World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(REVIEW ARTICLE)

Check for updates

Early screening factors associated with stunting risk in prospective brides

Vera Angraini [1], Desmawati Desmawati [2,*] and Defrin Defrin [3]

[1] *Master of Midwifery Program, Faculty of Medicine, Universitas Andalas, Indonesia.*
[2] *Department of Nutrition Science, Faculty of Medicine, Universitas Andalas, Indonesia.*
[3] *Department of Obstetrics and Gynecology, Faculty of Medicine, Universitas Andalas, Indonesia.*

World Journal of Advanced Research and Reviews, 2024, 21(03), 150–157

Publication history: Received on 06 January 2024; revised on 27 February 2024; accepted on 29 February 2024

Article DOI: https://doi.org/10.30574/wjarr.2024.21.3.0695

Abstract

Stunting is a major nutritional problem that has not been resolved. According to data from the World Health Organization (WHO), in 2022, the prevalence of stunting was 22.3%, or around 148.1 million. Stunting is influenced by maternal health in pregnancy, infants under five, and maternal health in the preconception period. This research aims to determine the early detection of stunting risk in brides. This study is a literature review using PubMed and the Google database to identify articles published in 2015–2023. The main objective of this study was to determine the risk factors for stunting in the preconception period. Although many studies discuss stunting, most tend to discuss the causes of stunting in the prenatal and infant-toddler phases. In addition, the preconception period has a major contribution to pregnancy, which will affect the health of the fetus in the womb. If not addressed, it will cause trans-generational problems. Prevention of stunting is more effective than treatment of stunting. Stunting can be prevented since the preconception period, especially in prospective brides, by detecting early screening for stunting risk. Early screening for stunting can be done by identifying factors that are at risk of stunting, including age, BMI, anemia, mid-upper arm circumference, and smoking behavior.

Keywords: Age; BMI; MUAC; Anemia; Smoking Behavior; Stunting

1. Introduction

The nutritional status of premarital women as prospective mothers contributes greatly to healthy pregnancy readiness. Nutritional status issues affecting the brain, intrauterine growth restriction (IUGR), and metabolic systems will have short-term health effects starting at the 1000 Days of Life. Long-term issues like cognitive decline, stunting, and an increased risk of degenerative diseases will result from short-term effects. It is not enough to blame children's stunting on their low weight or height. However, stunting is the beginning of short-term and long-term problems (1).

One serious nutritional issue that still has to be addressed is stunting. In 2022, the World Health Organization (WHO) reported that 22.3% of children, or around 148.1 million, were stunted (2). Stunting is a major nutritional problem that has not been resolved. Stunting has decreased from the previous year, but it is far from the 2030 Sustainable Development Goals (SDGs) target to end all forms of malnutrition (3). According to data from the Indonesian Nutrition Status Survey in 2022, the stunting rate in Indonesia was 21.7%, a decrease compared to 24.4% in 2021 (4). According to the WHO growth curve, stunting is characterized as low or extremely short stature with length/height for age and standard deviation (SD) less than -2. Chronic malnutrition linked to low socioeconomic levels, inadequate nutrition and maternal health, a history of recurrent sickness, and improper feeding practices for infants and young children are the main causes of stunting. Children with developmental delays cannot develop to their full physical and cognitive potential (5).

* Corresponding author: Desmawati Desmawati

Stunting is influenced by maternal health in the pregnant phase and infants under five and maternal health in the preconception period, namely women of childbearing age and adolescents (6). The optimal role of mothers in preventing stunting lies in three phases, namely the preconception phase, the prenatal phase, and the infant phase (7). Prospective brides are a strategic preconception group responsible for efforts to improve nutritional status, prepare a healthy family, and prevent and control infectious and non-communicable diseases to create a healthy pregnancy that can give birth to a quality generation. The Indonesian government developed the Elsimil application (Electronic Ready for Marriage and Pregnancy), which aims to screen for early detection of stunting risk in brides-to-be by filling out a questionnaire that focuses on stunting determinant variables age, Body Mass Index, anemia, Mid-Upper Arm Circumference (MUAC) and smoking behavior (8).

2. Material and methods

This research is a literature review. A literature search using PubMed and the Google database to identify articles published in 2015 - 2023. The keywords used to search for this article are age, Body Mass Index, Anemia, Middle Upper Arm Circumference, smoking behavior, and brides.

3. Results

Tabel 1 Summary of Finding early screening factors associated with stunting risk in prospective brides

No	Author	Research Title	Country	Method	Factors Associated with Stunting Risk
1.	Anthony Wemakor *et al*., 2018 (9)	Young maternal age is a risk factor for child undernutrition in Tamale Metropolis	Ghana	Case-Control	Age
2.	Melissa F Young *et al*., 2018 (10)	Role of maternal preconception nutrition on offspring growth and risk of stunting across the first 1000 days	Vietnam	Prospective Cohort	Body Mass Index
3.	Fadila Wirawan and Dieta Nurrika, 2022 (11)	Maternal pre-pregnancy anemia and childhood anemia in Indonesia	Indonesian	Cohort	Anemia
4.	Wiwie Putri Adila *et al*, 2023(12)	The relationship of chronic energy deficiency (CED), exclusive breastfeeding, and economic with stunting in Nagari Aua Kuning West Pasaman	Indonesian	Cross Sectional	Chronic Energy Deficiency
5.	Helen Andriani *et al.,* 2021 (13)	Second-Hand Smoke Exposure inside the House and Adverse Birth Outcomes in Indonesia: Evidence from Demographic and Health Survey 2017	Indonesian	Cohort	Smoking Behavior
6.	William Grandinata Soeseno, *et al.,* 2019 (14)	Hubungan suami perokok terhadap bayi berat lahir rendah pada neonatus di ruang Perinatologi RSUD Wangaya kota Denpasar (Relationship of a Smoking Husband to Neonatal Low Birth Weight in The Perinatology Room of RSUD Wangaya City of Denpasar)	Indonesian	Case Control	Smoking Behavior
7.	Olga A Kharkova *et al.,* 2017 (15)	Effect of smoking behavior before and during pregnancy on selected birth outcomes among singleton full-term pregnancy: A Murmansk county birth registry study	Russian	Cohort	Smoking Behavior

8.	Patricia A. Cavazos-Rehg *et al.,* 2015 (16)	Maternal Age and Risk of Labor and Delivery Complications	United State	Cohort	Age
9.	Jana Diabelková *et al.,* 2023 (17)	Adolescent Pregnancy Outcomes and Risk Factors	Slovakia	Cohort	Age
10.	Florent Fuchs *et al.,* 2018 (18)	Effect of maternal age on the risk of preterm birth	Canadian	Cohort	Age
11.	Sarka Lisonkova *et al.,* 2018 (19)	Association between prepregnancy body mass index and severe maternal morbidity	Washington	Cohort	Body Mass Index
12.	Arif Sapta Aji *et al.,* 2022 (20)	Association between pre-pregnancy body mass index and gestational weight gain on pregnancy outcomes	Indonesian	Cohort	Body Mass Index
13.	C M Ng *et al.,* 2019 (21)	Associations of pre-pregnancy body mass index, middle-upper arm circumference, and gestational weight gain	Malaysia	Cross-Sectional	Body Mass Index, Middle-Upper Arm Circumference
14.	Donugama Vasundhara *et al.,* 2020 (22)	Maternal MUAC and fetal Outcome in an Indian tertiary care Hospital	Indian	Prospective Cohort	Middle-Upper Arm Circumference
15.	Phuong H. Nguyen *et al.,* 2016 (23)	Impact of preconception micronutrient supplementation on anemia and iron status during pregnancy and postpartum	Vietnam	Randomized Control Trial	Anemia
16.	Shweta Kumari *et al.,* 2019 (24)	Maternal and severe anemia in delivering women is associated with a risk of preterm and low birth weight.	Indian	Cross-Sectional	Anemia
17.	Jeffrey Jap *et al.,* 2019 (25)	Importance of collaborative intervention of preconception nutrition in suppressing the stunting case in East Nusa Tenggara	Indonesian	Literature Study with Qualitative Approach	Anemia
18.	Rahayu Nurul Reski *et al.,* 2020 (26)	Anemia, chronic energy deficiency and their relationship in preconception women	Indonesian	Cross-Sectional	Anemia, Chronic Energy Deficiency
19.	Patrick Adu *et al.,* 2020 (27)	Low iron stores in preconception nulliparous women	Ghana	Cross-Sectional	Anemia
20.	Cezary Wojtyla *et al.,* 2021 (28)	The effect of active and passive maternal smoking before and during pregnancy on neonatal weight at birth	Poland	Literature Review	Smoking Behavior
21.	Derya Adibelli and Nurcan Kirca, 2020 (29)	The relationship between gestational active and passive smoking and early postpartum complications	Turkey	Case-Control	Smoking Behavior
22.	Samuel Dagne *et al.,* 2021 (30)	Chronic Energy Deficiency and Its Determinant Factors among Adults Aged 18-59 Years in Ethiopia	Ethiopia	Cross-Sectional	Chronic Energy Deficiency
23.	Arindah Nur Sartika *et al.,* 2021 (31)	Prenatal and postnatal determinants of stunting at age 0–11 months	Indonesian	Cross-Sectional	Body Mass Index
24.	Gusnedi *et al.,* 2023 (32)	Risk factors associated with childhood stunting in Indonesia	Indonesian	A systematic review and meta-analysis	Age

25.	Agus Santosa *et al.,* 2023 (33)	Effect of maternal and child factors on stunting: partial least squares structural equation modeling	Indonesian	Case-Control	Age, Anemia, Chronic Energy Deficiency
26.	Kencana Sari and Ratu Ayu Dewi Sartika, 2021 (34)	The Effect of the Physical Factors of Parents and Children on Stunting at Birth Among Newborns in Indonesia	Indonesian	Cross-Sectional	Age, Body Mass Index
27.	Sarah Hanieh *et al.,* 2019 (35)	The Stunting Tool for Early Prevention: development and external validation of a novel tool to predict risk of stunting in children at 3 years of age	Vietnam	Prospective Cohort	Age, Body Mass Index

4. Discussion

Based on a literature review, early screening factors associated with stunting risk in prospective brides are:

4.1. Age

Stunting is eight times more common in teenage moms than in older mothers. This is because adolescent mothers' growth periods during pregnancy compete with fetal development for nutrition, increasing the likelihood that the fetus will be underweight. (9). Pregnant women aged <20 years are at high risk for premature birth, chorioamnionitis, endometriosis, mild preeclampsia, severe preeclampsia, eclampsia, postpartum hemorrhage, fetal growth disorder, fetal distress, LBW, and a low Apgar score in the first minute. Pregnant women >35 years of age have a greater chance of experiencing premature birth, hypertension, and severe preeclampsia (17,18,36). Stunting is influenced by a mother's age indirectly through other variables. Pregnant women will struggle to get nutrients as fetal development proceeds, so fetuses are more likely to be born with a lower weight than adult mothers. Other factors include adolescent mothers' inability to ensure that their children receive an adequate nutritional intake because they are still in the growth phase of their lives. In addition, teenage moms are not psychologically prepared to nurse their newborns after giving birth. Teenage moms who drop out of school due to an early pregnancy may feel personally stressed. These issues frequently impact children's growth and development, leading to malnutrition and other growth-related issues (37).

4.2. Body Mass Index

BMI measurements can be used to evaluate nutritional status. BMI is significant in helping pre-conception women plan for a healthy pregnancy. The pre-pregnancy or early trimester body mass index determines the desired weight gain during pregnancy. Thus, with an optimal limit for determining the weight gain in pregnancies. Research suggests that the skinny or fat body mass Index before pregnancy increases the high risk in pregnancy and childbirth and identifies when women experience excessive or inadequate weight gain (19). When planning a pregnancy, a BMI of 18.5 to 25.0 is desirable. The ideal weight gain during pregnancy is calculated using BMI before or during the first trimester of pregnancy. For the ideal threshold for calculating weight gain during pregnancy to exist. According to research, having a BMI that is underweight or obese before becoming pregnant increases the likelihood of having a high pregnancy and giving birth, as well as identifying when women acquire too much or too underweight (38). Preconception maternal nutritional status affects fetal linear growth and the risk of stunting during the first 1000 days of life with a lower BMI <17.5 kg/m2 has a 1.3-fold risk of stunting (10). The preconception of female BMI and weight gain during pregnancy are strongly associated with pregnancy outcomes. In addition, women who have a low BMI and insufficient weight gain during pregnancy have a ten times greater risk of delivering an LBW child (20).

4.3. Anemia

Anemia that occurs before pregnancy and is not treated can increase metabolic requirements during pregnancy. Pregnant women need more iron than women who are not pregnant. Approximately one-third of the iron needs during pregnancy are related to the needs of the fetus and placenta. Therefore, unsatisfied iron needs, especially if anemia already exists, can affect the health of the mother and fetus (39). Anemia raises the risk of prenatal death, low birth weight, preterm birth, difficulties during pregnancy or labor, and antepartum or postpartum hemorrhage in women of reproductive age. A major influence occurs before or during pregnancy due to anemia. Pregnancy-related anemia increases the risk of nutritional deficits in the baby, which can result in LBW conditions, increased susceptibility to infectious illnesses, premature birth, and stunting (26). Anemia raises the likelihood of both intrauterine growth restriction (IUGR) and low birth weight (LBW) (40). Pregnancy-related moderate anemia is linked to higher LBW and

fetal growth restriction (27). Studies have shown that women who suffer from pre-pregnancy anemia have a 1.71 times greater risk of having children with anemia compared to women who do not have anemia (11). Pre-pregnancy Anemia is at increased risk during pregnancy, which will affect nutritional deficiency in the fetus and cause the baby with LBW to be more susceptible to infectious diseases, premature birth, and stunting (25).

4.4. Mid-upper Arm Circumference

The MUAC measurement has shown to be a reliable indicator of acute malnutrition, enabling the early detection and treatment of pregnancies at risk for health issues and, in the end, ending the malnutrition cycle that passes down through generations. According to research, women who have low MUAC measures before becoming pregnant typically do not acquire enough weight during their pregnancy (21). Research suggests that women pre-pregnancy with low MUAC or Chronic Energy Deficiency (CED) tend to have insufficient weight gain during pregnancy (21). Women with <23.5 cm are at risk of LBW, preterm birth, and SGA (22). MUAC measurement <23.5 cm is at risk of giving birth to a baby with low birth weight (LBW). Low MUAC Preconception is also at risk of anemia (41). This study is in line with previous research that says mothers who suffer from have an 8.24 times greater chance of giving birth to low-birth-weight babies who are at risk of growth failure later in life. The results of the study also show that there is a significant relationship between pregnant women who suffer from CED and the incidence of stunting in infants aged 6 to 24 months (42). Children born to women with persistent energy deficiencies are at risk for 11.278 stunting (12).

4.5. Smoking Behavior

Tobacco exposure in early pregnancy affects placental development directly or indirectly by reducing blood flow, which creates a pathological hypoxic environment. It is regularly reported that pregnancy-related tobacco exposure results in LBW. Every year, smoking during pregnancy results in the deaths of over 1,000 babies. Pregnant women who are around smokers run the risk of giving birth to babies that are smaller and have lower birth weights. (13). Women who smoke actively or passively before pregnancy and during pregnancy are at risk of LBW by 1.35 times compared to women who do not smoke. In smoking women, there is also a decrease in birth weight by 46-307 grams (28). Active and passive smoking increase the risk of low-birth-weight infants and significantly increases other adverse pregnancy outcomes such as prematurity, respiratory distress, antepartum and intrapartum stillbirth, perinatal mortality, long-term childhood morbidity, and sudden unexpected infant death (29,43). Pregnant women who smoke actively or passively are a major cause of growth and development disorders in toddlers. This is because pregnant women smoking increases the risk of Small for gestational age (SGA), low stature, and small head circumference. Smoking can also cause a decrease in the results of anthropometric measurements in children, such as birth weight, birth length, and head and chest circumference at birth, which are the main indicators of growth retardation in children (44). More specifically, children exposed to active smoking in early pregnancy are at risk of Tetralogy of Fallot (TOF) (45). Exposure to cigarette smoke can reduce blood flow to the placenta, which increases the risk of miscarriage, low baby weight, and baby respiratory problems (14). Smoking during pregnancy can interfere with the blood flow to the placenta so that the development of the placenta is impaired. This can lead to hypoxia and reduced availability of oxygen and micronutrients to the fetus. Women who smoke during pregnancy are also more prone to premature birth(15). Active or passive smoking increases the risk of having a child with LBW. It significantly increases other negative pregnancy outcomes such as premature birth, respiratory impairment, antepartum and intrapartum deaths, perinatal death, long-term child morbidity, and unexpected sudden infant deaths (46).

5. Conclusion

Stunting prevention is more effective than stunting treatment. The preconception period is an important period for the prevention of stunting, especially in prospective brides. Preconception screening of prospective brides is important to prevent short and long-term health problems. Risk factors for stunting in prospective brides are age, BMI, MUAC, Anemia, and Smoking Behavior.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] Soliman A, De Sanctis V, Alaaraj N, Ahmed S, Alyafei F, Hamed N, et al. Early and long-term consequences of nutritional stunting: From childhood to adulthood. Acta Biomedica. 2021;92(1).

[2] WHO. Stunting prevalence among children under 5 years of age (%) (model-based estimates). Global Health Observatory Data Repository [Internet]. 2023;35. Available from: https://www.who.int/data/gho/data/indicators/indicator-details/GHO/gho-jme-stunting-prevalence

[3] UNDP. Goal 2: Zero hunger | UNDP. United Nations Sustainable Development [Internet]. 2020;1. Available from: https://www.undp.org/

[4] Kemenkes RI. Buku Hasil Studi Status Gizi Indonesia (SSGI) Tahun 2022. Kemenkes RI [Internet]. 2022;1–14. Available from: https://www.litbang.kemkes.go.id/buku-saku-hasil-studi-status-gizi-indonesia-ssgi-tahun-2021/

[5] WHO. Reducing stunting in children: equity considerations for achieving the Global Nutrition Targets 2025. 2018.

[6] Vaivada T, Gaffey MF, Das JK, Bhutta ZA. Evidence-based interventions for improvement of maternal and child nutrition in low-income settings: What's new? Vol. 20, Current Opinion in Clinical Nutrition and Metabolic Care. 2017. p. 204–10.

[7] Saleh A, Syahrul S, Hadju V, Andriani I, Restika I. Role of Maternal in Preventing Stunting: a Systematic Review. Gac Sanit. 2021;35.

[8] BKKBN. Modul Aplikasi Elsimil bagi Calon Pengantin [Internet]. Jakarta; 2021. p. 1–58. Available from: https://id.scribd.com/document/543402407/MODUL-7-APLIKASI-ELSIMIL-BAGI-CALON-PENGANTIN

[9] Wemakor A, Garti H, Azongo T, Garti H, Atosona A. Young maternal age is a risk factor for child undernutrition in Tamale Metropolis, Ghana. BMC Res Notes. 2018;11(1).

[10] Young MF, Nguyen PH, Casanova IG, Addo OY, Tran LM, Nguyen S, et al. Role of maternal preconception nutrition on offspring growth and risk of stunting across the first 1000 days in Vietnam: A prospective cohort study. PLoS One. 2018;13(8).

[11] Wirawan F, Nurrika D. Maternal pre-pregnancy anemia and childhood anemia in Indonesia: a risk assessment using a population-based prospective longitudinal study. Epidemiol Health. 2022;44.

[12] Putri Adila W, Sri Yanti R, Sriyanti R. The relationship of chronic energy deficiency (CED), exclusive breastfeeding, and economic with stunting in Nagari Aua Kuning West Pasaman. Science Midwifery. 2023;10(6).

[13] Andriani H. Second-Hand Smoke Exposure inside the House and Adverse Birth Outcomes in Indonesia: Evidence from Demographic and Health Survey 2017. medRxiv [Internet]. 2021;11(20):1–10. Available from: https://doi.org/10.1101/2021.11.20.21266641

[14] Soeseno WG, Suryawan IWB, Widiasa AAM. Hubungan suami perokok terhadap bayi berat lahir rendah pada neonatus di ruang Perinatologi RSUD Wangaya kota Denpasar (Relationship of a Smoking Husband to Neonatal Low Birth Weight in The Perinatology Room of RSUD Wangaya City of Denpasar). Intisari Sains Medis. 2019;10(1):139–43.

[15] Kharkova OA, Grjibovski AM, Krettek A, Nieboer E, Odland J. Effect of smoking behavior before and during pregnancy on selected birth outcomes among singleton full-term pregnancy: A Murmansk county birth registry study. Int J Environ Res Public Health. 2017;14(8).

[16] Cavazos-Rehg PA, Krauss MJ, Spitznagel EL, Bommarito K, Madden T, Olsen MA, et al. Maternal Age and Risk of Labor and Delivery Complications. Matern Child Health J. 2015;19(6).

[17] Diabelková J, Rimárová K, Dorko E, Urdzík P, Houžvičková A, Argalášová Ľ. Adolescent Pregnancy Outcomes and Risk Factors. Int J Environ Res Public Health. 2023;20(5).

[18] Fuchs F, Monet B, Ducruet T, Chaillet N, Audibert F. Effect of maternal age on the risk of preterm birth: A large cohort study. PLoS One. 2018;13(1).

[19] Lisonkova S, Muraca GM, Potts J, Liauw J, Chan WS, Skoll A, et al. Association between prepregnancy body mass index and severe maternal morbidity. JAMA - Journal of the American Medical Association. 2017;318(18).

[20] Aji AS, Lipoeto NI, Yusrawati Y, Malik SG, Kusmayanti NA, Susanto I, et al. Association between pre-pregnancy body mass index and gestational weight gain on pregnancy outcomes: a cohort study in Indonesian pregnant women. BMC Pregnancy Childbirth. 2022;22(1).

[21] Ng CM, Badon SE, Dhivyalosini M, Hamid JJM, Rohana AJ, Teoh AN, et al. Associations of pre-pregnancy body mass index, middle-upper arm circumference, and gestational weight gain. Sexual and Reproductive Healthcare. 2019;20.

[22] Vasundhara D, Hemalatha R, Sharma S, Ramalaxmi BA, Bhaskar V, Babu JJ, et al. Maternal MUAC and fetal outcome in an Indian tertiary care hospital: A prospective observational study. Matern Child Nutr. 2020;16(2).

[23] Nguyen PH, Young M, Gonzalez-Casanova I, Pham HQ, Nguyen H, Truong T V., et al. Impact of preconception micronutrient supplementation on anemia and iron status during pregnancy and postpartum: A randomized controlled trial in Rural Vietnam. PLoS One. 2016;11(12).

[24] Kumari S, Garg N, Kumar A, Guru PKI, Ansari S, Anwar S, et al. Maternal and severe anemia in delivering women is associated with risk of preterm and low birth weight: A cross sectional study from Jharkhand, India. One Health. 2019;8.

[25] Jap J, Sumarmi S, Damayanti NA. Importance of collaborative intervention of preconceptionutrition in suppressing the stunting case in East Nusa Tenggara, Indonesia. Indian J Public Health Res Dev. 2019;10(9):698–702.

[26] Reski RN, Hadju V, Indriasari R, Muis M. Anemia, chronic energy deficiency and their relationship in preconception women. Enferm Clin. 2020;30:76–80.

[27] Adu P, Attivor W, Nartey ST, Ephraim RKD, Awuku YA. Low iron stores in preconception nulliparous women; a two-center cross-sectional study in peri-urban Ghana. Nutrition. 2020;71.

[28] Wojtyla C, Buciora PW, Ciebiera M, Orzechowski S, Wojtyla A. The effect of active and passive maternal smoking before and during pregnancy on neonatal weight at birth. Archives of Medical Science. 2021;17(2):352–60.

[29] Adibelli D, Kirca N. The relationship between gestational active and passive smoking and early postpartum complications. Journal of Maternal-Fetal and Neonatal Medicine. 2020;33(14).

[30] Dagne S, Menber Y, Wassihun Y, Dires G, Abera A, Adane S, et al. Chronic Energy Deficiency and Its Determinant Factors among Adults Aged 18-59 Years in Ethiopia: A Cross-Sectional Study. J Nutr Metab. 2021;2021.

[31] Sartika AN, Khoirunnisa M, Meiyetriani E, Ermayani E, Pramesthi IL, Nur Ananda AJ. Prenatal and postnatal determinants of stunting at age 0–11 months: A cross-sectional study in Indonesia. PLoS One. 2021;16(7 July).

[32] Gusnedi G, Nindrea RD, Purnakarya I, Umar HB, Andrafikar, Syafrawati, et al. Risk factors associated with childhood stunting in Indonesia: A systematic review and meta-analysis. Asia Pac J Clin Nutr. 2023;32(2).

[33] Santosa A, Arif EN, Ghoni DA. Effect of maternal and child factors on stunting: partial least squares structural equation modeling. Clin Exp Pediatr. 2022;65(2).

[34] Sari K, Sartika RAD. The effect of the physical factors of parents and children on stunting at birth among newborns in indonesia. Journal of Preventive Medicine and Public Health. 2021;54(5).

[35] Hanieh S, Braat S, Simpson JA, Ha TTT, Tran TD, Tuan T, et al. The Stunting Tool for Early Prevention: Development and external validation of a novel tool to predict risk of stunting in children at 3 years of age. BMJ Glob Health. 2019;4(6).

[36] Londero AP, Rossetti E, Pittini C, Cagnacci A, Driul L. Maternal age and the risk of adverse pregnancy outcomes: A retrospective cohort study. BMC Pregnancy Childbirth. 2019;19(1).

[37] Habimana S, Biracyaza E. Risk Factors Of Stunting Among Children Under 5 Years Of Age In The Eastern And Western Provinces Of Rwanda: Analysis Of Rwanda Demographic And Health Survey 2014/2015 . Pediatric Health Med Ther. 2019;Volume 10.

[38] Liu B, Xu G, Sun Y, Du Y, Gao R, Snetselaar LG, et al. Association between maternal pre-pregnancy obesity and preterm birth according to maternal age and race or ethnicity: a population-based study. Lancet Diabetes Endocrinol. 2019;7(9).

[39] Garzon S, Cacciato PM, Certelli C, Salvaggio C, Magliarditi M, Rizzo G. Iron deficiency anemia in pregnancy: Novel approaches for an old problem. Oman Med J. 2020;35(5):1–9.

[40] Young MF, Ramakrishnan U. Maternal Undernutrition before and during Pregnancy and Offspring Health and Development. Ann Nutr Metab. 2020;76(suppl 3):41–53.

[41] Lipoeto NI, Masrul, Nindrea RD. Nutritional contributors to maternal anemia in Indonesia: Chronic energy deficiency and micronutrients. Asia Pac J Clin Nutr. 2020;29:9–17.

[42] Sukmawati, Hendrayati, Chaerunnimah, Nurhumaira. Status Gizi Ibu Saat Hamil, Berat Badan Lahir Bayi Dengan Stunting Pada Balita. Media Gizi Pangan. 2018;25(1).

[43] Liu B, Xu G, Sun Y, Qiu X, Ryckman KK, Yu Y, et al. Maternal cigarette smoking before and during pregnancy and the risk of preterm birth: A dose–response analysis of 25 million mother–infant pairs. PLoS Med. 2020;17(8).

[44] Hamadneh S, Hamadneh J. Active and passive maternal smoking during pregnancy and birth outcomes: A study from a developing country. Ann Glob Health. 2021;87(1).

[45] Wang T, Chen L, Ni B, Sheng X, Huang P, Zhang S, et al. Maternal pre-pregnancy/early-pregnancy smoking and risk of congenital heart diseases in offspring: A prospective cohort study in Central China. J Glob Health. 2022;12.

[46] Anderson TM, Lavista Ferres JM, You Ren S, Moon RY, Goldstein RD, Ramirez JM, et al. Maternal smoking before and during pregnancy and the risk of sudden unexpected infant death. Pediatrics. 2019;143(4).