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By Ngadiyono Ngadiyono

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Innovation of the health monitoring system for pregnant and breastfeeding mothers through independent health applications as an effort to reduce stunting

Ngadiyono[1]*, Suparmi[1], Ulfah Musdalifah[1], Izzatul Arifah[2]

[1]Poltekkes Kemenkes Semarang, Semarang
[2]Universitas Muhammadiyah Surakarta, Sukoharjo
Corresponding author e-mail: *ngadiyonopolteksmg@gmail.com

Abstract

Background: Failure to grow in children or what is often called stunting is one of the focuses of global problems, including Indonesia. Globally, stunting is one of the goals Sustainable Development Goals (SDGs). Stunting is a problem of chronic malnutrition caused by inadequate nutritional intake over a long period of time due to providing food that does not meet nutritional needs. Stunting can occur when the fetus is still in the womb and only appears when the child is two years old. Based on the results of the Indonesian Nutritional Status Survey (SSGI), the stunting prevalence rate in Indonesia fell from 24.4% in 2021 to 21.6% in 2022. This figure is still above the threshold set by the World Health Organization (WHO), namely 20%. The stunting prevalence rate in Demak Regency was ranked seventh highest in Central Java in 2019 at 50.23% and is one of 60 stunting districts. In 2019 in Demak Regency there were 4.25% or 6,129 toddlers out of a total of 97,212 toddlers who had the potential to experience stunting. This situation is a priority for the Demak Regency government to handle by determining 10 locations that will be prioritized in 2020 and 2021

Purpose: To produce monitoring and promotion system application for pregnant and postpartum mothers as well as breastfeeding mothers including toddlers can detect early health problems for mothers and toddlers and is named the child stunting preventive application (ASTA).

Method: This research uses research and development methods orResearch and Development (R&D). This research method is used to produce certain products and test the effectiveness of a product. This research was conducted in December 2022. The population of this study was pregnant women in Demak Regency with a sample of 24 people who were divided into two, namely 12 people as the intervention group and 12 people as the control group. The influencing variable in this study is ASTA and the influenced variable is health maintenance behavior during pregnancy, postpartum and toddlers. This research is divided into four stages, namely design, analysis, engineering and evaluation.

Results: Based on the statistical test output, it is known that Asymp. Sig. (2-tailed) is worth 0.025. From this value it can be concluded that H_0 rejected. This means that there are differences in the level of potential stunting in the control group respondents in terms of the pre-post treatment results. Meanwhile, it is known that in the intervention group the value of Asymp. Sig. (2-tailed) namely 0.157. This value is >0.05, so it can be concluded that H_0 accepted. This means that there is no difference in the level of potential stunting between pre-post treatments in the intervention group given the ASTA application.

Conclusion: There is no significant effect of using the ASTA application on the criteria for potential stunting and there is no significant difference in potential stunting data between the control and intervention groups, either before or after treatment. However, the stunting prevalence ratio is 0.7 (<1) indicating that the ASTA application is a factor that can reduce the potential for stunting.

Keywords: Breastfeeding Mother; Mobile Health Apps; Pregnant Women; Stunting.

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INTRODUCTION

Growth failure in children or what is often called stunting is one focus global problems, including Indonesia. Stunting is one of the goals Sustainable Development Goals (SDGs). Stunting is a chronic malnutrition problem caused by inadequate nutritional intake over a period of time for quite a long time due to the provision of food that is not in accordance with nutritional needs. Stunting can occur from the fetus still in the womb and only appears when the child is two years old (Ministry of Health of the Republic of Indonesia, 2016). Stunting that occurs if it is not balanced with catch-up growth (catch up) resulting in decreased growth (Frongillo, Leroy, & Lapping, 2019).

Currently, Indonesia is in the process of realizing the second SDG, namely achieving food and nutrition security better, and supports sustainable agriculture. Prevention and handling of stunting is one of them priorities of the Indonesian government in 2025 (Nirmalasari, 2020). Based on the results of the Indonesian Nutrition Status Survey (SSGI), the stunting prevalence rate in Indonesia decreased from 24.4% in 2021 to 21.6% in 2022 (Ministry of Health of the Republic of Indonesia, 2022). This figure is still above the threshold set by the World Health Organization (WHO), namely 20%. In 2022, WHO reports that globally there will be 149.2 million children under 5 years of age who experience stunting, including 45.4 million children with underweight and 38.9 million overweight children. The number of children experiencing stunting has decreased steadily globally, except in Africa. In Southeast Asia and Africa, 51 million children under the age of 5 suffer from it underweight, and 151 million children under the age of 5 are stunted, and three quarters of these children live in Asia and Africa (World Health Organization, 2022).

Stunting reflects growth failure to achieve linear growth potential, which is caused by suboptimal health or chronic malnutrition since in the womb and even before birth (Dewey, & Begum, 2011; Widiastuty, & Harleli, 2021). The results of research in 2017 showed that the prevalence of stunting in toddlers (12–23 months) in Indonesia was 40.4%. Early initiation of breastfeeding and exclusive breastfeeding were found in 42.7% and 19.7% of infants, respectively. Early complementary feeding was found in 68.5% of babies. Multivariate analysis shows that LBW babies are 1.74 times more likely to experience stunting than normal weight babies. Boys are 1.27 times more likely to experience stunting than girls. Babies with a history of neonatal disease are 1.23 times more likely to experience stunting. Poverty is an indirect variable that is significantly related to stunting (Aryastami, Shankar, Kusumawardani, Besral, Jahari, & Achadi, 2017).

The stunting prevalence rate in Demak Regency was ranked seventh highest in Central Java in 2019 at 50.23% and is one of 60 stunting districts. In 2019 in Demak Regency there were 4.25% or 6,129 toddlers out of a total of 97,212 toddlers who had the potential to experience stunting. This situation is a priority for the Demak Regency government to handle by determining 10 locations that will be prioritized in 2020 and 2021. The Demak Regency Government will gradually address stunting in 10 villages, including Bumirejo Village in Karangawen District, three villages in Gajah District, two villages Kembangan in Bonang District, Betahwalang Village in Bonang District, Donorejo Village in Demak District, and Sidomulyo Village in Wonosalam District (Demak District Health Service, 2020). Efforts made to avoid stunting in children are not only through countermeasures for children who are born but also through efforts to prepare pregnant and breastfeeding mothers (Ruaida, 2018).

The use of smartphones provides new possibilities for improving healthcare services. For example, smartphone technology offers platform cost-effective means for distribution of evidence-based health information and behavior change interventions. Smartphones are well suited for implementing patient-centered interventions and improving patient self-management capabilities. The Covid-19 situation has reduced face-to-face interactions, while face-to-face meetings are considered to have many limitations, especially time and distance. Therefore, a solution is needed to continuously monitor patient health. Mobile apps is a software program that runs on smartphones and other mobile devices. Mobile health apps can help people maintain their health, disseminate useful information to others, and remove time and space constraints for patients and health workers (Icenogle,

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[2]Universitas Muhammadiyah Surakarta, Sukoharjo
Corresponding author e-mail: *ngadiyonopoltekesmg@gmail.com

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Steinberg, Duell, Chein, Chang, Chaudhary, & Bacchini, 2019). Therefore, implementing a mobile health application can help health workers monitor patient health even in the Covid-19 situation, as well as under time and place or distance constraints.

RESEARCH METHOD

Research using methods research and development (R&D), this method is used for produce certain products and test the effectiveness of a produ This research was conducted in December 2022, the population in this study is pregnant women in Demak Re ncy. The sample was divided into 24 people into two groups, namely 12 people, the intervention group is the group that is given education about stunting carried out by health workers through direct outreach and monitoring through applications (ASTA). Meanwhile, 12 people in the control group were the group who were given education about stunting by health workers through direct socialization and without monitoring via the application. Both groups given a pre-test and post-test in the form of filling out a questionnaire containin questions related to stunting.

Then the post-test was carried out after 2 weeks of providing education and monitoring. The influencing variable in this research is the Child Stunting Preventive Application (ASTA) and the affected variable is a health-preserving behavior during pregnancy, postpartum and toddlers. Sampling using technique purposive sampling based on inclusion and exclusion criteria. Knowledge assessment qualifications refers to ordinal data, namely, mild if there is no stunting until there is 1 sign of stunting, moderate category if there are 2 to 3 signs of stunting, and the severe category is if there are 4 or more signs of stunting. This research is divided into four stages, the first is planning, namely collecting initial needs data. Data collection was carried out through primary and secondary sources regarding stunting rates in Demak Regency. Data obtained is used as a control to compare the results of data collection with the treatment provided via the application. The second stage is that the data is processed and analyzed to find problems. Analysis related to alternative solutions developed in the form of analysis and model design by developing concepts or comprehensive material about pregnancy, postpartum breastfeeding mothers, and toddlers. Next create design of a digital monitoring and promotion concept that can be applied in monitoring the health promotion of pregnant women and breastfeeding. The third stage is the engineering stage, namely system development which is carried out based on analysis initial needs. The final stage is evaluation in the form of analysis regarding the comparison of primary and secondary data results reducing stunting rates by utilizing this monitoring system. This evaluation stage consists of term aspects short and long term. The short term is carried out by analyzing observations of the birth outcomes of mothers who Get services using the application. Meanwhile, long-term evaluations are carried out when the child is older turning 1 year old.

The instrument in this research is a stunting monitoring application called ASTA. In the application Login page available for mothers and midwives. Pregnant women and midwives will be included in the same group code. This app will be available on google play so it can be downloaded anytime and anywhere. First time to use the application, pregnant women and the health team must register first via sign up. Then the team will create a group code and activate the account. The analysis used is univariate, bivariate with statistical tests Wilcoxon.

This research has been approved by the Semarang Ministry of Health Polytechnic Ethics Committee, decision number: 562/EA/KEPK/2021.

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[1]Poltekkes Kemenkes Semarang, Semarang
[1]niversitas Muhammadiyah Surakarta, Sukoharjo
Corresponding author e-mail: *ngadiyonopolteksmg@gmail.com

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RESEARCH RESULTS

Table 1. Distribution of Participants' Characteristics (N=24)

Variable	Group	
	Control (n=12)	Intervention (n=12)
Mother's Age (Mean±SD)(Range)(Year)	(29.41±4.481)(21-39)	(29.16±4.793)(21-38)
Occupation (n/%)		
Civil servant	1/8.3	5/41.7
Housewife	7/58.3	3/25
Private	4/33.4	4/33.3
Participants Condition (n/%)		
Pregnant	9/75	9/75
Breast-feed	3/25	3/25
Pregnant's Age (Mean±SD)(Range)(Week)	(23.11±6.967)(14-38)	(23.44±9.178)(14-37)
Baby's Age (Mean±SD)(Range)(Month)	(4.33±2.054)(1-7)	(5±2.916)(1-10)
Risk of Stunting(n/%)		
Pre-treatment		
Low	6/50	7/58
Middle	5/42	3/25
High	1/8	2/17
Post-treatment		
Low	10/83	7/58
Middle	2/17	5/42
High	0/0	0/0

Based on Table 1, the average age of mothers in the control group was 29.41 with a standard deviation of 4,481 and an age range of 21 to 39 years, while in the intervention group the average age was 29.16 with a standard deviation of 4,793 and an age range of 21 to 38 years. Participant's profession were divided into three categories, in the control group namely 1 civil servant (8.3%), 7 housewives (58.3%), and 4 entrepreneurs (33.4%). In the intervention group there were 5 civil servants (41.7%), 3 housewives (25%), and 4 entrepreneurs (33.3%). The conditions of the participants in both the control and intervention groups were 9 (75%) pregnant women and 3 (25%) breastfeeding mothers. The average gestational age in the control group was 23.11 with a standard deviation of 6,967 and a range of 14 to 38 weeks, while the average of the intervention group was 23.44 with a standard deviation of 9,178 and a range of 14 to 37 weeks. The average age of babies in the control group was 4.33 with a standard deviation of 2,054 and was in the range of 1 to 7 months, while in the intervention group the average was 5 with a standard deviation of 2,916 and was in the range of 1 to 10 months.

Furthermore, the potential for stunting, in the control group of 12 participants, showed that there was a reduction in the potential for stunting to 83% in mild criteria after being given treatment (post-treatment). The potency score at pre-treatment was 50% mild, 42% moderate, and 8% severe criteria. Meanwhile, the post-treatment results showed that the potential criteria for mild stunting were 83%, moderate criteria were 17%, and

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[1]Poltekkes Kemenkes Semarang, Semarang
[2]Universitas Muhammadiyah Surakarta, Sukoharjo
Corresponding author e-mail: *ngadiyonopolteksmg@gmail.com

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severe criteria were 0%. Meanwhile, in the intervention group there was a stagnation in the percentage of respondents with the criteria for potential mild stunting, namely 58% at both pre-treatment and post-treatment. Meanwhile, there was a reduction in stunting potential in pre-treatment by 25% for mild criteria and 17% for severe criteria to 42% with mild stunting potential.

Table 2. Wilcoxon Test on Knowledge (N=24)

Knowledge	Control (pre-post treatment)			Intervention (pre-post treatment)		
	n	Mean	Sum of rank	n	Mean	Sum of rank
Negative	5[a]	3.00	15.00	2[a]	1.50	3.00
Positive	0[b]	.00	.00	0[b]	.00	.00
Ties	7[c]			10[c]		

The interpretation of the Wilcoxon test results in Table 2 is that in the control group there is a negative difference in the potential for stunting for pre treatment and post-treatment value 5. This indicates that there is a decrease in the potential stunting criteria value from the value pre-treatment to value post-treatment experienced by 5 participants. The positive difference in stunting potential shows a value of 0, which means that of the 12 participants, all of them experienced a decrease in the criteria for potential stunting to lower criteria mild or moderate in terms of criteria values pre-treatment and post-treatment. Ties are similarities in values pre-treatment and post-treatment. The result obtained is 7, so the conclusion that can be drawn is that there are 7 participants with the same criteria or pregnant on pre-treatment and post-treatment. Meanwhile, in the intervention group, the results were a negative difference between pre-treatment and post-treatment related to stunting potential is 2, which means that there are 2 participants whose stunting potential has decreased to lower or medium criteria. Positive difference between pre-treatment and post-treatment. The potential for stunting has a value of 0, meaning that no participant experienced an increase in the potential for stunting with this treatment ASTA app. It can be seen that the ties value is 10, so it can be concluded that there are 10 participants who are in the same criteria pre-treatment and post-treatment.

Table 3. Statistical Test of Stunting Potential

Stunting Potential	Pre-post treatment control	Pre-post treatment intervention
Z	-2.236 [b]	-1.414[b]
Asymp. Sig. (2-tailed)	.025	.157

Based on the statistical test output, it is known that Asymp. Sig. (2-tailed) is worth 0.025. From this value it can be concluded that H_0 rejected. This means that there are differences in the level of potential stunting in the control group participants in terms of the results pre-post treatment. Meanwhile, it is known that in the intervention group the value of Asymp. Sig. (2-tailed) namely 0.157. This value is >0.05, so it can be concluded that H_0 accepted. This means that there is no difference in the level of potential stunting between pre post-treatment in the intervention group who were given the ASTA application.

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[1]Poltekkes Kemenkes Semarang, Semarang
[2]Universitas Muhammadiyah Surakarta, Sukoharjo
Corresponding author e-mail: *ngadiyonopolteksmg@gmail.com

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DISCUSSION

Based on the results of the Wilcoxon statistical test on the level of potential stunting obtained in the control group, there was an influence on the level of potential stunting with a p-value of 0.025 (p<0.05). Meanwhile, in the intervention group, there was no effect of using the ASTA application on the level of potential stunting with a p-value of 0.157 (p > 0.05). These results were obtained with a total of 24 respondents consisting of 12 people in each control and intervention group. However, the prevalence ratio value shows 0.7, which proves that the implementation of ASTA is a protective factor against the potential for stunting. A minimum sample size is required to perform a particular analysis. For example, exploratory factor analysis cannot be performed if the sample size is less than 50, while simple linear regression analysis requires at least 50 samples.

Pearson correlation analysis requires a minimum sample size of 200 people, while the pre-test or pilot study requires a smaller sample size than the main research (Memon, Ting, Cheah, Thurasamy, Chuah, & Cham, 2020). The required sample size for a pilot study is at least 10–24 people or 20–50 people. However, the final decision regarding sample size is based on the time and cost of conducting the field study.

Stunting is a condition where children aged five years and under have a height that is lower than normal height for their age and this often occurs in developing countries today (Mistry, Hossain, & Arora, 2019). Stunting can affect a child's intelligence level and health status when they grow up. Stunting prevention is carried out from the time the baby is in the womb by meeting its nutritional needs (Aprillia, & Siauta, 2022). The role of midwives and health cadres is very important to prevent stunting from an early age. Previous research shows that the role of midwives is 16.7% and cadres are 21.35% influential on maternal behavior in preventing stunting (Wulandari, & Kusumastuti, 2020).The role of cadres is to help prevent stunting by providing education to pregnant women, monitoring nutritional requirements through providing food and vitamins, and improving health in the community. Comprehensive strengthening of cadres can support improving community health status (Huljannah, & Rochmah, 2022; Tampake, Arianty, Mangundap, Emy, & Sasmita, 2021).

Factors regarding the problem of stunting are influenced by many things, such as genetic factors inherited from parents, namely the parents' height and weight. Apart from that, educational factors, food availability at the household level, food consumption patterns, eating patterns, beliefs, traditions, culture, etc (Miko, & Al-Rahmad, 2017).Several research results state that nutritional status is also influenced by parental characteristics, such as maternal and paternal anthropometric measurements, where parental height will increase the risk of growth failure and underweight.

Research conducted in 2016 also revealed the same thing: stunting is the result of complex interactions that occur in the household, environment, socio-economy and culture which are interconnected with each other (De Onis, & Branca, 2016).The main cause of stunting is the economic, political and social crisis that occurs in society, resulting in food shortages, poverty, high inflation rates and unemployment. Meanwhile, the problems that arise in society are the lack of women's empowerment and human resources, low levels of education, knowledge and skills (Leroy, & Frongillo, 2019). The causes of malnutrition in children are directly influenced by food intake and health. Indirectly, this is caused by many factors, such as parenting patterns, family characteristics, food accessibility, health services and basic health.

The problem of stunting is a health case that attracts global attention, especially in developing countries. Indonesia is a country with a high prevalence of stunting compared to other developing countries. Stunting deserves great attention because it is associated with an increased risk of disease, less than optimal brain development, delays in motor development, mental growth and death. Several studies show the risks associated with stunting include decreased academic achievement, increased risk of obesity, increased vulnerability to non-communicable diseases, and increased risk of degenerative diseases (Suparmi, Rizkianti, Maisya, & Saptarini, 2018). The difficulty in identifying physical stunting is due to the fact that short stature is common in society so it is often considered

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[1]Poltekkes Kemenkes Semarang, Semarang
[2]Universitas Muhammadiyah Surakarta, Sukoharjo
Corresponding author e-mail: *ngadiyonopoltekesmg@gmail.com

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normal. The lack of routine assessment of linear growth in primary health care also explains why it takes so long to recognize stunted children. The problem of stunting in developing countries like Indonesia will become a public health problem that must be addressed seriously and continuously to ensure community growth (Beal, Tumilowicz, Sutrisna, Izwardy, & Neufeld, 2018).

Media coverage such as leaflets for counseling has also been proven to increase knowledge regarding stunting in pregnant women (Munthe, 2021). However, counseling is just written information without any real action, which will only have an effect in a short period of time (Veiga, Pereira, Amaral, Ferreira, & Correia, 2015). A mother's poor level of knowledge will result in a higher risk of malnutrition compared to mothers who have a good level of nutritional knowledge. Nutrition education programs to prevent stunting in the form of counseling have not been effective. This happens because the counseling carried out is still monologue or one-way communication. Monologue learning does not involve respondents or the community directly in the learning process. Counseling should be carried out as an active process between pregnant women and instructors or midwives (Lipoeto, & Khomsan, 2019). The ultimate goal of counseling is to shape people's behavior for the better so that it has a long-term effect to reduce the potential for stunting in the future.

The impact of Covid-19 has caused the number of stunted children in Indonesia to increase significantly. This is because the Covid-19 pandemic has had a major impact on the economy of the lower middle class, where many people have lost their jobs, making it difficult to meet their nutritional needs. A decrease in global gross domestic product (GDP) of 1% resulted in an increase in the stunting rate of 0.7 million children in the world (Friska, & Andriani, 2022). Stunting prevention is carried out from the time of pregnancy with the main aim of increasing nutritional intake. One of the government's effort to protect the health of mothers and children is by publishing the book Maternal and Child Health (MCH). The MCH book contains health material about pregnancy, childbirth and the postpartum period, as well as other important information to maintain the health of mothers and children, however the use of MCH books in practice is still low. Based on basic health research in 2018, it shows that only 60% of mothers have a MCH book, 30% do not have a MCH book, and 10% cannot show a MCH book. Meanwhile, 60% of mothers who have MCH books have not fully optimized them properly (Ministry of Health of the Republic of Indonesia, 2018).

Smartphone has become a communication tool and information medium that will continue to motivate health-based applications. Utilization smartphone as a medium of information through health applications mobile is an innovation in the field of health services (Feroz, Jabeen, & Saleem, 2020). This solution can provide more optimal services and reduce the imbalance in the ratio of demand and health services due to limited health workers (Liu, Lu, Zhao, Li, & Shi, 2022).Mobile health apps can provide services that can be accessed without space and time limitations. A dynamic relationship between health workers and the community can be formed through the availability of mobile health applications that have the potential to improve health quality (Schaaf, Warthin, Freedman, & Topp, 2020).In this case, using the ASTA application makes it easier for pregnant women to stay in touch with midwives without space and time limitations. Apart from that, pregnant women can still carry out health maintenance during pregnancy accompanied by a midwife. So it has the potential to increase the knowledge and actions of pregnant women to carry out health matters written in the MCH book and provide antenatal care (ANC).

Increasing knowledge and understanding of stunting must be carried out at all levels of society, including health workers, government, parents and students. Monitoring a child's growth and development is very important to detect growth and development disorders early on. One way is to take advantage of current applications and technological advances. Number of user's smartphone in Indonesia facilitates the implementation of health education through various platform and social media services to obtain information about stunting. It is hoped that health education through applications in the form of videos and explanations can prevent stunting. In Indonesia, currently many young people are researching and developing digital applications for stunting. This research is a development of

Ngadiyono[1]*, Suparmi[1], Ulfah Musdalifah[1], Izzatul Arifah[2]

[1]Poltekkes Kemenkes Semarang, Semarang
[2]Universitas Muhammadiyah Surakarta, Sukoharjo
Corresponding author e-mail: *ngadiyonopoltekesmg@gmail.com

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research on an Android-based stunting monitoring and mapping application. So thatit is hoped that it can foster good cooperation, especially between the government and the community in implementing stunting prevention (Selviyanti, Roziqin, Putra, & Noor, 2022).

The results of research on the application of ASTA did not have a significant effect. Even though there was a reduction in the risk of potential stunting, in the control group and intervention group there were no respondents who had the potential to experience severe stunting. All respondents were in the position of moderate and mild stunting (5 people in the intervention group were moderate, 7 people were mild, and in the control group 2 people were moderate, 10 people were mild). However, there were still respondents who did not experience a reduction in stunting rates (in the intervention group there were 3 respondents who still had the potential to experience moderate stunting, and in the control group there was 1 respondent who still had the potential to experience moderate stunting). This can be caused by several factors, one of which is the level of compliance. Level of compliance in carrying out checklist health, one of which is not regularly consuming blood supplement tablets to prevent anemia. As a result of this level of compliance, health checklists are reduced and incomplete. The role of cadres is very important so that they can contribute to encouraging pregnant women to pay attention to the importance of taking blood tablets to maintain the health of the mother and fetus.

Frequent ANC for pregnant women has the potential to reduce stunting rates, another factor is also age. Age is an indicator that can reflect a person's maturity in making decisions (Icenogle et al., 2019). Age can influence positive actions to prepare for a healthy and normal birth of a baby. People tend to be more compliant with ANC and think about taking health measures for the health of the mother and baby. According to the results of previous research, women aged 35–49 years have a better level of compliance than young pregnant women (15–24 years) in consuming blood supplement tablets. This is possible because pregnant women at that age already have experience and learning that consuming blood supplement tablets is important for pregnant women (Taye, Abeje, & Mekonen, 2015). Other research also proves that women over 35 years have good stunting behavior and this is supported by their level of education and employment. Apart from that, the next factor is family support which makes pregnant women feel calmer and less anxious, especially support from their husbands (Salamung, Haryanto, & Sustini, 2019). This too supported by other research that the family has an influence of 19.66% on the behavior of pregnant women to prevent stunting and a more important factor is the motivation of pregnant women to prevent stunting. Based on research in 2020, the direct influence of pregnant women's motivation to prevent stunting was 80.84%, and the indirect influence was 23.13%. The motivation of pregnant women to prevent stunting is related to behavioral control in the aspect of perceived strength, namely feelings and emotional bonds with the child that the child is the most important part for the mother and feelings of not wanting the child to experience stunting (Wulandari, & Kusumastuti, 2020).

CONCLUSION

There is no significant effect of using the ASTA application on the criteria for potential stunting and there is no significant difference in potential stunting data between the control and intervention groups, either before or after treatment. However, the stunting prevalence ratio is 0.7 (<1) indicating that the ASTA application is a factor that can reduce the potential for stunting.

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[1]Poltekkes Kemenkes Semarang, Semarang
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Ngadiyono[1]*, Suparmi[1], Ulfah Musdalifah[1], Izzatul Arifah[2]

[1]Poltekkes Kemenkes Semarang, Semarang
[2]Universitas Muhammadiyah Surakarta, Sukoharjo
Corresponding author e-mail: *ngadiyonopolteksmg@gmail.com

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Ngadiyono[1]*, Suparmi[1], Ulfah Musdalifah[1], Izzatul Arifah[2]

[1]Poltekkes Kemenkes Semarang, Semarang
[2]Universitas Muhammadiyah Surakarta, Sukoharjo
Corresponding author e-mail: *ngadiyonopolteksmg@gmail.com

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