ANALYSIS OF NUTRITION EDUCATION PROGRAMS FOR ADOLESCENT GIRLS IN AN EFFORT TO PREVENT STUNTING

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Abstract

Stunting remains a serious nutritional problem in Indonesia because it can affect children's long-term growth and development. Adolescent girls are an important group in stunting prevention because this is when they are experiencing rapid growth and preparing for preconception. This study aims to examine and analyze various nutrition education programs provided to adolescent girls as an effort to prevent stunting. This study uses the Systematic Literature Review method with reference to the PRISMA 2020 guidelines. From the search process, 20 relevant national and international articles published between 2020 and 2025 were selected. The results of the study show that most nutrition education programs are able to improve adolescent girls' knowledge, attitudes, and behaviors related to nutritious food consumption, the importance of iron, and understanding of the risks of stunting. Education conducted through activities at school, Islamic boarding schools, communities, and families has proven to be effective, especially when using interactive methods such as discussions, audiovisual media, booklets, or educational games. Overall, the results of the study show that nutrition education plays an important role and is an effective first step in early stunting prevention efforts.

Keywords: Nutrition education, Adolescent girls, Balanced nutritional behavior, Stunting Prevention, Literature review

INTRODUCTION

Indonesia is currently still facing the problem of double nutritional burden, which is a condition where malnutrition and malnutrition are more prevalent at the same time. Based on national data, the prevalence of malnutrition reached 19.6%, stunting at 37.2%. In addition, nutritional problems in adolescents and women of childbearing age are also quite high. This condition illustrates that efforts to improve nutrition are carried out since adolescence as the first step to prevent stunting in Indonesia [1]. Stuntinf is one of the chronic nutrirional problems that has a major impact on the quality of human resources in Indonesia. This condition is characterized by a child's height that is lower than the standard age due to malnutrition for a long time, especially in the period of the First 1,000 Days of Lfe (HPK). Stunting not only inhibits children's physical growth, but also has an impact on cognitive development, decreased productivity, and increased chronic risk in adulthood [2].

Based on the 2023 SSGI report, the national stunting prevalence is still at 21.5%, far below the WHO target of below 20%. Intervention efforts to prevent the increasing prevalence of stunting can be started from adolescence, because at this stage individuals are experiencing rapid growth and preparing for adulthood and becoming prospective parents who play an important role in determining the nutritional status of children in the future [3]. Adolescent girls have a strategic role in efforts to prevent stunting because they are mothers-to-be who will determine the nutritional status of the next generation [4].

Nutrition education about stunting is one of the efforts made by the government to reduce stunting rates in Indonesia. This program is included in specific nutrition interventions targeting pregnant women, lactating mothers, adolescent girls, and women of childbearing age. However, until now, there have not been many programs that focus on increasing the capacity of educators or cadres as the main implementers of nutrition education in the field

[5]. A low level of nutrition knowledge will affect attitudes and behaviors in choosing food, which can ultimately have an impact on nutritional status when the adolescent enters pregnancy and affect the nutritional condition of the baby to be born [6].

According to [7], handling the problem of stunting cannot be done only by health workers, but requires cooperation and concern from various sectors outside the health sector. Therefore, educational and socialization efforts are needed for adolescents so that they understand the causes, impacts, and ways to prevent stunting. This step is important to be taken in Bangka Regency as part of an early prevention strategy through increasing nutrition knowledge and awareness in adolescents.

Some of the results of previous research are still limited to the causes of stunting, types of stunting prevention foods, and indicators of stunting. According to [8], this study is different from previous research because it focuses on the solution aspect, namely the extent to which adolescents' level of compliance in consuming nutritious food has an effect on stunting prevention. Therefore, adolescence is an important phase in preparing a healthy generation that is free from chronic nutritional risks. Stunting prevention efforts must be started early, including through improving the nutritional knowledge and behavior of adolescent girls [9]. Nutrition education is one of the effective strategies to increase adolescent nutritional awareness and behavior [10]. Increasing nutritional literacy helps adolescents understand the importance of healthy eating habits and changing bad habits such as fast food consumption and low in vegetables. During this period, the need for energy and nutrients increased significantly.

However, many teens have an unbalanced diet. Through nutrition education, adolescents not only understand the concept of balanced nutrition, but also are skilled in applying it in daily life. Which can ultimately affect the quality of life and prevent nutritional problems such as stunting [11]. Other research has also shown that nutritional status monitoring and nutrition counseling activities in adolescents are effective in increasing awareness and improving eating habits.

In addition to being a national issue, stunting is also a global problem that requires cross-sector attention. The results of an international study by [12] show that malnutrition, including stunting, is still a threat to more than two billion of the world's population, with more than 151 million children under the age of five experiencing stunted growth. The study confirms that parental education, family economics, and environmental conditions are important determinants in stunting incidence.

A similar study by [13] in Dubai showed that the implementation of sustainable school nutrition programs has a significant effect on improving students' knowledge and healthy eating behaviors. Nutrition education programs in schools have been proven to be able to foster the habit of consuming nutritious food and strengthen awareness of the importance of a balanced diet. Health education in adolescents not only focuses on nutritional intake, but also includes reproductive health and the prevention of early marriage, which are indirect risk factors for stunting [14].

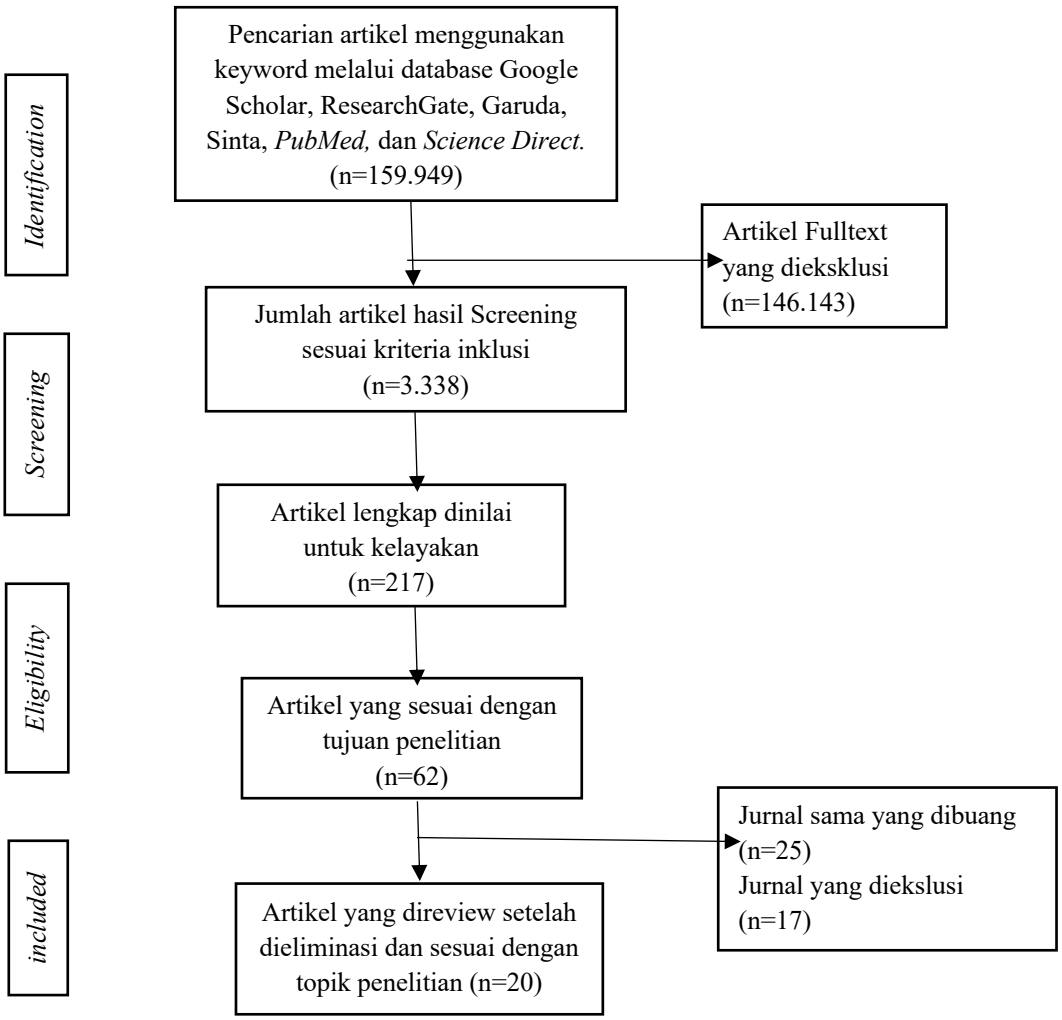
RESEARCH METHODS

This study uses the Literature Review (SLR) method which aims to trace and review various scientific evidence related to the analysis of education programs on stunting prevention given to public health cadres [15]. This study uses the Literature Review method. This method is used to study, identify, and synthesize the results of previous research that have similar topics. The Literature Review aims to obtain a comprehensive overview and essence of various studies that have been conducted previously, so that it can strengthen a

clear theoretical foundation for the topic being studied [16]. The article selection stage is carried out in stages according to the inclusion and exclusion criteria that have been set. Only articles that explicitly use behavioral theories such as Social Cognitive Theory (SCT), Health Belief Model (HBM), and Theory of Planned Behavior (TPB) are included in the analysis. This approach strengthens the validity of the study because it ensures that all the studies reviewed have the same theoretical basis in explaining changes in nutritional behavior [17]. This method was chosen because research on nutrition education in adolescents in efforts to prevent stunting has been widely carried out in various contexts, but the results are still widespread and have not been comprehensively synthesized [4]. With the LR approach, researchers can combine various empirical findings to produce more comprehensive conclusions about the effectiveness of adolescent nutrition education programs in various social environments such as schools, Islamic boarding schools, and communities [18], [19]. Therefore, only journals that discuss adolescent nutrition education, improving nutritional knowledge, and its relationship with stunting prevention are used to answer research questions. This selection process includes studies such as [20] that assess the effectiveness of balanced nutrition education in school adolescents.

In this study, the Literature Review (SLR) approach was used with reference to the PRISMA *(Preferred Reporting Items for Systematic Reviews and Meta-Analyses)* guideline which consisted of four stages, namely: identification, screening, eligibility, and inclusion These four stages are carried out to ensure that the reviewed article meets the standards of scientific relevance and validity in accordance with the research objectives. The PRISMA method assists researchers in selecting, assessing, and synthesizing observational research results in a structured manner through seven main stages [21].

Figure 1 PRISMA Stage Flow



RESEARCH RESULTS

This study uses the Systematic Literature Review (SLR) method in the process of searching, selection, and grouping articles that are relevant to the research objectives. This stage is carried out systematically to obtain literature that is in accordance with the focus of the research, namely nutrition education programs for adolescent girls in an effort to prevent stunting. The article data obtained is collected and then selected based on the inclusion and exclusion criteria that have been described in the relevant and qualified subchapters used in the analysis. The articles obtained came from various scientific sources such as Google Scholar, Garuda, Sinta, PubMed, Researchgate, ScienceDirect by using the keys: Nutrition Education Program in an Effort to Prevent Stunting, Nutrition Education, Stunting Prevention, From the search results, 20 articles were found that are considered relevant to the topic of this research. The articles were then further analyzed based on the suitability of the theme, research design, research subject, and results related to nutrition education and stunting prevention in adolescent girls. The following is a list of 20 summary articles used in the following study which are poured into a table.

Table 1. Literature Review

No	Nama Penulis, Tahun & Judul Artikel	Tujuan Penelitian	Metode Penelitian	Instrumen	Hasil Penelitian
1.	Asatuti, N. B., Sumardi, R. N., Ngardita, I. R., & Lusiana, S. A. (2021). *Pemantauan Status Gizi dan Edukasi Gizi pada Remaja sebagai Upaya Pencegahan Stunting.*	To analyze the relationship between nutritional status and nutritional knowledge of adolescents to stunting prevention.	A type of quantitative research with a cross-sectional design**.** Location: several high schools. Sample: 100 young women selected by *purposive sampling*. Analysis: *Chi-square test* with significance level of 0.05.	Nutritional knowledge questionnaire and healthy eating behavior, anthropometric measurements.	There was a significant relationship between the level of nutrition knowledge and the nutritional status of adolescents (p=0.012). Adolescents with good knowledge are more likely to adopt a balanced diet and have a lower risk of stunting.
2.	Atasasih, H., & Mulyani, S. (2022). *Sosialisasi "Isi Piringku" pada Remaja Pesantren sebagai Upaya Pencegahan Stunting.*	Knowing the influence of the socialization of Isi Piringku on the knowledge and nutritional behavior of pesantren adolescents.	One group pre-post test design**.** Location: Al-Falah Islamic Boarding School. Sample: 50 students, total sampling technique. Data analysis used *paired t-tests* to compare scores before and after the intervention.	Pre-post questionnaire on nutritional knowledge and eating behavior observation guide.	There was a significant improvement in adolescent eating knowledge and behavior after socialization (p<0.05). Participants understand the composition of a balanced diet and the importance of consuming vegetables and proteins.

3.	Sufi, W., & Efastri, S. M. (2022). *Program Dapur Sehat Atasi Stunting (DASHAT).*	Assessing the effectiveness of family-based nutrition education through the DASHAT program.	Types of quantitative descriptive **research.** Location: BKKBN assisted village. Sample: 30 families with young women, *purposive sampling technique*. Percentage descriptive data analysis.	Questionnaires and family interviews on the practice of consuming nutritious food.	Nutritional knowledge increased by 70%, nutritious food consumption practices increased by 60%. The DASHAT program is considered effective in strengthening the family's ability to prepare nutritious food to prevent stunting.
4.	Vinci, A. R., Nurulita, A., & Maesaroh, S. (2023). *Efektivitas Edukasi Mengenai Pencegahan Stunting kepada Kader: Systematic Literature Review.*	To find out the effectiveness of various forms of education regarding stunting prevention on improving the knowledge and skills of posyandu cadres in Indonesia.	Systematic Literature Review (SLR) research design with PRISMA 2020 guidelines**.** The search was carried out through Google Scholar, PubMed, and Garuda databases with keywords: *nutrition education, posyandu cadres, stunting prevention, nutrition intervention*. Of the 356 articles found, 9 articles met the inclusion criteria (in 2018–2023, cadre education research, had quantitative results).	The assessment instrument includes data extraction sheets (title, author, year, method, results), as well as article quality tests using the JBI Critical Appraisal Tool**.**	The results of the study showed that nutrition education in general was effective in improving the knowledge, attitudes, and skills of posyandu cadres in stunting prevention (an average increase in knowledge of 50–70%). The most effective method is interactive education using audiovisual media and hands-on practical training**.**

5.	Grisvia Zain Rahmah & Ratih Kurniasari (2023) — *The Influence of Nutrition Education Media Forms on Increasing Mother's Knowledge to Prevent Stunting in Children*	Assess the effectiveness of various forms of nutrition education media (flip sheets, stunting risk detection modules, and integrating cards) in improving mothers' knowledge about stunting prevention.	Design: *Literature Review* with a systematic review of 3 research journals on *the Sinta Ristekdikti* website (2019–2020). Inclusion criteria: Sinta 1–4 accredited journal, with the theme of innovative nutrition education media for mothers/mothers-to-be. Analysis steps: media identification, effectiveness test, and comparison Increase knowledge from pre-test and post-test.	The original instrument of each study was in the form of pre-test and post-test questionnaires to measure the improvement of maternal knowledge.	All nutrition education media are effective in increasing mothers' knowledge about stunting prevention. Interactive card media is considered the most effective because it is attractive and easy to understand, while flip sheets and modules are also influential but less interactive. Proven participatory nutrition education able to increase maternal awareness to prevent stunting.
6.	Nugraheni (2024). *Program Edukasi Gizi pada Remaja Putri untuk Mencegah Stunting: Tinjauan Literatur.*	Reviewing the effectiveness of adolescent nutrition education on stunting prevention.	Design of Systematic Literature Review (SLR) with the PRISMA approach. Source: 15 national & international journals.	Data extraction and thematic analysis forms.	Nutrition education is effective in improving nutrition literacy and healthy consumption behavior. However, most of the programs are not yet sustainable and have not been integrated with national policies.
7.	Supartono (2024)	Describe the application of nutrition education	Evaluative descriptive	Observation and documentation of activities	Thematic KKN contributes to increasing family and adolescent

	Edukasi dan Intervensi Gizi untuk Mencegah Stunting : Studi Kasus Program KKN New Zero Stunting Desa Jatiwangi	through KKN activities.			understanding of balanced nutrition.
8.	L. Jazuli and A. Fauzi (2023) *Analisis Tingkat Kepatuhan Siswi Remaja dalam Mengkonsumsi Makanan Bergizi terhadap Pencegahan Stunting di Kabupaten Karawang*	Analyzing the level of compliance of adolescent girls in consuming nutritious food to prevent stunting in Karawang Regency.	A type of descriptive quantitative research with a cross-sectional design**.** Location: Junior High School in the Karawang Regency Health Office's work area. Time: January 2023 (2nd to 3rd week). Population: young women ages 10–19. Sample: 86 female students (result of the Slovin formula from the Karawang adolescent population). Data analysis was carried out descriptively using frequency and percentage distributions.	Nutritious food consumption compliance questionnaire, knowledge questionnaire on stunting, and primary-secondary data collection through observation and *google form*.	Hasil shows that students' knowledge of stunting is still low (65.1%)**,** and the main media sources of information are websites (49%) and social media (35%)**.** The highest level of compliance was the consumption of nutritious foods (85%), while the lowest was the consumption of blood-boosting tablets (44%). Education and the environment affect adolescent nutritional behavior. Nutrition education and counseling by health workers directly are

					needed so that compliance increases and the risk of stunting decreases.
9.	E. Yuliantini, K. kamsiah, E. Eliana, A. S. Wijaya, and Y. Yunita (2023) *Pemberdayaan Masyarakat Melalui Edukasi Gizi: Strategi Pencegahan Stunting di Kabupaten Seluma.*	Empowering the community through nutrition education, prevention, and early detection of stunting among mothers under five, cadres, and village officials in Seluma Regency.	Type of activity: Community service based on education and mentoring. Design: *Pre-post test one group.* Location: Seluma Regency, Bengkulu. Sample: 40 mothers of toddlers. The implementation is through the stages of preparation, socialization, education, and demonstration of local food.	Nutrition knowledge questionnaire (pre-post test), observation of nutritious food processing practice skills, and educational media (modules, leaflets, and local food demonstrations).	There was a significant increase in the knowledge and skills of participants after nutrition education (pretest 40% → posttest 77.1%). The good category increased by 30 respondents. Participants better understand the prevention and early detection of stunting and are able to apply local food innovations based on snakehead fish and oyster mushrooms as an alternative to nutritious food. Increased community independence in stunting prevention in Seluma.yang rosdiana
10	M. Rosdiana, Delita Septia Rahayu, M. Al Ariq, S. Aisyah, W.	Evaluate the impact of adolescent empowerment programs through	Pre-experimental design, one group, pre-test and post-test**.** Location: Sukakarya Village,	Pre-test and post-test questionnaires (10 multiple-choice questions about	The average knowledge score increased from 6.60 to 7.73 after the intervention. Lecture

	Putri, and A. Nur Wulan (20250 *Empowerment Remaja melalui Edukasi Gizi Seimbang Upaya Pencegahan Stunting di Kelurahan Sukakarya Kota Sukabumi. Jurnal Abdi Masyarakat Indonesia*	balanced nutrition education on increasing adolescents' knowledge about stunting prevention.	Sukabumi City. Sample: 15 adolescent members of the Youth Posyandu (age 10–20 years). The activity was carried out in the form of a P2MFM Workshop (Increasing Knowledge Through Food Management).	balanced nutrition, "Fill My Plate", physical activity, food selection, and food waste). Media: PowerPoint, interactive discussions, and educational games "Nutriladders".	methods, interactive discussions, and educational games are effective in increasing adolescent knowledge and engagement. Participants were active and enthusiastic during the activity. This program has succeeded in improving the understanding of balanced nutrition and is recommended to be used as a routine activity with a wider scope.
11	D. Valeriani, D. Prihardini Wibawa, R. Safitri, and R. Apriyadi (2022) *Gerakan Pencegahan Dini Stunting Melalui Edukasi pada Remaja di Kabupaten Bangka.*	To provide education to adolescents about early prevention of stunting through increasing knowledge and awareness about balanced nutrition.	Types of descriptive qualitative research with a community-based participatory approach. The activity was carried out through counseling and group discussions in several secondary schools in Bangka Regency.	The instruments used were activity observation sheets, pre-post nutrition knowledge questionnaires, and documentation of educational activities.	The results showed a significant increase in adolescents' knowledge of balanced nutrition and stunting risk factors. Participants better understand the importance of a nutritious breakfast, iron intake, and anemia prevention. Educational activities also increase adolescents' awareness to become agents of

					change in stunting prevention campaigns in the school environment.
12	Rusilanti and N. Riska (2021) *Pengaruh Pelatihan Tentang Pemilihan Makanan Sehat untuk Mencegah Terjadinya Stunting melalui Edukasi Gizi terhadap Peningkatan Pengetahuan Remaja Putri.*	To find out the effect of training on healthy food selection through nutrition education on increasing the knowledge of adolescent girls in stunting prevention.	One group pre-test post-test research design. Location: Benda Baru Village, Pamulang, South Tangerang. Sample: 20 young women. The analysis used a t-test with a significance level of 0.05.	Knowledge tests (pre-test and post-test) through Google Form, educational media in the form of YouTube videos, ayocegahstunting.com websites, and discussions on WhatsApp Group.	The average pre-test score is 73.5 and post-test is 84.5. The results of the t-test showed t count (4.44) > t table (2.02), meaning that there was a significant effect of training on improving the knowledge of adolescent girls. Digital media-based nutrition education is effective in increasing adolescents' understanding and awareness of the importance of healthy food consumption to prevent stunting.
13	R. Nalubega, A. Batte, and S. Kiguli (2025) *Prevalence and predictors of stunting in children and adolescents*	To determine the prevalence of stunting and its predictors in children & adolescents 1–18 years of age with nephrotic syndrome at a national referral	Design: cross-sectional quantitative research. Location: Paediatric nephrology clinic at Mulago National Referral Hospital, Kampala. Sample: 94 children and adolescents	Medical and anthropometric data (height for age according to World Health Organization standards), history of proteinuria, duration of steroid therapy.	Stunting prevalence: 15.9% (95% CI 15.88-16.04). Independent predictors of stunting: persistent proteinuria (OR = 4.11; 95% CI 1.05-15.98; p < 0.041). Conclusions: The group

	aged 1-18 years with nephrotic syndrome attending Mulago Hospital, Uganda. BMC Nephrology	nephrology clinic in Uganda.	with nephrotics who had undergone steroid therapy ≥ 3 months. Analysis: multivariate logistic regression.		of children with nephrotic syndrome are particularly at risk of stunting, especially if proteinuria is still active.
14	S. B. Soofi *et al.* (2024) *Specialized nutritious foods and behavior change communication interventions during the first 1000 days of life to prevent stunting: a quasi-experimental study in Afghanistan. The American Journal of Clinical Nutrition*	To analyze the effectiveness of special nutritious feeding (SNF) and behavior change communication (SBCC) during the first 1000 days of life in reducing the prevalence of stunting and underweight in Afghanistan.	Quasi-experimental design of a community with intervention and control groups. Subjects: pregnant women, breastfeeding, and children aged 6–23 months. Analysis: *difference-in-differences (DID)* to compare changes in the prevalence of stunting and underweight.	Questionnaires of child-feeding behaviors, anthropometric measurements (BB/U, TB/U), and food consumption records.	The combined SNF and SBCC interventions reduced the prevalence of stunting by DID = −5 % (95% CI: −9.9 – −0.2) and underweight by DID = −4.6 % (95% CI: −8.6 – −0.5). Exclusive feeding and breastfeeding practices have increased significantly. The combination of nutrition interventions and behavioral education is effective in reducing stunting in vulnerable populations.
15	(Arndt et al., 2024) *Global, Regional, and National Progress Towards the 2030 Global*	Analyze global, regional, and national developments on global nutrition targets (including stunting, wasting,	The quantitative research uses *systematic analysis* based on secondary data from the Global Burden of Disease Study (GBD	Global data from 204 countries and territories (2012–2021), WHO nutrition indicators, national reports, and the 2021 GBD model.	Only a small percentage of countries have met the targets of stunting (4 countries) and anemia (5 countries) until 2021. Projections show that

	Nutrition Targets and Forecasts to 2050: A Systematic Analysis for the Global Burden of Disease Study 2021.)	anemia, and overweight) and project achievements until 2050.	2021). The analysis was performed with a Bayesian meta-regression model to estimate the prevalence and projected trends.		most countries will not achieve the 2030–2050 nutrition target**.** A significant relationship was found between human development rate (SDI) and the prevalence of malnutrition
16	Willmart, A. C., Krissandyani, F. N. R., & Nadhiroh, S. R. (2024). *Edukasi Gizi sebagai Upaya Peningkatan Pengetahuan Pencegahan Stunting pada Kader Posyandu dalam Program Desa Emas.*	Assess specifically whether nutrition education provided through interactive lectures and educational videos can increase the knowledge of posyandu cadres about stunting prevention, as well as identify the extent to which one-time training activities can improve the understanding of cadres.	Quantitative research with a pre-post test design without a control group**.** The population of all posyandu cadres in Gold Village. Samples were taken in total sampling. The intervention was in the form of nutrition education (interactive lecture + educational video) for 60 minutes. Measurements are carried out before and after education. Data analysis uses the Wilcoxon test to see changes in knowledge scores.	The 20-item knowledge questionnaire includes: definition of stunting, signs, risk factors, prevention, and the role of cadres. The instrument is tested validly and reliably. Educational media in the form of presentation slides, animated videos, and discussion sessions.	Knowledge scores before and after education did not increase significantly ($p = 0.721$). This means that one meeting is not enough to change the understanding of cadres. Cadres need repeated training, mentoring, and field practice so that their knowledge and educational skills develop.

17	Utami, A. S., & Ainy, A. (2023). *Systematic Review: Inovasi Program Pencegahan Stunting.*	Identify innovative forms of stunting prevention programs in various developing countries, analyze the effectiveness of each intervention, and see general patterns of innovation success at the family, community, and health service levels.	The research used a systematic review design with PRISMA guidelines. The search was conducted on the PubMed, ScienceDirect, Google Scholar, and Garuda databases. Inclusion criteria include: 2018–2023 articles, innovative interventions, and a focus on stunting prevention. Selection is carried out in 4 stages: identification, screening, eligibility, and inclusion. The analysis uses a thematic narrative approach to classify forms of innovation.	The data extraction sheet contains: type of innovation, target target, intervention component, program duration, outcome (exclusive breastfeeding, nutritional status, nutritional behavior), and evaluation design of each article.	The most effective innovations include: digital education for mothers/caregivers, nutrition monitoring applications, local food-based PMT, family-based breastfeeding counseling, home visit programs, and community empowerment. Success is influenced by program consistency and family involvement.
18	Emilda, A. S., dkk. (2024). *Pengaruh Edukasi Gizi dengan Media Booklet terhadap Pengetahuan Remaja Putri.*	Analyzing how much the provision of booklets containing nutrition and stunting materials can increase the understanding of adolescent girls about the risks, impacts, and	Quasi-experiment pre–post without control; purposive sampling of school-aged adolescent girls; Statistical test paired T-test.	The 15–20 page booklet contains: definition of stunting, causes, balanced nutrition, role of adolescents, anemia, SEZ, and educational illustrations. Questionnaire of 25 nutritional knowledge	The knowledge score increased significantly with p = 0.000. Adolescents better understand the role of balanced nutrition, the danger of anemia, as well as the relationship between adolescent

		efforts to prevent stunting.		items tested for validity and reliability.	nutritional status and the risk of stunting in the next generation. Booklets are considered easy to understand and attractive for teenagers.
19	Nikmawati, E. E. & Yulia, C. (2021). *Edukasi Gizi dan Pemberdayaan Perempuan sebagai Upaya Pencegahan Anemia dan Stunting.*	Increasing women's capacity in understanding nutrition and local food skills, so as to be able to overcome anemia and prevent stunting through increasing the consumption of nutritious food in households.	Participatory community-based research. Stages: counseling → demonstrations → practical training → evaluation. Participants: mothers, PKK cadres, young women.	Nutrition education modules, exercise sheets, cooking guides of local foods (moringa leaves, catfish, nuts). Before-after evaluation sheet. Cheap nutritious food recipe book.	Nutritional knowledge has increased significantly. Participants became more aware of anemia, iron needs, and the importance of consuming nutritious food every day. This program improves the ability of families to produce nutritious, low-cost food from local ingredients.
20	Lestari, E., Shaluhiyah, Z., & Adi, M. S. (2023). *Intervensi Pencegahan Stunting pada Masa Prakonsepsi: Literature Review.*	Describe the types of preconception interventions that have been shown to be effective in reducing the risk of stunting, as well as mapping what interventions are most influential in	Literature review; searches on PubMed, ScienceDirect, ProQuest; Article 2013–2022. Thematic analysis: nutrition, supplementation, education, reproductive counseling.	The extraction sheet contains: author name, year, location, population, type of intervention, duration of the program, outcome (nutritional status, anemia, preconception readiness).	Preconception interventions have a significant effect on pregnancy quality and stunting risk. Energy and iron supplementation, intensive nutrition education, and adolescent health checks

	improving the health of adolescent girls and mothers-to-be.	have been shown to improve nutritional status before pregnancy. The most effective interventions are those that are done at least 3 months before pregnancy.

DISCUSSION

Based on the results of the analysis of 20 national and international articles, it was revealed that nutrition education programs for adolescent girls have a strategic role in efforts to prevent stunting. In general, all articles emphasize that nutrition education is able to increase nutritional literacy, healthy eating behavior, and awareness of the importance of consuming balanced nutritious food. This is also in line with the life course approach, where young women are a key group that will determine the nutritional status of the next generation. Most national studies [10], [22], [23] shows that nutrition education is able to significantly increase knowledge and healthy eating behavior. For example, a study [10] found a significant relationship between the level of nutrition knowledge and the nutritional status of adolescents ($p=0.012$), while [22] showed a significant increase in knowledge and eating behavior after socialization of "Fill my plate" ($p<0.05$). This strengthens that participatory-based nutrition education is able to foster awareness and balanced nutrition practices.

Research [23] through the Healthy Kitchen to Overcome Stunting (DASHAT) program showed a significant increase in the family's ability to choose nutritious food ingredients and healthy cooking practices ($p=0.001$). Similar results can also be seen in the PMT Program Analysis (2022), where nutrition education accompanied by supplementary feeding has a real effect on improving adolescent nutritional status ($p<0.05$). As well as Community Empowerment through Nutrition Education [1] emphasizes that family- and community-based education can strengthen the practice of consuming nutritious food in households. The involvement of families, cadres, and village officials makes nutrition messages more contextual and sustainable. This approach has been shown to be effective in increasing knowledge (70%) and practices of consuming nutritious food (60%). These findings reinforce that nutrition education not only increases individual knowledge but is also able to improve nutritional behavior through the involvement of families, cadres, and village officials.

In addition to adolescents, nutrition education also plays an important role in preventing stunting through increasing the capacity of mothers-to-be. [24] found that education using booklet media significantly increased adolescent girls' knowledge of stunting prevention. However, the effectiveness of education is greatly influenced by the method and frequency of intervention. [25] reported that one-time education with methods and videos was not able to significantly increase cadre knowledge ($p = 0.721$), suggesting that intensive and continuous training is needed for targets such as cadres who have a major responsibility in health education in the community. This emphasizes the importance of a participatory, applicative, and periodic educational approach.

In terms of adolescent empowerment, [18] through the Youth Empowerment program in Sukabumi proved that there was an increase in balanced nutrition knowledge scores from 6.60 to 7.73 after interactive training. Activities packaged in the form of workshops, discussions, and educational games have proven to be effective in increasing adolescent understanding and engagement. This is in line with the Social Cognitive Theory theory which emphasizes the importance of learning through hands-on experience and social environments.

Preconception interventions also have a big role in preventing stunting. [26] shows that preconception education and nutritional supplementation can increase the readiness of mothers-to-be and reduce the risk of babies being born with growth disorders. This is in line with research [27] which found that women's empowerment through nutrition education and local food processing skills can increase nutritional literacy and family independence in meeting nutritional needs. Given the high stunting of adolescent girls in Indonesia, these findings confirm the importance of strengthening preconception programs in long-term

stunting prevention efforts. In addition to education and empowerment, stunting prevention program innovation is also an important factor. Research [28] on the "Important Umbrella" and "Gaya Puspaku" programs shows the success of increasing exclusive breastfeeding coverage through family-based education that involves the role of fathers as mothers' support partners.

From the results of the synthesis of various international journals, the same pattern is also seen. A study [29] in Afghanistan showed that a combination of special nutrition interventions (PMT program analysis) and a combination of behavior change (SBCC) during the first 1000 days of life was able to reduce the prevalence of stunting by 5% ($p<0.05$). Meanwhile, a global analysis by [5] in The Lancet reveals that only a few countries will achieve the 2030 stunting reduction target, so nutrition education and behavior-based interventions are still the main key.

However, some studies such as [10] and PMT program analysis (2022) highlight that knowledge improvement is not always followed by consistent behavior changes. This can be caused by social environmental factors, the availability of healthy food, and family support that is not optimal. Therefore, educational interventions need to be combined with structural approaches, such as healthy food policies in schools, financial support and cross-sector programs such as Zero Stunting KKN [19]. When compared to international research [30], it appears that stunting is also related to chronic health conditions and child nutrition in general. This means that nutrition education alone is not enough without the support of adequate health services and multi-level interventions. Overall, the results of the study show that nutritional education that is perceptive, contextual, and sustainable has a significant impact on improving the literacy and nutritional behavior of adolescent girls. With the support of families, schools, and government policies, nutrition education programs can be a sensitive intervention that directly contributes to long-term stunting prevention efforts.

CONCLUSION

Based on the results of the study of 20 national and international articles, it can be concluded that nutrition education programs have a significant relationship with the improvement of nutritional knowledge, attitudes, and behaviors of adolescent girls who play an important role in stunting prevention. Education carried out through a school, pesantren, and community approach has been proven to be able to improve adolescent nutritional literacy and encourage the application of nutritious food consumption patterns in daily life. Overall, the results of this study show that nutrition education carried out in an interactive, participatory, and community-based manner plays an important role in shaping healthy and sustainable adolescent nutritional behavior. Nutrition education programs that are integrated with policy support and involve various sectors can help break the cycle between generations of stunting. Thus, nutrition education can be an effective preventive strategy in improving the quality of adolescent girls' health and reducing the risk of stunting in the future.

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