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Changes in knowledge and attitudes toward balanced nutrition following peer education among female vocational college students: A one-group pretest-posttest study

Perubahan pengetahuan dan sikap terhadap gizi seimbang setelah edukasi sebaya pada mahasiswi perguruan tinggi vokasi: Studi one-group pretest-posttest

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Abstract

Background: Stunting remains a major public health concern in Indonesia. Adolescence is a critical period for nutrition interventions; however, inadequate knowledge and unfavorable attitudes toward balanced nutrition remain common among young people. Peer education has been proposed as a strategy to improve nutrition-related literacy through socially relevant learning approaches.
Objective: To assess changes in balanced nutrition knowledge and attitudes among female vocational college students following participation in a peer education intervention.
Methods: This quasi-experimental study employed an uncontrolled one-group pretest-posttest design. Conducted at Politeknik Negeri Madura, Indonesia, from October to November 2025, the study included 100 female students aged 18-21 years who completed both assessments. The GENZING (Gen Z Prevents Stunting) intervention consisted of four 60-minute peer-led educational sessions delivered by 10 trained peer educators who completed 12 hours of training. The posttest was administered one week after the final session. Knowledge and attitudes were measured using validated questionnaires and analyzed using the Wilcoxon signed-rank test.
Results: Complete paired data were available for all participants. Knowledge scores increased from a median of 30.0 (IQR: 28.0-32.0) to 41.0 (IQR: 40.0-43.0) ($Z = -8.52$, $p < 0.001$; $r = 0.60$, 95% CI: 0.48-0.72). Attitude scores increased from a median of 33.0 (IQR: 31.0-35.0) to 40.0 (IQR: 38.0-41.0) ($Z = -7.94$, $p < 0.001$; $r = 0.56$, 95% CI: 0.43-0.69).
Conclusion: Participation in the GENZING peer education program was associated with short-term increases in balanced nutrition knowledge and attitude scores among female vocational college students. Controlled multisite studies with longer follow-up periods and behavior-related outcomes are needed to strengthen the evidence base.

Keywords:
Peer education, nutrition education, knowledge, attitudes, female university students

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Abstrak

Latar belakang: *Stunting* masih menjadi permasalahan kesehatan masyarakat yang utama di Indonesia. Masa remaja merupakan periode penting untuk intervensi gizi, namun pengetahuan dan sikap terkait gizi seimbang masih belum optimal pada sebagian remaja dan dewasa muda. *Peer education* telah dikembangkan sebagai pendekatan untuk meningkatkan literasi gizi melalui proses pembelajaran yang partisipatif dan relevan secara sosial.
Tujuan: Menilai perubahan pengetahuan dan sikap mengenai gizi seimbang pada mahasiswi perguruan tinggi vokasi setelah mengikuti intervensi *peer education*.
Metode: Penelitian ini menggunakan desain kuasi-eksperimental dengan pendekatan *uncontrolled one-group pretest-posttest*. Penelitian dilaksanakan di Politeknik Negeri Madura, Indonesia, pada Oktober-November 2025 dengan melibatkan 100 mahasiswi berusia 18-21 tahun yang menyelesaikan pengukuran pretest dan posttest. Intervensi GENZING (*Gen Z Prevents Stunting*) terdiri atas empat sesi edukasi sebaya tatap muka berdurasi 60 menit yang disampaikan oleh 10 *peer educator* yang telah mengikuti pelatihan selama 12 jam. Posttest dilakukan satu minggu setelah sesi terakhir. Pengetahuan dan sikap diukur menggunakan kuesioner yang telah valid dan reliabel serta dianalisis menggunakan uji Wilcoxon *signed-rank*.
Hasil: Seluruh peserta memiliki data berpasangan yang lengkap. Skor pengetahuan meningkat dari median 30,0 (IQR: 28,0-32,0) menjadi 41,0 (IQR: 40,0-43,0) ($Z = -8,52$; $p < 0,001$; $r = 0,60$; IK95%: 0,48-0,72). Skor sikap meningkat dari median 33,0 (IQR: 31,0-35,0) menjadi 40,0 (IQR: 38,0-41,0) ($Z = -7,94$; $p < 0,001$; $r = 0,56$; 95% CI: 0,43-0,69).
Kesimpulan: Partisipasi dalam program *peer education* GENZING berhubungan dengan peningkatan jangka pendek skor pengetahuan dan sikap mengenai gizi seimbang pada mahasiswi perguruan tinggi vokasi. Penelitian terkontrol multisenter dengan periode tindak lanjut yang lebih panjang dan outcome perilaku diperlukan untuk memperkuat bukti yang tersedia.

Kata Kunci:
Peer education, pengetahuan, sikap, gizi seimbang, *stunting*, mahasiswa.

Introduction

Stunting among children under five years of age remains a significant public health concern in Indonesia. The 2024 Indonesian Nutrition Status Survey reported a national stunting prevalence of 19.8%, which, although lower than the 21.5% reported in 2023, remains substantially higher than the national target of 14.2% by 2029 (Ministry of Health of the Republic of Indonesia, 2025). Globally, stunting reflects chronic undernutrition resulting from a complex interplay of socioeconomic, educational, environmental, and healthcare-related factors (UNICEF, 2025). Stunting has been linked to poorer physical growth, cognitive development, and long-term human capital outcomes, underscoring the need for sustained and comprehensive prevention strategies**.**

Although stunting manifests during early childhood, its determinants operate across the life course, including during adolescence. Adolescence has been recognized as a *second window of opportunity* for nutritional interventions because it is characterized by rapid physical growth, increased nutritional requirements, and the development of long-term health behaviors (WHO, 2023). However, low levels of knowledge among adolescents regarding stunting and nutrition remain a major challenge in prevention efforts (Andiani et al., 2023). This condition highlights the importance of targeted educational interventions for adolescents, especially university students.

Previous research has consistently reported the positive effects of nutrition education interventions among adolescent populations; however, the evidence varies considerably in terms of study populations, intervention formats, and measured outcomes. For example, Oddo et al. (2022) evaluated school-based nutrition interventions among secondary school students in Indonesia and found improvements in nutrition knowledge and selected dietary behaviors compared with baseline assessment. Other studies have primarily examined the association between nutritional knowledge, dietary practices, and nutritional status among adolescents, suggesting that greater knowledge may be related to healthier eating behaviors (Rayipratiwi et al., 2023). Nevertheless, much of the existing literature has focused on school-aged adolescents, employed conventional educational approaches, and assessed short-term outcomes, particularly knowledge. Few studies have examined peer-led educational interventions among university students, especially in vocational higher education settings.

Furthermore, while improvements in knowledge are frequently reported, evidence regarding changes in attitudes toward balanced nutrition remains limited, and the sustainability of these effects over time is poorly understood. These gaps highlight the need for further research to examine the effectiveness of peer education in improving knowledge and attitudes related to balanced nutrition among female vocational college students.

Peer education is an educational approach that has been considered effective. This method utilizes peers as sources of health information, which may increase message acceptability because of social proximity and shared experiences. Research by Lubis et al. (2024) indicates that peer education can significantly improve adolescents' knowledge regarding stunting prevention. In addition, a recent systematic review has shown that peer-based interventions are effective in improving adolescents' knowledge, attitudes, and nutritional behaviors, including increased consumption of healthy foods (Ekubagewargies et al., 2025).

The effectiveness of peer education is closely related to the concept of *peerness*, which enhances communication by making it more relevant, flexible, and persuasive. Systematic studies have demonstrated that this approach can improve health literacy and promote healthy behaviors among adolescents through informal and participatory interactions (Dodd et al., 2022). In the context of higher education, this approach aligns with the concept of empowering students as *agents of change* in health promotion and disease prevention efforts.

As late adolescents, university students have the potential to improve health literacy within their communities. Student-based interventions, including peer education, have been shown to enhance public health knowledge while simultaneously strengthening students' competencies in community engagement (Gonzalez-Aquines et al., 2025). The GENZING/*Gen Z Cegah Stunting* (Gen Z Prevents Stunting) program represents such an innovation, integrating balanced nutrition education, anemia prevention, and strengthening of adolescent health posts (*Posyandu Remaja*).

Although nutrition education interventions have been widely studied among school-aged adolescents, the available evidence on peer-led approaches in higher education settings remains limited. In particular, few studies have examined peer education programs targeting female students in vocational colleges, a population that represents late adolescence and early adulthood, a critical stage for establishing health-related knowledge, attitudes, and future lifestyle practices. Furthermore, existing research has primarily focused on knowledge outcomes, while evidence regarding attitudes toward balanced nutrition remains relatively scarce. The GENZING (Gen Z Prevents Stunting) program offers a distinctive approach by integrating peer-led education on balanced nutrition, anemia prevention, and stunting awareness within a student empowerment framework. Within the context of vocational higher education, this study contributes to the literature by examining changes in knowledge and attitudes toward balanced nutrition among female students following participation in a structured peer education intervention. The findings are expected to inform the development of student-centered health promotion strategies that support broader stunting prevention initiatives.

Methods

Research Design

This study employed a quantitative quasi-experimental design using a one-group pretest-posttest approach to assess changes in students' knowledge and attitudes toward balanced nutrition following participation in the GENZING peer education program. The study hypothesized that the intervention would improve participants' knowledge and foster more positive attitudes regarding balanced nutrition. Knowledge scores were defined as the primary outcome, whereas attitude scores were considered the secondary outcome.

This study was conducted from October to November 2025 at Politeknik Negeri Madura and followed four sequential stages: baseline assessment (pretest), peer educator training, implementation of the peer education intervention, and post-intervention assessment (posttest). Participants completed a validated and reliable questionnaire before and after the intervention. Descriptive statistics were used to summarize the participants' characteristics and outcome measures. Differences between the pretest and posttest scores were analyzed using the Wilcoxon

signed-rank test because the data consisted of paired observations from the same participants and the distribution of score differences was not normally distributed. Statistical significance was set at $p < 0.05$. All analyses were performed using IBM SPSS Statistics version 26.0.

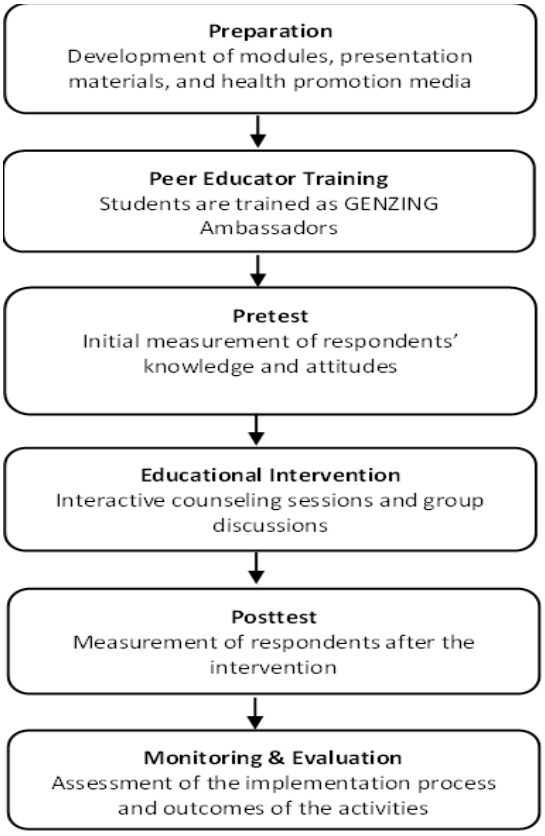


Figure 1. Study implementation flow

Knowledge was assessed using a structured questionnaire with scores ranging from 0 to 50. Attitudes toward balanced nutrition were assessed using a 10-item Likert scale, with possible scores ranging from 10 to 50. For both measures, higher scores indicated better knowledge and more positive attitudes toward balanced nutrition than lower scores. Score classifications were based on the modified Bloom's cut-off criteria, whereby scores ≥80% of the maximum possible score were categorized as good, scores of 60%-79% as moderate, and scores <60% as poor (Seid, 2018). Accordingly, for both knowledge and attitude measures, scores <30 were classified as poor, scores of 30-39 as moderate, and scores ≥40 as good.

Because this study used an uncontrolled pre-post design without a comparison group, the findings should be interpreted as evidence of changes after the intervention rather than definitive evidence of causality. Potential threats to internal validity include testing, history, maturation, regression to the mean, and Hawthorne effects. Ethical approval was obtained from the Ethics Committee of the Universitas Surabaya (Reference No. 724/KE/X/2025).

The GENZING (Gen Z Prevents Stunting) program was developed by the research team as a peer-education-based health promotion intervention grounded in health education, peer influence, and adolescent empowerment principles. The intervention aimed to improve knowledge and attitudes related to balanced nutrition, anemia prevention, and awareness of stunting among female vocational college students.

The educational materials included participant modules, presentation slides, educational videos, and health promotion media tailored to adolescents and young adults. Ten students were selected as GENZING Ambassadors based on their willingness to participate, communication skills, and academic performance. Before implementation, peer educators completed a structured four-session training program totaling 12 hours, covering balanced nutrition, anemia prevention, stunting awareness, communication techniques, group facilitation skills, and ethical considerations.

A total of 100 female students participated in the intervention and were organized into groups of approximately 10 participants, resulting in a peer educator-to-participant ratio of 1:10. Following the completion of the pretest, trained GENZING Ambassadors delivered four face-to-face educational sessions, each lasting approximately 60 minutes. The same educational content, materials, and learning activities were provided to all groups to ensure consistent implementation. The sessions incorporated interactive lectures, group discussions, question-and-answer activities, and peer-led learning exercises focusing on balanced nutrition, anemia prevention, and stunting-related health information.

Participants were considered to have completed the intervention if they attended at least three of the four sessions and completed both pre- and post-test assessments. The post-test was administered one week after the final educational session. Throughout the intervention period, faculty supervisors and members of the research team monitored the implementation using attendance records, participation logs, and standardized observation checklists to ensure

adherence to the intervention protocol and fidelity of content delivery across groups.

Study Participants and Setting

This study was conducted at Politeknik Negeri Madura (POLTERA), Sampang, East Java, Indonesia, between October and November 2025. The target population consisted of all active female students from the 2024 cohort (N = 133). Given the exploratory nature of this study and the finite size of the available population, a feasibility sample was used rather than a formal effect-size–based sample size calculation. All eligible students were invited to participate through announcements disseminated by the academic administration and student organizations. Of the 133 students screened for eligibility, 100 met the inclusion criteria, provided written informed consent, enrolled in the study, and completed both the pretest and posttest assessments. Therefore, all enrolled participants were included in the final analysis(Sugiyono, 2019).

The eligibility criteria included being an active female student in the 2024 cohort, willingness to participate, and attendance at the educational sessions and outcome assessments. Students with a documented history of thalassemia were excluded because the GENZING program included educational content related to anemia prevention, which could influence participants' interpretation of anemia-related information and introduce heterogeneity in baseline health knowledge and experiences. No additional exclusions were applied based on medical conditions, nutritional status, or previous exposure to nutrition education programs. Complete paired data were available for all 100 participants, and no participants were lost to follow-up during the study period.

Results

Table 1 presents the sociodemographic characteristics of the participants. A total of 100 female students completed both the pretest and posttest assessments and were included in the final analysis. The mean age of the participants was 19.4 ± 0.7 years (median = 19 years; IQR: 19–20 years). The largest age groups were 19 years (49.0%) and 20 years (33.0%). Most participants were enrolled in health-related study programs (79.0%), specifically Health Promotion and Nursing, while 21.0% were enrolled in non-health-related programs. In addition, 81.0% of participants reported previous exposure to information related to stunting, whereas 19.0% had not previously received such information. No missing data were identified, and complete paired observations were available for all participants.

Table 1. Sociodemographic Characteristics of Participants

Variable	f	%
Age		
18 years	9	9
19 years	49	49
20 years	33	33
21 years	9	9
Field of Study		
Health-related	79	79
Non-health	21	21
Exposure to Stunting Information		
Yes	81	81
No	19	19

All respondents participated in both pre- and post-test assessments to evaluate changes in knowledge and attitudes related to balanced nutrition (Table 2). Knowledge scores ranged from 0 to 50 and were categorized as poor (<30), moderate (30-39), or good (≥40). At baseline, the mean knowledge score was 30.17 ± 2.59, with a median score of 30.0 (IQR: 28.0-32.0). Following the intervention, the mean score increased to 41.23 ± 1.99, with a median of 41.0 (IQR: 40.0-43.0). The median change score was 11.0 (IQR: 9.0-13.0). According to the categorical classification, 95.0% of the participants were initially classified as having moderate knowledge, whereas 90.0% were classified as having good knowledge after the intervention. The Wilcoxon signed-rank test indicated a statistically significant increase in knowledge scores ($Z = -8.52$, $p < 0.001$), with a large effect size ($r = 0.60$, 95% CI: 0.48-0.72).

Attitude scores ranged from 10 to 50 and were categorized as poor (<30), moderate (30-39), and good (≥40). At baseline, the mean attitude score was 33.18 ± 2.63, with a median of 33.0 (IQR: 31.0–35.0). Following the intervention, the mean score increased to 39.58 ± 2.17, with a median of 40.0 (IQR: 38.0–41.0). The median change score was 6.0 points (IQR: 4.0–8.0). Before the intervention, 99.0% of participants were

categorized as having moderate attitudes and 1.0% as having poor attitudes. After the intervention, 72.0% were classified as having good attitudes and 28.0% as having moderate attitudes. The Wilcoxon signed-rank test demonstrated a statistically significant improvement in attitude scores ($Z = -7.94$, $p < 0.001$), with a moderate-to-large effect size ($r = 0.56$; 95% CI: 0.43–0.69).

Table 2. Analysis of Students' Knowledge and Attitudes Regarding Balanced Nutrition Before and After the Intervention

Variable	Category	f	%	Median (IQR)	Median Change (IQR)	Wilcoxon Z	p-value	Effect Size (r)	95% CI
Knowledge									
Before	Good	2	2,0	30.0	11.0	-8.52	<0.001	0.60	0.48-0.72
	Moderate	95	95,0	(28.0-32.0)	(9.0-13.0)				
	Poor	3	3,0						
After	Good	90	90,0	41.0					
	Moderate	10	10,0	(40.0-43.0)					
	Poor	0	–						
Attitudes									
Before	Good	0	–	33.0	6.0	-7.94	<0.001	0.56	0.43-0.69
	Moderate	99	99,0	(31.0-35.0)	(4.0-8.0)				
	Poor	1	1,0						
After	Good	72	72,0	40.0					
	Moderate	28	28,0	(38.0-41.0)					
	Poor	0	–						

Discussion

The present study observed substantial improvements in both knowledge and attitudes toward balanced nutrition following participation in the GENZING peer education program. Mean knowledge scores increased from 30.17 ± 2.59 at baseline to 41.23 ± 1.99 after the intervention, representing an average increase of 11.06 points. Similarly, mean attitude scores increased from 33.18 ± 2.63 to 39.58 ± 2.17, corresponding to an average increase of 6.40 points. In addition, the proportion of participants classified as having good knowledge increased from 2.0% to 90.0%, while the proportion classified as having good attitudes increased from 0% to 72.0%. These findings suggest that participation in the peer education program was associated with meaningful improvements in nutrition-related knowledge and attitudes among female vocational college students. However, given the uncontrolled pre-post design, alternative explanations such as testing effects, increased familiarity with questionnaire content, or exposure to external sources of information cannot be entirely excluded. At baseline, most participants demonstrated moderate levels of knowledge despite previous exposure to stunting-related information, suggesting that exposure to information alone may not be sufficient to achieve a comprehensive understanding of balanced nutrition and stunting-related issues. This observation is consistent with the findings of Mokoagow et al. (2024), who noted that adolescents often possess fragmented knowledge of nutrition and stunting despite access to multiple information sources.

The significant improvement observed in the post-test scores suggests that peer education may be a useful strategy for knowledge transfer. This approach operates through the mechanism of social proximity, allowing communication to be more contextual, easily understood, and relevant to respondents' daily lives (Veenstra, 2025). Lubis et al. (2024) demonstrated that peer-based education significantly improves adolescents' understanding of health issues compared with conventional methods. This finding is further supported by a systematic review by Ekubagewargies et al. (Ekubagewargies et al., 2025), who concluded that peer education contributes to improvements in knowledge, attitudes, and nutritional behaviors among adolescents through participatory and interactive approaches.

A similar pattern was observed for attitudes toward balanced nutrition, with most participants transitioning from the moderate to the good category following the intervention. Although improvements in knowledge and attitudes were observed concurrently, the present study was not designed to examine the relationship or causal pathway between these constructs. Therefore, the findings should not be interpreted as evidence that increased knowledge directly led to more favorable attitudes. Nevertheless, the observed changes are consistent with behavioral theories suggesting that educational interventions may influence multiple determinants of health-related decision-making. For example, the Capability, Opportunity, Motivation-Behavior (COM-B) framework proposes that behavior is shaped not only by knowledge and skills (capability) but also by environmental opportunities, social influences, and motivational factors (Keyworth et al., 2020). In the context of peer education, improvements in attitudes may have been influenced by exposure to supportive social interactions, shared learning experiences, and positive group norms, in addition to the educational content itself. These findings highlight the multifactorial nature of nutrition-related attitudes and underscore the importance of considering broader social and environmental influences when designing health promotion interventions(Mancone et al., 2024).

The observed improvements may also have been influenced by the educational strategies used in the GENZING program, which combined interactive lectures, group discussions, modules, and video-based learning. Previous studies have suggested that interactive and multimedia educational approaches can enhance learner engagement, facilitate knowledge acquisition, and support positive changes in health-related attitudes and behaviors (Murimi et al., 2018). Such approaches may be particularly beneficial in nutrition education because they provide multiple opportunities for participants to engage with and reinforce key concepts through discussions, reflections, and practical examples. However, the present intervention incorporated several educational components simultaneously, making it impossible to determine the independent contribution of any single element, including the use of visual or audio-visual media. Therefore, the observed changes should be interpreted as the result of the overall intervention package rather than the effect of a specific teaching method or educational medium alone.

Furthermore, the involvement of peer educators, referred to as GENZING Ambassadors, represents a plausible explanation for the observed changes, although this mechanism was not directly evaluated in this study. Peer education interventions are based on the premise that individuals may be more receptive to health messages delivered by peers who share similar social backgrounds, experiences, and communication styles. Consistent with this perspective, Widnall et al. (2024) reported that the concept of *peerness* may enhance the relevance and acceptability of health information through shared social identities and experiences. Within the context of the GENZING program, interactions with peer educators may have contributed to participant engagement and facilitated discussions of nutrition-related topics in a more relatable and accessible manner. However, because measures of educator competence, intervention fidelity, participant engagement, and message acceptability were not collected, the present study could not determine the extent to which peer educator characteristics influenced the observed changes. Future studies should incorporate process evaluation measures to better understand the mechanisms through which peer education interventions affect nutrition-related outcomes.

The findings of the present study are broadly consistent with previous research reporting improvements in nutrition-related knowledge and attitudes following educational interventions among adolescents and young adults (Oddo et al., 2022; Rayipratiwi et al., 2023). However, several differences should be considered when comparing these studies with the current investigation. Oddo et al. (2022) evaluated school-based nutrition education among secondary school students, whereas the present study focused on female students enrolled in vocational higher education. In addition, previous studies have often employed different intervention formats, durations, and follow-up periods, making direct comparisons difficult. Despite these methodological differences, both the current and previous studies reported favorable post-intervention changes in nutrition-related outcomes. Nevertheless, because the present study assessed knowledge and attitudes immediately after the intervention, the findings should not be interpreted as evidence of sustained

behavioral change or long-term intervention effects. Further longitudinal research is needed to determine whether these improvements are maintained over time and translated into healthier nutrition-related practices. Given that adolescence and early adulthood represent a critical period for establishing health-related knowledge, attitudes, and lifestyle patterns (WHO, 2023), interventions that strengthen nutritional literacy during this stage may contribute to broader health promotion and nutrition improvement efforts.

This study has several limitations. The uncontrolled one-group pretest-posttest design is vulnerable to testing, history, and Hawthorne effects, which limit causal interpretation. Selection bias may have occurred because the participants were recruited through purposive sampling from a single institution and consisted exclusively of female students, most of whom were enrolled in Health Promotion and Nursing programs and had prior exposure to stunting-related information. Outcomes were assessed using self-reported questionnaires, which may be subject to social desirability bias and measurement errors. Furthermore, the immediate posttest assessment did not permit the evaluation of the sustainability of the observed changes. Finally, the study measured only knowledge and attitudes and did not assess behavioral or clinical outcomes, limiting the generalizability and practical interpretation of its findings. Future research should employ controlled designs, longer follow-up periods, more diverse populations, and objective outcome measures to validate our findings.

Conclusion

In this one-group pretest-posttest study, participation in the GENZING peer education program was associated with short-term increases in balanced nutrition knowledge and attitude scores among female vocational college students. The observed pre- and post-differences suggest improvements in nutrition-related knowledge and attitudes within this sample; however, the absence of a control group precludes definitive conclusions regarding the intervention's effectiveness or causal impact. These findings indicate that peer education may be a useful approach for delivering balanced nutrition information and fostering positive attitudes toward nutrition among late adolescent students.

These findings may inform the development of student-centered health promotion initiatives in vocational higher education settings. However, additional research is required to strengthen the evidence base. Future studies should employ controlled and multisite study designs, incorporate longer follow-up periods, and include behavior-related and objective health outcomes to better evaluate the potential impact, sustainability, and generalizability of peer education intervention.

Conflict of Interest Declaration

The authors declare that they have no personal interest that may have impacted their work.

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