

NUTRITION EDUCATION INTERVENTION VIA INSTAGRAM AMONG ADOLESCENTS: A SCOPING REVIEW

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ABSTRACT

Adolescence is a phase of rapid and critical development, necessitating increased energy, protein, vitamin and mineral requirements. However, poor dietary patterns during adolescence pose a risk factor for malnutrition, negatively impacting health into adulthood and, requiring nutritional interventions to break the cycle intergenerational malnutrition. Social media-based nutritional interventions through instagram have the potential to provide health information for adolescents. Objective: This study aimed to evaluate the development stages of intervention media and the effectiveness of nutritional education interventions through instagram addressing adolescent nutritional issues. Method: The study follows Arksey and O'Malley framework with PRISMA-ScR systematic review method. Article searches were conducted on Google, Scopus, Science Direct, PubMed and Google Scholar databases using keywords "nutritional education" OR "nutrition-related interventions" AND "Instagram" OR "Instagram-based" AND "adolescent". Inclusion criteria required articles published between 2014 and 2024, involving adolescents aged 10-19 years, written in English or Indonesian, instagram as primary intervention media and employing quantitative and qualitative research designs. Results: Review results indicated interventions lasting an average duration of 2-12 weeks with varying content, although detailed reporting on content development was often lacking. Despite predominantly low intensity, interventions across 12 demonstrated significant improvement in knowledge, attitudes, practices, diet quality, compliance in consuming iron folic acid supplementation (IFAS), waist circumference, physical activity, nutritional intake (energy, protein, carbohydrates), and body image. Nutritional education interventions through instagram showed varying degrees of success among adolescents. Conclusions: Overall, this review highlights the need for the development stages and the importance of considering intervention intensity to enhance the effectiveness of nutritional education interventions through instagram.

Keywords: adolescent; intervention; instagram; nutrition education

INTRODUCTION

Adolescence is a phase of rapid and critical development that encompassed physical, emotional, cognitive, and social aspects (Katanic et al., 2023). Adolescence is divided into two phases: early adolescence, spanning ages 10 to 14 and late adolescence spanning ages 15 to 19 (Bhargava et al., 2020). Adolescents are projected to comprise nearly 16% of the global population, totaling 1.3 billion (Moore Heslin and McNulty, 2023). Adolescence is a crucial period in the human life cycle concerning the transition between childhood and adulthood (Kahssay, Mohamed and Gebre, 2020). The transition and development require an increased need for energy, protein, vitamins, and minerals (Shapu et al., 2020). Poor nutritional status (malnutrition) during adolescence can have enduring impacts on health that may persist into adulthood (Kim et al., 2023).

Malnutrition is a condition characterized by deficiency, excess, or imbalance of nutrients in an individual (Wells et al., 2021). Adolescents are particularly vulnerable to malnutrition due to the growth process, developmental changes and shifts in eating patterns that affect their nutrient intake (Nicholaus et al., 2020). Malnutrition in adolescents manifests as stunting, micronutrient deficiencies, as well as conditions of overweight or underweight conditions (Birru et al., 2021). Malnutrition during adolescence can lead to underweight, stunting, poor academic achievement, and infection risk (Pandurangi, Mummadi and Challa, 2022). Conversely, overnutrition can increase the incidence of non-communicable diseases such as cancer, heart disease, diabetes and hypertension (Shapu et al., 2020). Micronutrient deficiencies significantly elevate the global population's health risk (Nicholaus et al., 2020). Micronutrient deficiencies in vitamins and minerals during adolescence can impact development, neuropsychological behavior, growth, cognitive function, motor skills, memory, linguistics, and academic performance (Awasthi et al., 2022).

Adolescents can prevent malnutrition by adopting healthy eating patterns which are likely to persist into adulthood (Sinai et al., 2021). Eating patterns during adolescence encompasses the frequency, quantity, and timing of meals. Besides eating patterns, paying attention to the quality and diversity of food is vital for adolescents (Agustina et al., 2020). Food quality refers to dietary guidelines and the variety of major food groups consumed (Adeomi, Fatusi and K Klipstein-Grobusch, 2022), while food diversity is a qualitative indicator of the adequacy and quality of food at the individual level based on access to and consumption of various types of food (Adeomi, Fatusi and K Klipstein-Grobusch, 2022). Dietary patterns and nutritional behaviors undergo significant changes due to economic growth and urbanization. Nowadays, adolescents often exhibit poor dietary habits characterized by increased consumption of sugar, saturated fat, deficit in micronutrient sources, and folic acid (ALjaraedah, Takruri and Tayyem, 2019). These poor dietary patterns occurring during adolescence become risk factors for malnutrition (Salam, 2020; Said et al., 2023). Adolescence is considered a key period in shaping healthy eating patterns (Querol et al., 2021) as adolescents are the target of nutritional interventions to break the cycle of intergenerational malnutrition (Oddo, Roshita and Rah, 2019). Adolescence is an opportune time for preventive efforts through intervention because adolescents are more open to lifestyle changes (Shapu et al., 2020). Several studies indicate that adolescents often engage in unhealthy eating behaviors and have insufficient knowledge regarding their nutritional requirements (Thana Y et al., 2019; Moitra 2021). Therefore, interventions such as education and behavioral changes are recommended as preventive measures for adolescents (Shapu et al., 2020).

Nutrition interventions based on technology, especially social media, have proven effective in reaching adolescents (Kulandaivelu et al., 2023). These technology-based interventions are also cost-effective related with the usage of smartphones and social media as instruments in the intervention (Soltero et al., 2022). Recent research, indicates that 87% of adolescents actively seek health-related information through social media (Plaisime et al., 2020). Instagram is one of the social media platforms commonly used by adolescents, with an estimated 85% of adolescents aged 13-17 being instagram users (Chung et al., 2021). A comprehensive overview by Boulos et al. (2016) suggests that instagram has high potential as a social media platform for adolescents to obtain health information, especially given its user-friendly features. However, the effectiveness of nutrition education interventions through instagram has not been clearly established. Therefore, this scoping review aims to determine the characteristics and effectiveness of nutrition education

interventions through Instagram for adolescents by conducting a comprehensive review of previous scientific evidence. The questions addressed in this scoping review are:

1. What are the characteristics and stages of development of nutrition education interventions through Instagram used by researchers in addressing nutritional issues in adolescents?
2. How effective is nutrition education intervention through Instagram for adolescents?

METHOD

This type of research uses quantitative research, which examines social phenomena from the participants' perspective. The population in this study were all pregnant women of Konjo community in Batang, Kajang and Herlang Health Center Working Areas with a total population of 437 people. This research sample consists of pregnant women of the Konjo community who obey the taboo in the working areas of Batang, Kajang, and Herlang health centers. The sample was obtained by probability sampling as many as 60 people from the population.

RESULTS AND DISCUSSION

This research employs the Arksey and O'Malley framework (Kulandaivelu *et al.*, 2023) and is reviewed using the systematic review method referring to PRISMA-ScR (Preferred Reporting Items for Systematic Review and Meta-Analysis extension for scoping review) as shown in Figure 1 (Chung *et al.*, 2021). The inclusion criteria include: (1) Articles published between 2014-2024; (2) Articles involving adolescents aged 10-19 years; (3) Articles in English or Indonesian language; (4) Articles utilizing Instagram as the primary medium for nutrition education intervention; (5) Articles evaluating Instagram as a medium for nutrition education intervention; (6) Articles with both quantitative and qualitative research. Articles will be excluded if: (1) they are review articles or textbooks; (2) they are animal studies; (3) they are paid articles (not open access).

The databases used in this scoping review are Google, Scopus, Science Direct, PubMed and Google Scholar with the search keywords are "nutritional education" OR "nutrition-related interventions" AND "Instagram" OR "Instagram-based" AND "adolescent". The collected articles based on the search results in the database were then extracted and loaded into reference management software (Mendeley). Moreover, duplicate articles were deleted and followed by screening based on titles and abstracts. Ultimately, the selected articles were filtered based on their suitability according to the research's inclusion and exclusion criteria. Data extraction was conducted on articles deemed eligible based on the research criteria and then synthesized by the researcher. The synthesis results were further summarized in a table including: research context (author name, article year, country, article title), participants (age, gender), intervention characteristics (content, intervention duration), study design, and article outcomes. The data extraction can be seen in Table 1.

The synthesis of research data aims to identify intervention characteristics, intervention development stages, and intervention effectiveness. Assessment of intervention characteristics and effectiveness in this scoping review uses an intervention intensity scale, which is a point-scale assessment tool designed to evaluate the characteristics and effectiveness of an intervention. Intervention intensity is categorized into high, moderate, and low intensities (Srbely *et al.*, 2019). Interventions were analysed based on four intervention characteristics and assessed using a Likert scale with 5 items (Shapu *et al.*, 2020). The four assessment characteristics are as follows:

1. Intervention duration indicates the length of the intervention (1 = ≤6 weeks; 2 = 6 to 11 weeks; 3 = 12 weeks to 5 months; 4 = 6 to 12 months; 5 = ≥ 12 months).
2. Frequency of contact/access with the intervention assesses how often contact/access between the intervention and participants occurs. Frequency scores (1 = monthly; 2 = every two to three months; 3 = monthly; 4 = weekly; 5 = daily).
3. Type of contact or level of personalization evaluates the type and level of contact with the intervention (1 = environmental; 2 = only adolescents; 3 = adolescent group and teacher; 4 = adolescent group and parents; 5 = group (adolescents, parents, and teachers).
4. Reach of intervention strategies assesses the settings used during intervention implementation, such as home or school (1 = one setting; 3 = two settings; 5 = three settings or more).

The total intensity score was obtained by summing the scores from the four intervention intensity characteristics, with the overall total score being 20. Intervention intensity is considered low if the total score is ≤10.5, moderate if the total score is 10.51-13.39, and high if the score is ≥ 13.5 (Shapu *et al.*, 2020).

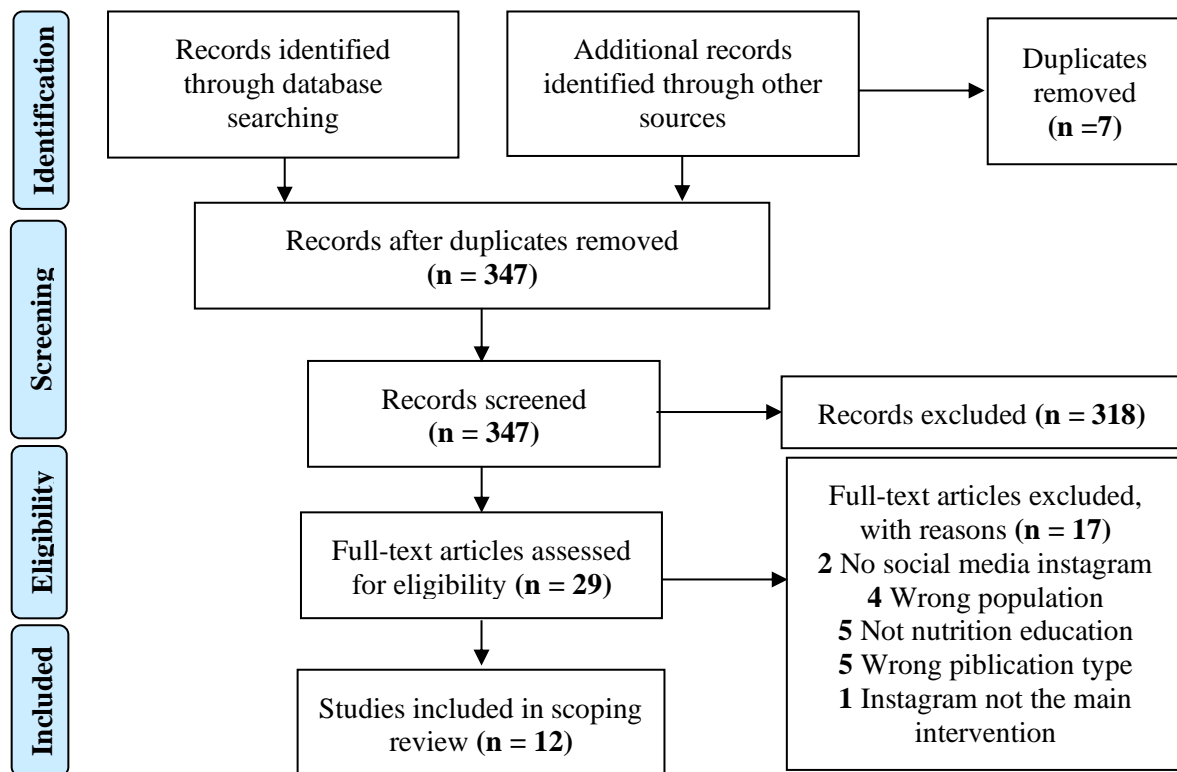


Figure 1. PRISMA Flow Diagram

Study characteristics

The search results from the databases yielded a total of 354 articles that met the research inclusion criteria. The next step involved removing duplicate articles, resulting in 347 articles being screened based on their titles and abstracts. Out of these, 318 articles were found to be irrelevant and 29 articles were assessed for eligibility based on full-text examination. The researcher excluded 17 articles due to their lack of conformity with the inclusion criteria. The final outcome of this selection process resulted 12 articles deemed suitable and included in this scoping review (Figure 1). The synthesis of the 12 journals revealed that 11 articles originated from Indonesia and one

article from Malaysia. The research designs used in the articles were as follows: 5 articles with quasi-experimental designs with one-group pre-post-test design, 4 articles with quasi-experimental designs with pre-post-test control group design, one article with quasi-experimental feasibility with pre-post-test design, one article with quasi-experimental design with two-group pre-post-test design, and one article with qualitative evaluation design. The characteristics of the articles can be seen in Table 1.

Study participants characteristics

The total sample in this article ranges from 16 to 144 participants. Seven intervention articles focus on adolescent girls; 4 articles have a higher proportion of female adolescent samples (>69.6%) compared to male adolescent samples, and one article focuses on male adolescent samples. Seven articles conducted interventions on high school adolescents; 2 articles focus on junior high school adolescents; 2 articles focus on college female students, and one article does not report the educational status of the samples. The age range of the samples in the articles is between 13-23 years old. Participant characteristics can be seen in Table 1.

Instagram interventions characteristics

The duration of nutrition education interventions via Instagram ranges from 2 weeks to 12 weeks, with the most common intervention duration being < 30 days or 4 weeks (6/12, 50%; 4 articles did not report the intervention duration). Five (42%) articles upload education on the Instagram feed; three (25%) of them with education postings in the form of images, while one (8.3%) article uses educational videos shared using the Instagram story feature, and six (50%) articles do not report the form of intervention provided. The content of nutrition education interventions includes; four articles discuss balanced nutrition content; three articles discuss dietary recommendations or food sources (energy, protein, vegetables, and fruits); two articles discuss weight loss management content; two articles discuss sports or physical activity content; two articles discuss the content of chronic energy deficiency (CED) risk; other contents related to body image, food labelling, and nutrition, the importance of breakfast and healthy eating. The development of intervention content based on adolescent needs is carried out by three articles (3/12; 25%). Three articles (3/12; 25%) with additional intervention components include monitoring of iron tablet consumption, short quizzes, and feedback messages, websites with calculators to calculate body mass index (BMI). The summary data of intervention characteristics through Instagram can be seen in Table 2.

Table 1.
 Characteristics of Included Studies

Author /Year /Country	Title	Study Design/ Sample Size	Participants	Timing Of Outcome Assessment	Social Media	Outcome
Zaki and Sari, 2019/ Indonesia	Social Media-Based Nutrition Education Improves Knowledge and Energy - Protein Intakes of Adolescent Girl with Chronic Energy Deficiency	Quasi experiment one group pretest postest/ N: 110	Female; 15-17 years	Post-intervention 2 weeks	Instagram and whatsapp group	Nutrition knowledge, energy intake, protein intake

Author /Year /Country	Title	Study Design/ Sample Size	Participants	Timing Of Outcome Assessment	Social Media	Outcome
Mulyani <i>et al.</i> , 2020/ Indonesia	Effect of motivational interviewing and nutrition education class based on instagram for change healthy weight loss knowledge and diet quality in obese female students	Quasi experiment with pre-post control group design/ N: 45	Female; 19-23 years	Post-intervention 30 days	Nutrition education class based on instagram	Healthy weight loss knowledge, diet quality
Rahmiwati <i>et al.</i> , 2023/ Indonesia	Effect of Local Culture-based Nutrition Education on Compliance with Iron and Folic Acid Supplementation in Female Adolescents	Quasi experiment design/ N: 106	Female; 15-17 years	Post-intervention 12 weeks	Instagram	Knowledge and attitudes in consuming IFAS
Dieny <i>et al.</i> , 2021/ Indonesia	Nutrition Class by Instagram: Interventions to Improve The Diet Quality, Physical Activity and Waist Circumference Among Female College Students with Obese	Quasi experiment with pre-post control group design/ N: 30	Female; 19-23 years	Post-intervention 30 days	Instagram	Knowledge, quality of diet, body weight, body mass index, waist circumference, percent body fat
Jefrydin <i>et al.</i> , 2020/ Malaysia	Use of Instagram® to Educate Adolescents on Nutrition Labelling: A Feasibility Study in Selangor, Malaysia	Quasi experiment pre-post design feasibility/ N: 144	Female (72.6%) Male (27.4%); 13-14 years	Post-intervention 12 weeks	Instagram	Weight, waist circumference, nutrition knowledge, attitude, practice
Dewi KB, Ipa and Wirdani, 2020/ Indonesia	Nutritional Education Effects Through Instagram on Energy Influence and Youth Nutrition Status	Quasi experiment with one group pre-post design/ N: 48	Female (69.6%); 16-18 years	Post-intervention 2 weeks	Instagram	Energy intake Nutritional status
Al-fadhilah, Anna and Afifah, 2023/ Indonesia	The Influence of Instagram and Zoom Meeting-Based Nutrition Education on Knowledge and Attitudes Among 13-18 Year Olds in Lamongan District	Quasi experiment one group pre-post test design N: 100	Female (81%); 13-18 years	Not reported	Instagram	Knowledge and attitudes about The First 100 Days of Life

Author /Year /Country	Title	Study Design/ Sample Size	Participants	Timing Of Outcome Assessment	Social Media	Outcome
Rusdi, Rahmy and Helmizar, 2020/ Indonesia	The Influence of Nutrition Education Using Instagram on Balanced Nutrition Behavior Change for Anemia Prevention in Adolescent Girls at SMA N 2 Padang	Quasi experiment with pre-post control group design N: 60	Female; 16-71 years	Post-intervention 18 days	Instagram	Knowledge, Attitudes Practice
Suryana <i>et al.</i> , 2023/ Indoensia	The Influence of Balanced Nutrition Counseling Using Instagram Social Media on Knowledge, Energy, and Protein Intake Among High School Adolescent Girls.	Quasi experiment with two group pre-post design N: 62	Female; 15-16 years	Post intervention 18 days	Instagram	Knowledge of balanced nutrition Energy intake Protein intake
Januraga <i>et al.</i> , 2021/ Indonesia	Qualitative Evaluation Of A Social Media Campaign To Improve Healthy Food Habits Among Urban Adolescent Females In Indonesia	Qualitative evaluation design N: 37	Female; 16-19 years	Post campaign two months	Instagram	Qualitative individual interviews, FGD
Jannah, Desi and Nopriantini, 2021/ Indoensia	The Effect of Nutrition Education Through Instagram The Four Pillars of Balanced Nutrition Towards Nutritional Knowledge of Adolescent Boys At Senior High School In Pontianak District	Pre-experimental with one group pre-post test N: 35	Male; 16-17 years	NR	Instagram	Konwledge
Triana, Anshory and Saputri G., 2023/ Indonesia	The Effectiveness of Nutrition Education Using Instagram on Body Image Perception and Eating Patterns of Adolescents with Overweight Incidence at SMPN 4 Samarinda	Quasi experiment with one group pre-post test N: 16	Female (75%); 13-15 years	NR	Instagram	Body image perception Eating patterns

Table 2.

Summary of Instagram Intervention Characteristics

Study (n = 12)	Duration	Frequency	Content	Development	Additional Intervention
Zaki and Sari, 2019	2 weeks	Twice posted on instagram feed for two weeks	Balanced nutrition; chronic energy deficiency risk; body image; diverse food intake; energy, protein, vegetable and fruit source consumption, sample menu's	Developed based on selection theme and concludes with testing the acceptance of the infographics.	No
Mulyani <i>et al.</i> , 2020	30 days	One day one topic	Definition, methods of measuring, dietary recommendation s, healthy diet tips and trick, exercise recommendation s and other physical activities for obesity	NR	No
Rahmiwati <i>et al.</i> , 2023	12 weeks	Video instagram stories once every two weeks 3-5 minutes per video	Local culture	NR	Monitoring of IFAS
Dieny <i>et al.</i> , 2021	30 days	One day one topic	Understanding and how to measure obesity; recommended dietary intake, halthy diet tips and tricks; sports recommendation s and other physical activities for obesity	NR	
Jefrydin <i>et al.</i> , 2020	12 weeks	Education uploaded on feed every week (Friday)	Introduction to nutrition labelling; serving size and macronutrients; nutrition information	Conten developed based on need analysis before study	Short quizzes, polls and feedback message

			panel; nutrition claims; energy labelling; healthier choice logo; nutrition labelling usage on food choices		
Dewi KB, Ipa and Wirdani, 2020	2 weeks	Four times a week	The importance of breakfast	NR	No
Al-fadhilah, Anna and Afifah, 2023	NR	NR	NR	NR	No
Rusdi, Rahmy and Helmizar, 2020	18 days	Once every 2 days through image postings	Balanced nutrition	Preparing the intervention media	No
Suryana <i>et al.</i> , 2023	18 days	Once every 2 days through image postings on feed with total 25 postings	Balanced nutrition, My Plate concept, the impact of chronic energy deficiency	NR	No
Januraga <i>et al.</i> , 2021	NR	NR	Healthy eating	NR	Website, BMI calculator
Jannah, Desi and Noprianti ni, 2021	NR	NR	Four pillars of balanced nutrition	NR	No
Triana, Anshory and Saputri G., 2023	NR	NR	Not reported	NR	No

Instagram intervention intensity

The overall intensity assessment categories are presented in Table 3. The results of this scoping review indicate that 12 articles have low scores for intervention intensity, with the highest score being 10 in two articles. Eight articles with low intensity show significant effective results ($p < 0.05$) in improving adolescent knowledge. Three articles with low intensity show significant effective results ($p < 0.05$) in increasing energy and protein intake, and two articles show significant effective results in improving adolescent attitudes. Intervention durations of ≤ 6 weeks were obtained in six articles, showing significant results in improving knowledge in five articles and energy and protein intake in two articles. Other significant outcomes include dietary quality, waist circumference, and physical activity found in one article. Intervention durations of 12 weeks to 5 months were obtained in two articles which illustrating significant results in improving knowledge and

adherence to IFAS consumption in one article, and attitudes and practices in another article. Intervention durations were not found in four articles. Weekly intervention frequency contacts were obtained in four articles, showing significant results in improving knowledge in two articles, energy intake in one article, protein intake in one article, attitude in one article, and adherence and practice in one article. Daily intervention frequency contacts were obtained in four articles, showing significant results in improving knowledge in all articles, dietary quality, waist circumference, and physical activity in one article, and energy and protein intake in one article. There were four articles where intervention frequency contacts were not found. Overall, the level of personalization in all articles was only for adolescents, indicating that the interventions provided did not involve parents or teachers. The same was found in the range of intervention strategies across all studies, which were only conducted at the school level.

Stage of Intervention Development

The majority of the studies in this scoping review did not provide detailed explanations of the media intervention development stages. The results of the scoping review indicate that the media intervention development stages were only found in three out of the total 12 articles. Media intervention development in the first article pertained to improving CED issues among adolescent girls, with stages involving theme determination based on CED improvement material, followed by acceptance testing on a population with characteristics similar to the sample. Acceptance testing included font size, images, colours, amount of material, and preference level. Media intervention development in the second article related to nutrition labelling content involved the following stages: focus group discussions (FGD) to determine themes based on participant responses. Participants were first given a questionnaire to identify personal, behavioural, and environmental factors influencing food label reading practices. This stage resulted in intervention themes including knowledge, misconceptions, awareness, and credibility of information on food and nutrition labels. Media intervention development in the third article involved initial media preparation and pre-test implementation stages.

Effects of Instagram Intervention

The influence of education intervention through Instagram shows significant results ($p < 0.05$) in eight out of nine articles reporting knowledge, three out of four articles reporting attitudes, one out of two articles reporting practices, diet quality, waist circumference, one article reporting compliance of IFAS, one article reporting physical activity, one article reporting body image, three out of four articles reporting energy intake, carbohydrate intake showed significant results reported by only one article, protein intake showed significant results in three articles that reported it. The overall effects of instagram intervention can be seen in Table 3.

Table 3.
 Summary of Overall Intervention Intensity Results

Study (n=12)	Duration ¹	Frequency of Contact ²	Level of Personalization ³	Reach of Intervention ⁴	Overall Intensity Score	Overall Intensity Rating ⁵	Effective ⁶	
							Outcome	(Y/N) ⁷
Zaki and Sari, 2019	1	4	2	1	8	Low	Knowledge	Y
							Energy intake	Y
							Protein intake	Y
Mulyani <i>et al.</i> , 2020	1	5	2	1	9	Low	Knowledge	Y
							Diet quality	N

Study (n=12)	Duration ¹	Frequency of Contact ²	Level of Personalization ³	Reach of Intervention ⁴	Overall Intensity Score	Overall Intensity Rating ⁵	Effectiveness ⁶	
							Outcome	(Y/N) ⁷
Rahmiwati <i>et al.</i> , 2023	3	4	2	1	10	Low	Knowledge Attitudes Compliance IFAS	Y Y Y
Dieny <i>et al.</i> , 2021	1	5	2	1	9	Low	Knowledge Quality of diet Body weight Body mass index Waist circumference Percent body fat Physical activity	Y Y N N Y N Y
Jefrydin <i>et al.</i> , 2020	3	4	2	1	10	Low	Knowledge Attitude Practice	N Y Y
Dewi KB, Ipa and Wirdani, 2020	1	4	2	1	8	Low	Energy intake Nutritional status	N N
Al-fadhilah, Anna and Afifah, 2023	NR	NR	2	1	3	Low	Knowledge Attitudes	Y Y
Rusdi, Rahmy and Helmizar, 2020	1	5	2	1	9	Low	Knowledge Attitudes Practice	Y N N
Suryana <i>et al.</i> , 2023	1	5	2	1	9	Low	Knowledge Energy intake Protein intake	Y Y Y
Januraga <i>et al.</i> , 2021	NR	NR	2	1	3	Low	NR	NR
Jannah, Desi and Nopriantini, 2021	NR	NR	2	1	3	Low	Knowledge	Y
Triana, Anshory and Saputri G., 2023	NR	NR	2	1	3	Low	Body image Energy intake Protein intake Fat intake Carbohydrates intake	Y Y Y N Y

¹ Duration: 1 = ≤6 weeks; 2 = 6 to 11 weeks; 3 = 12 weeks to 5 months; 4 = 6 to 12 months; 5 = ≥ 12 months. ² Frequency of contact: 1 = every month; 2 = two to three months; 3 = monthly; 4 = weekly; 5 = daily. ³ Level of personalization: 1 = environmental; 2 = only adolescents; 3 = group (adolescents and teachers); 4 = group (adolescents and parents); 5 = group (adolescents, parents, and teachers). ⁴ Reach of intervention: 1 = one setting; 3 = two settings; 5 = three settings or more. ⁵ Overall intensity rating: low = ≤10.5; moderate = 10.51-13.39; high= score ≥ 13.5. ⁶ Effectiveness of the intervention is defined by statistical significance increase (p<0.05) in outcome (Y = yes; N = no). ⁷ NR: refers to not reported in the study.

This scoping review aims to investigate the developmental stages, characteristics, and effectiveness

of nutrition education interventions through instagram among adolescents. A total of 12 articles were deemed eligible based on the criteria. The findings indicate that the characteristics of nutrition education interventions through instagram vary, including posts on instagram feeds, educational posts in the form of images and videos, with durations ranging from 2 to 12 weeks. Although the content of nutrition education interventions shows a fairly comprehensive scope, only a few articles or 25% reported the content development process. The low development of content based on needs may potentially affect the effectiveness of the provided education interventions. The development of nutrition education content should be tailored to the needs, preferences, and characteristics of the adolescent group because it is known to be more effective in achieving intervention goals (Plaisime et al., 2020). This is consistent with the review conducted by Kulandaivelu et al. (2023) which stated that developing education interventions through social media based on the needs of the target population, namely adolescents, is one of the factors that can influence the implementation and success of the intervention.

The results of the scoping review indicate the effectiveness of nutrition education interventions through instagram on several nutrition-related outcomes. However, based on the intensity of the interventions, all eleven articles were classified as low-intensity interventions. The low intensity scores were attributed to the short duration of the interventions, low level of personalization in the interventions, and limited scope of intervention strategies (school/home). Among eight articles reporting intervention durations, six or 75% of them had durations of ≤ 6 weeks with low scores. However, this short duration did not affect the effectiveness of the interventions on several outcome measures (such as knowledge, energy intake, protein intake, diet quality, waist circumference, and physical activity). These findings are consistent with previous reviews conducted by Srbely et al. (2019) which stated that there is no relationship between the duration of the intervention and the effectiveness of the intervention in increasing dairy product/calcium consumption in preschool-aged children, and the review conducted by Shapu et al. (2020) for increasing adolescents' knowledge, attitudes, and practices regarding malnutrition.

The level of personalization/contact in the intervention across all articles was only conducted on adolescents. The score for the level of personalization/contact in the intervention is known to be better if nutritional education interventions involve parents and teachers. The systematic review meta-analysis conducted by Jacob et al. (2021) stated that multi-component interventions involving teachers, parents, and digital components are a good strategy to support the effectiveness of nutritional education interventions in adolescents aged 10-19 years. However, different results are shown in this scoping review, where the level of personalization/contact in the intervention across articles is not associated with intervention effectiveness. These findings are consistent with the review Srbely et al. (2019) which stated that there is no relationship between the level of personalization/contact in the intervention and intervention effectiveness.

The scope of intervention strategies in all articles is only carried out in one setting, namely schools. Nutritional education interventions that involve multiple settings such as schools and homes are known to have higher intervention intensity scores. This is because both the home (family) and school play important roles in implementing healthy lifestyles during adolescence (Yu et al., 2020). The results of this scoping indicate that although nutritional education interventions with a single setting, are associated with intervention effectiveness. This finding is consistent with the results of the review conducted by Marquez et al. (2015) the study demonstrated that the effectiveness of the

intervention is 81.8% using a single setting approach.

CONCLUSION

Nutritional education interventions through instagram demonstrate varying degrees of success among adolescents. This scoping review has identified the characteristics and effectiveness of nutritional education through instagram among adolescents, but in terms of the development stage, the information from these studies was often lacking. The overall results of this review indicate the need for the development and enhancement of intervention characteristics and intensity to support intervention effectiveness and sustainability of its benefits.

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