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Original Article

Online educational intervention: Improving maternal knowledge and attitudes in providing developmental stimulation for stunting toddlers

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Abstract

Stunting remains a significant public health concern, impacting physical growth and impeding children's development. Mothers, who play a crucial role in stimulating children's development, often encounter barriers in providing effective stimulation, primarily due to limited access to appropriate resources and information. Online education can bridge this gap by offering easily accessible learning. This aim of this study was to determine the effect of online education on maternal knowledge and attitudes in providing developmental stimulation for stunting toddlers. A quasi-experimental research design was employed, comprising a treatment group and a control group, each consisting of 46 mothers with stunting toddlers, sampled purposively. The treatment group received an online developmental stimulation educational intervention through WhatsApp groups for twelve meetings, each lasting 1.5 to 2 hours. Meanwhile, the control group participated in a stunting assistance program provided by the community health centers (*Puskesmas*). To compare the knowledge and attitudes between groups, Mann-Whitney and independent Student t-test were used. The assessment of intervention effects on knowledge and attitudes was conducted using Wilcoxon and paired Student t-test within each group. Following the educational intervention on developmental stimulation, there was a significant increase in knowledge; however, there was no significant difference in attitudes. The treatment group (mean score 3.9±1.76) had a higher increase in knowledge scores compared to the control group (2.0±2.25) with a $p<0.001$. Nonetheless, no significant difference in attitudes was observed between the two groups with the mean change scores was 5.8±15.31 in treatment group and 2.5±18.69 for control group, with a $p=0.335$. This study suggests that providing online education leads to increased knowledge scores but does not impact attitudes significantly. Additional educational approaches should be considered to enhance maternal attitudes.

Keywords: Stunting, child development, online education, knowledge, attitudes

Introduction

The growth and development of children at an early age are critical phases that significantly influence brain development [1]. Appropriate stimulation during this period plays a crucial role in children's cognitive, emotional, and social development [2]. Unfortunately, nutritional challenges, inadequate health conditions, and insufficient stimulation during infancy can lead to

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stunting [3]. According to data from the Indonesian Nutrition Status Survey (SSGI) in 2022, the prevalence of stunting in Indonesia has decreased to 21.6% from the previous 24.4% [4]. Despite this decline, the figure still surpasses the WHO standard, which sets the prevalence of stunting at below 20% [4]. Young children who experience stunting are at risk of facing obstacles in mental and social-emotional development [5], cognitive function [6-10], as well as academic achievement [11], with a 3.6 times higher risk of poor cognitive development compared to children who do not experience stunting. Moreover, this risk negatively affects emotional development into adulthood [12-14].

The process of child development is influenced by various factors, including stimulation, and there exists a relationship between the frequency of stimulation and child development [15]. A high level of frequency and variety of stimulation in children can strengthen the synaptic connection between the right and left brain, thereby promoting the formation of multiple intelligences and broader, higher intelligence [16]. The role of parents or caregivers is paramount in supporting the development of children's social and emotional competence [17]. Specifically, mothers have a central role in providing nutritional intake, developmental stimulation, and positive interactions with children. However, mothers with stunting toddlers may encounter challenges in providing appropriate developmental stimulation for their children. Several studies have demonstrated that parenting practices, including stimulating development in stunting toddlers, must commence at an early age to achieve optimal development [18].

To unlock the developmental potential of children, it is crucial for parents, caregivers, and families to receive support in providing appropriate care and protection [19]. Education plays a key role in enhancing family capabilities by providing information and knowledge about health and imparting skills so that individuals can voluntarily adopt healthy behaviors [20,21]. The relationship between parental knowledge, stimulation, and the incidence of stunting in toddlers has been proven significant [22]. Nutrition education and counseling programs have been effective in enhancing maternal knowledge about stunting prevention, boosting self-confidence, and helping to manage stress [23]. Knowledge is a domain that influences a person's behavior, such that higher knowledge typically correlates with better behavior, leading to the display of positive attitudes [24].

With advancements in information technology, developmental stimulation education through online platforms has become increasingly accessible to many mothers. Several educational applications have been developed to assist mothers in stimulating the growth and development of children, particularly for toddlers experiencing stunting problems. However, despite the existing studies on the effect of online developmental stimulation education on mothers with stunting toddlers, the limited available studies necessitate a deeper understanding of the potential of this intervention within the population of mothers with stunting toddlers in the area of Surabaya, Indonesia. Therefore, this study aimed to determine the effect of developmental stimulation education through an online platform on the knowledge and attitudes of mothers with stunting toddlers, concerning the stimulation of growth and development in stunting toddlers.

Methods

Study design and setting

This study employed a quasi-experimental design with a pre-test, post-test, control group design approach to determine the effectiveness of online developmental stimulation education. This study was conducted from September 2022 to February 2023.

Participants

The research population comprised mothers with stunting toddlers aged 2–5 years who participated in a stunting assistance program at the community health centers (CHC), in Indonesian known as *Pusat Kesehatan Masyarakat* or *Puskesmas*, in Surabaya, Indonesia. In this study, children were classified as stunted based on the criterion of a Z-score less than -2 standard deviations (SD) from the median, according to the World Health Organization (WHO) standards established in 2006. The research sample consisted of 96 respondents, with 46 in the

treatment group and 46 in the control group. Research subjects were selected using a purposive approach and were randomly allocated to CHC. The sampling methodology involved a two-step process. First, the selection of health center locations was done randomly, considering their significance as main health centers, high prevalence of stunting cases, and active implementation of programs to assist children with stunting. Following this, the mothers were then purposively chosen from these locations. A total of nine CHCs were selected, with four CHCs receiving a developmental stimulation educational intervention, while five CHCs served as the control group. Careful selection of research subjects was conducted based on specific inclusion criteria, including residence in Surabaya, Indonesia having stunting toddlers aged 2–5 years, possessing a smartphone, and being able to use the WhatsApp application. Mothers with stunted children having chronic illnesses, those leaving the WhatsApp group, and participants withdrawing from the study were excluded from the study.

Interventions

A developmental stimulation educational intervention was conducted online through WhatsApp groups (WAGs) using educational tools in the form of a digital book (e-module) and video materials provided by the researchers. The educational e-module was developed by the researchers, validated by experts in material, media, and language, and tested on a limited number of respondents. Testing was carried out by obtaining feedback from 30 respondents using a Likert scale to assess the practicality of the e-module. The results showed good perceptions in terms of appearance, content and motivational aspects of the e-module, showcasing its effectiveness for mothers of stunted toddlers. The establishment of WAGs was based on CHCs, namely WAG Education at CHC Gading, CHC Sidotopo Wetan, CHC Lidah Kulon, and CHC Tanah Kalikedinding. The educational intervention spanned 12 meetings, occurring twice a week. The first meeting was dedicated to video material delivery, while the second meeting involved the dissemination of e-module material.

Modules were created based on the results of needs analysis and from various references and were divided into six chapters covering essential topics for child development (ages 2–5). The mothers were allotted ten minutes to review the modules before engaging in discussions, with avenues for questions provided through group chat or private messaging. Evaluations followed the completion of each educational topic. To ensure engagement, a multifaceted approach included clear communication, interactive sessions, open communication channels, positive reinforcement, and integrated assessments, fostering active participation and comprehension of the module content.

Data collection

Data collection was conducted through interviews using a research instrument in the form of a questionnaire. Before implementation, the researchers tested the validity and reliability of the questionnaire using the Pearson correlation and Cronbach alpha tests. The results of the validity and reliability tests for all items were found to be valid (r>0.3) and reliable (α>0.7). Data collection was divided into two stages, focusing on both the treatment and control groups, with assessments conducted before the intervention (pre-test) and after the intervention (post-test). Measurements were employed to evaluate/assess maternal knowledge and attitudes in providing developmental stimulation.

Statistical analysis

The data were examined for completeness and analyzed using the Statistical Package for the Social Sciences (SPSS) version 25.0. The analysis involved a comparative test before and after the intervention between the treatment and control groups. Before the intervention, the knowledge variable was assessed using the Mann-Whitney test, and the attitude variable was evaluated using the independent Student t-test. After the intervention, both the knowledge and attitude variables were analyzed using the Mann-Whitney test. The statistical test before and after the intervention in the treatment group utilized the Wilcoxon test, while the paired Student t-test was employed in the control group. Changes in scores between the treatment and control groups for the knowledge variable were determined using the independent Student t-test, whereas the Mann-Whitney test was used for the attitude variable.

Results

Individual characteristics of the respondents

The characteristics of the respondents are presented in **Table 1**. The mothers in both the treatment and control groups are similar in terms of education and employment status (**Table 1**). Although there is a slight tendency towards older age in the treatment group, a notable disparity exists in media exposure. Specifically, 56.5% of mothers in the treatment group were exposed to electronic media, whereas only 23.9% of mothers in the control group reported such exposure. Additionally, 43.5% of mothers in the treatment group were exposed to non-electronic media, while in the control group, this figure was 76.1%.

Table 1. Characteristics of respondents

Variables	Treatment group (n=46)	Control group (n=46)	*p*-value
	Frequency (%)	Frequency (%)	
Maternal age (years old), mean±SD	34.3±6.6	31.9±5.7	0.063
Maternal education			0.676
Low	20 (21.7)	23 (50.0)	
High	26 (28.3)	23 (50.0)	
Employment status			0.572
Working	9 (19.6)	6 (13)	
Not working	37 (80.4)	40 (87)	
Media exposure			0.003
Electronic	26 (56.5)	11 (23.9)	
Non-electronic	20 (43.5)	35 (76.1)	

Differences in knowledge and attitudes before the intervention between the treatment and control groups

The results of the statistical tests conducted before the administration of the intervention, indicating no significant differences in either knowledge or attitudes between the two groups, with a $p>0.05$ (**Table 2**). This implies that there is no statistically significant difference between the treatment and control groups before the intervention was administered.

Table 2. Comparison of baseline knowledge and attitude scores among mothers between treatment and control groups

Domain	Treatment group (n=46)		Control group (n=46)		*p*-value
	Min-max	Mean±SD	Min-max	Mean±SD	
Knowledge score	12–17	13.7±1.43	12–18	14.2±1.79	0.248[a]
Attitude score	42–120	84.6±15.2	18–125	85.3±24.8	0.856[b]

[a] Analyzed using Mann Whitney
[b] Analyzed using independent Student t-test

Differences in knowledge and attitudes before and after the intervention within the treatment and control group

Table 3 illustrates significant differences in the treatment group before and after the intervention. Prior to the intervention, the treatment group had an average knowledge score of 13.7±1.43, which subsequently increased to 17.6±1.23 after the intervention ($p<0.001$). The treatment group also had an average attitude score of 84.6±15.2 before the intervention, rising to 90.3±17.5 after the intervention ($p=0.001$) (**Table 3**).

In the control group, which did not receive the intervention, the pre-intervention average knowledge score was 14.2±1.79, demonstrating a significant increase to 16.2±1.68 during the post-test measurement ($p<0.001$). Concerning attitudes, although there was an increase from 85.3±24.77 to 87.8±15.08 after the intervention, this difference did not reach a statistically significant level ($p=0.369$).

Changes in knowledge and attitude scores between the treatment and control groups

Developmental stimulation educational intervention significantly affected knowledge, while there was no significant difference in attitudes (**Table 4**). The treatment group (mean±SD = 3.9±1.76) had a more substantial increase in knowledge scores compared to the control group

(mean±SD = 2.0±2.25) with a p=0.001. However, there was no significant difference in attitudes between the two groups. The average change score between the treatment group (mean±SD = 5.8±15.31) and the control group (mean±SD = 2.5±18.69) yielded a p=0.335.

Table 3. Comparison of maternal knowledge and attitude scores before and after the provision of developmental stimulation education in the treatment and control groups

Group/domain	Pre-intervention (n=46)		Post-intervention (n=46)		p-value
	Min-max	mean±SD	Min-max	mean±SD	
Treatment group					
Knowledge	12–17	13.7±1.43	15–20	17.6±1.23	<0.001[a]
Attitudes	42–120	84.6±15.16	46–125	90.3±17.52	0.001[a]
Control group					
Knowledge	12–18	14.2±1.79	12–19	16.2±1.68	<0.001[a]
Attitudes	18–125	85.3±24.77	56–125	87.8±15.08	0.369[b]

[a] Analyzed using Wilcoxon test
[b] Analyzed using paired Student t-test

Table 4. Changes in knowledge and attitude scores between the treatment and control groups

Domain	Treatment group (n=46)		Control group (n=46)		p-value
	Min-max	Mean±SD	Min-max	Mean±SD	
Knowledge	-2–7	3.9±1.76	-4–7	2.0±2.25	<0.001[a]
Attitudes	-59–37	5.8±15.31	-30–40	2.5±18.69	0.335[b]

[a] Analyzed using Wilcoxon test
[b] Analyzed using paired Student t-test

Discussion

Differences in knowledge and attitudes before and after the intervention between the treatment and control groups

Our data indicated that within the treatment group, maternal knowledge and attitude scores increased after the provision of the online developmental stimulation educational intervention using e-module media. The intervention significantly increased maternal understanding of developmental stimulation in stunting toddlers, with post-intervention knowledge scores increased significantly compared to baseline score pre-intervention. This considerable improvement, substantiated by pertinent references, implies a significant positive impact on maternal awareness and comprehension.

The results of this study are consistent with the results of several relevant references. Providing an online developmental stimulation educational intervention using e-module media is one effective method of offering practical education to parents [25,26]. These results are also consistent with a similar study, wherein the effectiveness of online methods increased maternal knowledge and attitudes in postpartum care after receiving online education [27]. Educating parents about stimulation practices can significantly affect children's development. Parental knowledge about child development is linked to how parents provide stimulation. Mothers with a robust understanding of child development exhibit more positive interactions with their children compared to those lacking such knowledge. The role of parents is pivotal in supporting the development of children's social skills through nurturing, enhancing development, modeling positive relationships, and providing experiences and opportunities to enrich and stimulate children's development [28].

Several questions in the questionnaire had significant changes in maternal knowledge. Notably, there was a substantial shift in maternal knowledge of "Understanding children's emotional development." The proportion of correct answers surged from 10.9% before the intervention to 63% after the intervention. This indicates that the online developmental stimulation educational intervention has effectively enhanced mothers' comprehension of children's emotional development.

Parents play a crucial role in providing positive affirmations, demonstrating love and respect, and fostering a sense of security [28]. Simple activities such as playing, reading, and singing with children play a pivotal role in stimulating early childhood [29]. For children aged 2–

6 years, their brain's capacity to absorb various forms of information is remarkably high, with a notable focus on tasks [30,31]. Consequently, this can improve children's abilities in thinking, communicating, and interacting with others. Regrettably, many children do not receive adequate stimulation during this critical period. Hence, programs that promote early childhood stimulation at home can have a profound impact, particularly for children at risk of developmental delays [29].

The analysis showed a significant improvement in maternal attitudes towards developmental stimulation after the online educational intervention for mothers with stunted toddlers. Parental support aids in reducing the risk of internalizing behaviors such as anxiety and depression, which can impede children's adjustment and ability to function effectively at home, school, and in the environment. Symptoms such as extreme fear, feelings of helplessness, hopelessness, apathy, depression, and isolation are indicators of emotional difficulties observed in very young children experiencing inadequate parental care [28]. Following the intervention, there was an upsurge in mothers' positive attitudes towards providing stimulation for child development, particularly in behavior belief and outcome evaluation statements. Improvements are especially noticeable in areas such as teaching self-control, fostering interaction, time management, disciplining during child training, and providing stimulation through games.

The significant differences in attitudes hold crucial implications for the effectiveness of the online developmental stimulation educational intervention in altering the attitudes of mothers with stunting toddlers concerning the stimulation of child development. Heightened positive attitudes among mothers can contribute to changes in childcare practices, which, in turn, can positively affect the development of stunting toddlers. The online developmental stimulation educational intervention has substantial potential in transforming maternal attitudes and behaviors, consequently fostering the optimal development of stunting toddlers.

In the control group, there was a notable increase in scores in the knowledge variable, with a $p<0.001$. However, this was not the case for the attitude variable, as there was no significant difference in the measurement results before and after the intervention, yielding a $p=0.369$. This could be attributed to the research respondents being mothers with stunting children aged 2–5 years who had received a stunting assistance program from the health service in collaboration with the Surabaya government. It is possible that mothers in the control group were keen on stimulating their children's growth and development but lacked effective knowledge on how to do so. Therefore, it is crucial to consider the content of online developmental stimulation educational intervention materials for mothers. Generally, it is important to recognize that parental knowledge about child development is associated with their practices and behaviors in educating children [28].

Several studies demonstrate that early intervention can prevent developmental disorders and enhance cognitive and socio-emotional development in toddlers through enriching parenting practices, such as responsive stimulation provided at home [29,32,33]. Psychosocial stimulation intervention/training programs for caregivers on how to support children's development through responsive and sensitive interactions between caregivers and children have exhibited overall positive effects, albeit these effects tend to be small to moderate, on child developmental outcomes, including cognitive, language, and motor skills [33].

Changes in knowledge and attitude scores between the treatment and control groups

The provision of the online developmental stimulation educational intervention using e-module media, as indicated by the results of the statistical analysis in **Table 4**, indicates significant differences in the changes in scores between the treatment and control groups in the knowledge variable. Concerning the knowledge variable, the average change in maternal knowledge scores in the treatment group was 3.9±1.76, while in the control group, it was 2.0±2.25. In other words, the group of mothers who received the online developmental stimulation educational intervention experienced a more substantial increase in knowledge compared to the control group. However, this was not the case for the attitude variable. Concerning the attitude variable, the average attitude score of the control group before the intervention was 85.3±24.8, which subsequently rose to 87.8±15.1 after the intervention ($p=0.369$).

Following the provision of the online developmental stimulation educational intervention to mothers with stunting toddlers aged 2–5 years, it is evident that there was a significant effect on the knowledge variable, with a $p<0.001$, between the treatment and control groups. The results of this study are consistent with several studies investigating the effect of educational interventions on child development and maternal knowledge. For instance, a study conducted in Indonesia revealed that a nutrition package intervention comprising maternal education and behavior change communication through home visits enhanced maternal understanding and behavior change communication regarding child growth and development [34]. Another study conducted in Kenya assessed the effectiveness of two group-based parenting models for responsive stimulation of early childhood development and integrated nutrition education, with the results demonstrating an improvement in child development [35].

However, this was not the case for the attitude variable. Although the treatment group had an average score increase of 90.3±17.5, while the control group reached 87.8±15.1, this difference did not demonstrate statistical significance ($p=0.623$). Various factors can influence the results of this study, including media exposure. Analysis of the characteristics of the mother respondents revealed a notable disparity exists in media exposure between the treatment and control groups. Specifically, 56.5% of mothers in the treatment group were exposed to electronic media, whereas only 23.9% of mothers in the control group reported such exposure. In contrast, the majority of mothers in both groups reported exposure to non-electronic media. For instance, a study indicated that selective exposure to certain types of media can foster antagonistic perceptions toward that media. In other words, if individuals are solely exposed to media that aligns with their perspectives or attitudes, they are more inclined to perceive that media as hostile or biased against their viewpoints. The results of this study suggest that media exposure choices can influence the way in which individuals perceive and interpret news or other media content [36]. Additional studies demonstrate that media exposure positively influences health behavior by diminishing perceptions of vulnerability [37]. Generally, educational interventions for mothers have been proven to enhance maternal knowledge and behavior, ultimately fostering a positive impact on child development [35,38].

The results of this study are consistent with prior studies that have demonstrated the efficacy of the TPB approach in promoting behavioral changes across various contexts [39,40]. Furthermore, this study underscores the significance of providing educational interventions to mothers to enhance child development stimulation practices and socio-emotional development in children [39,41]. Several studies reveal that early intervention can prevent developmental disorders and enhance cognitive and socio-emotional development in toddlers through enriching parenting practices, such as responsive stimulation provided at home [29,32,33]. Online education delivery methods can be an effective choice. Numerous instances have illustrated the use of this approach, particularly for mothers with stunting children. A randomized controlled trial of an internet-based educational intervention successfully increased parental knowledge and reduced child behavioral problems among mothers with mental health issues [42].

The study has notable limitations to consider. There is a significant difference in media exposure between the treatment and control groups, potentially biasing the observed changes in maternal attitudes. External factors like socio-economic conditions and cultural nuances were not thoroughly addressed, affecting the generalizability of the findings. The short two-month intervention period may not fully capture long-term effects on attitudes, and the study's geographic specificity may limit broader applicability. These limitations emphasize the importance of nuanced research designs for a comprehensive understanding of online developmental stimulation educational interventions.

Conclusion

This research confirms the effectiveness of online developmental stimulation interventions for mothers with stunting toddlers. This intervention significantly increases mothers' knowledge, especially in understanding children's emotional development, and positively influences attitudes. Although the control group demonstrated increased knowledge, targeted content is critical to establishing effective parenting practices. Disparities in media exposure between groups influence differences in attitudes. Overall, these findings emphasize the importance of

tailored online interventions in promoting optimal child development and preventing developmental disorders.

Ethics approval

This research protocol has received ethical approval from the Health Research Ethics Commission, Faculty of Public Health, Diponegoro University, Semarang, Indonesia with the ethical approval number 57/EA/KEPK-FKM/2022.

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Competing interests

All the authors declare that there are no conflicts of interest.

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Underlying data

All data underlying the results are available from the corresponding author upon request.

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