

Dietary nitrate
supplementation
(11.9 mmol of nitrate)
~2.5 h prior to
exercise



Power



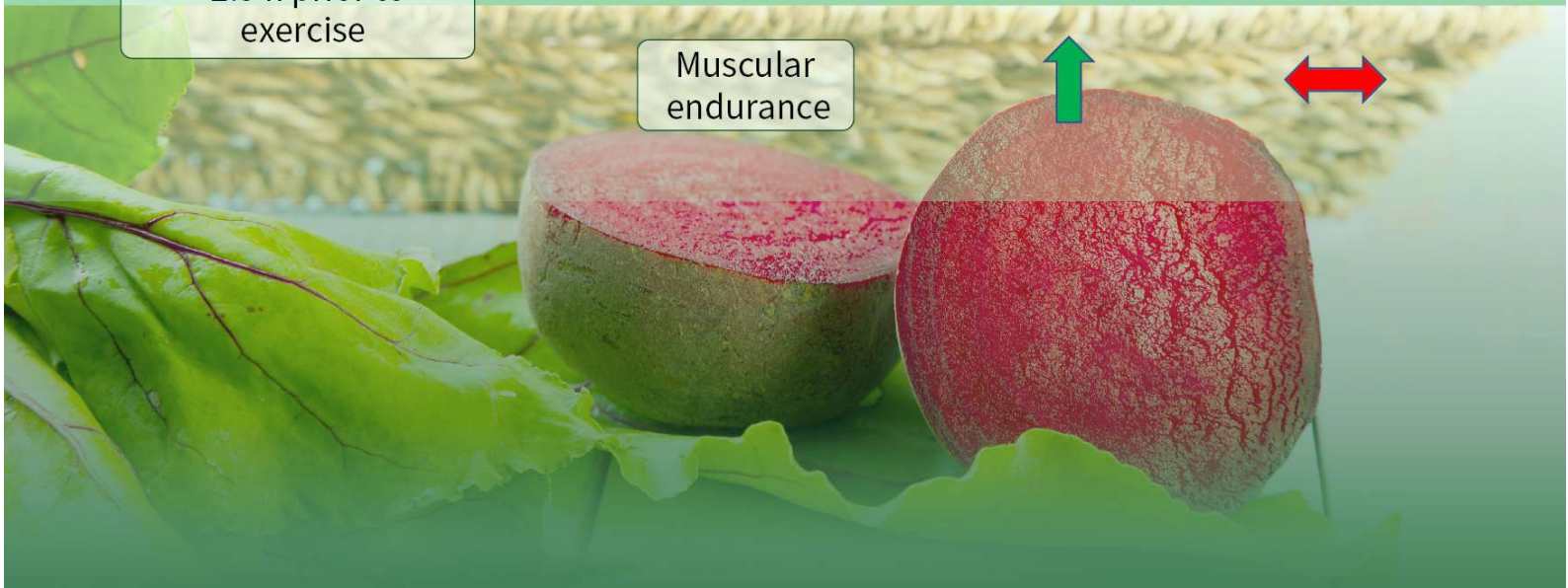
Speed



Bench press

Back squat

Muscular
endurance



Dietary Nitrate Ingestion Increases Bench Press Endurance in Males

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Interests: obesity; caloric restriction; dietary interventions; overfeeding; pregnancy; gestational diabetes; breast feeding; infant formula

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Interests: feeding practices; eating behaviour; infants; pregnant women; micronutrients; traditional foods

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Section Board Member

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Section Board Member

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Interests: reproductive medicine; developmental origins of Health; fetal therapy; maternal and childhood nutrition

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Section Board Member

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Interests: developmental programming; maternal health; pregnancy; birth weight; young adults; diabetes complications; diabetic nephropathy; cardiovascular disease; anti diabetic drugs; dietary intake; nutrient status

Dr. Tim Green [Website](#) [SciProfiles](#)

Section Board Member

Discipline of Paediatrics and Reproductive Health, School of Medicine, The University of Adelaide, Adelaide, Australia

Interests: micronutrients in pre-pregnancy, pregnancy; lactation; early life

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Interests: obesity prevention; women's health; pregnancy; physical activity; lifestyle change; implementation
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Prof. Dr. Megumi Haruna Website SciProfiles

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Interests: pregnancy; maternal and infant health; women's health; lifestyle intervention; childbirth; breastfeeding
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Prof. Dr. Eef Hogervorst Website

Section Board Member

Department of Human Sciences, Loughborough University, Loughborough, Leicestershire LE11 3TU, UK

Interests: early diagnoses and modifiable risk and protective factors (e.g., hormones, exercise and nutrition) for dementia and age-related cognitive decline; development and validation of cognitive tests and computerized diagnostic systems

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Prof. Dr. Shannon L. Kelleher Website SciProfiles

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Interests: Role of diet; genetics; environmental factors on maternal and infant health; mammary gland development; gastrointestinal development; impact on host-microbiome interactions

Prof. Dr. Donna Kritz - Silverstein Website SciProfiles

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Department of Family Medicine and Public Health, University of California San Diego, 9500 Gilman Drive, La Jolla, CA 92093, USA

Interests: Epidemiology; Public Health; Women's health; diabetes; cardiovascular disease; bone density; cholesterol; cognitive function; dental (oral) health

Prof. Dr. Annunziata Lapolla Website SciProfiles

Section Board Member

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Interests: diabetes; obesity; gestational diabetes; diabetes in pregnancy; obesity in pregnancy

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Section Board Member

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Interests: polycystic ovary syndrome; amenorrhea; metabolic syndrome; menopause; estrogen; progesterin; vitamin D; vitamin K2; osteoporosis



Dr. Michele D. Levine Website SciProfiles

Section Board Member

Department of Psychiatry, University of Pittsburgh, Pittsburgh, PA 15261, USA

Interests: pregnant/postpartum women's health; binge eating and obesity; women's smoking behavior

Dr. Siew S. Lim Website SciProfiles

Section Board Member

Eastern Health Clinical School, Monash University, Box Hill, VIC 3128, Australia

Interests: lifestyle; young women; preconception; postpartum; gestational diabetes; diabetes prevention

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2. Department of Primary Care and Public Health, Imperial College London, Charing Cross Campus, The Reynolds Building, St Dunstan's Road, London W6 8RP, United Kingdom

Interests: pregnancy nutrition; lifecourse epidemiology; metabolic disease; gestational diabetes mellitus; child obesity; sex differences

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Dr. Zaher Merhi Website SciProfiles

Section Board Member

Division of Reproductive Endocrinology and Infertility, Department of Obstetrics and Gynecology, SUNY Downstate Health Sciences University, Brooklyn, NY 11203, USA

Interests: effect of glycation products on ovarian function; effect of obesity of ovarian function; effect of unhealthy diet on reproduction; PCOS



Dr. Jose M. Moran Website SciProfiles

Section Board Member

Metabolic Bone Diseases Research Group, University of Extremadura, 10003 Cáceres, Spain

Interests: genetics of bone density; nutrition and women bone health; polyunsaturated fatty acid intake and women bone health

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Dr. Lisa Moran Website SciProfiles

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Interests: polycystic ovary syndrome; infertility; lifestyle; weight management; women's health
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Section Board Member

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Interests: diabetes; metabolic diseases; islets, beta cells; inflammation; fetal programming; maternal programming;



Dr. Siobhain M. O'Mahony Website

Section Board Member

1. APC Microbiome Ireland, Biosciences Institute, University College Cork, T12 YT20 Cork, Ireland

2. Department of Anatomy and Neuroscience, University College Cork, T12 YT20 Cork, Ireland

Interests: brain-gut-microbiota axis; maternal health; Stress; Visceral pain



Dr. Amanda Patterson Website SciProfiles

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School of Health Sciences, Faculty of Health and Medicine, and Priority Research Centre for Physical Activity and Nutrition, University of Newcastle, Callaghan, NSW 2308, Australia

Interests: diet quality; young women; iron deficiency; mental health; cognitive function

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Prof. Dr. Nancy King Reame Website SciProfiles

Section Board Member

School of Nursing, Columbia University, New York, NY 10032, USA

Interests: menopause; FSH; estrogen; reproductive neuroendocrinology; vasomotor symptoms; women's health; black cohort; clinical studies

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Prof. Dr. Regine P.M. Steegers-Theunissen Website SciProfiles

Section Board Member

Department of Obstetrics and Gynecology, Erasmus MC, University Medical Center, 3000 CA Rotterdam, The Netherlands

Interests: periconception; pregnancy; folic acid; Vitamin B12; homocysteine; eHealth



Dr. Amie Steel Website SciProfiles

Section Board Member

Australian Research Centre in Complementary and Integrative Medicine, Faculty of Health, University of Technology Sydney, Ultimo, NSW 2007, Australia

Interests: women's health; pregnancy; fertility; preconception health; complementary medicine



Prof. Dr. Didier Vieau Website SciProfiles

Section Board Member

INSERM UMR-S1172, Alzheimer and Tauopathies, Labex DISTALZ, Lille University, Lille, France

Interests: perinatal programming of chronic adult diseases in the offspring; neuroendocrinology; maternal malnutrition; diabetes; obesity; HPA axis; tauopathies; Alzheimer disease; insulin resistance

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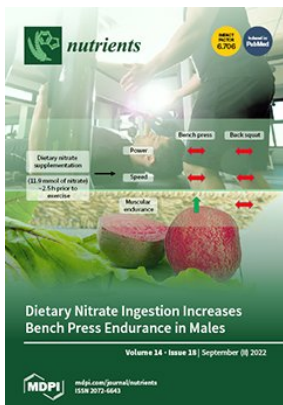


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Nutrition in Women

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by  Kathryn M. Eck,  Virginia Quick and  Carol Byrd-Bredbenner

Nutrients 2022, 14(18), 3876; <https://doi.org/10.3390/nu14183876> - 19 Sep 2022

Cited by 1 | Viewed by 1551

Abstract Body dissatisfaction is a common condition that poses health behavior risks, such as the use of maladaptive eating styles instead of adaptive eating styles. Few studies have simultaneously examined both adaptive and maladaptive eating styles and their association with body dissatisfaction in a [...] [Read more](#).

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Correlations between Fatty Acid Profile and Body Fat Distribution in Postmenopausal Women—A Cross Sectional Study

by  Anna Maria Cybulska,  Kamila Rachubińska,  Karolina Skonieczna-Żydecka,  Arleta Drozd,  Jolanta Pawlik,  Ewa Stachowska,  Aneta Cymbaluk-Płoska and  Elżbieta Grochans

Nutrients 2022, 14(18), 3865; <https://doi.org/10.3390/nu14183865> - 18 Sep 2022

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Abstract The aim of the study was to assess the fatty acid profile of the whole blood of postmenopausal women, taking into account anthropometric parameters. The study involved 156 healthy women with an average age of 60 (SD = 6.3 years) years who were [...] [Read more](#).

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High Prevalence of Anemia and Poor Compliance with Preventive Strategies among Pregnant Women in Mwanza City, Northwest Tanzania: A Hospital-Based Cross-Sectional Study

by  Eveline T. Konje,  Bernadin Vicent Ngaila,  Albert Kihunrwa,  Stella Mugassa,  Namanya Basinda and  Deborah Dewey

Nutrients 2022, 14(18), 3850; <https://doi.org/10.3390/nu14183850> - 17 Sep 2022

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Abstract Anemia in pregnancy is prevalent in Tanzania despite the implementation of existing prevention strategies. This study aims to determine the level of compliance with anemia preventive strategies among pregnant women and the factors associated with poor compliance. A cross sectional study was conducted [...] [Read more](#).







(This article belongs to the Special Issue **Maternal Nutrition in Pregnancy**)

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Brief Report



Estimated Choline Intakes and Dietary Sources of Choline in Pregnant Australian Women

by  Yasmine Probst,  Dian C. Sulistyoningrum,  Merryn J. Netting,  Jacqueline F. Gould,  Simon Wood,  Maria Makrides,  Karen P. Best and  Tim J. Green

Nutrients 2022, 14(18), 3819; <https://doi.org/10.3390/nu14183819> - 16 Sep 2022

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Abstract (1) Background: Despite the postulated importance of choline during pregnancy, little is known about the choline intake of Australians during pregnancy. In this study, we estimated dietary intakes of choline in early and late pregnancy, compared those intakes to recommendations, and investigated food [...] [Read more](#).

(This article belongs to the Section **Nutrition in Women**)

Short-Chain Fatty Acid Reference Ranges in Pregnant Women from a Mediterranean Region of Northern Spain: ECLIPSES Study

by  Carla Martín-Grau,  Andrés Díaz-López,  Estefania Aparicio and  Victoria Arija

Nutrients 2022, 14(18), 3798; <https://doi.org/10.3390/nu14183798> - 15 Sep 2022

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Abstract Maternal short-chain fatty acids (SCFAs) play a critical role in fetal development and metabolic programming. However, an important gap in the analysis of such relationships is the lack of reference values in pregnant women. Therefore, we establish serum SCFA percentile reference ranges both [...] [Read more](#). (This article belongs to the Special Issue **Maternal Nutrition in Pregnancy**)

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Polyphenol Intake in Pregnant Women on Gestational Diabetes Risk and Neurodevelopmental Disorders in Offspring: A Systematic Review

by  Blanca Salinas-Roca,  Laura Rubió-Piqué and  Anna Montull-López

Nutrients 2022, 14(18), 3753; <https://doi.org/10.3390/nu14183753> - 11 Sep 2022

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Abstract The intake of foods containing polyphenols can have a protective role to avoid comorbidities during pregnancy and, at the same time, promote transgenerational health. This review aims to describe the effect of polyphenol intake through supplements or polyphenol-rich foods during pregnancy on the [...] [Read more](#). (This article belongs to the Special Issue **Effects of Nutritional Supplementation during Pregnancy on Maternal and Fetal Health Outcomes**)

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Low Aerobic Capacity Accelerates Lipid Accumulation and Metabolic Abnormalities Caused by High-Fat Diet-Induced Obesity in Postpartum Mice

by  Mon-Chien Lee,  Yi-Ju Hsu,  Hsin-Ching Sung,  Ya-Ting Wen,  Li Wei and  Chi-Chang Huang

Nutrients 2022, 14(18), 3746; <https://doi.org/10.3390/nu14183746> - 10 Sep 2022

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Abstract Women during pregnancy and postpartum show high rates of obesity and metabolic diseases, especially women with excessive caloric intake. In the past, it was proved that individuals with high intrinsic aerobic exercise capacities showed higher lipid metabolism and lower fat production than those [...] [Read more](#). (This article belongs to the Special Issue **Healthy Eating, Physical Activity, and Weight Changes among Pregnant and Postpartum Women**)

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Predictors of Poor Neonatal Outcomes among Pregnant Women in Indonesia: A Systematic Review and Meta-Analysis

by  Siti Helmyati,  Maria Wigati,  Muhammad Hafizh Hariawan,  Erri Larene Safika,  Mira Dewi,  Cindra Tri Yuniar and  Trias Mahmudiono

Nutrients 2022, 14(18), 3740; <https://doi.org/10.3390/nu14183740> - 10 Sep 2022

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Abstract Objectives: This study aimed to examine the association between maternal health behaviors and neonatal outcomes among the Indonesian population. Methods: Articles were collected from PubMed, EBSCO, ProQuest, DOAJ, and GARUDA. Funnel plots and Egger's tests analyzed indications of publication bias. A Mantel–Haenszel random-effects [...] [Read more](#).

(This article belongs to the Section **Nutrition in Women**)

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Open Access **Feature Paper** **Article**



Composition of Maternal Circulating Short-Chain Fatty Acids in Gestational Diabetes Mellitus and Their Associations with Placental Metabolism

by Shuxian Wang, Yu Liu, Shengtang Qin and Huixia Yang

Nutrients **2022**, *14*(18), 3727; <https://doi.org/10.3390/nu14183727> - 09 Sep 2022

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Abstract Short-chain fatty acids (SCFAs), which are produced by gut microbiota from dietary fiber, have become candidates for gestational diabetes mellitus (GDM) treatment. However, the associations of circulating SCFAs with maternal–neonatal clinical parameters in GDM and further influences on placental immune–metabolic responses are unclear. [...] [Read more](#).

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Open Access **Commentary**



Relevance of Vitamin D and Its Deficiency for the Ovarian Follicle and the Oocyte: An Update

by Arkadiusz Grzeczka, Szymon Graczyk, Agnieszka Skowronska, Mariusz T. Skowronski and Paweł Kordowitzki

Nutrients **2022**, *14*(18), 3712; <https://doi.org/10.3390/nu14183712> - 09 Sep 2022

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Abstract For many years, vitamin D (VD) has been known to be an essential micronutrient with important relevance not only for the skeletal system, but also for numerous other mammalian organ systems. Low levels of VD result in a VD deficiency, which is a [...] [Read more](#).

(This article belongs to the Special Issue **Impact of Nutrition on Female Reproductive Disorders**)

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Open Access **Article**



Bacon, Brownie, or Broccoli? Beliefs about Stress-Relieving Foods and Their Relationship to Orthorexia Nervosa

by Annebirth Steinmann, Alea Ruf, Kira F. Ahrens, Andreas Reif and Silke Matura

Nutrients **2022**, *14*(18), 3673; <https://doi.org/10.3390/nu14183673> - 06 Sep 2022

Cited by 1 | Viewed by 941

Abstract Background: Nutritional beliefs play an important role when it comes to food choice. However, little attention has been paid to which foods individuals believe to be comforting when experiencing stress. With increasing health awareness in the general public, this study aims to examine [...] [Read more](#).

(This article belongs to the Special Issue **Eating Disorders, and Nutritional Beliefs, Trends or Practices**)

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Siti Helmyati, Maria Wigati, Muhammad Hafizh Hariawan, Erri Larene Safika, Mira Dewi, Cindra Tri Yuniar and Trias Mahmudiono



<https://doi.org/10.3390/nu14183740>

Article

Predictors of Poor Neonatal Outcomes among Pregnant Women in Indonesia: A Systematic Review and Meta-Analysis

Siti Helmyati ^{1,2,*}, Maria Wigati ^{1,2}, Muhammad Hafizh Hariawan ³, Erri Larene Safika ⁴, Mira Dewi ⁵, Cindra Tri Yuniar ⁶ and Trias Mahmudiono ⁷

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- * Correspondence: siti.helmyati@gmail.com

Abstract: Objectives: This study aimed to examine the association between maternal health behaviors and neonatal outcomes among the Indonesian population. Methods: Articles were collected from PubMed, EBSCO, ProQuest, DOAJ, and GARUDA. Funnel plots and Egger's tests analyzed indications of publication bias. A Mantel–Haenszel random-effects model was used to see the overall effect size of exposures on outcomes. Heterogeneity was seen based on I^2 . Data collected from articles included the author, year of publication, location of the study, study design, number of samples, risk factors, and effect sizes. Results: We identified 24 relevant studies, including eight from the primary databases and 16 from an additional database. A total of 12 studies were included in the meta-analysis, examining the association between maternal health behaviors and neonatal outcomes. The pooled odds ratio (OR) for passive smoking and low-birth-weight (LBW) was 3.41 (95% CI: 1.75–6.63, $I^2 = 40%$, four studies). The pooled OR for incomplete antenatal care (ANC) and LBW was 6.29 (95% CI: 2.11–18.82, $I^2 = 70%$, four studies). The pooled OR for incomplete ANC and neonatal mortality was 2.59 (95% CI: 1.01–6.66, $I^2 = 93%$, four studies). Conclusions: The results indicated that pregnant women with incomplete ANC had a higher risk of LBW and neonatal mortality, and those who were passively exposed to smoking had a higher risk of LBW. Further investigations are needed, considering the high heterogeneity found, and additional meta-analyses should be based on the variations of socio-demographic conditions.

Keywords: child mortality; health behavior; low birth weight; pregnancy outcomes; prenatal care; smoking



Citation: Helmyati, S.; Wigati, M.; Hariawan, M.H.; Safika, E.L.; Dewi, M.; Yuniar, C.T.; Mahmudiono, T. Predictors of Poor Neonatal Outcomes among Pregnant Women in Indonesia: A Systematic Review and Meta-Analysis. *Nutrients* **2022**, *14*, 3740. <https://doi.org/10.3390/nu14183740>

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1. Introduction

Maternal and child health and nutrition (MCHN) remain a problem in Indonesia and many low- and middle-income countries, which might as well burden the economy of a country's health system [1]. Compared to neighborhood countries in Southeast Asia, protection for Indonesian young children under five is still needed to lower the mortality rate among them [2]. The country's latest survey in 2015 documented the maternal mortality ratio of 305 per 100,000 live births [3]. According to routine national health data, the aggregate number of maternal deaths increased from 4197 in 2019 to 4627 in 2020. Additionally, it was reported that 28,158 children under five died in 2020. Of that number, 72% were neonates [4].

It was said that to pursue the optimum potential of the children, physical and social environmental balance was necessary. The domain covered individual levels such as nurturing culture within family, peers, and school conditions, to the community at a larger system [5]. However, the period between pregnancy and children of 24 months old, also known as the first 1000 days of life of children, might be the most prominent factor [6,7]. That being said, maternal diet and lifestyle affect neonatal outcomes. For example, poor antenatal care, environmental exposure, chronic malnutrition, inadequate personal hygiene and sanitation, anemia in pregnant women, and high second-hand smoke exposure during pregnancy contribute to poorer health outcomes for children such as stunting, low birth weight (LBW), impaired cognitive function, altered metabolic dynamics, and lower immune system response of the children [8].

The issue of MCHN has been a concern for many practitioners for years [9–11]. Nevertheless, information from Indonesian studies was lacking. It is unfortunate since as the largest archipelago country in the world with more than 270 million people in 2022 [12], diverse cultures and demographic situations might affect maternal behaviors that influence neonatal outcomes. Several examples include the effect of socio-culture on the perceived concept of health, traditional care during pregnancy, and health-seeking behaviors within community groups [13–24]. These situations might be Indonesia-specific and different from other cultures across countries, which could be an interesting case study for public health stakeholders worldwide. Thus, we aimed to elaborate on various Indonesian studies published in domestic and international sources. The results are expected to support evidence-based policy making in Indonesia and other countries with similar characteristics.

The findings in this study should be considered with some limitations. First, several articles included in this meta-analysis had a considerable risk of bias, with a NOS score below five. Second, there were high scores of heterogeneities for the meta-analysis of (1) incomplete ANC and LBW and (2) incomplete ANC and neonatal mortality. Third, funnel plots are disavowed with such a small sample size ($n < 10$ studies), as the inference of the plot itself can be biased.

2. Materials and Methods

2.1. Study Design and Research Sample

This systematic review and meta-analysis followed the guidelines set by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement [25]. The research sample in this meta-analysis included articles published from January 1990 to May 2021, which were contained in the PubMed, EBSCO, ProQuest, and DOAJ databases. We were specifically looking at the impact of health-related behavior of pregnant women on neonatal outcomes.

2.2. Operational Definition

The exposure or case was any health-related behaviors of Indonesian pregnant women, such as supplement consumption, exposure to smoke, and pregnancy care. Meanwhile, neonatal outcomes were defined as the health conditions of newborns until the age of 28 days. It included birth weight, birth length, death, and other conditions. For analysis, LBW was defined as a baby born with a weight below 2500 g, while neonatal mortality or neonatal death was defined as the death after a live birth during the first to 28 days of life [26].

2.3. Research Query

Queries used in this research were adjusted to MeSH. We search from PUBMED, PROQUEST, DOAJ, and EBSCO as primary databases and GARUDA as the additional database with the following query “pregnant women” AND (“smoking behavior” OR “secondhand smoking” OR “passive smoking” OR “dietary supplements” OR “snack” OR “snack food” OR “snacking” OR “dietary fiber” OR “dietary calcium” OR “antenatal care” OR “prenatal care” OR “sleeping habit” OR “sleep” OR “dietary sugar” OR “protein

deficiency" OR "dietary energy intake" OR "dietary protein intake" OR "protein-energy malnutrition" OR "dietary sodium chloride OR hygiene OR activities") AND ("body length" OR "birth weight" OR "low birth weight" OR "neonatal anemia" OR "pregnancy outcome" OR "head circumference" OR "upper arm" OR "upper arm circumference" OR "infant" OR "newborn") AND "Indonesia".

2.4. Additional Resource

We added additional journals from GARUDA [27], a scientific article database managed by Indonesia's Ministry of Education, Culture, Research, and Technology. It contains articles either in Bahasa Indonesia or English from local researchers. GARUDA is a comprehensive database covering all subjects from arts and humanities, behavioral sciences, and social sciences to medicine, pharmacology, physical sciences, engineering, and mathematics. It is designed for browsing, indexing, abstracting, monitoring, and improving the standard of scholarly publications in Indonesia. To date, it contains more than 2500 publishers and 13,000 journals.

2.5. Data Collection Procedures

Articles were selected based on population–exposure–comparison–outcome (PECO). The population in this study included pregnant women in Indonesia. The exposure was health-related behavior of pregnant women. The comparison for this study was pregnant women in Indonesia without direction. Meanwhile, pregnancy outcomes such as birth weight, birth length, death, and other conditions in newborns were measured as outcomes.

The data collection process can be seen in Figure 1. We collected full-text original articles from January 1990 to May 2021. The inclusion criteria for the articles were: (1) original articles in Bahasa Indonesia or English, (2) original research articles fulfilling PECO criteria, and (3) observational studies conducted in Indonesia, either cohort or case-control. Articles were excluded if full texts were not available or data incomplete. After collecting the articles, three reviewers (MW, ELS, MHH) who are fluent in Bahasa Indonesian and English separately examined the title, the abstract, and the full text. We moved to the next stage of assessment when the consensus was achieved in the initial review phase. While checking duplicates and reviewing articles, we used Rayyan, a web and mobile app for systematic reviews [28]. We tabled the articles' information, including the authors' names, year of publication, study location, study design, sample size, risk factors, and effect size.

2.6. Data Analysis

Review Manager 5.310 and STATA 1611 were used for the data analysis to analyze the pooled effect size, including odds ratio (OR) and heterogeneity from the collected articles. The Mantel–Haenszel random-effects method was used to conduct the meta-analysis. A forest plot was produced to show the estimated effect, the number of variations between studies, and confidence intervals (CI) from individual studies meta-analyses [29]. For articles that have an effect size of relative risk (RR), calculations in Stata 16 were performed to obtain the effect size in the form of odds ratio (OR) formulated from summary data such as effect size and CI to convert RR to OR before analyzing the pooled effect size. Substantial heterogeneity was based on the I^2 value ($I^2 = 50\text{--}90\%$) [30]. Analyses of funnel plots and Egger's test were conducted to see potential publication bias. The Newcastle–Ottawa Scale (NOS) was used to assess the quality of the selected articles [31]. Due to the limited research in Indonesia, specifically for articles in Indonesian, we used SINTA [32], a Science and Technology Index developed by the Ministry of Research and Technology of Indonesia, to assess the quality of articles in addition to using NOS. We were only looking for journals with a SINTA index 1–3. Journal assessment at SINTA was based on several aspects, such as the number of articles with the Scopus index, the number of citations on Scopus, and the number of sources on Google Scholar.

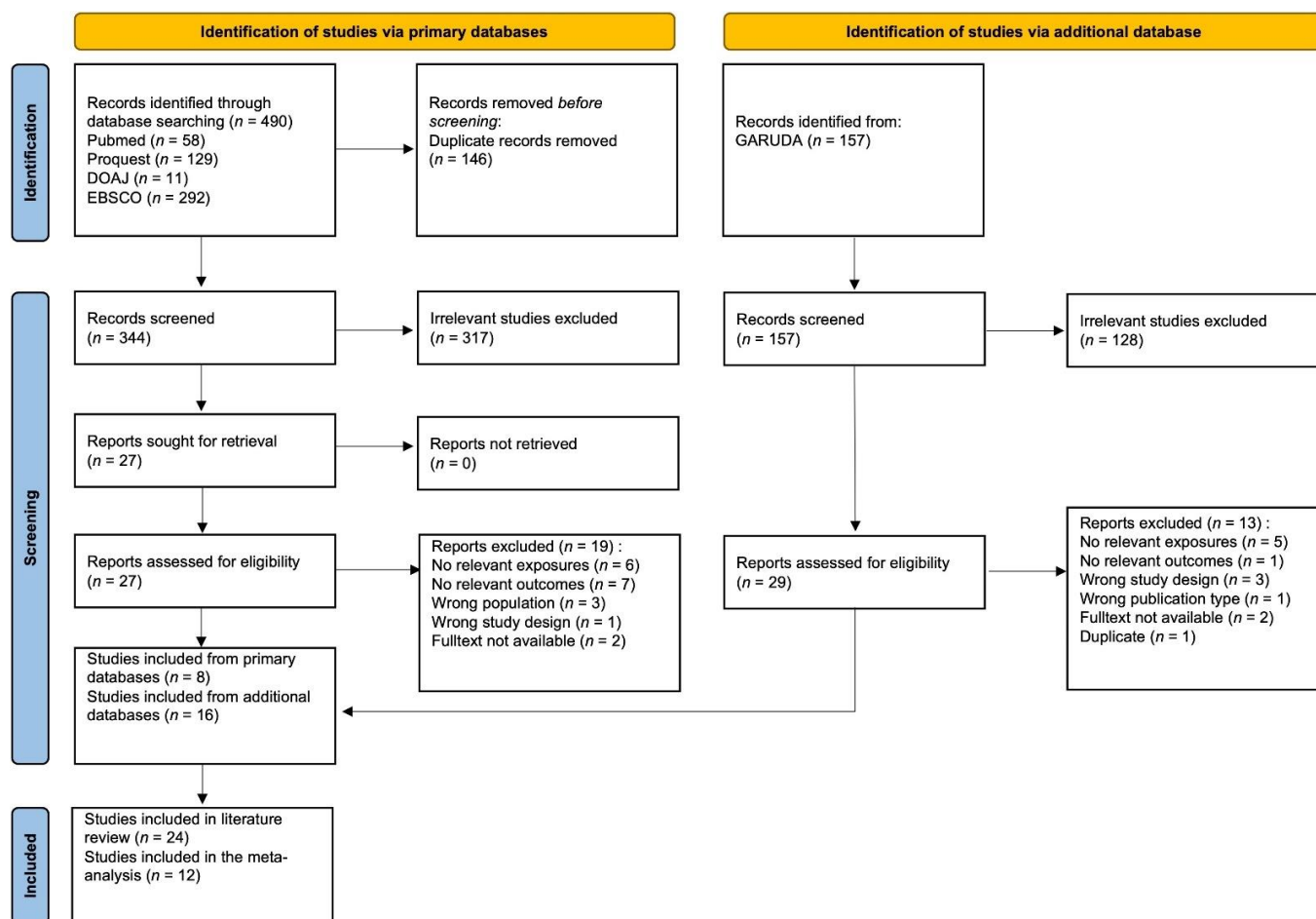


Figure 1. Data collection process.

3. Results

3.1. Characteristics of Included Studies

This study retrieved 490 articles, with 59 articles from PUBMED, 129 from PROQUEST, 11 from DOAJ, and 292 from EBSCO. After duplications were removed, 344 articles were screened for abstracts, which resulted in 27 articles screened for full-text review. As many as eight articles were selected for this study. Additional resources were also included from GARUDA, an Indonesian scientific journal database. Using the same query, we found 157 journal articles, with 16 papers selected from full-text reviews. Finally, 24 articles from additional sources were selected, and 12 were analyzed for meta-analysis. Twelve studies were not included in the meta-analysis because they did not have comparable outcomes or interventions. There should be at least two studies with the same outcome for a meta-analysis to be conducted [33].

Table 1 shows all studies included in the literature review. All studies included were conducted across Indonesia. As for studies in the Indonesia database, we only had those published in journals with SINTA index three or above. Six studies were found on Sumatera Island [34–39], five on Java Island [40–44], four on Sulawesi Island [45–48], two on Borneo Island [49,50], three in East Nusa Tenggara [51–53], one in Bali [54], and one in Maluku Island [55]. Seventeen studies were conducted by case-control study design, and eight by cohort study design.

Table 1. General characteristics of studies.

No	First Author, Publication Year	Study Year	Study Design	Location	Study Subject	Control	Health-Related Behaviors	Neonatal Outcomes	Effect Size	95% CI	Other Results	Article Quality ^a		
1	Abdullah et al., 2012 [45]	2009	Case-control	Makassar, South Sulawesi	40	Mothers with early neonatal death history	120	Mothers without early neonatal death history	0–4 ANC visits 0–3 ANC visits	Early neonatal death Early neonatal mortality	OR 1.558 OR 7.3	0.32–7.47 N/A	p value = 0.000; B = 0.748; Sig = 0.650	7
2	Abdullah et al., 2016 [52]	2013	Matched case-control	East Nusa Tenggara	152	Mothers with neonatal death history reported to health service	308	Mothers without neonatal deaths history reported to health service	Did not take all recommended iron supplements	Neonatal death	OR 2.27	1.13–4.54	Several infants' habits also significantly influenced the risk of neonatal death (did not initiate early breastfeeding, did not practice the kangaroo method and had health problems) Results were descriptively analyzed	7
3	Alfianti and Darmawati, 2016 [34]	2016	Retrospective	Banda Aceh	35	Mothers who gave birth to LBW baby	N/A	N/A	Smoking	Low-birth weight	N/A	N/A	Path analysis found that LBW was significantly affected by maternal health status and obedience to the traditional pregnancy rate The author did not define what complete ANC visits is	1
4	Anggrahini et al., 2020 [51]	2016–2017	Case-control	East Nusa Tenggara	50	Mothers who gave birth to LBW baby	50	Mothers who gave birth to NBW baby	Obedience to traditional pregnancy care	Low-birth weight	N/A	N/A	ANC visits were the only health behavior discussed in this article	5
5	Astuti, 2020 [35]	2020	Case-control	South Bengkulu	15	Mothers who gave birth to LBW baby	15	Mothers who gave birth to NBW baby	Have complete ANC visits	Low-birth weight	8	N/A		3
6	Diniya et al., 2016 [49]	2013–2015	Case-control	Banjar	41	Mothers who gave birth to LBW baby	123	Mothers who gave birth to NBW baby	Have complete ANC visits	Low-birth weight	OR 3.73	1.61–8.66		4
7	Ernawati, 2016 [40]	N/A	Case-control	Pati, Central Java	32	Mothers who gave birth to LBW baby	32	Mothers who gave birth to NBW baby	Frequency ANC visits Have complete ANC visits	Low-birth weight Low-birth weight	N/A OR 4.911	N/A 1.591–15.157	-	7
8	Heldawati et al., 2018 [46]	2015–2016	Retrospective cohort	Palu, Central Sulawesi	34	Preeclamptic pregnant women	34	non-preeclamptic pregnant women	<4 ANC visits	Low-birth weight	$p=0.013$	N/A	-	5
9	Ibrahim et al., 2012 [55]	2006–2007	Cohort	Indonesia	1867	Pregnant women with 2–3 ANC visits during pregnancy	11,118	Pregnant women with four or more ANC visits during pregnancy	4–6 ANC visits 7–9 ANC visits Ten or more ANC visits	Neonatal mortality Neonatal mortality Neonatal mortality	RR 1.01 RR 0.65 RR 0.60	0.61–1.68 0.40–1.08 0.32–1.13	The frequency of ANC visits in the third trimester is significantly associated with the risk of neonatal death.	7

Table 1. Cont.

No	First Author, Publication Year	Study Year	Study Design	Location	Study Subject	Control	Health-Related Behaviors	Neonatal Outcomes	Effect Size	95% CI	Other Results	Article Quality ^a		
10	Lestari et al., 2015 [54]	2013	case-control	Gianyar, Bali	58	Infants with low birth weight	58	Infants with average birth weight	Husband's smoking exposure Family members smoking exposure	Low-birth weight Low-birth weight	OR 6.37 OR 6.577	2.836–14.309 2.894–14.948	-	3
11	Mahdalena, 2014 [50]	2012	Retrospective cohort	South Kalimantan	45	Active and passive smoking pregnant women	22	Nonsmoking pregnant women	Non-smoking Passive smoking Active smoking	Low-birth weight Low-birth weight Low birth weight	$p = 0.78$	N/A	-	3
12	Musrifa et al., 2014 [53]	2013	Case-control	East Nusa Tenggara	29	Mothers with early neonatal death history	58	Mothers without early neonatal death history	Husband's smoking exposure (passive smoking) Body weighing	Early neonatal death Low birth weight	OR 2.758 OR 2.5	0.72–10.50 1.26–5.03	-	6
13	Nur et al., 2016 [47]	2015	Case-control	Palu, Central Sulawesi	58	Mothers giving birth to LBW infant	116	Mother giving birth to normal weight infant	Blood pressure checking Hemoglobin level examination	Low birth weight Low birth weight Low birth weight	OR 2.69 OR 3.15	1.39–5.18 1.45–6.85	The pregnancy gap was found to be another risk factor for LBW	4
14	Nur, 2018 [48]	N/A	Case-control	Palu, Central Sulawesi	63	Mothers giving birth to LBW infant	63	Mother giving birth to normal weight infant	Passive smoking Mother sun exposure for the entire pregnancy (weekday)	Low birth weight	OR 2.21	1.07–4.58	Premature rupture of membranes and light placenta is found to be the other risk factors of LBW	3
15	Oktaria et al., 2021 [41]	2015–2017	Community-based cohort	Yogyakarta	422	Pregnant women and their infants from birth until 12 months	N/A	N/A	Q2 v Q1 Q3 v Q1 Q4 v Q1	pneumonia onset in the first postnatal year pneumonia onset in the first postnatal year pneumonia onset in the first postnatal year	HR 0.72 HR 0.85 HR 0.25	0.41–1.26 0.49–1.49 0.25–0.90		8

Table 1. Cont.

No	First Author, Publication Year	Study Year	Study Design	Location	Study Subject	Control	Health-Related Behaviors	Neonatal Outcomes	Effect Size	95% CI	Other Results	Article Quality ^a		
								Mother sun exposure for the entire pregnancy (weekend)						
								Q2 v Q1	pneumonia onset in the first postnatal year	HR 0.68	0.38–1.22			
								Q3 v Q1	pneumonia onset in the first postnatal year	HR 0.91	0.53–1.55			
								Q4 v Q1	pneumonia onset in the first postnatal year	HR 0.46	0.24–0.87			
								Father smokes every day	Smoke exposure pneumonia onset in the first postnatal year	HR 1.57	1.02–2.41			
16	Paunno et al., 2015 [55]	2007–2008	Case-control	Ambon, Maluku	69	Mothers with stillbirth history	69	Mothers without stillbirth history	Passive smoking	Stillbirth	OR 3.36	1.22–10.17	The other risk factors of stillbirth were ANC quality and anemia status.	6
17	Rahim, 2020 [44]	2017–2018	Case-control	Kuningan, West Java	27	Mothers giving birth to LBW infant	27	Mother giving birth to normal weight infant	0–3 ANC visits	Low birth weight	OR 2.17	0.36–13.01	The small number of subjects could be the cause of the insignificant results	8
18	Rini et al., 2018 [36]	2012–2015	Case-control	Lampung	22	Mothers giving birth to LBW infant	22	Mother giving birth to normal weight infant	Passive smoking	Low birth weight	OR 2	0.62–6.42	Passive smoking is the only health behavior analyzed	4
19	Riyanti et al., 2018 [37]	2015–2016	Case-control	Bener Meriah, Aceh	38	Mother giving birth to LBW infant	38	Mother giving birth to normal weight infant	Active Smoking	Low birth weight	OR 1.45	0.43–1.02	Maternal age, number of children, and anemia are also found to be the risk factors for LBW	5
20	Savitri et al., 2018 [42]	2012–2014	Cohort	Jakarta	1099	Pregnant women Ramadhan exposure	252	Pregnant women without Ramadhan exposure	Four or more ANC visits	Low birth weight	OR 0.28	0.08–1.02		8
								Fasted at any trimester	birth weight	β –63.7	–230.5 to 103			
								Fasted in the first trimester	birth weight	β –23.4	–246.8 to 200.1			
								Fasted in the second trimester	birth weight	β –35.3	–224.2 to 153.7			
								Fasted in the third trimester	birth weight	β –121.8	–318 to 74.4			
21	Soesanti et al., 2020 [43]	2012–2017	Cohort	Jakarta	133	Pregnant women who use household pesticide	151	Pregnant women who did not use household pesticide	Use of household pesticide	birth weight	β –121.4	–227.6 to –15.2		7
								Use of household pesticide	birth length	β –4.0	–9.3 to 1.4			
								Use of household pesticide	Head circumference	β –6.4	–12.1 to –0.7			

Table 1. Cont.

No	First Author, Publication Year	Study Year	Study Design	Location	Study Subject	Control	Health-Related Behaviors	Neonatal Outcomes	Effect Size	95% CI	Other Results	Article Quality ^a
22	Sutan et al., 2014 [38]	2010–2012	Unmatched case-control retrospective	Aceh	250 Mothers with LBW babies who died during the neonatal period	250 Mothers with LBW babies who survived during the neonatal period	0–3 ANC visits	Neonatal mortality among low birth weight	OR 3.57	2.38–5.38		7
23	Syari et al., 2015 [39]	2015	Case-control	Padang, West Sumatera	19 Mother giving birth to LBW infant	21 Mother giving birth to normal weight infant	Energy intake Protein intake Fat intake Carbohydrate intake	Low birth weight Low birth weight Low birth weight Low birth weight	OR 76 OR 8.5 OR 7 OR 12	7.7–754 1.54–47 1.7–30.5 2.7–53.3	Macronutrient intake was the only health behavior discussed in the article	7
24	Titaley et al., 2010 [24]	1994, 1997, 2002–2003	Cohort	Indonesia	442 Mothers with recent early death neonate	40134 Mothers with singleton live-born infants	Iron/folic acid supplementation	Neonatal mortality	HR 0.53	0.36–0.77	Iron and folic acid supplementation provide the main protective effect combined with no other form of neonatal care or <2 tetanus toxoid injections	7

^a Newcastle–Ottawa Scale [35]. N/A, data not available.

Regarding the year of publication, all studies were published between 2010 and 2020. Maternal health behaviors identified from the collected studies based on the queries inputted were ANC visits, active and passive smoking, iron and folic acid supplementation, sun exposure, obedience to traditional pregnancy care, fasting, and the use of household pesticides, and macronutrient intake. In contrast, the pregnancy outcomes were low birth weight, neonatal mortality, stillbirth, head circumference, and pneumonia in the first postnatal year. However, only a few maternal health behaviors and outcomes were eligible to be analyzed for meta-analysis. The exposures for this meta-analysis were maternal health behaviors such as active and passive smoking and ANC visits, while the outcomes were LBW and neonatal mortality.

3.2. Quality of Studies

The NOS assessment form was used for assessing the quality of nonrandomized studies, including case-control and cohort studies. Sixteen studies included in this systematic review and meta-analysis had scores above or equal to 5 points, which means they had no considerable risk of bias. Approximately eight studies scored below 5 points, regarded as having a potential bias [56]. Complete results of the quality analysis for all articles can be seen in Table 1.

Relation between maternal smoking behaviors, antenatal care, and infants born with low birth weight.

A meta-analysis examining the relationship between smoke exposure and LBW was conducted on four studies discussing the association between maternal smoke exposure and birth weight. Those research studies were performed in western Indonesia (Lampung), middle (Bali, Kalimantan), and Eastern Indonesia (Sulawesi). Three studies used case control, and one used retrospective cohort design. From the case-control studies, there were 143 cases of infants with LBW and 143 controls, while in the cohort study, there were 45 subjects exposed to SHS and 22 subjects not exposed to SHS.

Another four studies were included to assess the association between ANC and LBW. These studies used a case-control design and were conducted in western Indonesia. In total, there were 138 cases of mothers who gave birth to a LBW baby and 220 mothers as controls who gave birth to average birth weight (NBW) baby.

In Figure 2, exposures were analyzed to see the overall effect on the behavior of pregnant women toward LBW babies. Based on the analysis of pooled articles, the odds of babies born with LBW were 6.3 times greater in pregnant women with incomplete ANC (95% CI: 2.11–18.82) and 3.4 times greater in pregnant women who became passive smokers (95% CI: 1.75–6.63). Although the overall effect size for incomplete ANC was greater than passive smoking, there was an indication of a high variation in the research on the relationship between incomplete ANC and LBW cases in Indonesia, as indicated from $I^2 > 50\%$ and $p_{\text{heterogeneity}} < 0.05$.

3.3. Relation between Antenatal Care and Neonatal Mortality

Four studies from 2012 to 2018 were analyzed to understand the relationship between incomplete ANC and neonatal mortality. Three studies were case control, and one was a cohort. From the case-control studies, there were 319 cases of mothers with a history of neonatal mortality and 428 controls. Meanwhile, the cohort study found 1867 subjects exposed to low ANC and 11,118 subjects with good ANC. Figure 3 shows that the odds of neonatal mortality were increased 2.5 times if the mother did not obtain complete ANC (95% CI: 1.01–6.66). However, this result must be carefully examined since the heterogeneity test showed 91.53%. There was a wide range of sample sizes between Ibrahim et al. [55] and the other three studies, which may contribute to the results.

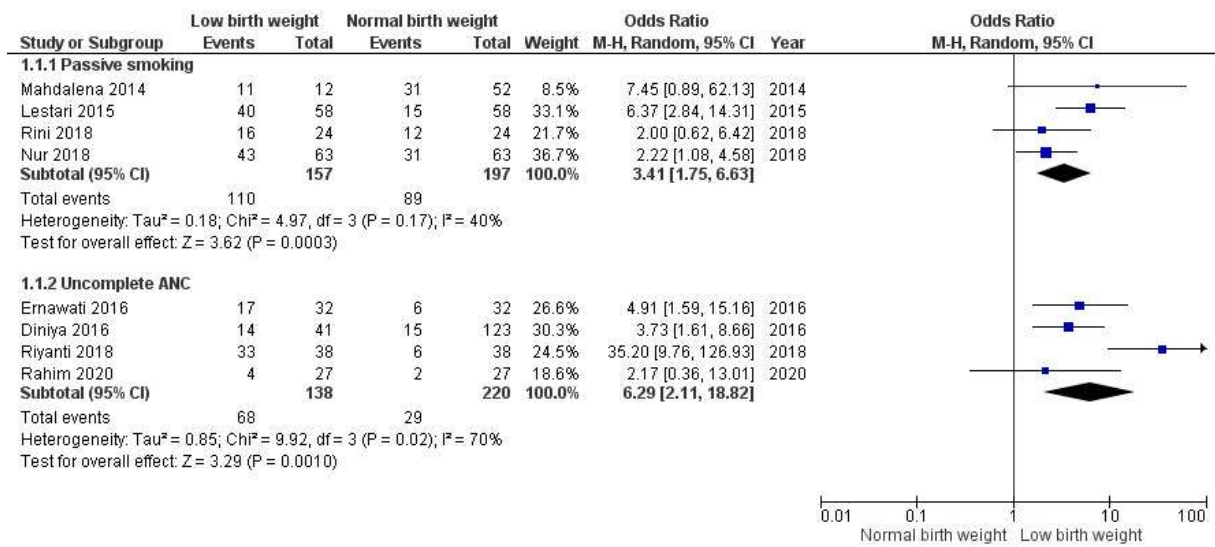


Figure 2. Association between passive smoking, active smoking, incomplete ANC, and LBW.

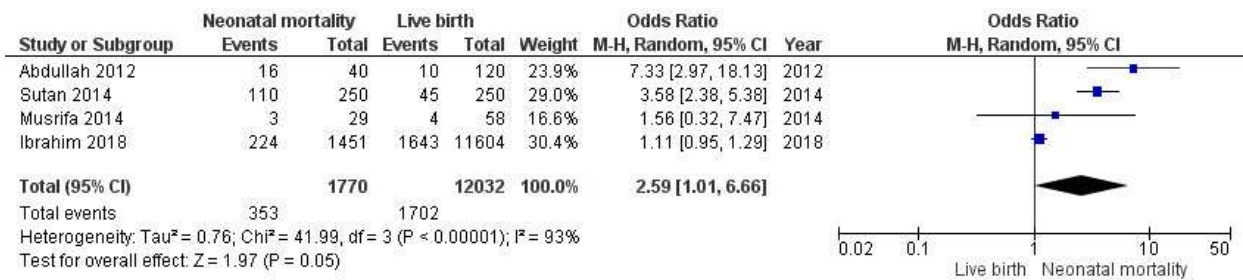


Figure 3. Association between incomplete ANC and neonatal mortality.

3.4. Potential for Publication Bias Analysis

Considering the potential for publication bias in our results, we conducted Egger’s tests followed by a funnel plot analysis. The Egger’s tests in Table 2 showed that the p values of all pairs of maternal health-related behaviors and outcomes were >0.05, indicating no publication bias. However, due to the small number of studies included in this meta-analysis, the power of Egger’s test to detect publication bias is low.

Table 2. Publication bias analysis.

Risk Factors	Outcomes	p Value ^a
Passive smoking	Low birth weight	0.656
Incomplete ANC	Low birth weight	0.876
Incomplete ANC	Neonatal mortality	0.717

^a Egger’s test, significant if p < 0.05.

Corresponding with the results of Egger’s tests, the funnel plots in Figure 4 demonstrate the variety of shapes of the pooled studies. Figure 4B,C seemed asymmetrical, while Figure 4A seemed more symmetrical. This pattern supported previous results that showed that the studies had a high publication heterogeneity. Therefore, the conclusion was difficult to reach since the number of studies was limited.

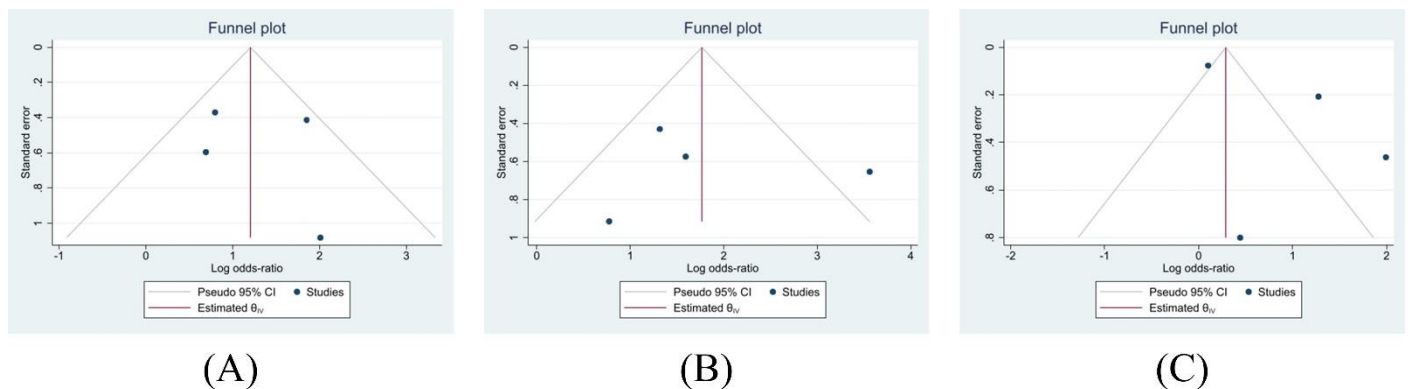


Figure 4. Funnel plot graph: (A) passive smoking and LBW, (B) incomplete ANC and LBW, and (C) incomplete ANC and neonatal death.

4. Discussion

This systematic review and meta-analysis evaluated the association between maternal health behaviors and neonatal outcomes in Indonesia. These findings confirmed that mothers who did not have ≥ 4 ANC visits had a higher risk of giving birth to LBW infants (OR 6.29, 95% CI: 2.11–18.82), as did mothers who were exposed to cigarette smoke (OR 3.41, 95% CI: 1.75–6.63).

Studies from developing countries have shown evidence about the importance of ANC in mitigating the prevalence of LBW and neonatal mortality [44]. A study in Sulawesi, Indonesia, found that pregnant women who were not receiving several ANC contents, including regular checks of blood pressure, hemoglobin, and body weight measurement, had a higher risk of giving birth to LBW infants [47].

The WHO recommended the Focused Antenatal Care (FANC) model, indicating that pregnant women should make at least four ANC visits. This has been updated to 2016 WHO ANC Model, which recommends a minimum of eight ANC contacts during pregnancy [57]. It aims to decrease maternal morbidity and mortality. A survival analysis from the IDHS reported that ANC, not postnatal care, reduced the risk of neonatal death by 51%. Unfortunately, several studies found disparities in ANC utilization in developing countries, including Indonesia. Discrepancies could occur due to geographical, demographic, socioeconomic conditions, and cultural differences, resulting in decreased access, service quality, and affordability [58].

A previous study reported that the eastern part of Indonesia had the lowest distribution of ≥ 4 ANC visits. Its proportion was centered in the central region, namely the Java-Bali region, followed by the western part. Regional geographic conditions in eastern Indonesia are also more extreme and challenging to reach than in their western counterparts, making some areas fall into a small category. Further, Java-Bali and Kalimantan regions were dominated by wealthier women, while the remaining sites were by the poor ones [52]. Socio-economic factors were also related to ANC visits among adolescents and young women in Indonesia [59]. To overcome this disparity, the Indonesian government launched the world's most comprehensive single-payer health insurance called Jaminan Kesehatan Nasional (JKN) to ensure the nation's universal health coverage [60]. This expansion of health insurance coverage has improved access to MCHN services, which is helpful for the poorest quantile households and remote areas in the eastern part of Indonesia. However, the discrepancy in maternal health services coverage persists across socioeconomic groups and geographical regions, which may be caused by the inequitable distribution of the subsidy and maternal health services provided by JKN [61].

Our study found that passive smoking was associated with a higher risk of LBW in Indonesia. Exposure to tobacco smoke (ETS), or passive smoking, is passive second-hand smoke (SHS) exposure to tobacco smoke from an active smoker and has harmful impacts on health and pregnancy outcomes. Following our results, other studies have shown increased

risks of LBW, preterm delivery, and trimmer head circumference in mothers exposed to SHS [62]. A meta-analysis by Leonardi-Bee et al. [63] found that ETS reduces mean birth weight by 33 g or more and increases LBW by 22%. Although other studies supported our results, we found heterogeneity in our analysis that socio-demographic variations might cause. Two studies were conducted in hospital settings [47,50], one in a maternity clinic [36], and the other in a community setting [54]. The sample size in all studies was relatively small, with a wide range of CI.

A study in Ambon, Indonesia, reported that pregnant passive smoker women had a 2.8-times higher chance of stillbirth after adjusting for ANC quality, anemia, and education [55]. Tobacco smoke contains many harmful toxins and may adversely affect pregnant women through various mechanisms. Research showed that passive smokers possibly inhale fetal toxins in greater concentrations. Several mechanisms have been suggested concerning why passive smoking affects neonatal birth weight. Nicotine or polycyclic aromatic hydrocarbons from cigarette smoke may directly affect fetal growth, with nicotine constricting uteroplacental arteries while reducing blood flow and oxygen to the fetus and other toxins that may have unidentified mechanisms [63].

We found additional factors that may influence adverse neonatal outcomes in Indonesia. A study in East Nusa Tenggara, Indonesia, found that pregnant mothers chose not to conduct standard ANC, kept working hard in domestic work, and followed several food restrictions because of the cultural beliefs that follow 'traditional pregnancy care' to ensure a smooth delivery. In low socio-economic conditions, smooth pregnancy and delivery are considered valuable and could save more costs. Further, these recommendations are passed down by parents-in-laws [51]. These 'traditional pregnancy care' practices must be carefully considered in MCHN programs since many cultures in Indonesia also have some rules and taboos concerning pregnant women. The majority are afraid and uncomfortable disobeying the traditional rules [64].

A study in Padang, Indonesia, reported that pregnant women with inadequate energy, protein, fat, and carbohydrate intake had a higher risk for LBW [39]. A study in Indonesia said that fasting pregnant women had a significantly lower energy intake during the one month of Ramadhan, but fasting was not associated with LBW [42]. This result was similar to studies in other countries [65]. Acute respiratory infection (ARI), pneumonia, and vitamin D deficiency at birth are common in Indonesia. A cohort study in Yogyakarta, Indonesia, reported that vitamin D supplementation and safe sun exposure during pregnancy had the potential to reduce ARI incidence in infants [41]. Therefore, appropriate macro- and micronutrient intake plays a role in protecting against adverse neonatal outcomes and should be emphasized during pregnancy.

Findings in our study suggest that local governments should increase the ANC quality in each district, along with the JKN intervention in providing health insurance for pregnant mothers and equal distribution of maternal health services, to narrow the gap in maternal health services across the country. Health providers must have strong communication skills and knowledge of nutrition and health behavior for pregnant women, so that they can effectively give proper education based on local customs. Further, health providers and the government need to cooperate with local organizations to campaign for smoking cessation programs and strengthen education about the dangers of cigarette smoke for pregnant women and infants.

The findings in this study should be considered with caution. First, several articles included in this meta-analysis had a considerable risk of bias, with a NOS score below five. Second, there were high scores of heterogeneities for the meta-analysis of (1) incomplete ANC and LBW and (2) incomplete ANC and neonatal mortality. Third, funnel plots are disavowed with such a small sample size ($n < 10$ studies), as the inference of the plot itself can be biased. As proposed by Sterne et al. [66], it would be hard to achieve any definite conclusions within a meta-analysis with high heterogeneity since there were possible socio-demographic variations and seasonality effects in those studies. This is not an exaggeration considering the situation of Indonesia as a vast archipelago country. Although these

limitations impede concluding a fixed relationship between maternal health behaviors and neonatal outcomes in Indonesia, this analysis still provides broadening views and improves the scarcity in the literature. These findings also show the need to improve the quality of the research and publications conducted in Indonesia. Furthermore, the authors would like to propose the importance of the socio-demographic and cultural approach analysis based on the study sites in Indonesia. Study results might be different because of the high variabilities of these factors.

5. Conclusions

Our meta-analysis of studies in Indonesia found that pregnant women who had less than four ANC visits had a higher risk of giving birth to LBW infants. Pregnant women exposed to cigarette smoke also had a higher chance of LBW. These results must be carefully interpreted since we discovered high heterogeneity among the included studies. Further investigation needs to be performed to assess the health-related behaviors among pregnant women and their association with neonatal outcomes in Indonesia. The evidence is still scarce, and we can reach better conclusions about the significant associations with more precise findings.

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References

1. Moran, P.S.; Wuytack, F.; Turner, M.; Normand, C.; Brown, S.; Begley, C.; Daly, D. Economic burden of maternal morbidity—A systematic review of cost-of-illness studies. *PLoS ONE* **2020**, *15*, e0227377. [[CrossRef](#)] [[PubMed](#)]
2. World Health Organization. Maternal Mortality. 2019. Available online: <https://apps.who.int/iris/bitstream/handle/10665/329886/WHO-RHR-19.20-eng.pdf>. (accessed on 2 February 2022).
3. Badan Pusat Statistik. Survei Penduduk Antar Sensus (SUPAS), 2015. 2016. Available online: <https://sirusa.bps.go.id/sirusa/index.php/dasar/pdf?kd=2&th=2015> (accessed on 2 February 2022).
4. Kementerian Kesehatan, R.I. Profil Kesehatan Indonesia The Indonesian Health Profile. 2020. Available online: <https://pusdatin.kemkes.go.id/resources/download/pusdatin/profil-kesehatan-indonesia/Profil-Kesehatan-indonesia-2019.pdf> (accessed on 2 February 2022).
5. Kuruvilla, C.; Sathyamurthi, K. Social determinants of child health and development—A participatory approach. *Int. J. Curr. Res.* **2016**, *8*, 38295–38300.
6. Romano-Keeler, J.; Sun, J. The First 1000 Days: Assembly of the Neonatal Microbiome and Its Impact on Health Outcomes. *Newborn* **2022**, *1*, 219–226. [[CrossRef](#)]
7. UNICEF. First 1000 Days The Critical Window to Ensure That Children Survive and Thrive. 2017. Available online: <https://www.unicef.org/southafrica/sites/unicef.org.southafrica/files/2019-03/ZAF-First-1000-days-brief-2017.pdf> (accessed on 2 February 2022).
8. Titaley, C.R.; Ariawan, I.; Hapsari, D.; Muasyaroh, A.; Dibley, M.J. 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*, 1106. [[CrossRef](#)] [[PubMed](#)]

9. Helmyati, S.; Rahayu, E.S.; Kandarina, B.J.I.; Juffrie, M. No Difference Between Iron Supplementation Only and Iron Supplementation with Synbiotic Fermented Milk on Iron Status, Growth, and Gut Microbiota Profile in Elementary School Children with Iron Deficiency. *Curr. Nutr. Food Sci.* **2018**, *16*, 220–227. [CrossRef]
10. Helmyati, S.; Sudargo, T.; Kandarina, B.I.; Yuliati, E.; Wisnusanti, S.U.; Puspitaningrum, V.A.D.; Juffrie, M. Tempeh extract fortified with iron and synbiotic as a strategy against anemia. *Int. Food Res. J.* **2016**, *23*, 2296–2299.
11. Helmyati, S.; Shanti, K.; Sari, F.; Sari, M.; Atmaka, D.; Pratama, R.; Wigati, M.; Wisnusanti, S.; Nisa', F.; Rahayu, E. Synbiotic Fermented Milk with Double Fortification (Fe-Zn) as a Strategy to Address Stunting: A Randomized Controlled Trial among Children under Five in Yogyakarta, Indonesia. *Processes* **2021**, *9*, 543. [CrossRef]
12. Badan Pusat Statistik. Jumlah Penduduk Pertengahan Tahun (Ribuan Jiwa), 2020–2022. 2022. Available online: <https://www.bps.go.id/indicator/12/1975/1/jumlah-penduduk-pertengahan-tahun.html> (accessed on 2 February 2022).
13. Widayanti, A.W.; Green, J.A.; Heydon, S.; Norris, P. Health-Seeking Behavior of People in Indonesia: A Narrative Review. *J. Epidemiology Glob. Heal.* **2020**, *10*, 6–15. [CrossRef]
14. Suswardany, D.L.; Sibbritt, D.W.; Supardi, S.; Pardosi, J.F.; Chang, S.; Adams, J. A cross-sectional analysis of traditional medicine use for malaria alongside free antimalarial drugs treatment amongst adults in high-risk malaria endemic provinces of Indonesia. *PLoS ONE* **2017**, *12*, e0173522. [CrossRef]
15. Supardi, S.; Susyanty, A.L. Penggunaan obat tradisional dalam upaya pengobatan sendiri di Indonesia-(analisis data Susenas tahun 2007) [The use of traditional medicines in self-medication in Indonesia-an analysis of National Socio-Economic Survey 2007]. *Bul. Penelit. Kesehat.* **2010**, *38*, 80–89.
16. Supardi, S.; Jamal, S. Raharni Pola Penggunaan Obat, Obat Tradisional dan Cara Tradisional dalam Pengobatan Sendiri di Indonesia [The pattern of the use of medicine, traditional medicine and traditional methods self-medication]. *Bul. Penel. Kesehat.* **2005**, *33*, 192–198.
17. Handayani, L.; Siswanto, S.; Ma'ruf, N.A.; Hapsari, D. Pola pencarian pengobatan di Indonesia: Analisis data Susenas 2001 [Health seeking behaviour pattern in Indonesia: An analysis of National Socio-Economic survey 2001]. *Bul. Penelit. Kesehat.* **2003**, *31*, 33–47.
18. Ahmad, R.A.; Richardus, J.H.; De Vlas, S.J. Care-seeking behaviour among individuals with TB symptoms in Jogjakarta Province, Indonesia: A community-based study. *Int. Health* **2013**, *5*, 51–57. [CrossRef] [PubMed]
19. Fles, R.; Bos, A.C.R.K.; Rachmawati, D.; Waliyanti, E.; Tan, I.B.; Haryana, S.M.; Schmidt, M.K.; Dewi, F.S.T. The role of Indonesian patients' health behaviors in delaying the diagnosis of nasopharyngeal carcinoma. *BMC Public Health* **2017**, *17*, 510. [CrossRef]
20. Ariyanto, Y.; Wati, D.M. Understanding social context on TB cases. *J. Phys. Conf. Ser.* **2017**, *801*, 012035. [CrossRef]
21. Suhariadi, F.; Zein, R.A.; Alfian, I.N.; Hadi, C. The tale of seeking treatment: A qualitative study of pulmonary tuberculosis patients. *Psychol. Community Health* **2016**, *5*, 229–243. [CrossRef]
22. Brooks, M.I.; Thabrany, H.; Fox, M.P.; Wirtz, V.J.; Feeley, F.G.; Sabin, L.L. Health facility and skilled birth deliveries among poor women with Jamkesmas health insurance in Indonesia: A mixed-methods study. *BMC Health Serv. Res.* **2017**, *17*, 105. [CrossRef]
23. Nasir, S.; Ahmed, R.; Kurniasih, M.; Limato, R.; Tulloch, O.; Syafruddin, D.; De Koning, K. Challenges that Hinders Parturients to Deliver in Health Facilities: A Qualitative Analysis in Two Districts of Indonesia. *Makara J. Health Res.* **2016**, *20*, 79–87. [CrossRef]
24. Titaley, C.R.; Hunter, C.L.; Dibley, M.J.; Heywood, P. Why do some women still prefer traditional birth attendants and home delivery?: A qualitative study on delivery care services in West Java Province, Indonesia. *BMC Pregnancy Childbirth* **2010**, *10*, 43. [CrossRef]
25. Page, M.J.; McKenzie, J.E.; Bossuyt, P.M.; Boutron, I.; Hoffmann, T.C.; Mulrow, C.D.; Shamseer, L.; Tetzlaff, J.M.; Akl, E.A.; Brennan, S.E.; et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *Int. J. Surg.* **2021**, *372*, n71. [CrossRef]
26. World Health Organization. *ICD-10: International Statistical Classification of Diseases and Related Health Problems: Tenth Revision*, 2nd ed.; World Health Organization: Geneva, Switzerland, 2004; Available online: <https://apps.who.int/iris/handle/10665/42980> (accessed on 7 February 2022).
27. The Ministry of Education, Culture, Research, and Technology of Indonesia. GARUDA: Garba Rujukan Digital. 2018. Available online: <https://garuda.kemdikbud.go.id/> (accessed on 7 February 2022).
28. Ouzzani, M.; Hammady, H.; Fedorowicz, Z.; Elmagarmid, A. Rayyan—A web and mobile app for systematic reviews. *Syst. Rev.* **2016**, *5*, 210. [CrossRef] [PubMed]
29. Lewis, S.; Clarke, M. Forest plots: Trying to see the wood and the trees. *BMJ* **2001**, *322*, 1479–1480. [CrossRef]
30. Deeks, J.J.; Higgins, J.P.T.; Altman, D.G. Chapter 10: Analysing data and undertaking meta-analyses. In *Cochrane Handbook for Systematic Reviews of Interventions Version 6.2 (Updated February 2021)*; Higgins, J.P.T., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M.J., Welch, V.A., Eds.; Cochrane: London, UK, 2021; Available online: www.training.cochrane.org/handbook (accessed on 7 February 2022).
31. Wells, G.; Shea, B.; O'Connell, D.; Peterson, J.; Welch, V.; Losos, M.; Tugwell, P. The Newcastle-Ottawa Scale (NOS) for Assessing the Quality of Nonrandomised Studies in Meta-Analyses. Ottawa Hospital Research Institute. 2014. Available online: http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp (accessed on 21 July 2021).
32. Director General of Strengthening Research and Development, Ministry of Research Technology and Higher Education of the Republic of Indonesia. SINTA (Science and Technology Index). 2017. Available online: <https://sinta.kemdikbud.go.id/> (accessed on 7 February 2022).

33. Ryan, R.; Cochrane Consumers and Communication Review Group. Cochrane Consumers and Communication Group: Meta-Analysis. 2016. Available online: <http://cccr.org.cochrane.org>. (accessed on 12 February 2022).
34. Alfianti, C.I.; Darmawati. Factors influencing the occurrence of low birth weight in Banda Aceh. *JIM Fak. Keperawat.* **2016**, *1*. (In Bahasa Indonesia)
35. Astuti, E.R. The relationship between antenatal care and the incidence of low birth weight incidence in working area of Seginim Public Health Center South Bengkulu Regency. *J. Sains. Kesehat.* **2020**, *27*, 30–34, (In Bahasa Indonesia). [[CrossRef](#)]
36. Rini, K.S.; Istikomah, I. Relationship between passive smokers pregnant women with low birth weight (LBW) in newborns in Pringsewu Regency, Lampung. *J. Wacana Kesehat.* **2018**, *3*, 253–259, (In Bahasa Indonesia).
37. Riyanti, R.; Sipayung, N.A. Risk factors associated with the incidence of low birth weight babies (LBW) among coffee farming women in Bener Meriah Regency. *J. Bidan Komunitas* **2018**, *1*, 39–47, (In Bahasa Indonesia). [[CrossRef](#)]
38. Sutan, R.; Berkat, S. Does cultural practice affects neonatal survival- a case control study among low birth weight babies in Aceh Province, Indonesia. *BMC Pregnancy Childbirth* **2014**, *14*, 342. [[CrossRef](#)]
39. Syari, M.; Serudji, J.; Mariati, U. The role of maternal macronutrient intake on infant birth weight in Padang City. *J. Kesehat. Andalas* **2015**, *4*, 729–736, (In Bahasa Indonesia). [[CrossRef](#)]
40. Ernawati, A. Risk factors of low birth weight from the quality of health services and pregnancy factors (study at Margorejo Health Center and Juwana Health Center in Pati Regency). *J. Litbang Media Inf. Penelit. Pengemb. IPTEK* **2016**, *12*, 41–50, (In Bahasa Indonesia) [[CrossRef](#)]
41. Oktaria, V.; Danchin, M.; Triasih, R.; Soenarto, Y.; Bines, J.E.; Ponsonby, A.-L.; Clarke, M.W.; Graham, S.M. The incidence of acute respiratory infection in Indonesian infants and association with vitamin D deficiency. *PLoS ONE* **2021**, *16*, e0248722. [[CrossRef](#)]
42. Savitri, A.I.; Amelia, D.; Painter, R.C.; Baharuddin, M.; Roseboom, T.J.; Grobbee, D.E.; Uiterwaal, C.S.P.M. Ramadan during pregnancy and birth weight of newborns. *J. Nutr. Sci.* **2018**, *7*, e5. [[CrossRef](#)] [[PubMed](#)]
43. Soesanti, F.; Idris, N.S.; Klipstein-Grobush, K.; Hendarto, A.; Grobbee, D.E.; Uiterwaal, C.S.P.M. The effect of non-organophosphate household pesticides exposure during pregnancy on infants birth sizes and growth rate: A cohort study. *BMC Pregnancy Childbirth* **2020**, *20*, 476. [[CrossRef](#)]
44. Rahim, F.K. Compliance of iron consumption and quality of antenatal care visits and its effect to the event of low birth weight in Kuningan, Indonesia. *J. Ilmu Kesehat. Bhakti Husada* **2020**, *11*, 83–94, (In Bahasa Indonesia). [[CrossRef](#)]
45. Abdullah, A.Z.; Naiem, M.F.; Mahmud, N.U. Risk factor of early neonatal mortality in the maternity hospital. *Kesmas Natl. Public Health J.* **2012**, *6*. (In Bahasa Indonesia). [[CrossRef](#)]
46. Heldawati, P.L.; Kartasurya, M.I.; Nugraheni, S.A. Differences on baby birth weight between mothers with preeclampsia and non-preeclampsia mothers (study on third trimester pregnant women at Anutapura General Hospital Palu, Central Sulawesi). *J. Manaj. Kesehat. Indones.* **2018**, *6*, 98–106, (In Bahasa Indonesia). [[CrossRef](#)]
47. Nur, R.; Arifuddin, A.; Novila, R. Analysis of risk factors for low birth weight at Anutapura General Hospital Palu. *Prev. J. Kesehat. Masy* **2016**, *7*, 29–42, (In Bahasa Indonesia).
48. Nur, A.F. The risk of exposure to cigarette smoke, premature rupture of membranes and mild placenta to LBW at Anutapura Hospital Palu. *J. Kesehat. Tadulako* **2018**, *4*, 73–78, (In Bahasa Indonesia). [[CrossRef](#)]
49. Diniya, A.; Musafaah, N.; Rahayu, M. Risk factors related to the weight of newborns in the working area of the Martapura Health Center, Banjar Regency. *J. Publ. Kesehat. Masy Indones.* **2016**, *3*, 100–105, (In Bahasa Indonesia).
50. Mahdalena, N.E.; Noor, H.S. The effect of cigarette smoke on the weight of newborns in Banjarbaru Hospital. *J. Skala Kesehat.* **2014**, *5*, 2–7, (In Bahasa Indonesia). [[CrossRef](#)]
51. Anggrahini, S.M.; Notobroto, H.B.; Irwanto, I.; Suryawan, A. Structural Model of Maternal Behavior in Community Setting to Prevent Low Birth Weight in East Nusa Tenggara, Indonesia. *Folia Medica Indones.* **2020**, *56*, 60–66. [[CrossRef](#)]
52. Abdullah, A.; Hort, K.; Butu, Y.; Simpson, L. Risk factors associated with neonatal deaths: A matched case-control study in Indonesia. *Glob. Health Action* **2016**, *9*, 30445. [[CrossRef](#)] [[PubMed](#)]
53. Musrifah, M.; Wulandari, L.P.L.; Wirawan, D.N. Paparan Asap Rokok sebagai Faktor Risiko Kematian Neonatal Dini di Kota Mataram Provinsi Nusa Tenggara Barat. *Public Health Prev. Med. Arch.* **2014**, *2*, 70, (In Bahasa Indonesia). [[CrossRef](#)]
54. Lestari, K.S.D.; Putra, I.W.G.A.E.; Karmaya, I.N.M. Household smoke exposure as risk factor of low birth weight among infants in Gianyar. *Public Health Prev. Med. Arch.* **2015**, *3*, 11, (In Bahasa Indonesia). [[CrossRef](#)]
55. Paunno, M.; Emilia, O.; Wahab, A. Pengaruh ibu hamil perokok pasif terhadap kejadian lahir mati di kota ambon. *J. Kesehat. Reproduksi* **2015**, *2*, 127–138, (In Bahasa Indonesia). [[CrossRef](#)]
56. Luchini, C.; Stubbs, B.; Solmi, M.; Veronese, N. Assessing the quality of studies in meta-analyses: Advantages and limitations of the Newcastle Ottawa Scale. *World J. Meta-Anal.* **2017**, *5*, 80–84. [[CrossRef](#)]
57. World Health Organization. *WHO Recommendations on Antenatal Care for a Positive Pregnancy Experience*; World Health Organization: Geneva, Switzerland, 2019.
58. Laksono, A.D.; Rukmini, R.; Wulandari, R.D. Regional disparities in antenatal care utilization in Indonesia. *PLoS ONE* **2020**, *15*, e0224006. [[CrossRef](#)]
59. Efendi, F.; Chen, C.-M.; Kurniati, A.; Berliana, S.M. Determinants of utilization of antenatal care services among adolescent girls and young women in Indonesia. *Women Health* **2017**, *57*, 614–629. [[CrossRef](#)]
60. Agustina, R.; Dartanto, T.; Sitompul, R.; Susiloretni, K.A.; Suparmi; Achadi, E.L.; Taher, A.; Wirawan, F.; Sungkar, S.; Sudarmono, P.; et al. Universal health coverage in Indonesia: Concept, progress, and challenges. *Lancet* **2019**, *393*, 75–102. [[CrossRef](#)]

61. Anindya, K.; Lee, J.T.; McPake, B.; Wilopo, S.A.; Millett, C.; Carvalho, N. Impact of Indonesia's national health insurance scheme on inequality in access to maternal health services: A propensity score matched analysis. *J. Glob. Health* **2020**, *10*, 010429. [[CrossRef](#)]
62. Cui, H.; Gong, T.-T.; Liu, C.-X.; Wu, Q.-J. Associations between Passive Maternal Smoking during Pregnancy and Preterm Birth: Evidence from a Meta-Analysis of Observational Studies. *PLoS ONE* **2016**, *11*, e0147848. [[CrossRef](#)]
63. Leonardi-Bee, J.; Smyth, A.; Britton, J.; Coleman, T. Environmental tobacco smoke and fetal health: Systematic review and meta-analysis. *Arch. Dis. Child. Fetal Neonatal Ed.* **2008**, *93*, F351–F361. [[CrossRef](#)] [[PubMed](#)]
64. Agus, Y.; Horiuchi, S.; E Porter, S. Rural Indonesia women's traditional beliefs about antenatal care. *BMC Res. Notes* **2012**, *5*, 589. [[CrossRef](#)] [[PubMed](#)]
65. Hızlı, D.; Yılmaz, S.S.; Onaran, Y.; Kafalı, H.; Danışman, N.; Mollamahmutoğlu, L. Impact of maternal fasting during Ramadan on fetal Doppler parameters, maternal lipid levels and neonatal outcomes. *J. Matern. Neonatal Med.* **2012**, *25*, 975–977. [[CrossRef](#)]
66. Sterne, J.A.C.; Sutton, A.J.; Ioannidis, J.P.A.; Terrin, N.; Jones, D.R.; Lau, J.; Carpenter, J.; Rücker, G.; Harbord, R.M.; Schmid, C.H.; et al. Recommendations for examining and interpreting funnel plot asymmetry in meta-analyses of randomised controlled trials. *BMJ* **2011**, *343*, d4002. [[CrossRef](#)] [[PubMed](#)]