

# The effect of nutrition and reproductive health education intervention on pregnant women in reducing stunting in Indonesia: A-quasi experimental study

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## Research Article

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# Abstract

**Background:** Almost one-third of children under five suffer from stunting in Indonesia. Stunting can be prevented optimally since the period of pregnancy as the initial phase of the first 1000 days of life. This study aims to determine the effect of nutrition education and reproductive health on pregnant women in Bogor Regency, Indonesia.

**Methods:** A quasi-experimental study was conducted among 194 pregnant women from August to November 2019. The pregnant women were randomly selected from two different villages that were the stunting locus in Bogor Regency. The intervention group (n=97) received two hours of nutrition and reproductive health education in small groups (4-5 mothers per group) every two weeks for three consecutive months. This interactive education had been given by a facilitator using some techniques such as role-playing, lectures, simulation, and games. The control group (n=97) were to obtain regular health care services. A structured questionnaire was applied to collect data consisting of maternal characteristics, nutritional and reproductive health knowledge, attitudes, and practices in the intervention and control groups. Data were analyzed using t-test and chi-square analysis.

**Results:** Pregnant women in the intervention group indicate a significant increase in knowledge, attitudes, and practices regarding nutrition and health reproductive after being given an education. The pretest and posttest mean scores in the intervention group were 55.1 and 83.1; 40.2 and 49.0; and 36.2 and 40.2, for the overall mother's knowledge, attitudes, and practices, respectively. Whereas in the control group, there was no significance between the pretest and posttest mean for these three variables. There was a significant difference ( $p < 0.05$ ) in the posttest mean between the intervention group and the control group, but the difference was not significant ( $p > 0.05$ ) at the pretest.

**Conclusion:** Providing nutrition and reproductive health education through small groups with interactive methods improves the knowledge, attitudes, and practices of pregnant women. This intervention has the potential to be replicated and developed into large-scale implementation by optimizing collaboration between government, non-governmental organizations, and maternal and child health service providers.

## Introduction

Reducing stunting is part of the Sustainable Development Goals (SDGs) [1]. In many countries, interventions to reduce stunting have been carried out since the pregnancy period [2, 3]. Poor maternal reproductive health and nutrition during pregnancy has lifelong impacts on the health of the offspring [4]. Furthermore, inadequate infant and child feeding practices, repeated infection, and inadequate psychosocial stimulation in the first 1,000 days of a child's life strongly contribute to stunted growth and development [5, 6]. Stunting reflects shortness-for-age, is a well-established risk marker of growth failure, and is measured by a height-for-age z-score of more than 2 standard deviations below the World Health Organization (WHO) Child Growth Standards median [7]. This chronic malnutrition is related to many indices of functional impairment, including cognitive and physical development, metabolic disorders that

an increased risk of degenerative diseases, and socio-emotional development [8–11]. These serious health problems have an impact on the high health care costs of a country, therefore effective prevention is needed in reducing its prevalence [12].

World Health Organization (WHO) reported that stunting is declining too slowly from 32.4% in 2000 to 21.3% in 2019. which of the three regions stunting affects 1 in every 3 children [13, 14]. The slow progress of stunting is also happening in Indonesia in the last five years, from 37.2–30.8% [15]. The stunting rate is relatively high based on WHO categories of public health significance for stunting (30–39%)[16]. The incidence of stunting in this country is influenced by many factors consisting of characteristics of children (sex of the child, breastfeeding status, early initiation of breastfeeding, infectious diseases particularly diarrhea and acute respiratory infections, birthweight), household characteristics (family size and structure including mother education and her knowledge about nutrition and reproductive health, household and housing characteristics, and healthcare services, and community (environmental level characteristics) [4, 17–19]. According to these previous studies, harmoniously shows that maternal characteristics (health, nutrition, and, socio-demography) significantly influence the occurrence of stunting among children under five. In general, these studies recommended early integrated interventions to reduce stunting in Indonesia, one of them is through effective education to improve the knowledge, attitudes, and practices of pregnant women regarding nutrition and reproductive health using multi-sectorial approaches. Other scientific evidence shows that more than one-third of mothers do not yet know about stunting, so health promotion and education to improve mothers' knowledge, attitude and practices need to be done [20].

The strategy to improve the mother's knowledge, attitude, and practices regarding nutrition and reproductive health have consistently contributed to reducing child stunting in Indonesia [20, 21]. Most of the mothers in this country are the primary caregivers for their babies and decide on feeding patterns, immunization, and health services [4, 17]. Therefore, educational methods as an intervention to improve the mother's knowledge, attitudes, and practices have been carried out based on the theory of changes behavior [22, 23]. Research about Knowledge, Attitude, and Behavior (KAB) has been able to assess the success of an educational method by applying a pre-test and post-test research design such as a quasi-experimental or randomized trial [23]. The interactions between knowledge, attitude, and behavior initiate a potentially reciprocal and dynamic relationship. The mother's knowledge regarding nutrition and reproductive health can inform her attitude about that topic, and how that attitude can influence her behavior [23]. The improvement of these aspects is very important to do during the pregnancy period to determine the next quality of life for the mother and her babies. One of the scientific evidence that is the success of early breastfeeding initiation and exclusive breastfeeding can be determined by the intention of mothers to breastfeed since the period of pregnancy [24–26].

Therefore, the purpose of this study was to assess the effectiveness of nutrition education and reproductive health on pregnant women in improving the mother's knowledge, attitudes, and practices regarding nutrition and reproductive health in Bogor District, in West Java Province, where the stunting rate in this province (about 31%) is higher than the national stunting prevalence [27]. The preliminary

studies in this region showed there are 29.7% of children were stunted (19% stunting and 10.7% severe stunting). This study used interactive education methods that cover 3 topics namely parenting, balanced diet and immunization, and reproductive health. Furthermore, each topic was given by different techniques, namely through role-playing, exercises, and, fun games which are supported by interesting props. Thus, the government and other health care providers can adopt or modify this educational method as an effort to reduce the prevalence of stunting early on.

## Methods

### Study Area and Period

The study was conducted in Bogor regency from August to November 2019. The district is demographically located close to the National Capital as the center of government, services, and trade, with fairly high development activities. The estimated population in this district reaches 5,715,009 people and occupies the highest rank in West Java Province. Of this amount, there are 49% of the female population, where the estimated number of pregnant women is 40,896 pregnant women.

Bogor District consists of 40 sub-districts with various types of regional morphology, namely the lowlands and highlands. Most of the population is poorly educated and in general, the residents' livelihoods in this district work as entrepreneurs, private employees/employees, and laborers, while the majority of mothers are housewives. Moreover, most mothers are the primary caregivers in childcare [28].

### Design and Samples

A quasi-experimental with the two group's pretest-posttest design was conducted on pregnant women. The source population in this study were all pregnant women in Bogor District which are the focus locations for stunting consisting of 10 villages. Meanwhile, pregnant women selected from the four villages were the study population.

### Inclusion and Exclusion Criteria

Pregnant women who lived at least 6 months in these villages were included in this study because it was related to homogeneity in access to information exposure and health services regarding nutrition and reproductive health. Another inclusion criterion is the mother's maximum gestational age of 27 weeks (end of the second trimester) so that this intervention can be used as early prevention of stunting before the delivery period. Meanwhile, the exclusion criteria were mothers who had been confirmed or diagnosed with serious health problems requiring a special diet and nutritional needs, as well as premature delivery during the data collection period.

### Sample Size Determination

The sample size was calculated using a sample size for the two-sample test of proportions formulas with a one-sided alternative hypothesis, using the following assumptions: 95% confidence level, 82.6% of pregnant women whose improved knowledge regarding appropriate dietary practice after being given nutrition education in the intervention group ( $P_1$ ), and 47.8% of pregnant women whose improved

knowledge regarding appropriate dietary practice without nutrition education in the control group ( $P_2$ ) based on previous study [29], 90% power, 10% contingency for loss to follow-up was added, and design effect 2. The calculated sample size was 97 pregnant women for the intervention group and the control group respectively, therefore the total sample was 194 pregnant women.

### **Sampling Technique and Procedure**

The sampling procedure is illustrated in Fig. 1. Pregnant women living in four selected villages as stunting location focus from 10 villages in Bogor District identified from The Bogor District Health Office data, and also recommended as priority areas for intervention. Furthermore, all eligible pregnant women were included in this study, and participants were selected by the simple random sampling method.

### **Data collection and measurements**

This study consists of three stages, namely: 1) instrument development, 2) training for facilitators and, 3) nutrition and reproductive health education intervention on a pregnant woman (Fig. 2). The following are the stages of this study:

#### **1. Instrument development**

A Focus Group Discussion (FGD) was conducted to develop a research instrument including leaflet, module, and questionnaire involving stakeholders, community leaders, cadres, and pregnant women. After that, nutrition and reproductive health expert judgment was carried out on the research instruments to fulfill the evidence based on the test content. This study also uses 'nutrition discs' that are educational tools developed and produced by Pergizi Pangan Indonesia (Indonesian Nutrition and Food Expert Association), which is an organization of nutrition and food experts. Furthermore, the facilitator uses the leaflet, module, and nutrition discs to educate pregnant women in the intervention group. The structured questionnaire was applied to collect data on the intervention group and the control group. Maternal socio-demographic characteristics, and other information such as obstetric history, nutrition, and reproductive health, and utilization of health services were collected only at baseline. Whereas knowledge, attitude, and practices regarding nutritional and reproductive health were collected both at baseline and end line by using 23, 16, and 12 questions, respectively. For knowledge, participants choose one of the four answer choices (A, B, C, or D), then were given a score = 1 if the answer is correct, and the score = 0 if the answer is wrong. Items of attitude measured using a four-point Likert scale (strongly disagree = 1; through strongly agree = 4). Then, the value of each Likert scale assessed by the participants for each question was summed and calculated the average. Similarly, items of practices regarding nutrition and health reproductive were collected using a four-point Likert scale (never = 1; through most of the time = 4). Then, each item was summed to get an overall score and calculated the average score.

#### **2. Training on facilitators**

The facilitators were cadres or community health workers that work in their local communities who give health education to the pregnant woman in the intervention group. They were given training about the health educational skills method and knowledge regarding nutritional and reproductive health. A pretest-

posttest was applied to ensure the homogeneity of the facilitators' skills and knowledge. All facilitators had appropriate socio-demographics' characteristics. They are entirely housewives with low socioeconomic levels and served as a cadre for at least one year.

### **3. The nutrition and health reproductive education intervention on pregnant women in the intervention group.**

Nutrition and health reproductive education only given for the intervention group. They were grouped into small groups (4–5 mothers per group) that received two hours of nutrition and reproductive health education from a facilitator every two weeks for three consecutive months. The education consists of three sessions that include theoretical (lectures) and practical sessions regarding: (1) parenting (psycho-emotional and nutrition parenting) that complemented by role-playing; (2) Balance diet, immunity, and stunting. The education was reinforced by the simulation to assess nutritional status and nutritional requirements for the first 1000 days of life. In this section, the facilitator uses nutrition discs, which are tools designed in two packages, namely: one packet consisting of 8 nutrition discs which function to determine the nutritional status of children based on age groups, and one other packet consists of 8 nutrition discs which made for mothers pregnant in knowing the gestational age and meeting the needs of balanced nutrition from the gestational period, aged 0–72 months period until adolescence (19 years); and (3) Health reproductive education, equipped with the games of myths and facts. While for the control group, nutrition education was given by cadres based on the general usual nutrition and reproductive health education that is provided in the health program regularly every month. In this routine health program, the pregnant women are informed about maternal and child health includes nutrition and health reproductive, measure the child's weight and height, and given primary immunizations.

#### **Quality Assurance Of Data Collection**

Four women nutritionists and two public health practitioners received as data collectors and supervisors have given two days of training. The questionnaire was pre-tested on five percent of the representative sample assessed in other areas with characteristics approaching the study area. Data collectors administered the questionnaire through face-to-face interviews at the pregnant women's homes and were controlled by supervisors periodically. All questionnaires were verified for completeness and accuracy by data collectors.

#### **Data Processing And Analysis**

All data in the questionnaire were checked for missing values, included maternal characteristics and knowledge, attitudes, and practices. Furthermore, data were coded and inputted using SPSS version 20.0. Variables with continuous data, including knowledge, attitudes, and practices score, were analyzed for normality using the Kolmogorov–Smirnov test. Descriptive statistics consisting of the mean, standard deviation, and percentage analyzed by univariate analysis. While variables with categorical data were analyzed using the Chi-square test. A 95% confidence level and a value with  $P < 0.05$  were used to assess the statistical significance. Independent t-test was used to see significant differences in pretest and

posttest scores between groups in the intervention group and control group and paired t-test for continuous variables within groups at pretest and posttest

## **Ethical consideration**

Ethics Commission of Health Research of the Faculty of Medicine and Health in Universitas Muhammadiyah Jakarta acceded this study with approval number 001/PE/KE/FKK-UMJ/2019. The Government in Bogor District and each village as the study area has obtained permission. The Health office of Bogor district, the national population and family planning board, and community health centers where the villages are located also approved this study. The comfort of pregnant women while being a participant is the main thing in the data collection process, and the confidentiality of their identity was well guarded.

## **Results**

### **Maternal Characteristics**

Maternal characteristics include socio-demographic characteristics, and obstetric history, information on nutrition and reproductive health, and utilization of health services represented in **Table 1**. A total of 194 pregnant women have participated (97 in each group).

#### ***a. Socio-demographic characteristics***

Most of the participants belonged to the reproductive age (19-35 years) category. Of 97 participants in each group, about 86.6% and 83.5% of participants were within the age range of 19-35 years in the intervention group (IG) and control group (CG), respectively. One-third of participants in each group had short stature (height <150 cm), as much as 33.0% in IG and 28.9% in CG. Almost all participants were housewives in both IG (95.9%) and CG (94.8%). Nearly half of participants have graduated from elementary school, as much as 45.4% in IG and 42.3% in CG. Similarly, with a mother's education, most of the fathers have had an elementary education level in both the IG (79.4%) and CG (70.1%). Family income in two groups in the range  $\geq$  of 1500000-3000000, as much as 59.8% and 62.9% for the IG and CG group, severally. Father and mother make decisions related to health problems together, in both the IG (85.6%) and CG (84.5%). Other than that, most of the participants are the original population, both in the IG (78.4%) and CG (79.4%).

#### ***b. Obstetric history, information on nutrition and reproductive health, and utilization of health services***

Of 194 participants, most of them have health insurance provided by the government that is about 68.0% and 71.1% in the IG and CG group, respectively (**Table 1**). The majority of participants are multigravida (has been pregnant 2-4 times), that is 68.0% (IG), and 69.1% (CG) for each group. Two-thirds of them have been received information about nutrition and health reproductive both in the IG (69.1%) and CG (67.0%). They obtained general information on antenatal care, at least once in the trimester of pregnancy. Commonly, before the current pregnancy, they used hormonal contraceptive methods such as

injection and pills, about 44.4% and 26.8%; and 45.4% and 24.7% for the IG and CG, sequentially. Nevertheless, there are still more than a third of participants who gave birth at home for her last child for both groups. About 35.1% and 30.9% of them were delivered by traditional birth attendance for the IG and CG, respectively.

### Effect of Nutrition and reproductive health interventions

**Table 2** presented that the overall mean nutritional and reproductive knowledge scores were highly significantly improved ( $P < 0.001$ ) from 55.1 to 83.1 of IG. The paired t-test indicated that there was a highly significant difference ( $P < 0.05$ ) between pretest and posttest in IG. Similarly, the overall mean attitude score was a significant difference between pretest and posttest ( $P < 0.05$ ), which is from 40.2 to 49.0 in IG. The highest attitude score was an increase in nutritional parenting form (3.4) from 10.2 to 13.8 and the lowest in reproductive health (2.4) from 7.8 to 10.2. The paired t-test also represented that there increased overall mean practices score in IG ( $P < 0.05$ ), which is from 36.2 to 40.2. The independent test indicated that there was a significant difference in all aspects consisting of knowledge, attitude, and practices in the posttest between IG and CG ( $P < 0.05$ ), but there was no significant difference at pretest ( $P > 0.05$ )

### Nutrition and reproductive health knowledge of Pregnant Women

The knowledge of parenting consists of psycho-emotional parenting and nutritional parenting. In psycho-emotional parenting knowledge, almost all of the participants (93.8%) in the IG knew the consequences of not providing psycho-emotional parenting since the pregnancy period towards the growth and development of the baby at the posttest (**Table 3**). While in the nutritional parenting knowledge, almost 100% of participants knew about the dietary source of macronutrients and micronutrients rich foods for babies more than six months old that is 95.9% and 96.9%, respectively. There was a significant difference between pretest and posttest in IG ( $P < 0.001$ ) for each question in this aspect. The participant's knowledge of nutrition during pregnancy, stunting, and immunity improved after education. Almost 100% of participants (92.8%) knew the dietary source of macronutrients rich foods (92.8%), understanding of stunting such as sign and symptom (94.8%), and the benefits of immunization in childcare (92.8%). Similarly, their reproductive health knowledge also improves at the posttest. As much as 92.8% of participants knew the benefits of antenatal care for maternal and babies' health. The paired t-test indicated that nutrition and reproductive health knowledge of participants were highly significantly ( $P < 0.001$ ) increased after education in IG, but no significant difference in CG ( $P > 0.05$ ) in all questions.

## Discussion

The failure of fetal growth in the pregnancy period is significantly related to stunted child growth [30]. Pregnant women have central plays in achieve optimal growth since this critical period [4, 30]. Of 194 pregnant women who participated in this study have a high risk of having stunted children, generally. They live in rural areas with low socioeconomic levels that are related to a lack of food availability in the household [31, 32]. Another study among pregnant women in rural Punjab showed that education and

parity were associated with knowledge, attitude, and dietary practices significantly [33, 34]. World Health Organization (WHO) reported that mothers with low income and a low level of education experience more difficulty affording adequate food that will provide a nutritious and diverse diet [35]. The findings of this study also indicate that about one-third of them (33.0% and 28.9% in IG and CG, respectively) also have a short stature (less than 150 cm), which is at risk of having stunted children [36–38]. A 19-year-old woman with a height less than – 2 standard deviation (SD) (less than 150 cm) had short stature according to WHO provision [39]. Javid and Pu were showed the Pakistan Demographic and Health Survey of 2012–13 that short stature mothers (height less than 150 cm) were about 2.0 times more likely to have a stunted child compared to tall stature mothers [37]. They also have not utilized health services optimally. More than a third of participants who have given birth delivered their babies at home and helped by traditional birth attendants. They did not receive adequate health care in the early life of the baby as a crucial stage associated with pregnancy outcomes. This condition indicates a low quality of maternal health care, which may significantly affect child stunting [40, 41].

The knowledge, attitude, and practices regarding nutrition and reproductive health are the main factors that can influence pregnancy outcomes [42, 43]. The finding of this study indicates that participants have a lack of knowledge, attitude, and practices regarding nutrition and reproductive at baseline. In this study, the knowledge, attitudes, and practices mean were highly significantly ( $P < 0.001$ ) improve after education in the IG. In the CG, there was no significant difference ( $P > 0.05$ ) improvement mean of knowledge, attitude, and practices regarding nutrition and health reproductive between pretest and posttest. This study also proves that education intervention effectively provides a significant ( $P < 0.05$ ) difference between the mean knowledge, attitude, and practices between the IG and CG at the end line. About 82.1 and 55.9, 49.0 and 40.5, and 40.2 and 36.3, respectively of the IG and CG between pretest and posttest. Similarly, a cluster randomized control trial study among pregnant women in Northeast Ethiopia shows that nutrition education improved significantly ( $P < 0.001$ ) mean nutritional knowledge in the intervention group, about 6.9 at baseline to 13.4 after nutrition education. There was a significant difference ( $P < 0.001$ ) in mean nutritional knowledge between the intervention group and control group at baseline. The study also shows that proportion of healthy dietary practices significantly different ( $P < 0.001$ ) between pregnant women who were given nutrition education in the intervention group compared to the control group at the end line [29]. A study among pregnant women in Addis Adaba shows that nutrition knowledge improved after the nutrition education program from 53.9–97.0%, whereas dietary practice during pregnancy increased from 46.8–83.7% [44]. These studies reinforce the evidence that nutrition education has a positive effect in improving the knowledge, attitude, and practices of pregnant women.

Nutrition and health reproductive education is a specific intervention in The Global Nutrition target in 2025 [7] to reach the target of 40% reduction in the number of children under-5 who stunted. This intervention can be delivered effectively through community health workers who have a high potential to improve maternal and child health among the hard-to-reach population, particularly in rural areas [13]. A study in Bangladesh shows that maternal counseling using a framework of essential health care (EHC) can improve knowledge and dietary practices on child feeding to reduce the stunting prevalence effectively [2]. The study in West Gojjam Zone, Ethiopia, shows that pregnant women who had given

nutrition education are 2.02 times more likely to improve their dietary practices than those who have not given nutrition education [45]. Furthermore, the proper knowledge and the dietary practices simultaneously influence gestational weight gain, degrade the risk of anemia in the last trimester of pregnancy, improved the baby's birth weight, and reduce the risk of preterm birth [46]. This study strengthens scientific evidence that nutrition and reproductive health education during pregnancy improved the knowledge, attitude, and practices of pregnant women, which contribute to increased maternal and neonatal health and reduce childhood stunting [29, 30, 47, 48].

Nutrition and reproductive health knowledge on pregnant women that related to stunting improved significantly by education intervention [29, 40]. A formative research study conducted in 10 provinces in Indonesia which implemented the National Nutrition Communication Campaign (NNCC) showed that only 2.1% of 3150 mothers had known about stunting, and about two-thirds of them assumed that stunting was caused by heredity [20]. Nevertheless, a study among childbearing age women in Lagos State, Nigeria, reported that 61.89% and 86.89% of them had accomplished knowledge and positive attitude regarding nutrition, respectively [48]. The finding of this study shows that the number of participants who answered correctly for all questions increased significantly ( $P < 0.001$ ) in IG. In parenting knowledge, almost 100% of participants knew the ways to improve '*bonding*' between mothers, fetus, and fathers during pregnancy (90.7%), and the consequences of not providing psycho-emotional parenting since pregnancy period towards the baby's growth and development (93.8%). A previous study shows that maternal depression is associated with child stunting, psychological and intellectual development. The lack of psycho-emotional parenting since the pregnancy period weakens 'mother-child' attachment that affects the nutritional status and development of children [49, 50]. In nutrition parenting, almost 100% of participants correctly answered the question about the timing of complementary feeding for babies (93.8%), a dietary source of macronutrients rich foods for babies > 6 months old (95.9%), and dietary source of micronutrients rich foods for babies > 6 months old 96.9%. Mistry et al. show that maternal counseling is associated with improving feeding practices in the early life of a child, which decreased stunting prevalence significantly [2]. The participants improved their knowledge about nutrition during pregnancy, stunting, and immunity after education. Most of the participants knew about: a balanced diet (85.6%), the benefit of a balanced diet during pregnancy for fetus and mother (84.55%), the dietary source of macronutrients rich foods (92.8%), understood about stunting (94.8%), synergetic effect of nutrition and infection towards stunting (82.5%), and the benefits of immunization in childcare (92.8%). A study in Dissie Town, Northeast, Ethiopia, shows that the number of participants who answered correctly increased after nutrition education. Almost all of the participants knew about a balanced diet (95.7%), the benefit of a balanced diet for fetus and mother (89.9%), and the synergetic effect between nutrition and infection (97.1%). Also, all participants (100%) knew about the dietary source of macronutrients and micronutrients rich foods [29]. Generally, the increase in the number of participants who answered correctly in Dissie Town is higher than in this study. The participants live in urban areas, so they get better access to health facilities. They also have a higher socioeconomic status, for example, education, occupation, family income. Other than that, this finding study also shows that the number of participants who answered correctly in reproductive health knowledge. As much as 92.8% of participants knew the

benefits of antenatal care for maternal and baby health after education. Similarly, a quasi-experimental study in Brebes District, Central Java in Indonesia, shows that reproductive health education improved the knowledge among brides and grooms [51]. Another evidence in Somalia shows that they have a lack of knowledge about reproductive health that confirmed the need for proper nutrition education [52]. Reproductive health during the pregnancy period is fundamental to ensuring all women have access to respectful and high-quality maternity care to increase maternal health and pregnancy outcomes [53].

This study contributes to increasing intensive nutrition and reproductive health education efforts implemented for the wider community. These provide scientific evidence as consideration for policymakers, researchers, program practitioners and implementers, non-governmental organizations, health workers, community health workers, and the entire community to increase knowledge, attitudes, and practices regarding nutrition and reproductive health to reduce the prevalence of stunting from 27.7–14% in 2024 as the national target in Indonesia, and achieved The Global Nutrition target in 2025 to reach the target of 40% reduction in the number of children under-5 who stunted.

## **Conclusion**

Nutrition and reproductive health education intervention by optimizing the role of community health workers as agents of behavior change is effective in improving knowledge, attitude, and practices regarding nutrition and reproductive health on pregnant women in the study area. The pregnant women had good knowledge, attitudes, and practices regarding psycho-emotional parenting, nutrition parenting, nutrition during pregnancy, stunting, and immunity, also about reproductive health were strategic effort to accelerate prevalence of stunting reduction in the early 1000-day period of life.

## **Recommendations**

Cross-sectoral cooperation, especially collaboration between the health office and the National Population and Family Planning Agency, and optimization of community empowerment are needed to strengthen education on nutrition and reproductive health of pregnant women sustainably. The education methods also need to be adapted to the local culture, for helping community health workers to carry out health promotion and readily accepted by pregnant women to accelerate the improvement of knowledge, attitudes, and practices regarding nutrition and reproductive health. Also, the process of continuous supervising by health workers, such as midwives, nutritionists, public health workers, or other health practitioners, so that nutrition and reproductive health education programs continued until the first two years of a baby's life, as a critical period of infant growth and development in preventing stunting.

## **Declarations**

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### **Authors' contributions**

TAEP: have study ideas, drafting, and design research, perform statistical analysis and interpretation of results, and drafting a manuscript. The author review and approved the manuscript. FRA: compiling and designed the study, perform statistical analysis and interpretation of the results, and prepare the manuscript. The author reviews and approved the manuscript. WKS: drafting and designed the study, conduct statistical analysis and interpretation of results, drafting a manuscript. The author review and approved the manuscript. IIS: compiling and design research, perform statistical analysis and interpretation of the results, and prepare the manuscript. The author reviews and approved the manuscript. ZHW: compiling and designed the study, perform statistical analysis and interpretation of the results, and prepare the manuscript. The author reviews and approved the manuscript.

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### **Data of availability and materials**

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

### **Ethics approval and consent to participate**

Ethical approval obtained from the Ethics Commission of Health Research of the Faculty of Medicine and Health in Universitas Muhammadiyah Jakarta acceded this study with approval number 001/PE/KE/FKK-UMJ/2019. Also, the government in Bogor District and each village as the study area has obtained permission. Informed consent is ensured by the study participants. Confidentiality was maintained throughout the study by excluding personal identifiers from the data collection form. The pregnant women during data collection were also given priority during the data collection period. In this study the authors confirmed that all methods were carried out in accordance with the relevant guidelines and regulations (**Declaration of Helsinki**).

### **Consent for publication**

Not applicable.

## Competing interests

The authors declare that they have no competing interests

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## References

1. Organization, W.H., *Reducing stunting in children: equity considerations for achieving the global nutrition targets 2025*. 2018.
2. Mistry, S.K., M.B. Hossain, and A. Arora, *Maternal nutrition counselling is associated with reduced stunting prevalence and improved feeding practices in early childhood: a post-program comparison study*. Nutrition journal, 2019. **18**(1): p. 47.
3. Dhaded, S.M., et al., *Preconception nutrition intervention improved birth length and reduced stunting and wasting in newborns in South Asia: The Women First Randomized Controlled Trial*. Plos one, 2020. **15**(1): p. e0218960.
4. Titaley, C.R., et al., *Determinants of the stunting of children under two years old in Indonesia: A multilevel analysis of the 2013 Indonesia Basic Health Survey*. Nutrients, 2019. **11**(5): p. 1106.
5. Uwiringiyimana, V., et al., *Predictors of stunting with particular focus on complementary feeding practices: a cross-sectional study in the northern province of Rwanda*. Nutrition, 2019. **60**: p. 11-18.
6. Millward, D.J., *Nutrition, infection and stunting: the roles of deficiencies of individual nutrients and foods, and of inflammation, as determinants of reduced linear growth of children*. Nutrition research reviews, 2017. **30**(1): p. 50.
7. Gordon J R and M.C. J, *What's at stake*. Can Pharm J, 1989. **122**(2): p. 74-78.
8. Alam, M.A., et al., *Impact of early-onset persistent stunting on cognitive development at 5 years of age: Results from a multi-country cohort study*. PloS one, 2020. **15**(1): p. e0227839.
9. Sanou, A.S., et al., *Association between stunting and neuro-psychological outcomes among children in Burkina Faso, West Africa*. Child and adolescent psychiatry and mental health, 2018. **12**(1): p. 30.
10. De Lucia Rolfe, E., et al., *Associations of stunting in early childhood with cardiometabolic risk factors in adulthood*. PloS one, 2018. **13**(4): p. e0192196.
11. Walker, S.P., et al., *Early childhood stunting is associated with poor psychological functioning in late adolescence and effects are reduced by psychosocial stimulation*. The Journal of nutrition, 2007. **137**(11): p. 2464-2469.

12. Hoddinott, J., et al., *The economic rationale for investing in stunting reduction*. Maternal & child nutrition, 2013. **9**: p. 69-82.
13. WHO, U. and C. Mathers, *Global strategy for women's, children's and adolescents' health (2016-2030)*. Organization, 2016.
14. Data, U., *Malnutrition in Children*, UNICEF, Editor. 2020.
15. Data, P., *Situasi dan Analisis ASI Eksklusif*, in *Jakarta: Kemenkes, K.K. RI*, Editor. 2014.
16. Lele, U., et al., *Measuring food and nutrition security: An independent technical assessment and user's guide for existing indicators*. Food Security Information Network, 2016.
17. Torlesse, H., et al., *Determinants of stunting in Indonesian children: evidence from a cross-sectional survey indicate a prominent role for the water, sanitation and hygiene sector in stunting reduction*. BMC public health, 2016. **16**(1): p. 669.
18. Beal, T., et al., *A review of child stunting determinants in Indonesia*. Maternal & child nutrition, 2018. **14**(4): p. e12617.
19. Khan, S., S. Zaheer, and N.F. Safdar, *Determinants of stunting, underweight and wasting among children < 5 years of age: evidence from 2012-2013 Pakistan demographic and health survey*. BMC Public Health, 2019. **19**(1): p. 358.
20. Hall, C., et al., *Maternal knowledge of stunting in rural Indonesia*. International Journal of Child Health and Nutrition, 2018. **7**(4): p. 139-145.
21. Simanjuntak, B.Y., et al., *Maternal Knowledge, Attitude, and Practices about Traditional Food Feeding with Stunting and Wasting of Toddlers in Farmer Families*. Kesmas: National Public Health Journal, 2019. **14**(2): p. 58-64.
22. Mahmudiono, T., et al., *The Effectiveness of Nutrition Education for Overweight/Obese Mother with Stunted Children (NEO-MOM) in Reducing the Double Burden of Malnutrition*. nutrients, 2018. **10**(12): p. 1910.
23. Schrader, P. and K.A. Lawless, *The knowledge, attitudes, & behaviors approach how to evaluate performance and learning in complex environments*. Performance Improvement, 2004. **43**(9): p. 8-15.
24. Permatasari, T.A.E., et al., *Exclusive breastfeeding intention among pregnant women*. Kesmas: National Public Health Journal, 2018. **12**(3): p. 134-141.
25. Permatasari, T.A.E. and A. Syafruddin, *Early initiation of breastfeeding related to exclusive breastfeeding and breastfeeding duration in rural and urban areas in Subang, West Java, Indonesia*. Journal of Health Research, 2016. **30**(5): p. 337-345.
26. Permatasari, T.A.E., et al., *Does Breastfeeding Intention Among Pregnant Mothers Associated with Early Initiation of Breastfeeding?* Indonesian Journal of Reproductive Health, 2016. **7**(3): p. 169-184.
27. Kementerian Kesehatan, R.I., *Hasil Utama Riset Kesehatan Dasar*, B.P.d. Pengembangan, Editor. 2018, Kementerian Kesehatan Republik Indonesia: Jakarta.
28. Dinas Kesehatan, P.J.B., *Profil Kesehatan Dinas Kesehatan Provinsi Jawa Barat*, D. Kesehatan, Editor. 2017, Provinsi Jawa Barat: Bandung.

29. Diddana, T.Z., et al., *Effect of nutrition education based on health belief model on nutritional knowledge and dietary practice of pregnant women in Dessie Town, Northeast Ethiopia: A cluster randomized control trial*. Journal of Nutrition and Metabolism, 2018. **2018**.
30. Vir, S.C., *Improving women's nutrition imperative for rapid reduction of childhood stunting in South Asia: coupling of nutrition specific interventions with nutrition sensitive measures essential*. Maternal & child nutrition, 2016. **12**: p. 72-90.
31. Jonah, C.M., W.C. Sambu, and J.D. May, *A comparative analysis of socioeconomic inequities in stunting: a case of three middle-income African countries*. Archives of Public Health, 2018. **76**(1): p. 77.
32. Nshimiyiryo, A., et al., *Risk factors for stunting among children under five years: a cross-sectional population-based study in Rwanda using the 2015 Demographic and Health Survey*. BMC public health, 2019. **19**(1): p. 1-10.
33. Malkanthi, R.L.D.K., K.D.R.R. Silva, and U.K. Jayasinghe-Mudalige, *Risk factors associated with high prevalence of anemia among children under 5 years of age in paddy-farming households in Sri Lanka*. Food and Nutrition Bulletin, 2010. **31**(4): p. 475-482.
34. S, S.T. and D. SS, *Knowledge, attitude, practice and determining factors regarding nutrition during pregnancy among females of rural Punjab*. Int J Community Med Public Health, 2019. **6**(7): p. 2874.
35. Organization, W.H., *Reducing Stunting*, W.H. Organization, Editor. 2018.
36. Sinha, B., et al., *Low-birthweight infants born to short-stature mothers are at additional risk of stunting and poor growth velocity: Evidence from secondary data analyses*. Maternal & child nutrition, 2018. **14**(1): p. e12504.
37. Javid, N. and C. Pu, *Maternal stature, maternal education and child growth in Pakistan: a cross-sectional study*. AIMS Public Health, 2020. **7**(2): p. 380.
38. Addo, O.Y., et al., *Maternal height and child growth patterns*. The Journal of pediatrics, 2013. **163**(2): p. 549-554. e1.
39. Group, W.M.G.R.S. and M. de Onis, *WHO Child Growth Standards based on length/height, weight and age*. Acta paediatrica, 2006. **95**: p. 76-85.
40. Beake, S., et al., *Interventions for women who have a caesarean birth to increase uptake and duration of breastfeeding: A systematic review*. Maternal & child nutrition, 2017. **13**(4): p. e12390.
41. Wong, K.L., et al., *Socioeconomic inequalities in skilled birth attendance and child stunting in selected low and middle income countries: Wealth quintiles or deciles?* PloS one, 2017. **12**(5): p. e0174823.
42. Hitachi, M., et al., *Correlates of exclusive breastfeeding practices in rural and urban Niger: a community-based cross-sectional study*. International breastfeeding journal, 2019. **14**(1): p. 32.
43. Garg, R., et al., *Breastfeeding knowledge and practices among rural women of Punjab, India: a community-based study*. Breastfeeding Medicine, 2010. **5**(6): p. 303-307.

44. Mugyia, A.S.N., et al., *Knowledge and attitudes of pregnant mothers towards maternal dietary practices during pregnancy at the Etoug-Ebe Baptist Hospital Yaounde*. Health sciences and disease, 2016. **17**(2).
45. Demilew, Y.M., G.D. Alene, and T. Belachew, *Effect of guided counseling on dietary practices of pregnant women in West Gojjam Zone, Ethiopia*. Plos one, 2020. **15**(5): p. e0233429.
46. Girard, A.W. and O. Olude, *Nutrition education and counselling provided during pregnancy: effects on maternal, neonatal and child health outcomes*. Paediatric and perinatal epidemiology, 2012. **26**: p. 191-204.
47. Svefors, P., et al., *Relative importance of prenatal and postnatal determinants of stunting: data mining approaches to the MINIMat cohort, Bangladesh*. BMJ open, 2019. **9**(8): p. e025154.
48. Dewey, K.G., *Reducing stunting by improving maternal, infant and young child nutrition in regions such as South Asia: evidence, challenges and opportunities*. Maternal & Child Nutrition, 2016. **12**: p. 27-38.
49. Hagan, O.C., et al., *Impact of universal childhood vaccination against hepatitis B in Ghana: A pilot study*. Journal of public health in Africa, 2018. **9**(2).
50. Rondó, P., et al., *Maternal stress and distress and child nutritional status*. European journal of clinical nutrition, 2013. **67**(4): p. 348-352.
51. Wemakor, A. and K.A. Mensah, *Association between maternal depression and child stunting in Northern Ghana: a cross-sectional study*. BMC public health, 2016. **16**(1): p. 869.
52. Nugraheni, S.A., et al., *Knowledge and attitudes about reproductive health and pregnancy preparedness: preliminary study of brides and grooms in Brebes district, Central Java, Indonesia*. 2018.
53. Gure, F., M. Yusuf, and A.M. Foster, *Exploring Somali women's reproductive health knowledge and experiences: results from focus group discussions in Mogadishu*. Reproductive health matters, 2015. **23**(46): p. 136-144.

## Tables

**Table 1**

Maternal characteristics between intervention and control groups in two areas of community health centers in Bogor District ( $n_1=n_2 = 97$ )

Variables	Frequencies and Percentages				p-value
	Intervention Group		Control Group		
	n	%	n	%	
<b>A. Socio-demographic Characteristics</b>					
<b>Age</b>					
19-25 years	41	42.3	36	37.1	0.53
26-35 years	43	44.3	45	46.4	
>35 years	13	13.4	16	16.5	
<b>Mother's height</b>					
<150 cm	32	33.0	28	28.9	0.058
150-160 cm	63	64.9	59	60.8	
>160 cm	2	2.1	10	10.3	
<b>Mother's education level</b>					
Elementary School ( $\leq 6$ years)	44	45.4	41	42.3	0.51
Junior High School (7-9 years)	38	39.1	39	40.2	
Senior High School (9-12 years)	15	15.5	14	14.4	
College (>12 years)	0	0.0	3	3.1	
<b>Mother's occupation</b>					
Housewife	93	95.9	92	94.8	0.39
Working Mothers	4	4.1	3	3.1	
<b>Father's education</b>					
Elementary School ( $\leq 6$ years)	77	79.4	68	70.1	0.48
Junior High School (7-9 years)	18	18.6	25	25.8	
Senior High School (9-12 years)	1	1.0	1	1.0	
College (>12 years)	1	1.0	3	3.1	
<b>Father's occupation</b>					
Entrepreneur	26	26.8	21	21.7	0.64
Private employees	10	10.3	14	14.4	
Government employees	1	1.0	0	0.0	
Labour	49	50.5	53	54.6	
Others	11	11.3	9	9.3	
<b>Family income</b>					
< 1500000 (IDR)	19	19.6	20	20.6	0.19
$\geq 1500000$ -3000000 (IDR)	58	59.8	61	62.9	
>3000000 (IDR)	20	20.6	16	16.5	
<b>The decision maker in the household</b>					
Father	8	8.2	10	10.3	0.32
Mother	6	6.2	5	5.2	
Father and Mother	83	85.6	82	84.5	
<b>Residence status</b>					
Original population	76	78.4	77	79.4	0.72
Migrants	21	21.6	20	20.6	

<b>B. Obstetric History, Information of Nutrition and Reproductive Health, and Utilization of Health Services</b>					
<b>Health insurance</b>					
No	31	32.0	28	28.9	0.34
Yes	66	68.0	69	71.1	
<b>Parity</b>					
Primigravida (pregnant for the first time)	27	27.9	20	20.6	0.26
Multigravida (has been pregnant 2-4 times)	66	68.0	67	69.1	
Grande multigravida (has been pregnant ≥5 times)	4	4.1	10	10.3	
<b>Exposure to nutrition and health Reproductive</b>					
No	30	30.9	32	33.0	0.43
Yes	67	69.1	65	67.0	
<b>Contraceptive methods (before the current pregnancy)</b>					
Do not use any method of contraception	21	21.7	20	20.6	0.39
Natural birth control	4	4.1	5	5.2	
Injection	43	44.3	44	45.4	
Pills	26	26.8	24	24.7	
Others contraception (IUD/Vaginal ring/condoms)	3	3.1	4	4.1	
<b>Place of Delivery (the last childbirth)</b>					
Have never been pregnant before	27	27.8	20	20.6	0.09
At home	35	36.1	35	36.1	
Health facilities (birth center/hospital)	35	36.1	42	43.3	
<b>Birth Attendants (the last childbirth)</b>					
Have never been pregnant before	27	27.8	20	20.6	0.31
Traditional birth attendant (TBA)	34	35.1	30	30.9	
Skilled birth attendants (doctor, nurse, midwife)	36	37.1	47	48.5	

**Table 2**

Effects of nutrition and reproductive health interventions on the knowledge, attitudes, and practices of pregnant women ( $n_1=n_2 = 97$ )

Variables	Group	Research Period (Mean Score±SD)		P-value <sup>a</sup>
		Pre-test	Post-test	
<b>Knowledge parenting</b>				
• Psycho-emotional parenting (5 items)	Intervention	53.4±3.8	83.1±5.3	<0.001
	Control	53.2±6.2	53.8±5.7	0.78
	P-value <sup>b</sup>	0.96	<0.001	
• nutritional parenting (5 items)	Intervention	62.1±5.4	86.6±4.8	<0.001
	Control	62.4±4.3	62.9±3.9	0.51
	P-value <sup>b</sup>	0.42	<0.001	
<i>Nutrition during pregnancy, stunting and immunity (8 items)</i>	Intervention	54.9±4.4	85.0±2.6	<0.001
	Control	55.3±3.5	56.0±3.8	0.28
	P-value <sup>b</sup>	0.65	<0.001	
<i>Reproductive health (5 items)</i>	Intervention	49.9±3.7	77.5±5.6	<0.001
	Control	50.1±4.2	50.9±4.8	0.31
	P-value <sup>b</sup>	0.89	<0.001	
Overall knowledge score (23 items, multiple choice questions))	Intervention	55.1±4.6	83.1±5.2	<0.001
	Control	55.3±4.2	55.9±3.4	0.26
	P-value <sup>b</sup>	0.72	<0.001	
<b>Attitude parenting</b>				
• psycho-emotional parenting (4 items)	Intervention	9.6±1.7	12.8±2.9	<0.001
	Control	9.3±4.4	9.5±3.4	0.22
	P-value <sup>b</sup>	0.49	<0.001	
• nutritional parenting (4 items)	Intervention	10.2±6.1	13.6±4.4	<0.001
	Control	10.6±4.8	10.8±3.2	0.67
	P-value <sup>b</sup>	0.35	<0.001	
<i>Nutrition during pregnancy, stunting and immunity (4 items)</i>	Intervention	9.6±3.6	12.2±2.8	<0.001
	Control	9.7±3.4	9.8±3.6	0.49
	P-value <sup>b</sup>	0.54	<0.001	
<i>Reproductive health (4 items)</i>	Intervention	7.8±4.9	10.2±2.7	0.003
	Control	7.5±5.5	7.5±4.8	0.98
	P-value <sup>b</sup>	0.46	<0.001	
Overall Attitude score (16 items, 4 point likert scale)	Intervention	40.2±4.2	49.0±4.5	<0.001
	Control	40.1±3.8	40.5±5.2	0.25
	P-value <sup>b</sup>	0.82	<0.001	
<b>Practices</b>				
Psychoemotional parenting during pregnancy (4 items)	Intervention	9.0±3.6	12.2±6.7	<0.001
	Control	8.8±4.7	9.0±4.6	0.62
	P-value <sup>b</sup>	0.66	<0.001	
Dietary practices (4 items)	Intervention	9.2±5.2	12.9±4.2	<0.001
	Control	9.1±3.9	9.4±3.6	0.29
	P-value <sup>b</sup>	0.78	<0.001	
Reproductive Health (4items)	Intervention	7.4±4.1	10.4±5.4	0.010
	Control	7.2±6.4	7.4±3.1	0.46
	P-value <sup>b</sup>	0.58	0.002	
Overall practices score (12 items, 4 point likert scale)	Intervention	36.2±4.3	40.2 ±4.9	<0.001
	Control	36.0±6.2	36.3±6.8	0.33
	P-value <sup>b</sup>	0.45	<0.001	

a = paired t-test; b = independent t-test

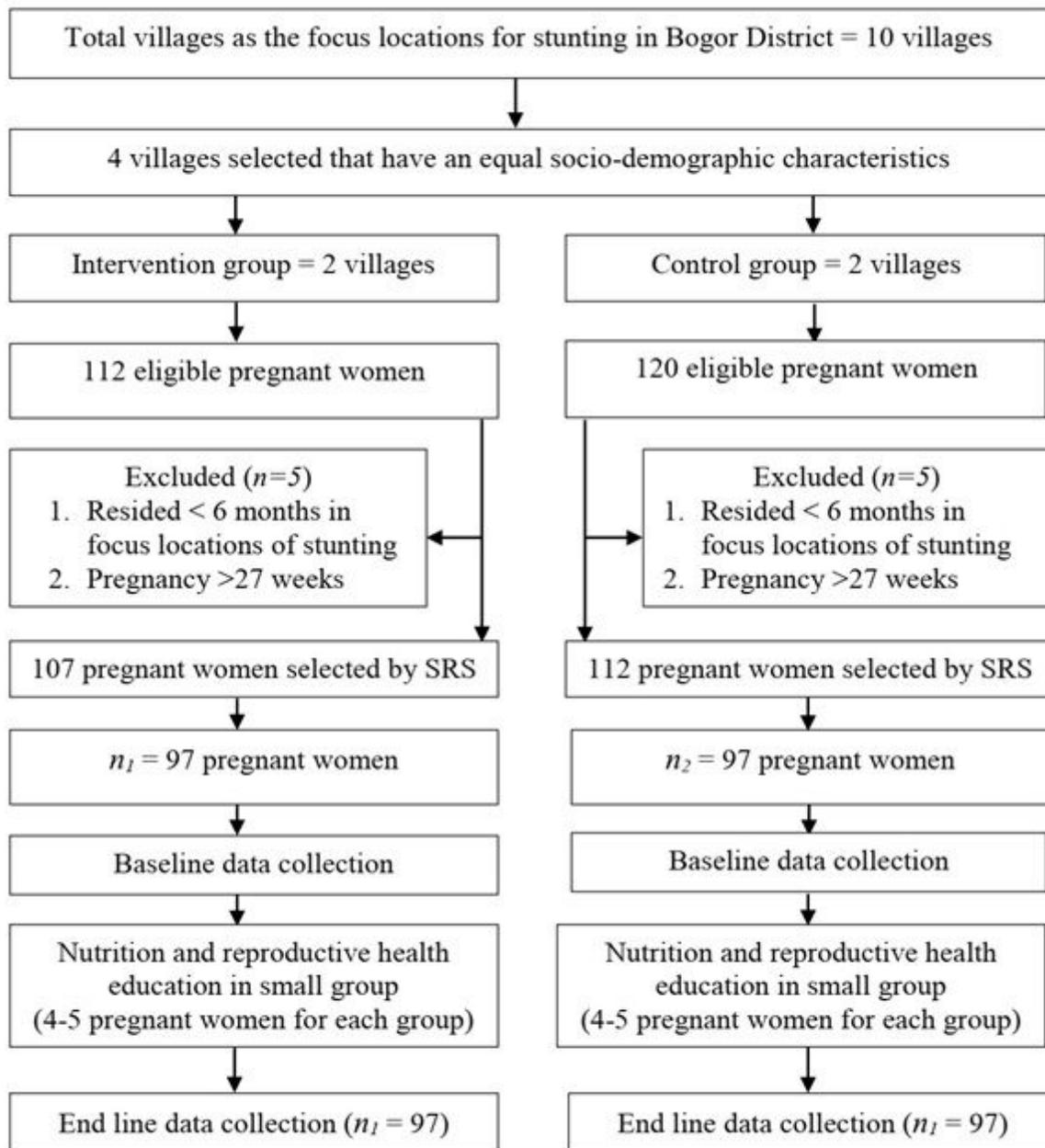
**Table 3**

Nutrition and reproductive health knowledge of the pregnant women in intervention and control Group ( $n_1=n_2 = 97$ )

Knowledge Variables	Research Period	Correct Answer (Frequencies and Percentages)		P-value
		Intervention Group	Control Group	
<b><i>Parenting</i></b>				
<b>• Psycho-emotional parenting</b>				
The benefits of psycho-emotional parenting during pregnancy for fetus and mother	Pre-test	45(46.4)	44(45.4)	0.68
	Post-test	75(77.3)	44(45.4)	<0.001
Appropriate practice of psycho-emotional parenting during feeding period	Pre-test	34(35.1)	36(37.1)	0.24
	Post-test	73(75.3)	37(38.1)	<0.001
Ways to improve ' <i>bonding</i> ' between mothers, fetus, and fathers during pregnancy	Pre-test	60(61.9)	59(60.8)	0.74
	Post-test	88(90.7)	60(61.9)	<0.001
The benefits of exclusive breastfeeding towards the baby's psycho-emotional development	Pre-test	50(51.5)	50(51.5)	0.98
	Post-test	76(78.4)	50(51.5)	<0.001
The consequences of not providing psycho-emotional parenting since pregnancy period towards the babies' growth and development	Pre-test	70(72.2)	69(71.1)	0.84
	Post-test	91(93.8)	70(72.2)	<0.001
<b>• Nutritional parenting</b>				
The best nutrition source for babies 0-6 months	Pre-test	40(41.2)	42(43.3)	0.37
	Post-test	72(74.2)	43(44.3)	<0.001
Timing of complementary feeding for babies	Pre-test	76(78.4)	75(77.3)	0.69
	Post-test	91(93.8)	75(77.3)	<0.001
Dietary source of macronutrients rich foods for babies >6 months old	Pre-test	77(79.4)	77(79.3)	0.007
	Post-test	93(95.9)	78(80.4)	0.009
Dietary source of micronutrients rich foods for babies >6 months old	Pre-test	78(80.4)	78(80.4)	0.98
	Post-test	94(96.9)	78(80.4)	0.001
Appropriate food processing techniques according to the stages of the baby's age	Pre-test	30(30.9)	31(31.9)	0.85
	Post-test	70(72.2)	31(31.9)	<0.001
<b><i>Nutrition during pregnancy, stunting, and Immunity</i></b>				
Understanding of balanced diet	Pre-test	55(56.7)	57(58.8)	0.26
	Post-test	83(85.6)	58(59.8)	<0.001
The benefit of a balanced diet during pregnancy for fetus and mother	Pre-test	57(58.8)	56(57.7)	0.39
	Post-test	82(84.5)	58(59.8)	<0.001
Dietary source of macronutrients rich foods	Pre-test	60(61.9)	59(60.8)	0.28
	Post-test	90(92.8)	60(61.9)	<0.001
Dietary source of	Pre-test		60(61.9)	0.47

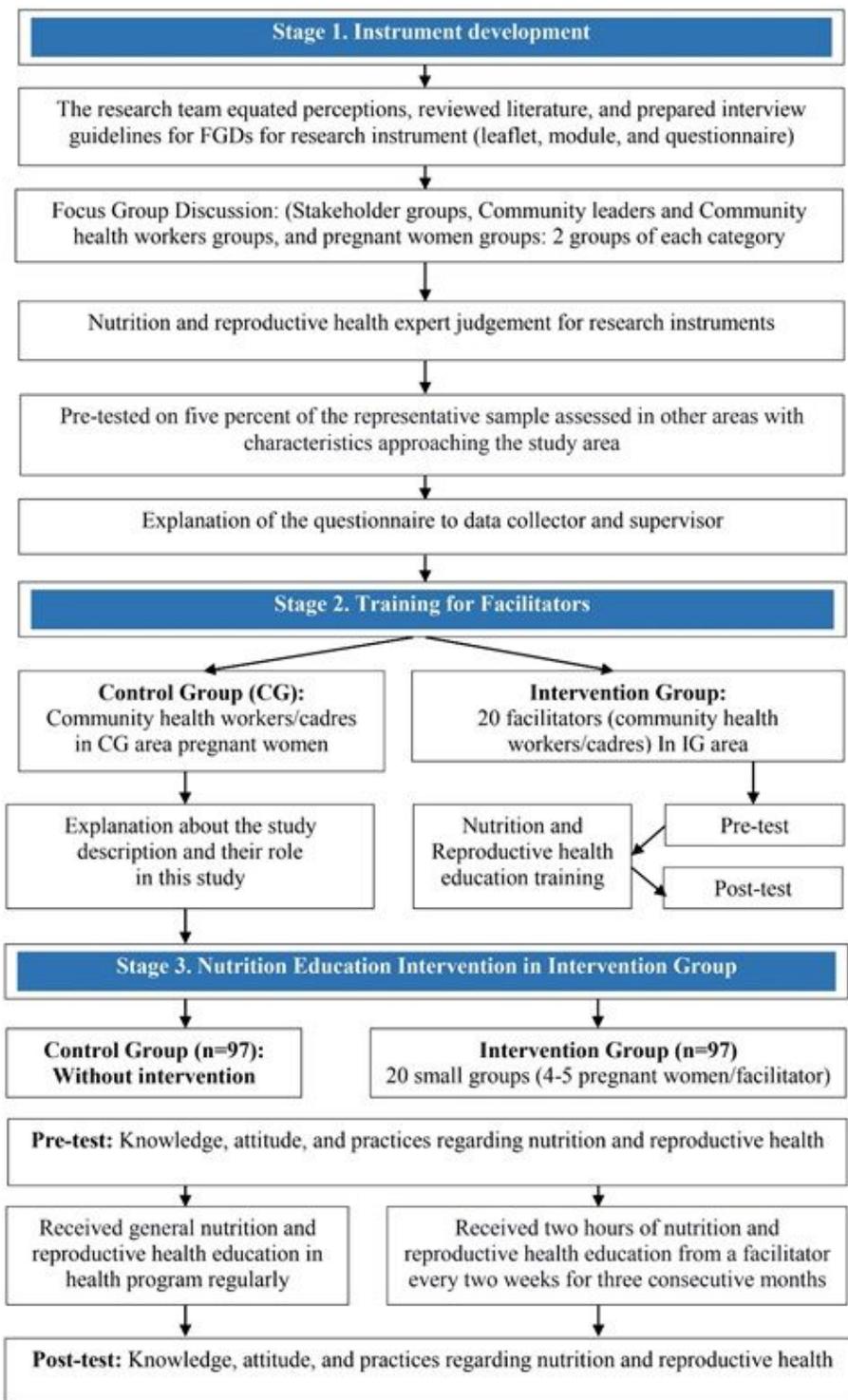
micronutrients rich foods		59(60.8)		
	Post-test		61(62.9)	<0.001
Understanding of stunting	Pre-test	82(84.5)		0.75
	Post-test	58(59.8)	57(58.8)	<0.001
Long-term consequences of stunting in early life	Pre-test	90(94.8)		0.14
	Post-test	45(46.4)	48(49.5)	<0.001
Synergetic effect of nutrition and infection towards stunting	Pre-test	79(81.4)		0.42
	Post-test	41(42.3)	40(41.2)	<0.001
benefits of immunization in childcare	Pre-test	80(82.5)		0.56
	Post-test	67(69.1)	66(68.0)	<0.001
<b><i>Reproductive Health</i></b>				
Benefits of family planning for maternal and babies health	Pre-test	46(47.4)		0.35
	Post-test	78(80.4)	48(49.5)	<0.001
Appropriate contraception method for postpartum mothers	Pre-test	21(21.7)		0.44
	Post-test	75(78.4)	22(22.7)	<0.001
Benefits of antenatal care for maternal and babies health	Pre-test	70(72.2)		0.52
	Post-test	90(92.8)	71(73.2)	<0.001
Appropriate breast healthcare practice during pregnancy and lactation period	Pre-test	53(54.6)		0.12
	Post-test	77(79.4)	51(52.6)	<0.001
Appropriate women's reproductive (sexual health/reproductive organs hygiene) healthcare practice	Pre-test	52(53.6)		0.26
	Post-test	79(81.4)	54(55.7)	<0.001

## Figures



**Figure 1**

Sampling procedure of pregnant women. SRS=Simple Random Sampling;  $n_1$  = sample size for intervention group;  $n_2$  = sample size for control group



**Figure 1**

The stages of data collection and measurements