group, women (50.9%) outnumbered men by a slight margin ($P < 0.001$). The group was associated with advanced age, low household income, low education

Table 1. Number of teeth by the general characteristics of the study participants

Characteristics	Number of teeth			*P*-value[1)]
	NT1 (0-10)	NT2 (11-20)	NT3 (21-28)	
Gender (n = 13,199)				
Men	555 (49.1)	560 (44.7)	4,678 (41.5)	< 0.001
Women	570 (50.9)	702 (55.3)	6,134 (58.5)	
Age (year) (n = 13,199)				
19–29	0 (0.0)	3 (0.2)	1,559 (15.1)	< 0.001
30–39	3 (0.3)	12 (1.0)	2,087 (18.7)	
40–49	9 (0.6)	42 (3.3)	2,368 (21.1)	
50–59	65 (5.7)	206 (17.3)	2,222 (21.6)	
≥ 60	1,048 (93.4)	999 (78.2)	2,576 (23.6)	
Household income (n = 13,161)				
Lower	630 (54.5)	527 (40.3)	1,484 (13.8)	< 0.001
Median	404 (37.4)	573 (46.8)	5,834 (53.4)	
Upper	82 (8.0)	160 (13.0)	3,467 (32.8)	
Education (n = 12,566)				
≤ Primary school	664 (63.7)	598 (47.4)	1,367 (12.9)	< 0.001
Middle school	142 (14.3)	196 (17.0)	895 (8.8)	
High school	162 (16.3)	258 (24.2)	3,608 (35.3)	
≥ College	59 (5.7)	128 (11.4)	4,489 (43.0)	
Hypertension (n = 13,169)				
Hypertension	702 (62.9)	714 (56.9)	2,854 (25.7)	< 0.001
Pre-hypertension	230 (19.7)	277 (21.3)	2,687 (25.1)	
Normal	187 (17.4)	268 (21.8)	5,250 (49.1)	
Diabetes (n = 12,384)				
Diabetes	279 (27.2)	305 (26.0)	1,006 (9.4)	< 0.001
Pre-diabetes	285 (29.4)	335 (29.9)	2,342 (22.4)	
Normal	400 (43.4)	513 (44.1)	6,919 (68.2)	
Tooth brushing (times/day) (n = 12,759)				
≤ 1	244 (26.4)	170 (13.2)	778 (6.8)	< 0.001
≥ 2	670 (73.6)	1,033 (86.8)	9,864 (93.2)	
OBS (n = 13,199)				
T1	72 (9.3)	97 (11.7)	1,305 (12.5)	< 0.001
T2	373 (35.5)	309 (29.5)	2,734 (24.0)	
T3	584 (55.2)	573 (58.8)	7,152 (63.5)	

n (weighted %).
OBS, oxidative balance score.
[1)]*P*-value was calculated by complex sample chi-square test.

level, hypertension, and brushing teeth once or less per day ($P < 0.001$). Furthermore, the highest percentage of OBS T3 was observed in the NT3 (21–28 teeth) group at 63.5% ($P < 0.001$).

2. Oxidative balance score by general characteristics

Table 2 shows the OBS by the general characteristics of the study participants. In the T3 group, women over men, advanced age, higher household income, college graduates or higher, normal blood pressure, and non-diabetics were more likely to be represented ($P < 0.001$).

3. Detailed items of oxidative balance score by number of teeth

Table 3 shows the mean OBS by the number of teeth. Total MET, n-3 fatty acids, vitamin C, retinol, and β-carotene, belonging to the antioxidant group in OBS, were significantly higher in the NT3 (21–28 teeth) group ($P < 0.001$). However, in the pro-oxidants group, variables such as alcohol, n-6 fatty acids, and PUFAs, excluding BMI, showed higher oxidative promotion scores for pro-oxidants in the NT3 (21–28 teeth) group ($P < 0.001$).

Table 2. OBS levels by the general characteristics of the study participants

Characteristics	OBS			*P*-value[1)]
	T1	T2	T3	
Gender (n = 13,199)				
Men	763 (47.5)	1,114 (32.6)	3,916 (45.5)	< 0.001
Women	711 (52.5)	2,302 (67.4)	4,393 (54.5)	
Age (year) (n = 13,199)				
19–29	243 (16.8)	356 (11.5)	963 (11.9)	< 0.001
30–39	261 (16.2)	478 (13.5)	1,363 (16.2)	
40–49	285 (17.0)	546 (15.7)	1,588 (18.7)	
50–59	311 (22.5)	614 (19.2)	1.568 (19.6)	
≥ 60	374 (27.6)	1,422 (40.1)	2,827 (33.6)	
Household income (n = 13,161)				
Lower	241 (17.1)	854 (24.9)	1,546 (18.0)	< 0.001
Median	768 (52.3)	1.711 (50.5)	4,332 (51.6)	
Upper	450 (30.6)	838 (24.6)	2,421 (30.3)	
Education (n = 12,566)				
≤ Primary school	210 (16.4)	946 (28.3)	1,473 (17.6)	< 0.001
Middle school	120 (10.7)	310 (9.8)	803 (10.0)	
High school	485 (35.0)	891 (28.6)	2,652 (33.9)	
≥ College	529 (37.8)	1,058 (33.2)	3,089 (38.5)	
Hypertension (n = 13,169)				
Hypertension	442 (30.9)	1,308 (37.0)	2,520 (29.8)	< 0.001
Pre-hypertension	395 (26.4)	845 (25.6)	1,954 (23.4)	
Normal	627 (42.7)	1,248 (37.4)	3,830 (46.8)	
Diabetes (n = 12,384)				
Diabetes	171 (13.5)	488 (14.4)	931 (11.3)	< 0.001
Pre-diabetes	352 (24.4)	792 (24.6)	1,818 (23.1)	
Normal	814 (62.1)	1,885 (61.0)	5,133 (65.7)	
Tooth brushing (times/day) (n = 12,759)				
≤ 1	132 (8.8)	338 (9.9)	722 (8.4)	0.068
≥ 2	1,279 (91.2)	2,888 (90.1)	7,400 (91.6)	

n (weighted %).
OBS, oxidative balance score.
[1)]*P*-value was calculated by complex sample chi-square test.

https://doi.org/10.5720/kjcn.2025.00325

Table 3. Detailed items average of OBS by number of teeth

Characteristics	Number of teeth			*P*-value[2]
	NT1 (0-10)	NT2 (11-20)	NT3 (21-28)	
Antioxidants				
Total MET	306.22 ± 23.18	467.67 ± 27.31	726.86 ± 14.83	< 0.001
n-3 fatty acids (g)	1.34 ± 0.06	1.65 ± 0.07	1.91 ± 0.02	< 0.001
Vitamin C (mg)	46.72 ± 2.42	53.52 ± 2.10	63.72 ± 1.02	< 0.001
Retinol (μg)	68.41 ± 6.66	103.83 ± 15.23	149.57 ± 4.82	< 0.001
β-carotene (μg)	2,229.38 ± 100.19	2,630.90 ± 103.66	2,793.91 ± 53.32	< 0.001
Pro-oxidants				
Alcohol[1]	2.22 ± 0.03	2.23 ± 0.03	2.14 ± 0.00	0.003
Smoking[1]	2.20 ± 0.05	2.20 ± 0.04	2.13 ± 0.02	0.221
BMI[1]	2.03 ± 0.03	1.90 ± 0.03	2.07 ± 0.01	< 0.001
n-6 fatty acids (g)	5.58 ± 0.22	6.97 ± 0.22	9.79 ± 0.10	< 0.001
PUFA (g)	6.93 ± 0.27	8.62 ± 0.26	11.72 ± 0.12	< 0.001

Mean ± SE.
OBS, oxidative balance score; MET, metabolic equivalent of task; BMI, body mass index; PUFA, polyunsaturated fatty acid.
[1]Maximum value (score 3): alcohol: less than 1 drink per month, smoking: non-smoker, BMI: normal weight (18.5–22.9kg/m^2).
[2]*P*-value was calculated by analysis of variance (ANOVA) in a complex sampling general linear model.

4. Distribution of oxidative balance score categories according to sociodemographic and health-related characteristics

Table 4 presents the likelihood of being classified into the lower (T1) or intermediate (T2) OBS categories according to sociodemographic and health-related characteristics. The distribution of OBS exhibited disparities in accordance with the participants' sociodemographic and health-related characteristics. Household income (lower) and education (≤ primary school) levels were significantly associated with belonging to OBS T2 (OR: 1.70, 95% CI: 1.482–1.951, OR: 1.86, 95% CI: 1.642–2.112, respectively). Additionally, health-related characteristics such as hypertension, diabetes, and ≤ 1 daily toothbrushing were associated with a higher likelihood of belonging to OBS T2 (OR: 1.55, 95% CI: 1.392–1.733, OR: 1.37, 95% CI: 1.190–1.585, OR: 1.20, 95% CI: 1.025–1.421, respectively).

5. Relationship between number of teeth and oxidative balance score

Table 5 shows the likelihood of belonging to lower tooth count categories according to OBS levels. In the group with OBS level T2, the likelihood of having NT1 teeth (0–10) was found to be significant (OR: 1.65, 95% CI: 1.378–1.989). Model 2, adjusted for demographic variables, yielded a significant result (OR: 1.48, 95% CI: 1.205–1.831), as did Model 3, adjusted for all variables (OR: 1.51, 95% CI: 1.195–1.908). In the multinomial model, a significant association was observed for the NT1 category, whereas no significant association was found for the NT2 category after adjustment.

DISCUSSION

This study used raw data from the 7th KNHANES, representative of Korean adults, for the analysis to determine the association between number of teeth and OBS. A significant association was identified between number of teeth and OBS in the study involving 13,199 study participants. In the group with OBS as T2, the likelihood of belonging to tooth count NT1 (0–10 teeth) was found to be OR: 1.51, 95% CI: 1.195–1.908 in the model adjusted for all variables. Additionally, the likelihood of belonging to NT2 (11–20 teeth) was OR: 1.22, 95% CI: 1.056–1.423 in the unadjusted model, but was not significant in the adjusted model.

These results suggest that the difference between the NT1 (0–10) group, which experienced extreme tooth loss, and the NT2 (11–20 teeth) group could be explained by confounding variables such as socioeconomic and health variables. The number of teeth was

Table 4. Distribution of OBS categories according to sociodemographic and health-related characteristics

Characteristics	OBS	
	T1	T2
Gender		
Men	1.086 (0.949–1.242)	0.578 (0.526–0.637)**
Women	Ref.	Ref.
Age (year)		
19-29	1.710 (1.364–2.144)**	0.806 (0.680–0.955)*
30-39	1.216 (0.982–1.505)	0.699 (0.606–0.806)**
40-49	1.104 (0.891–1.367)	0.702 (0.604–0.816)**
50-59	1.394 (1.146–1.696)**	0.822 (0.721–0.936)*
≥ 60	Ref.	Ref.
Household income		
Lower	0.942 (0.744–1.192)	1.700 (1.482–1.951)**
Median	1.004 (0.848–1.189)	1.203 (1.077–1.344)*
Upper	Ref.	Ref.
Education		
≤ Primary school	0.952 (0.763–1.189)	1.863 (1.642–2.112)**
Middle school	1.093 (0.825–1.448)	1.141 (0.969–1.343)
High school	1.050 (0.880–1.253)	0.977 (0.872–1.095)
≥ College	Ref.	Ref.
Hypertension		
Hypertension	1.139 (0.975–1.329)	1.553 (1.392–1.733)**
Pre-hypertension	1.232 (1.048–1.447)*	1.364 (1.205–1.544)**
Normal	Ref.	Ref.
Diabetes		
Diabetes	1.270 (1.046–1.542)*	1.373 (1.190–1.585)**
Pre-diabetes	1.117 (0.944–1.321)	1.148 (1.016–1.297)*
Normal	Ref.	Ref.
Tooth brushing (times/day)		
≤ 1	1.064 (0.868–1.316)	1.207 (1.025–1.421)*
≥ 2	Ref.	Ref.

OR (95% CI).
ORs indicate the likelihood of belonging to the T1 or T2 OBS categories.
OBS, oxidative balance score; Ref, reference; OR, odds ratio; CI, confidence interval.
*$P < 0.05$, **$P < 0.001$.

influenced by age and socioeconomic factors, suggesting that residual confounding may have remained [20].

The primary causes of tooth loss include dental caries and periodontal disease. The development of dental caries is driven by a complex interplay between acid-producing bacteria in the oral cavity, host saliva components, and carbohydrate intake [21]. Therefore, oxidative stress plays a role in the mechanism that induces intracellular signaling, thereby promoting the differentiation and growth of acid-producing bacteria that cause dental caries [22]. Dental caries forms and progresses over time, reaching deeper tissues and ultimately leading to tooth collapse. Periodontal disease is also a multifactorial disorder. When activated phagocytes produce excess ROS in the gingival sulcus, the antioxidant capacity decreases. Ultimately, increased oxidative stress in affected tissues leads to the destruction of periodontal tissue and tooth loss [23, 24].

Previous studies have demonstrated a negative, linear relationship between OBS and periodontitis [4, 5]. In contrast, our study results showed partial agreement, revealing a correlation between the number of teeth and the T2 group, which is defined as the median score relative to the highest OBS score.

In this study, a significant association with the number of remaining teeth was observed only in the OBS T2 group. While OBS T2 indicates a medium level of oxidative balance, T1 and T3 reflect low and high levels, respectively. This phenomenon may also be interpreted as reflecting the characteristic that, within the extreme OBS (T1, T3) ranges, dental condition has already been affected to a certain degree, thereby hindering the statistical detection of changes based on differences in OBS levels. Furthermore, the distribution of the sample and statistical power may have contributed to the lack of significant association observed in the extreme OBS ranges.

Furthermore, this study found that pro-oxidants, such as alcohol, n-6 fatty acids, and PUFAs, had higher oxidative promotion scores in the NT3 (21–28 teeth) group. Previous studies have highlighted the positive effects of alcohol consumption, as evidenced by changes in biomarkers. Specifically, as reported in a systematic literature review, higher levels of high-density lipoprotein cholesterol and adiponectin as well as lower levels of fibrinogen have been observed with moderate alcohol consumption (up to one drink per day for women and up to two drinks per day for men) in relation to coronary artery disease and biological markers [25]. However, the aforementioned biomarkers are not specifically related to oral diseases. A previous systematic review of tooth loss and mortality from cardiovascular disease found a

https://doi.org/10.5720/kjcn.2025.00325

Table 5. Relationship between number of teeth and OBS

Variables [Ref. NT3 (21-28)]	Model 1		Model 2		Model 3	
	Adjusted OR (95% CI)	*P*-value	Adjusted OR (95% CI)	*P*-value	Adjusted OR (95% CI)	*P*-value
NT1 (0-10)						
OBS T1	0.851 (0.616–1.174)	0.325	1.159 (0.769–1.747)	0.48	1.169 (0.719–1.898)	0.528
OBS T2	1.655 (1.378–1.989)	< 0.001	1.485 (1.205–1.831)	< 0.001	1.510 (1.195–1.908)	< 0.001
OBS T3	Ref.		Ref.		Ref.	
NT2 (11-20)						
OBS T1	0.841 (0.666–1.061)	0.144	0.869 (0.645–1.171)	0.356	0.785 (0.572–1.077)	0.133
OBS T2	1.226 (1.056–1.423)	0.007	1.118 (0.937–1.333)	0.215	1.086 (0.893–1.320)	0.406
OBS T3	Ref.		Ref.		Ref.	

Results of multiple multinomial logistic regression models.
ORs indicate the likelihood of belonging to the NT1 or NT2 number of teeth categories.
Model 1 unadjusted model. Model 2 adjusted for socioeconomic variables (gender, age, household income and education). Model 3 adjusted for the same factors as Model 2 plus general health variables (hypertension, diabetes mellitus and toothbrushing).
OBS, oxidative balance score; Ref, reference; OR, odds ratio; CI, confidence interval.

significant association in cases with 0–9 teeth [26]. Consequently, oral diseases exhibit shared risk factors with systemic diseases and are associated with them, indicating the necessity for a comprehensive approach to their management and prevention.

Another previous study on the antibacterial activity of wine against periodontal pathogens reported moderate antimicrobial impact on *Aggregatibacter actinomycetemcomitans*, *Porphyromonas gingivalis*, and *Fusobacterium nucleatum* [27]. The results revealed that the polyphenol components in wine exerted an antimicrobial effect. Given that the drinking variables in this study utilized data on drinking frequency but did not account for alcohol consumption volume or type of alcohol consumed, further research could benefit from considering a broader range of drinking variables.

Furthermore, previous studies on dietary n-6 fatty acids and PUFAs have underscored the importance of examining the ratio between n-6 and n-3, as opposed to merely evaluating the intake of individual fatty acids. A three-year longitudinal study of Japanese older adults examined the relationship between fatty acids and periodontal disease, revealing that a higher ratio of n-6 to n-3 PUFAs was significantly associated with an increased incidence of periodontal disease [28]. Conversely, a Mendelian randomization study using data from the National Health and Nutrition Examination Survey (NHANES) 2011–2014 on the association between PUFAs and periodontitis reported no evidence that heightened n-3 fatty acid concentrations or diminished n-6 to n-3 fatty acid ratios hinder periodontitis [29].

As demonstrated in the findings of this study, previous research has frequently yielded contradictory results regarding the relationship between nutrient composition and inflammatory diseases [4, 30, 31]. Therefore, a more integrated consideration of dietary antioxidant and pro-oxidant exposure is imperative for further research in this area. Although this study considered single n-6 fatty acids and total PUFAs as pro-oxidant factors, future research should incorporate OBS that accounts for the n-6 to n-3 ratio.

It is a well-established fact that smoking and obesity, as measured by BMI, have deleterious effects on both oral and chronic diseases. Smoking has been demonstrated to exacerbate inflammation in the oral mucosa and periodontal tissues and may potentially cause malignant tumors [32]. A correlation with the number of decayed teeth was observed among those who smoked daily over four years [33]. Individuals with obesity exhibit elevated levels of pro-inflammatory adipokines, such as tumor necrosis factor-α (TNF-α) and leptin [34, 35]. These inflammatory cytokines have been shown to increase the activity of proteases and matrix metalloproteinases, which can lead to a loss of attachment in periodontal tissues and bone resorption [36, 37].

On the other hand, the five antioxidant components used in this study attained high antioxidant scores in the NT3 (21–28 teeth) group with statistical significance. A

previous study that utilized data from 2009 to 2014 under the NHANES investigated the correlation between the composite dietary antioxidant index and periodontitis. This finding aligns with previous studies that also examined the effects of vitamin C, retinol, and carotene, reporting a significant association between the composite dietary antioxidant index and clinical attachment loss of teeth, as well as the number of remaining teeth [38]. These findings suggest that dietary antioxidant intake could contribute to eliminating excessive free radicals and protecting periodontal tissues from oxidative stress [38, 39].

Another previous study confirmed that administering n-3 fatty acid supplements to patients with chronic periodontitis reduced periodontal pocket depth and inflammation [40]. N-3 fatty acids have been shown to mitigate inflammation in gingival tissues through the suppression of pro-inflammatory mediators, specifically TNF-α and interleukin-1 beta (IL-1β) [41].

Physical activity also reduces the levels of inflammatory cytokines such as TNF-α and IL-6 and increases the levels of anti-inflammatory cytokines such as adiponectin [42]. Consequently, consistent engagement in physical activity has been demonstrated to exert a positive influence on the prevention and management of inflammation within the body.

The repercussions of oxidative stress and imbalance have been demonstrated to exert a detrimental influence on dental caries and periodontitis. Amelioration of this imbalance can be achieved by implementing health behaviors that promote oxidative balance and the dietary intake of antioxidants. This study makes a significant contribution to the field by employing a cross-sectional investigation strategy, utilizing data from the KNHANES, a nationally representative survey, to present the potential for number of teeth categories based on OBS levels among Korean adults.

Limitations

A potential limitation of this study is its cross-sectional design, which precludes the ability to ascertain cause-and-effect relationships. Moreover, a discerning interpretation of the results of this study is warranted. The etiology of periodontitis and dental caries is multifactorial, and the process of tooth loss may be protracted. Furthermore, among individual socioeconomic factors, household income and education level in particular may act as factors influencing OBS levels and the number of remaining teeth. Therefore, future studies should implement a stratified analysis based on socioeconomic factors to achieve a more precise evaluation of the relationship between OBS and the number of remaining teeth. The dependent variable in this study, the number of remaining teeth (NT), is a significant indicator of oral health. However, the method is limited in its capacity to adequately reflect detailed intraoral conditions, such as the presence or absence of prosthetics, implants, and the state of periodontal tissues. Since the applied dietary data signifies the aggregate of nutrient intakes from foods consumed by an individual over the course of a day, there may be errors in reporting during the quantitative estimation of nutrient intake, including fatty acid intake. In particular, while the amount of lipids such as PUFAs and n-6 fatty acids is being evaluated, it is crucial to consider the potential for unexpected associations to exist between fatty acid intake and oxidation scores due to constraints on factors that directly influence oxidative stress, such as cooking methods (e.g., the use of oxidized oils).

Notwithstanding, this study is among the first to propose the potential categorization of OBS levels and tooth counts. Subsequent longitudinal studies may be necessary to identify improvements in specific OBS items and ascertain the causal relationship between OBS and number of teeth.

Conclusion

In conclusion, this study demonstrated a correlation between number of teeth and OBS in Korean adults. Specially in the group with OBS level T2, the likelihood of having NT1 teeth (0–10 teeth) was found to be significant. As this study examines cross-sectional associations, the necessity of conducting longitudinal research as subsequent studies is evident to ascertain the existence of causality.

CONFLICT OF INTEREST

There are no financial or other issues that might lead to conflict of interest.

https://doi.org/10.5720/kjcn.2025.00325

FUNDING

The present research was supported by the research fund of Dankook University in 2024 (43898).

DATA AVAILABILITY

The data used is publicly available at the Korean National Health and Nutrition Examination Survey (https://knhanes.kdca.go.kr/knhanes/eng/intr/dataIntr.do.).

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https://doi.org/10.5720/kjcn.2025.00325

Korean J Community Nutr. 2026 Feb;31(1):75-86
https://doi.org/10.5720/kjcn.2025.00269
eISSN 2951-3146

KJCN
Korean Journal of Community Nutrition

Research Article

경기지역 부모의 성장 걱정 수준별 유아의 식행동 비교에 관한 기술연구

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Evaluation of young children's dietary behaviors by parental growth concern levels in Gyeonggi area: a descriptive study

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Received: September 19, 2025
Revised: January 8, 2026
Accepted: January 26, 2026

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Objectives: This study investigated differences in dietary habits, lifestyle patterns, and feeding-related developmental issues among Korean preschool children based on their parents' levels of growth concern, and examined the associations between parental growth concern and children's eating behaviors.

Methods: A cross-sectional study was conducted with parents of children aged 1–5 years residing in Gyeonggi Province, Korea. Participants were classified into high, moderate, and low growth concern groups using the children's dietary screening test. Data were collected on the children's anthropometric status, lifestyle routines, dietary intake patterns, eating behaviors, and mealtime media exposure.

Results: Children in the high growth concern group showed a higher prevalence of underweight; irregular sleep and mealtime routines; and more frequent eating difficulties, including picky eating, slow eating, and oral processing problems. Mealtime media exposure was associated with lower fruit and vegetable intake and higher consumption of processed and sugar-rich foods. Higher parental growth concern did not correlate with healthier dietary or lifestyle outcomes.

Conclusion: Preschool children's dietary behaviors and routines differed according to the parents' levels of growth concern. Higher levels of parental concern were associated with increased feeding difficulties and greater mealtime media exposure. These findings suggest that excessive concern may contribute to maladaptive eating patterns in children. Evidence-based parental guidance and structured nutrition education are essential to promote healthy growth and eating behaviors during early childhood.

Keywords: child, preschool; eating behavior; nutritional status; parenting; feeding behavior; growth and development

INTRODUCTION

유아기는 급격한 성장과 발달이 이루어지는 시기이기 때문에 부모는 유아의 식습관에 높은 관심을 갖는다. 특히 이 시기의 균형 잡힌 영양 섭취는 두뇌와 신체 발달에 영향을 미치며, 유아가 먹는 것에 대한 즐거움을 느끼고 바람직한 식습관을 길러주는 결정적 시기이기도 하다. 그러나 국민건강영양조사[1]에 따르면 만 3–5세의 채소 섭취량은 2008년 98.6 g에서 2021년 76.7 g으로 지속적으로 감소하고 있고, 만 3–5세의 음료 섭취량은 2008년 25.7 g에서 2021년 58.9 g으로 증가하였으며, 당류 섭취량은 2008년 4.3 g에서 2024년 12.4 g이고 급증하였다. 또한, 청소년건강행태조사[2]에 따르면, 주3회 이상 패스트푸드 섭취율이 21.4%에 달하여 채소 섭취의 부족과 달고 기름진 간식 섭취의 문제점이 나타나고 있다. 실제로 가공식품과 패스트푸드 섭취가 증가는 동물성 지방, 나트륨, 단순당의 섭취가 증가하고, 반대로 비타민 및 무기질, 식이섬유 섭취가 부족해져 영양 불균형을 초래할 수 있으며[3], 이로 인해 소아비만 증가에 영향을 줄 수 있다.

한편, 최근 10년간 아동 및 청소년 비만 유병률[4]을 보면 2012년 9.7%, 2021년 19.3%로 약 2배 증가하였고, 제7기(2016–2018년) 국민건강영양조사[1] 자료에 따르면 만 2–3세 유아의 과체중 및 비만은 15.8%로 나타났다. 영유아 건강검진 자료를 활용한 영유아 영양 건강행태 빅데이터 분석 결과[5], 2012–2016년 6차 검진(54–60개월)에서 저체중이 2012년 3.6%에서 2016년 4.1%로 증가하였고, '편식'하는 경우와 '아침을 거르는' 경우가 높은 것으로 분석되었다. 아침을 거르는 경우는 저체중과 비만인 경우 모두 높은 수치로 나타나 영양 불균형과의 연관성을 보였다. 특히, TV를 2시간 이상 시청하면서 식사 속도가 빠른 경우 비만율이 높은 것으로 나타났으며 어릴 때부터 스마트폰이나 TV와 같은 매체에 과도하게 노출될 경우 신체활동에 적극적으로 참여하지 않고, 고열량 고지방 고당 음료를 섭취하고, 나트륨 섭취도 더 높은 것으로 나타난다[6]. 최근 유아의 매체 의존도가 높아지는데, 이는 부모가 유아에게 음식을 먹이기 위한 수단으로 사용되어 유아는 음식에 집중하지 못하게 된다[7]. 따라서 식사 시간은 가족들과 대화와 긍정적 경험으로 인식할 수 있도록 환경을 조성하는 것은 부모의 중요한 역할이라 할 수 있다[7]. 자녀의 식습관은 형성 과정에서 부모의 다양한 영향에 의해 결정된다. 부모의 영양지식, 가정 내 식품의 접근성, 부모의 식행동 모델링, 자녀에 대한 양육 태도 등이 복합적으로 작용하여 자녀의 식습관에 영향을 미친다[8]. 부모가 식생활이나 식습관과 관련하여 긍정적인 강화나 지지를 제공할 경우 자녀의 식행동과 식습관에 바람직한 영향을 미치며, 반대로 부모가 지나치게 통제적인 양육 행동을 보이는 경우에는 부정적인 식습관을 유도할 수 있다[8, 9]. 따라서 부모가 어떠한 태도를 가지고 식사지도를 하는지에 따라 유아의 식행동 및 식습관은 달라질 수 있다. 그러나 선행연구에서는 주로 초등학생을 대상으로 하는 식생활 스크리닝(dietary screening test, DST) 연구와 체중군별 식생활 위험요인에 대한 연구에 집중되었다. 특히, '부모의 성장 걱정 수준'이 유아의 식생활에 어떤 영향을 미치는지 조사한 연구는 매우 제한적이다. 부모의 성장 걱정 수준을 체계적으로 분류하고, 이에 따른 유아의 식습관 및 생활습관을 비교한 연구는 국내에서 이루어지지 않았다. 이에 본 연구는 DST을 활용하여 부모의 성장 걱정 수준에 따라 유아의 식습관, 생활습관, 섭식 발달 문제의 차이를 분석하고, 이를 바탕으로 유아 식생활 개선을 위한 기초자료를 제공하고자 한다.

METHODS

Ethics statement

Written informed consent was obtained from the parents or legal guardians of all participating children. The study protocol was approved by the Institutional Review Board (IRB) of Suwon University (approval number: 2403-045-01).

1. 연구설계

본 연구는 경기지역 일부 유아를 대상으로 부모의 성장 걱정 수준에 따라 유아의 식행동 특성을 비교하기 위한 기술연구(descriptive study)이며, STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) 보고 지침(https://www.strobe-statement.org/)을 준수하여 기술하였다.

2. 조사대상 및 방법

본 조사는 2023년 2월 23일부터 10월 31일까지 경기도 화성시 관내 어린이집 및 유치원 재원 중인 만 1–5세 유아의 부모를 대상으로 온라인 DST 설문조사를 실시하였다. 화성시 어린이·사회복지급식관리지원센터는 관내 어린이집 및 유치원에 공문을 통해 조사 협조를 요청하였고, 각 기관은 유아 부모에게 DST 모바일 설문 링크를 배포하였다. 이후 부모가 해당 링크에 자발적으로 접속하여 관련 설문에 직접 응답하였다. 총 5,634명이 조사에 참여하였으나, 연령 기준 13–72개월을 만족한 유아만 선별하여 5,175명의 결과를 통계 처리하여 분석하였다. 또한 표본수의 적정성을 확인하기 위해 G*Power 3.1을 사용하여 F-tests의 'one-way analysis of variance (ANOVA): fixed effects, omnibus, one-way' 모형(집단 수 3개, $\alpha = 0.05$, $1-\beta = 0.80$, effect size $f = 0.25$)으로 사전 전력분석을 수행한 결과, 최소 필요 표본수는 약 159명으로 산출되었다. 본 연구의 표본수 5,175명은 이 기준들을 상회하여 통계적 검정력이 충분함을 확인하였다.

https://doi.org/10.5720/kjcn.2025.00269

3. 조사내용

조사대상자의 식습관 및 식행동 평가는 Han 등[9]이 개발한 DST의 문항을 사용하였고, 선행연구에서 확인된 신뢰도(Cronbach's α)는 0.63–0.89 범위였다. DST는 유아의 식사와 관련된 다양한 문제점을 진단해 주는 검사로, 생활습관, 식사의 질, 섭식 발달, 기질적 특성, 식행동 문제, 식품 알레르기 등의 문제를 종합적으로 평가한다. 일반사항으로는 낮 시간대 양육자, 부모의 연령 및 교육수준, 유아의 성별, 연령, 키, 몸무게, 건강기능식품 섭취 여부, 만성질환 및 식품알레르기 여부로 구성하였다. DST의 상세 설문 항목은 걱정 영역(성장 및 식사에 대한 걱정), 생활습관 영역(취침 시간, 평균 수면 시간, 식사 소요 시간)을 조사하였고, 식습관 특성으로 식품 섭취 균형(곡류, 육류·생선·달걀·콩류, 채소류, 김치류, 유제품, 과일류 섭취빈도), 간식의 건전성(과자, 초콜릿과 같은 가공 간식, 패스트푸드의 섭취빈도), 식사의 규칙성(하루 중 식사 횟수, 아침 식사 빈도) 등으로 구성하였다. 또한 식행동 특성으로 섭식발달(물고 있다가 뱉기, 삼키다가 헛구역질, 단단한 식품 씹기 어려움, 질긴 식품 씹기 어려움), 기질적 특성(먹는 것에 까다로움, 식사의 불규칙성, 식사 중 과활동성), 식행동 문제(식사 거부, 식사 중 매체 노출, 스스로 식사의 어려움)를 조사하였다[10].

유아의 신체 계측은 부모가 온라인 설문 조사에 직접 입력한 수치로 체질량지수(body mass index [BMI], kg/m^2)를 산출하고, 2017 소아청소년 성장도표[11]의 성별·연령별 백분위수를 근거로 하여 연령은 24개월 이상의 유아를 대상으로 저체중은 5백분위 미만, 정상체중은 5백분위 이상–85백분위 미만, 과체중은 85백분위 이상–95백분위 미만, 비만은 95백분위 이상으로 판정하였다[11].

유아의 성장에 대한 걱정 수준은 Likert 5점 척도(5점 '매우 그렇다'–1점 '전혀 그렇지 않다')의 변수를 '매우 그렇다'와 '그러한 편이다'는 '고성장걱정군'으로, '보통이다'는 '보통성장걱정군'으로, '그렇지 않은 편이다' 및 '전혀 그렇지 않다'는 '저성장걱정군'으로 재분류하여 변수로 이용하였다.

4. 통계분석

자료의 통계처리는 SPSS Statistics ver. 28.0 (IBM Corp.)을 사용하여 수행하였다. 식습관 및 식행동의 세부 항목은 빈도와 백분율로 제시하였으며, 식행동 특성은 평균과 표준편차로 나타내었다. 걱정 수준별 일반사항 및 생활습관, 식습관 항목에 대한 분포 비교는 카이제곱검정(Chi-square test)을 실시하였고, 평균 비교는 일원배치 분산분석(ANOVA)을 사용하였으며, 유의한 차이가 있는 경우에는 Duncan 다중 범위 검정(Duncan's multiple range test)을 사용하여 사후 분석을 수행하였다. 부모의 성장 걱정과 식행동의 상관관계를 확인하기 위해 피어슨의 상관관계 분석(Pearson's correlation analysis)을 실시하였고, 부모의 성장 걱정에 식행동이 미치는 차이를 설명하기 위하여 다변량분산분석(multivariate analysis of variance)을 이용하였다. 모든 통계 분석에서 유의수준은 $P < 0.05$로 설정하였다.

RESULTS

1. 일반사항

조사 대상의 일반적 특성은 Table 1에 제시하였다. 조사 대상자는 총 5,175명이었고, 조사 대상자에 대한 부모의 성장에 대한 걱정 수준에 따라, '고성장걱정군'은 1,402명(27.1%), '보통성장걱정군'은 1,049명(20.3%), '저성장걱정군'은 2,724명(52.6%)으로 분류하였다. 성별은 남아 2,502명(48.3%), 여아는 2,673명(51.7%)이었고, 고성장걱정군은 남아 비율(50.9%)이 높고, 저성장걱정군은 여아 비율(53.3%)이 높게 나타나 성장 걱정에 관한 관심도가 유의적인 차이를 보였다($P = 0.030$). 유아의 평균 연령은 40.23개월이고 고성장걱정군 유아의 연령은 42.27개월, 보통성장걱정군은 39.98개월, 저성장걱정군은 39.27개월로 유의한 차이가 나타났다($P < 0.001$). 연령대별로는 고성장걱정군은 만 3–5세가 62.8%, 저성장걱정군은 52.5%로 높아 유의한 차이를 보였다($P < 0.001$).

부모의 연령은 20대(5.7%), 30대(76.0%), 40대 이상(18.3%)으로 30대가 가장 많았고, 걱정 수준별 차이를 살펴본 결과, 고성장걱정군에서 30대는 78.1%, 저성장걱정군에서 30대는 76.1%로 30대 비율이 가장 높았다($P = 0.021$). 부모의 학력은 대졸(76.9%), 대학원졸 이상(11.6%), 고등학교졸 이하(11.5%)로 조사되었으며, 낮시간대 양육자는 보육교사(66.5%), 부모(29.6%), 조부모 등(3.9%) 순으로 나타났다.

2. 건강기능식품 섭취 및 질환 조사

조사 대상의 건강기능식품 섭취에 대한 조사한 결과는 Table 2에 제시하였다. 조사 대상자의 71.6%가 건강기능식품을 섭취하고 있었으며, 성장 걱정 수준별로 고성장걱정군은 건강기능식품이 76.9%가 섭취해 유의한 차이를 보였다($P < 0.001$). 섭취하는 건강기능식품의 종류는 영양제(89.4%), 유산균(11.7%), 홍삼(10.2%), 한약(2.8%) 순이었다. 조사 대상자의 12.6%가 만성 질환을 치료하고 있었고, 성장 걱정 수준별 만성 질환 여부는 고성장걱정군(16.3%)이 유의하게 높았다($P < 0.001$). 만성 질환의 종류는 알레르기 비염(69.9%), 아토피 피부염(22.3%) 순이었고, 식품 알레르기 유병률은 6.5%로 조사되었다.

3. 신체 성장

조사 대상의 신체적 성장 현황은 Table 3에 제시하였다. 출생 시 체중 평균은 3.88 kg, 현재 신장과 체중은 평균 96.40 cm, 14.93 kg으로 나타났고, BMI는 전체 평균 16.03 kg/m^{2}으로 나타났다. BMI 비만도 판정 시 저체중(6.9%), 정상체중(76.0%), 과체중(8.7%), 비만(8.4%)으로 나타나 과체중 이상 비율이 17.1%

Table 1. General characteristics of the participants according to parental growth concern level

Variables	Total (n = 5,175)	Parental growth concern level[1]			*P*-value
		High (n = 1,402)	Moderate (n = 1,049)	Low (n = 2,724)	
Child gender					0.030[2]
Boys	2,502 (48.3)	714 (50.9)	516 (49.2)	1,272 (46.7)	
Girls	2,673 (51.7)	688 (49.1)	533 (50.8)	1,452 (53.3)	
Child age (mo)	40.23 ± 14.76	42.27 ± 14.49[a]	39.98 ± 14.44[b]	39.27 ± 14.88[b]	< 0.001[3]
1–2 yr	2,264 (43.7)	522 (37.2)	449 (42.8)	1,293 (47.5)	< 0.001[2]
3–5 yr	2,911 (56.3)	880 (62.8)	600 (57.2)	1,431 (52.5)	
Parent age (yr)					
20s	293 (5.7)	65 (4.6)	62 (5.9)	166 (6.1)	0.021[2]
30s	3,930 (76.0)	1,093 (78.1)	765 (72.9)	2,072 (76.1)	
≥ 40s	949 (18.3)	242 (17.3)	222 (21.2)	485 (17.8)	
Education level of parent[4]					0.150[2]
≤ High school	591 (11.5)	158 (11.4)	129 (12.3)	304 (11.3)	
College	3,947 (76.9)	1,082 (78.1)	813 (77.5)	2,052 (76.1)	
≥ Graduate school	593 (11.6)	146 (10.5)	107 (10.2)	340 (12.6)	
Childminder					0.379[2]
Parents	1,531 (29.6)	392 (28.0)	325 (31.0)	814 (29.9)	
Daycare teachers	3,442 (66.5)	961 (68.5)	6,811 (64.9)	1,800 (66.1)	
Grandparents/others	202 (3.9)	49 (3.5)	43 (4.1)	110 (4.0)	

n (%) or Mean ± SD.
[1]Parental growth concern level was categorized as low (1–2), moderate (3), or high (4–5) based on a 5-point Likert scale.
[2]Chi-square test.
[3]One-way analysis of variance (ANOVA).
[4]Education level of parent was available for 5,131 participants (high = 1,386, moderate = 1,049, low = 2,696), excluding missing data.
[ab]Different superscript letters in the same row indicate significant differences among groups, assessed using Duncan's multiple range test at $P < 0.05$.

에 달하였다. 성장 걱정 수준별 비교에서, 고성장걱정군은 정상체중(80.0%), 저체중(10.5%) 순이고, 저성장걱정군은 정상체중(73.4%), 비만군(11.3%) 순으로 유의한 차이를 보였다($P < 0.001$).

4. 생활습관

수면시간과 식사시간, 운동시간에 대한 조사한 결과인 생활습관은 Table 4에 제시하였다. 국제 수면학회에서 유아에게 권장 취침시간인 10시 이후 취침하는 아동은 15.2%로 조사되었고, 성장 걱정 수준별로는 보통성장걱정군(16.8%), 고성장걱정군(16.4%), 저성장걱정군(14.1%) 순으로 조사되었다($P = 0.042$). 수면시간 권장기준으로 만 1–2세는 11–14시간, 만 3–5세는 10–13시간인데 50.5%가 수면 시간이 부족하거나 많은 것으로 나타났다. 식사에 대한 걱정 수준별로 고성장걱정군은 식사걱정이 많은 군이 66.5% 비율로 높았고, 저성장걱정군은 식사걱정이 낮은 군이 51.3%로 높게 나타나 식사 걱정과 성장 걱정은 유의한 관련을 보였다($P < 0.001$). 식사 소요 시간은 1시간 이상의 느린 식사하는 비율이 9.8%였고, 10분 이하의 빠른 식사 비율은 2.7%로 나타났다. 성장 걱정 수준별로 식사 소요 시간은 고성장걱정군에서 10–60분 동안 식사하는 보통 속도의 유아가 80.6%, 60분 이상 식사를 하는 느린 식사를 하는 비율이 17.3%, 저성장걱정군에서 보통 속도의 식사는 90.5%, 느린 속도 식사의 유아는 6.2%로 유의한 차이가 있었다($P < 0.001$). 운동 빈도는 저성장걱정군에서 주 5회 이상인 경우가 58.5%, 고성장걱정군에서 주 4회 이하인 경우 49.4%로 가장 높았다($P < 0.001$).

5. 식습관 특성 평가

식품군 균형, 간식의 섭취 건전성, 식사의 규칙성에 대한 식습관 특성은 Table 5에 제시하였다. 식품군 균형 중 밥, 빵, 국수 등의 곡류 식품을 하루에 2회 이하 섭취하는 유아는 27.3%였으며, 육류·생선·달걀·콩류 등 단백질 식품을 하루에 1회 이하 섭취하는 유아는 15.7%였고, 채소류를 하루 1회 이하 섭취하는 비율은 43.0%로 나타났고, 김치류를 하루 1회 이하 섭취는 74.0%, 과일류 주 4회 이하 섭취는 53.1%, 유제품 주 2회 이하 섭취는 12.2%로 조사되었다. 간식의 건전성에서는 과자, 초콜릿, 콜라, 사이다, 아이스크림 등의 가공 간식을 주 3회 이상 섭취하는 비율은 70.3%, 패스트푸드를 주 3회 이상 섭취하는 비율은 3.6%로 나타났다. 식사의 규칙성에서는 하루 중 2끼 이하 식사

https://doi.org/10.5720/kjcn.2025.00269

Table 2. Dietary supplement use, chronic diseases, and food allergies of the children

Variables	Total (n = 5,175)	Parental growth concern level			*P*-value
		High (n = 1,402)	Moderate (n = 1,049)	Low (n = 2,724)	
Dietary supplements intake					< 0.001[1]
No	1,469 (28.4)	324 (23.1)	309 (29.5)	836 (30.7)	
Yes	3,706 (71.6)	1,078 (76.9)	740 (70.5)	1,888 (69.3)	
Types of dietary supplements[2]					
Nutritional supplements	3,313 (78.4)	967 (77.8)	672 (86.6)	1,674 (78.2)	< 0.001[1]
Lactobacillus	433 (10.2)	104 (8.4)	31 (4.0)	249 (11.6)	0.104[1]
Red ginseng	377 (8.9)	120 (9.6)	21 (2.7)	188 (8.8)	0.093[1]
Oriental medicine	104 (2.5)	52 (4.2)	52 (6.7)	31 (1.4)	< 0.001[1]
Chronic disease					< 0.001[1]
No	4,524 (87.4)	1,173 (83.7)	899 (85.7)	2,452 (90.0)	
Yes	651 (12.6)	229 (16.3)	150 (14.3)	272 (10.0)	
Types of chronic disease[3]					
Allergic rhinitis	455 (69.9)	160 (69.9)	105 (70.0)	190 (69.9)	< 0.001[1]
Atopic dermatitis	145 (22.3)	54 (23.6)	34 (22.7)	57 (21.0)	0.003[1]
Pollen allergy	28 (4.3)	8 (3.5)	10 (6.7)	10 (3.7)	0.088[1]
Others[4]	102 (15.6)	38 (16.6)	23 (15.3)	41 (15.0)	0.043[1]
Food allergy					0.123[1]
No	4,840 (93.5)	1,309 (93.4)	968 (92.3)	2,563 (94.1)	
Yes	335 (6.5)	93 (6.6)	81 (7.7)	161 (5.9)	

n (%).
[1]Chi-square test.
[2]Multiple responses (n = 4,227).
[3]Multiple responses (n = 730).
[4]Asthma, precocious puberty, etc.

Table 3. Anthropometric characteristics of the children

Variables	Total (n = 5,175)	Parental growth concern level			*P*-value
		High (n = 1,402)	Moderate (n = 1,049)	Low (n = 2,724)	
Birth weight (kg)	3.88 ± 5.34	3.44 ± 2.91[a]	4.09 ± 7.34[b]	4.02 ± 5.38[b]	0.001[1]
Height (cm)	96.40 ± 10.23	94.71 ± 9.62[a]	95.44 ± 9.84[a]	97.64 ± 10.51[b]	< 0.001[1]
Weight (kg)	14.93 ± 3.28	13.94 ± 2.67[a]	14.51 ± 2.85[b]	15.60 ± 3.56[c]	< 0.001[1]
BMI (kg/m^2)[2]	16.03 ± 9.39	15.90 ± 17.48	15.84 ± 2.15	16.15 ± 1.66	0.606[1]
Weight status[2, 3]					< 0.001[4]
Underweight	312 (6.9)	134 (10.5)	71 (7.8)	107 (4.6)	
Normal weight	3,427 (76.0)	1,013 (80.0)	704 (77.4)	1,710 (73.4)	
Overweight	390 (8.7)	67 (5.3)	74 (8.1)	249 (10.7)	
Obesity	378 (8.4)	53 (4.2)	61 (6.7)	264 (11.3)	

Mean ± SD or n (%).
[1]One-way ANOVA.
[2]Since body mass index (BMI) is assessed only for children aged ≥ 2 years, the total sample size for BMI-related variables was n = 4,507 (high = 1,267, moderate = 910, low = 2,330).
[3]Underweight: BMI percentile < 5, normal weight: 5 ≤ BMI percentile < 85, overweight: 85 ≤ BMI percentile < 95, obesity: BMI percentile ≥ 95.
[4]Chi-square test.
[abc]Different superscript letters in the same row indicate significant differences among groups, assessed using Duncan's multiple range test at $P < 0.05$.

Table 4. Lifestyle characteristics of the children

Variables	Total (n = 5,175)	Parental growth concern level			*P*-value
		High (n = 1,402)	Moderate (n = 1,049)	Low (n = 2,724)	
Bedtime					
Before 10 pm	4,386 (84.8)	1,172 (83.6)	873 (83.2)	2,341 (85.9)	0.042[1)]
After 10 pm	789 (15.2)	230 (16.4)	176 (16.8)	383 (14.1)	
Average sleep duration (hr)	10.02 ± 1.22	9.94 ± 1.16[a]	9.93 ± 1.22[a]	10.10 ± 1.24[b]	< 0.001[2)]
Within the range of recommended sleep hours[3)]	2,562 (49.5)	694 (49.5)	495 (47.2)	1,373 (50.4)	0.241[1)]
Out of the range of recommended sleep hours	2,613 (50.5)	708 (50.5)	554 (52.8)	1,351 (49.6)	
Worrying about meal					< 0.001[2)]
High	1,980 (38.3)	933 (66.5)	450 (42.9)	597 (21.8)	
Moderate	1,417 (27.4)	316 (22.5)	371 (35.4)	730 (26.8)	
Low	1,778 (34.4)	153 (10.9)	228 (21.7)	1,397 (51.3)	
Average meal duration (min)	33.10 ± 13.56	37.46 ± 15.66[a]	33.30 ± 12.98[b]	30.77 ± 12.04[c]	< 0.001[2)]
10 to < 60	4,528 (87.5)	1,130 (80.6)	933 (88.9)	2,465 (90.5)	< 0.001[1)]
≥ 60	506 (9.8)	243 (17.3)	95 (9.1)	168 (6.2)	
< 10	141 (2.7)	29 (2.1)	21 (2.0)	91 (3.3)	
Frequency of exercise					< 0.001[1)]
≥ 5 times a week	2,871 (55.5)	710 (50.6)	568 (54.1)	1,593 (58.5)	
≤ 4 times a week	2,304 (44.5)	692 (49.4)	481 (45.9)	1,131 (41.5)	

n (%) or Mean ± SD.
[1)]Chi-square test.
[2)]One-way ANOVA.
[3)]Recommended sleep duration: 11–14 h (ages 1–2 years), 10–13 h (ages 3–5 years).
[abc]Different superscript letters in the same row indicate significant differences among groups, assessed using Duncan's multiple range test at $P < 0.05$.

를 하는 경우가 14.6%, 아침 식사 결식이 주 2회 이하인 경우가 16.7%로 조사되었다. 성장 걱정 수준별 식습관 특성에서 고성장걱정군은 곡류 섭취(≤ 2회/일)는 26.9% ($P = 0.003$), 육류·생선·달걀·콩류 식품 섭취(≤ 1회/일)는 18.3% ($P < 0.001$), 채소류 섭취(≤ 1회/일)는 46.4% ($P < 0.001$), 김치류 섭취(≤ 1회/일)는 75.9% ($P = 0.037$)로 조사되었고, 간식에서 단가공 식품 섭취(≥ 3회/주)는 72.7% ($P = 0.010$)이고, 식사의 규칙성에서 하루 중 2끼 이하 식사를 하는 경우는 16.0% ($P < 0.001$), 아침 식사를 주 2회 이하로 하는 경우는 18.0% ($P = 0.008$)로 유의한 차이를 보였다.

6. 부모의 성장 걱정과 식행동 간 상관관계

부모의 성장 걱정과 식행동 간에 상관관계 분석을 한 결과(Table 6), 유의한 양의 상관관계를 보였다($P < 0.001$). 즉, 성장걱정이 높을수록 아동의 식행동 문제 점수가 높아지는 경향을 나타냈다. 특히, 뱉기(r = 0.27), 질긴 식품 씹기 어려움(r = 0.23), 까다로운 식사(r = 0.31), 식사의 불규칙성(r = 0.26), 식사 거부(r = 0.26) 등에서 상대적으로 높은 상관을 보였다.

7. 식행동 특성 평가

식행동 특성은 섭식 발달, 기질적 특성, 문제 식행동을 포함하여 조사한 결과로 Table 7에 제시하였다. 성장 걱정 수준별에 따른 식행동 변수의 다변량 효과가 유의하였다(Pillai's Trace = 0.131, Wilks' Lambda = 0.870, Hotelling's Trace = 0.149, Roy's Largest Root = 0.145, $P < 0.001$). 즉, 성장걱정 수준에 따라 식행동 전반이 서로 다른 양상을 보임을 의미한다. Partial η^2 값도 0.03–0.08 범위로, 성장걱정이 식행동에 작은–중간 정도의 효과 크기를 갖는 것으로 나타났다. 종합하면, 성장걱정 수준이 높은 부모의 자녀일수록 까다로운 식사, 식사 중 과활동성, 질긴 식품 씹기 어려움, 식사의 자발성, 뱉기 등 전반적 식행동 문제가 더 심하게 나타났다. 섭식 발달 요인에서 '음식을 삼키지 않고, 입에 물고 있거나 뱉는다'는 평균 점수 2.43점(5점 기준)이었고, '질긴 식품을 잘 씹어 먹지 못한다'는 2.65점, '단단한 식품을 잘 씹어 먹지 못한다'는 2.17점, '음식을 삼키다가 헛구역질을 한다'는 1.85점으로 조사되었다. 기질적 특성 중 '먹는 것에 까다롭다'는 2.88점, '식사하는 동안 돌아다니거나 산만하다'는 2.67점, '식사량과 식사 시간이 일정하지 않다'는 2.20점으로 나타났다. 식사 중 문제 행동에서는 '스스로 식사를 잘 하지 않는다'는 2.58점, '식사할 때 TV를 시청한다'는 2.28점, '식사할 때 스마트폰을

https://doi.org/10.5720/kjcn.2025.00269

Table 5. The frequency of food intake and eating habits

Variables	Total (n = 5,175)	Parental growth concern level			*P*-value[1]
		High (n = 1,402)	Moderate (n = 1,049)	Low (n = 2,724)	
Dietary factors					
Grains					0.003
≥ 3 times/day	3,764 (72.7)	1,025 (73.1)	720 (68.6)	2,019 (74.1)	
≤ 2 times/day	1,411 (27.3)	377 (26.9)	329 (31.4)	705 (25.9)	
Meat, fish, eggs, and beans					< 0.001
≥ 2 times/day	4,363 (84.3)	1,146 (81.7)	867 (82.7)	2,350 (86.3)	
≤ 1 times/day	812 (15.7)	256 (18.3)	182 (17.3)	374 (13.7)	
Vegetables (except *kimchi*)					< 0.001
≥ 2 times/day	2,951 (57.0)	751 (53.6)	566 (54.0)	1,634 (60.0)	
≤ 1 times/day	2,224 (43.0)	651 (46.4)	483 (46.0)	1,090 (40.0)	
Kimchi					0.037
≥ 2 times/day	1,347 (26.0)	338 (24.1)	260 (24.8)	746 (27.5)	
≤ 1 times/day	3,828 (74.0)	1,064 (75.9)	789 (75.2)	1,975 (72.5)	
Fruits					0.119
≥ 5 times/week	2,426 (46.9)	631 (45.0)	482 (45.9)	1,313 (48.2)	
≤ 4 times/week	2,749 (53.1)	771 (55.0)	567 (54.1)	1,411 (51.8)	
Dairy products					0.073
≥ 3 times/week	4,543 (87.8)	1,213 (86.5)	912 (86.9)	2,418 (88.8)	
≤ 2 times/week	632 (12.2)	189 (13.5)	137 (13.1)	306 (11.2)	
Snacking					
Processed food[2]					0.010
≥ 3 times/week	3,639 (70.3)	1,019 (72.7)	754 (71.9)	1,866 (68.5)	
≤ 2 times/week	1,536 (29.7)	383 (27.3)	295 (28.1)	858 (31.5)	
Fast food					0.835
≥ 3 times/week	184 (3.6)	53 (3.8)	35 (3.3)	96 (3.5)	
≤ 2 times/week	4,991 (96.4)	1,349 (96.2)	1,014 (96.7)	2,628 (96.5)	
Meal regularity					
Meal frequency					< 0.001
≥ 3 times/day	4,417 (85.4)	1,177 (84.0)	864 (82.4)	2,376 (87.2)	
≤ 2 times/day	758 (14.6)	225 (16.0)	185 (17.6)	348 (12.8)	
Breakfast eating					0.008
≥ 3 times/week	4,313 (83.3)	1,150 (82.0)	852 (81.2)	2,311 (84.8)	
≤ 2 times/week	862 (16.7)	252 (18.0)	197 (18.8)	413 (15.2)	

n (%).
[1]Chi-square test.
[2]Processed food: chocolate, cola, cider, ice cream, etc.

사용한다'는 1.98점, '먹는 것을 거부한다'는 1.82점으로 나타났다. 성장 걱정 수준별 비교한 결과, 고성장걱정군은 섭식발달 요인인 물고 있다가 뱉기($P < 0.001$), 삼키다 헛구역질($P < 0.001$), 단단한 식품 씹기 어려움($P < 0.001$), 질긴 식품 씹기 어려움($P < 0.001$) 점수가 유의하게 높았다. 고성장걱정군은 식사 행동 문제에서 식사 거부($P < 0.001$)와 식사 중 산만함($P < 0.001$), 보통성장걱정군과 고성장걱정군은 식사 중 스마트폰 사용($P < 0.001$)과 식사 중 TV시청($P < 0.001$)의 점수가 높았다.

DISCUSSION

사회적으로 건강·영양에 대해 다양한 우려와 불안이 확산된 현 시점에서 유아 부모는 건강·영양 문제에 대해 높은 관심과 민감성을 보이는 것으로 나타났다[12]. 본 조사에서는 만 1–5세의 유아를 둔 부모를 대상으로 유아의 성장 걱정을 하는 정도에 따라 고성장걱정군(27.1%), 보통성장걱정군(20.3%), 저성장걱정군(52.6%)으로 분류하였고, 성장 걱정 수준에 따라 신체 성장 발

Table 6. Correlations between parental growth concern and eating behavior variables

Variables[1)]	1	2	3	4	5	6	7	8	9	10	11	12
1. Parental growth concern	1.00											
2. Swallowing problems	0.27***	1.00										
3. Retching while swallowing food	0.20***	0.39***	1.00									
4. Difficultly chewing hard foods	0.22***	0.43***	0.36***	1.00								
5. Difficultly chewing tough foods	0.23***	0.48***	0.36***	0.62***	1.00							
6. Picky eating behavior	0.31***	0.37***	0.26***	0.29***	0.32***	1.00						
7. Irregular eating behavior	0.26***	0.32***	0.18***	0.19***	0.21***	0.38***	1.00					
8. Focusing on the meal or attention	0.19***	0.29***	0.14***	0.13***	0.17***	0.29***	0.36***	1.00				
9. Refusal to eat	0.26***	0.46***	0.40***	0.31***	0.30***	0.50***	0.39***	0.27***	1.00			
10. Low eating autonomy	0.07***	0.13***	0.06***	0.08***	0.08***	0.23***	0.25***	0.15***	0.18***	1.00		
11. Watching smart phone while eating	0.08***	0.14***	0.04***	0.07***	0.06***	0.22***	0.28***	0.25***	0.17***	0.66***	1.00	
12. Watching TV while eating	0.24***	0.34***	0.24***	0.23***	0.24***	0.35***	0.29***	0.45***	0.35***	0.23***	0.23***	1.00

[1)]The 5-point Likert scale: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree.
[2)]Pearson's correlation.
***$P < 0.001$.

달, 생활습관, 식습관, 식행동 및 섭식 발달 문제에서 유의한 차이가 있음을 확인하였다. 성장 걱정 수준별 일반적 특성을 살펴본 결과, 고성장걱정군은 남아의 부모인 경우, 유아의 연령이 높을수록, 부모의 연령은 30대인 경우의 비율이 높았다. 건강기능식품을 유아의 71.6%가 섭취하고 있으며, 고성장걱정군에서 건강기능식품 제공 비율과 만성 질환 유병률이 높은 것으로 나타나 부모의 불안이 건강기능식품 섭취로 이어질 수 있음을 시사한다. 그러나 부모의 과도한 걱정이 바람직한 건강 관리 행동으로 연결되지 않고, 건강기능식품에 의존하는 경향으로 나타날 수 있음을 주의 깊게 살펴볼 필요가 있겠다.

본 연구에서 유아의 신체 성장 상태를 성장 걱정 수준별로 분석한 결과, 고성장걱정군에서 저체중 비율이 높고, 저성장걱정군에서 비만 비율이 높은 것으로 보아 부모는 비만보다 저체중을 더 우려하는 경향이 있음을 시사한다. 경북 지역 유아를 대상으로 한 연구[13]에서 과체중군의 어머니들은 정상체중군에 비해 자녀의 체형을 잘못 인식하고 있는 비율이 높은 것으로 보아 자녀의 체형을 부분적으로 왜곡하여 인식하고 있었다. 체형 인지와 걱정 수준의 연관이 높은 것[14]을 볼 때 제 체형을 올바르게 인지할 수 있도록 체형인지에 대한 교육이 필요하겠다[15]. 반면 저체중아는 질병에 대한 저항력 낮아 병원 진료의 빈도가 높을 수 있으며[16, 17], 저체중아는 인스턴트식품·패스트푸드·탄산음료 등의 섭취 빈도가 높은 반면, 채소·과일·우유 등의 섭취빈도는 낮았음을 보고하였다[16, 18]. 식행동적인 요인에서 문제점도 나타났는데, 씹고 삼키는 섭식 발달의 어려움, 까다로운 기질적 특성, 식사 중 문제 행동, 음식에 대한 흥미 저하나 식사 거부 등의 요인이 정상아나 비만아에 비해 저체중아에서 높은 비율로 나타나[16] 저체중아에 대해서는 단순히 영양소의 적정 섭취뿐 아니라, 개인의 기질이 까다로운 특성인지, 혹은 씹고 삼키는 문제가 이어져 음식 섭취에 어려움을 겪고 있는 것은 아닌지 다각적인 접근이 필요하다[16].

생활리듬과 관련하여 보통성장걱정군과 고성장걱정군에서 10시 이후 취침시간인 비율이 15.2%로 높았고, 수면시간은 3.8%가 연령에 비해 부적합하였다. 만 3–5세 유아는 하루 약 12시간의 수면을 권장하는데, 본 조사는 평균 10.02시간으로 나타났으며, 유아의 수면시간과 BMI 연구[19]의 만 5세 유아 수면시간 9.53시간과 비슷한 결과로 조사되었다. 국내에서 연구된 유아의 수면연구에서 비만군의 수면시간이 더 짧은 것으로 나타나 수면이 비만에 미치는 영향이 유아기부터에서 시작됨을 확인할 수 있었다[16, 20]. 식사 속도와 관련된 조사 결과를 보면 고성장걱정군은 느린 식사의 비율이 높고, 저성장걱정군은 빠른 식사 비율이 높았다. 부모는 빠른 식사보다 느린 식사를 더 걱정하는 것으로 보였는데, 느린 식사는 곧 식사량의 부족으로 인식하기 때문으로 추측된다. 반면, 빠른 식사 속도는 혈당을 급격히 상승시키고, 이를 조절하기 위해 인슐린 분비가 빠르게 증가하면서 대사가 지방을 축적 방향으로 전환되어 비만의 위험 요인으로 지적

https://doi.org/10.5720/kjcn.2025.00269

Table 7. Differences in eating behavior characteristics

Variables[1)]	Total (n = 5,175)	Parental growth concern level			*P*-value[2)]	Partial η^2
		High (n = 1,402)	Moderate (n = 1,049)	Low (n = 2,724)		
Swallowing problems	2.43 ± 1.53	2.83 ± 1.21[a]	2.53 ± 1.14[b]	2.19 ± 1.07[c]	< 0.001	0.056
Retching while swallowing food	1.85 ± 0.94	2.09 ± 1.04[a]	1.91 ± 0.95[b]	1.71 ± 0.84[c]	< 0.001	0.030
Difficultly chewing hard foods	2.17 ± 1.09	2.44 ± 1.16[a]	2.30 ± 1.08[b]	1.98 ± 1.01[c]	< 0.001	0.035
Difficultly chewing tough foods	2.65 ± 1.22	3.03 ± 1.22[a]	2.73 ± 1.21[b]	2.43 ± 1.17[c]	< 0.001	0.044
Picky eating behavior	2.88 ± 1.20	3.37 ± 1.17[a]	2.99 ± 1.12[b]	2.58 ± 1.15[c]	< 0.001	0.080
Irregular eating behavior	2.20 ± 0.94	2.48 ± 1.02[a]	2.33 ± 0.90[b]	2.00 ± 0.86[c]	< 0.001	0.052
Distractibility during mealtime	2.67 ± 1.18	2.94 ± 1.23[a]	2.80 ± 1.14[b]	2.48 ± 1.14[c]	< 0.001	0.030
Refusal to eat	1.82 ± 0.94	2.14 ± 1.07[a]	1.91 ± 0.96[b]	1.63 ± 0.80[c]	< 0.001	0.056
Low eating autonomy	2.58 ± 1.12	2.91 ± 1.16[a]	2.70 ± 1.07[b]	2.36 ± 1.08[c]	< 0.001	0.004
Watching smart phone while eating	1.98 ± 1.17	2.06 ± 1.21[a]	2.06 ± 1.17[a]	1.91 ± 1.14[b]	< 0.001	0.005
Watching TV while eating	2.28 ± 1.25	2.37 ± 1.30[a]	2.38 ± 1.22[a]	2.20 ± 1.22[b]	< 0.001	0.044

Mean ± SD.
[1)]The 5-point Likert scale: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree.
[2)]Multivariate test (MANOVA): Pillai's trace = 0.131 ($P < 0.001$), Wilks' lambda = 0.870 ($P < 0.001$), Hotelling's trace = 0.149 ($P < 0.001$), Roy's largest root = 0.145 ($P < 0.001$).
[abc]Different superscript letters in the same row indicate significant differences among groups, assessed using Duncan's multiple range test at $P < 0.05$.

될 수 있다[9, 21]. 식사 시간 동안의 미디어 사용과 식행동 사이의 관련성을 조사한 연구에서 유아의 30.7%가 식사 중 TV를 시청하거나 스마트폰을 사용이 높은 비율로 조사되었으며, 식사 중 미디어 사용은 고열량, 고지방, 고당류 식품 섭취 증가 및 과일·채소 섭취 감소와 관련이 있었다[6]. 식사 어려움, 느린 식사, 까다로움과 같은 식사 문제, 식사 거부, 자발적 식사 부족은 미디어 사용 시간과 관련이 있었다[22]. 과학기술정보통신부의 스마트폰 과의존 실태조사[23]에 따르면 유치원생의 스마트폰 과의존 위험률은 2016년 17.6%에서 2023년 25.0%로 증가한 것으로 조사되었다. 이러한 스마트폰 사용은 연령이 점차 낮아짐에 따라 과의존 및 중독 문제로 이어질 수 있으며, 특히 유아의 경우 화면 시청 시간이 많을수록 야간 수면 시간이 줄어들고, 취침 시간이 늦어지는 경향이 있었다[23]. 미국에서 시행된 청소년 뇌인지 발달(adolescent brain cognitive development) 연구에 참여한 어린이를 대상으로 화면 사용 시간과 비만의 연관성[24]을 분석한 결과, TV, SNS, 문자메시지, 비디오게임 등의 화면 사용 시간이 많을수록 1년 후의 BMI 백분위수가 유의하게 높았다[16, 24]. 이와 유사하게 국내에서 스마트폰 사용 특성과 비만과의 관련성 연구결과[25], 매체 사용의 증가가 신체활동 저하 및 패스트푸드 섭취 및 단맛 음료 섭취 등 잘못된 식습관과 관계가 있음을 지적함에 따라 비만아에 대해 식사 시 스마트폰 사용을 줄이는 교육의 필요성이 제기되고 있다. 또한, 고성장걱정군이 운동은 적게 하는 것으로 조사되어 건강에 대한 높은 관심이 반드시 건강한 생활습관으로 이어지지 않을 수 있음을 시사한다.

식품군 섭취를 분석한 결과, 고성장걱정군에서 곡류(≤ 2회/일) 26.9%, 육류·생선·달걀·콩류(≤ 1회/일) 18.3%, 채소류(≤ 1회/일) 46.4%, 김치류(≤ 1회/일) 75.9%로 나타나 일부 식품군은 권장 섭취기준보다 부족하게 조사되었다. 전국 영유아를 대상으로 식생활 모니터링 보고서[26]에서도 채소류(≤ 2회/일) 78.3%, 김치류(≤ 2회/일) 89.5%, 과일류(≤ 4회/주) 53.8% 섭취가 특히 부족한 것으로 나타났다. 국민건강영양조사 결과[1]에서 만 3–5세의 채소 섭취량은 2008년은 98.6 g에서 2021년 76.7 g으로, 과일섭취량 2008년 141.7 g에서 2021년 128.6 g으로 감소하였다. 유아를 대상으로 편식실태를 조사한 결과[27], 56.5%의 유아가 콩, 버섯을 비롯한 다양한 채소류를 기피하였으며, 채소를 편식하는 주된 요인은 익숙하지 않은 맛, 조직감, 향 순으로 조사되었다[27]. 이러한 결과는 채소류에 대한 접근성을 높이고, 조리 방법의 다양화와 반복적인 식품 노출을 통해 채소의 수용성 제고가 필요함을 의미한다. 채소·과일류는 에너지 함량이 낮고 비타민·무기질 등 다양한 영양소가 풍부하여, 충분한 섭취는 균형적인 식사에 기여하고, 어린이의 비만 예방에도 중요한 역할을 한다[28]. 따라서 유아기부터 이러한 식품에 대한 긍정적 경험을 확대하여, 식습관 형성의 기반을 마련하는 영양교육이 중요하다. 김치는 우리나라의 대표적인 전통 발효 식품으로, 면역력 향상[29, 30], 뇌질환 개선[31], 치아 건강[32], 피부 미용[33, 34], 비만 억제[35] 등 다양한 효능이 과학적으로 입증되었다. 그러나, 사회 변화로 전통적인 식생활이 위축되면서 김치 소비는 감소하는 추세이다. 따라서 김치 문화를 계승해야 할 세대인 어린이들의 김치 섭취 확대는 중요한 과제로 제기되며[36], 이를 위해 백김치, 김치주먹밥, 김치전 등 연령별 기호에 맞는 조리법 활용하여 김치에 대한 친숙도를 높이는 조리 교육 프로그램의 개발이 필요하며, 이를 통해 김치의 문화적·영양적 가치를 자연스럽게 전달할 수 있도

록 해야 한다. 간식의 건전성 결과, 고성장걱정군에서는 가공 간식(≥ 3회/주) 섭취 비율이 72.7%로 높게 나타났고, 식사의 규칙성 부분에서는 하루 식사 중 식사 횟수(≤ 2회/일)는 16.0%, 아침식사 횟수(≤ 2회/주)는 18.0%로 높은 비율을 보였다. 아침식사를 규칙적으로 하는 것은 영양 섭취에 균형에 도움을 줄 뿐만 아니라[16], 학습능력과 체중조절에도 중요한 역할을 하는 것으로 보고되었다[37]. 따라서 성장기 유아의 정상적인 신체적, 정신적 발달을 지원하기 위해서는 아침식사의 중요성에 대한 구체적이고 실질적인 논의가 요구된다. 또한 성장기 유아는 충분한 영양 섭취를 위해 성인에 비해 건강한 간식의 중요성이 더 강조되어야 하며, 권장하는 건강 간식은 영양밀도가 높은 우유와 과일과 같은 식품을 말하며, 이는 성장기 영유아의 균형 잡힌 영양섭취에 기여할 수 있다. 그러나 현실적으로 가공된 단맛 식품의 구입이 쉽고, 많은 어린이집에서 간식으로 과자가 때때로 제공되고 있는 실정이다. 따라서 간식의 질의 향상을 위해 어린이집 및 가정에서의 간식 제공 지침에 대한 행정적 지원 체계의 마련이 필요하다. 특히, 건강한 간식의 정의와 예시를 명확히 하고, 이를 급식 기준 및 교육자료로 제시하여 실천 가능성을 높이는 접근이 필요하겠다.

식행동 특성 중에서 성장걱정과 '까다로움 식사', '뱉기', '질긴 식품 씹기 어려움', '식사의 불규칙성', '식사 거부' 문항이 높은 상관이 나타나, 부모의 걱정수준과 유아의 기질적 특성과 관련성을 보여주었다. 까다로운 식습관을 가지는 유아는 매 끼니에서 여러 식품군의 균형적 섭취가 부족하고, 가공식품·단 음식·패스트푸드 등의 섭취를 절제하지 못하며, 아침식사를 거르고, 식사 전 손 씻기와 같은 바람직한 식생활 환경 점수도 낮게 나타났다[38]. 유아와 어머니의 식행동 간의 관계는 유아의 까다로움과 어머니의 까다로움, 유아의 과활동성과 어머니의 까다로움과 정적 상관이 있는 것으로 나타났다[39]. 반면, 부모의 과도한 식생활 조절 및 식사강요는 부정적인 식환경을 조성하여 식사의 즐거움을 저해하고, 결과적으로 까다로운 식행동이 증가하는 요인으로 작용하였다[39, 40]. 유아의 식행동은 부모의 식행동 및 훈육태도와 상호작용하며, 특히 부모의 식습관, 식태도 등이 자녀의 식습관에 영향을 미치는 요인으로 작용한다[41]. 까다로운 식습관을 보이는 유아는 채소 선호도가 낮으므로, 부모가 끼니마다 김치와 같은 채소 반찬을 골고루 섭취하는 모델링을 통해 식환경 개선이 가능하다[39]. 이 과정에서 건강에 유익한 식품 섭취를 강요하거나 고지방 고당류 식품 섭취를 억제하는 것은 효과적이지 않고, 긍정적인 식환경을 통해 식사 시간과 섭취에 대해 자율성을 부여하고, 지속적인 지지와 격려를 제공하는 것이 식생활 개선에 효과적인 접근으로 판단된다[39]. 또한 부모의 건강관심도가 높을수록 미취학 아동의 식생활 및 식습관에 긍정적인 차이가 있고[16], 자녀의 식행동에 대한 관심과 실천 수준도 높아져 자녀의 식생동 실천 여부를 좌우할 수 있음을 알 수 있었다[42]. 이러한 점을 바탕으로, 유아의 부모를 대상으로 영양교육은 건강관심도가 낮은 부모에게는 유아의 식습관과 성장 및 건강의 연관성 등 기본적인 식습관 내용으로 쉽게 구성하고, 반대로 건강관심도가 높은 부모의 경우 지속 가능한 올바른 식습관을 실천을 위한 구체적이고 실천 가능한 전략 방안을 제시하는 것이 효과적일 것이다. 그러나 어머니가 자녀의 건강·영양을 위해 최선을 다하는 것은 중요하지만, 민감하게 반응할 경우, 오히려 부정적인 결과로 나타날 수 있으므로[39], 전문가의 다양한 의견을 폭넓게 수용하고 합리적인 판단을 할 수 있도록 지원하는 것이 필요하다. 나아가 어머니의 불안을 완화하고, 자녀의 건강을 적절히 관리할 수 있도록 신뢰가 높고 정확한 건강·영양 및 안전에 대한 정보를 제공하며, 실질적이고 올바른 관리 방법을 알려주기 위해 다각적인 부모교육 프로그램이 요구되며[42], 이를 위한 정책적 개입도 병행되어야 한다.

Limitations

본 연구는 5,000명 이상의 대규모 표본을 기반으로 하였고, DST 도구를 활용하여 유아 식습관을 다각적으로 평가했다는 점에서 의의가 있다. 그러나 조사 대상이 경기도 일부 지역의 유아와 부모로 한정되어 본 연구의 결과를 일반화하기에는 한계가 있고, 유아의 식생활 평가를 위한 설문 내용은 유아 스스로의 응답이 아닌 부모에 의한 간접 평가로 이루어 졌다는 점 역시 제한점으로 작용한다. 그럼에도 불구하고 본 연구는 유아의 식습관과 생활습관을 종합적으로 평가할 수 있는 도구를 활용하여 유아의 올바른 식생활 실천 가능성을 예측하고자 하였다는 점에 의의가 있다. 특히 부모의 성장 걱정 수준과 유아의 식습관 간 관계를 실증적으로 확인하여 향후 부모 교육 및 영양상담 전략 개발에 근거자료를 제공하였다. 여성의 경제 활동 증가로 유아의 양육 주체가 어머니뿐 아니라 조부모, 어린이집 및 유치원 교사 등으로 확대되고 있음을 고려할 때 추후 연구에서는 다양한 양육자를 포함한 식사지도 연구도 진행되어야 할 것으로 생각된다.

Conclusion

본 연구는 유아 부모의 성장에 대한 걱정 수준에 따라 일반 특성, 성장 상태, 생활습관 및 식습관, 섭식 발달 등의 차이를 분석하여, 유아의 건강한 식생활 실천 가능성과 그에 영향을 미치는 요인을 탐색하였다. 성장 걱정 수준이 높은 부모의 자녀는 저체중 유아의 비율이 높고, 까다로운 기질, 씹고 삼키는 섭식 발달 문제, 식사 중 문제 행동이 높게 나타나 행동적·심리적 식사 관련 어려움이 있었다. 이는 단순한 체중 증가가 아닌, 행동적 중재가 병행되는 맞춤형 다각적 접근이 필요함을 시사한다. 또한 고성장걱정군에서 유아들의 운동 부족, 느린 식사, 수면 부족, 섭식 문제와 같은 건강위험 행동 비율이 높게 나타났으며, 이는 부모의 성장 걱정이 자녀의 식행동을 긍정적으로 이끄는 데 반드시 효과적인 것은 아님을 시사한다. 따라서 건강 관심도가 낮은 부모에게는 유아기 올바른 식습관의 중요성에 대

https://doi.org/10.5720/kjcn.2025.00269

한 기본 개념 중심의 교육이, 건강 관심도가 높으며, 성장 걱정이 지나친 경우의 부모에게는 과도한 통제가 아니라 실천 가능한 전략과 긍정적 식사 환경 조성을 강조하는 접근이 요구된다. 또한, 부모의 건강 관심도는 자녀의 식생활에 영향을 미치는 만큼, 부모가 자녀 급식 및 건강에 대해 보다 신뢰할 수 있는 정보를 바탕으로 올바른 판단을 할 수 있도록 정확하고 검증된 영양 정보 제공과 함께 부모교육 프로그램을 다양하게 개발할 필요가 있다. 나아가 유아기의 건강한 식습관 형성을 위한 정책적 지원과 교육 개입도 병행되어야 할 것이다. 본 연구는 일부 지역 유아와 부모에 국한되어 표집하였고, 유아가 아닌 부모의 간접 응답에 의존한 점에서 일반화에 한계가 있으며, 향후 연구에서는 조부모, 보육 교사 등 다양한 양육자를 포함한 식사 지도 방식의 연구로 확대가 필요하다.

CONFLICT OF INTEREST

There are no financial or other issues that might lead to conflict of interest.

FUNDING

None.

DATA AVAILABILITY

Research data is available upon request to the corresponding author.

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https://doi.org/10.5720/kjcn.2025.00269

Korean J Community Nutr. 2026 Feb;31(1):87-100
https://doi.org/10.5720/kjcn.2025.00367
eISSN 2951-3146

KJCN
Korean Journal of Community Nutrition

Research Article

한국 노인의 성별 및 가구 유형에 따른 식생활 형태 및 영양소 섭취 실태 비교: 제8기 국민건강영양조사를 활용한 단면연구

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Comparison of dietary behaviors and nutrient intake by gender and household type among older Koreans: a cross-sectional study using data from the 8th Korea National Health and Nutrition Examination Survey

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Received: December 19, 2025
Revised: January 29, 2026
Accepted: February 11, 2026

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Objectives: This study aimed to identify gender- and household type-specific nutritional vulnerability among older Koreans by comparing dietary behaviors, nutrient intake, and diet quality.
Methods: We analyzed data from 2,412 adults aged ≥ 65 years (1,118 men; 1,294 women) from the 8th Korea National Health and Nutrition Examination Survey (2019–2021). Household type was classified as one-person, couple-only, or with-children. Outcome variables included dietary behavior, daily energy and nutrient intake, and diet quality, assessed using the Korean Healthy Eating Index (KHEI). Analyses were carried out accounting for the complex sampling design, adjusting for age, residential area, education level, household income level, economic activity status, self-rated health status, and survey year.
Results: Elderly men in one-person households, compared with those in couple-only households, were more likely to skip breakfast and lunch and to consume less energy. The odds of intake below the estimated average requirement (EAR) were higher for iron (odds ratio [OR] = 1.731, P = 0.022) and zinc (OR = 2.460, P = 0.002) among men in one-person households. The KHEI score was the lowest among men in one-person households. Elderly women in with-children households, compared with those in couple-only households, were more likely to skip breakfast and to consume less energy. The risks of intake below the estimated energy requirement (EER) and EAR were higher among women in with-children households than those in couple-only households (EER: OR = 1.448; magnesium: OR = 2.090; iron: OR = 1.692; zinc: OR = 1.902; folate: OR = 2.282; all P < 0.05). The KHEI score was lower among women in with-children households.
Conclusion: Elderly men living alone and elderly women living with children showed significantly greater nutritional vulnerability. More attention should be given to understanding how gender-specific household types can affect nutritional vulnerability in later life.

Keywords: aged; gender identity; family characteristics

INTRODUCTION

전 세계적으로 고령화가 가속화되면서 노인의 식생활과 영양상태는 건강한 노후를 위한 중요한 사회적 과제로 떠오르고 있다. 의료 기술의 발달과 생활 수준의 향상으로 평균 수명이 증가함에 따라, 우리나라의 경우 65세 이상 노인 인구 비율이 2000년에는 7%였으나, 2024년에는 20%로 증가하였다[1]. 이와 같은 고령화 현상은 의료비 부담(증가), 복지 정책 확대, 사회·경제적 부담 등 다양한 사회 문제를 야기할 수 있으며[2], 특히 노인의 생활 방식과 건강 상태에 직·간접적인 영향을 미치고 있다.

또한 노인의 가족 혹은 가구 형태가 점차 변화하고 있으며, 다양해지고 있다. 인문사회학적 관점에서 가구는 단순한 동거 단위를 넘어, 자원·활동·지출을 정기적으로 공유하며 상호의 존적 관계를 이루는 사회적 조직으로 이해된다[3]. 이러한 관점에서 볼 때, 가구 형태의 변화는 단순한 거주 형태의 변화가 아니라 가족 내 상호작용과 생활 방식의 변화를 의미한다. 통계청 자료에 따르면, 65세 이상 1인가구 비율은 2000년 3.8%에서 2024년 10.3%로 증가하였다[4]. 혼자 사는 노인은 배우자나 가족과 함께 사는 노인에 비해 사회적 고립을 경험할 가능성이 높으며, 이는 신체적·정신적 건강뿐만 아니라 식생활과 영양상태에도 부정적인 영향을 미칠 수 있다고 알려져 있다[5, 6].

65세 이상 노인의 배우자 유무에 따른 건강 상태와 삶의 질 차이를 분석한 선행연구에 따르면 무배우자 군이 유배우자 군에 비해 만성질환 유병 개수가 더 많았으며, 주관적 건강 인식이 더 부정적인 경향을 보이고 전반적인 삶의 질 수준도 낮은 것으로 보고되었다[7]. 이는 배우자의 존재가 노인의 건강 유지 및 삶의 질 향상에 있어 긍정적인 영향을 미칠 수 있음을 시사한다. 식생활 측면에서도 이러한 차이가 관찰되었는데 혼자 사는 노인은 가족과 함께 사는 노인에 비해 식사 결식률이 높고 혼자 식사하는 비율 또한 상대적으로 높은 것으로 보고되었다[8]. 이러한 식사 패턴의 차이는 주요 영양소섭취에도 영향을 미쳐 1인가구 노인이 배우자와 함께 사는 노인에 비해 칼슘, 칼륨, 리보플라빈, 나이아신, 비타민 C 등 여러 영양소의 섭취 수준이 전반적으로 낮은 경향을 보이는 것으로 보고되었다. 또한 1인가구 노인은 에너지 및 영양소 섭취 부족 위험이 배우자와 함께 사는 노인보다 높은 것으로 보고되었다[9]. 이와 같이 국내외에서는 노인의 가구 유형에 따른 식생활과 영양소 섭취의 차이를 규명하기 위한 다양한 연구가 수행되어 왔으며[10-16], 많은 선행연구에서 1인가구 노인은 사회적·심리적 고립과 낮은 영양섭취 등 전반적으로 취약한 건강 특성이 보고되었다.

그러나 일부 연구[14, 17]에서는 자녀동거가구에서도 특정 식품 섭취량이 낮거나 식사의 질이 떨어지는 등 취약성이 보고되었다. 특히 자녀와의 동거는 부부만 사는 가구와 달리 가구 구성과 일상적 생활 맥락이 상이할 수 있으며, 이러한 차이는 노인의 식생활에도 영향을 미칠 가능성이 있다. 전통적으로 자녀와의 동거는 보호적인 요소로 생각되어 왔으나 자녀나 손주와 함께 거주하는 여성 노인의 경우 가사와 식사준비를 전담하거나 경제적 부담을 떠안아 식생활에 부정적 영향을 미칠 수 있다[18-21].

따라서 기존의 1인가구와 부부 동거 가구만의 비교 혹은 독거와 비독거만의 비교에서 벗어나 자녀동거가구를 별도로 분류하여 분석할 필요가 있다. 또한, 선행연구들은 특정 지역(예: 농촌, 경기북부 등)이나 제한된 대상 집단(예: 급식서비스 이용 노인)을 중심으로 수행되어 결과의 일반화에 한계가 있으며, 가구 유형과 더불어 성별 특성을 함께 고려한 통합적 분석은 부족한 실정이다.

따라서 본 연구에서는 현실적인 가족 구성 형태를 반영한 세 가지 가구 유형(1인가구, 부부가구, 자녀동거가구)을 설정하고, 전국 대표성을 지닌 국민건강영양조사(Korea National Health and Nutrition Examination Survey) 제8기 자료를 활용하여, 한국 노인의 성별과 가구 유형에 따른 식생활 형태, 에너지 및 영양소 섭취 상태, 식사의 질을 체계적으로 분석하고자 한다. 이를 통해 가구 구조의 다양성과 성별 특성이 식행동 및 영양섭취에 미치는 영향을 보다 정밀하게 파악하고, 향후 노인 대상 맞춤형 영양정책 및 건강증진 프로그램 개발을 위한 기초자료를 제공하고자 한다.

METHODS

Ethics statement

This study was exempted by the Inha University Institutional Review Board (IRB) (IRB No. 250428-4A).

1. 연구설계

본 연구는 2019년부터 2021년까지 제8기 국민건강영양조사 원시자료를 분석한 단면연구로 Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) 보고 지침을 참고하여 기술하였다(https://www.strobe-statement.org/).

2. 연구 자료 및 대상

본 연구는 Fig. 1과 같이 국민건강영양조사 제8기(2019–2021) 전체 참여자 22,559명 중 65세 미만인 17,274명을 제외하고 65세 이상 5,285명을 대상으로 하였다. 가구 유형이 '기타' 또는 '모름/무응답'으로 분류된 406명을 제외한 4,879명을 포함하였으며, 식사요법 여부 문항에서 '예' 또는 '모름/무응답'으로 응답하였거나 해당 변수에 대한 결측이 있는 대상자 1,705명을 제외하고 '아니오'라고 응답한 3,174명을 포함하였다. 일일 에너지섭취량이 500 kcal 미만 또는 5,000 kcal 초과로 보고된 35명을 제외한 3,139명을 포함하였다. 영양교육 및 상담 경험 여부에 대해 '모름/무응답'으로 응답한 대상자(n = 1)와 가구소득수

https://doi.org/10.5720/kjcn.2025.00367

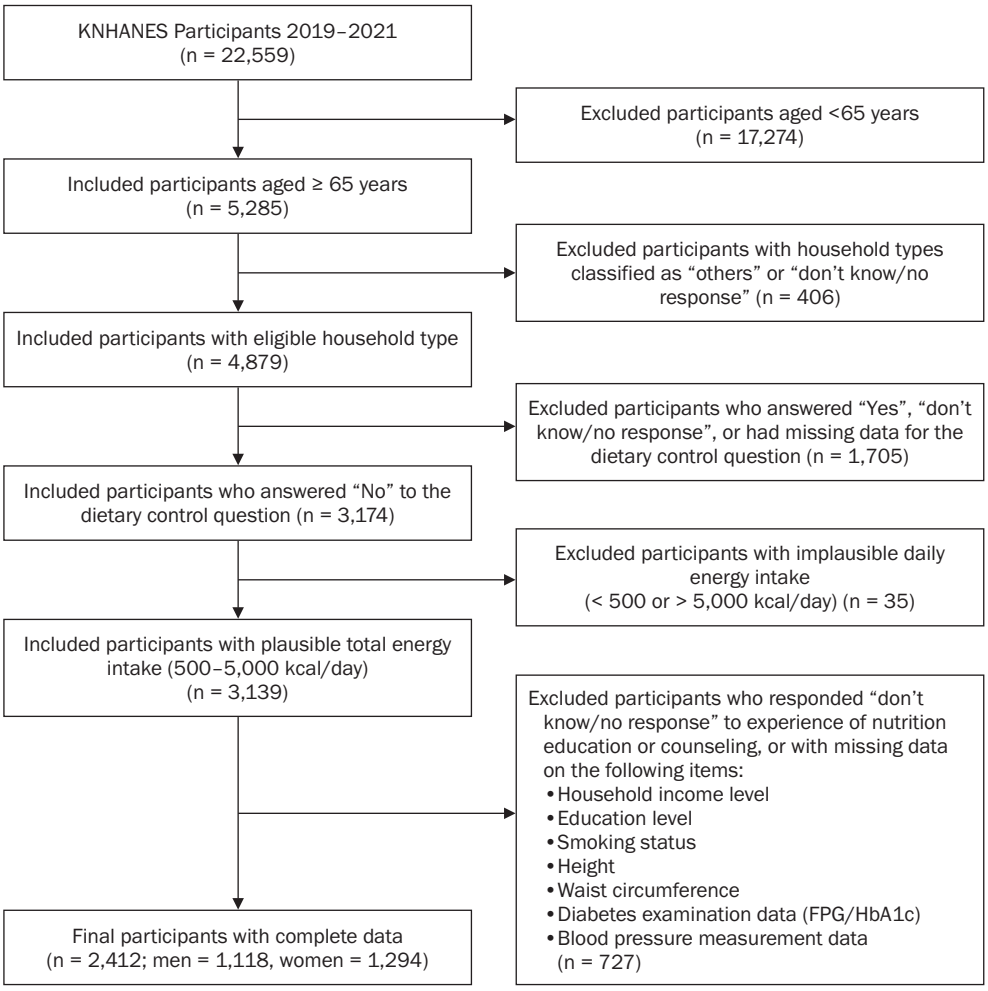

Fig. 1. Flowchart of inclusion and exclusion of study participants. KNHANES, Korea National Health and Nutrition Examination Survey; FPG, fasting plasma glucose; HbA1c, glycated hemoglobin.

준(n = 24), 교육수준(n = 452), 흡연 여부(n = 4), 신장(n = 67), 허리둘레(n = 5)에서 결측이 있는 대상자, 그리고 당뇨병 및 고혈압 유병 여부 산출에 필요한 검진조사 자료가 없는 대상자(당뇨병 관련 검사 결측 n = 166, 혈압 측정치 결측 n = 8)를 포함한 총 727명을 제외하였다. 최종적으로 2,412명(남자 1,118명, 여자 1,294명)이 분석 대상으로 선정하였다.

또한 식사요법 여부가 식이행동과 영양소섭취패턴에 영향을 미칠 수 있어 확인하는 보조분석을 실시하였다. 식사요법을 시행한다고 응답한 참여자('예' 응답자)만을 추출하여 보조 분석을 수행하였다. 그 결과, 보조분석에서는 남성 노인에서 탄수화물 에너지 구성비 및 한국식생활평가지수(Korean Healthy Eating Index, KHEI)의 일부 세부항목(우유·유제품, 총 당류, 지방 점수)이, 여성 노인에서는 탄수화물의 평균필요량(estimated average requirement, EAR) 미만 위험과 KHEI 항목의 총 에너지 점수가 식이요법을 시행하지 않는 참여자와는 다르게 유의하게 나타났다. 이러한 결과로 식사요법을 시행하는 노인에서 특정 식품군 섭취나 에너지 조절 등 식습관 특성이 일반 노인과 다르게 나타날 수 있음을 확인하였으며, 이에 본 연구에서는 식사요법 '예' 응답자를 분석에서 제외하였다.

3. 연구 내용

1) 독립변수: 가구 유형

국민건강조사의 설문 항목 중 '가구 세대구성코드' 변수를 사용하여 연구대상자의 가구 유형을 분류하였다. 연구대상자의 가구 유형은 다음과 같이 세 가지로 분류하였다. 첫째는 가구세대구성코드에서 '1세대 1인가구' 에 해당하는 1인가구, 둘째는 '1세대 부부가구' 에 해당하는 부부가구, 마지막으로 '2세대 부부 + 미혼자녀', '2세대 편부모 + 미혼자녀', '3세대이상가구'를 통합하여 자녀동거가구로 정의하였다. 이러한 분류는 배우자 또는 자녀와의 동거여부가 노인의 식사 행태 및 영양섭취 상태에

중요한 영향을 미친다는 선행연구 결과[8, 9, 22, 23]의 가구분류방법을 참고하여 설정하였다.

한편, 가구 세대구성코드의 '1세대 기타' 와 '2세대 기타' 항목에는 비혈연 동거인이 포함되어 있을 수 있어 가족 구조의 특성이 불분명하다. 이러한 집단을 포함할 경우 세부 분석 및 해석의 일관성이 저해되고, 다른 가구유형과의 비교에서 동질성을 확보하기 어려워 통계적 검정력과 결과의 신뢰성이 저하될 수 있다. 따라서 본 연구에서는 분석의 타당성을 확보하기 위해 해당 집단을 제외하였다.

2) 종속변수: 식생활 관련 변수

식생활 형태는 끼니별 결식 여부, 끼니별 동반 식사 여부, 외식 빈도, 영양교육 및 상담 경험 여부, 식이보충제 복용 여부, 영양표시 인지 여부 변수를 사용하였다. 이는 국민건강영양조사의 원자료 그대로 사용하였으며, 설문 항목에 '모름/무응답', '비해당' (초등학생 미만) 이라고 답한 자는 분석에서 제외하였다. 외식 빈도는 최근 1년간 평균 외식 빈도 문항을 이용하여, '≥ 1회/일', '주 5–6회', '주 3–4회', '주 1–2회', '월 1–3회', '월 1회 미만'으로 재 분류하여 분석에 사용하였다.

에너지 및 영양소 섭취량은 개인별 24시간 회상법을 통해 산출하여 제공된 가공 자료를 이용하여 분석하였다.

식사의 질은 KHEI를 이용하여 평가하였다. KHEI는 국민건강영양조사 자료를 기반으로 개발된 지수로[24] 한국 성인의 전반적인 식이 질을 종합적으로 평가할 수 있으며, 적정성(adequacy), 절제성(moderation), 균형성(energy balance)의 세 영역으로 구성되어 있다. 각 영역은 아침 식사 여부, 잡곡, 과일, 채소, 우유 및 유제품, 고기·생선·달걀·콩류, 포화지방, 나트륨, 당류, 탄수화물, 지방, 총 에너지 등 세부 항목으로 이루어져 있으며, 총점은 0점에서 100점까지 산출된다. 점수가 높을수록 한국 식생활 지침을 잘 준수하여 식사의 질이 우수함을 의미한다.

3) 일반적 특성

일반적 특성으로 연령, 거주지역, 교육수준, 가구소득수준, 경제활동상태, 흡연 여부, 음주 여부, 주관적 건강 상태, 체질량지수(body mass index, BMI), 비만 유병 여부, 복부비만 유병 여부, 당뇨병 유병 여부, 고혈압 유병 여부를 알아보았다. 연령은 65–74세, 75세 이상으로 구분하였으며, 거주지역은 원자료의 '동'을 도시, '읍·면'은 농촌으로 구분하였다. 교육수준은 '교육수준 재분류 코드'와 가구소득수준은 '소득 4분위수(가구)' 변수의 원자료 그대로 사용하였다. 경제활동상태는 원자료 그대로 사용하였으며, 설문 항목에 '모름', '무응답', '비해당' (만 15세 미만)이라고 답한 자는 분석에서 제외하였다. 흡연 여부는 평생 담배 5갑(100개비) 이상을 피웠고 현재 흡연 중인 경우를 '예', 그렇지 않은 경우를 '아니오'로 분류하였으며, 음주 여부는 최근 1년 동안 월 1회 이상 음주한 경우를 '예', 그렇지 않은 경우를 '아니오'로 분류하여 분석에 사용하였다. 주관적 건강상태는 '주관적 건강인지' 변수의 원자료에서 설문 항목에 '모름·무응답' 이라고 답한 자는 제외하였고, 나머지 항목은 재 분류하여 분석에 사용하였다. 비만 유병 여부는 BMI를 기준으로 정의하였다. BMI는 체중(kg)을 신장(m)의 제곱으로 나누어 산출하였으며, BMI가 25 kg/m^2 이상인 경우를 비만으로 분류하였다. 복부비만 유병 여부는 대한비만학회 기준을 적용하여 허리둘레를 기준으로 정의하였으며[25], 남자는 90 cm 이상, 여자는 85 cm 이상인 경우를 복부 비만으로 분류하였다. 당뇨병 유병 여부는 8시간 이상 공복 상태에서 측정된 공복혈당 및 당화혈색소 수치를 기준으로 정의하였다. 공복혈당이 126 mg/dL 이상이거나 의사로부터 당뇨병 진단을 받았거나 혈당강하제 복용 또는 인슐린 주사를 사용하는 경우, 혹은 당화혈색소가 6.5% 이상인 경우를 당뇨병으로 분류하였다. 수축기 혈압이 140 mmHg 이상, 이완기 혈압이 90 mmHg 이상, 또는 고혈압 약물을 복용한 경우를 고혈압으로 분류하였다.

4. 통계 분석

본 연구의 모든 자료 처리와 통계 분석은 IBM SPSS Statistics 29.0 프로그램(IBM Corp.)을 사용하여 수행하였다. 제8기(2019–2021) 국민건강영양조사 원시자료는 기수 내 3개 연도의 자료를 통합하여 결합하였으며, 층화, 집락, 통합가중치 등의 요소를 고려해 복합 표본 통계 분석을 시행하였다. 모든 분석 시 통계적 유의성은 $P < 0.05$를 기준으로 검정하였으며, 연속형 변수는 복합표본 일반선형모형(general linear model)을 사용하였다. 단순 평균 차이를 검정할 때는 분산분석(analysis of variance)을 실시하였으며, 공변량을 함께 고려할 필요가 있는 경우에는 공분산분석(analysis of covariance)을 적용하였다. 유의한 결과에 대해서는 Bonferroni 방법을 사용하여 사후검정을 실시하였다. 범주형 변수는 복합표본 교차분석(complex sample crosstabs)을 통해 카이제곱 검정(Chi-square test, χ^2 test) 또는 공변량을 보정한 후 복합표본 로지스틱회귀 분석(complex sample logistic regression analysis)을 실시하였다. 분석시 공변량으로 연령, 거주지역, 교육수준, 가구소득수준, 경제활동상태, 주관적 건강상태, 조사연도, 총 에너지 섭취량이 사용되었다.

RESULTS

1. 대상자의 일반적 특성

연구대상자의 일반적 특성은 가구 유형 및 성별에 따라 Table 1에 제시하였다. 가구유형 간 연령($P < 0.001$)과 교육수준($P = 0.002$)은 여성에서만 유의한 차이가 나타났다. 1인가구 여성은 평균 연령이 74.5세이고, 75세 이상 고령자 비율 역시 54.0%로 다른 가구 유형에 비해 높은 경향을 보였다. 또한 교육 수준은 1인가구에서 초등학교 이하 학력이 74.2%로 높은 반면, 자녀동거

https://doi.org/10.5720/kjcn.2025.00367

Table 1. General characteristics of the participants by household type and gender

Variables	Men (n = 1,118)			*P*-value	Women (n = 1,294)			*P*-value
	One-person (n = 170)	Couple-only (n = 737)	With-children (n = 211)		One-person (n = 468)	Couple-only (n = 535)	With-children (n = 291)	
Age (year)								
65–74	104 (62.0)	441 (61.4)	138 (63.3)	0.896	200 (46.0)	392 (73.8)	199 (70.2)	< 0.001
≥ 75	66 (38.0)	296 (38.6)	73 (36.7)		268 (54.0)	143 (26.2)	92 (29.8)	
Mean age (year)	72.69 ± 0.42	72.89 ± 0.20	72.09 ± 0.44	0.175	74.45 ± 0.27[a]	71.27 ± 0.22[b]	71.92 ± 0.33[b]	< 0.001
Residential area				0.002				< 0.001
Urban	121 (75.0)	478 (68.8)	172 (82.3)		307 (70.3)	355 (68.9)	237 (86.8)	
Rural	49 (25.0)	259 (31.2)	39 (17.7)		161 (29.7)	180 (31.1)	54 (13.2)	
Education level				0.731				0.002
≤ Elementary school	62 (33.2)	304 (39.9)	80 (39.4)		357 (74.2)	335 (59.4)	184 (59.5)	
Middle school	41 (23.5)	143 (19.6)	34 (17.8)		49 (11.1)	99 (19.9)	52 (17.7)	
High school	40 (27.0)	178 (24.6)	63 (28.6)		42 (10.2)	77 (16.0)	40 (17.4)	
≥ College	27 (16.2)	112 (16.0)	34 (14.3)		20 (4.5)	24 (4.7)	15 (5.5)	
Household income level				< 0.001				< 0.001
Lowest quartile	111 (64.8)	287 (38.0)	34 (18.8)		354 (72.9)	250 (45.0)	77 (32.2)	
Lower-middle quartile	31 (18.3)	266 (35.4)	62 (32.6)		89 (21.2)	184 (35.0)	80 (27.5)	
Upper-middle quartile	22 (13.6)	126 (18.3)	60 (24.3)		17 (4.1)	79 (15.8)	79 (22.2)	
Highest quartile	6 (3.3)	58 (8.3)	55 (24.3)		8 (1.8)	22 (4.1)	55 (18.1)	
Currently working[1)]				0.153				0.291
Yes	66 (38.5)	351 (48.0)	97 (43.6)		171 (35.9)	185 (33.3)	89 (29.5)	
No	104 (61.5)	386 (52.0)	114 (56.4)		297 (64.1)	350 (66.7)	202 (70.5)	
Smoking status[2)]				0.158				0.297
Yes	45 (27.4)	132 (19.0)	48 (20.9)		20 (4.8)	10 (2.5)	12 (5.1)	
No	125 (72.6)	605 (81.0)	163 (79.1)		448 (95.2)	525 (97.5)	279 (94.9)	
Drinking status[3)]				0.922				0.883
Yes	99 (59.6)	443 (59.9)	127 (58.4)		78 (17.7)	94 (17.5)	52 (18.8)	
No	71 (40.4)	294 (40.1)	84 (41.6)		390 (82.3)	441 (82.5)	239 (81.2)	
Self-rated health status[4)]				0.018				0.542
Good	37 (23.4)	248 (33.6)	69 (32.5)		90 (20.3)	111 (21.0)	77 (25.6)	
Fair	86 (48.1)	369 (50.9)	104 (51.5)		220 (47.1)	252 (46.2)	126 (44.4)	
Poor	47 (28.5)	120 (15.5)	38 (16.0)		158 (32.6)	172 (32.8)	88 (29.9)	
BMI (kg/m^2)	23.47 ± 0.23	23.85 ± 0.15	23.60 ± 0.24	0.329	24.19 ± 0.18	24.44 ± 0.17	24.32 ± 0.30	0.657
Obesity[5)]	52 (28.0)	233 (31.8)	65 (32.0)	0.700	175 (37.2)	201 (38.6)	118 (39.2)	0.878
Abdominal obesity[6)]	71 (43.3)	325 (44.4)	90 (43.8)	0.970	251 (53.3)	273 (52.4)	170 (54.8)	0.821
Diabetes[7)]	42 (24.3)	189 (25.0)	58 (30.0)	0.345	123 (26.6)	134 (24.7)	75 (24.2)	0.777
Hypertension[8)]	98 (60.1)	424 (57.5)	116 (56.0)	0.785	315 (65.6)	348 (65.0)	182 (60.5)	0.332

n (weighted %) or weighted mean ± SE.
Statistical analysis: Values were obtained using the general linear model for continuous variables and the χ^2 test for categorical variables in complex sample survey data analysis ($P < 0.05$).
BMI, body mass index.
[1)]Currently working: "Yes" = currently employed; "No" = unemployed or economically inactive individuals.
[2)]Smoking status: "Yes" = current smoker; "No" = former smoker or never smoker.
[3)]Drinking status: "Yes" = consumed alcohol at least once a month in the past year; "No" = lifetime abstainer or consumed less than once a month.
[4)]Self-rated health status: "Good" = very good or good, "Fair" = fair, "Poor" = poor or very poor.
[5)]Obesity: defined as BMI ≥ 25 kg/m^2.
[6)]Abdominal obesity: defined as a waist circumference ≥ 90 cm for men and ≥ 85 cm for women.
[7)]Diabetes: defined as fasting plasma glucose (FPG) ≥ 126 mg/dL, HbA1c ≥ 6.5%, or current use of antidiabetic medication.
[8)]Hypertension: defined as systolic blood pressure ≥ 140 mmHg, diastolic blood pressure ≥ 90 mmHg, or current use of antihypertensive medication.
[a,b]Values are significantly different according to the Bonferroni post hoc test ($P < 0.05$).

https://doi.org/10.5720/kjcn.2025.00367

가구에서는 고등학교 졸업(17.4%)과 대졸 이상(5.5%) 비율이 상대적으로 높아 가구유형 간 차이가 나타났다. 가구소득수준은 남녀 모두에서 가구유형 간 유의한 차이가 나타났다($P < 0.001$). 1인가구는 최하 소득분위 비율이 남성 64.8%, 여성 72.9%로 다른 가구 유형에 비해 높은 경향을 보였으며, 자녀동거가구는 상위 소득분위 비율이 높아(남성 24.3%, 여성 18.1%) 가구유형에 따른 소득 수준의 차이가 뚜렷하게 나타났다. 거주지역도 남녀 모두에서 가구유형 간 유의한 차이가 나타났다(남성 $P = 0.002$, 여성 $P < 0.001$). 부부가구의 농촌 거주 비율이 높은 경향을 보였으며(남성 31.2%, 여성 31.1%), 자녀동거가구는 도시 거주 비율이 높은 경향을 보였다(남성 82.3%, 여성 86.8%).

주관적 건강 상태는 남성에서만 가구유형 간 유의한 차이가 나타났다($P = 0.018$). 부부가구는 '좋음' 응답 비율이 33.6%이고, 1인가구는 '나쁨' 응답 비율이 28.5%로 다른 가구 유형에 비해 유의하게 높은 경향을 보였다. BMI, 비만 유병 여부, 복부비만 유병 여부, 당뇨병 유병 여부 및 고혈압 유병 여부는 남성과 여성 모두에서 가구유형 간 유의한 차이가 나타나지 않았다.

2. 가구유형 및 성별에 따른 식행동 및 영양 관련 요인의 차이

연구대상자의 식행동 및 영양 관련 요인은 가구 유형 및 성별에 따라 Table 2에 제시하였다. 아침식사 결식 여부는 남성과 여성 모두에서 가구유형 간 유의한 차이가 나타났다($P < 0.001$). 남성은 1인가구에서(10.2%), 여성은 자녀동거가구에서(11.8%) 아침식사 결식률이 다른 가구 유형에 비해 높은 경향을 보였다. 점심식사 결식 여부는 남성에서만 유의한 차이가 나타났으며($P = 0.008$), 1인가구에서 12.0%로 높은 결식률을 보였다. 반면, 저녁식사 결식 여부는 남성과 여성 모두에서 가구유형 간 유의한 차이가 나타나지 않았다. 식사 동반 여부는 아침·점심·저녁 모두에서 남성과 여성의 가구유형 간 유의한 차이가 나타났으며($P < 0.001$), 남성과 여성 모두 부부가구에서 동반 식사 비율이 다른 가구 유형에 비해 높은 경향을 보였다.

외식 빈도는 여성에서만 가구유형 간 유의한 차이가 나타났다($P = 0.003$). 여성 1인가구는 '월 1회 미만' 외식 비율이 37.7%로 다른 가구 유형에 비해 높은 경향을 보였다. 또한, 영양표시 인지 여부 역시 여성에서만 유의한 차이가 나타났으며($P = 0.001$), 자녀동거가구에서 50.9%로 인지율이 높은 경향을 보였다.

3. 가구 유형 및 성별에 따른 1일 에너지 및 영양소 섭취량과 에너지 구성비의 비교

1일 에너지 및 영양소 섭취량과 에너지 구성비는 가구 유형 및 성별에 따라 Table 3에 제시하였다. 남성에서는 총 에너지 섭취량이 가구유형 간 유의한 차이가 나타났으며($P = 0.033$), 부부가구에서 1,848.9 kcal로 다른 가구 유형에 비해 유의하게 높고, 1인가구에서 1,682 kcal로 유의하게 낮은 경향을 보였다. 단백질, 탄수화물, 칼륨, 마그네슘, 철, 아연, 엽산 섭취에서도 부부가구에서 유의하게 높은 경향을 보였으며, 1인가구에서 유의하게 낮은 경향을 보였다($P < 0.05$). 그러나 비타민 A ($P = 0.029$)와 지방 에너지구성비($P = 0.020$)는 자녀동거가구에서 유의하게 높은 경향을 보였으며, 1인가구에서 유의하게 낮은 경향을 보였다. 칼슘, 나트륨, 티아민 등 다른 영양소에서는 가구유형 간 유의한 차이가 나타나지 않았다.

여성에서는 총 에너지 섭취량이 가구유형 간 유의한 차이가 나타났으며($P = 0.035$), 부부가구에서 1,439.4 kcal로 다른 가구 유형에 비해 유의하게 높고, 자녀동거가구에서 1,346.8 kcal로 유의하게 낮은 경향을 보였다. 단백질, 탄수화물, 칼슘, 나트륨, 칼륨, 마그네슘, 철, 아연, 티아민, 엽산, 비타민 B_2 섭취는 부부가구에서 유의하게 높은 경향을 보였으며($P < 0.05$), 칼슘($P = 0.002$), 티아민($P = 0.034$) 섭취는 1인가구에서, 나머지 영양소는 자녀동거가구에서 유의하게 낮은 경향을 보였다($P < 0.05$). 그러나 비타민 A, 비타민 C 및 탄수화물·단백질·지방 에너지구성비에서는 가구유형 간 유의한 차이가 나타나지 않았다.

4. 가구 유형 및 성별에 따른 에너지 및 영양소 섭취 미달 위험

가구유형 및 성별에 따른 에너지 및 영양소 섭취가 추정 필요량(estimated energy requirement, EER) 또는 EAR 미만일 위험은 공변량을 포함한 다중 로지스틱 회귀분석으로 분석하였으며, 그 결과는 Table 4에 제시하였다. 남성에서는 1인가구에서 철 EAR 미만 위험이 1.731배(odds ratio [OR]: 1.731; 95% confidence interval [CI]: 1.083–2.766), 아연 EAR 미만 위험이 2.460배(OR: 2.460; 95% CI: 1.394–4.343)로 부부가구에 비해 유의하게 높았다($P = 0.022$, $P = 0.002$). 그러나 에너지, 단백질, 칼슘, 마그네슘을 비롯한 다른 영양소에서는 가구 유형에 따른 유의한 차이가 나타나지 않았으며, 자녀동거가구와는 모든 영양소에서 유의한 차이가 나타나지 않았다.

남성의 탄수화물섭취량은 응답 분포의 극단적인 편중으로 인해 로지스틱 회귀분석의 추정값 산출이 불가능하여, 분석에서 제외하였다. 1인가구를 기준그룹(reference group)으로 설정하여 분석한 결과에서도 1인가구의 남성이 다른 가구 유형의 남성에 비하여 미달 위험이 높은 것을 확인하였다.

여성에서는 자녀동거가구에서 에너지 EER 미만 위험이 1.448배(OR: 1.448; 95% CI: 1.004–2.089), 마그네슘 EAR 미만 위험이 2.090배(OR: 2.090; 95% CI: 1.330–3.286), 철 EAR 미만 위험이 1.692배(OR: 1.692; 95% CI: 1.137–2.519), 아연 EAR 미만 위험이 1.902배(OR: 1.902; 95% CI: 1.129–3.204), 엽산 EAR 미만 위험이 2.282배(OR: 2.282; 95% CI: 1.470–3.541)로 부부가구에 비해 유의하게 높았다($P < 0.05$). 또한 1인가구에서도 엽산 EAR 미만 위험이 1.625배(OR: 1.625; 95% CI: 1.118–2.363)로 부부가구에 비해 유의하게 높았다($P = 0.011$). 그러나 단백질, 탄수화물, 칼슘 등을 비롯한 다른 영양소에서는 1인가구와 자녀동거가구 모두에서 유의한 차이가 나

https://doi.org/10.5720/kjcn.2025.00367

Table 2. Differences in dietary behaviors and nutrition-related factors by household type and gender

Variables	Men (n = 1,118)			*P*-value	Women (n = 1,294)			*P*-value
	One-person (n = 170)	Couple-only (n = 737)	With-children (n = 211)		One-person (n = 468)	Couple-only (n = 535)	With-children (n = 291)	
Breakfast skipping status				< 0.001				< 0.001
Yes	17 (10.2)	22 (2.8)	11 (3.5)		26 (5.7)	19 (3.6)	32 (11.8)	
No	153 (89.8)	715 (97.2)	200 (96.5)		442 (94.3)	516 (96.4)	259 (88.2)	
Lunch skipping status				0.008				0.062
Yes	22 (12.0)	27 (4.5)	16 (9.4)		59 (12.9)	34 (7.6)	23 (8.4)	
No	148 (88.0)	710 (95.5)	195 (90.6)		409 (87.1)	501 (92.4)	268 (91.6)	
Dinner skipping status				0.399				0.253
Yes	5 (3.5)	15 (1.8)	3 (1.3)		32 (7.0)	24 (4.6)	10 (4.0)	
No	165 (96.5)	722 (98.2)	208 (98.7)		436 (93.0)	511 (95.4)	281 (96.0)	
Breakfast companionship status[1)]				< 0.001				< 0.001
Yes	17 (9.4)	600 (81.0)	140 (66.3)		26 (4.8)	434 (78.5)	160 (53.8)	
No	138 (81.4)	118 (16.4)	56 (27.6)		412 (88.3)	77 (16.6)	101 (34.5)	
Not applicable	15 (9.2)	19 (2.6)	15 (6.1)		30 (6.9)	24 (4.9)	30 (11.7)	
Lunch companionship status[1)]				< 0.001				< 0.001
Yes	40 (22.3)	541 (71.0)	122 (56.2)		85 (18.0)	399 (72.2)	153 (47.7)	
No	114 (69.1)	177 (25.4)	80 (38.2)		346 (74.2)	108 (21.5)	125 (47.6)	
Not applicable	16 (8.6)	19 (3.6)	9 (5.6)		37 (7.8)	28 (6.3)	13 (4.7)	
Dinner companionship status[1)]				< 0.001				< 0.001
Yes	22 (11.5)	663 (90.2)	165 (78.5)		37 (7.5)	477 (87.3)	197 (65.0)	
No	146 (86.5)	67 (8.9)	46 (21.5)		418 (90.0)	51 (11.3)	92 (33.4)	
Not applicable	2 (2.0)	7 (0.9)	0 (0.0)		13 (2.6)	7 (1.4)	2 (1.6)	
Frequency of eating out				0.098				0.003
≥ Once/day	14 (8.9)	25 (4.2)	19 (8.9)		7 (1.1)	7 (0.9)	6 (2.1)	
5–6 times/week	14 (8.4)	71 (10.0)	23 (8.9)		23 (5.4)	15 (2.3)	14 (4.6)	
3–4 times/week	18 (10.3)	61 (8.0)	27 (11.9)		24 (5.2)	16 (3.1)	22 (6.9)	
1–2 times/week	40 (23.2)	163 (22.3)	55 (26.0)		101 (22.4)	111 (22.4)	57 (19.7)	
1–3 times/month	48 (28.0)	282 (37.2)	54 (28.3)		133 (28.1)	217 (40.1)	119 (40.5)	
< Once/month	36 (21.2)	135 (18.2)	33 (16.1)		180 (37.7)	169 (31.3)	73 (26.2)	
Experience of nutrition education or counseling				0.671				0.159
Yes	6 (3.9)	22 (2.7)	3 (2.1)		37 (7.3)	27 (4.5)	14 (4.3)	
No	164 (96.1)	715 (97.3)	208 (97.9)		431 (92.7)	508 (95.5)	277 (95.7)	
Dietary supplement use[2)]				0.111				0.195
Yes	90 (51.2)	425 (59.3)	117 (52.3)		297 (65.5)	361 (70.3)	183 (64.1)	
No	80 (48.8)	312 (40.7)	94 (47.7)		171 (34.5)	174 (29.7)	108 (35.9)	
Awareness of nutrition labeling				0.688				0.001
Yes	74 (45.4)	318 (44.7)	88 (41.4)		154 (37.0)	251 (49.9)	139 (50.9)	
No	96 (54.6)	419 (55.3)	123 (58.6)		314 (63.0)	284 (50.1)	152 (49.1)	

n (weighted %).

n: unweighted value, %: weighted value.

Statistical analysis: χ^2 tests were used for categorical variables in complex sample survey data analysis ($P < 0.05$).

[1)]Companionship status: "Yes" = ate the meal with family or others; "No" = ate alone; "Not applicable" = meal frequency was ≤ 2 times per week during the past year.

[2)]Dietary supplement use: Use of dietary supplements for ≥ 2 weeks during the past year.

Table 3. Comparison of daily energy and nutrient consumption and energy distribution ratios by household type and gender

Variables	Men (n = 1,118)			*P*-value	Women (n = 1,294)			*P*-value
	One-person (n = 170)	Couple-only (n = 737)	With-children (n = 211)		One-person (n = 468)	Couple-only (n = 535)	With-children (n = 291)	
Energy (kcal)	1,681.98 ± 52.65^{b}	1,848.92 ± 23.50^{a}	1,836.76 ± 49.93^{ab}	0.033	1,373.38 ± 27.84^{ab}	1,439.42 ± 27.13^{a}	1,346.75 ± 28.66^{b}	0.035
Protein (g)	57.37 ± 2.22^{b}	66.76 ± 1.15^{a}	65.43 ± 2.20^{a}	0.004	46.68 ± 1.22^{ab}	51.37 ± 1.93^{a}	45.91 ± 1.34^{b}	0.033
Carbohydrate (g)	268.36 ± 6.88^{b}	298.00 ± 3.63^{a}	292.06 ± 7.28^{a}	0.003	234.59 ± 4.75^{ab}	246.69 ± 4.22^{a}	228.66 ± 4.91^{b}	0.009
Calcium (mg)	461.38 ± 22.44	527.74 ± 12.69	534.23 ± 24.61	0.051	399.12 ± 13.41^{b}	465.04 ± 13.61^{a}	403.00 ± 18.00^{b}	0.002
Sodium (mg)	3,309.06 ± 176.23	3,400.07 ± 71.02	3,431.21 ± 133.89	0.864	2,333.42 ± 71.19^{b}	2,690.67 ± 88.69^{a}	2,315.41 ± 97.34^{b}	0.003
Potassium (mg)	2,464.25 ± 98.39^{b}	2,945.25 ± 51.24^{a}	2,859.41 ± 107.58^{a}	0.001	2,253.29 ± 66.46^{b}	2,497.07 ± 60.18^{a}	2,143.53 ± 68.16^{b}	< 0.001
Magnesium (mg)	285.88 ± 9.60^{b}	347.19 ± 5.36^{a}	338.09 ± 11.43^{a}	< 0.001	254.97 ± 6.13^{b}	287.69 ± 7.83^{a}	244.38 ± 7.11^{b}	< 0.001
Iron (mg)	8.05 ± 0.47^{b}	9.98 ± 0.23^{a}	9.45 ± 0.41^{ab}	0.004	7.04 ± 0.25^{b}	8.21 ± 0.32^{a}	6.91 ± 0.26^{b}	0.003
Zinc (mg)	9.32 ± 0.39^{b}	10.94 ± 0.21^{a}	10.70 ± 0.38^{a}	0.007	7.87 ± 0.20^{ab}	8.46 ± 0.21^{a}	7.54 ± 0.23^{b}	0.006
Vitamin A (μg RAE)	282.86 ± 22.19^{b}	352.78 ± 12.30^{a}	375.35 ± 34.58^{a}	0.029	300.60 ± 15.54	350.78 ± 15.68	301.33 ± 22.52	0.088
Thiamin (mg)	0.97 ± 0.05	1.09 ± 0.02	1.07 ± 0.05	0.133	0.81 ± 0.02^{b}	0.90 ± 0.02^{a}	0.81 ± 0.03^{ab}	0.034
Folate (μg DFE)	312.20 ± 12.37^{b}	362.69 ± 6.76^{a}	354.91 ± 13.73^{a}	0.012	275.85 ± 7.62^{b}	314.28 ± 8.40^{a}	255.19 ± 8.37^{b}	< 0.001
Vitamin C (mg)	62.18 ± 7.13	61.33 ± 2.38	59.22 ± 4.29	0.847	56.41 ± 3.66	65.56 ± 3.75	56.54 ± 4.05	0.146
Vitamin B_2 (mg)	1.25 ± 0.06	1.39 ± 0.03	1.41 ± 0.06	0.131	1.03 ± 0.03^{b}	1.16 ± 0.04^{a}	1.02 ± 0.04^{b}	0.005
Carbohydrates (%)[1)]	64.96 ± 0.88	65.87 ± 0.45	65.07 ± 0.72	0.459	69.25 ± 0.57	69.63 ± 0.45	68.63 ± 0.66	0.403
Protein (%)[1)]	13.56 ± 0.27	14.36 ± 0.15	14.14 ± 0.25	0.059	13.51 ± 0.20	13.93 ± 0.19	13.48 ± 0.25	0.217
Fat (%)[1)]	16.21 ± 0.56^{ab}	16.47 ± 0.27^{b}	17.79 ± 0.49^{a}	0.020	16.41 ± 0.42	15.99 ± 0.33	17.28 ± 0.55	0.117

Mean ± SE.

Statistical analysis: Values were obtained using a general linear model for continuous variables in complex sample survey data analysis ($P < 0.05$).

[1)]Carbohydrate (%), protein (%), and fat (%) indicate the percentage contribution of each macronutrient to total daily energy intake, adjusted for total energy intake.

[a,b]Values are significantly different according to the Bonferroni post hoc test ($P < 0.05$).

https://doi.org/10.5720/kjcn.2025.00367

Table 4. Risk of energy intake below the EER and nutrient intake below the EAR by household type and gender

Variables	Men (n = 1,118)			Women (n = 1,294)		
	Couple-only (n = 737)	One-person (n = 170)	With-children (n = 211)	Couple-only (n = 535)	One-person (n = 468)	With-children (n = 291)
Energy (kcal)[1)]	1.000 (Ref.)	1.241 (0.820–1.878)	1.022 (0.701–1.490)	1.000 (Ref.)	1.036 (0.742–1.446)	1.448 (1.004–2.089)*
Protein (g)	1.000 (Ref.)	1.303 (0.748–2.271)	0.785 (0.446–1.382)	1.000 (Ref.)	1.210 (0.802–1.827)	1.371 (0.798–2.355)
Carbohydrate (g)	-	-	-	1.000 (Ref.)	0.957 (0.216–4.234)	0.377 (0.064–2.201)
Calcium (mg)	1.000 (Ref.)	1.043 (0.633–1.717)	0.728 (0.487–1.089)	1.000 (Ref.)	1.214 (0.770–1.912)	1.102 (0.643–1.888)
Magnesium (mg)	1.000 (Ref.)	1.529 (0.935–2.503)	1.218 (0.743–1.998)	1.000 (Ref.)	1.346 (0.916–1.980)	2.090 (1.330–3.286)*
Iron (mg)	1.000 (Ref.)	1.731 (1.083–2.766)*	1.009 (0.633–1.609)	1.000 (Ref.)	1.286 (0.869–1.902)	1.692 (1.137–2.519)*
Zinc (mg)	1.000 (Ref.)	2.460 (1.394–4.343)*	0.813 (0.498–1.325)	1.000 (Ref.)	1.475 (0.971–2.239)	1.902 (1.129–3.204)*
Vitamin A (μg RAE)	1.000 (Ref.)	1.315 (0.778–2.221)	0.835 (0.499–1.397)	1.000 (Ref.)	0.871 (0.604–1.255)	1.124 (0.707–1.787)
Thiamin (mg)	1.000 (Ref.)	1.438 (0.879–2.352)	1.478 (0.916–2.384)	1.000 (Ref.)	1.244 (0.879–1.760)	1.466 (0.895–2.402)
Folate (μg DFE)	1.000 (Ref.)	1.170 (0.783–1.751)	1.070 (0.680–1.682)	1.000 (Ref.)	1.625 (1.118–2.363)*	2.282 (1.470–3.541)*
Vitamin C (mg)	1.000 (Ref.)	1.135 (0.717–1.799)	1.276 (0.808–2.015)	1.000 (Ref.)	1.039 (0.731–1.476)	1.158 (0.759–1.769)
Vitamin B_2 (mg)	1.000 (Ref.)	1.311 (0.825–2.084)	1.047 (0.691–1.588)	1.000 (Ref.)	0.962 (0.699–1.324)	1.396 (0.909–2.144)

Odds ratios (95% confidence intervals).

Statistical analysis: Values were obtained using logistic regression analysis in complex sample survey data analysis.

Energy intake was adjusted for age, residential area, education level, household income level, economic activity status, self-rated health status, and survey year. Other nutrients were adjusted for age, residential area, education level, household income, economic activity status, self-rated health, total energy intake, and survey year.

Logistic regression could not be performed for carbohydrate intake in men due to a highly skewed response distribution.

EER, estimated energy requirement; EAR, estimated average requirement.

*$P < 0.05$.

[1)]Energy intake was assessed based on the EER, as the 2020 Dietary Reference Intakes for Koreans (KDRIs) do not define an EAR for energy.

https://doi.org/10.5720/kjcn.2025.00367

타나지 않았다. 1인가구를 기준그룹으로 설정하여 분석한 결과에서도 1인가구의 여성은 부부가구의 여성보다 엽산섭취 미달 유의하게 높은 경우를 제외하고 다른 가구 유형의 여성과 비교하여 미달 위험에 유의한 차이가 없었다.

5. 가구 유형 및 성별에 따른 한국식생활평가지수 점수의 차이

KHEI 점수는 가구유형 및 성별에 따라 Table 5에 제시하였다. 남성에서는 총 KHEI 점수가 가구유형 간 유의한 차이가 나타났으며($P < 0.001$), 부부가구에서 67.20점으로 다른 가구 유형에 비해 유의하게 높고 1인가구가 60.79점으로 유의하게 낮은 점수를 보였다. 아침식사, 잡곡, 총 과일, 신선과일, 김치를 제외한 채소, 육류·생선·달걀·콩류, 총 에너지 항목에서도 부부가구가 유의하게 높은 점수를 보였으며, 1인가구에서 유의하게 낮은 점수를 보였다($P < 0.05$). 반면, 총 채소 우유 및 유제품, 포화지방산 등 다른 항목에서는 가구유형 간 유의한 차이가 나타나지 않았다.

여성에서도 총 KHEI 점수가 가구유형 간 유의한 차이가 나타났으며($P = 0.004$), 부부가구에서 68.95점으로 다른 가구 유형에 비해 유의하게 높고 자녀동거가구에서 65.59점으로 유의하게 낮은 점수를 보였다. 아침식사($P = 0.019$)와 총 채소($P = 0.046$), 포화지방산($P = 0.007$)에서도 부부가구가 유의하게 높은 점수를 보였으며, 자녀동거가구에서 유의하게 낮은 점수를 보였다. 반면 나트륨은 자녀동거가구에서 유의하게 높은 점수를 보였으며, 부부가구에서 유의하게 낮은 점수를 보였다($P = 0.026$). 잡곡, 총 과일, 신선과일 등 다른 항목에서는 가구유형 간 유의한 차이가 나타나지 않았다.

DISCUSSION

본 연구는 국민건강영양조사 제8기(2019–2021년) 자료를 활용하여 노인의 가구유형과 성별에 따른 식생활, 영양소 섭취, 식사의 질을 분석하였다. 그 결과, 남성 노인은 1인가구에서, 여성 노인은 자녀동거가구에서 결식률이 높고 에너지 및 영양소 섭취 수준과 식사의 질이 낮은 경향을 보여, 동일한 가구유형이라도 성별에 따라 영양 취약성이 다르게 나타날 수 있음을 시사하였다.

남성 노인의 가구유형별 식행동을 분석한 결과, 1인가구에서 아침 및 점심 결식률이 부부가구와 자녀동거가구에 비해 유의하게 높게 나타났으며, 끼니별 동반식사 비율 또한 다른 가구유형에 비해 낮은 것으로 나타났다. 이러한 결과는 가족과의 동거 여부가 결식률 및 혼식 행태에 영향을 미친다는 선행연구의 보고[8, 26, 27]와 일치하는 양상으로, 가구유형에 따른 식행동의 차이가 반복적으로 관찰되고 있음을 시사한다. 또한 남성 노인의 가구유형별 에너지 및 영양소 섭취 수준을 분석한 결과, 1인가구가 부부가구 및 자녀동거가구에 비해 총 에너지 섭취량과 대부분의 영양소 섭취량이 낮았으며, 특히 철과 아연의 EAR 미만 위험이 각각 1.731배, 2.460배로 부부가구에 비해 유의하게 높게 나타났다. 이는 1인가구 노인의 주요 영양소 섭취 저하 및 부족 위험을 보고한 선행연구[28] 및 국민건강영양조사 자료(2013–2016)를 활용한 연구[8]와 유사한 결과로, 남성 1인가구에서 영양섭취 취약성이 일관되게 나타남을 보여준다. 아울러 본 연구에서 확인된 남성 1인가구의 낮은 KHEI 점수와 식사의 질 저하 결과는 최근 연구[29]에서도 동일하게 보고되어, 이러한 영양 취약성이 특정 시기나 단일 연구에 국한된 현상이 아니라 구조적으로 반복되는 특성일 가능성을 시사한다.

이러한 취약성은 식사 준비 및 조리와 같은 일상적 식생활 수행 능력의 차이에서 기인할 수 있다. 실제로 남성 노인의 상당수가 식사 준비를 배우자에게 의존하며 스스로 식사를 준비하는 비율이 낮은 것으로 보고되었고[30], 최근 일본에서 수행된 전향적 코호트 연구에서는 조리 역량이 낮은 남성 노인이 독거 상태일 때 건강 위험과 사망 위험이 유의하게 높아지는 것으로 나타나, 조리 능력과 동거 여부가 남성 노인의 식생활 및 건강에 중요한 보호·위험 요인으로 작용할 수 있음을 시사한다[31]. 또한 1인가구 성인은 식사 준비를 대신해주거나 함께할 수 있는 가족 구성원이 부족하여, 조리에 소요되는 시간과 노력을 줄이기 위한 대안으로 다인가구에 비해 가정 간편식(home meal replacement) 섭취빈도가 유의하게 높은 것으로 보고되었으며[32], 이러한 식사 방식은 음식 선택의 다양성을 제한하여 균형 잡힌 식사를 유지하기 어렵게 만들고 영양 섭취 저하로 이어질 수 있다. 더불어 거주 형태에 따라 노인의 식생활 패턴에 유의한 차이가 나타나며, 혼자 거주하는 노인의 경우 과일과 채소 섭취가 적고 전반적인 식사의 질이 낮은 식생활 패턴을 보이는 것으로 보고되었다[33]. 또한 한국 성인을 대상으로 거주 형태에 따른 식생활 패턴을 분석한 연구에서도 혼자 거주하는 경우 가족과 함께 거주하는 경우에 비해 건강하지 않은 식생활 패턴이 더 빈번하게 나타난 것으로 보고되어, 거주 형태가 식생활의 질과 밀접하게 연관될 수 있음을 보여준다[34]. 따라서 조리 능력 부족과 식사 준비의 어려움, 식습관 개선 동기의 부족 등은 끼니별 결식률 증가와 에너지·영양소 섭취 저하로 이어져 궁극적으로 식사의 질을 저하시킬 수 있다. 이러한 특성을 고려할 때, 남성 1인가구의 영양 취약성을 완화하기 위해서는 기초적인 조리 기술 습득을 돕는 교육과 실천 가능한 식생활 정보 제공, 그리고 이를 지속적으로 지원할 수 있는 지역사회 기반의 체계적인 정책 마련이 필요함을 시사한다.

여성 노인의 경우, 본 연구에서는 식행동과 에너지·영양소 섭취 및 식사의 질이 자녀동거가구에서도 취약성이 확인되었다. 가구유형별 식행동을 분석한 결과, 자녀동거가구에서 아침 결식률이 1인가구와 부부가구에 비해 유의하게 높게 나타났으며, 끼니별 동반식사 비율은 부부 가구에 비해 낮은 것으로 나타났다. 이는 선행연구에서 1인가구가 다인가구에 비해 아침 결식 및 끼니별 혼식 빈도가 유의하게 높다고 보고한 결과[26]와는

https://doi.org/10.5720/kjcn.2025.00367

Table 5. Differences in KHEI scores by household type and gender

Variables	Men (n = 1,118)			*P*-value	Women (n = 1,294)			*P*-value
	One-person (n = 170)	Couple-only (n = 737)	With-children (n = 211)		One-person (n = 468)	Couple-only (n = 535)	With-children (n = 291)	
Total KHEI score (0–100)	60.79 ± 1.02[b]	67.20 ± 0.62[a]	65.61 ± 0.96[a]	< 0.001	67.14 ± 0.99[a]	68.95 ± 0.87[a]	65.59 ± 1.22[ab]	0.004
Adequacy								
Breakfast (0–10)	9.04 ± 0.21[b]	9.70 ± 0.07[a]	9.46 ± 0.16[ab]	0.007	9.03 ± 0.23[b]	9.40 ± 0.18[a]	8.79 ± 0.25[b]	0.019
Mixed grains (0–5)	1.58 ± 0.21[b]	2.66 ± 0.11[a]	2.30 ± 0.19[a]	< 0.001	2.37 ± 0.16	2.29 ± 0.15	2.06 ± 0.18	0.260
Total fruits (0–5)	1.84 ± 0.19[b]	2.52 ± 0.11[a]	2.49 ± 0.19[a]	0.015	3.29 ± 0.18	3.40 ± 0.14	3.01 ± 0.19	0.163
Fresh fruits (0–5)	1.91 ± 0.21[b]	2.67 ± 0.12[a]	2.67 ± 0.21[a]	0.011	3.32 ± 0.19	3.43 ± 0.15	3.04 ± 0.20	0.192
Total vegetables (0–5)	3.53 ± 0.13	3.90 ± 0.07	3.87 ± 0.12	0.052	3.73 ± 0.10[b]	3.96 ± 0.10[a]	3.72 ± 0.11[ab]	0.046
Vegetables, excluding *kimchi* and pickles (0–5)	2.78 ± 0.16[b]	3.41 ± 0.09[a]	3.22 ± 0.13[a]	0.002	3.78 ± 0.12	4.00 ± 0.11	3.77 ± 0.11	0.127
Meat, fish, eggs, and beans (0–10)	6.41 ± 0.33[b]	7.43 ± 0.17[a]	6.84 ± 0.26[ab]	0.003	7.33 ± 0.25	7.63 ± 0.19	7.02 ± 0.27	0.063
Milk and milk products (0–10)	2.42 ± 0.41	2.90 ± 0.24	2.67 ± 0.32	0.457	4.02 ± 0.36	3.91 ± 0.34	3.45 ± 0.40	0.321
Moderation								
Saturated fatty acid (0–10)	8.36 ± 0.29	8.82 ± 0.17	8.64 ± 0.22	0.286	7.87 ± 0.26[b]	8.51 ± 0.20[a]	7.83 ± 0.30[b]	0.007
Sodium (0–10)	6.81 ± 0.29	6.65 ± 0.16	6.60 ± 0.26	0.844	8.24 ± 0.18[a]	7.89 ± 0.19[a]	8.43 ± 0.18[ab]	0.026
Total sugar (0–10)	7.33 ± 0.33	6.92 ± 0.19	7.17 ± 0.28	0.449	5.66 ± 0.32	5.76 ± 0.30	5.74 ± 0.33	0.946
Energy balance								
Carbohydrate (0–5)	2.44 ± 0.19	2.61 ± 0.13	2.82 ± 0.18	0.243	2.22 ± 0.16	2.23 ± 0.14	2.35 ± 0.17	0.722
Fat (0–5)	3.38 ± 0.17	3.44 ± 0.12	3.69 ± 0.17	0.241	3.13 ± 0.16	3.15 ± 0.14	2.98 ± 0.17	0.565
Total energy (0–5)	2.97 ± 0.22[b]	3.56 ± 0.12[a]	3.19 ± 0.17[ab]	0.013	3.16 ± 0.17	3.38 ± 0.15	3.41 ± 0.21	0.411

Mean ± SE.

Statistical analysis: Values were obtained using the general linear model for continuous variables in complex sample survey data analysis ($P < 0.05$).

All variables were adjusted for age, residential area, education level, household income, economic activity status, self-rated health, and survey year.

KHEI, Korean Healthy Eating Index.

[a,b]Values are significantly different according to the Bonferroni post hoc test ($P < 0.05$).

https://doi.org/10.5720/kjcn.2025.00367

다소 상이하나, 본 연구에서 다인가구를 부부가구와 자녀동거가구로 세분화함으로써 자녀동거가구에서 결식률이 유의하게 높은 것으로 나타나는 차별적인 양상을 확인하였다. 이는 자녀동거가구가 항상 보호적 환경을 제공한다고 가정해 온 기존의 관점과 달리, 본 연구는 여성 노인에게는 자녀와의 동거가 오히려 식사 규칙성을 약화시키는 또 다른 형태의 취약성으로 작용할 수 있다는 가능성을 보여준다. 또한 여성노인의 식행동이 가구유형에 따라 다르게 나타날 수 있으며, 자녀동거가구에 대한 추가적인 탐색과 세분화된 분석이 필요함을 시사한다. 여성 노인의 가구유형별 에너지 및 영양소 섭취 수준을 분석한 결과, 자녀동거가구가 부부가구에 비해 총 에너지 섭취량과 대부분의 영양소 섭취량이 낮았으며, 특히 에너지 EER 미만 위험과 마그네슘, 철, 아연, 엽산의 EAR 미만 위험이 각각 1.448배, 2.090배, 1.692배, 1.902배, 2.282배로 유의하게 높게 나타났다. 선행연구에서는 독거 여성 노인의 영양섭취 상태가 비독거 여성 노인보다 전반적으로 낮으며[28, 35], 에너지 필요추정량 대비 섭취 부족 비율 또한 혼자 사는 가구에서 높게 나타난다고 보고하였다[36]. 또한 한국인 영양소섭취기준대비 에너지 및 주요 영양소의 부족섭취자 비율이 1인가구에서 다인가구보다 높게 나타난 바 있다[37]. 이는 본 연구 결과와 다른 양상을 보였다. 반면, 일본 오하사마 지역 노인을 대상으로 한 연구에서는 배우자 없이 자녀 등 가족과 거주하는 여성에서 과일 및 단백질 식품 섭취가 낮게 나타났다고 보고되어[17], 자녀동거가구 여성에서 단백질섭취가 부부가구에 비해 낮게 나타난 본 연구 결과와 유사한 경향을 보였다. 이는 자녀동거가구 여성의 영양 취약성이 특정 국가에 국한되지 않을 가능성을 보여주며, 가구 구성 방식에 따라 여성 노인의 영양섭취 양상이 다양하게 나타날 수 있음을 보여준다. 또한 본 연구결과 여성노인 자녀동거가구의 낮은 KHEI 점수 및 아침식사, 포화지방산 섭취는 선행연구에서도 배우자 없이 다른 사람과 거주하는 경우가 1인가구나 배우자와 거주하는 경우 보다 KHEI 점수, 아침식사, 총 과일, 신선과일 섭취 등에서 유의미하게 낮게 나타나 유사하였다[14]. 따라서 여성 노인의 식사의 질은 단순히 독거 여부 뿐만 아니라 '누구와 함께 사는지'도 중요한 영향을 미친다고 하겠다.

한편, 여성 노인의 가구유형별 에너지 및 영양소 섭취 수준(Table 3)을 분석한 결과에서 대부분 1인가구 여성 노인은 자녀동거가구와 유의한 차이를 보이지 않았으나 부부동거가구와는 유의한 차이를 보였다. 1인가구 여성의 에너지 및 영양소 섭취 미달 위험은 부부동거가구와 비교하여 엽산에서만 유의하게 나타났고 자녀동거가구와는 유의한 차이가 발견되지 않았다. 식사의 질의 경우 1인가구 여성 노인이 자녀동거가구 여성 노인과 부부동거가구 여성 노인의 중간에 놓이는 결과를 보인다. 즉, 기존의 1인가구 여성 노인이 식생활에서 가장 취약할 것이라는 생각과 달리 본 연구에서는 자녀동거가구 여성 노인도 1인가구 여성 노인과 비슷한 수준으로 가장 취약하다는 점을 보여준다 하겠다.

본 연구의 결과는, 기존 연구에서 주로 취약 집단으로 지목된 1인가구와 달리, 여성 노인의 경우 자녀와의 동거가 식생활 및 영양 측면에서 취약 요인으로 작용할 수 있음을 보여준다. 이는 여성 노인이 가족 내에서 가사 노동, 식사 준비, 자녀 및 손주 돌봄, 경제적 부담 등 다양한 역할을 수행하게 되면서, 자신의 식사와 건강 관리에 상대적으로 소홀해질 가능성이 있음을 시사한다. 실제로 자녀 또는 손주와 함께 거주하는 여성 노인의 경우, 가사와 식사 준비를 전담하는 경우가 많아 자신의 식사를 소홀히 하게 될 가능성이 있으며[18-20], 자녀의 경제적 자립이 어려운 경우, 경제적·식생활 관련 부담이 발생하여 영양섭취와 식사의 질에 부정적인 영향을 미칠 수 있다[21]. 이러한 맥락에서 볼 때, 자녀와의 동거가 노인의 식생활에 항상 긍정적인 영향을 미친다고 단정하기 어렵고, 가정 내 역할 부담, 경제적 부담, 돌봄 스트레스 등이 복합적으로 작용할 경우, 식생활의 질 저하와 영양소 섭취 불균형으로 이어질 가능성이 있다.

특히 본 연구에서 자녀동거가구가 남성과 여성 노인의 식생활에 서로 다른 방향으로 작용한 점은, 가정 내에서 수행하는 역할과 식사 준비의 책임이 성별에 따라 구조적으로 다르기 때문일 가능성이 있다. 일반적으로 남성 노인의 경우 배우자 또는 가족 구성원이 식사 준비를 담당하는 비율이 높아, 동거는 규칙적인 식사 제공과 영양 섭취를 유지하는 보호 요인으로 작용할 수 있다. 반면 여성 노인은 자녀와 동거할 경우 가사 노동, 식사 준비, 손주 돌봄 등 가족 내 역할 부담이 확대되면서 자신의 식사를 우선순위에서 뒤로 미루게 될 가능성이 크다. 즉, 남성에게 동거는 '식사 지원'의 의미가 큰 반면, 여성에게는 '돌봄 및 가사 부담'의 의미가 더 크게 작용할 수 있으며, 이러한 역할 부담의 차이가 자녀동거의 영향이 성별에 따라 상반된 양상으로 나타난 배경일 수 있다.

따라서 여성 노인의 영양 취약성을 개선하기 위해서는 가구유형별 생활환경을 고려한 다차원적 접근이 필요하며, 자녀동거가구의 특성을 반영한 가정 내 역할 조정 교육, 소득 및 돌봄 지원, 그리고 지역사회 기반 맞춤형 영양·식생활 프로그램과 정책 마련이 요구된다.

Limitations

첫째, 국민건강영양조사를 활용한 단면연구로 가구유형 및 성별과 영양섭취 간의 인과관계를 명확히 규명하는 데 한계가 있다. 둘째, 1일간의 24시간 회상법을 통해 수집된 자료로 섭취량을 조사하였기 때문에, 평균적인 식습관을 반영하는 데에는 한계가 있다. 또한 회상의 부정확성으로 인해 실제 섭취량과의 오차가 발생할 수 있다. 셋째, 본 연구에서는 가구 유형을 1인가구, 부부가구, 자녀동거가구의 세 범주로 구분하여 분석하였다. 자녀동거가구는 부부와 미혼자녀로 구성된 2세대가구, 편부모와 미혼자녀로 구성된 2세대가구, 손자녀까지 포함된 3세대이상가구가 모두 포함한 집단이었다. 이들 가구의 구조적 특성과

https://doi.org/10.5720/kjcn.2025.00367

생활양식, 식사 행태가 서로 다를 수 있음으로 결과 해석에 한계가 있을 수 있다. 따라서 향후 연구에서는 자녀동거가구를 세분화하여 분석함으로써 여성 노인 집단 내에서 보다 구체적인 영양 취약 요인을 규명할 필요가 있다.

Conclusion

본 연구결과, 남성 노인은 1인가구에서, 여성 노인은 1인가구와 더불어 자녀동거가구에서도 식생활 및 영양 섭취의 취약성이 두드러지는 경향을 보였다. 특히 여성 노인의 경우, 기존 연구에서 드물게 제시되었던 자녀동거가구에서의 영양 취약성을 재확인함으로써, 관련 근거를 보완하였다는 점에서 의의가 있다. 따라서 여러 선행연구에서 제안된 여성 노인의 경우 가족 내 돌봄과 가사 책임, 경제적 부담 등 생활환경적 요인이, 남성노인의 경우에는 조리 실력 부족, 식사 준비의 어려움, 식습관을 바꾸려는 동기의 부족 등 식생활 수행 관련 개인적 요인이 영양소 섭취 및 식사의 질에 영향을 미칠 수 있음을 향후 종적연구설계에서 질적연구와 양적연구가 함께 하는 혼합연구로 보다 자세한 연구가 필요하다 하겠다. 이는 성별 차이를 고려한 맞춤형 영양지원 방안과 정책 수립에 필수적인 정보를 제공할 것이며, 노인의 식생활의 질 향상과 건강한 노후를 위한 실질적인 기반 마련에 기여할 것이다.

CONFLICT OF INTEREST

There are no financial or other issues that might lead to conflict of interest.

FUNDING

None.

DATA AVAILABILITY

The data that support the findings of this study are openly available in KNHANES at https://knhanes.kdca.go.kr/knhanes/main.do.

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https://doi.org/10.5720/kjcn.2025.00367

Korean J Community Nutr. 2026 Feb;31(1):101-113
https://doi.org/10.5720/kjcn.2025.00353
eISSN 2951-3146

KJCN
Korean Journal of Community Nutrition

Research Article

고령친화우수식품이 농촌여성 노인의 건강, 영양 및 식품 섭취에 미치는 효과

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Effects of senior-friendly foods on health, nutritional status, and dietary intake among rural elderly women in Korea: a quasi-experimental study

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Received: December 11, 2025
Revised: January 16, 2026
Accepted: February 10, 2026

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Objectives: We evaluated the impacts on health, nutritional status, and dietary intake of providing senior-friendly foods to community-dwelling elderly women in a rural area in Korea.

Methods: A pretest–posttest nonequivalent control group design with repeated measures was conducted among 71 rural-dwelling elderly women. Changes in health indicators, nutritional status, and dietary intake were assessed at three time points: baseline, post-intervention, and two months after intervention.

Results: Immediately after a three month intervention, significant differences were observed between the intervention and control groups in frailty score, Dysphagia Handicap Index, Mini Nutritional Assessment, social isolation, resilience, quality of life, and depression ($P < 0.05$). Significant group-by-time interaction effects were found for muscle mass, hemoglobin A1c, and energy, protein, and micronutrient intake, all of which showed significant improvements in the intervention group ($P < 0.05$).

Conclusion: Providing senior-friendly foods effectively improved physical and physiological health and emotional well-being among rural older adults. This intervention also contributed broadly to improved dietary intake. These findings provide empirical evidence to support the development of community-based integrated care models and tailored nutrition intervention programs for rural elderly populations in Korea.

Trial Registration: Clinical Research Information Service Identifier: KCT0011666.

Keywords: senior-friendly foods; community-dwelling elderly women; health status; nutritional status

INTRODUCTION

2025년 한국은 합계 출산율 0.7명대를 기록하고 기대수명은 83.7세로 높은 수준으로 고령화 속도가 매우 빠르게 가속화되고 있으며, 65세 이상 인구 비율이 20.3%로 공식적으로 초고령사회에 진입하였다[1]. 생산가능인구의 급감은 노동력 부족으로 이어지고, 고령인구의 증가는 만성 질병 치료 및 관리에 필요한 의료비 증가, 생산성, 고령인구 부양 문제 등 여러 사회적 부담을 가중시킨다. 특히 여성의 기대수명은 OECD 최상위권인 86세 이상으로, 베이비붐 세대의 고령화가 본격화되는 2030년대에는 고령 인구의 폭발적 증가가 예상된다. 사회적 측면에서는 빈곤한 독거노인 가구의 증가와 치매 및 만성질환 유병률 상승으로 의료 및 돌봄 서비스 수요가 급증할 것으로 전망된다[2].

이러한 상황에서 노인이 자신이 살아온 집과 지역사회에서 건강하게 독립적으로 생활하기를 희망하는 요구를 반영하여, 우리나라는 Aging in Place 개념에 기반한 지역사회 통합 돌봄 정책을 단계적으로 추진하고 있다[3]. 고령자의 건강 유지와 기능적 독립을 위한 핵심 요소로 식사서비스와 영양관리는 지역사회 통합 돌봄 체계에서 중요한 영역으로 지속적으로 강조되고 있으나[4, 5], 현재 지역사회 기반 인프라는 충분히 구축되지 못한 실정으로, 특히 고령자가 일상생활에서 필수적인 식사와 영양 관리를 지속적으로 지원받는 데에는 구조적 한계가 있다[3].

노인은 노화로 인한 신체 기능 저하와 만성질환, 노쇠로 인해 저작 및 연하 능력이 감소하여 식욕 저하를 경험하게 되며, 이로 인해 식사량이 감소하여 식품 섭취의 다양성 및 균형이 깨져 영양소 섭취량이 감소하여 영양 불량의 위험이 증가한다[6, 7]. 이러한 영양 불량은 근감소증으로 이어져 신체 기능 저하를 가속화하는 악순환을 초래할 수 있다. 따라서 노인의 기능적 특성을 고려한 맞춤형 식사 제공을 통해 식사의 양과 질적 확보는 노인이 지역사회에서의 독립적 생활을 유지하는 데 필수적이다.

또한 노인의 식생활과 영양 상태는 개인적 요인뿐만 아니라 거주 지역의 사회·환경적 요인에 의해 크게 영향을 받아 노인의 전반적인 식생활평가지수는 도시 지역이 농촌 지역보다 유의하게 높았으며[8], 농촌 거주 노인의 낮은 식사의 질은 식료품 접근성과 식품의 유통 환경 등 지역사회의 구조적 요인과 밀접한 관련이 있는 것으로 보고되었다[9]. 이는 농촌 노인의 건강한 식생활을 유지하기 위해서는 개인의 노력만으로는 한계가 있으며, 지역사회 차원의 식품 환경 개선과 실질적인 식사 서비스 및 영양 중재가 필요함을 시사한다. 실제로 저소득 독거노인을 대상으로 한 맞춤형 영양관리 프로그램 연구에서도 영양 교육의 중요성과 더불어, 영양 상태 개선을 위해서는 국가 차원의 직접적인 식품 지원 병행의 필요성을 시사하였다[10].

한편 노인의 저작과 삼킴 관련한 구강기능 저하는 식품 선택과 섭취에 직접적인 영향을 미치는 중요한 요인이다. 저작 불편을 겪는 노인은 정상군에 비해 모든 영양소 섭취량이 유의하게 낮았으며, 특히 식이 섬유, 비타민, 무기질 섭취 부족이 두드러졌는데 이는 채소 및 과일류 섭취 감소와 관련이 있는 것으로 나타났다[11]. 2020년 노인실태조사에 따르면 재가 독거노인 중 저작이 불편한 노인은 영양 불량 위험이 약 2배 이상 높은 것으로 보고되었다[12]. 이러한 결과는 노인의 구강 건강 저하는 식품선택과 섭취 양상에 영향을 미치며, 이는 신체적, 정서적, 생리적 건강지표의 변화로 이어질 가능성이 있다.

이에 따라 고령자의 저작·연하 기능과 영양 요구를 반영한 고령친화우수식품이 하나의 대안으로 제시되고 있다. 고령친화우수식품은 노인의 씹기 및 삼킴 능력, 소화·흡수 변화, 영양 요구를 고려하여 물성, 영양 성분, 섭취 편의성을 설계한 식품으로, 물성 특성에 따라 1단계(잇몸으로 으깰 수 있는 정도), 2단계(혀로 으깰 수 있는 정도), 3단계(삼키기 쉬운 정도)로 구분된다[13, 14]. 이 제도는 노쇠 예방과 노인 맞춤형 영양 공급을 목적으로 도입되었으나, 실제 재가 노인을 대상으로 한 적용 효과에 대한 실증 연구는 아직 제한적인 수준이다.

기존의 맞춤형 영양관리 및 영양교육 프로그램 관련 선행연구[15-18]는 주로 영양 교육이나 일반적인 식사 제공을 중심으로 영양 섭취 변화나 일부 건강 지표를 평가하는 데 초점을 두어 왔다. 그러나 이러한 연구들은 고령자의 저작·연하 기능과 같은 기능적 특성을 충분히 반영한 식품의 물성 차이를 체계적으로 고려하지 못했다는 한계가 있다. 또한 고령친화우수식품을 실제 식단에 적용하여 신체적, 생리적, 정서적 건강 변화와 구강 기능, 영양 섭취 및 식품 섭취 양상의 변화를 분석한 연구는 제한적이다.

본 연구에서는 고령친화우수식품 제공이 농촌 지역 재가 여성 노인의 건강과 영양에 미치는 영향을 분석하여 재가 노인 스스로 건강한 식생활을 유지하는데 고령친화우수식품 제공이 도움이 될 수 있다는 근거를 마련하고자 한다.

METHODS

Ethics statement

Written informed consent was obtained from all participants and/or their guardians for the survey. Survey procedures and protocols were approved by the Ministry of Health and Welfare-Designated Public Institutional Review Board (IRB) (IRB No. P01-202404-01-050).

1. 연구설계

본 연구는 농촌거주 재가여성 노인을 대상으로 비 동등성 사전-사후 반복 측정(pretest-posttest nonequivalent control group design with repeated measures) 설계이다. 본 연구는 비무작위 중재연구 보고를 위한 TREND (Transparent Reporting of Evaluations with Nonrandomized Designs) 지침에 따라 기술되었다.

https://doi.org/10.5720/kjcn.2025.00353

2. 연구대상 및 기간

본 연구는 G*Power 3.1.9.7 프로그램을 활용하여 산출하였다. 효과크기 0.25, 유의수준 0.05, 검정력 0.80 최소 표본 수는 44명(중재군 22명. 대조군 22명)이며, 중도 탈락율을 고려하여 중재군 55명, 대조군 25명 총 80명을 모집하였다. 연구 진행 중 9명(컨디션 난조 5명, 개인 일정 1명, 병원 입원 1명, 기타 2명)이 중도 탈락하여 최종 분석에는 71명이 참여하였다. 사전조사는 2025년 5월에 진행하였고, 사후 조사는 2025년 6월 3일부터 8월 23일까지 총 12주간 고령친화우수식품 꾸러미를 제공 완료 직후와 중재 종료 후 8주에 실시하여 총 3회 자료수집을 하였다. 연구 지역은 고령친화우수식품의 냉장·유통이 가능한 콜드체인 시스템 인프라를 갖추고 노인 인구 비율이 높은 경상남도 합천군으로 임의 선정하였다.

연구대상자 선정 기준은 만 65세 이상 1인 가구 노인 맞춤 돌봄 서비스 대상자, 스스로 조리 수행이 가능한 자, 가정에 주방기물(냉장고, 가스레인지) 및 조리 기구(냄비, 그릇) 구비하고 있는 자이며, 제외 기준은 고령친화우수식품 섭취 경험이 있는 자로 설정하였다. 남성 노인의 모집이 제한적이어서, 본 연구에서는 여성 노인을 대상으로 대상자를 모집하였다.

대상자 모집 기간은 2024년 4월 23일부터 4월 30일까지 합천군 노인복지관 게시판 공고와 노인맞춤돌봄서비스 수행기관 홍보를 통해 이루어졌다. 모집된 대상자 중, 가정에서 주 3회 직접 음식을 받을 수 있는 사람은 중재군으로, 맞춤형 돌봄 서비스에서 식사서비스를 받고 있는 사람을 중재군으로 하였다.

3. 고령친화우수식품 꾸러미 구성 및 제공

고령친화우수식품꾸러미(이하 식품꾸러미)는 고령친화우수식품 및 고령친화우수후보식품(기계적 물성측정과 관능검사를 거쳐 저작과 삼킴이 쉬운 식품)으로 일반식단–고령친화식단–식품꾸러미의 3단계 과정을 거쳐 구성하였다.

2020년 한국인 영양소섭취기준과 노인 식단사례를 조사하여 식품꾸러미 구성을 위한 식단작성기준을 수립하였다(Table 1). 한진숙[19]의 재가노인을 위한 식단 레시피 제공시스템의 절차에 따라 식단과 메뉴 구성을 하였다. 1단계는 고령친화우수식품 분류표를 참고하여 밥, 국, 주찬, 부찬 2종, 김치로 4주 사이클 일반식단을 개발하였다. 일반식단 구성에 대한 전문가(영양학교수 2인, 영양사 3인) 자문을 거쳐 일반식을 수정한 후 식단 적합성 평가와 실험조리를 거쳐 일반식단을 확정하였다. 2단계는 일반식단을 고령친화우수식품 및 후보식품의 수급 현황을 고려하여 일부 일반식단을 고령친화식품으로 메뉴를 변경하였다. 노인의 국에 대한 선호도, 주찬의 식품섭취다양성 확보, 고령친화우수식품 개발이 미흡한 부찬 등 고령친화우수식품 34종과 고령친화우수후보식품 32종을 메뉴에 활용하였다. 3단계는 고령친화식단을 토대로 1회 평균 비용 20,000원의 식품꾸러미를 구성하였다. 식품꾸러미는 주찬 100 g (포장 단위가 100 g 미만일 경우 해당 단위 제공), 부찬 60 g, 국은 건더기 100 g과 국물 100 mL를 기본으로 하되, 건더기가 없는 국(재첩국, 다슬기국, 미소 된장국 등)은 200 mL 분량으로 하였다. 1회 제공하는 식품꾸러미는 점심식사 기준 2회 섭취 분량으로 고령친화우수식품 2종과 후보식품을 포함하여 4종 이상으로 구성하였다. 본 식품꾸러미는 3개월간 주 3회로 총 36회에 걸쳐 가정으로 생활지원사를 통해 대상자에게 배송하였다(Table 1). 연구팀은 생활지원사에게 식품꾸러미 확인사항, 제공된 식품의 보관방법 및 조리법, 식단 구성 예시 등을 포함하는 식단안내문 제공과 식품꾸러미 내용 확인사항, 제품 누락상황 파악, 제공 방법 등 식사관리 모니터링을 카카오채널을 통해 주기적으로 업로드하여 실시간으로 이용할 수 있도록 하였다.

4. 변수 및 자료수집방법

1) 신체적 건강

신체적 건강은 신체계측, 노쇠, 근감소증으로 평가하였으며, 신체계측은 키, 몸무게, body mass index (BMI), 체지방량, 근육량, 종아리둘레, 상완위둘레를 측정하였다. 노쇠평가는 Short Physical Performance Battery test 100 (SPPB) 검사를 통해 평가하였으며, SPPB는 미국의 National Institute of Aging이 노인의 역학연구 설립을 위한 연구에서 처음 사용하였으며 노인의 신체기능을 간편하게 평가하기 위해 사용되고 있다[20]. SPPB 100 검사는 chair stand 검사, gait speed 검사, timed up and go 검사, one leg stand 검사로 판단할 수 있으며, SPPB 점수가 2점 이하 노쇠,

Table 1. Nutritional and menu planning criteria for senior-friendly food packages

Item	Description
Target population	Community-dwelling elderly woman
Meal plan format	Four-week cycle menu (designed so that senior-friendly foods are provided at least three times per week)
Meal composition	Steamed rice and soup, four side dishes (1 main dish, 2 side dishes, 1 type of *kimchi*) + snack Special meals; - Wednesday: “Energy boost day” - Saturday: “Gourmet day”
Nutritional standards	Based on 2020 Dietary Reference Intakes for Koreans (KDRIs) For women aged 75 years and older, providing at least 50% of the recommended daily intake Lunch: 600–700 kcal, protein 20–30 g Snack: 130–150 kcal
Meal cost	Regular meal: KRW 4,508 per meal Food package: KRW 20,000 per package

3-9점 전 노쇠, 10-12점 정상으로 판단한다. 모든 검사는 측정의 일관성과 신뢰도 확보를 위해 숙련된 1인의 검사자에 의해 시행되었다.

2) 생리적 건강

생리적 건강은 식후 혈당, 당화혈색소(hemoglobin A1c; HbA1c), 혈중지질, 콜레스테롤, 수축기 혈압과 이완기 혈압으로 측정하였다.

3) 정서적 건강

정서적 건강은 소외감은 Russell 등[21]이 제작한 The University of California, Los Angeles Loneliness Scale Loneliness Scale (UCLA)을 Kim & Kim [22]이 표준화한 한국판 UCLA 외로움 측도(Korean-UCLA Loneliness Scale)로 측정하였으며, 10문항 5점 척도로 점수가 높을수록 소외감 수준이 높음을 의미한다. 본 연구에서 도구의 신뢰도는 Cronbach's α = 0.956이었다. 우울은 Yesavage 등[23]이 개발한 노인우울척도 단축형(Short form of Geriatric Depression Scale)을 Cho 등[24]이 한국에 맞게 수정·보완한 한국판 단축형 노인우울척도로 측정하였으며, 4점 이하 정상, 5-9점 경증 우울, 10-15점 중증 우울로 평가하며 도구의 신뢰도(Cronbach's α)는 0.931로 나타났다. 사회적지지는 Park [25]이 개발한 한국형 사회적지지 도구(Korean Social Support Questionnaire)로 측정하였으며, 12문항 5점 척도이며, 점수가 높을수록 사회적지지가 높음을 의미한다. 본 연구에서 도구의 신뢰도는 Cronbach's α = 0.964였다.

4) 구강 건강

구강평가는 구강건강영향지수는 Slade & Spencer [26]가 개발한 구강건강영향지수(Oral Health Impact Profile-49)를 Bae 등[27]이 한국 실정에 맞게 번역 후 신뢰성과 타당성을 검증한 Korea Oral Health Impact Profile-14 (KOHIP-14) 도구를 이용하였으며, 점수가 높을수록 구강 건강 상태가 나쁘다는 것을 의미한다. 본 연구에서 도구의 신뢰도는 Cronbach's α = 0.931이었다. 삼킴 능력은 Sobol 등[28]이 개발한 삼킴 장애 지수(Dysphagia Handicap Index, DHI)로 측정하였으며, 기능 9문항, 신체 9문항, 감정 7문항의 세부 영역으로 분류하여 총 25문항으로 점수가 높을수록 삼킴으로 인한 장애지수가 높다는 것을 의미하며, 도구의 신뢰도는 Cronbach's α = 0.885였다.

5) 영양상태

대상자의 영양상태 Vellas 등[29]이 개발한 간이영양평가(The Mini Nutritional Assessment; MNA)와 노인영양지수(Nutrition Quotient for the Elderly; NQ-E)로 평가하였다. MNA는 18문항으로 구성되어 있으며 24점 양호, 17-23점 영양불량 위험, 17점 미만 영양불량으로 평가하며, NQ-E는 만 65세 이상 노인을 대상으로 개인 또는 집단의 영양 상태와 식사의 질을 종합적으로 평가하는 도구[30]로 식행동, 균형성, 다양성과 절제의 4개 영역 총 19문항으로 산출된 각 영역별 가중치를 적용한 후 최종 산출한 점수로 62점 기준으로 양호와 모니터링 집단으로 분류한다. 본 연구에서 도구의 신뢰도는 Cronbach's α = 0.682였다.

6) 식사섭취량

식사섭취량은 24시간 회상법으로, 생활지원사가 작성한 3일간의 식사일기와 식사 전·후 식판사진을 함께 활용하여 산정하였다. 생활지원사는 사전에 식사일기 작성 방법, 식판 사진 촬영 등에 대한 교육을 이수하였다. 식사섭취량 분석에 참여한 6명의 영양사는 수집된 식사일기와 식판 사진의 각 식품의 섭취량 기준을 정하여 식사섭취량을 기록하고 교차 점검하였다. 식품섭취량 산정 시에는 식품 코드집과 표준 레시피 기준을 적용하여 입력 오류를 최소화하였으며, 2020년 한국인 영양소 섭취기준에 근거하여 CAN-Pro 6.0 (Web version; Korean Nutrition Society)으로 영양소 섭취량을 분석하였다.

5. 통계분석

자료는 IBM SPSS Statistics 24.0 (IBM Corp.)을 이용하여 분석하였으며, $P < 0.05$를 통계적 유의 수준으로 설정하였다. 분석 방법은 다음과 같다.

중재군과 대조군의 사전 동질성 검증은 t-test와 χ^2 검정으로 분석하였으며, 일반적 특성, 신체적·생리적·정서적 건강과 구강·영양평가는 빈도(n)와 백분율(%), 평균과 표준편차(mean ± standard deviation)로 기술하였다.

식품꾸러미 제공 전, 종료 직후, 종료 후 2개월 시점의 신체적·생리적·정서적 건강 지표, 구강·영양평가 결과 및 영양소 섭취량 변화는 반복측정 분산분석(repeated-measures ANOVA)을 사용하여 시간에 따른 변화와 집단 간 중재 효과를 분석하였다. 구형성 검증(Mauchly's test) 결과 $P < 0.05$인 경우 Greenhouse-Geisser 보정을 적용한 F값과 P값을 보고하였다.

RESULTS

1. 연구대상자 일반적 특성 및 동질성 검증

연구대상자의 인구사회학적 특성 및 중재군과 대조군의 사전 동질성 검증 결과는 Table 2와 같다. 중재군과 대조군의 연령, 혼인 상태, 동거 형태, 월수입, 교육 수준, 질병 수, 복용 약물 수 등의 인구사회학적 특성에서는 두 그룹 간에 유의한 차이가 없었다. 혼인 상태에서는 사별상태가 58명(81.7%)으로 가장 많았으며, 거주 형태는 독거노인이 60명(84.5%)으로 가장 많았다. 월수입의 경우 1백만 원 미만이 67명(94.4%)으로 경제적 수준이 낮은 편이었고, 교육 수준은 초등학교 졸업 이하가 대부분(68명, 95.7%)이었다. 질병의 수는 평균 2.26 ± 1.29개였으며,

https://doi.org/10.5720/kjcn.2025.00353

Table 2. Participant general characteristics and homogeneity test results (n = 71)

Characteristics	Total (n = 71)	Intervention (n = 53)	Control (n = 18)	*P*-value[1)]
Sex, women	71 (100.0)	53 (100.0)	18 (100.0)	
Age (year)	79.08 ± 5.89	77.47 ± 5.56	80.70 ± 4.89	0.157
Marital status				0.088
Married	12 (16.9)	11 (20.8)	1 (5.6)	
Widowed	58 (81.7)	41 (77.4)	17 (94.4)	
Divorced	1 (1.4)	1 (1.8)	0 (0.0)	
Living arrangement				0.235
Alone	60 (84.5)	42 (79.2)	18 (100.0)	
With spouse	11 (15.5)	11 (20.8)	0 (0.0)	
Monthly income (KRW)				0.265
None	1 (1.4)	1 (1.9)	0 (0.0)	
< 1 million	67 (94.4)	50 (94.3)	17 (94.4)	
> 1 million	3 (4.2)	2 (3.8)	1 (5.6)	
Education				0.601
None	42 (59.1)	29 (54.7)	13 (72.2)	
Elementary	26 (36.6)	21 (39.6)	5 (27.8)	
Middle	2 (2.8)	2 (3.8)	0 (0.0)	
High school	1 (1.4)	1 (1.9)	0 (0.0)	
Number of diseases	2.26 ± 1.29	2.13 ± 1.16	2.39 ± 1.69	0.523
Number of medication	2.45 ± 1.31	2.30 ± 1.23	2.61 ± 1.54	0.250
Physical Health				
Skeletal muscle mass (kg)	18.29 ± 2.85	18.51 ± 2.55	17.62 ± 3.61	0.257
Body fat mass (kg)	18.12 ± 5.38	18.43 ± 5.34	17.19 ± 5.57	0.400
Weight (kg)	52.96 ± 7.93	53.61 ± 8.36	51.05 ± 6.33	0.239
BMI (kg/m^2)	24.04 ± 2.85	23.99 ± 2.93	24.17 ± 2.70	0.849
Calf circumference (cm)	30.51 ± 2.38	30.80 ± 2.46	29.66 ± 1.94	0.137
Arm circumference (cm)	24.54 ± 2.51	24.59 ± 2.56	24.41 ± 2.41	0.871
Physiological Health				
HbA1c (%)	6.17 ± 1.02	6.02 ± 0.92	6.59 ± 1.23	0.096
Glucose (mg/dL)	148.65 ± 49.24	153.11 ± 44.95	135.50 ± 59.65	0.192
Total cholesterol (mg/dL)	178.30 ± 39.55	175.23 ± 38.19	187.33 ± 43.17	0.265
HDL cholesterol (mg/dL)	50.69 ± 12.40	50.13 ± 11.46	52.33 ± 15.08	0.519
Triglycerides (mg/dL)	147.97 ± 77.34	148.51 ± 77.64	146.39 ± 78.67	0.921
SBP (mmHg)	136.61 ± 14.97	135.72 ± 15.47	139.22 ± 13.43	0.395
DBP (mmHg)	75.07 ± 10.16	75.04 ± 10.65	75.17 ± 8.82	0.963
Emotional health				
Loneliness	17.04 ± 6.77	16.21 ± 5.96	19.10 ± 8.32	0.103
Resilience	53.03 ± 10.41	55.13 ± 10.22	50.94 ± 11.68	0.084
Depression	5.94 ± 1.71	5.45 ± 1.29	6.44 ± 2.17	0.082
Social support	47.30 ± 8.28	47.72 ± 7.74	46.89 ± 8.68	0.705
Quality of life	8.19 ± 3.02	7.83 ± 2.67	8.56 ± 4.06	0.390
KOHIP-14	32.32 ± 11.88	32.32 ± 11.55	32.50 ± 13.02	0.922
DHI	7.75 ± 10.48	6.91 ± 9.84	8.00 ± 7.82	0.670
MNA	23.65 ± 3.29	23.97 ± 3.34	23.33 ± 2.68	0.465
NQ-E	49.38 ± 6.12	49.23 ± 6.34	49.61 ± 5.54	0.819

n (%) or Mean ± SD.

BMI, body mass index; HbA1c, hemoglobin A1c; HDL, high-density lipoprotein; SBP, systolic blood pressure; DBP, diastolic blood pressure; KOHIP-14, Korea Oral Health Impact Profile-14; DHI, Dysphagia Handicap Index; MNA, Mini Nutrition Assessment; NQ-E, Nutrition Quotient-Elderly.

[1)]*P*-values from t-test and Chi-square tests.

약물복용은 평균 2.45 ± 1.31개였다. 신체적 건강(체중, BMI, 종아리둘레, 상완위둘레, 골격근량, 체지방량), 생리적 건강(HbA1c, 혈당, 총콜레스테롤, 혈압), 정서적 건강(소외감, 회복탄력성, 사회적지지, 삶의 질), 구강평가(KOHIP-14, DHI), 영양평가(MNA, NQ-E)는 사전 동질성 검증 결과 두 집단 간 유의한 차이가 없어 사전 조건이 동질한 것으로 확인되었다.

2. 신체적 건강

중재군과 대조군의 신체적 건강 변화를 사전, 사후, 사후 2개월 시점에서 비교한 결과는 Table 3과 같다. 체중, BMI, 종아리 둘레, 상완위둘레, 체지방량은 중재군과 대조군 모두 시간적 변화, 집단별, 시간과 집단과의 상호작용 효과에서 유의한 차이를 보이지 않았다.

골격근지수는 대조군, 중재군과의 집단별 유의한 차이는 보이지 않았으나, 시간과 집단과의 상호작용 효과에는 유의한 차이가 있었다(F = 3.40, P = 0.041).

노쇠비율은 중재군 52.8%에서 사후 49.1%로 감소하였다가 사후 2개월 56.6%로 증가하였으며, 대조군 사전 72.2%에서 사후 2개월 83.3%로 비율이 상승하였다. 노쇠 점수는 중재군과 대조군 모두에서 전 노쇠 비율의 변화가 관찰되었으나, 이러한 변화는 통계적으로 유의미한 시간 효과나 그룹 간 상호작용 효과를 보이지 않았다.

Table 3. Changes in physical health among participants (n = 71)

Physical health	Pre-int.	Post-int.	2 Months after-int.	Within-subject effects		
				Time	Group	Group × time
Weight (kg)				0.614	2.764	0.535
Int.	53.61 ± 8.36	52.82 ± 8.15	52.74 ± 8.69			
Con.	52.39 ± 9.69	51.44 ± 9.68	51.28 ± 8.94			
BMI (kg/m^2)				0.674	0.834	0.686
Int.	23.99 ± 2.93	23.67 ± 2.85	23.57 ± 2.67			
Con.	24.17 ± 2.70	23.78 ± 2.57	23.81 ± 2.66			
Calf circumference (cm)				0.692	0.194	0.671
Int.	30.80 ± 2.46	31.19 ± 3.09	30.29 ± 3.04			
Con.	29.66 ± 1.94	28.97 ± 2.10	29.04 ± 2.29			
Arm circumference (cm)				0.687	0.744	0.534
Int.	24.59 ± 2.56	25.21 ± 2.72	25.64 ± 2.37			
Con.	24.41 ± 2.41	22.82 ± 2.26	22.85 ± 2.20			
Skeletal muscle mass				0.561	0.263	0.041
Int.	18.51 ± 2.55	18.63 ± 2.79	18.94 ± 3.14			
Con.	17.62 ± 3.61	17.63 ± 1.93	16.79 ± 2.76			
Body fat mass				0.172	0.522	0.071
Int.	18.43 ± 5.34	17.40 ± 5.35	17.00 ± 5.47			
Con.	17.19 ± 5.57	16.36 ± 4.89	17.86 ± 5.02			
Frailty score				0.113	0.172	0.884
Int.	9.08 ± 1.96	9.45 ± 1.70	9.00 ± 2.02			
Con.	7.78 ± 1.93	8.44 ± 1.98	7.83 ± 1.69			
Frailty						
Int.						
Normal	25 (47.2)	27 (50.9)	23 (43.4)			
Pre-frailty	28 (52.8)	26 (49.1)	30 (56.6)			
Frailty	0 (0.0)	0 (0.0)	0 (0.0)			
Con.						
Normal	5 (27.8)	4 (22.2)	3 (16.7)			
Pre-frailty	13 (72.2)	14 (77.8)	15 (83.3)			
Frailty	0 (0.0)	0 (0.0)	0 (0.0)			

Mean ± SD or n (%).
The P-value for physical health was calculated using repeated-measures ANOVA.
Int., intervention; Con., control; BMI, body mass index.

https://doi.org/10.5720/kjcn.2025.00353

3. 생리적 건강

식품꾸러미 제공에 대한 중재군과 대조군의 생리적 건강 지표 변화는 Table 4와 같다.

중재군의 HbA1c는 사전 6.58% ± 1.16%에서 사후 2개월 6.28% ± 0.82%로 감소하는 경향을 보였으며, 시간과 그룹의 상호작용 효과가 통계적으로 유의하였다(F = 11.84, P < 0.001).

혈당, 총콜레스테롤, 수축기 혈압, 이완기 혈압, 혈중지질은 그룹, 시간, 그룹과 시간과의 상호작용 중재효과 모두 유의하지 않았다. High-density lipoprotein (HDL) 콜레스테롤은 시간의 경과에 따라 대조군 중재군 모두 감소하는 경향을 보였으나 군간 차이는 통계적으로 유의한 차이를 보이지 않았다. 하지만 시간의 변화에 따라 통계적 유의한 차이는 나타났다(F = 44.12, P < 0.001).

4. 정서적 건강

식품꾸러미 제공에 대한 중재군과 대조군의 정서적 건강 지표를 분석한 결과는 Table 5에 제시하였다. 중재군과 대조군 두 집단간의 소외감, 회복탄력성, 우울, 삶의 질 모두 사후 유의한 차이가 관찰되었으며(P < 0.05), 회복탄력성과 삶의 질은 시간의 경과에 따라 유의한 변화를 보였다(P < 0.05). 집단과 시간의 경과에 따른 상호작용은 정서적 건강 모든 변수에서 그룹 간 변화 양상의 차이가 없었다.

5. 구강 건강

식품꾸러미 제공에 따른 중재군과 대조군의 구강평가 결과는 Table 6에 제시하였다. KOHIP-14는 중재군에서 사전 32.32 ± 11.55점, 사후 28.64 ± 13.93점, 사후 2개월 28.98 ± 11.42점으로 감소하는 경향을 보였으나, 시간 효과, 그룹 효과, 그리고 시간과 그룹 상호작용 효과 모두 통계적으로 유의하지 않았다.

DHI는 중재군에서 사전 9.06 ± 9.84점에서 사후 6.11 ± 8.92점으로 유의하게 감소한 후, 사후 2개월에는 9.17 ± 12.07점으로 다시 증가하는 양상을 보였다. 반복측정 분산분석 결과, 고령친화식품 제공이 삼킴 장애 점수의 전반적인 수준을 대조군보다 낮게 유지하는 데 기여했으나(F = 3.794, P = 0.045), 시간 경과에 따른 삼킴 장애의 개선 효과는 두 그룹 간에 통계적으로 유의한 차이를 보이지 않았다(F = 1.021, P = 0.354).

Table 4. Changes in physiological health among participants (n = 71)

Physiological health	Pre-int.	Post-int.	2 Months after-int.	Within-subject effects		
				Time	Group	Group × time
HbA1c (%)[1)]				0.612	0.462	< 0.001
Int.	6.58 ± 1.16	6.39 ± 0.73	6.28 ± 0.82			
Con.	6.59 ± 1.23	6.39 ± 0.77	6.31 ± 0.85			
Glucose (mg/dL)				0.271	0.301	0.321
Int.	153.11 ± 44.95	141.47 ± 42.03	141.81 ± 46.38			
Con.	135.50 ± 59.65	127.11 ± 35.51	142.56 ± 50.32			
Total cholesterol (mg/dL)				0.062	0.624	0.242
Int.	175.23 ± 38.19	175.93 ± 34.97	169.29 ± 38.73			
Con.	187.33 ± 43.17	173.83 ± 39.19	172.94 ± 33.43			
HDL (mg/dL)				< 0.001	0.900	0.231
Int.	50.13 ± 11.46	46.57 ± 11.33	43.30 ± 9.90			
Con.	52.33 ± 15.08	45.11 ± 11.65	41.50 ± 12.37			
Triglycerides (mg/dL)				0.351	0.781	0.811
Int.	148.51 ± 77.64	149.06 ± 74.94	137.14 ± 60.01			
Con.	146.39 ± 78.67	161.44 ± 112.94	140.72 ± 87.73			
SBP (mmHg)[1)]				0.341	0.461	0.791
Int.	135.72 ± 15.47	137.58 ± 17.33	131.36 ± 28.49			
Con.	139.22 ± 13.43	138.00 ± 9.02	135.94 ± 10.09			
DBP (mmHg)[1)]				0.222	0.541	0.441
Int.	75.04 ± 10.65	75.08 ± 9.24	74.11 ± 10.74			
Con.	75.17 ± 8.82	72.44 ± 8.94	72.28 ± 6.47			

Mean ± SD.
The P-value for physiological health was calculated using repeated-measures ANOVA.
Int., intervention; Con., control; HDL, high-density lipoprotein; SBP, systolic blood pressure; DBP, diastolic blood pressure.
[1)]Greenhouse–Geisser correction applied.

Table 5. Changes in emotional health among participants (n = 71)

Emotional health	Pre-int.	Post-int.	2 Months after-int.	Within-subject effects		
				Time	Group	Group × time
Loneliness				0.933	0.01	0.933
Int.	16.21 ± 5.96	16.38 ± 6.91	16.06 ± 6.66			
Con.	19.10 ± 8.32	20.33 ± 12.07	20.56 ± 10.16			
Resilience				0.009	0.045	0.485
Int.	55.13 ± 10.22	56.28 ± 7.06	52.49 ± 11.14			
Con.	50.94 ± 11.68	55.44 ± 9.72	47.50 ± 17.25			
Depression				0.399	0.012	0.545
Int.	5.45 ± 1.29	5.25 ± 1.02	5.57 ± 1.73			
Normal	8 (15.1)	11 (20.7)	10 (18.9)			
Mild	44 (83.0)	42 (79.3)	43 (81.1)			
Severe	1 (1.9)	0 (0.0)	0 (0.0)			
Con.	6.44 ± 2.18	5.89 ± 1.68	5.94 ± 1.89			
Normal	2 (10.0)	2 (15.0)	2 (10.0)			
Mild	14 (80.0)	15 (80.0)	15 (85.0)			
Severe	2 (10.0)	1 (5.0)	1 (5.0)			
Social support				0.062	0.728	0.398
Int.	47.72 ± 7.74	48.59 ± 5.47	47.23 ± 7.02			
Con.	46.89 ± 8.68	50.06 ± 9.13	45.17 ± 9.73			
Quality of life				0.048	0.025	0.63
Int.	7.83 ± 2.67	8.00 ± 2.67	6.87 ± 1.79			
Con.	8.56 ± 4.06	9.28 ± 3.25	8.44 ± 2.89			

Mean ± SD or n (%).
The *P*-value for emotional health was calculated using repeated-measures ANOVA.
Int., intervention; Con., control.

Table 6. Changes in oral health scores among participants (n = 71)

Variables	Pre-int.	Post-int.	2 Months after-int.	Within-subject effects		
				Time	Group	Group × time
KOHIP-14				0.159	0.629	0.284
Int.	32.32 ± 11.55	28.64 ± 13.93	28.98 ± 11.42			
Con.	32.00 ± 13.03	33.00 ± 12.62	29.06 ± 12.45			
DHI				0.036	0.045	0.354
Int.	9.06 ± 9.84	6.11 ± 8.92	9.17 ± 12.07			
Con.	10.40 ± 7.82	11.11 ± 15.63	14.44 ± 14.84			

Mean ± SD.
The *P*-value for oral health was calculated using repeated-measures ANOVA.
Int., intervention; Con., control; KOHIP-14, Korea Oral Health Impact Profile-14; DHI, Dysphagia Handicap Index.

6. 영양상태

식품꾸러미 제공에 따른 중재군과 대조군의 영양상태 결과는 Table 7에 제시하였다. MNA 점수는 중재군에서 사전 23.97 ± 3.34점, 사후 23.95 ± 3.43점, 사후 2개월 23.77 ± 3.78점으로 비교적 안정적으로 유지된 반면, 대조군에서는 사전 23.44 ± 2.72점에서 사후 21.71 ± 3.18점으로 감소한 후 사후 2개월에도 21.74 ± 3.85점으로 낮은 수준을 보였다. 반복측정 분산분석 결과, 고령친화식품 제공이 대조군에 비해 중재군의 전반적인 MNA 점수를 더 양호하게 유지하는 데 기여했지만($F = 5.138$, $P = 0.027$), MNA 점수의 시간 경과에 따른 변화 양상이나 중재의 차별적 개선 효과는 통계적으로 유의하지 않았다. NQ-E는 중재군에서 사전 62.42 ± 7.26점, 사후 67.65 ± 8.94점, 사후 2개월 64.68 ± 7.15점으로 나타났으며, 영양지수 '양호'에 해당하는 대상자는 사전 27명(50.9%), 사후 38명(71.7%),

https://doi.org/10.5720/kjcn.2025.00353

Table 7. Changes in nutritional assessment results among participants (n = 71)

Variables	Pre-int.	Post-int.	2 Months after-int.	Within-subject effects		
				Time	Group	Group × time
MNA				0.187	0.027	0.261
Int.	23.97 ± 3.34	23.95 ± 3.43	23.77 ± 3.78			
Adequate	28 (52.8)	29 (54.7)	29 (54.7)			
At risk of malnutrition	23 (43.4)	22 (41.5)	21 (39.6)			
Malnutrition	2 (3.8)	2 (3.8)	3 (5.7)			
Con.	23.44 ± 2.72	21.71 ± 3.18	21.74 ± 3.85			
Adequate	6 (33.33)	4 (22.22)	3 (16.67)			
At risk of malnutrition	11 (61.11)	12 (66.66)	12 (66.66)			
Malnutrition	1 (5.56)	2 (11.12)	3 (16.67)			
NQ-E				0.974	0.187	0.163
Int.	62.42 ± 7.26	67.65 ± 8.94	64.68 ± 7.15			
Good	27 (50.9)	38 (71.7)	34 (64.1)			
Monitoring	26 (49.1)	15 (28.3)	19 (35.9)			
Con.	57.52 ± 7.78	57.64 ± 7.82	57.53 ± 7.91			
Good	5 (27.78)	4 (22.22)	4 (22.22)			
Monitoring	13 (72.22)	14 (77.78)	14 (77.78)			

Mean ± SD or n (%).
The *P*-value for nutritional assessment was calculated using repeated-measures ANOVA.
Int., intervention; Con., control; MNA, Mini Nutritional Assessment; NQ-E, Nutrition Quotient for Elderly.

사후 2개월 34명(64.1%)이었으며 중재군과 대조군 간의 그룹 효과, 시간 효과 및 시간과 그룹 간의 상호작용 효과에 대한 분석결과 통계적으로 유의하지 않은 것으로 나타났다.

7. 영양소 섭취량

식품꾸러미 제공에 대한 중재군과 대조군의 에너지 및 주요 영양소 섭취 변화는 Table 8에 제시하였다. 에너지 섭취, 탄수화물, 단백질, 지방, 섬유소는 시간, 집단, 시간과 집단과의 상호작용 모두 통계적으로 유의하였다($P < 0.05$). 비타민 A와 C 섭취량은 집단 간 비교에서 중재군이 대조군보다 유의하게 높은 섭취량을 보였으며($P < 0.05$), 이는 중재 기간 동안 지속적으로 유지되었다. 비타민 B_2와 D 섭취량은 전체 대상자를 기준으로 시간의 경과에 따라 유의한 증가 양상을 보여 통계적으로 유의한 시간 효과가 확인되었다($P < 0.05$). 그러나 비타민 B_2, C와 D 모두에서 시간과 집단 간 상호작용 효과는 통계적으로 유의하지 않아, 시간에 따른 변화 양상은 두 집단 간에 유사하게 나타났다. 칼슘, 철과 마그네슘은 두 그룹 간의 유의한 차이가 있지만($P < 0.05$), 시간 및 시간과 집단간의 상호작용 효과는 유의하지 않았다. 콜레스테롤 섭취량은 시간, 집단 그리고 시간과 집단간의 상호작용 효과 모두에서 통계적으로 유의한 차이를 보이지 않았다.

DISCUSSION

본 연구는 농촌 지역에 거주하는 여성노인을 대상으로 고령친화식품꾸러미(이하 식품꾸러미) 제공이 건강과 영양 상태에 미치는 효과를 분석하기 위하여 중재군과 대조군을 비교·분석하였다.

본 연구는 비 동등성 대조군 전후 반복측정 설계를 적용한 준실험연구로서, 인간을 대상으로 하는 연구의 특성상 무작위 배정이 이루어지지 않아 내적 타당성에 한계가 있을 수 있으나 이를 최소화하기 위해 중재군과 대조군 간 사전 동질성 검증을 실시하였다. 주요 인구사회학적 특성과 건강 관련 변수에서 유의한 차이가 없음을 확인하였다.

연구참여자의 평균 연령은 79.08세로 국민건강영양조사(2019–2022년)에 보고된 전체 노인 평균 연령보다 높은 수준이었으며, 이는 농촌 지역이 후기 고령자가 많은 것으로 보이며, 평균 질병 수는 2.26개로 국민건강영양조사 결과와 유사하였으나, 평균 복용 약물 수는 2.45개로 다소 낮았다. 본 연구에서 교육수준은 초등학교 졸업 이하가 67명(94.3%)으로 대부분을 차지하였고, 독거노인은 60명(84.5%)으로 높은 비율을 보였다. 이러한 특성은 농촌 노인이 도시 노인에 비해 신체적 기능 저하와 함께 낮은 교육 및 경제 수준으로 인해 건강과 영양 불평등에 취약하다는 선행연구의 보고와 유사한 경향을 보인다[31, 32].

신체적 건강을 평가할 때 근육량과 체지방량은 이동능력과 일

Table 8. Changes in nutrient intake among participants (n = 71)

Classification	Pre-int.	Post-int.	2 Months after-int.	Within-subject effects		
				Time	Group	Group × time
Energy (kcal)				< 0.001	< 0.001	< 0.001
Int.	1,217.40 ± 337.29	1,651.99 ± 318.48	1,471.32 ± 365.84			
Con.	922.46 ± 330.41	1,063.27 ± 371.76	1,232.15 ± 478.24			
Carbohydrates (g)				< 0.001	< 0.001	0.004
Int.	207.69 ± 61.40	258.12 ± 49.35	243.70 ± 55.24			
Con.	161.85 ± 58.88	175.29 ± 61.04	205.58 ± 72.50			
Protein (g)				< 0.001	< 0.001	< 0.001
Int.	42.76 ± 12.76	63.01 ± 14.79	52.12 ± 16.33			
Con.	31.36 ± 12.71	40.61 ± 19.78	46.41 ± 25.21			
Lipids (g)				< 0.001	< 0.001	0.001
Int.	22.59 ± 9.09	37.89 ± 11.19	30.66 ± 11.83			
Con.	15.25 ± 7.30	19.87 ± 12.90	23.17 ± 14.78			
Fibers (g)				< 0.001	< 0.001	0.006
Int.	16.65 ± 4.98	22.66 ± 6.55	22.05 ± 5.89			
Con.	11.51 ± 4.74	12.03 ± 7.20	14.93 ± 7.02			
Vitamin A (μg RAE)				0.848	< 0.001	0.034
Int.	279.35 ± 166.36	252.49 ± 128.84	287.08 ± 135.90			
Con.	107.31 ± 79.35	136.13 ± 104.32	108.60 ± 83.34			
Vitamin B_2 (mg)				< 0.001	0.247	0.512
Int.	0.80 ± 0.22	1.74 ± 5.87	1.16 ± 0.40			
Con.	0.66 ± 0.29	0.64 ± 0.22	0.86 ± 0.49			
Vitamin C (mg)				0.904	< 0.001	0.756
Int.	53.00 ± 34 .82	56.33 ± 39.59	55.12 ± 28.98			
Con.	27.86 ± 16.26	26.95 ± 22.30	27.01 ± 17.61			
Vitamin D (μg)				< 0.001	0.133	0.042
Int.	1.25 ± 1.55	1.31 ± 1.51	1.35 ± 1.51			
Con.	0.57 ± 0.77	1.16 ± 1.98	3.88 ± 5.58			
Calcium (mg)				0.168	< 0.001	0.378
Int.	448.25 ± 224.17	471.22 ± 159.41	540.13 ± 194.10			
Con.	313.23 ± 200.74	255.71 ± 122.93	322.78 ± 199.43			
Sodium (mg)				< 0.001	0.006	0.552
Int.	3,029.56 ± 1,133.59	3,773.10 ± 930.08	3,885.95 ± 1,148.92			
Con.	2,283.58 ± 1,478.20	2,977.82 ± 1,480.40	3,392.96 ± 2,004.27			
Iron (mg)				0.001	< 0.001	0.489
Int.	9.10 ± 2.82	9.02 ± 2.76	10.58 ± 3.05			
Con.	5.89 ± 2.87	6.57 ± 2.76	7.99 ± 3.42			
Magnesium (mg)				0.002	< 0.001	0.167
Int.	206.22 ± 70.31	185.60 ± 70.08	246.26 ± 78.81			
Con.	140.52 ± 71.32	143.68 ± 86.90	176.00 ± 98.50			
Cholesterol (mg)				0.123	0.118	0.640
Int.	139.01 ± 127.35	162.28 ± 110.84	173.75 ± 141.65			
Con.	100.51 ± 88.61	132.04 ± 151.34	121.76 ± 114.99			

Mean ± SD.
The *P*-value for nutritional assessment was calculated using repeated-measures ANOVA.
Int., intervention; Con., control.

https://doi.org/10.5720/kjcn.2025.00353

상생활 수행에 직접적인 영향을 미치는 핵심 지표이다[18]. 본 연구의 신체적 건강 지표 분석 결과, 체지방률은 유의한 변화가 나타나지 않았으나, 근육량은 집단과 시간 간 상호작용 효과가 유의하게 나타났다. 또한 노쇠 점수는 중재군과 대조군 간 집단 효과에서 유의한 차이를 보여, 중재군이 상대적으로 낮은 노쇠 수준을 유지하였다. 노쇠 수준 개선은 노인의 독립적인 생활 유지 기간을 연장하고, 요양 시설 입소율 감소를 통해 국가 의료 재정 부담 경감에 기여할 수 있다[32]. 단백질 섭취 증가가 근육 단백질 합성을 촉진하여 근육량 감소를 억제하고 근육량 유지 측면에서 고령친화식품 제공의 긍정적인 효과를 시사한다. 선행연구에서도 단기 영양중재는 체중이나 체지방 변화보다는 근육량 유지 및 근감소 예방에 더 효과적인 것으로 보고된 바 있다[33].

생리적 건강지표 분석 결과, HbA1c에서는 집단과 시간 간 유의한 상호작용 효과가 나타났으며, 중재군은 사후 및 사후 2개월까지 혈당이 안정적으로 유지되었다. 이는 영양중재가 혈당 조절에 긍정적인 영향을 미친다는 선행연구와 일치한다[15]. 혈당과 중성지방에서는 유의한 차이는 없었으나, 중재군의 감소 경향은 장기적인 식이행동 변화 가능성을 시사한다. 총콜레스테롤은 시점 간 유의한 감소를 보여 식이 중재의 혈중 지질 개선 가능성을 확인하였으나, HDL 콜레스테롤은 두 집단 모두에서 시간의 경과에 따라 유의하게 감소하여 단기간 중재의 한계를 나타냈다.

정서적 건강지표에서는 소외감, 회복탄력성, 우울, 삶의 질에서 두 집단 간 유의한 차이가 나타났다. 이는 고령친화식품 섭취를 통한 영양 상태 개선이 신체적 활력을 높이고, 사회활동 참여 증가와 우울 감소, 자아 효능감 향상으로 이어져 회복탄력성을 증진시킨다는 선행연구와 일치한다[34, 35]. 그러나 사후 2개월 시점에서는 정서적 건강지표 대부분이 감소하여, 사회적 관계 형성과 정서적 변화는 단기간 중재만으로 지속되기 어렵다는 한계를 보여주었다. 이에 따라 향후 연구에서는 지역사회 자조모임 연계 및 장기적 참여가 가능한 통합 중재 프로그램이 필요할 것으로 판단된다. 하지만 식품꾸러미가 생활지원사를 통해 정기적으로 전달되었다는 점에서, 식품 제공 자체의 효과뿐만 아니라 생활지원사의 방문과 상호작용이 대상자의 정서적 안정감, 사회적 지지 인식, 건강행동 변화에 영향을 미쳤을 가능성이 있어, 고령친화우수식품 꾸러미 제공의 영향으로 해석하는 데 제한점이 된다.

구강상태 평가에서 DHI는 시간의 변화와 집단 간 유의한 차이를 보였으나, 집단과 시간 간의 상호작용 효과는 나타나지 않았다. 이는 중재 효과가 특정 시점에서 나타나기는 했으나, 시간의 경과에 따라 두 집단 간 변화 양상이 뚜렷하게 분화되지는 않았음을 의미한다. 선행연구에서도 고령자의 연하 기능은 근육량, 치아 상태, 신경계 기능 등 복합적인 요인의 영향을 받아 단기간의 영양중재만으로는 구조적 개선이 제한적임을 보고하고 있다[36, 37].

영양상태 평가에서는 MNA에서 중재군과 대조군 간 유의한 차이가 관찰되었다. 사후 2개월 시점에서 이러한 효과가 감소한 점은 단기간의 식품 제공만으로는 행동 변화의 지속성이 확보되기 어렵다는 점을 보여주며, 지속적인 식품제공, 영양교육 및 상담을 병행한 행동 변화 전략의 필요성을 시사한다.

영양소섭취량 분석에서는 에너지와 주요 영양소(탄수화물, 단백질, 지방, 섬유소)에서 집단, 시간, 시간과 집단간의 상호작용 효과가 모두 유의하였다. 이는 제공한 식품꾸러미가 대상자의 식사 섭취량을 증가시켜 영양소 섭취량의 증가로 나타난 것이며 이는 농촌 노인에게 식품꾸러미를 주기적 제공하는 것이 건강한 식생활 유지에 필수조건임을 뒷받침해준다[15]. 특히 고령친화우수식품은 노인의 영양특성에 맞게 단백질 함량이 높은 주찬류의 제품을 식품꾸러미에 포함하여 대상자의 단백질 섭취가 유의적으로 증가한다는 것을 확인하였다. 단백질은 노인의 근감소증 예방과 관리를 위하여 충분하게 섭취하는 것이 매우 중요하다[15, 18]. 비타민B_2, C와 D 섭취량의 증가는 조리 부담 없이 섭취 가능한 채소·과일 기반 식품 구성이 고령자의 영양섭취 개선에 효과적으로 향후 고령친화우수식품의 제품 개발에서 주요하게 고려해야 할 요소이다.

무기질은 칼슘, 마그네슘과 철분은 두 집단 간 유의한 효과가 나타나, 고령친화식품이 노인에게 부족하기 쉬운 무기질의 결핍을 개선하는데 기여할 수 있음을 알 수 있었다. 콜레스테롤 섭취량은 집단, 시간, 집단과 시간의 상호작용 효과 모두 유의한 차이가 없었으며, 이는 단백질 식품 섭취 증가가 혈중 콜레스테롤 섭취 증가로 직결되지 않는 것으로 나타났다[15, 36]. 한편, 나트륨 섭취는 시간의 경과에 따라 증가하는 경향을 보였는데 이는 식사량이 증가하면 당연히 나트륨의 섭취량이 증가하며 특히 고령친화식품은 가공식품으로 나트륨 섭취량 증가에 기여한 것으로 보인다. 따라서 고령친화식품을 식단에 포함할 때에는 저염으로 조리하는 것이 필요하며 향후 고령친화식품 개발시에는 나트륨 함량을 줄이는 것이 고령친화식품 소비 활성화에 주요한 요소가 될 것으로 판단된다.

Limitations

본 연구는 고령친화식품 제공이 농촌 노인의 신체적·생리적·정서적 건강에 긍정적인 영향을 미칠 가능성을 확인하였으나, 몇 가지 한계를 지닌다.

첫째, 단일 지역 여성 노인을 대상으로 수행된 연구로, 문화적 특성이나 경제 수준 등 지역적 맥락에 따른 중재 효과의 차이를 충분히 반영하지 못하였다. 향후에는 다양한 농촌 환경과 도시 지역을 포함한 반복연구를 통해 결과의 일반화 가능성을 평가할 필요가 있다.

둘째, 3개월 정도의 고령친화우수식품 제공으로 근육량 변화나 대사 지표의 장기적 효과를 평가하는 데 한계가 있었다. 이에 따라 장기 중재 및 추적 연구가 요구된다.

셋째, 연구 과정에서 생활지원사의 정기적 방문이 정서적 건

강지표에 영향을 미쳤을 가능성을 완전히 배제할 수 없으므로, 향후 연구에서는 대조군에도 유사한 빈도의 사회적 접촉을 제공하는 설계가 필요하다.

마지막으로, 연구 참여자가 모두 여성 노인으로 구성되어 있어, 본 연구 결과를 전체 농촌 노인 인구로 일반화하는 데 제약이 존재한다.

Conclusion

본 연구 결과, 고령친화식품 꾸러미 제공 프로그램이 농촌여성 노인의 혈당 조절 등 생리적 건강지표뿐만 아니라 회복탄력성 및 삶의 질 등 정서적 건강에도 긍정적인 변화를 확인하였다. 이러한 결과는 고령친화우수식품 섭취가 신체적·정서적 건강과 관련하여 잠재적 영향을 가질 수 있음을 시사하며, 향후 농촌 지역 노인을 대상으로 한 프로그램 개발 시 사회적 교류 증진(예: 공동 식사), 교통 지원, 원격 상담 등 다양한 지원 요소를 결합한 통합적 중재 모델의 적용과 그 효과 평가 필요성을 제안한다. 본 연구 결과는 농촌 노인을 대상으로 한 고령친화식품 지원 프로그램을 계획할 때 참고할 수 있는 기초 자료를 제공하며, 장기적으로는 한국형 고령자 식단 가이드라인에서 고령친화식품 활용 가능성에 대해 검토되기를 기대한다.

CONFLICT OF INTEREST

There are no financial or other issues that might lead to conflicts of interest.

FUNDING

This work was supported by the 2024 Senior-Friendly Food Pilot Project, funded by the Korea Food Industry Cluster Promotion Agency.

DATA AVAILABILITY

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request. Requests for data access may be directed to the following email address: hanmiky@dit.ac.kr

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Instructions for authors

KJCN
Korean Journal of Community Nutrition

Revised in October 15, 2024

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It is essential that at least one author of the manuscript is a member of the Korean Society of Community Nutrition. Exceptions will be made when the Editorial Committee invites authors and when researchers affiliated with institutions outside Korea submits.

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2) **Reviews:** Reviews provide concise and precise updates on the latest progress made within the scope of the journal. Systematic reviews should follow the PRISMA guidelines.
3) **Research notes:** Research notes discuss new ideas, research methods, or policy issues relevant to community nutrition.
4) **Educational materials:** Educational materials describe contents of nutrition education program, its application or new approaches to nutrition education.

4. RESEARCH AND PUBLICATION ETHICS

1) **Duplicate publication:** The manuscript must be original and not published or submitted for publication in other scientific journals.
2) **Authorship:** All authors listed in a manuscript must have contributed substantially to the research design, collection and analysis of data, or preparation of the manuscript. And they should agree to be responsible for investigating and solving research-related problems.
3) **Protection of human subjects:** Research carried out on human subjects must be in compliance with the Helsinki Declaration, and authors should specify that it was reviewed and approved by an Institutional Review Board (IRB).
4) **Conflicts of interest:** Authors must disclose any financial or personal relationships with the company or organization sponsoring the research.
5) **Adherence to the ethics guidelines:** Authors should adhere to the research ethics regulations and guidelines of Korean Society of Community Nutrition. For the policies on the research and publication ethics not stated in these instructions, international standards of publication ethics for editors and authors (http://publicationethics.org/international-standards-editorsand-authors) can be applied.
6) **Copyright:** Copyright of the published article belongs to the Korean Society of Community Nutrition. A copyright transfer form should be signed by all author(s) and sent when the manuscript is submitted.
7) **Preprints:** The journal does not accept research articles that have been shared as preprints.

5. CONSIDERATION OF SEX/GENDER

In all studies, sex (a biological variable) or gender (a socio, cultural, and psychological trait) should be factored into research designs and analyses and reported in a manuscript as follows.

- Sex and gender should be described separately and correctly.
- Both sexes/genders should be included in the human studies, and the differences between the sexes/genders should be analyzed and reported.
- If only one sex/gender is reported, or included in the

study, the reason the other sex/gender is not reported or included should be explained based on reasonable and scientific basis.

6. SUBMISSION

A manuscript file without authors' information must be submitted through our online submission system (https://submit-kjcn.or.kr) by the corresponding author. In addition, authors should remember to upload the author's information separately. This includes the title page, copyright transfer agreement signed by all authors, IRB approval, and author checklist. You can upload these documents to the "Attachment" section on the submission site.

7. PEER REVIEW

A submitted manuscript without authors' information is sent to two independent reviewers selected by an editor-in-chief or an editor. Reviewers review the manuscript in detail according to the KJCN review guidelines. The editor-in-chief then makes an initial decision based on the reviewers' comments and notifies the corresponding author of the decision within six weeks of receipt of a manuscript. One additional reviewer can be appointed when the two reviewers' comments are not in agreement.

8. MANUSCRIPT PREPARATION

1) **General:** Text must be written in Korean or English using MS Word program. The designated font style for English is Times New Roman in 11-point and the text should be 200%-spaced or double-spaced. Each page must be numbered beginning with the abstract page. Manuscripts are to have line numbers in the left margin.
2) **Title page:** The title page should include the following:
   - The type of manuscript (research articles, reviews, research notes, and educational materials)
   - The running head summarizing in Englisgh (50 characters or less including spaces)
   - Titles should be written in sentence case (only the first word of the text and proper nouns are capitalized). For observational studies (cross-sectional, case-control, or prospective cohort), clinical trials, systematic reviews, or meta-analyses, the subtitle should include the study design.
   - The names and affiliations, positions of all authors

A corresponding author should be marked with "†" at the end of the name. If some of the authors have different affiliations, superscript 1), 2), 3) should be placed at the end of each author's name in this order and the same number should be placed in front of the affiliation. 1), 2), 3) are attached in the same order, even if they belong to the same organization but have different positions.

The position of the researcher (professor, lecturer, student, researcher, etc.) should be listed in front of the affiliation. If there is no position and title, only the name is given. For minors who are not currently affiliated, submit the final affiliation, position, and school year separately.

<Example>
Youngok Kim[1)], Jin-Sook Yoon[2)†], Kil-dong Hong[3)], Na-ra Kim[4)]
[1)]Professor, Department of Food and Nutrition, Dongduk Women's University, Seoul, Korea
[2)]Professor, Department of Food and Nutrition, Keimyung University, Daegu, Korea
[3)]Student, Graduate School of Education, Keimyung University, Daegu, Korea
[4)]Student, OO High School, Daegu, Korea

- The name, address, telephone number, fax number, and email address of the corresponding author in English. Country code is also indicated for telephone and fax numbers.

<Example>
Kil-dong Hong
... ... (address)
Tel: +82-2-749-0747
Fax: +82-2-749-0746
Email: kjcn45@koscom.or.kr

- ORCID (https//orcid.org/)
  All authors should register their affiliation and position at ORCID. When author identification is required, this information can be used. ORCID numbers of all authors should be indicated without blinding.

<Example>
Kil-Dong Hong https://orcid.org/****-****-****-****

• Funding

When there is no funding associated with the manuscript, “None” should be stated.

<Example>

This research was supported by a grant from the National Research Foundation of Korea (Grant No. ***).

3) Arrangement of research articles: Each manuscript should be divided into the following sections in the order: Title page, Abstract, Introduction, Methods, Results, Discussion, Conflict of Interest, Acknowledgments, References, followed by Tables and Figures. These section headings and subheadings should be written in English. In case of educational materials, the contents of the results and discussion can be composed of contents, evaluation, and implications. In the case of a review, unlike the structure of a research articles, it can be described as an introduction, body, and conclusion. However, a scoping review or a systematic review should follow the structure of the research articles.

The journal encourages authors to describe the study according to the reporting guidelines relevant to their research design, such as those outlined by the EQUATOR Network (http://www.equator-network.org/home/) and the United States National Institutes of Health/ National Library of Medicine (http://www.nlm.nih.gov/services/research_report_guide.html).

• Ethics Statement

Authors should present an “Ethics statement” immediately after the heading “Methods”. In case of reviews, research notes and educational materials, “Ethics statement” should be presented after introduction section.

<Example>

The informed written consent was obtained from each participant. The study protocol was approved by the Institutional Review Board of *** (approval number).]

<Example>

Obtainment of informed consent was exempted by the institutional review board.

• Study Design

Authors should present the study design (e.g., descriptive analysis, randomized controlled trial, cohort study, or meta-analysis) and any reporting guidelines referenced in the "Methods" section.

<Example>

This was a cross-sectional study. It was described according to the STROBE statement (https://www.strobe-statement.org/).

• Discussion

Authors should interpret the results and provide the Limitations and Conclusion in the latter part of the “Discussion” section.

• Conflict of Interest

<Example>

There are no financial or other issues that might lead to conflict of interest.

<Example>

Kildong Hong has been an editor since 2021. However, he was not involved in the review process of this manuscript. Otherwise, there was no conflict of interest.

• Acknowledgments

Describe the person who helped write the thesis or research but was not appropriate as an author.

<Example>

We thank the physicians who performed the sample collection.

• Data Availability

Authors should provide a data availability statement. Providing access to research data is optional.

<Example>

The data that support the findings of this study are openly available in [repository name e.g “KNHANES”] at http://doi.org/[doi].

4) Abstract: A structured abstract of 250~300 words must be written in English under the following headings: Objectives, Methods, Results, and Conclusion. Abstracts should be accompanied by keywords in English.

5) Keywords: A Three to five keywords are recommended with one or two words except for technical terms. The terminology should be listed, in principle, in MeSH (www.nlm.nih.gov/mesh/MBrowser.html). Keywords are written in lowercase letters except for proper nouns,

and keywords are separated by a semicolon (;).

6) **Abbreviations:** All abbreviations must be defined in parentheses at first mention in the text. Abbreviations used in a table or figure should be defined in their respective table footnote or figure legend.

7) **Numbers and measurements:** Numbers should be presented in Arabic numerals. For most measurements, the International System of Units (SI) is recommended. The unit symbol should be placed after the numerical value and a space should be left between the numerical value and the unit symbol except %, ˚C.

8) **References**

- References should be numbered consecutively in the order in which they appear in the text using Arabic numerals in brackets.
- When more than one reference is cited at the same point in the text, they are included in the same bracket as below.

<Example>
[1-3] or [4, 7]

- When the authors' names of the references are inserted in the text, the last names of the authors are given in English. When the reference has two authors, both authors' names should be joined by '&,' and when the reference has more than two authors, the first author's name should be given followed by *'et al'*.

<Example>
Kim [2], Park & Lee [5], Brown *et al*. [7]

- Reference list should be given in English in numerical order corresponding to the order of citation in the text.
- References should follow the National Library of Medicine (NLM) style guide (http://www.nlm.nih.gov/citingmedicine).
- Abbreviations of journal names should be written according to the international rules for the abbreviation (https://www.ncbi.nlm.nih.gov/journals) or KoreaMed (https://www.koreamed.org/JournalBrowserNew.php).
- Master's thesis and doctoral dissertation should be cited less than three.

(1) Journal articles

① *Published journal articles*

Authors. Article title. Journal title Year of publication; Volume(Issue): Start page-Last page.

<Example> Mo YJ, Kim SB. Sodium related recognition, dietary attitude and education needs of dietitians working at customized home visiting health service. Korean J Community Nutr 2014; 19(6): 558-567.

When an article has more than six authors, the names of the first six authors should be given followed by 'et al.'

<Example> Yon MY, Lee HS, Kim DH, Lee JY, Nam JW, Moon GI et al. Breast-feeding and obesity in early childhood - based on the KNHANES 2008 through 2011-. Korean J Community Nutr 2013; 18(6): 644-651.

② *Forthcoming journal articles*

Authors. Article title. Journal title Year of publication. Forthcoming.

<Example> Kim YS, Lee HM, Kim JH. Sodium-related eating behaviors of parents and its relationship to eating behaviors of their preschool children. Korean J Community Nutr 2015. Forthcoming.

(2) Books

① *Entire books*

Authors. Title. Edition. Publisher; Year of publication. p. Start page-Last page.

<Example> Park YS, Lee JW, Seo JS, Lee BK, Lee HS, Lee SK. Nutrition education and counselling. 5th ed. Kyomunsa; 2014. p. 32-55.
<Example> Ministry of Health and Welfare (KR), The Korean Nutrition Society. Dietary reference intakes for Koreans 2020: Minerals. Ministry of Health and Welfare; 2020. p. 25-46.

② *Book chapter*

Chapter authors. Chapter title. In: Editor names, editors. Book title. Edition. Publisher; Year of publication. p. Start page-Last page.

<Example> Tamura T, Picciano MF, McGuire MK. Folate in pregnancy and lactation. In: Bailey LB, editor. Folate in Health and Disease. 2nd ed. CRC press; 2010. p. 111-131.

③ *Translated books*

Translators. Translated title(translated version). Edition. Original language originally written by authors. Publisher; Year of publication. p. Start page-Last page.

<Example> Mo SM, Kwon SJ, Lee KS. Do you know dining table of children? (translated version). 1st ed. Japanese original written by Adachi M. Kyomunsa; 2000. p. 20-22.

(3) Scientific reports

Authors. Report title. Performing organization; Year of publication Month of publication. Report No. Report number.

<Example> Lee YM. A study on development of food safety and nutrition education program for preschooler. Ministry of Food and Drug Safety; 2013 Nov. Report No. 13162consumer110.

(4) Thesis and dissertaion

Author. Title. [Book type]. Publisher; Year of publication. master's thesis for master degree, dissertation for doctoral degree

<Example> Ahn SY. The perception of sugar reduction in nutrition teachers or dieticians in charge of school meals and their use of added sugar in Seoul. [master's thesis]. Sookmyung Women's University; 2014.

(5) Conference papers

Authors of paper. Title of paper. Proceedings of Conference title; Year Month Day; Place of conference: p. Start page-Last page.

<Example> Shim JE. Infant and child feeding practices for development of healthy eating habits. Proceedings of 2014 Annual Conference of the Korean Society of Community Nutrition; 2014 Nov 14; Seoul: p. 195-213.

(6) Articles in magazine or newspaper

① *Magazine articles*

Author. Article title. Magaxine title. Year Month: Page.

<Example> Lee BM. Nutrition treatment of hereditary metabolic diseases. Nutrition and Dietetics. 2013 Dec: 12-19.

② *Newspaper articles*

Author or Organization. Article title. Newspaper title. Year Month Day; Section: Page.

<Example> Lee JH. Sodium reduction need to readjust policy. Food and Beverage News. 2014 Sep 29; Sect. A: 1.

(7) Materials on the internet

① *Web sites*

Author or Organization. Title [Internet]. Publisher; Year [cited Year Month Day]. Available from: electronic address

<Example> The Korean Society of Community Nutrition. Nutrient story [Internet]. The Korean Society of Community Nutrition; 2007 [cited 2015 May 12]. Available from: http://www.dietnet.or.kr/

② *Web page*

Author or Organization. Title [Internet]. Publisher; Year [updated Year Month Day; cited Year Month Day]. Available from: electronic address

<Example> Ministry of Food and Drug Safety. Winter food poisoning, be careful of norovirus [Internet]. Ministry of Food and Drug Safety; 2014 Nov 14 [updated 2014 Dec 11; cited 2015 Feb 1]; Available from: http://www.mfds.go.kr/fm/article/view.do?articleKey=1245&searchTitleFlag=1&boardKey=4&menuKey=167&currentPageNo=1

9) Tables and Figures: Tables and Figures must be written in English, and limited to a maximum of 10 altogether. Each table and figure should be prepared on a separate page and placed at the end of the text according to the order cited in the text. Citation of tables or figures in the text is as Table 1 or Fig. 1. Vertical lines are not used in tables. A title should be placed at the top of a table or at the bottom of a figure. The footnotes of the table are presented on Arabic numerals as superscripts 1), 2), 3). In case of indicating levels of significance, *P*-values should be presented in the body of each table, and if necessary, symbols can be used as *, **, ***, etc. To indicate the result of multi-range tests, letters such as a, b, c, etc. can be used.

9. PUBLICATION

Once the review process is completed, the manuscript cannot undergo any modifications in their contents or changes of the authors. PDF page proofs will be emailed

to the corresponding author and should be returned within 3 days. The author pays the publication fee for the published paper, including manuscript editing fees, reference proofreading fees, and file processing fees. Authors who choose to withdraw a manuscript after it has undergone peer-review will be charged the review fee.

Any issues not indicated in these instructions will be reviewed and decided by the Editorial Committee. Any additional questions or information on manuscript submission and publication can be clarified by contacting the editorial office.

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The code of research ethics of the Korean Society of Community Nutrition

KJCN
Korean Journal of Community Nutrition

Enactment Jan 21, 2008
1st revision April 19, 2010
2nd revision March 28, 2014
3rd revision February 28, 2020

I. GENERAL RULES

1. Title

This code is titled as 'The Code of Research Ethics of the Korean Society of Community Nutrition.'

2. Purpose

The purpose of the code is to establish the standard for the research ethics observed by the members of the Korean Society of Community Nutrition and the contributors to the Korean Journal of Community Nutrition, and determine the establishment and operation of the Committee on the Research Ethics (hereafter the 'Committee') for fair and systematic verification in the case of the scientific misconduct.

II. ETHICS CODE FOR A RESEARCHER

3. Integrity of Researcher

A researcher should conduct research and publish research results with research integrity.

4. Inclusion of Scientific Misconduct

(1) Fabrication refers to the act of creating, documenting, or reporting the data or the research results that do not exist.
(2) Falsification refers to the act of creating the documentation that do not match study results by manipulating the research materials, equipment, or procedures or changing or omitting data or research results.
(3) Plagiarism refers to steal others' ideas, procedures, results, or records without legitimate authorization.
(4) The improper authorship refers to the act which confers authorship on the person without any academic contribution due to gratitude or seniority, or does not reward with authorship without proper cause to the person who academically contributes or devotes the research contents or results.
(5) It includes the acts which seriously exceed generally accepted criteria.

5. Prohibition of Duplicate Submission or Duplicate Publication of Research Product

A researcher should not submit or publish the same research results in two different places.

6. Authorship

Contributors who have made substantive intellectual contributions to a paper are given credit as author and authorship is based on the following four criteria.
(1) Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND
(2) Drafting the work or reviewing it critically for important intellectual content; AND
(3) Final approval of the version to be published; AND
(4) Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

7. Record of Published Work

(1) An author should accept the credit for only the accomplishments of the research he/she conducted or contributed to and take responsibility for them.

(2) The order of the authors (including translators) of articles or other publications should be determined with fairness according to the extent of the contribution to research regardless of relative positions. Simply being in a particular position should not guarantee a credit as a co-author, the first author, or a corresponding author. Neither the act of not crediting the sufficient contribution to research with authorship can be justified. When the contribution to research is low, a statement of appreciation is expressed in a footnote, a preface, or an acknowledgement.

8. Citation and Reference

(1) An author who cites academic materials should make efforts to describe them accurately and state their sources clearly. The materials that are obtained from personal communication can be cited with the permission from the researcher who provides information.

(2) When an author cites or makes a reference to others' words, he/she should state the fact in a footnote, and distinguish them from his/her original thoughts or results of interpretation.

9. Role and Ethics for a Journal Editor

(1) An editor should request a reviewer with expertise in the field, objectivity, and impartial judgment for the evaluation of submitted manuscripts.

(2) An editor should not disclose the information about the author or the content of the manuscript until the submitted manuscript is decided to be published.

10. Role and Ethics for a Reviewer

(1) A reviewer should evaluate the manuscript under review with commitment and impartiality within a specified period and notify a journal editor of results.

(2) A reviewer should notify a journal editor immediately of the intention to resign from reviewing a manuscript when he/she believes oneself to be unsuitable for reviewing the manuscript.

(3) A reviewer should evaluate a manuscript with objective criteria and impartiality without consideration of one's academic beliefs or personal relationship with its author. A reviewer should not reject a manuscript without logical reasons or on the reason that it is in conflict with his/her own view or interpretation, and rate a manuscript without reading it thoroughly.

(4) A reviewer should respect an author's personality and individuality as an intellectual and use comments in a polite and gentle manner as much as possible, and should not use degrading or insulting expressions.

(5) A reviewer should maintain confidentiality of a manuscript under review and should not cite the content of a manuscript prior to its publication.

III. ESTABLISHEMENT AND OPERATION OF THE COMMITTEE

11. Function of the Committee

The Committee reviews and decides the issues below related to the research ethics of the members of the Korean Society of Community Nutrition.

1. The establishment of the research ethics
2. The prevention and investigation on the scientific misconduct
3. Whistleblower protection and confidentiality
4. Verification on the violation of the research ethics, process of the verification results and follow-up measures
5. Restoration in the honor of the examinee
6. Other issues imposed by the chair of the Committee

12. Organizing Principles of the Committee

The Committee consists of 5 members. The committee is chaired by the President of the Society and the Editor-in-chief serves as the associate chair of the committee. The other three are appointed by the President of the Society with the recommendation from the Executive Board.

13. Report and Receipt of the Scientific Misconduct

The whistle-blower may provide the information to the secretariat of the editorial board in the Korean Society of Community Nutrition directly or through the telephone, written document or e-mail on the real name. However, if the contents and evidence of the misconduct are specific, the report provided by an anonymous informant is considered as the case by the real-name person.

14. Authority for Verification and Recommendation of the Committee

The Committee is authorized to conduct an investigation about the allegation of the violation of the ethics code using a wide range of evidence from informants, the person under investigation, witnesses, and reference materials. The committee reviews and decides the status of violation of the ethics code based on the results of investigation, and recommends appropriate sanctions to the president based on the decision.

15. Verification Process of the Committee

The verification process for the act of violation of research ethics proceeds in the order of preliminary inquiry, investigation, and judgment. The investigation should be completed within 6 months. However, when the investigation is unlikely to be completed within the time frame, the investigation period may be extended with the committee chair's approval. When an informant or the person under investigation disagrees with the decision, he/she may file an appeal within 30 days from receiving notification, and the Committee may conduct reinvestigation if necessary.

16. Assurance of Opportunity to Be Heard

The member who is alleged to violate the Code of Research Ethics should be given a written notice of the overview of the issue under investigation. He/she is guaranteed to have an opportunity to submit a letter of explanation, and as long as he/she whishes, an opportunity to attend one or more of the Committee meetings in the investigation procedure and provide an oral explanation.

17. Confidentiality Duty for a Member of the Committee

A member of the Committee shall not disclose the identification of the reporter and the member suspected of the research ethics violation until the final decision is confirmed by the society.

18. Disciplinary Procedures and Content

In the event of proposed disciplinary measures by the Ethics Committee, the committee chair convenes the Executive Board and makes a final decision on the status and the content of discipline. The member who is determined to have violated the Code of Research Ethics may be given disciplines including warning, ban on manuscript submission for a specified period, and suspension or cancellation of membership depending on the severity of the issue, and the article may be retracted and the results may be disclosed if necessary.

19. Revision of the Code of Research Ethics

Revision procedure of the Code of Research Ethics follows the revision procedure of the code of the Society.

Author's checklist

KJCN
Korean Journal of Community Nutrition

Revised in October 15, 2024

Authors' quick submission checklist
(※ Please include the checklist when submitting the manuscript to the submission site.)

Category		Items to review	Check
Title page	1. Title	- Spelling and typographical errors in paper titles. - Titles should be written in sentence case, with only the first word of the text and proper-nouns capitalized. The study design should be included in the title or subtitle. e.g., Development and Effectiveness Evaluation of the STEAM Education Program on Food Groups for Kindergarteners -> Development and effectiveness evaluation of the STEAM education program on food groups for kindergarteners: a non-randomized controlled study e.g., Program Evaluation using the RE-AIM Framework: A Systematic Review and Application to a Pilot Health Promotion Program for Children -> Evaluation of the pilot health promotion program for children: a systematic review	
	2. Author Information	- Include all author titles and affiliations, and indicate the position before the affiliation	
	3. Submission	- The title page, the copyright transfer agreement, and IRB approval are all included when submitting your paper to the submission site by uploading them to the 'Attachment' section. - Remove the cover page including author information from the submitted paper before submitting	
	4. ORCID	- ORCID should be stated for all authors e.g., Gildong Hong: https://orcid.org/https://orcid.org/0000-0000-0000-0000	
	5. Funding	e.g., This research was supported by a grant from the National Research Foundation of Korea (Grant No. 000). - When there is no funding associated with the manuscript, 'None.' should be stated.	
Abstract	1. Structure	- Objectives-Methods-Results-Conclusion	
	2. Keywords	- Three to five keywords are recommended with one or two words except for technical terms. - The terminology should be listed, in principle, in MeSH (www.nlm.nih.gov/mesh/MBrowser.html). - Keywords are written in lowercase letters except for proper nouns, and keywords are separated by a semicolon (;).	
	3. Abbreviations	- Abbreviations should only be used if they are repeatedly used throughout the abstract. If an abbreviation is not used after it has been defined, use the full name instead - Define an abbreviation the first time it appears in the abstract	
Main body	1. Structure	- Title page, Abstract, Introduction, Methods (including ethics statement), Results, Discussion, Conflict of Interest, Acknowledgments, Data Availability References, Tables, and Figures - Include 'Study Design' in Method, subheadings in Results, and 'Limitations' and 'Conclusion' in Discussion - Upload tables and figures as a single file and do not separate them	
	2. Statistical software	- Enter the correct type and version of statistical software e.g., IBM SPSS Statistics 25 (IBM Corp.) e.g., SAS 9.4 (SAS Institute)	
	3. Ethics Statement	- Authors should present an "Ethics Statement" immediately after the heading "Methods". In case of reviews, research notes and educational materials, "Ethics statement" should be presented after introduction section e.g., The informed written consent was obtained from each participant. The study protocol was approved by the Institutional Review Board of *** (approval number: ***). *IRB approval statement will be included in the final version, but do not include specific IRB information (e.g., institution name) when submitting. e.g., Obtainment of informed consent was exempted by the institutional review board.	

(continued to the next page)

(Continued)

Category		Items to review	Check
	4. Conflict of Interest	- Conflict of interest must be stated. e.g., There are no financial or other issues that might lead to conflict of interest. e.g., Gildong Hong has been an editor since 2021. However, he was not involved in the review process of this manuscript. Otherwise, there was no conflict of interest. *Author information will be included in the final version but do not include it when submitting.	
	5. Acknowledgments	- List individuals who contributed to the writing or research, but do not meet the criteria for authorship. e.g., We thank the physicians who performed the sample collection. *This information will be included in the final version, but do not include it when submitting.	
	6. Data Availability	- Authors should provide a data availability statement. Providing access to research data is optional. e.g., The data that support the findings of this study are openly available in [repository name e.g "KNHANES"] at http://doi.org/[doi].	
	7. References	- Notation method: [1], [2, 5], [15-20], etc. without spaces before square brackets, when adding commas between references, add a space after commas. e.g., research on something [1] or Kim & Lee's research [2, 5] - References in the text should be listed in numerical order - The number of citations for the type of dissertation should not exceed 3. - Verify that the reference adheres to the KJCN guidelines	
	8. Other indications such as units	- Write numbers and units with a space (50 kg, 600 kcal), but attach % and °C. - g/dl (X), g/dL (O) - When indicating P-value, use capital, italic P: e.g., *P*-value - Use a en-dash "–" to indicate a range of numbers: e.g., 20–25 - Use comma notation to separate thousands (this also applies to text and tables): For example, 65,450,000.	
	9. Tables, figures	- Capitalize only the first letter of table and figure titles - Capitalize only the first letter of variables in the table - Use lowercase 'n' in tables and figures. - Additional checklists for tables and figures can be found in the section below.	

*Examples shown in the tables are based on recent publication, 2024.

GUIDELINE FOR TABLES AND FIGURES

Please adhere the following guidelines for tables and figures.

1. To indicate the total number of items outside of the table's body, include it in parentheses at the end of the table's title. For example, "Sociodemographic characteristics of children (n = 80)"
2. The table heading should provide a descriptive title for the values presented, rather than simply using "Mean ± SD" as the title.
3. When describing the contents of the table in the text:
   ① To present an average value, use Mean ± SD or Mean ± SE, and be mindful of spacing (e.g., 22.0 ± 2.3, with a space before and after the '±' symbol)
   ② Units should be written in parentheses within the table (e.g., Energy (kcal/day)) instead of next to it (Energy, kcal/day)
4. Footnotes or legends explanations for tables or figures should be written in English
5. The footnotes or legends should be arranged in the following order: Values displayed as statistical outcomes, statistical analysis method, indication of significance, etc.
   ① The presentation of values of statistical outcomes, such as n (%), Mean ± SD, n (%) or Mean ± SD, etc, are displayed in the first line of the footnote without comment numbers.
   ② Statistical analysis method and significance indication - Both statistical analysis methods and significance are discussed. - Post-hoc analysis results can only be presented when the ANOVA test yields significant results.
   ③ The full name of any abbreviations used in the title or table body should be provided in the footnote.
   ④ Any other content that requires explanation should be accompanied by corresponding comment numbers, following the submission guidelines. Verify that the comment numbers match the numbers indicated in the table body.

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Korean Journal of Community Nutrition

Manuscript Title: _____

Author(s): _____

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2. The authors have made substantive intellectual contributions to the manuscript and accept responsibility for the contents of the manuscript together.

3. The manuscript or any part of it has not been published elsewhere (abstracts excluded). The manuscript is not currently being considered for publication by any other journals and will not be submitted for such review while under review by the journal.

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All of the authors read the Copyright Transfer and Statement of Originality, and agree to the above.

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투고규정

KJCN
Korean Journal of Community Nutrition

(2024년 10월 15일 개정)

1. 학회지의 특성

본 학회지는 대한지역사회영양학회의 학술지로서, 전문가 심사를 거친 논문만을 게재하고, 논문 전문은 학회 홈페이지를 통해 공개된다. 학회지는 2개월마다(2월, 4월, 6월, 8월, 10월, 12월) 발행되며, 발행일은 발간월의 마지막 날이다. 생애주기영양, 영양판정, 영양교육, 영양역학, 식행동, 임상영양, 국제영양, 영양정책, 급식 및 외식 관리, 식문화와 기타 지역사회영양학 분야의 연구논문(research articles), 종설(reviews), 연구단보(research notes), 교육자료(educational materials) 등을 게재할 수 있다.

2. 투고 자격

저자 중 적어도 1명이 대한지역사회영양학회 회원이어야 투고할 수 있으며, 비회원의 경우 편집위원회에서 위촉 또는 국외 기관에 소속된 저자가 투고할 시 가능하다.

3. 원고의 종류

1) **연구논문:** 지역사회영양학 분야의 새로운 논문
2) **종설:** 특정 주제에 대하여 간결하고 정확하게 최신문헌 및 견해를 기술한 논문, 체계적인 문헌고찰은 PRISMA 가이드라인을 따라야 함
3) **연구단보:** 지역사회영양학과 관련된 새로운 아이디어, 연구방법, 정책적 이슈 등에 대한 토의 보고
4) **교육자료:** 영양교육 프로그램의 내용과 활용, 또는 새로운 교육 접근방법 등에 관한 논문

4. 연구 및 출판윤리

1) **이중게재:** 원고는 다른 학회지에 발표되거나 투고되지 않은 것이어야 한다.
2) **저자됨:** 원고의 저자는 연구설계, 자료 수집 및 분석, 원고 작성에 기여를 하고, 연구와 관련된 문제의 조사와 해결에 책임을 다할 것을 동의한 자이어야 한다.
3) **피험자 보호:** 연구의 대상이 사람인 경우 헬싱키 선언에 입각하여 피험자를 보호하여야 하며, 연구를 수행하기 전 기관생명윤리위원회(Institutional Review Board; IRB)의 승인을 받아야 한다.
4) **이해관계:** 연구를 지원하는 회사나 기관과 경제적 또는 개인적 관계가 있는 경우 이를 논문에 명백하게 기술해야 한다.
5) **윤리규정 준수:** 저자는 본 학회 연구윤리규정을 준수하여야 하며, 본 규정에 언급되지 않은 연구 및 출판윤리에 대해서는 국제표준출판윤리규정(http://publicationethics.org/international-standards-editors-and-authors)을 적용한다.
6) **저작권:** 본 학회지에 게재된 논문의 저작권은 본 학회에 귀속된다. 논문투고 시 모든 저자는 저작권이전동의서에 사인하여 제출해야 한다.
7) **프리프린트(preprint):** 본 학회지는 프리프린트로 사전 공유된 연구논문을 허용하지 않는다.

5. 성(SEX)/젠더(GENDER)에 대한 고려

논문에서 결과에 영향을 줄 수 있는 인자로 생물학적 성(sex) 또는 사회문화적 성인 젠더(gender)를 인식하고 이에 대한 아래 내용을 논문에 포함하여야 한다.

- 성별 기술에서 성(sex)과 젠더(gender)를 구분하여 올바르게 기술한다.
- 연구 대상에 남성과 여성을 대상으로 포함하여 연구하고 그 결과를 비교분석하여 논문을 발표한다.
- 단일 성을 대상으로 연구한 경우는 학술적으로 타당한 근거를 제시한다.

6. 논문투고

교신저자는 온라인투고시스템(https://submit-kjcn.or.kr)으로 저자정보가 삭제된 원고파일을 제출한다. 저자정보가 포함된 표지, 모든 저자의 서명이 작성된 IRB 승인서 사본, 저자체크리스트는 온라인 투고사이트 '첨부파일'에 업로드 한다.

7. 전문가 심사

편집위원장 또는 편집위원은 저자정보가 삭제된 투고논문을 두 명의 전문가에게 심사하도록 보내고, 심사자는 대한지역사회영양학회지의 심사규정에 따라 심사한다. 편집위원장은 심사자의 의견에 따라 첫 번째 결정을 내리고 6주 안에 교신저자에게 알린다.

두 명의 심사자의 의견이 다를 때에는 또 다른 심사자에게 심사하도록 한다.

8. 원고 작성법

1) 원고 작성: 원고는 MS 워드를 사용하여 한글 또는 영문으로 작성한다. 글자 크기는 11 point, 행간은 200% 또는 2줄 간격으로 하며, 영문 글꼴은 Times New Roman으로 한다. 영문초록을 1쪽으로 하여 쪽번호를 표기하며, 원고 왼쪽 여백에 줄 번호를 매긴다.

2) 표지: 다음의 내용을 포함한다.

- 원고의 종류(연구논문, 종설, 연구단보, 교육자료)
- 압축한 제목(Running head)은 공백 포함 50자 이내의 영문으로 기재
- 제목을 국문논문은 국문과 영문 모두 기재, 영문논문은 영문만 기재
- 영문 제목은 기본적으로 소문자로 작성(단, 문장의 첫 단어와 고유 명사는 대문자로 작성). 관찰 연구(단면조사연구, 환자-대조군 연구 또는 전향적 코호트 연구), 임상 연구, 체계적 문헌고찰 또는 메타 분석의 경우 제목 또는 부제목에 연구디자인 제시
- 저자, 소속 및 직위를 국문과 영문으로 기재, 단 영문논문의 경우 영문으로만 기재

  교신저자 이름 뒤에는 "†" 표시를 윗첨자로 하여 붙이고, 소속기관이 다를 경우는 저자이름 끝에 1), 2), 3)을 윗첨자로 하여 순서에 따라 붙이고, 해당인의 소속기관명 앞에 같은 숫자를 붙인다. 소속이 같으나, 직위가 다를 경우에도 1), 2), 3)을 윗첨자로 하여 순서에 따라 붙인다. 연구자의 직위(교수, 강사, 학생, 연구원 등)는 영문의 경우 소속 앞에 기재한다. 소속과 직위가 없는 경우에는 이름만 기재한다. 현재 소속이 없는 미성년자의 경우 최종 소속, 직위, 재학년도를 별도로 제출한다.

〈예〉

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- 교신저자의 성명, 주소 및 전화번호, 팩스번호, 전자우편주소를 영문으로 기재. 전화와 팩스번호는 국가코드도 표기

〈예〉

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- ORCID (https//orcid.org/)

  모든 저자는 ORCID 등록시 소속과 직위를 등록해야하며, 이는 추후 저자신분 확인이 필요할 경우 자료로 활용할 수 있다. 모든 저자의 ORCID 번호를 블라인드 없이 표기하며, 그 예는 다음과 같다.

〈예〉

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- 연구지원내역(Funding)

  해당하는 내용이 없더라도 'None.' 으로 기재한다.

〈예〉

This research was supported by a grant from the National Research Foundation of Korea (Grant No. ***).

3) 원고의 구성: 원고의 부제목은 모두 영문으로 작성하고, 구성은 다음과 같다. Title page, Abstract, Introduction, Methods, Results, Discussion, Conflict of Interest, Acknowledgments, Data Availability, References, Tables, Figures 순으로 한다. 단, 교육자료의 경우 결과와 고찰의 내용을 콘텐츠(Contents), 평가(Evaluation), 시사점(Implications) 등의 내용으로 구성할 수 있다. 종설의 경우 연구논문의 구성과 달리 서론, 본론, 결론의 구성으로 기술할 수 있다. 그러나 주제범위 고찰(scoping review)이나 체계적 고찰(systematic review)은 연구논문의 구성을 따라야 한다.

  본 학회지는 EQUATOR 네트워크(http://www.equator-network.org/home/)와 미국국립보건원/국립의학도서관(http://www.nlm.nih.gov/services/research_report_guide.html)에서 안내하는 보고지침에 따라 원고를 구성하도록 권장한다.

- 연구윤리(Ethics Statement)

저자는 "방법(Method)" 연구윤리에 관해 영문으로 기술해야 한다. 부제목 바로 아래에 제시하며 종설, 연구노트, 교육자료 등의 경우에는 서론 뒤(본론 전)에 제시한다.

〈예〉
The informed written consent was obtained from each participant. The study protocol was approved by the Institutional Review Board of *** (approval number: IRB승인번호).
〈예〉
Obtainment of informed consent was exempted by the institutional review board.

• 연구설계(Study design)
저자는 "방법(Methods)" 연구설계에 연구설계(기술분석, 무작위 대조연구, 코호트 연구 또는 메타 분석 등) 및 참고한 보고지침을 제시한다.

〈예〉 This was a cross-sectional study. It was described according to the STROBE statement (https://www.strobe-statement.org/).

• 고찰(Discussion)
저자는 결과를 해석하고 "고찰(Discussion)"의 후반부에 Limitations 및 Conclusion을 제시한다.

• 이해상충(Conflict of Interest)

〈예〉
There are no financial or other issues that might lead to conflict of interest.
〈예〉
Kildong Hong has been an editor since 2021. However, he was not involved in the review process of this manuscript. Otherwise, there was no conflict of interest.

• 감사의 글(Acknowledgments)
논문작성이나 연구를 도왔지만 저자로서 적절하지 않은 분 등을 기술한다.

〈예〉
We thank the physicians who performed the sample collection.

• 데이터가용성(Data Availability)
저자는 데이터가용성에 대한 설명을 작성해야하며, 데이터에 대해 접근을 허용하는 것은 선택사항이다.
〈예〉
The data that support the findings of this study are openly available in [repository name e.g "KNHANES"] at http://doi.org/[doi].

4) **영문초록:** 영문초록은 목적(Objectives), 연구방법(Methods), 결과(Results), 결론(Conclusion)의 소제목으로 구분하여 250~300단어로 작성한다. 초록 아래쪽에 주제어(Keywords)를 영문으로 표기한다.
5) **키워드:** 전문 용어를 제외한 1~2개의 단어로 구성된 3~5개의 키워드를 기재한다. 해당 키워드는 MeSH(https://meshb.nlm.nih.gov/search) 에 검색되는 단어로 작성한다. 키워드는 고유명사를 제외하고 모두 소문자로 표기하며, 구분 기호는 세미콜론(;)으로 작성한다.
6) **약어:** 제일 처음 나오는 곳에 완전한 이름을 먼저 표기한 후 괄호 안에 약어를 표기하며, 표 또는 그림에 사용된 약어는 각주 또는 그림 설명에서 설명한다.
7) **수량 및 단위:** 수량은 아라비아 숫자로, 도량단위는 SI 단위를 권장한다. %, ℃를 제외한 모든 단위는 숫자와 띄어쓴다.
8) **참고문헌**
• 본문 중에는 인용된 순서대로 [ ] 안에 번호로 기재한다.
• 본문의 한 문장에서 여러 개의 참고문헌을 인용할 때에는 다음과 같이 기재한다.

〈예〉 Kim [3]은, Park & Lee [5]는, Brown 등[7]은

• 본문 중에 참고문헌의 저자를 기재하는 경우 영문 last name을 표기한다. 저자가 2명일 경우에는 두 저자 사이에 &를 삽입하고, 3인 이상일 때는 제1저자만 표기하고 "등"을 쓴다.

〈예〉 Kim [3]은, Park & Lee [5]는, Brown 등[7]은

• 참고문헌 목록은 인용된 순서에 따라 아라비아 숫자와 함께 영문으로 표기한다.
• The National Library of Medicine (NLM) 표준체제(http://www.nlm.nih.gov/citingmedicine)를 따라 작성한다.
• 학회지명은 약어로 표기하되 국제 약어 관례(PubMed 등재지 검색 사이트 http://www.ncbi.nlm.nih.gov/journals) 또는 KoreaMed 등재지 검색 사이트(http://www.koreamed.org/JournalBrowserNew.php)를 참고한다.
• 학위논문은 필요한 경우 3개 이내로 인용한다.

(1) 학술지

① 출판된 학술지 논문

저자명. 논문명. 학술지약어 연도; 권(호): 시작페이지-마지막 페이지. 순으로 기재

〈예〉

Mo YJ, Kim SB. Sodium related recognition, dietary attitude and education needs of dietitians working at customized home visiting health service. Korean J Community Nutr 2014; 19(6): 558-567.

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Yon MY, Lee HS, Kim DH, Lee JY, Nam JW, Moon GI et al. Breastfeeding and obesity in early childhood - based on the KNHANES 2008 through 2011-. Korean J Community Nutr 2013; 18(6): 644-651.

② 출판 예정 학술지 논문

저자명. 논문명. 학술지약어 연도. Forthcoming. 순으로 기재

〈예〉

Kim YS, Lee HM, Kim JH. Sodium-related eating behaviors of parents and its relationship to eating behaviors of their preschool children. Korean J Community Nutr 2015. Forthcoming.

(2) 저서

① 단행본

저자명. 서명. 판차사항. 출판사; 연도. p. 시작페이지-마지막페이지 순으로 기재

〈예〉

Park YS, Lee JW, Seo JS, Lee BK, Lee HS, Lee SK. Nutrition education and counselling. 5th ed. Kyomunsa; 2014. p. 32-55.

〈예〉

Ministry of Health and Welfare (KR), The Korean Nutrition Society. Dietary reference intakes for Koreans 2020: Minerals. Ministry of Health and Welfare; 2020. p. 25-46.

② 단행본 내의 한 장(book chapter)

장(chaper) 저자. 장(chapter) 제목. In: 편집자, editors. 서명. 판차사항. 출판사; 연도. p. 시작 페이지-마지막페이지. 순으로 기재

〈예〉

Tamura T, Picciano MF, McGuire MK. Folate in pregnancy and lactation. In: Bailey LB, editor. Folate in Health and Disease. 2nd ed. CRC press; 2010. p. 111-131.

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9) 표 또는 그림

표와 그림은 영문으로 작성하며, 합하여 10개 이내로 하고, 한 장에 하나씩 작성하여 인용된 순서대로 본문 뒤에 첨부한다. 본문에 인용할 때는 Table 1 또는 Fig. 1 등으로 표기한다. 표 작성 시에는 종선은 사용하지 않는 것을 원칙으로 하며, 표의 제목은 표의 상단에, 그림의 제목은 그림의 하단에 기재한다. 각주는 $^{1), 2), 3)}$ 등으로 나타내고 하단에 그 내용을 표시한다. 단, 통계분석의 유의성 표시는 표 본문에 *P*-values를 제시하는 것으로 하고, 필요한 경우 $^{*, **, ***}$ 등으로, 다중 범위 검정에서는 $^{a, b, c}$ 등으로 사용한다.

9. 출판

심사가 끝난 논문은 내용이나 저자를 바꿀 수 없다. 교신저자는 교정본 PDF 파일을 e-mail로 받으면 3일 이내에 교정하여 보내야 한다. 원하는 저자에 한하여 게재된 논문의 별쇄본 20부를 제공한다. 저자는 게재된 논문의 게재료로 원고 편집비, 참고문헌 교정비, 파일 가공비 등 소요되는 비용을 부담한다. 단, 심사과정이 시작된 이후 논문을 철회한 경우에는 논문의 심사 단계에서 발생한 심사료 비용을 부담한다. 본 규정에 명시되지 아니한 사항은 편집위원회의 심의를 거쳐 결정한다.

논문투고와 출판 관련 모든 문의사항은 편집사무실로 연락한다.

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KJCN
Korean Journal of Community Nutrition

제정 2008. 1. 21
1차 개정 2010. 4. 19
2차 개정 2014. 3. 28
3차 개정 2020. 2. 28

제1장 총칙

제1조 (명칭)
이 규정은 "대한지역사회영양학회 연구윤리규정"이라 한다.

제2조 (목적)
이 규정은 대한지역사회영양학회 회원 및 대한지역사회영양학회지 투고자가 지켜야 할 연구윤리의 기준을 확립하고, 연구부정행위 발생 시 공정하고 체계적인 검증을 위한 연구윤리위원회(이하 "위원회"라 한다)의 설치 및 운영에 관한 사항을 규정함을 목적으로 한다.

제2장 연구자의 윤리규정

제3조 (연구의 진실성)
연구자는 연구의 진실성을 준수하여 연구를 수행하고 그 결과를 발표하여야 한다.

제4조 (연구부정행위의 범위)
연구부정행위는 다음 각 호와 같다.
1. 위조란 존재하지 않는 데이터나 연구 결과를 만들어 내고 이를 기록하거나 보고하는 행위를 의미한다.
2. 변조란 연구자료, 장비 또는 과정을 조작하거나, 데이터나 연구 결과를 변경하거나 생략하여 연구 기록이 연구결과와 부합하지 않게 하는 행위를 의미한다.
3. 표절이란 정당한 권한 없이 타인의 아이디어, 과정, 결과 또는 기록을 도용하는 것을 의미한다.
4. 부당한 논문저자 표시란 연구내용 또는 결과에 대하여 학문적으로 공헌 또는 기여를 한 사람에게 정당한 이유없이 논문저자 자격을 부여하지 않거나, 학문적으로 공헌 또는 기여를 하지 않은 자에게 감사의 표시 또는 예우 등을 이유로 논문저자 자격을 부여하는 행위를 말한다.
5. 기타 통상적으로 용인되는 범위를 심각하게 벗어난 행위를 포함한다.

제5조 (연구물의 중복 투고 및 이중 게재금지)
연구자는 연구결과를 중복 투고 및 이중 게재 하지 않아야 한다.

제6조 (저자됨)
저자는 출판하는 논문의 연구에 지적인 공헌을 한 자로서 다음 각 호의 자격을 모두 충족하여야 한다.
1. 연구의 구상이나 설계 또는 자료의 수집이나 분석이나 해석을 하는 데 있어서 상당한 공헌을 한 자
2. 논문의 초안을 작성하거나 주요 내용을 검토한 자
3. 출간될 원고를 최종 승인한 자
4. 연구의 정확성이나 무결성과 관련된 문제를 적절히 조사하고 해결하는 것에 책임이 있음을 동의한 자

제7조 (출판 업적의 명기)

① 저자는 자신이 행하거나 기여한 연구에 대해서만 업적을 인정받으며 그에 대한 책임을 진다.

② 논문이나 기타 출판의 저자(역자 포함)의 순서는 상대적 지위에 관계없이 연구에 기여한 정도에 따라 공정하게 정해져야 한다. 단순히 특정 직책으로 인하여 공동저자, 제1저자, 또는 교신저자가 될 수 없다. 연구에 충분히 기여했음에도 저자로 인정되지 않는 행위 또한 정당화될 수 없다. 연구에 대한 기여도가 낮을 경우 각주, 서문, 사의 등에서 사사의 글로 표시한다.

제8조 (인용 및 참고 표시)

① 저자가 학술 자료를 인용할 경우에는 정확하게 기술하도록 노력해야 하고 출처를 명확히 밝혀야 한다. 개인적인 접촉으로 얻은 자료의 경우에는 정보를 제공한 연구자의 동의를 받은 후 인용할 수 있다.

② 저자가 타인의 글을 인용하거나 참고할 경우에는 각주를 통해 인용 및 참고 여부를 밝혀야 하며, 선행연구의 결과인 부분과 저자의 독창적인 견해 또는 해석의 결과인 부분이 구분될 수 있도록 하여야 한다.

제9조 (논문 편집위원회의 역할및 윤리)

① 편집위원은 투고된 논문을 해당 분야의 전문적 지식과 객관적이고 공정한 판단 능력을 지닌 심사위원에게 평가 하도록 의뢰하여야 한다.

② 편집위원은 투고된 논문의 게재가 결정될 때까지는 저자에 대한 사항이나 논문의 내용을 공개하지 않아야 한다.

제10조 (논문 심사위원의 역할및 윤리)

① 심사위원은 심사 대상 논문을 심사규정이 정한 기간 내에 성실하고 공정하게 평가하고 결과를 편집위원에게 통보하여야 한다.

② 심사위원은 자신이 논문의 내용을 평가하기에 적임자가 아니라고 판단될 경우에는 편집위원에게 즉시 사퇴의사를 통보하여야 한다.

③ 심사위원은 심사 대상 논문을 개인적인 학술적 신념이나 저자와의 사적인 친분 관계를 떠나 객관적 기준에 의해 공정하게 심사하여야 한다. 충분한 근거를 명시하지 않은 채 논문을 탈락시키거나, 심사자 본인의 관점이나 해석과 상충된다는 이유로 논문을 탈락시켜서는 안 되며, 심사 대상 논문을 제대로 읽지 않은 채 평가하지 않아야 한다.

④ 심사위원은 전문 지식인으로서의 저자의 인격과 독립성을 존중하여야 하고, 평가의견은 가급적 정중하고 부드러운 표현을 사용하며 저자를 비하하거나 모욕적인 표현을 해서는 안 된다.

⑤ 심사위원은 심사 대상 논문에 대한 비밀을 지켜야 하며, 논문이 게재된 학술지가 출판되기 전에 논문의 내용을 인용해서는 안 된다.

제3장 연구윤리위원회의 설치와 운영

제11조 (위원회의 기능)

위원회는 대한지역사회영양학회 회원의 연구윤리와 관련된 다음 각 호의 사항을 심의, 의결한다.

1. 연구윤리 확립에 관한 사항
2. 연구부정행위의 예방, 조사에 관한 사항
3. 제보자 보호와 비밀유지에 관한 사항
4. 연구윤리 위반 검증 및 검증결과 처리와 후속조차에 관한 사항
5. 피조사자 명예회복 조치에 관한 사항
6. 기타 위원회 위원장이 부여하는 사항

제12조 (위원회의 구성)

위원회는 위원 5인 이상으로 구성하며, 위원장은 학회장으로 하고 부위원장은 편집위원장으로 하며 그 외 3인은 상임 이사회의 추천을 받아 학회장이 임명한다.

제13조 (연구부정행위의 제보 및 접수)

제보자는 대한지역사회영양학회 편집위원회 사무국에 직접 또는 전화, 서면, 전자우편 등으로 제보할 수 있으며 실명으로 제보해야 한다. 단, 익명제보라 하더라도 구체적인 연구부정행위의 내용과 증거를 포함하여 제보한 경우 이를 실명제보에 준한다.

제14조 (위원회의 검증 및 심의 권한)
위원회는 윤리규정 위반으로 보고된 사안에 대하여 제보자, 피조사자, 증인, 참고인 및 증거자료 등을 통하여 폭넓게 조사를 실시할 수 있고, 그러한 조사 결과에 따라 윤리규정 위반여부를 심의·판정한다.

제15조 (위원회의 검증 절차)
연구윤리 위반행위에 대한 검증절차는 예비조사, 본조사, 판정의 단계로 진행하며 모든 조사 일정은 6개월 이내에 종료되어야 한다. 단, 이 기간 내에 조사가 이루어지기 어렵다고 판단될 경우에는 위원장의 승인을 거쳐 조사 기간을 연장할 수 있다. 제보자 또는 피조사자가 판정에 불복할 경우에는 통보를 받은 날로부터 30일 이내에 이의신청을 할 수 있으며, 윤리위원회에서 이를 검토하여 필요한 경우 재조사를 실시할 수 있다.

제16조 (소명기회의 보장)
연구윤리규정 위반으로 보고된 회원에게는 조사대상이 된 사안의 개요를 서면 통지하고 정해진 기간 내에 소명서를 제출할 기회를 보장하고 본인이 희망하는 경우 본 조사 절차 중 1회 이상 윤리위원회의 회의에 출석하여 구술로 해명할 수 있는 기회를 주는 등 충분한 소명 기회를 주어야 한다.

제17조 (연구윤리위원의 비밀 보호 의무)
연구윤리위원은 제보자의 신원을 노출시켜서는 안 되며, 학회의 최종 결정이 내려질 때까지 연구윤리규정 위반으로 보고된 회원의 신분을 공개해서도 안 된다.

제18조 (징계의 절차 및 내용)
위원회의 징계 건의가 있을 경우, 위원장은 상임이사회를 소집하여 징계 여부 및 징계 내용을 최종적으로 결정한다. 연구윤리규정을 위반했다고 판정된 회원에 대해서는 사안의 경중을 고려하여 경고, 일정기간의 논문투고금지, 회원자격의 정지 또는 박탈 등의 징계를 할 수 있으며, 필요한 경우 논문 게재 취소와 그 결과를 공개할 수 있다.

제19조 (연구윤리규정의 개정)
연구윤리규정의 개정 절차는 본 학회의 규정 개정절차에 준한다.

자가점검표

KJCN
Korean Journal of Community Nutrition

(2024년 10월 15일 개정)

[논문 투고 전 저자 확인사항]
(※ Check 후 투고사이트에 함께 제출합니다.)

구분		확인사항	Check
논문표지	1. 제목	- 논문제목 철자 및 오타 - 영문 제목은 기본적으로 소문자로 작성(단, 문장의 첫 단어와 고유 명사는 대문자로 작성) 관찰 연구(단면조사연구, 환자-대조군 연구 또는 전향적 코호트 연구), 임상 연구, 체계적 문헌고찰 또는 메타 분석의 경우; 제목 또는 부제목에 연구디자인 제시 예) Development and Effectiveness Evaluation of the STEAM Education Program on Food Groups for Kindergarteners -〉 Development and effectiveness evaluation of the STEAM education program on food groups for kindergarteners: a non-randomized controlled study 예) Program Evaluation using the RE-AIM Framework: A Systematic Review and Application to a Pilot Health Promotion Program for Children -〉 Evaluation of the pilot health promotion program for children: a systematic review	
	2. 저자정보	- 저자, 소속 및 직위를 국문과 영문으로 기재, 단 영문논문의 경우 영문으로만 기재, 영문 기재시 소속 앞으로 직위 표기 - 저자 중 1인 이상은 학회 회원일 것. 단, 비회원의 경우 편집위원회에서 위촉 또는 국외 기관에 소속된 저자가 투고할 시 가능	
	3. 제출	- 논문표지는 본 체크리스트 및 저작권이전동의서, IRB승인서와 함께 투고사이트 '첨부파일'에 업로드 (투고사이트에 논문 제출시 동시 제출, 투고논문에는 표지부분 삭제)	
	4. ORCID	- 모든 저자의 ORCID 기술 예) Gildong Hong: https://orcid.org/0000-0000-0000-0000	
	5. Funding (연구지원내역)	예) This research was supported by a grant from the National Research Foundation of Korea (Grant No. 000). - 해당하는 내용이 없더라도 'None.' 으로 기재	
영문초록	1. 작성순서	- Objectives-Methods-Results-Conclusion 의 순서	
	2. 키워드	- 전문 용어를 제외한 1~2개의 단어로 구성된 3~5개의 키워드 기재 - 키워드는 MeSH (https://meshb.nlm.nih.gov/search)에 검색되는 단어로 작성 - 키워드는 고유명사를 제외하고 모두 소문자로 표기하며, 구분 기호는 세미콜론(;)으로 작성	
	3. 약어사용	- 약어를 정의하고, 그 약어가 논문에서 더 이상 사용되지 않는다면 약어 사용할 필요 없음. 전체 명칭 (full name)으로 작성 - 약어를 두 번 이상 본문에서 사용할 경우, 맨 처음 약어가 등장할 때 전체 명칭에 대해 약어 정의	
논문본문	1. 작성순서	- 원고의 부제목은 모두 영문으로 작성 Title page, Abstract, Introduction, Methods, Results, Discussion, Conflict of Interest, Acknowledgments, Data Availability, References, Tables, Figures 순서로 작성 - Method의 Study design, Results의 소제목, Discussion의 Limitations, Conclusion 반드시 작성 - 투고 시 표, 그림을 포함하여 하나의 파일로 업로드	
	2. 통계 패키지 정보 기입	- 종류 및 버전 정확히 기입 예) IBM SPSS Statistics 25 (IBM Corp.) 예) SAS 9.4 (SAS Institute)	
	3. Ethics Statement (연구윤리)	- 저자는 "방법(Method)" 부제목 바로 아래에 연구윤리에 관해 영문으로 기술. 종설, 연구노트, 교육자료 등의 경우에는 서론 뒤(본론 전)에 영문으로 제시. 예) The informed written consent was obtained from each participant. The study protocol was approved by the Institutional Review Board of *** (approval number: ***). *IRB 기관표시는 최종본에 기재(투고시 내용 삭제후 업로드) 예) Obtainment of informed consent was exempted by the institutional review board.	
	4. Conflict of Interest (이해상충)	예) There are no financial or other issues that might lead to conflict of interest. 예) Gildong Hong has been an editor since 2021. However, he was not involved in the review process of this manuscript. Otherwise, there was no conflict of interest. *저자정보는 최종본에 기재(투고시 내용 삭제후 업로드)	

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구분		확인사항	Check
	5. Acknowledgments (감사의 글)	– 논문작성이나 연구를 도왔지만 저자로서 적절하지 않은 분 등을 기술. 예) We thank the physicians who performed the sample collection. *관련내용은 최종본에 기재(투고시 내용 삭제후 업로드)	
	6. Data Availability (데이터가용성)	– 저자는 데이터가용성에 대한 설명을 작성해야하며, 데이터에 대해 접근을 허용하는 것은 선택사항 예) The data that support the findings of this study are openly available in [repository name e.g "KNHANES"] at http://doi.org/[doi].	
	7. 참고문헌	– 표기방법: 대괄호[ ] 앞 띄어쓰기 없이 [1], [2, 5], [15–20] 등 표기, 문헌 사이 쉼표 추가시, 쉼표 뒤 띄어쓰기 예) ~에 관한 연구[1] 또는 Kim & Lee의 연구[2, 5] – 본문 내 참고문헌의 인용이 번호순으로 되어 있는지 확인 – 학위 논문 인용은 3개 이내로 제한 – 참고문헌 표기 규정에 맞는지 확인	
	8. 단위 등 기타 표시	– 숫자와 단위 띄어쓰기(50 kg, 600 kcal), 단, %, ℃ 붙임 – g/dl(X), g/dL(O) – P값 표기 시 : P 대문자, 기울임체 : 예) *P*–value – 숫자 등의 범위 표기 시 '–'를 사용: 예) 20–25 – 천 단위 쉼표 표기(본문, 표에도 적용): 예) 65,450,000	
	9. 표, 그림	– 표와 그림 제목: 첫 글자만 대문자 – 표에서 변수들 영문 표기시 : 첫 글자만 대문자 – 표와 그림에서 n을 소문자로 표기 – 투고규정에 따르며 그 외 형식은 별첨한 가이드라인에 따름	

*예시는 2024년도 최근 게재논문을 참고.

[논문 투고 전 저자 확인사항_표와 그림]

표와 그림 작성 시 다음의 사항을 유의하여 주시기 바랍니다.

1. 자료의 전체 수를 표 본문의 내용 밖으로 표시하고자 할 때는 표 제목 끝의 괄호 안에 제시
   예) Sociodemographic characteristics of children (n = 80)

2. 표 본문의 제목줄(table head)은 가능하면 제시된 값을 설명하는 것으로 하고, 단순히 Mean ± SD 등 만을 제목으로 하는 것을 지양함

3. 표 본문의 내용 작성 시
- 평균값을 제시하는 경우 Mean ± SD, Mean ± SE 으로 사용, 띄어쓰기 확인
  예) 22.0 ± 2.3 : ' ± ' 앞뒤로 띄어쓰기
- 표에서 단위는 괄호 안에 넣어서 표기
  예) Energy (kcal/day) (O)
  Energy, kcal/day (X)

4. 표와 그림을 설명하는 주석은 모두 영문으로 표기

5. 주석의 기술 순서는 가능하면 자료의 형태, 통계분석 방법 및 유의성 표시, 기타의 순서로 작성함
   1) 자료의 형태 제시
      예) n (%), Mean ± SD, n (%) or Mean ± SD 등 주석 번호 없이 첫줄에 제시
   2) 통계분석 방법 및 유의성 표시
      ① 통계적 유의성 뿐 아니라 통계분석 방법도 함께 제시함
      ② 사후검정 결과는 분산분석 등의 유의확률 제시가 선행되어야 함
   3) 약어를 사용한 경우 전체 명칭(full name)을 주석으로 제시함
   4) 기타 설명이 필요한 내용은 이후 투고규정에 따라 순서대로 번호를 달고 각주로 제시하며 표 본문에 표기한 번호와의 일치여부 확인