

The Effect of Maternal Underweight in Pregnancy and Pre-pregnancy on Fetal Birth Weight

Ecenur Özkul Erdoğan* and Joudi Swaid

Department of Nutrition and Dietetics, Faculty of Health Sciences, Bahcesehir University, Istanbul, Turkey

***Corresponding Author:** Ecenur Özkul Erdoğan, Department of Nutrition and Dietetics, Faculty of Health Sciences, Bahcesehir University, Istanbul, Turkey.

Received: April 25, 2023; **Published:** May 17, 2023

Abstract

Pregnancy is a critical stage for pregnant women who must receive highly advanced medical, social and psychological care. Pregnant women encounter the most common problems: malnutrition, underweight/overweight, obesity, and bad follow-up. Medical research conducted about pregnancy indicated that both women to be pregnant and pregnant women face complications that will surely affect the fetus's health and birth weight. With this research, we are going to discuss the risk factors of being underweight, plus the weight loss' reasons for pregnant women such as hyperemesis gravidarum, intrahepatic cholestasis, preeclampsia, eating disorders, poor diet and anemia, and adolescence. We will conclude with the outcomes of being underweight on both fetus, maternal life, and health.

Keywords: *Pregnancy; Underweight; Eating Disorders; Adolescence*

Introduction

Both pregnancy supervising doctors and the dietitians must start a healthy diet for the mother and fetus prior to pregnancy and after birth breastfeeding, so that to ensure a sufficient diet of vitamins and minerals to save both mother and fetus from upcoming illnesses and refrain from the high consumption of refined sugar and saturated fat to reduce the risk of low birth weight of newborn babies [1].

Nowadays, we witness a sharp rise in the number of overweight and obese pregnant women [1]. The dense research on pregnant women or those to be pregnant noticed that pregnant women with high BMI might face problems affecting the newborn babies. This result includes underweight pregnant women with low BMI < 18.5 kg/m², precisely in the western world's research [2]. Most pregnant women try to lose weight during pregnancy, to avoid the extra weight problems after birth along with nutritional programs for breastfeeding. At the same time, some pregnant women suffer significant weight loss in the early stage of pregnancy and also, till the second trimester of pregnancy, while other pregnant women gain weight of their fetus and a few extra pounds but luckily all end with birth.

Risk factors of underweight during pregnancy

It's well known, that pregnancy and giving birth to newborn babies is very hard but at the same time, it is a very exciting and interesting experience for mothers as they practice their natural instinctive life role. Pregnant women with a lack of normal BMI suffer multi health risks including their pregnancy status and health after birth.

General risks for maternal and fetal maternal factors

The group of underweight pregnant women includes sick women with chronic diseases confined to nutritional intake and those who suffer genetic predisposed features in their youth. In 2017, it was clear that both 10.4% of pregnant women less than 20 and 7.4% of those aged 20 - 24 suffered underweight, In addition to 4.2% of pregnant women in Denmark.

It is noticed that pregnant women who suffer chronic symptoms such as inflammatory bowel disease plus women who follow restrictive diets (plant-based diet) encounter nutritional deficiencies and malabsorption. Moreover, low BMI is more frequent in women from lower socioeconomic strata or addicted to spirits or drugs. It also noticed the relation between reduced BMI risk of some of pregnancy complications and the rising risk of others. In an American research, death and maternal morbidity are higher in both low and high BMI levels. The outstanding noted abstract was that underweight pregnant women had a double possibility of transfusion required hemorrhage as in normal-weight women. To the researchers, underweight women approach transfusion points due to their higher occurrence of anemia compared to a normal BMI. A low BMI is linked to preeclampsia, gestational diabetic Mellitus, birth weight lower than 4 kg, placenta hypertension, and C section [3].

Fetal factors

Contrary to normal-weight pregnant women, underweight pregnant women have slightly exposure to an unintended abortion compared with women of normal weight. A study of 30 cohort studies about underweight pregnant women showed a relative risk of spontaneous abortion. The concentration in most studies about the relation between BMI and congenital malformations was on the relation between high BMI and congenital abnormalities. However, a few studies about underweight pregnant women showed a rising risk of neural tube deformations is still groundless. Underweight pregnant women (mainly the young ones) may highly suffer gastroschisis risk. A low BMI may have a minor protective influence on stillbirth. A meta-analysis of 38 researches published in 2014 showed the rise in both the risk of stillbirth and BMI. Synchronous rise of stillbirth risk of which underweight pregnant women recorded 8% lesser opportunity compared with normal-weight pregnant women. In the same study low BMI wasn't connected with neonatal risk of newborn death. According to a 2017 meta-analysis, SGA and preterm delivery are both related to maternal weight gain in pregnancy which makes such women closer to the recommendation, while underweight women who lose weight during pregnancy had a higher risk of SGA and preterm birth. A 2012 Danish study stated less weight gain than recommended in 35% of underweight women [3].

Weight loss causes in pregnant women

Eating disorders

Anorexia nervosa

There are significant postpartum and intrapartum effects of physiological and psychological interaction between anorexia and pregnancy on maternal and fetus. Possible disorders accompanied with sexual dysfunction, menstrual dysfunction, and low bone density, are noticed in women prior to pregnancy, but in pregnancy, they show obstetric complications like low birth weight in offspring, preterm, miscarriage and consequential complications during pregnancy [1]. 1% of women of childbearing age are affected with a severe psychiatric disorder (Anorexia Nervosa). Yet, their pregnancy results are badly understandable. Women who suffer anorexia nervosa follow highly strict diets and may possibly suffered malnutrition which greatly increases birth complications risk, restricted fetal growth and low birth weight. Only the one hand, some data show severe malnutrition caused by famine in pregnancy is linked to increasing neonatal mortality risk. On the other hand, other data show the increasing risk of cesarean delivery, preterm birth, and gestational diabetes due to fasting even if not associated with bad nutrition. Moreover, severe anorexia nervosa may cause liver steatosis, structural abnormalities, cardiac arrhythmias, pancytopenia, and electrolyte imbalance. Which may cause pregnancy complications in a later stage [4].

Pica

Sufficient nutrition is the main cause of good health of the humans, mainly pregnant women. In general, pica is recurring ingestion of uneatable items, which is usually insatiable that causes compulsive consumption [5]. One theory states that pica can be traced in many conditions e.g. autism, schizophrenia, and cultural rituals. Yet, in pregnancy precisely, pregnant women may not have pica before pregnancy [6]. Pregnant women who suffer deficiencies in iron, potassium and zinc are more likely to have pica but, in another theory, pica is the immune response theory and an active stress mediator through the immune system. Geophagia may have a possible effect on the maternal secretory immune system. Monkeys among other primates who regularly eat dirt may have less parasites load than monkeys who don't eat dirt [6]. In western's countries, the most common ingested pica substance is ice, while in other countries and pending availability and preferences the most pica substances are chalk, soil, and clay [7]. A lot of pregnant women show a tendency to pica prior to pregnancy or during childhood or family history with noting that family income doesn't affect the pica behavior as it really changes the ingested substance and pica isn't common among the rural underprivileged obstetric population. Severe pica is more prevalent in the reproductive age group, who suffer from malnutrition. Obviously, birth-of-the-women suffer more pica more than two babies, possibly as a result of depleted body sources. Most women tend to substance texture, taste and smell, while others think that pica reduces their vomit or nausea and smooths their painful delivery. but, only practices pica as a result of religious concepts [7].

Preeclampsia

influences 3 to 5% of pregnant women in the form of edema, hypertension, and proteinuria. Moreover, the same is noticed in women with preeclampsia, function disorders of many organs such as the kidney and liver and a limitation of fetus growth are also noticed. Unfortunately, death takes place when neglecting preeclampsia treatment which is one of the main reasons for maternal and child death in underdeveloped countries [8]. Advices define preeclampsia as arterial hypertension accompanied with proteinuria after the 20th week but it may cause another hypertensive situation and arterial hypertension becomes clear when the systolic blood pressure is > 140 mm Hg and diastolic blood pressure is > 90 mm Hg, considering the fifth Korotkoff sound [9]. Hypertension confirms preeclampsia which occurs in the context of rising systemic vascular resistance and afterload plus reduced cardiac output and intravascular volumes as compared to normotensive pregnant control patients. The usual dip in nocturnal BP becomes less or disappears as conduct artery compliance becomes less. In spite of the activation of RAAS, it has been noticed that decrease of Renin levels, and angiotensin II and aldosterone in preeclampsia compared with normal pregnancy (in spite of the fact that it remains higher than non-pregnant women, with sensitivity rise to Ang II and norepinephrine). In spite of less components of RAAS levels, there are 2 causes for hypertensive in preeclampsia. The first cause, in normal pregnancy, AT1R is less regulated by reactive oxygen species. In the case of preeclampsia, AT1R complexes with bradykinin receptor B2 creates a heterodimer to give the pressor effects of Ang II. The second cause, is placental hypoxia, essential to produce circulating antibodies to AT1R, which increases vasoconstriction via endothelin-1 activation which leads to the increase of both sensitivities to circulating Ang II and placental hypoxia [10]. Presently, due to the change of preeclampsia idea, the diagnosis of PE with proteinuria absence may be based on the existence of abdominal pain, headache, laboratory tests and visual turbidity [9]. To define proteinuria, the loss of 300 mg of protein or more in a day of urine specimen amount must be taken into consideration. To reach a more credible diagnosis, it would be enough to consider estimations in a separate sample of urine with a proteinuria ratio > 0.3 [9]. The increase of renal tubular permeability to the majority of large molecular weight proteins, like hemoglobin, albumin, and transferrin, is the outcome of the proteinuria existence in preeclampsia setting. Mediating renal tubular injury of preeclampsia setting SFLT-1 inhibition of VEGF involves reduced nitric oxide and high circulating SFLT-1 which also cause glomerular endothelial injury process known as glomerular endothelin (pathognomonic for preeclampsia) [10].

Classification

Among many classifications of hypertensive disorders in pregnancy, the ISSHP classification in 2014 was as follows [10]:

- 1) White coat hypertension.

- 2) Gestational hypertension.
- 3) Preeclampsia with or without overlapping chronic hypertension.
- 4) Chronic hypertension.

Hyperemesis gravidarum

It is vomiting during pregnancy causing volume depletion, and weight loss leading to ketonuria and/or ketonemia, due to the absence of consensus on specific diagnostic standards, it generally means the severe end of the spectrum related to vomiting and nausea in the first trimester of pregnancy (from 4 to 5 weeks). [11]. Hormonal factors may cause hyperemesis gravidarum while *Helicobacter pylori*, gastrointestinal dysmotility, psychosocial factors, and placenta-related factors, are other possible reasons. In addition, to genetic factors [12]. The first HG definition was in 1956 by a panel selected by the American Pharmaceutical and Chemical Boards that define HG as refractory vomiting and a group of disorders including electrolyte balance changes, liver and kidney damage, retinal hemorrhage, weight loss, neurological disorders, ketosis and ketonuria. In a new international consensus hyperemesis gravidarum is composed from symptoms starting from 16 before gestational age, a vomiting and nausea with noting that one of these symptoms is severe e.g. normal drinking failure, loss of appetite and limited daily living activity. Dehydration was linked to the hyperemesis gravidarum definition. Clinical practices consider HG as the more severe NVP expression along with complications, e.g. dehydration and metabolic syndromes such as malnutrition, weight loss, or electrolyte deficiency. A study states that maternal malnutrition caused by HG may result in vitamin K deficiency which in turn may induces clotting. Moreover, there are possible complications associated with hyperemesis gravidarum as acute kidney and liver failure, small gestational age, maternal death, electrolyte disturbances, thyrotoxicosis, renal and neuromuscular complications, placental abruption, esophageal rupture, neurodevelopment delay of the infant and preeclampsia [12].

Adolescent pregnancy

16 - 19 associated with multi-psychological, physical, reproductive health, and social changes [13]. When adolescent girls become pregnant for the second time they endanger their own health and the baby's which results in adverse socioeconomic, medical, educational, and parenting [14]. Medical studies show a non-stop rise in pregnancy frequency of adolescent girls in underdeveloped countries with higher different maternal and perinatal results [13]. Pregnancy repetition in adolescent girls is both an international phenomenon and a local interest as in the case of South Africa [14]. The few studies performed about adolescent pregnancy in Africa presented undecisive and irrelevant results on the problems' distribution [13]. Pregnancy repetition in adolescent girls prevailed in Durban, Kwazulu-Natal war reported as 17.6% in 2013 [14]. Globally speaking, pregnancy and childbirth complications are the second death cause of girls aged 15 to 19. Round 3 million girls aged from 15 to 19 experience dangerous abortions a year. Adolescent mothers' infants encounter a significant mortality risk higher than babies of women aged 20 to 24 and adult pregnant women face lesser pregnancy fetal complications than those of pregnant teenagers such as preterm labor, low birth weight, preeclampsia [15]. The majority of unplanned pregnancy of teenager girls suffer lots of health problems due to their poor education, which may cause unsuitable weight gain which affects fetal birth weight as indicated in some data, both poor weight gain and underweight pregnant women encounter increased low-birth-weight infants and preterm birth [15].

Intrahepatic cholestasis in pregnancy

Also known as obstetric cholestasis, is a liver disorder in the late second and early third trimester of pregnancy, characterized with increased serum bile acids, other liver function tests and pruritus. These symptoms rapidly disappear after delivery with noting that pathophysiology is not completely understood and associated with increased risk of different obstetrical results including meconium passage, stillbirth, fetal asphyxiation, and respiratory distress syndrome. This process will cover diagnosis, clinical presentation in addition to the condition handling [16]. The aiding factors of development are genetic susceptibility and reproductive hormones mainly estrogen. Hepatic biliary canalicular transport proteins and the expression of nuclear hepatic bile acid receptors are reduced in genetically highly

sensitive women leading to damage of hepatic bile acid hemostasis and the following increased bile acid levels [16]. Liver built-in liver cholestasis in newborn babies birth weight was less than those of normal pregnancy. Moreover, these symptoms are associated with a lower birth weight than late-onset intrahepatic cholestasis of pregnancy [17].

Anemia and poor diet

It is a worldwide phenomenon affecting 38% of pregnant women and 50% of those was caused by iron deficiency. Anemia may cause severe risky different results including fetal hypoxia, puerperal infection and premature birth [18]. As a serious hidden cause for both child and mother death worldwide during pregnancy, malnutrition reduces fetal growth, and indirectly make 20% of the children dwarf in the first 2 years of their life, causes 800 000 of newborn deaths, 400 000 death reasons of infants, and 20% deaths of mothers at delivery [19]. Quick fetal growth in the third period of pregnancy rises the need for iron and micronutrients which explains the link between LBW, newborn death to third trimester Hb levels. It is noticed that underweight and anemia phenomena are mentioned in 1/3 of the participants' studies but the percentage is still rising. The spread of underweight regarding the stable anemia rates during this study period, malnutrition may cause most of mothers underweight in the area. At the same time, micronutrient deficiencies are highly responsible for anemia high rates in underweight pregnant women [19].

The results of the underweight phenomenon in both pre-pregnancy and pregnancy stages

The following is a series of the problems which pregnant women encounter in pregnancy.

Preterm birthweight

It is a major reason for the newborn death rate and a long-term disease worldwide. A serious assessment of the causes and risks factors of their phenomenon is a basic process to get effective measures to minimize it. BMI and gaining weight before and during pregnancy have been relevant causes of PTB. An old study of about 9 thousand women of single baby deliveries in Lima-Peru from 2006 to 2009, indicated a separate link between variant premature birth pending on BMI and pregnancy weight gain. Yet, this phenomenon showed lower rates in overweight women and normal BMI but, it was noticed that pregnancy weight gain high rate were accompanied with an increasing premature births rate. These outcomes stress the bad need for more studies to increase our information about the specific characteristics of premature delivery and the importance of these results for public health [20].

Maternal age

Few studies made about the highest risky factors leading to negative pregnancy results questioned BMI in a pre-pregnancy stage as per maternal age. The outcomes of this study showed that the link between the pre-pregnancy period with different pregnancy results is strictly according to the mother's age. A new study based on birth certificate information in the U.S, N.V.S.S focused on the relation between premature birth and pre-pregnancy overweight, which differs according to the mother's age. It is noticed that these studies agree that prior pregnancy consultations and risk evaluations must be conducted in the light of maternal age [21].

Uteroplacental insufficiency

The reasons of negative pregnancy results are both complex and multi- factors. But, the womb's environment of the various weight apparent kinds may explain the links of pregnancy results with pre-pregnancy BMI. Contrary to healthy weight women, underweight women have less plasma volume in addition to Renin-Aldosterone response in pregnancy, but, it may occur with uterine-central inadequacy and increasing SGA spread. Old studies presumed that intrauterine (inflammatory) infection may take place on a causal pathway between pre-pregnancy body mass index and premature birth, but some studies showed the disappearance of the increasing spread of after-delivery infective complications [22].

The relation between offspring adulthood and maternal underweight

Mother underweight is rare in advanced communities, but, the main possible mechanism of developing chronic diseases in offspring's adulthood is the contradiction between bad nutrition environment and uterine and normal or extreme nutrition in the postpartum period with quick growth existence [23]. It is known that maternal low weight is a fatal cause for low newborn weight which is expectant of negative brain development. Moreover, a proof from a U.S. cohort study stated that pre-pregnancy BMI occurred with rising of delayed intellectual development in 2 years old kids. Our best information about advanced countries shows the rarely reported effect of mothers' weight loss on offspring incidence of underweight, stunting, and thinness in childhood. As for intellectual development, birth cohort study outcomes indicated that the low and extreme maternal pre-pregnancy BMI occurred with rising risk of postponed intellectual progress in 2 years old U.S. children [23].

Conclusion

The main points to be discussed when studying pregnancy are common problems in pre-pregnancy and pregnancy periods such as malnutrition and under/overweight. In pregnancy study, the focus is on a strict healthy diet for pregnant women or those to be pregnant paralleled with a comprehensive precautionary plan against pregnancy diseases and complications. Moreover, all medical researches and studies about pregnancy showed the large differences between pregnant women in advanced communities and those in underdeveloped communities which included many effective factors such as life standards and style, health services levels, social environments, human and social awareness among pregnant women. There is a necessity to mention some of the main causes of weight loss during pregnancy, it was found that these diseases mostly affect the pregnancies women and cause unwanted weight loss and complications such as Utero-pla-Central Insufficiency, and preterm birth weight. Furthermore, the article found that there is an effect on offspring's health and brain development in later life.

Conflict of Interest

There is no financial interest or any conflict of interest exists.

Bibliography

1. Arnold C., *et al.* "The effects of eating disorders in pregnancy on mother and baby: a review". *Psychiatria Danubina* 31.3 (2019): 615-618.
2. Ward VB. "Eating disorders in pregnancy". *BMJ* 336.7635 (2008): 93-96.
3. Helgstrand S and Andersen AMN. "Maternal underweight and the risk of spontaneous abortion". *Acta Obstetrica et Gynecologica Scandinavica* 84.12 (2005): 1197-1201.
4. Ante Z., *et al.* "Pregnancy outcomes in women with anorexia nervosa". *The International Journal of Eating Disorders* 53.5 (2020): 403-412.
5. Konlan KD., *et al.* "Practices of pica among pregnant women in a tertiary healthcare facility in Ghana". *Nursing Open* 7.3 (2020): 783-792.
6. Al Nasser Y., *et al.* "Pica" (2022).
7. Kirar D and Pathak Dr V. "Impact of pica in pregnancy over fetomaternal outcome at tertiary care center in central India". *International Journal of Clinical Obstetrics and Gynaecology* 5.5 (2021): 72-75.
8. Filipek A and Jurewicz E. "Preeklampsja - choroba kobiet w ciąży". *Postępy Biochemii* 64.4 (2018): 232-229.

9. Ramos JGL., *et al.* "Preeclampsia". *Revista Brasileira de Ginecologia E Obstetrícia* 39.9 (2017): 496-512.
10. Ives CW., *et al.* "Preeclampsia-Pathophysiology and Clinical Presentations: JACC State-of-the-Art Review". *Journal of the American College of Cardiology* 76.14 (2020): 1690-1702.
11. Lk J and HM. "Hyperemesis Gravidarum". Retrieved from PubMed website (2021).
12. Liu C., *et al.* "Emerging Progress in Nausea and Vomiting of Pregnancy and Hyperemesis Gravidarum: Challenges and Opportunities". *Frontiers in Medicine* (2022): 8.
13. Kassa GM., *et al.* "Prevalence and determinants of adolescent pregnancy in Africa: a systematic review and Meta-analysis". *Reproductive Health* 15.1 (2018).
14. Govender D., *et al.* "Scoping review of risk factors of and interventions for adolescent repeat pregnancies: A public health perspective". *African Journal of Primary Health Care and Family Medicine* 10.1 (2018).
15. Vivatkusol Y., *et al.* "Inappropriate gestational weight gain among teenage pregnancies: prevalence and pregnancy outcomes". *International Journal of Women's Health* 9 (2017): 347-352.
16. Pillarisetty LS and Sharma A. Pregnancy Intrahepatic Cholestasis (2022).
17. Li L., *et al.* "Effect of Intrahepatic Cholestasis of Pregnancy on Neonatal Birth Weight: A Meta-Analysis". *Journal of Clinical Research in Pediatric Endocrinology* 10.1 (2018): 38-43.
18. Tan J., *et al.* "Association between Maternal Weight Indicators and Iron Deficiency Anemia during Pregnancy". *Chinese Medical Journal* 131.21 (2018): 2566-2574.
19. Patel A., *et al.* "Maternal anemia and underweight as determinants of pregnancy outcomes: a cohort study in eastern rural Maharashtra, India". *BMJ Open* 8.8 (2018): e021623.
20. Pigatti Silva F., *et al.* "Role of Body Mass Index and gestational weight gain on preterm birth and adverse perinatal outcomes". *Scientific Reports* 9.1 (2019).
21. Tang J., *et al.* "Association of maternal pre-pregnancy low or increased body mass index with adverse pregnancy outcomes". *Scientific Reports* 11.1 (2021): 3831.
22. Bellver J and Mariani G. "Impact of parental over- and underweight on the health of offspring". *Fertility and Sterility* 111.6 (2019): 1054-1064.
23. Li C., *et al.* "Effect of maternal pre-pregnancy underweight and average gestational weight gain on physical growth and intellectual development of early school-aged children". *Scientific Reports* (2018): 8.

Volume 18 Issue 5 May 2023

©All rights reserved by Staniša Stojiljković, *et al.*