



# AFFECT OF MATERNAL NUTRITION ON A HEALTHY PREGNANCY

<sup>1</sup>Dr. Mukesh Savaria, <sup>2</sup>Dr. Harvinder Popli, <sup>3</sup>Dr. Neha Singh, <sup>4</sup>Dr. Imran Ahmed, <sup>5</sup>Ram Iswar Sah

<sup>1</sup>Post-Graduate student of Master of Public Health, <sup>2</sup>Dean and Offg. Registrar of DPSRU, <sup>3</sup>House-Physician of SHMC, <sup>4</sup>Post-Graduate student of Master of Public Health, <sup>5</sup> Post-Graduate student of Master of Hospital Management

<sup>1</sup>Department of Public Health, <sup>2</sup>Dean and Offg. Registrar of DPSRU, <sup>3</sup>Department of Homoeopathy, <sup>4</sup>Department of Public Health, <sup>5</sup>Department of Hospital Management

<sup>1,2,4,5</sup>Delhi Pharmaceutical Sciences and Research University, New Delhi, India

<sup>3</sup>Dr. B.R.Sur Homoeopathic Medical College, Hospital and Research Centre, New Delhi, India

## **ABSTRACT**

World Health Organisation (WHO) defines Nutrition as the intake of food considered in relation to the body's dietary needs. Nutrition has important implications on people's health throughout their life cycle particularly during periods of rapid growth and development, namely during pregnancy and early childhood. Pregnancy is a critical period during which good maternal nutrition is a key factor affecting both mother and child's health. Infant birth weight and wellbeing affects maternal weight gain during pregnancy, and results differ depending on the nutritional status of the mother pre-pregnancy. Birth weight and gestational age have long been known as primary determinants of infant morbidity and mortality [1]. Women with childbearing potential ought to keep up great nourishing status through a way of life that upgrades maternal wellbeing and diminishes their kids' danger of birth absconds, problematic foetal development and improvement and interminable medical problems. During pregnancy, the main components of a health-promoting lifestyle include healthy weight gain; intake of a variety of foods; Dietary intake of various nutrients, adequate and timely supplementation of vitamins and minerals [25]. Prenatal weight gain is associated with improved pregnancy outcomes according to ranges suggested by WHO. For most women, average energy needs during pregnancy range from 1900-2200 kcal a day [20], but the pre-pregnancy body mass index, weight gain rate, maternal age, and physiological appetite must be considered when tailoring this recommendation to the woman. In general, the intake of more food to meet energy needs and the improved absorption and quality of the nutrient use that occurs during pregnancy are sufficient to meet most nutrient needs. Supplementation of vitamins and minerals is also ideal for other nutrients and conditions. This paper highlights an overview on Maternal nutrition, its role and other important factors affecting healthy pregnancy outcomes as well as management strategies for achieving positive outcomes for pregnancy.

**KEY WORDS** : Maternal nutritional status, adverse birth outcomes, Dietary allowances

## **INTRODUCTION**

World Health Organisation (WHO) defines Nutrition as the intake of food considered in relation to the body's dietary needs. On April 1, 2016, The United Nation's General Assembly adopted a resolution proclaiming a United Nations Decade of Action on Nutrition from 2016 to 2025 [1] Nutrition has important implications on people's health throughout their life cycle particularly during periods of rapid growth and development, namely during pregnancy and early childhood. This period is referred to as "the first 1000 days of life" [2], during which maternal and child nutrition, including both under- and over – nutrition, has been found to influence ideal development and ailment defenselessness further throughout the life. Maternal nutritional status is one of the strongest predictors of growth and development in the first 1000 days of life. Women of childbearing age are at greater risk of adverse health outcomes than the other population groups as of increased physiological demands of Pregnancy [3]. For achieving a healthy pregnancy and birth outcome, good nutrition prior to conception and during pregnancy is an essential component [4]. Maternal nourishment is a crucial determinant of fetal development, birth weight and baby dreariness; poor

sustenance frequently prompts long haul, irreversible and adverse results to the hatchling. The association between maternal and child malnutrition with growth and development has been well documented in the literature. An audit of proOf from different examinations uncovered an immediate relationship between constrained maternal weight gain during pregnancy and both disabled fetal development and low birth weight [5]. Also, excess maternal weight gain was found to be correlated with high birth weight and foetal growth (large-for-gestational age) [6] as well as adverse cardio-metabolic profile in off- spring [7]. Notwithstanding maternal weight increase, maternal eating routine synthesis and micronutrient status during pregnancy appear to be related with birth results and kid wellbeing status. When a pregnant woman does not get the calories, key nutrients or essential proteins she needs to support her baby's development, her baby is placed at risk for developmental delays, birth defects and cognitive deficits [8].

### **SOCIO EPIDEMIOLOGICAL BURDANCE**

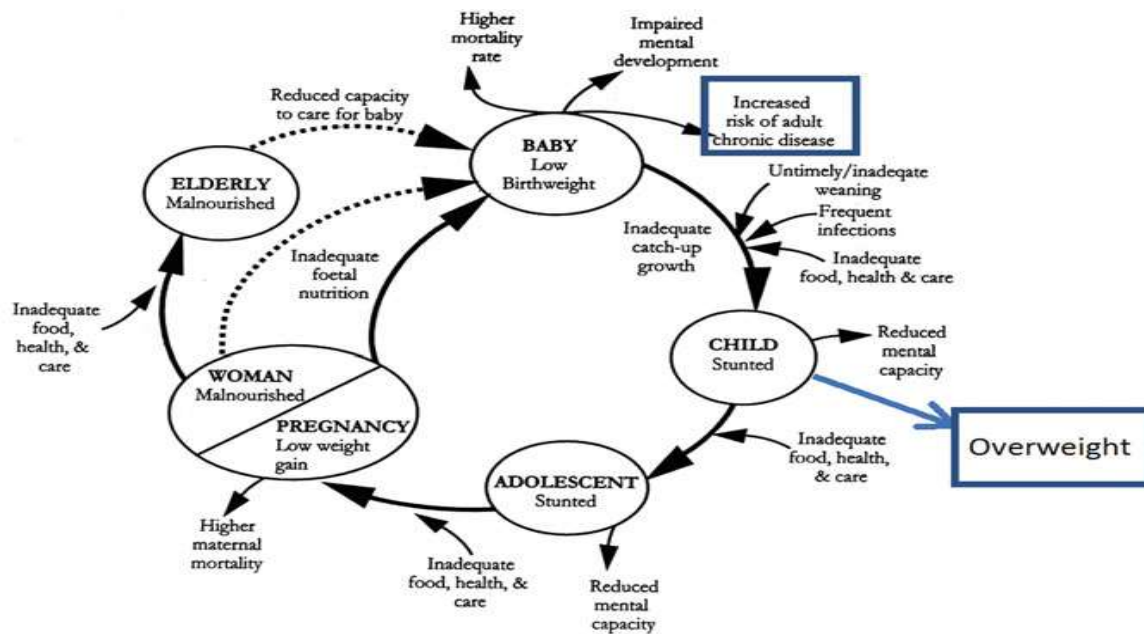
World Health association (WHO) in its review of Nationally representative survey from 1993 to 2005 detailed that all around 42 % of pregnant women were iron deficient, and 90 % of these had a place with Africa and Asia [9]. India, which carries a third of the burden of under nutrition globally, has particularly disadvantaged maternal endowments at the beginning of pregnancy. In India, the prevalence of anaemia is the highest in the world. Indian diets usually suffer from lack of iron, folic acid, and vitamin B12 because of low vegetable consumption and poor availability from nutrient-rich food [10]. Apart from dietary deficiency, malaria, hookworm, and other helminthic infestations also require treatment to reduce anaemia. 40% of maternal mortality incidences in India are directly or indirectly related to anaemia. Maternal mortality rate (MMR) increases 8–10 times when haemoglobin is less than 5 g %. IUGR, pre-maturity and low birth weight cause poor growth during infancy, childhood, and adolescence resulting into low adult height and malnutrition [11].

According to World Health organisation's (WHO) Global burden report: In 2014, more than 1.9 billion adults worldwide, 18 years and older, were overweight while 462 million were underweight. More than 600 million were obese. round the same time, 42 million youngsters younger than five were overweight or hefty however 156 million were influenced by hindering (low stature for-age). While 50 million youngsters were influenced by squandering (low weight-for-tallness). Poor sustenance keeps on causing almost 50% of passings in kids under five, while low- and center salary nations presently witness a synchronous ascent in youth overweight and weight – expanding at a rate 30% quicker than in more extravagant nations [12].

### **ROLE OF NUTRITION IN PREGNANCY**

Women's nutrition can play a key role in reproductive health before and during pregnancy, and is recognized as important for improving the outcomes of pregnancy [13]. The availability and supply of nutrients to the developing foetus depends on the nutritional status of the mother, which in turn depends on her nutrient reserves, dietary intake and compulsory needs. Most of the studies that explored the importance of nutrition during pregnancy usually concentrate on the second and/or third trimesters during which time main processes such as organogenesis were completed[13]. Nutritional status of women shortly before birth or during early pregnancy (< 12 weeks gestation), Where women are typically unaware of their pregnancy status, it may affect the outcomes of pregnancy by affecting vital developmental processes that begin early in pregnancy as well as nutritional availability. Animal studies recommended that dietary periconception may influence the hypothalamic – pituitary – adrenal hub, which thus impacts results, for example, pre-eclampsia and unexpected labor [14], Ensuring satisfactory supplement gracefully to the baby all through growth likewise relies upon placental capacity, which is resolved during early pregnancy and might be affected by maternal nourishment during early pregnancy. Maternal endocrine and metabolic reactions that occur early in pregnancy in turn affect the availability and use of available nutrients later in pregnancy for the rapidly developing foetus. It has been shown that maternal nutritional interventions are successful in improving the birth outcomes in low- and middle-income populations. Most effectiveness proof is derived from laboratory trials in relatively small populations where treatments are administered under conditions that are suitable or at least 'best practice' [13]. It is also necessary to demonstrate that interventions can be effectively implemented in large populations under normal conditions, and thus have an effect on health and nutrition. Any of the health issues that could be prevented by providing proper nutrition before, during and during pregnancies include: risk of fetal and child mortality, intrauterine growth retardation, low birth weight and premature births, reduced birth defects, cretinism, impaired brain development and risk of infection. Successful outcome of pregnancy results in well-developed babies who can make a positive contribution to growth and understand their potential. The babies should have solid foundations to emerge from the intergenerational malnutrition process (Fig. 1).





Source : United Nations Subcommittee on Nutrition Fourth Report on the World Nutrition Situation, 2000 - modified

### WEIGHT GAIN DURING PREGNANCY

Recommendations for weight gain during pregnancy should be individualized to boost pregnancy outcomes according to the body mass index (BMI). BMI or Quetlet's Index is used to evaluate the prevalence of undernourishment, overweight and obesity within a population and the risk factors associated with it. BMI accounts for the difference in body composition by defining the level of adiposity according to the relationship of weight to height and eliminates dependence on frame size. BMI is measured as weight (in Kg) divided by height (in meters<sup>2</sup>) [15].

BMI is measured according to WHO 2004 classification

#### WHO's BMI CLASSIFICATION

BMI (kg / m <sup>2</sup> )	Nutritional Status
BMI < 18.5	Under weight
BMI Range between 18.5–24.9	Normal
BMI Range between 25–29.9	Overweight
BMI > 30 kg	Obese

Before and after birth obesity raises the risk for a variety of pregnancy complications. Being overweight or obese before origination expands the dangers of blood vessel hypertension and gestational diabetes mellitus during pregnancy, with relating negative wellbeing outcomes, and is an immediate reason for macrosomia, which can change the digestion of the youngster's glucose and lipids and trigger hypertension. Prenatal weight gain within the recommended ranges of the World Health Organization (WHO) is associated with improved pregnancy outcomes even within these ranges, many women do not gain. For a woman of average weight, the estimated weight gain during pregnancy is 10–16 kg for those with regular BMI, 13–18 kg for those who are underweight, 7–11 for those who are overweight, and 5–9 kg for the obese. During pregnancy both unnecessary and inadequate weight gain has negative impacts. For every additional kilogram a mother gains above that prescribed, the child's risk of obesity rises by 8 percent during adulthood. A high maternal BMI pre-pregnancy is associated with an even greater risk of obesity than an excessive increase in weight during pregnancy. Reducing body weight to the usual pre-design range and dietary management to reduce weight gain during pregnancy are safe, cost-effective methods of reducing NCD risk [15].

Data from NNMB suggested that mean birth weights showed significant differences between BMI classes. In severe chronic energy deficiency groups the odds ratio for LBW was found to be three times higher compared to normal mother BMI groups [16]. In adult women, the prevalence of low BMI < 18.5kg / m) has declined in Africa and Asia since 1980, but remains higher than 10 per cent in these two large developing regions. The prevalence of overweight (BMI > 25 kg / m<sup>2</sup>) and obesity (BMI > 30 kg / m<sup>2</sup>) has increased in all regions over the same time period. Maternal obesity during pregnancy, childbirth, and postpartum contributes to multiple adverse maternal and foetal complications[17].

## **ROLE OF MACRONUTRIENTS AND MICRONUTRIENTS**

### **MACRONUTRIENTS**

Human body requires macronutrients in large quantities(in gram). They normally include water, carbohydrates, fat and protein. Macronutrients (except water) are also called energy-providing nutrients. Energy is measured in calories and is essential for the body to grow, repair and develop new tissues, conduct nerve impulses and regulate life process [18].

**Carbohydrates** – are required for vitality and give body's fundamental wellspring of vitality (4 calories for every gram); they structure the significant piece of put away nourishment in the body for later utilization of vitality and exist in three structure: sugar, starch and fiber. The mind works altogether on glucose alone. When in overabundance, it is put away in the liver as Glycogen. Carbohydrates are also important for fat oxidation and can also be converted into protein [18,19] .

**Fats** – are utilized in making steroids and hormones and fill in as solvents for hormones and fat dissolvable nutrients. Fats have the most elevated caloric substance and give the biggest measure of vitality when consumed. At the point when estimated by a calorimeter, fats give around 9 calories for each gram of fat, making them twice as vitality rich than protein and sugars. Additional fat is put away in fat tissue and is singed when the body has come up short on carbohydrates [18].

**Proteins** – they give amino acids and make up a large portion of the cell structure including the cell film. They are the last to be utilized of all macronutrients. In instances of extraordinary starvation, the muscles in the body, that are comprised of proteins, are utilized to give vitality. This is called muscle squandering. Concerning sugars, proteins likewise give 4 calories for every gram [18].

**Water** – makes up a huge piece of our body weight and is the principle part of our body liquids. The body needs more water each day than some other supplement and we recharge it through nourishments and fluids we eat and drink. Water fills in as a transporter, conveying supplements to cells and evacuating squanders through pee. It is additionally a mandatory operator in the guideline of internal heat level and ionic equalization of the blood. Water is totally basic for the body's digestion and is likewise required for ointment and stun absorber [18].

### **MICRONUTRIENTS**

These supplements incorporate minerals and nutrients. Not at all like macronutrients, these are required in exact moment sums. Together, they are critical for the typical working of the body. Their primary capacity is to empower the numerous synthetic responses to happen in the body. Micronutrients don't work for the arrangement of energy [18,19].

**Vitamins**– are basic for ordinary digestion, development and advancement, and guideline of cell work. They cooperate with compounds and different substances that are essential for a solid life. Nutrients are either fat dissolvable or water-solvent. Fat solvent Vitamins Can be put away in the greasy tissues in the body when in excess [19]. Water solvent nutrients are discharged in pee when in overabundance thus should be taken every day. Water dissolvable nutrients incorporate Vitamin B and C. Green verdant vegetables are plentiful in Vitamin B, while Vitamin C is found liberally in citrus natural products. Fat solvent nutrients are Vitamin A, D, E and K. Green verdant vegetables, milk and dairy items and plant oils give these vitamins [19].

**Minerals** – Minerals are found in ionized structure in the body. They are additionally ordered into macrominerals and microminerals (or follow minerals). Macrominerals present in the body incorporate Calcium, Potassium, Iron, Sodium and Magnesium. Iron is a constituent of Hemoglobin which is available in the blood [19].

Microminerals incorporate Copper, Zinc, Cobalt, Chromium and Fluoride. They are for the most part cofactors, and are essential for the capacity of catalysts in the body, yet are required distinctly in minor amounts. Around 4% of the body's mass comprises of minerals [18,19].

## **RECOMMENDED DIETARY ALLOWANCES (RDA) FOR INDIAN POPULATION**

People need a wide scope of supplements to lead a sound and dynamic life. The measure of every supplement required for an individual relies upon age, body weight, physical movement, physiological state (pregnancy, lactation) and so on. So fundamentally the prerequisite for supplements changes from individual to person. The expression "Supplement Requirement" characterizes as The prerequisite for a specific supplement is the base sum that should be devoured to forestall manifestations of inadequacy and to keep up agreeable degree of the supplement in the body [20].

The Recommended Dietary Allowances (RDA) are the degrees of admission of the basic supplements that are decided to be satisfactory or adequate to meet the supplement prerequisite of about every one of the (97 to 98 percent) sound people in a specific life stage and sexual orientation group(15). For the Indian population, the dietary measures have been figured by the Indian Council of Medical Research (ICMR). These proposals have been

distributed as "Supplement Requirements and Recommended Dietary Allowances for Indians" (ICMR 2010), the suggestions are continually changed at whatever point new information is accessible. The last suggestions were overhauled in 2010, in light of the new rules of the International Joint FAO/WHO/UNU Consultative Group and dependent on the information on Indians that had collected after 1989 proposals [20]. Table 1 and Table 2 speak to these suggestions.

Recommended Dietary Allowances (RDA) For Energy, protein, Fat, and Minerals for Indian Women (Table1)

Group	Particulars	Body wt. kg	Net Energy Kcal/d	Protein g/d	Visible fat g/day	Calcium mg/d	Iron mg/d	Zinc mg/d	Magnesium mg/d
Woman	Sedentary work	55	1900	55	20	600	21	10	310
	Moderate work	55	2230	55	25	600	21	10	310
	Heavy work	55	2850	55	30	600	21	10	310
	Pregnant women	55	+350	78	30	1200	35	12	310
	Lactation 0-6months	55	+600	74	30	1200	21	12	310
	6-12 months	55	+520	68	30	1200	21	12	310
Girls	16-17 years	52.1	2440	55.5	35	800	26	12	235
	13-15 years	46.6	2330	51.9	40	800	27	11	210
	10-12 years	35	2010	40.4	35	800	27	9	160

Recommended Dietary Allowances (RDA) for water soluble and Fat soluble vitamins for Indian Women (Table 2)

Group	Particulars	Body weight Kg	Vitamin A Retinol	Vitamin A B-carotene	Thiamine mg/d	Riboflavin mg/d	Niacin equivalent mg/d	Vitamin mg/d	Ascorbic acid mg/d	Dietary folate ug/d	Vitamin B12 ug/d
Women	Sedentary work	55	600	4800	1	1.1	12	2	40	200	1.0
	Moderate work	55	600	4800	1.1	1.3	14	2	40	200	1.0
	Heavy work	55	600	4800	1.4	1.7	16	2	40	200	1.0
	Pregnant	55	800	6400	+0.2	+0.3	+2	2.5	60	500	1.2
	Lactating 0-6 months	55	950	7600	+0.3	+0.4	+4	2.5	80	300	1.5
	6-12 months	55	950	7600	+0.2	+0.3	+3	2.5	80	300	1.5
Girls	16-17 years	52.1	600	4800	1.0	1.2	14	2.0	40	200	0.2-1.0
Girls	13-15 years	46.6	600	4800	1.2	1.4	14	2.0	40	150	0.2-1.0
Girls	10-12 years	35	600	4800	1.0	1.2	13	1.6	40	140	0.2-1.0

### **DIETARY INTAKE DURING PREGNANCY IN RELATION WITH BIRTH WEIGHT**

During pregnancy " Food for two " a familiar adage. Numerous studies have been performed to test the truthfulness of those terms or the effect of maternal dietary intake during pregnancy on the nutritional status of offspring researchers around the world. Neonate nutritional status depends on mother's intake of different food groups, macro and micronutrient, and insufficient dietary intake during this rapid gestational growth process result in growth failure. Required Indian Dietary Allowances (RDA), ICMR, 2010 required an additional 350 kcal / day energy consumption,



and 23 gm / day protein. Fat intake will raise to 30gm / day, 1200mg / day of calcium, 35mg / day of iron and 800µg / day of retinol [20]. International organizations (FAO / WHO / UN) recommended that pregnant women increase their energy consumption in the first trimester by 85 kcal / day, in the second trimester by 285 kcal / day and in the third trimester 475 kcal / day [21].

### **1. Intake of Different Food groups:**

Poor women in both rural and urban areas have low intakes of a variety of dense micronutrient foods, such as green leafy vegetables, fruits, and dairy. The Pune Maternal Nutrition study found that at 18 weeks, mothers with higher milk intakes and at 28 weeks, green leafy vegetables and fruit had nearly 200 g heavier babies than those who never consumed them [22]. Women who consumed little or no milk gave birth to babies weighing less than women who consumed more milk [23]. Whereas the lengths and diameter of the head were identical [23]. The nutrient intake and nutritional status is positively associated with dietary diversity [17,24].

### **2. Macro nutrient intake:**

During the last trimester of pregnancy [23], low birth weight (LBW) prevalence was significantly higher among pregnant women with mean caloric intake of less than 70 percent of RDA and protein intake of less than 40 gm (60 percent). Intake of calories during pregnancy is positively related to the newborn's birth weight [23]. Nutrition Supplementation to chronically undernourished populations in adequate quantity and length contributes to substantial rises in birth weight as well as reductions in birth levels for LBW and low for gestational age (SGA) [23]. During the third trimester, neonate birth weight was significantly correlated with intakes of energy, protein, and calcium. Higher consumption of fat at week 18 was correlated with neonatal length ( $p < 0.001$ ), birth weight ( $p < 0.05$ ) and skin fold thickness of triceps ( $p < 0.05$ ) [13]. Small concentrations of most n-3 and 20:3 n-6 fatty acids and high concentrations of 20:4 n-6 remained associated with lower birth weight, higher risk of SGA, or both. Low saturated fatty acid intake was related to decreased birth weight and increased risk of SGA. There was a substantially higher risk of LBW among pregnant women who either did not eat fish or had low intake of EPA (Eicosapentaenoic acid) during the third trimester [23].

### **3. Micronutrient Intake:**

The majority of pregnant women consumed < 50 percent of the recommended calories in addition to 99, 86.2, 75.4, 23.6 and 3.9 percent of pregnant women consumed < 50 percent of the recommended folic acid, zinc, iron, copper and magnesium respectively [25]. Some research found no association between mean infant birth weight and maternal energy and protein intake, but rather birth weight showed a strong linkage with dietary intake.

## **MICRONUTRIENT DEFICIENCY DURING PREGNANCY IN RELATIONN WITH BIRTH WEIGHT**

### **Anemia:**

World Health organisation (WHO) in its review of nationally representative survey from 1993 to 2005 concluded that 42 % of pregnant women were anaemic all over the world, and 90 % of these women came from Africa and Asia [9]. In India, the prevalence of anaemia is the highest in the world. The 18% of perinatal mortality is due to maternal anemia in low- and middle-income countries [26]. Maternal Optimal anemia was an independent preterm delivery risk factor, LBW, poor Apgar scores and intrauterine fetal mortality [17].

### **Vitamin B-12 Deficiency:**

Insufficiency of vitamin B12 was 21%, 19% and 29% respectively in the first, second and third sections, with high levels for the Indian subcontinent and the Eastern Mediterranean [27] respectively. There is a link between increasing concentrations of antenatal vitamin B12 and weight of birth in Indian babies. The low level of maternal vitamin B12 translates into a higher status of neonatal vitamin B12, as demonstrated by concentrations of cord serum vitamin B12 [27]. Lower concentrations of vitamin B12 during each of the three trimesters of pregnancy had a significantly higher risk of delivering an IUGR (Intra-uterine growth retardation) or LBW baby compared to higher-concentration women [17,27].

### **Zinc deficiency:**

In a few yet not all exploration, zinc inadequacy has been related with pregnancy and conveyance intricacies, just as development hindrance, intrinsic imperfections, and disabled neurobehavioral and immunological advancement in the embryo [28]. Maternal zinc restriction substantially decreased offspring birth weight and body weight at later point in time [17].

### **Iodine deficiency:**

extreme iodine deficiency during pregnancy contributes to risk of mental retardation, cretinism and premature delivery, but less is known for other outcomes, especially in marginal iodine deficiency [17,28].

**Mineral deficiency and other elements:**

Mineral deficiencies such as magnesium, selenium, copper and calcium were also associated with complications of pregnancy, childbirth or fetal development [28]. Magnesium restriction did not affect the birth weight but if it persisted postnatally during lactation and weaning it decreased the offspring's body weight at weaning and afterwards. Aside from magnesium, the profile of other biochemical components, to be specific calcium, zinc, and iron in the neonates' umbilical string blood with ordinary birth weight (NBW) was fundamentally higher than in the neonates' umbilical line blood with LBW [17,28].

**STRATEGIES FOR IMPROVING BETTER PREGNANCY OUTCOMES****A) PRIOR TO PREGNANCY****1. Adequate nutrition for a woman throughout life cycle:**

It is important to have adequate nutrition to prevent stunting and encourage proper mom's growth from conception through infancy to adulthood. It is because stunted growth may lead to a small pelvis causing obstructed labor and potential fetal death. One factor affecting women's reproductive life is the undernutrition of potential mothers during their growth and development. Chronic undernutrition bringing about maternal hindering or intense or incessant undernutrition bringing about low pregnancy weight can likewise negatively affect conceptive execution as reflected in decreased neonatal size and its related mortality and bleakness dangers. There is strong awareness of a positive relationship between maternal size (height and weight) and neonatal size [13,29].

**2. Adequate nutrition for women who intend to become Pregnant:**

Nutritional requirements vary across different age groups and with certain health conditions. Pregnancy is one such example of varying dietary needs. Women planning to become pregnant should have sufficient protein, vitamin and mineral supplies before and during pregnancies. It is to ensure that the woman is in a good nutritional condition to provide all the nutrients required within the first few weeks for the rapid increase in the number of cells and the growth of the zygote. Deficiencies of certain micronutrients, such as folic acid, magnesium, and iodine, shortly after birth affect the foetus. Permanent harm shall be done by the time the pregnancy is detected. Maternal nutrition can not be discussed during pregnancy alone, for positive outcome of pregnancy. Women planning to become pregnant should eat a varied diet rich in protein sources, berries, and vegetables [13].

**B) DURING PREGNANCY****1. Varied diet for pregnant women:**

Pregnant women should eat varied diets with sufficient nutritional supply to meet the increasing fetus' needs, e.g. protein-rich foods, iron, iodine, vitamin A, folic acid, zinc and calcium.

**2. Increase nutrient supply for pregnant women:**

During pregnancy the need for both energy and nutrients increases [30]. Only a small amount of additional energy is required for well-nourished women because the body adapts to the increased energy requirements and becomes more energy-efficient through reduced physical activity and a lower metabolic rate. Micronutrient supplementation, as a portion of prenatal care, may minimize maternal morbidity and mortality directly by treating a pregnancy-related disease or indirectly by reducing the risk of complications at delivery. Nevertheless, the efficacy of iron and folate supplementation interventions has continued to concentrate on child outcomes, perinatal death, premature delivery and low birth weight [13,30].

**CONCLUSION**

In life, diet has a profound impact on health which plays a very important role in affecting fetal growth and birth outcome. It's a significant modifiable risk factor for public health. The supplementation of macronutrients has had a beneficial impact in developing countries. During pregnancy, micronutrient profile plays a significant role in influencing birth weight and other birth outcomes, and is affected by dietary intake before and during pregnancy. Maternal weight gain according to WHO standards are positively correlated with mean birth weight and mothers with low BMI were found to be more likely to deliver a baby with LBW. Various studies carried out in different parts of the world have shown that it is important for the mother to be in a state of sufficient nutrition before and during pregnancy for an improved outcome of pregnancy. The government of India aims to provide multipronged maternal and child nutrition and health services through the Integrated Child Development Scheme and Reproductive, Maternal, Newborn, Child & Adolescent Health (RMNCH)+A programs. These ambitious programs seek to universally expand the quality and coverage of maternal health services, including iron folic acid (IFA) and calcium supplementation, weighing of PW, and counselling on diet, weight gain, rest, and hygiene. Despite a strong policy commitment and program priority to improve maternal nutrition, many proven maternal nutrition interventions are

not yet reaching majority of women during pregnancy. Nourishment instruction ought to be given utilizing each chance to mothers, fathers, more seasoned ladies and youngsters with the goal that they would be promoters of acceptable sustenance for pregnant ladies. Women of childbearing years should start their pregnancies in good nutritional status to maximize the health outcomes of both mother and child. Consequently, advice needs to reach out to women before they become pregnant, as well as during prenatal and postpartum care.

## **REFERENCES**

1. Baker P, Hawkes C, Wingrove K, Demaio AR, Parkhurst J, Thow AM, Walls H. What drives political commitment for nutrition? A review and framework synthesis to inform the United Nations Decade of Action on Nutrition. *BMJ global health*. 2018 Feb 1;3(1):e000485
2. Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P, de Onis M, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. *Lancet*. 2013;382(9890):427–51. doi:10.1016/S0140-6736(13)60937-X
3. Chauliac M, Masse-Rimbault AM. Women's lives, mothers' health. *Children in the tropics*. 1985(159)
4. Kontic-Vucinic O, Sulovic N, Radunovic N. Micronutrients in women's reproductive health: II. Minerals and trace elements. *International journal of fertility and women's medicine*. 2006;51(3):116-24.
5. Siega-Riz AM, Viswanathan M, Moos MK, Deierlein A, Mumford S, Knaack J, et al. A systematic review of outcomes of maternal weight gain according to the Institute of Medicine recommendations: birthweight, fetal growth, and postpartum weight retention. *Am J Obstet Gynecol*. 2009;201(4):339. e1–14. doi:10.1016/j.ajog.2009.07.002.
6. Li N, Liu E, Guo J, Pan L, Li B, Wang P, et al. Maternal prepregnancy body mass index and gestational weight gain on pregnancy outcomes. 2013.
7. Victora CG, de Onis M, Hallal PC, Blossner M, Shrimpton R. Worldwide timing of growth faltering: revisiting implications for interventions. *Pediatrics*. 2010;125(3):e473–80. doi:10.1542/peds.2009-1519.
8. Lander RL, Hambidge KM, Westcott JE, Tejada G, Diba TS, Mastiholi SC, Khan US, Garcés A, Figueroa L, Tshetu A, Lokangaka A. Pregnant women in four low-middle income countries have a high prevalence of inadequate dietary intakes that are improved by dietary diversity. *Nutrients*. 2019 Jul;11(7):1560.
9. Williams J, Mai CT, Mulinare J, Isenburg J, Flood TJ, Ethen M, Frohnert B, Kirby RS. Updated estimates of neural tube defects prevented by mandatory folic acid fortification—United States, 1995–2011. *MMWR. Morbidity and mortality weekly report*. 2015 Jan 16;64(1):1.
10. Pitkin RM. Folate and neural tube defects. *The American journal of clinical nutrition*. 2007 Jan 1;85(1):285S-8S.
11. Arenz S, Ruckerl R, Koletzko B, von Kries R. Breast-feeding and childhood obesity—a systematic review. *Int J Obes Relat Metab Disord*. 2004;28(10): 1247–56.
12. <https://www.who.int/nutrition/double-burden-malnutrition/en/>
13. Nnam NM. Improving maternal nutrition for better pregnancy outcomes. *Proceedings of the Nutrition Society*. 2015 Nov;74(4):454-9.
14. Bloomfield FH, Oliver MH, Hawkins P et al. (2004) Periconceptional undernutrition in sheep accelerates maturation of the fetal hypothalamic-pituitary-adrenal axis in late gestation. *Endocrine* 145, 4278–4285.
15. Dr. MeijaL, Dr. RezebergaD, proper maternal nutrition during pregnancy planning and pregnancy: a healthy start in life (2017).
16. Naidu AN, Rao NP. Body mass index: a measure of the nutritional status in Indian populations. *European journal of clinical nutrition*. 1994 Nov;48:S131-40.
17. Tyagi S, Toteja GS, Bhatia N. Maternal nutritional status and its relation with birth weight. *Int J Health Sci Res*. 2017;7(8):422-33.
18. [www.foodpyramid.com/6-essential-nutrients](http://www.foodpyramid.com/6-essential-nutrients)
19. [www.fao.org/docrep/017/i3261e/i3261e05.pdf](http://www.fao.org/docrep/017/i3261e/i3261e05.pdf)
20. Nutrient requirement & recommended dietary allowances for Indians. A report of the Expert Group of the Indian Council of Medical Research, Indian council of Medical research, New Delhi, 2010.
21. Food and Agricultural Organization / World Health Organization/ United Nations University. Energy and protein requirements. Report of a joint FAO/ WHO/ UNU consultation. (WHO technical report series no. 724) Geneva, Switzerland: World health organization, 1985
22. Durrani AM, Rani A. Effect of maternal dietary intake on the weight of the newborn in Aligarh city, India. *Nigerian medical journal: journal of the Nigeria Medical Association*. 2011 Jul;52(3):177.



23. Mannion CA, Gray-Donald K, Koski KG. Association of low intake of milk and vitamin D during pregnancy with decreased birth weight. *Cmaj*. 2006 Apr 25;174(9):1273-7.
24. Kiboi W, Kimiywe J, Chege P. Dietary diversity, nutrient intake and nutritional status among pregnant women in Laikipia County, Kenya. *International Journal of Health Sciences & Research*. 2016:378-9.
25. Kolte D, Sharma R, Vali S. Correlates between micronutrient intake of pregnant women and birth weight of infants from Central India. *The Internet Journal of Nutrition and Wellnees*. 2009;8(2).
26. Rahman MM, Abe SK, Rahman MS, Kanda M, Narita S, Bilano V, Ota E, Gilmour S, Shibuya K. Maternal anemia and risk of adverse birth and health outcomes in low-and middle-income countries: systematic review and meta-analysis, 2. *The American journal of clinical nutrition*. 2016 Feb 1;103(2):495-504.
27. Muthayya S, Kurpad AV, Duggan CP, Bosch RJ, Dwarkanath P, Mhaskar A, Mhaskar R, Thomas A, Vaz M, Bhat S, Fawzi WW. Low maternal vitamin B 12 status is associated with intrauterine growth retardation in urban South Indians. *European journal of clinical nutrition*. 2006 Jun;60(6):791-801.
28. Black RE. Micronutrients in pregnancy. *British Journal of Nutrition*. 2001 May;85(S2):S193-7.
29. Moore VM, Davies MJ, Willson KJ, Worsley A, Robinson JS. Dietary composition of pregnant women is related to size of the baby at birth. *The Journal of nutrition*. 2004 Jul 1;134(7):1820-6.
30. Moghaddam Tabrizi F, Saraswathi G. Maternal anthropometric measurements and other factors: relation with birth weight of neonates. *Nutrition research and practice*. 2012 Apr 1;6(2):132-7.

