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THE ROLE OF ANTENATAL CARE AND ULTRASOUND ON STUNTING DETECTION: NARRATIVE REVIEW

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ABSTRACT

Stunting is one of the health problems in the world that causes developmental disorders through decreased physical, mental and social abilities. Many factors influence the incidence ofstunting, such as Intrauterine Growth Retardation (IUGR), premature birth, Low Birth Length (LBL), LowBirth Weight (LBW), and a history of maternal pregnancies such as mothers with malnutrition and the low frequency of Antenatal Care (ANC) attendance. The process of becoming stunted has started since theintrauterine period, therefore stunting prevention can be done since pregnancy. This study uses the Narrative Review method. Literature review through Pubmed NCBI, Science Direct, and Springer Linkdatabases. The keywords used are "Antenatal care and stunting" AND "Antenatal ultrasonography and stunting".The criteria for articles in this study are full text, free access, research articles, review articles, in English,population and samples of pregnant women who carry out antenatal care and antenatal ultrasound examinations, and the publication period of the last 10 years (2012-2022). We found 7 articles which discusses about this. High ANC coverage is needed to optimize maternal health and nutrition as well as intrauterine fetal growth. Antenatal Ultrasonography (USG) has proven useful by enabling early detection of problems such as IUGR, increasing the accuracy of gestational age assessment which will assist management in cases of suspected preterm birth, and being a positive predictor of parent-infant interaction which can promote healthy fetal development. High ANC coverage and regular antenatal ultrasound examinations can detect and reduce the incidence of stunting.

Keywords: Antenatal Care, Antenatal Ultrasonography, Stunting

Introduction

Stunting is a health problem in the world, especially in poor and developing countries. Stunting is a poor predictor of the quality of human resources in a country [1]. Stunting causes developmental disorders through decreased physical, mental and social abilities which will reduce the competitiveness of the nation's children. The global stunting rate will reach 22% by 2020 [2]. In Southeast Asia the incidence of stunting reached the second highest percentage in the Asia region in 2020, amounting to 27.4% [3]. In Indonesia in 2017 stunting at the age of 0-23 months was 20.1% and for ages 0-59 months it was 29.1% [4]. Ministry of Health report on Basic Health Research 2018 presentation of stunting in children reached 30.8% [5]. In 2021 the percentage of stunting incidents will decrease to around 28% and is targeted to be 14% in 2024 [6].

Stunting is a form of growth failure (growth faltering) due to accumulation of inadequate nutrition that lasts for a long time from pregnancy to the age of 24 months [7]. Many factors influence the incidence of stunting in Indonesia. The first study showed that low birth length (LBL)

was a factor associated with stunting [8], [9], [10]. The next study on the Analysis of Risk Factors for Stunting in Toddlers (0-59 Months) in Developing Countries, Southeast Asia, and Indonesia showed that Low Birth Weight (LBW) had a significant influence on stunting [11]; [12]; [9]; [10]. Another study regarding the determinants of stunting from prenatal and postnatal factors showed that children with a birth weight <2,500 g and were born prematurely had the possibility of experiencing stunting later in life [13]. The next study is about the Determinants of Stunting in Toddlers where the history of the mother's pregnancy, for example, mothers with a history of stunting, giving birth to children with LBW, poor nutritional status during pregnancy has a significant effect on the incidence of stunting [14], as well as in studies regarding the relationship between maternal factors and the incidence of stunting in children (24-59 months) [15].

Intrauterine Growth Retardation (IUGR) and premature birth are strongly associated with stunting in children in Indonesia. In a secondary analysis of data collected between 1995 and 1999 in RCTs in rural Indonesia, IUGR and preterm birth were associated with stunting at 24 months of age. Children aged less than 24-59 months tend to grow well if at birth they weigh between 2500-4000 grams, compared to children born weighing <2500 grams. Furthermore Birth Weight (BBL) and Birth Length (PBL) are the strongest negative predictors of height and positive predictors of linear growth in infants 0-12 months [16]. A longitudinal study also shows that it is difficult for babies with LBW to reach normal weight when they reach one year of age and it is difficult to catch up with growth in later childhood [17]. Next, the Balitbangkes Child Growth and Development Cohort Study has successfully followed and analyzed 220 pregnant women until delivery, a multivariate analysis was carried out regarding the factors that influence infant PBL. This study shows that the condition of the mother during pregnancy greatly influences the growth of the fetus she contains, which in turn affects the body length of the baby who will be born later. It can be said that pregnant women who do not do pregnancy checks and are malnourished will be at risk of giving birth to babies with sub-optimal body lengths [18]. It can be concluded that efforts to detect fetal growth disorders as an effort to keep babies born normally are very important, so that nutritional status in the future will be better [19].

Methods

This study uses the Narrative Review method with a qualitative descriptive approach. The protocolused is PRISMA flowchart diagram. While the literature search strategy used in this research is to analyzethe inclusion and exclusion criteria that have been determined based on the language, article types, population and sample, outcome, and year of publication.

Table 1. Inclusion and Exclusion Criteria

Criteria	Inclusion	Exclusion
Language	English	Indonesia, French, Spanish, Russian, Chinese Arabic
Article Types	Full text, research article, and review article	Abstract article; paid article; books, conference papers, protocols
Population andsample	Pregnant women who carry out both antenatal care and antenatal ultrasound examinations	Pregnant women who just carry out antenatal care not antenatal ultrasound examinations
Outcome	Antenatal care and antenatal ultrasound results	Not aiming to fulfill antenatal care and antenatal ultrasound examinations
Publication Year	Last 10 years (2012-2022)	More than last 10 years

This study uses electronic databases, namely Pubmed NCBI, ScienceDirect, and Springer Link. The keywords used in English are "Antenatal care and stunting" AND "Antenatal ultrasonography and stunting". The data obtained were extracted manually and analyzed descriptively.

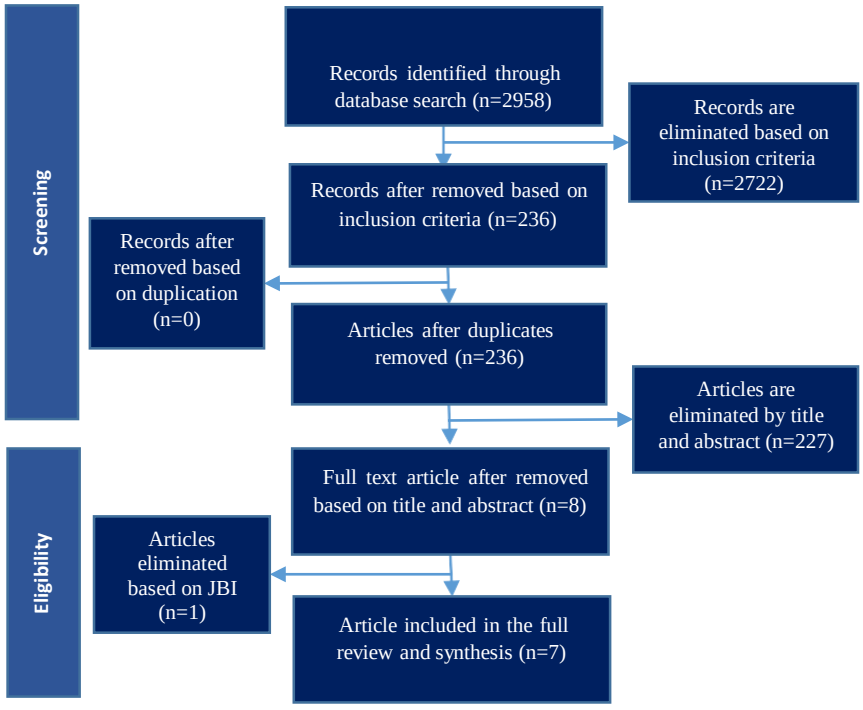

Figure 1. Prisma Flow Diagram

Results

The number of articles obtained from the search is 2958 articles. After adjusting to the inclusion criteria, 236 articles were obtained. Further duplication was done and the remaining 236 articles. Then after checking the title and abstract, 8 articles were obtained but only 7 articles obtained in the full review and synthesis. All articles describe the fulfillment of antenatal care and antenatal ultrasound examinations. Theresults of the analysis will be presented in the following table (Table 2):

Table 1. Extraction Data

Author and Year	Design	Sample	Result
C. Lees et al, 2013	Cohort outcomes for a prospective multicenter randomized	Women with a singleton fetus at 26–32 weeks of gestation, Abdominal Circumference (AC) <10th percentile and umbilical artery Doppler pulsatilityindex >95th percentile.	Five-hundred and three of 542 eligible women formed the study group. Mean ± SD gestational age at diagnosis was 29 ± 1.6 weeks and mean ± SD estimated fetal weight was 881 ± 217 g; 12 (2.4%) babies died in utero. Gestational age at delivery was 30.7 ± 2.3 weeks, and birth weight was 1013 ± 321 g. Overall, 81% of deliveries were indicated by fetal condition and 97% were by Cesarean section. Of 491 liveborn babies, outcomes were available for 490 amongst whom there were 27 (5.5%) deaths and 118 (24%) babies suffered severe morbidity. These babies were smaller at birth (867 ±251 g) and born earlier (29.6 ± 2.0 weeks).
Julia Unterscheider et al, 2014	The Prospective Observational Trial	1,200 ultrasound - dated singleton IUGRpregnancies	Of 1,116 non-anomalous singleton infants with EFW <10th centile, 6 resulted in perinatal deaths including 3 stillbirths and 3 early neonatal deaths. Perinatal deaths occurred between 24+6 and 35+0 weeks gestation corresponding to birthweights ranging from 460 to 2260 grams.
Jens Henrichs et al, 2016	Cluster Randomized Trial	15,000 women with a singleton pregnancy receiving care in 60participating primary care midwifery practices will be included at 22 weeks of gestation	Sensitive measures to detect IUGR during late pregnancy and subsequent adequate clinical management of IUGR are important to decrease perinatal mortality and morbidity. 1) a major spin-off of the IRIS study is the development of a consensus-based multidisciplinary protocol for the detection and management of IUGR. This protocol can be used as starting point for the development of a multidisciplinary guideline for prenatal care of IUGR in the Netherlands. 2) As recommended in the recent Cochrane review by Bricker et al. (2015), the current study extends previous work by investigating the impact of routine third trimester ultrasound screening on maternal prenatal and postnatal psychological functioning and on long-term offspring neurodevelopmental outcome. 3) We will identify pregnant women's and professionals ethical dilemmas related to positive, unexpected and unclear findings during ultrasound screening. Based on these results recommendations for future practice can be formulated.

Sunita Taneja et al, 2020	Randomized controlled trial	13,500 married women aged 18 to 30 years will be enrolled and randomized to receive either the pre and peri-conception intervention package or routine care (first randomization). Interventions will be delivered until women are confirmed to be pregnant or complete 18 months of follow up.	Existing evidence supports that the first 1000 days of life i.e. from conception to two years are critical for optimal growth and brain development but may not be sufficient. Studies have examined the effects of individual interventions on birth outcomes and early childhood growth and development, targeting the pregnancy period and/or the postnatal period and have observed low to modest effects sizes. Observational studies indicate that health prior to conception (pre- and peri-conception period) is linked to birth outcomes and could influence health across generations. However, intervention trials are yet to substantiate the initial observations and reliable evidence is required.
Lisbeth A. Andreasen et al, 2021	A historical, observational, multicenter study	All women who gave birth to a child with a birthweight < 2.3rd centile from 1 September 2012 to 31 August 2015	Among 78 544 pregnancies, 3069 (3.9%) had a fetal growth restriction. Detection occurred in 31% of fetal growth-restricted pregnancies. Clinical experience (defined as years since graduation) of the first consultation midwife was positively associated with detection, with a hazard ratio [HR] of 1.15, 95% confidence interval [CI] 1.03-1.28), for every 10 years of additional experience. The hazard of detection increased with the number of midwife consultations (HR 1.15, 95% CI 1.05-1.26) and with multiparity (HR 1.28, 95% CI 1.03-1.58). After adjusting for all covariates, an unexplained difference between hospitals (P =.01) remained.
S. Z.Wanyonyi et al, 2021	An open-label randomized controlled trial	Low-risk pregnant women were randomly allocated (ratio of 1:1) to routine ultrasound for fetal growth assessment between 36+0 and 37+6weeks' gestation (intervention group) or to standard care, which involved a selective growth scan on clinical suspicion of fetal growth abnormality based on serial SFH measurements (control group)	Thirty-six babies in the intervention group and 26 in the control group had a birth weight <10th centile. The detection rate of SGA infants by routine third-trimester ultrasound vs that by standard care was 52.8% (19/36) vs 7.7% (2/26) (P<0.001) and the specificity was 95.5% (191/200) and 97.9% (191/195), respectively (P=0.08). The detection rate of severe SGA was 66.7% (12/18) by routine ultrasound vs 8.3% (1/12) by selective ultrasound based on SFH measurements (P<0.001), with specificities of 91.7% (200/218) and 98.1% (205/209), respectively (P=0.006). The area under the ROC curve of routine third-trimester ultrasound in prediction of SGA was significantly greater than that of selective ultrasound based on SFH measurements (0.92 (95%CI, 0.87–0.96) vs 0.68 (95% CI, 0.58–0.77); P<0.001).

Matias Vieira et al, 2022	C.	A pragmatic, superiority, 2- arm, parallel group, open, cluster randomized control trial	All women who gave birth in participating clusters (maternity units) during the year prior to randomization and during the trial (November 2016 to February 2019)	The primary outcome was ultrasound detection of SGA (estimated fetal weight <10th centile using customised centiles (intervention) or Hadlock centiles (standard care)) confirmed at birth (birthweight <10th centile by both customised and population centiles). Secondary outcomes were maternal and neonatal outcomes, including induction of labour, gestational age at delivery, mode of birth, neonatal morbidity, and stillbirth/perinatal mortality.

Discussion

Stunting prevention can be carried out from pregnancy until the child is 24 months old because the process of stunting does not start when the child is born, but from the fetus during pregnancy. A cohort study in Bangladesh on the Determinants of Stunting from Prenatal and Postnatal Factors strengthens the evidence that the process of becoming stunted has started since the intrauterine period [20].

High coverage of antenatal care is necessary to optimize maternal health and nutrition and fetal growth in a population. A study on antenatal care in several developing countries showed that a mother who had four antenatal visits, one of which was with an obstetrics and gynecology specialist, was associated with a reduced risk of stunting. In addition, increased access to health services and skilled delivery assistance at health facilities was associated with increased length/height-for-age scores in children. With increased coverage of antenatal care and delivery in health facilities, it accounted for 40%, 34%, and 29% of the change in length/height-for-age scores in Pakistan, Senegal, and Rwanda [21]. The Guideline Development Group (GDG) adds that assessment of fetal growth reduces adverse perinatal conditions [22].

Antenatal ultrasound (USG) examination is a superior examination in antenatal care. Antenatal ultrasound is a diagnostic imaging tool that uses high-frequency sound waves to create real-time visual images of the developing fetus in the uterus [23]. Based on PMK RI No. 9 of 2014, Health Services During Pregnancy is the provision of health services and counseling including stimulation and nutrition so that the pregnancy takes place healthy and the fetus is born healthy and intelligent. Health services using antenatal ultrasound are standard prenatal services in almost all countries [24], because it can provide various information about the age and development of pregnancy, the position of the placenta, the amount of amniotic fluid, the health and development of the fetus, predicts the date of birth and is proven not to cause harmful effects to pregnant women and the fetus [25]; [26]; [27]. The GDG notes that antenatal ultrasound examinations to detect pregnancy complications and confirm fetal survival can increase the utilization of antenatal care [22].

Antenatal ultrasound examination is used in certain conditions during pregnancy, such as where there is concern about fetal growth and clinical complications. However, because adverse outcomes can also occur in pregnancies without risk factors, this assumption has led to the assumption that antenatal ultrasound screening in all pregnancies will prove beneficial by enabling early detection of problems such as multiple pregnancies, mal presentation, IUGR, congenital anomalies, and previa placenta – and by enabling accurate estimation of gestational age and appropriate management of pregnancy for possible complications [22]. The International Society of Ultrasound in Obstetrics and Gynecology (ISUOG) recommends that pregnant women have routine antenatal ultrasounds between 18-22 weeks of gestation to ensure gestational age and take measurements of the fetus so that growth abnormalities can be recognized quickly [28].

Antenatal ultrasound examination after 24 weeks of gestation is not recommended who have undergone an ultrasound examination at the beginning. However, health professionals should consider offering antenatal ultrasound examinations to pregnant women who have not previously had this examination, for the purpose of identifying the number of fetuses, presentation and location of the placenta [22].

The evidence for early ultrasound comes from a Cochrane study that included 11 RCTs, involving 37,505 women. The intervention in all trials involved ultrasound examinations before 24 weeks of gestation, with women in the control group undergoing selective ultrasound scans. Examination includes assessment of gestational age, number of fetuses, fetal anatomy, and location of the placenta. Screenings were performed between 10 and 20 weeks of gestation, with three trials evaluating scans before 14 weeks, early (at 18-20 weeks) and late (at 31-33 weeks). Early ultrasound examination can improve the detection of congenital anomalies (RR: 3,46), there is little or no difference for the occurrence of perinatal death (RR: 0,89) and LBW (RR: 1,04), also little or no effect in cases small to gestation (RR: 1,05).

The evidence regarding the final ultrasound comes from a Cochrane study that included 13 RCTs performed at HIC. Most of the women in this trial underwent an early ultrasound examination and were randomized to undergo another examination in the third trimester between 30 and 36 weeks of gestation in secret. Examinations that are usually performed vary including assessment of estimation of body weight, fetal anatomy, amniotic fluid volume and maturity of the placenta. Delay in ultrasound examination may have little or no effect on perinatal mortality (RR: 1,01) and premature labour (RR: 0,96), has little or no effect in cases small to gestation (RR: 0.98) and LBW (RR: 0,92).

There are many other benefits of antenatal ultrasound examinations. A body of evidence from high-income countries suggests that expectant mothers and fathers have the emotional experience of enjoying seeing their fetus for the first time during an antenatal ultrasound examination. A number of studies have found that ultrasound examinations improve maternal

attachment during pregnancy, a positive predictor of parent-infant interaction that can promote healthy fetal development. However, it is agreed that studies that follow up on parent-child behavior and healthy child development after birth in low- and middle-income countries are needed to test the co-benefits of antenatal ultrasound for child development there [29].

Another study in the form of a qualitative test shows that pregnant women generally expect information from health workers. An evidence shows that, the lack of ultrasound equipment in health care facilities, reduces the presence of pregnant women in antenatal care. Although there is some evidence that the pregnant woman does not understand that ultrasound is a diagnostic tool and the negative findings found after undergoing the examination are the increasing anxiety in the pregnant woman. Furthermore, the GDG emphasizes another benefit of antenatal ultrasound, especially increased accuracy of gestational age assessment, which will assist management in cases of suspected preterm birth. The GDG also noted that antenatal ultrasound examinations, when accompanied by estimation of gestational age, diagnosis, and management, can reduce morbidity and mortality [22].

Regarding stunting, antenatal ultrasound can detect stunting events. A study shows that stunting in the fetus is a long-term process such as chronic malnutrition in children, which requires proof of one or several associated risk factors for several months or during pregnancy [30]. This proof can be done using ultrasound. Another study on maternal characteristics and stunting in the Philippines showed that ultrasound examinations during pregnancy reduced the likelihood of stunting in children by 29% where pregnant women considered antenatal ultrasound examinations in the second trimester specifically as a way to ensure that the child is growing normally and there are no abnormalities [31]. Another study showed that using ultrasound, examination of femur length to measure fetal growth rate was found to reach a peak in the second trimester of pregnancy and gradually decrease in the third trimester [32]. Subsequent studies conducted in Brazil, China, India, Italy, Kenya, Oman, England, and the United States, of 60 206 single live births during the study period, all newborns born between 33 weeks and 42 weeks of gestation, 6 days after birth through a reliable ultrasound examination, showing stunting affects 3.8% of all newborns. Clinical suspicion of IUGR and congenital abnormalities related to stunting [33]. This clinical suspicion can be made with Doppler ultrasound which is one of the antenatal ultrasound examination technologies that evaluates the umbilical artery to assess fetal condition in the third trimester. It is widely used in high-risk pregnancies to identify fetal survival and educe perinatal mortality. This ultrasound technology is useful as an antenatal intervention to detect fetal survival and predict complications, in apparently normal pregnancies, particularly IUGR and preeclampsia [22].

The relationship between maternal nutritional status and fetal growth can help us to better understand the process of intrauterine linear growth. A study of fetal growth as measured by ultrasound in Guatemala to explore the relationship between maternal weight gain gestation and

linear growth. Another study shows through ultrasound examination, changes in pregnant women's weight have an effect on intrauterine fetal growth and baby's length at birth against the background that stunting at birth is associated with an increased risk of stunting in children and adults. The antenatal ultrasound examination in this study was carried out at 15-24 weeks and 28-32 weeks of pregnancy. This study shows that maternal weight gain from the first to the second trimester is associated with the length of the fetal femur and tibia (at weeks 17 and 30) and the length of the baby at birth. From this study it has been proven that when the factors that cause fetal growth restriction occur in early pregnancy, the linear growth of the fetus is affected. Ultrasound estimation of the growth velocity of femur length measured in non-growth retarded fetuses shows that indeed peak growth velocity occurs during the early second trimester, with femoral bone growth continuing until late in the third trimester [34]. In another study from rural Malawi, low maternal weight gain in late pregnancy was associated with infant length at birth. A better understanding of the relationship between maternal nutritional status at various gestational periods and fetal growth and length at birth can help us to understand better the process of linear growth in utero [35]. Regarding gestational age bias, neonatal maturity examination with age estimation from biparietal diameter measurements using ultrasound as the gold standard was made early in the second trimester [34].

Subsequent studies have shown that the use of antenatal ultrasound provides opportunities for early detection and intervention of stunting. A prospective data set of women participating in a randomized controlled clinical trial of preconception micronutrient supplementation in Vietnam (n=1137). The inclusion criteria were that at least the pregnant women underwent antenatal ultrasound examination during the second (n=712) or third (n=798) trimester of pregnancy, single birth, and child anthropometric information for 1 year. Fetal measurements were taken during routine antenatal visits using ultrasound. Ultrasound measurements included head circumference, biparietal diameter, abdominal circumference, and femur length. A multivariate regression model was used to examine the relationship between ultrasound examination and stunting at one year of age. This study shows that antenatal ultrasound examination during the third trimester is associated with the results of measuring the height of one year old children and it is concluded that antenatal ultrasound examination can be a useful predictor of child growth up to one year. Prenatal detection of children at risk for growth retardation can contribute to the implementation of timely interventions to promote child growth [36].

So to assist government programs in reducing the incidence of stunting, antenatal ultrasound can be used to identify IUGR so that nutritional interventions can be carried out in pregnant women and for better fetal growth. There are recommendations for health workers to prevent stunting during pregnancy by providing additional food to pregnant women and promoting the improvement of maternal nutritional status during pregnancy to prevent stunting in children in the future [37]. In

another study, baby length was measured from birth to age 2, and those classified as stunted tended to be more stunted [38]. Babies born with stunting are more likely to receive nutritional supplementation than those who were not born. This suggests that, with sufficient resources and early intervention, babies born with stunting are able to catch up to growth in the postnatal period [39].

As additional information, the GDG notes that antenatal ultrasound is an examination that can be transferred from sonographers and doctors who have received training to nurses and midwives, provided that all receive ongoing training, accompanied by quality improvement and supervision activities. The cost of antenatal ultrasound examinations can be reduced if they are also used for other indications (eg obstetric emergencies) or by other medical departments. The implementation of this recommendation will be seen in the use of USG facilities at the health service level everywhere [22].

Conclusion

Prevention of stunting can be done since pregnancy. Stunting in the fetus is a long-term process such as chronic malnutrition in children, which requires proof of one or several associated risk factors for several months or during pregnancy. The relationship between the nutritional status of the mother examined in antenatal care at various gestational periods and the growth of the fetus identified by antenatal ultrasound can help us to understand better the process of intrauterine linear growth. High coverage of antenatal care is needed to optimize maternal health and nutrition as well as fetal growth where four antenatal visits with one visit being carried out with an obstetrics and gynecology specialist have been associated with a reduced risk of stunting and an increase in length/height for age scores in children. Changes in pregnant women's weight during antenatal visits have an effect on intrauterine fetal growth and infant length at birth where stunting at birth is associated with an increased risk of stunting in childhood and adulthood. There are recommendations for health workers to prevent stunting during pregnancy by providing additional food to pregnant women and promoting the improvement of maternal nutritional status during pregnancy to prevent stunting in children in the future. The use of antenatal ultrasound provides an opportunity to detect early IUGR and intervene in stunting and by enabling accurate gestational age estimation which will assist management in cases of suspected preterm birth. Pregnant women should do routine antenatal ultrasound between 18-22 weeks of gestation to ensure gestational age and take measurements of the fetus so that growth abnormalities can be recognized quickly. Antenatal ultrasound can also be a predictor of positive parent-infant interactions that can promote healthy fetal development.

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Conflict of Interest

There is no conflict of interest with the parties involved in this study.

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