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Effects of Nutrition in Pregnancy

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ABSTRACT

BACKGROUND: Nutrition is important for women. It is crucial for women's participation, survival, and well-being in addition to being a human right. Children's nutrition, growth, health, and development outcomes over the 1,000-day window from conception to age two and beyond are significantly influenced by women's diet, particularly during the nutritionally susceptible periods of pregnancy and lactation.

There is mounting evidence that excessive weight gain, poor nutrition during pregnancy, and a high body mass index (BMI) prior to pregnancy raise the incidence of non-communicable diseases (NCDs), which could have detrimental impacts on pregnancy duration and outcome. Pregnancy is frequently described as a "teachable moment" when women are inspired to make positive behavioral changes related to their health and wellbeing. This is especially beneficial in light of the growing body of research showing that early life nutrition can program the infant's long-term health.

Objectives: the purpose of this study Pregnancy is often referred to as a "teachable moment" where women are motivated to make positive behavioural changes related to their health and wellbeing this is particularly advantageous given the recent rise in research demonstrating that early life nutrition can program the long-term health of the infant. Understanding the importance of nutrition during this critical period can empower women to make informed choices that positively impact their own health and that of their unborn child

METHOD: The Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Review (PRISMA-ScR) standards were followed in the course of this review. For the review, academic papers published in electronic databases such as PubMed, Scopus, and Google Scholar between 2005 and 2025 were found using search terms such as effects, nutrition, malnutrition pregnancy and women.

Conclusion: pregnancy is often referred to as a teachable moment where women are expected to make positives behavioural changes related to their health and wellbeing, this has contributed why nutrition is very important and should be consider as a priority during pregnancy, A healthy diet during pregnancy is vital for the well-being of both the mother and the developing baby. Proper nutrition supports optimal fetal growth and development, helps

prevent complications, and contributes to the long- term health of both individuals

Keywords: Effects, Nutrition, malnutrition, Pregnancy, Women.

1.0 INTRODUCTION

Women's nutrition matters. Not only is it a human right; it is also essential for women's survival, well-being and participation. Women's nutrition – especially during the nutritionally vulnerable period of pregnancy and breastfeeding – is also an important determinant of children's nutrition, growth, health and development outcomes during the 1,000-day window from conception to age 2, and beyond [1]. There is increasing evidence that A high body mass index (BMI) before pregnancy, excessive weight gain and

Inadequate nutrition during pregnancy Increase the prevalence of non-communicable diseases (NCDs) and may have negative effects on the duration and outcome of pregnancy [2]. Underweight and overweight newborns are exposed to intrauterine programming, with a corresponding risk for the development of metabolic disease in their lifetime [3].

Maternal nutrition is a crucial component of a healthy pregnancy that should be emphasised during antenatal consults. Optimal nutrition is essential for the growth and development of the fetus, the sustained health of the mother during pregnancy, and can have long-term effects on the health of the mother and her infant. Many pregnant women rely on their health professional (obstetrician, midwife, and general practitioner) for nutrition information during routine antenatal visits, as very few seek advice from a dietician [4, 5].

Pregnancy is often referred to as a “teachable moment” where women are motivated to make positive behavioural changes related to their health and wellbeing this is particularly advantageous given the recent rise in research demonstrating that early life nutrition can program the long-term health of the infant [4].

A healthy diet during pregnancy is vital for the well-being of both the mother and the developing baby. Proper nutrition supports optimal fetal growth and development, helps prevent complications, and contributes to the long- term health of both individuals [6]. Understanding the importance of nutrition during this critical period can empower women to make informed choices that positively impact their own health and that of their unborn child. Pregnancy is a period of dynamic physiological changes, demanding increased nutrient intake to support the growing baby and maternal health. Adequate nutrition plays a fundamental role in ensuring optimal pregnancy outcomes and the long-term well-being of the child [6].

Despite recognition of the importance of women's nutrition, the prevalence of malnutrition in women – in all its forms – is unacceptably high. Malnutrition, including underweight, short stature, anaemia and overweight, affects millions of women around the world, including during the nutritionally demanding periods of pregnancy and breastfeeding [7]. While there have been important reductions in the prevalence of underweight in LMICs, progress has been uneven across regions and within countries; prevalence is still high in sub-Saharan Africa and South Asia, and low-income women within countries are most impacted.² At the same time, the prevalence of overweight and obesity among women has increased over the past three decades and now affects more than half a billion (610 million) women [1, 7].

While there have been important reductions in the prevalence of underweight in LMICs, progress has been uneven across regions and within countries; prevalence is still high in sub-Saharan Africa and South Asia, and low-income women within countries are most impacted [8]. At the same time, the prevalence of overweight and obesity among women has increased over the past three decades and now affects more than half a billion (610 million) women [7].

While global estimates on micronutrient deficiencies and dietary quality among women are limited, available evidence suggests that women's diets are poor, and deficiencies of key micronutrients (e.g., iron, folate, vitamins B12 and D, iodine, and zinc) are widely prevalent, irrespective of whether women are underweight, normal weight or overweight [9,10].

All forms of malnutrition in women – underweight, short stature, anaemia and overweight — have serious consequences for women's health, well-being and participation. Women who are underweight or overweight before

pregnancy face additional risk factors when they become pregnant, such as gestational diabetes, hypertension, pre-eclampsia and caesarean section, as well as poor pregnancy and breastfeeding outcomes [11].

2.0 NUTRITION DURING PREGNANCY

Before and during pregnancy, women and their partners should have clear information about the role of a healthy lifestyle in the long-term health of the mother and the child. All health care professionals who provide services and advice to future parents should agree on the guidelines, so as not to give contradictory advice on nutrition during pregnancy [2].

Special attention and individual dietary recommendations should be given to pregnant women in the following cases:

- Maternal obesity (BMI > 30 kg/m²), which is associated with higher risks for spontaneous abortion, premature birth, Gestational diabetes and arterial hypertension for the mother and a higher risk for increased body mass, heart disease and neural tube defect for the newborn
- Pregnancy after gastrointestinal (especially bariatric) procedures, which are associated with a risk for deficiency in multiple vitamins and minerals, often resulting in anaemia in the expectant mother and complications for the fetus
- Adolescent pregnancy, which is often accompanied by a poor diet, alcohol consumption and smoking, which are the causes of a number of health risks for the mother and child
- Addiction of expectant mothers to tobacco smoking, alcohol or drugs;
- Multi-fetal pregnancy, which should be strictly monitored to ensure that the nutritional needs are met [2, 12].

Consumption of alcohol during pregnancy is harmful for the fetus. Children heavily exposed to alcohol antenatally may suffer from a number of physical and mental disorders before and after delivery and during their life course. They have a higher risk for impaired growth and may have neural disorders, resulting in serious learning and behavioural problems. Children exposed to smaller quantities of alcohol may develop similar but milder symptoms [13].

2.1 Key nutrients of importance during pregnancy

Maternal health and well-being benefit from a varied and nutritious diet, and pregnant women should be encouraged to choose foods that are high in essential vitamins and minerals and concentrate on the quality of their diet. [14]. To help with food selection that promotes an overall healthy diet during pregnancy, the Royal College of Obstetricians and Gynecologists (RCOG) has developed and published general dietary guidelines and recommendations (see below for their list of recommendations):

- 1) Base meals on starchy foods such as potatoes, bread, rice and pasta.
- 2) Choose whole grains and fibre-rich foods where possible such as oats, beans, lentils, grains and seeds, wholegrain bread, brown rice and wholemeal pasta.
- 3) Eat at least five portions of different fruit and vegetables every day (potatoes do not count towards this target). Do not count pure fruit juice for more than one portion of the five-a day.
- 4) Eat as little fried food as possible and avoid drinks that are high in added sugars, and other foods such as sweets, cakes and biscuits that have a high fat and/or sugar content.
- 5) Eat some protein every day; choose lean meat when selecting meat sources. Lentils, beans and tofu are also a good source of protein.
- 6) Aim to eat two portions of fish a week.
- 7) Eat dairy foods regularly but choose low-fat varieties such as skimmed milk or low-fat yogurt.
- 8) Stay mindful of the portion size of meals and snacks consumed, and how often you eat.
- 9) Always eat breakfast [15].

There are several essential nutrients that require special consideration in addition to the guidelines intended to assist expectant mothers in maintaining a generally healthy diet. First, it is important to note that pregnancy greatly increases the absorption and metabolism of a variety of vital nutrients from the diet and from the mother's storage. As such, although nutrient requirements are increased due to the demands of pregnancy, for many nutrients the dietary

recommendations do not exceed the recommendations for non-pregnant women. However, it is crucial to emphasise to pregnant women the importance of aiming to meet the recommendations.

2.2 Balanced nutrition during pregnancy

A healthy diet during pregnancy is vital for the well-being of both the mother and the developing baby. Proper nutrition supports optimal fetal growth and development, helps prevent complications, and contributes to the long-term health of both individuals. Adequate nutrition plays a fundamental role in ensuring optimal pregnancy outcomes and the long-term well-being of the child [6].

A complete, well-balanced diet consists of: All product groups; Nutritious items from each product group, includes a variety of items from every product category, it includes local foods, particularly fruits and vegetables, as well as seasonal fruit, berries, and vegetables. It also includes the suggested foods in the amounts determined for each person based on their weight, degree of physical activity, and potential metabolic issues. [2].

Unhealthy and potentially dangerous substances in the diet during pregnancy

The Unhealthy and potentially dangerous substances in the diet during pregnancy includes:

- Artificial sweeteners
- Bisphenol A
- Polychlorinated Biphenyls and Dioxins
- Leads
- Vitamin A
- Mercury [2].

Safe nutrition

Food-borne infections are more likely to occur during pregnancy because of the immune system's partial suppression. As a result, when cooking, all hygiene regulations should be followed, and eggs, meat, and fish should be properly heated. Uncooked animal products include the protozoan *Toxoplasma gondii*, and berries and vegetables that have come into contact with contaminated soil may also carry toxoplasma cysts. Because cysts can survive in frozen and smoked meat, pregnant women should avoid eating meat that has not been heat-processed or that has only been lightly heated. They should also properly wash any fruits and vegetables that may have come into touch with dirt.

WHO---recommended quantities of minerals and vitamins per day during pregnancy and lactation

Micronutrient	WHO recommendation
Vitamin A, µg	800.0µg
Thiamine (vitamin B1), mg	1.4mg
Riboflavin (vitamin B2), mg	1.4mg
Niacin (vitamin B3), mg	18.0mg
Vitamin B6, mg	1.9mg
Vitamin B12, µg	2.6µg
Vitamin C, mg	55.0mg
Vitamin D, µg	5.0µg
Vitamin E, mg	15.0mg
Folic acid, µg	600.0µg

Iron, mg	27.0mg
Zinc, mg	10.0mg
Copper, mg	1.15mg
Selenium, µg	30.0µg
Iodine, µg	250.0µg
Calcium, g	1.5---2.0g

Women's nutrition before pregnancy

Women who will become mothers need nutritious and safe diets during the critical period before pregnancy for their own health, nutrition and well-being and that of their newborn [16,17]. However, many women suffer from malnutrition prior to becoming pregnant; they may be underweight, micronutrient deficient, and/or anemic as a result of insufficient food intake or infection, or they may be overweight or micronutrient deficient as a result of limited access to, availability of, and affordability of nutrient-dense diets. Pregnancies are frequently unplanned in many contexts, and women are frequently ignorant of their pregnancy status or reluctant to disclose it in the early stages of pregnancy. This makes it challenging to make major dietary or nutritional adjustments in the early stages of pregnancy, which emphasizes the importance of encouraging women to eat healthily and take care of themselves before being pregnant. [16]. Pre-pregnancy measures should also take into account strategies and interventions that deal with the underlying social factors that contribute to women's poor nutrition. For example, social security programs like cash transfers can help boost household food intake and address the root causes of women's poor nutrition. [18]. Expanding family-friendly policies* to facilitate working women's access to health services and nutrition counselling before pregnancy is also a promising approach [19].

Fortifying staple foods (such as wheat flour, rice, cooking oil, and salt) with one or more micronutrients (such as folic acid, iron, vitamin A, and iodine) can enhance women's diets and improve pregnancy outcomes in environments where micronutrient deficiencies are common. Neural tube malformations in infants have significantly decreased as a result of the successful implementation of folic acid fortification of flours and cereals in nations all over the world. [20-22]. Currently required in more than 80 countries, iron fortification of staple foods (such as rice, flour, and cereals) improves biomarkers for iron status and anemia. [22, 23]. Similarly, salt iodization works well to increase iodine intake and prevent and manage iodine deficiency in nursing mothers and expectant mothers. [23].

Women's nutrition during pregnancy

All pregnant women require nutritious diets containing adequate energy, protein, vitamins and minerals, along with adequate services and practices for optimal maternal and newborn outcomes [16]. To guarantee that these nutritional needs are met during pregnancy, a complete approach is required, including micronutrient supplementation, monitoring appropriate weight gain, nutritional counseling, and preventive deworming when needed.

Nutritional diet advice can improve gestational weight gain, lower the risk of preterm birth, increase birthweight, and reduce maternal anemia in late pregnancy.

[16]. Pregnant women who receive counseling on healthy eating, exercise, and rest are less likely to experience excessive weight gain during pregnancy, gestational diabetes, caesarean delivery, macrosomia, large-for-gestational-age kids, and postnatal weight retention. Furthermore, their children are less likely to become fat adults. [24, 25].

Causes of poor nutrition in women

Poor food, poor services, poor practices, and a lackluster supportive environment are the main causes of malnutrition in women at all stages of life. Women's access to diets and care is restricted by a number of factors, including the dearth of healthy, affordable, and safe foods; the lack of opportunities for women to receive nutrition services; the

lack of knowledge about the importance of preconception nutrition care; and harmful gendered social norms and social and cultural practices.

Poor diets. Poor maternal diets are a major risk factor for poor health before and during pregnancy and can contribute to poor pregnancy outcomes [26, 27]. The consumption of fruits, vegetables, meat, and dairy products in women's diets varies little between countries. Micronutrient deficits result from differences between daily dietary requirements and the ingestion of high-quality nutrients (including calcium, iron, zinc, vitamin A, and B vitamins). [10, 28,29]. Women's diets are still not ideal and lack variety, even though they might be better during pregnancy than they were before or after. It can be particularly challenging to meet additional micronutrient needs during pregnancy; in particular, dietary interventions are frequently insufficient to meet the need for iron. [30].

Women's diets are also being impacted by shifts in taste preferences toward sugary and salty foods as well as the social attractiveness of such items. Convenience plays a significant role in the meals that families choose to buy and eat because of the time and effort required for breastfeeding and food preparation, which may be limited due to the growing number of women working both formally and informally. These easily accessible foods are frequently highly processed and/or low in nutrients. Additionally, sedentary lives and a lack of exercise alternatives may discourage women from engaging in physical activity. [30].

Poor nutrition services. Women's nutrition, including before and during pregnancy and while breastfeeding, is also determined by their access to and use of services: health services, water and sanitation services, and social safety nets for the most vulnerable women. Limited access to these services can increase the risk of infection and disease and result in poor outcomes for women and their children [30].

Poor care practices. Poor care behaviors at the individual, household, community, and society levels are the main cause of malnutrition in women. When taken as a whole, these elements affect women's capacity to make knowledgeable choices regarding their care and diet. Women's food and care-seeking behaviors and choices are influenced at the individual and household levels by their knowledge, attitudes, and values, pregnancy-related anxieties, a lack of family support, and household dynamics surrounding food distribution. [31, 32]. At a broader community and societal level, harmful cultural beliefs and practices about pregnancy (e.g., restrictive or excessive food intake), gender norms, and gender and income inequality, may also limit women's access to resources and information, and can influence gendered practices on what women eat, when they eat and how much they eat [30].

Weak enabling environment. Despite a solid body of research and international guidelines to promote women's nutrition, it can be difficult to turn these into successful policies and initiatives. [33]. It is generally known that during the first 1,000 days of life, a mother's nutritional state has a significant impact on her child's growth and development. However, strategies and initiatives aimed at this crucial developmental stage frequently overlook women's nutrition. [31, 34]. A lack of prioritization and funding for maternal nutrition has also meant that there are few large-scale comprehensive programmes [34] maternal nutrition programs have also mostly depended on the health system to provide women with inadequate coverage of nutrition services throughout pregnancy. [30].

Effect of maternal diet before and after pregnancy

A healthy supply of nutrients, especially micronutrients in the mother's bloodstream, is essential for fetal development.

Maternal nutrition directly affects the health of their offspring as adults, which may play a significant role in the global obesity and NCD epidemics [2]. Additionally, insulin-related metabolic disorders, type II diabetes, central adiposity, abnormal lipid metabolism, obesity, arterial hypertension, cardiovascular diseases, deadly ischemic diseases, and renal disorders are all directly linked to low birth weight [2].

Weight gain during pregnancy

There are detrimental effects from both excessive and insufficient weight growth during pregnancy.

The likelihood that a child would grow up to be obese increases by 8% for each kilogram that a woman accumulates over the acceptable amount Excessive weight gain during pregnancy is linked to a lower risk of obesity than a high pre-

pregnancy maternal BMI. Lowering body weight to within the normal range prior to conception and controlling food to prevent weight gain during pregnancy are safe and economical ways to reduce the risk of NCDs. [2]

3.0 DISCUSSION

Future generations may be impacted by inadequate nutrition (both maternal and paternal), high calorie intake, and micronutrient deficiencies. Priority should be given to a prenatal approach that encourages healthy food, an active lifestyle, and a normal body weight for expectant mothers. [2].

Pregnancy is a good time to change habits and introduce dietary and lifestyle changes with a positive health impact, as most women are not indifferent to the health of their unborn child.

The primary risk factors for the health of unborn children and the development of NCDs in later life include obesity, a poor diet, and a sedentary lifestyle. Improving the nutritional condition of women of reproductive age is the primary strategy for halting the spread of avoidable, nutrition-related NCDs, with proper consideration given to the variations among population groups in various demographic, social, and economic strata. [2].

To "ensure that every child has the best start in life," a sophisticated strategy for enhancing the mother's diet is needed. This concept should be integrated into the country's health care system, with a focus on early life health promotion, encompassing preconception, as well as the health of the mother, newborn, infant, and young once.

4.0 Lines of action

4.1 Development of a supportive environment

Accessible information about the optimal diet of mothers and children at health care facilities and on the Internet

Education for health care professionals about the principles of a healthy diet and lifestyle and effectively conveying this information to patients

Education of future parents about healthy eating and lifestyle by health care professionals and also at school

Elaboration of specific guidance for health care personnel and women on preventing insufficient and excessive weight and obesity before, during and after pregnancy

Availability of e---health to health care professionals to resolve multi---disciplinary problems

Legislative provisions for social guarantees to enable mothers to take pre--- and postnatal leave to ensure exclusive breastfeeding during the first 6 months after the birth of their child

Promotion of child---friendly hospitals that provide support in the primary care setting after discharge from a maternity ward

Implementation of the International Code of Marketing of Breast---milk Substitutes, in line with the World Health Assembly resolution

Restrictions on marketing of unhealthy foods and sweetened soft drinks to children have been included in recommendations, policy planning documents and separate regulations [2].

5.0 RECOMMENDATION

Because adequate maternal vitamin D is necessary for the development of the fetal skeleton, muscular system, brain, and immune system, expectant mothers are frequently advised to take extra vitamin D throughout pregnancy, particularly in the Northern Hemisphere.

Regardless of the child's postnatal nutrition, vitamin D insufficiency may have a detrimental impact on the development of the child's bone tissue and result in long-term skeletal problems including osteoporosis.

The risk of various micronutrient deficiencies increases with BMI. Micronutrients are crucial for human growth, especially the development of the neurological system; they also assist lower insulin resistance and regulate energy metabolism.

Vitamin K is required for bone health and coagulation homeostasis. Vitamin E is an antioxidant that ensures the formation and development of healthy cells in the fetus and protects pregnant women from toxins [2].

During gestation, the fetus accumulates 1 g/day of magnesium, and pregnant women should have sufficient quantities of magnesium to prevent leg cramps and pre-eclampsia [2].

REFERENCES

- 1) United Nations Children's Fund (UNICEF) Programming Guidance, Prevention of malnutrition in women before and during pregnancy and while breastfeeding. New York: UNICEF, 2021.
- 2) Laila Meija, Dace Rezeberga, Proper maternal nutrition during pregnancy planning and pregnancy: a healthy start in life
- 3) Butte NF, King JC. Energy requirements during pregnancy and lactation. *Public Health Nutrition* 2005;8:1010–1027.
- 4) Jamie V de Seymour Kathryn L Beck Cathryn A Conlon Nutrition in pregnancy 2019 Elsevier Ltd.
- 5) British Nutrition Foundation. Nutrition for pregnancy. Available at: <https://www.nutrition.org.uk/healthyliving/nutritionforpregnancy.html>.
- 6) Wang Fleischhacker The importance of diet during pregnancy: Impacts on the developing baby and maternal health *Clin Nutr Hosp Diet*. 2023; 43(3): 01- 2
- 7) United Nations Children's Fund. (2021). Global Nutrition Database. UNICEF: New York.
- 8) Victora, C.G., Christian, P., Vidaletti, L.P. (2021). Revisiting maternal and child undernutrition in low-income and middle-income countries: variable progress towards an unfinished agenda. *The Lancet* 397(10282):1388-1399.
- 9) Torheim, L.E., Elin, L., Ferguson, E., (2010). Women in Resource-Poor Settings Are at Risk of Inadequate Intakes of Multiple Micronutrients. *J Nutr* 140(11): p. 2051S-2058S.
- 10) Gernand, A., Schulze, K. J., Stewart, C. P. (2016). Micronutrient deficiencies in pregnancy worldwide: Health effects and prevention. *Nature reviews. Endocrinology* 12(5): 274-289.
- 11) Dean, S.V., Lassi, Z.S., Imam, A. (2014). Preconception care: nutritional risks and interventions. *Reproductive health* 11(3): p. S3-S3.
- 12) Maternal nutrition during pregnancy and lactation. Washington DC; 2004 (http://www.coregroup.org/storage/documents/Workingpapers/MaternalNutritionDietaryGuide_AED.pdf).
- 13) Patra J, Bakker R, Irving H, Jaddoe VWV, Malini S, Rehm J. Dose–response relationship between alcohol consumption before and during pregnancy and the risks of low birth weight, preterm birth and small-for-gestational age (SGA) – a systematic review and meta-analyses. *Br J Obstet Gynaecol* 2011; 118:1411–1421.
- 14) Jamie V. S, Kathryn L.B, Cathryn A.C. (2019). Nutrition in pregnancy obstetrics, gynaecology and reproductive medicine 29:8
- 15) British Nutrition Foundation. Nutrition for pregnancy. Available at: <https://www.nutrition.org.uk/healthyliving/nutritionforpregnancy.html>.
- 16) World Health Organization. (2013). Preconception care: Maximizing the gains for maternal and child health. A policy brief. WHO: Geneva.
- 17) Ramakrishnan, U., Grant, F., Goldenberg, T. (2012). Effect of Women's Nutrition before and during Early Pregnancy on Maternal and Infant Outcomes: A Systematic Review. *Paediatric and Perinatal Epidemiology* 26(s1): p. 285-301.

- 18) Barker, M., Dombrowski, S.U., Colbourn, T. (2018). Intervention strategies to improve nutrition and health behaviours before conception. *The Lancet* 391(10132): p. 1853-1864.
- 19) United Nations Children's Fund. (2020). Family Friendly Policies. Handbook for Business. UNICEF East Asia and Pacific Regional Office: Bangkok
- 20) López-Camelo, J.S., E.E. Castilla, and I.M. Orioli. (2010). Folic acid flour fortification: Impact on the frequencies of 52 congenital anomaly types in three South American countries. *American Journal of Medical Genetics Part A*, 152A (10): p. 2444-2458.
- 21) Centeno, T.E., Pachón, H., Guetterman, H. M. (2019). Fortification of wheat and maize flour with folic acid for population health outcomes. *Cochrane Database Syst Rev*, 7(7).
- 22) Pachón, H., Spohrer, R., Mei, Z. (2015). Evidence of the effectiveness of flour fortification programs on iron status and anemia: a systematic review. *Nutrition Reviews*, 73(11): p. 780-795.
- 23) Gera, T., Sachdev, H.S., Boy, E. (2012). Effect of iron-fortified foods on hematologic and biological outcomes: systematic review of randomized controlled trials. *Am J Clin Nutr*. 96(2):309-24.
- 24) Cantor, A.G., Jungbauer, R.M., and McDonagh, M. (2021). Counseling and Behavioral Interventions for Healthy Weight and Weight Gain in Pregnancy: Evidence Report and Systematic Review for the US Preventive Services Task Force. *JAMA*, 325(20): p. 2094-2109.
- 25) Muktabhant, B., Lawrie, T. A. And Lumbiganon, P (2015). Diet or exercise, or both, for preventing excessive weight gain in pregnancy. *Cochrane Database of Systematic Reviews*, 2015(6).
- 26) United Nations Children's Fund (2021). UNICEF Gender Action Plan 2021-2025. UNICEF: New York.
- 27) Raghavan, R., Dreibelbis, C., and Kingshipp, B.L. (2019). Dietary patterns before and during pregnancy and birth outcomes: a systematic review. *American Journal of Clinical Nutrition* 109(1): p. 729S-756S.
- 28) Torheim, L.E., Elin, L., and Ferguson, E. (2010). Women in Resource-Poor Settings Are at Risk of Inadequate Intakes of Multiple Micronutrients. *J Nutr* 140(11): p. 2051S-2058S.
- 29) Harika, R., Faber, M., and Samuel, F. (2017). Micronutrient Status and Dietary Intake of Iron, Vitamin A, Iodine, Folate and Zinc in Women of Reproductive Age and Pregnant Women in Ethiopia, Kenya, Nigeria and South Africa: A Systematic Review of Data from 2005 to 2015. *Nutrients* 9(10): p. 1096.
- 30) United Nations Children's Fund. UNICEF Programming Guidance. Prevention of malnutrition in women before and during pregnancy and while breastfeeding. New York: UNICEF, 2021.
- 31) Kavle, J.A., and Landry, M. (2018). Addressing barriers to maternal nutrition in low- and middle-income countries: A review of the evidence and programme implications. *Maternal & Child Nutrition* 14(1): p. e12508.
- 32) Siekmans, K., Roche, M., and Kung'u, J.K. (2018). Barriers and enablers for iron folic acid (IFA) supplementation in pregnant women. *Maternal & Child Nutrition* 14(S5): p. e12532.
- 33) World Health Organization. (2018). Global nutrition policy review 2016-2017: country progress in creating enabling policy environments for promoting healthy diets and nutrition. WHO: Geneva.
- 34) Victora, C.G., Barros, F.C., and Assunção, M.C. (2012). Scaling up Maternal Nutrition Programs to Improve Birth Outcomes: A Review of Implementation Issues. *Food and Nutrition Bulletin* 33(2_suppl1): p. S6-S26.