Kufa Medical Journal | Vol. 19, No. 1, 2023

Original article | DOI: https://doi.org/10.36330/kmj.v19i1.12078

Submitted at: 14 May 23
Accepted at: 30 May 23

# Body Mass Index Categories Among Pregnant Women Attending Primary Health Care Centers / Baghdad 2022

**Zainab Ghassan Lutfi [(1)],Mohsin Ahmed Jasim [(2)], And Dalya Talal Fathi Al–Azzawi [(3)]**

[(1)]MBChB , FICMS/ FM family physician specialist , Nutrition Research Institute / ministry of health, Iraq. [(2)]MBChB ,FIBMS/ CM ; FABHS / SCN , consultant doctor Ministry of Health , Nutrition Research Institute / ministry of health , Iraq. [(3)]MBChB, FICMS / FM family physician specialist , Al-Mustanseryia PHC training center / Baghdad, Iraq.

Corresponding Author Email: mohsinmohsinnri@gmail.com

## Abstract

**Background:** Recommended weight gain to support a healthy pregnancy vary by prepregnant body mass index. Insufficient weight gain especially associated with prepregnant underweight is associated with increased risk of spontaneous preterm delivery, small for gestational age. Extensive weight gain often results in large for gestational age babies also may increase risk during delivery. Good nutrition and a healthy diet during pregnancy are critical for a mother's health, as well as that of her child. A healthy diet contains adequate energy, protein, vitamins and mineral obtained from a variety of foods including green and orange vegetables, meat, fish, beans, nuts, whole grains, and fruit. Many studies have suggested that weight gain during pregnancy is affected by prepregnancy BMI. This study is conducted to determine maternal weight gain, pattern and associated of some selected socio-demographic factors. **Method:** A cross-sectional analytic study wholly done from July 4$^{th}$ to December 20$^{th}$; the sample size was 114 pregnant antenatal care files archived selected from primary health care centers. It searched for the full previous pregnancy files and with frequent visits from the beginning of pregnancy to birth. The data and information were collected from antenatal care files from six primary health care centers of As-Salam, AL-A'dil, AL-Mansour, AL-A'dhamiya 3rd, AL-Baladiyaat, AL-Mustansiriya. The exclusion criteria exclude all incomplete files, pregnant women less than 18 years, and pregnant with chronic disease multiple pregnancy. Frequencies and percentage were calculated; Chi square test were used; and the statistical probability were consider significant if P value < 0.05. **Results:** The current study was conducted through 114 pregnant care files or antenatal care in 6 primary health care centers. 73% of them gained excessive weight during pregnancy; 11% of them gained insufficient weight gain during pregnancy; and 17% of pregnant women had adequate weight gain during pregnancy. There was a statistically significant association between weight gain during pregnancy and primary health care centers, as representing social factor, and also significant association between pre pregnancy BMI and gestational weight gain. **Conclusion:** Gestational weight gain was significantly affected by pre pregnancy body mass index. Prevalence of excessive weight gain increases with the increase of the pre-pregnancy body mass index and with the increase of age in pregnant women. Weight gain during pregnancy should be monitored and intervention should be developed.

**Keywords:** BMI, Gestational, Pregnancy, Weight Gain.

## INTRODUCTION

Women form an important pillar of society and are the primary caretakers. They suffer from poor health outcome with repercussion on them and their families. Good nutrition is very important for all but more so for women. Weight gain during pregnancy is an important indicator in the prediction of morbidity and mortality in infant and mother[1]. Pregnancy requires a healthy diet that includes an adequate intake of energy, protein, vitamins and minerals to meet maternal and fetal needs[2]. Maternal under-nutrition is highly prevalent and is recognized as a key determinant of poor perinatal outcomes. However, obesity and overweight is also associated with poor pregnancy outcomes and many women in a variety of settings gain excessive weight during pregnancy. Multiple studies show broad agreement on amounts of weight gain that are related to the birth of infants with weights that place them within the lowest category of risk for death or health problems[3]. Pre-pregnancy weight status influences the relationship between weight gain and birth weight, recommended weight gain to support a healthy pregnancy and infant vary by pre-pregnant body mass index. There is evidence for the role of regular weighing and weight management intervention [4]. Multiple studies conducted in different regions of the world recorded the prevalence of excessive gestational weight gain[5]. Such studies have showed that pregnant women with overweight or obesity pre-pregnancy BMI are more likely to develop excessive pregnancy weight gain[6]. The high rate excessive gestational weight gain is becoming a worldwide epidemic[7]. United States excessive pregnancy weight gain were reported[8]; Chinese pregnant women is between 46.5% and 53.6% excessive weight gain[9]; in England, 40% of pregnant women are overweight or obese [10]; and in Australia, 13% of pregnant women are overweight, 20% are obese[11]. Low- and middle-income countries (LMICs) where multiple nutritional deficiencies often co-exist. In resource poor countries in sub-Saharan Africa, south-central and south-east Asia, maternal under-nutrition is highly prevalent and is recognized as a key determinant of poor perinatal outcomes[12]. Optimal nutrition during pregnancy actually begins pre-conceptually, nutritional deficiency can result in a preterm delivery[13]. WHO's responsibility is to monitor progress towards the global goal for reducing maternal death through strategies for ending preventable maternal mortality and improving maternal health and well-being. This includes good nutrition, recommended weight gain monitoring to support a healthy pregnancy[14].

Insufficient weight gain especially associated with pre-pregnant underweight is associated with increased risk of spontaneous preterm delivery, small for gestational age. Extensive weight gain often results in large for gestational age babies also may increase risks during delivery[15]. To alleviate the increasingly serious problem, Institute Of Medicine(IOM) revised prenatal weight gain goal. In 1990, the U.S.A. Institute Of Medicine (IOM), produced guidelines for GWG which were been updated in 2009; these guidelines are widely considered to be the international gold Standard however not provide recommendations for different classes of obesity (I,II,III) as defined by WHO. Women who are underweight at the start of pregnancy, i.e. BMI < 18.5 kg/m2, should aim to gain 12.5–18 kg, women who are normal weight at the start of pregnancy, i.e. BMI 18.5–24.9 kg/m2, should aim to gain 11.5–16 kg, overweight women, i.e. BMI 25–29.9 kg/m2, should aim to gain 7–11.5 kg, while obese women, i.e. BMI > 30 kg/m2, should aim to gain 5–9 kg [16] [17]. Height and pre-pregnant weight should be measured, not asked to determine pre-pregnant BMI. Self-reported pre-pregnancy weight can be used if necessary but it is subjected to error and usually under-reported. If pre-pregnant weight is unknown or unreliable, the weight at 1st visit should be used assuming she is early in pregnancy as a

good estimate of pre-pregnant weight. If she started prenatal care late and has no idea of her pre-pregnant weight, she need to be estimated to have appropriate gain to that point [4].

The aims of this study are to determine the:

1- pre-pregnancy body mass index categories among pregnant women in the recorded antenatal care files and association with some socio-demographic variables.
1. weight gain during pregnancy, pattern, association with pre-pregnancy BMI and some socio-demographic factors.

## METHODOLOGY

This is a cross-sectional analytic study wholly done from July 4th to December 20th; the sample size was 114 pregnant antenatal care files archived selected from primary health care centers. It searched for the full previous pregnancy files and with frequent visits from the beginning of pregnancy to birth. The data and information were collected from antenatal care files from six primary health care centers of As-Salam, AL-A'dil, AL-Mansour, AL-A'dhamiya 3rd, AL-Baladiyaat, AL-Mustansiriya. Chosen randomly by simple random samples, three sectors from each of Baghdad Ar-Rusafa, and Al- Karkh health directorates, one primary health care center from each sector. Included files were singleton pregnancy, with no primary pregnancy-related diseases and chronic illness before pregnancy full information about pre-pregnancy body weight, height, regular monthly visits weighting, gravida, para, abortion, last menstrual cycle, and other demographic factors. Therefore, they included 114 archived antenatal care files that were searched for previous complete pregnancy. When a woman seems to have a positive pregnancy test, and registered in antenatal care, her weight at that time will be pre-pregnancy weight. Her pre-pregnancy BMI will be calculated according to formula kg/m² and the chart that pregnant women belongs to, whether normal, overweight, obese underweight, will be chosen and the weight at each regularly scheduled prenatal visit will be evaluated by monitoring progress toward meeting weight gain goals: adequate, insufficient, or exceeding. The total gestational weight gain will be calculated as a difference between body weight at pre-pregnancy, at the first visit and last antenatal visit prior delivery.

The exclusion criteria were used to exclude pregnant women files less than 18 years, BMI for age using other growth charts, and pregnant woman has chronic disease that may effects weight.

A questionnaire was designed to collect data about pregnant women through the archived antenatal care files about previous pregnancy; it was divided into the following sections:

1- Directorate, sector, primary health care center,
2- Demographic data which consist of age, occupation, educational level, number of children, weight, and height,
3- Antenatal data : - last menstrual period, parity, medical history
4- weight at each monthly scheduled antenatal visit

The Pilot study

A pilot study was carried out in Al-A'dhamiya 3rd Primary Health Care Center over ten antenatal files for pregnant women which are not included in the studied sample. The reliability of IOM maternal weight gain charts[16] was used and the availability of pre pregnant weight and height in the archived antenatal care files were used to calculate prepragnant BMI and to assess gestational weight gain during the frequent follow up visits weighing.

### Data analysis

The data management and statistical analysis were performed by using SPSS version 25 to

analyze, frequencies and percentage, the Chi - square test was used to test association and the statistical probability was considered significant if P value < 0.05.

For ethical issues, the study was approved by Public Health Directorate/ Ministry Of Health/ Iraq

## RESULTS

One hundred fourteen antenatal care files were collected from 6 primary health care centers where 69(60.5%) were from Al Karkh Health Directorate and 45(39.5%) from Ar-Rusafa Health Directorate. The files that were collected from primary health care centers were 25(21.9%) from Al-Mansour, 22(19.3%) from As-Salam, 22(19.3%) from Al- A'dil, 16(14%) from Al-Mustansiriya, while 10(14.0%) from Al-Baldiyaat. 66(57.9%) were between the age of 20 and 29, 9( 7.9%) were between the age of 40 and 49. 32(28%) of pregnant women have a primary school, and 27(23.7%) have an intermediate school 25(21.9%) have university degree. Only 5(4.4%) of pregnant women did not go to school and only 2 (1.8%) of pregnant women had higher degree (Master, Diploma). 103(90.4%) of the pregnant women did not work outside the home while 11(9.6%) of them had work outside the home. Pregnant women for the first time were 43(37.7%) and those who had pregnancies for 2$^{nd}$ and 3$^{rd}$ time were 52(45.6%); pregnant women for the fifth time or more were 8(7.0%). Pregnant women who had one child were 49(43.0%) and those had four children or more were 11( 9.6%). 103(90.4%) of pregnant women did not have an abortion. Table (1) showed the pre pregnancy BMI distribution among the studied samples, pregnant women who had an overweight BMI were 44(38.6%) while those with obese category were 37(32.5%). Pregnant women who had normal BMI were 33(28.9%). Table (2) illustrated the distribution of weight gain through studied archived antenatal care files. The pregnant women who gained excessive gestational weight gain were 83(72.8%) whereas those who had normal (sufficient) weight gain were 19(16.7%). Pregnant women who had insufficient weight gain during pregnancy were 12(10.5%); no pregnant files belongs to underweight category according to pre pregnancy weight. Table (3) illustrated the relation between pre- pregnancy BMI and some socio-demographic variables. There was a statistical significant relationship between pre pregnancy BMI and age. Pregnant women aged between 20 and 29 were 66(57.9 %) and 29(43.9%) of them were overweight. Yet, there was no significant relationship between pre pregnancy BMI and primary health care centers, educational level, work and number of children they have, p value (0.00) . Table (4) demonstrated that there was a significant statistical association between maternal weight gain and primary health care centers, p value was (0.022); pregnant women had excess maternal weight in all primary health care centers. There was statistical significant relationship between gestational weight gain and pre pregnancy BMI (P value = 0.022); pregnant women with BMI were classified overweight or obese pre-pregnancy; they get excess maternal weight gain. There was no significant statistical association between gestational weight gain and educational level, occupation, age, number of children number of pregnancy; these factors not play role in maternal weight gain in this study.

**Table (1): Distribution of pregnant care files according to pre pregnancy to BMI (n= 114)**

| Body mass index category | Number | Percentage % |
|---|---|---|
| Normal | 33 | 28.9 |
| Over weight | 44 | 38.6 |
| Obese | 37 | 32.5 |

**Table (2): Distribution of pregnant care files according to weight gain during pregnancy (n= 114)**

| Weight gain | Number | Percentage |
|---|---|---|
| in sufficient weight gain | 12 | 10.5 |
| Normal weight gain | 19 | 16.7 |
| Excess weight gain | 83 | 72.8 |

**Table (3): the relationship between pre-pregnancy BMI and primary health care centers, demography, and work (n = 114).**

| | | | P | T | P |
|---|---|---|---|---|---|
| **Age** | | | | | |
| | N | C | C | | |
| 18 - < 20 | 1 | 3 | 0 | 1 | 0 |
| 20 -29 | 1 | 2 | 2 | 6 | |
| 30 -39 | 4 | 9 | 1 | 2 | |
| 40 -49 | 1 | 3 | 5 | 9 | |
| **PHCCs** | | | | | |
| As-Salam | 3 | 1 | 8 | 2 | |
| Al-A'dil | 5 | 1 | 7 | 2 | |
| Al-Mansour | 7 | 1 | 7 | 2 | 0 |
| Al-A'dhamiya | 1 | 4 | 4 | 1 | |
| Al-Mustansirya | 4 | 4 | 8 | 1 | |
| Al-Baladiaat | 3 | 4 | 3 | 1 | |
| **Education** | | | | | |
| Not go to school | 1 | 2 | 2 | 5 | |
| Primary | 1 | 7 | 1 | 3 | 0 |
| Middle | 8 | 1 | 9 | 2 | |
| Secondary | 9 | 1 | 4 | 2 | |
| Collage | 3 | 1 | 8 | 2 | |
| Master | 0 | 1 | 1 | 2 | |
| **Number of children** | | | | | |
| Not has child | 1 | 1 | 7 | 4 | |
| 1 | 1 | 1 | 2 | 4 | 0 |
| 2-3 | 2 | 4 | 5 | 1 | |
| 4 and more | 2 | 4 | 5 | 1 | |
| **Occupation** | | | | | |
| Work out side | 3 | 6 | 7 | 1 | |
| Not work out side | 3 | 3 | 3 | 9 | 0 |

**Table (4): Relation of maternal weight gain and primary health care centers, demographic, work**

| | | | | | |
|---|---|---|---|---|---|
| Primary health care centers | | | | | |
| PHCCs | I | A | E | T | P |
| As-Salam | 0 | 2 | 2 | 2 | 0 |
| Al-A'dil | 3 | 4 | 1 | 2 | |
| Al-Mansour | 3 | 8 | 1 | 2 | |
| Al-A'dhamiya | 3 | 1 | 1 | 1 | |
| Al-Mustansirya | 0 | 1 | 1 | 1 | |
| Al-Baladiaat | 3 | 3 | 4 | 1 | |
| pre pregnancy BMI | | | | | |
| Normal | 5 | 1 | 1 | 3 | |
| Over weight | 6 | 6 | 3 | 4 | |
| Obese | 1 | 3 | 3 | 3 | |
| Education | | | | | |
| Not go to | 0 | 0 | 5 | 5 | |
| Primary | 4 | 6 | 2 | 3 | 0 |
| Middle | 4 | 6 | 1 | 2 | |
| Secondary | 2 | 4 | 1 | 2 | |
| Collage | 2 | | 2 | 2 | |
| Master / diploma | 0 | 0 | 2 | 2 | |
| Number of children | | | | | |
| Primigravida | 3 | 8 | 3 | 4 | |
| 1 | 8 | 8 | 3 | 4 | 0 |
| 2-3 | 1 | 2 | 8 | 1 | |
| 4 and more | 0 | 1 | 1 | 1 | |
| Occupation | | | | | |
| Work out side | 0 | 2 | 1 | 1 | |
| Not work out | 1 | 1 | 6 | 9 | 0 |
| Age | | | | | |
| < 20 | 3 | 5 | 7 | 1 | |
| 20 -29 | 6 | 1 | 5 | 6 | 0 |
| 30-39 | 2 | 3 | 1 | 2 | |
| 40 -49 | 1 | 1 | 7 | 9 | |

## DISCUSSION

Weight gain during pregnancy is an important indicator in the prediction of morbidity and mortality in infants and mothers[4]. The objective of the present study was to find out the gestational weight gain and the factors affecting it because gestational weight gain is a potentially modifiable risk factor for a number of adverse maternal and neonatal outcomes[12]. In the current study, most of pregnant women (72.3%) had excess gestational weight gain; this goes in line with McDowell M,2019[18] who stated that the most common outcome was GWG above recommendations (51.4%). Furthermore, Dolatian [19] stated that 50% of

women exceed their weight gain goals, with overweight and obese women having the highest prevalence of excessive weight gain.

An increasing number of women who have a pre-pregnancy BMI were either overweight or obese leading to excessive gestational weight gain[20]. This was in line with the current study as more than half of pregnant women (71%) had overweight or obese pre-pregnancy BMI. This also goes in line with VKMT, 2021[21] in Croatia who stated that pre-pregnancy BMI among pregnant women 5.3% were underweight, 65.5% had normal BMI, 20.4% were overweight and 8.8% were obese. It also agrees with Dolatian, 2020 [19] in Ilam province who stated that 39.6% of pregnant women were overweight and 57.7% were obese. This is due to the increase prevalence of obesity (Olson, 2022)[22]. Age factor had a statistically significant relationship with the increase in pre- pregnancy overweight / obese BMI. In the current study, more than half ( 66%) of pregnant women were between 20 and 29 years old and had a significant association with overweight and obese pre-pregnancy BMI. This agrees with Restall, 2014[20], Bogaerts, 2012[23], Koleilat, 2013[24] who showed that the younger age (< 30 years) was a risk factor for increasing pre-pregnancy BMI. Age had no statistically significant relationship with gestational weight gain; this goes in line with El-Gobashy, 2015[25]. However, another study had a different opinion; Bogaerts, 2012[23] stated that the younger age was a risk factor for excessive gestational weight gain m women during pregnancy. this may be because older women have lower anabolism than younger or because younger women are less disciplined regarding lifestyle choices(Rogozinska, 2019)[26].

The consistency of education level parity, occupation and pre-pregnancy BMI (overweight/ obesity ) and gestational weight gain were not statistically significant. However, most studies mentioned the relationship between parity and excessive gestational weight gain, primiparity was more likely to develop excessive gestational weight gain multipara who have fertility experience (Herring, 2012)[27]. There was no significant correlation between excessive gestational weight gain and education level in this study. The employment status of pregnant women was not associated with gestational weight gain ( Dolin CD, 2020)[28], (Rosal MC, 2016)[29]. However, Suliga, 2018 [30]. and Lai, 2019 [31] found that unemployed pregnant women were more likely to develop excessive gestational weight gain and that women who live at home for long time do not have enough daily activities during pregnancy.

## CONCLUSION

More than half of pregnant women between 20 and 29 years old (28%) had primary education and majority of them unemployed. Less than half of them were pregnant for the first time. More than half of pregnant women had pre-pregnancy BMI (overweight/obese) and most of them had an excessive gestational weight gain. In the current study, an increase in pre-pregnancy BMI was a major cause of weight gain during pregnancy. There was a positive correlation between age of pregnant women and pre-pregnancy BMI. High prevalence of excessive weight gain in all primary health care centers has been found.

## RECOMMENDATION

Prenatal care providers are recommended to evaluate maternal weight at each regularly scheduled prenatal visit, to monitor progress toward meeting weight gain goals, and to provide individualized counseling if significant deviations from women's goals occur. Therefore, it is recommended to activate gestational weight gain charts in the antenatal care files and weight management comprehensive intervention for pregnant women.

**REFERENCE**

1- Jones R. Practical nutrition. CCAPS Publishing ; 2018

2 – Thompson J. Nutrition an applied approach. New York, NY: Person ; 2018

3 - World Health Organization, Maternal Health WHO,: https://www.who.int/health-topics/maternal-health#tab=tab_1, 2023

4 –. Elsevier. Krause and Mahan's Food & the Nutrition Care Process [Internet]. [cited 2023 May 11]. Available from: https://www.elsevier.com/books/krause-and-mahans-food-and-the-nutrition-care-process/raymond/978-0-323-63655-1

5- Morisset AS;Dubois L;Colapinto CK;Luo ZC;Fraser WD; Prepregnancy body mass index as a significant predictor of total gestational weight gain and birth weight [Internet]. U.S. National Library of Medicine; [cited 2023 May 30]. Available from: https://pubmed.ncbi.nlm.nih.gov/28145732/

6- [Internet]. [cited 2023 May 29]. Available from: https://www.cengage.com/c/nutrition-through-the-life-cyle-7e-brown/9781337919333

7-. Power ML;Gaspar-Oishi M;Gibson K;Kelly EW;Lott ML;Mackeen AD;Overcash RT;Rhoades CP;Turrentine M;Yamamura Y;Schulkin J; A survey of women and their providers regarding gestational weight gain [Internet]. U.S. National Library of Medicine; [cited 2023 May 30]. Available from: https://pubmed.ncbi.nlm.nih.gov/31038383/

8-. Bider-Canfield Z;Martinez MP;Wang X;Yu W;Bautista MP;Brookey J;Page KA;Buchanan TA;Xiang AH; Maternal obesity, gestational diabetes, breastfeeding and childhood overweight at age 2 years [Internet]. U.S. National Library of Medicine; [cited 2023 May 30]. Available from: https://pubmed.ncbi.nlm.nih.gov/26956226/

9 - Zhou M, Peng X, Yi H, Tang S, You H. Determinants of excessive gestational weight gain: A systematic review and meta-analysis - archives of public health [Internet]. BioMed Central; 2022 [cited 2023 May 30]. Available from: https://archpublichealth.biomedcentral.com/articles/10.1186/s13690-022-00864-9

10 - CD; HNJJ. A nationally representative study of Maternal Obesity in England, UK: Trends in incidence and demographic inequalities in 619 323 births, 1989-2007 [Internet]. U.S. National Library of Medicine; [cited 2023 May 30]. Available from: https://pubmed.ncbi.nlm.nih.gov/20029373/

11 - LK; MHKV. Overweight and obesity in Australian mothers: Epidemic or endemic? [Internet]. U.S. National Library of Medicine; [cited 2023 May 30]. Available from: https://pubmed.ncbi.nlm.nih.gov/22339524/

12 -Who recommendations on Antenatal Care for a positive pregnancy experience [Internet]. World Health Organization. World Health Organization; [cited 2023Jan12]. Available from: https://www.who.int/publications-detail-redirect/9789241549912.

13 -Malnutrition [Internet]. World Health Organization. World Health Organization; [cited 2023Jan13]. Available from: https://www.who.int/news-room/questions-and-answers/item/malnutrition

14 - The global strategy for women's, Children's and Adolescents' Health (2016-2030) [Internet]. World Health Organization. World Health Organization; [cited 2023Jan13]. Available from: https://www.who.int/publications-detail-redirect/the-global-strategy-for-women-s-children-s-and-adolescents-health-(2016-2030)-early-childhood-development-report-by-the-director-general

15 - Rahman MM;Abe SK;Kanda M;Narita S;Rahman MS;Bilano V;Ota E;Gilmour S;Shibuya K; Maternal body mass index and risk of birth and maternal health outcomes in

low- and middle-income countries: A systematic review and meta-analysis [Internet]. U.S. National Library of Medicine; [cited 2023 May 28]. Available from: https://pubmed.ncbi.nlm.nih.gov/26094567/

16 – Appendix 8: Institute of Medicine Pregnancy Weight Gain Guidelines. Nutrition in the Childbearing Years. 2011;297–297. doi:10.1002/9781444344790.app8

17 -Weight gain during pregnancy [Internet]. ACOG. [cited 2022Jan13]. Available from:https://www.acog.org/en/Clinical/Clinical%20Guidance/Committee%20Opinion/Articles/2013/01/Weight%20Gain%20During%20Pregnancy

18- McDowell M, Cain MA, Brumley J. Excessive gestational weight gain. Journal of Midwifery & Women's Health. 2018; doi:10.1111/jmwh.12927

19 - Dolatian,M.etal.(2020), weight gain during pregnancy and it is associated factors: A path analysis ; Nursing Open, 7(5), pp. 1568 – 1577. Available at: https: // doi. Org/ 10.1002/ nop 2.5 39.

20 –Restall A, Taylor RS, Thompson JM,Flower D, Dekker ga,Kenny LC,et al. Risk factors for excessive gestational weight gain in a healthy, nulliparous cohort. J Obes.2012;2014:18391.

21- R; VKMT. Prevalence and impact of pre-pregnancy body mass index on pregnancy outcome: A cross-sectional study in Croatia [Internet]. U.S. National Library of Medicine; [cited 2023 May1.

22- Olson CM, Strawderman MS, Graham ML. Association between consistent weight gain tracking and gestational weight gain: Secondary analysis of a randomized trial. Obesity. 2017;25(7):1217–27.

23 - Bogaerts A, Van den Bergh B, Nuyts E, Martens E, Witters I, Devlieger R. Socio-demographic and obstetrical correlates of pre-pregnancy body mass index and gestational weight gain. Clinical Obesity. 2012;2(5–6):150–9. doi:10.1111/cob.12004

24 - 1. Koleilat M, Kim LP, Whaley SE. Focusing on excessive gestational weight gain through weight tracking among participants of the Special Supplemental Nutrition Program for Women, infants, and children (WIC) in Southern California. Californian Journal of Health Promotion. 2017;15(3):15–24. doi:10.32398/cjhp.v15i3.1905

25 - El-Gobashy R, Eshra D, Aly I. Relationship between sociodemographics, dietary intake, activities of daily living and gestational weight among pregnant women in a rural areal. Menoufia Nursing Journal. 2016;1(2):115–21. doi:10.21608/menj.2016.120403

26- Rogozińska E, Zamora J, Marlin N, Betrán AP, Astrup A, Bogaerts A, et al. Gestational weight gain outside the Institute of Medicine Recommendations and Adverse Pregnancy Outcomes: Analysis using individual participant data from Randomised Trials. BMC Pregnancy and Childbirth. 2019;19(1). doi:10.1186/s12884-019-2472-7

27- Herring SJ, Nelson DB, Davey A, Klotz AA, Dibble LV, Oken E, et al. Determinants of excessive gestational weight gain in urban, low-income women. Women's Health Issues. 2012;22(5). doi:10.1016/j.whi.2012.05.004

28 - Dolin CD, Gross RS, Deierlein AL, Berube LT, Katzow M, Yaghoubian Y, et al. Predictors of gestational weight gain in a low-income Hispanic population: Sociodemographic characteristics, health behaviors, and psychosocial stressors. International Journal of Environmental Research and Public Health. 2020;17(1):352. doi:10.3390/ijerph17010352

29 – Rosal MC, Wang ML, Moore Simas TA, Bodenlos JS, Crawford SL, Leung K, et al.

Predictors of gestational weight gain among white and latina women and associations with birth weight. Journal of Pregnancy. 2016;2016:1–11. doi:10.1155/2016/8984928

30 –. Suliga E, Rokita W, Adamczyk-Gruszka O, Pazera G, Cieśla E, Głuszek S. Factors associated with gestational weight gain: A cross-sectional survey. BMC Pregnancy and Childbirth. 2018;18(1). doi:10.1186/s12884-018-2112-7

31 - 1. Lai JS, Soh SE, Loy SL, Colega M, Kramer MS, Chan JK, et al. Macronutrient composition and food groups associated with gestational weight gain: The gusto study. European Journal of Nutrition. 2018;58(3):1081–94. doi:10.1007/s00394-018-1623-3.