Factors associated with patterns of weight gain among pregnant women in northern west bank area of Nablus†

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ABSTRACT

Factors related to weight gain during pregnancy among Palestinian women in the North of West Bank were not studied before. The aim of this study was to evaluate various factors in relation to inadequate weight gain and excessive weight gain relative to normal weight among a group of pregnant Palestinian women. The study involved 387 pregnant women who were recruited from Palestinian Ministry of Health outpatient clinics during 2017-2018. Data were collected using a self-administered questionnaire that included questions about demographic data, obstetric history, physical activity performance and knowledge about weight gain during pregnancy. Data regarding anthropometric height and weight to calculate the body mass index (BMI) and weight gain each trimester were collected from the women files. Data was analyzed by SPSS. 34.7% of the study participants gained inadequate weight and only 20.3% gained excessive weight. Being overweight and obese was associated with 9 times and 3 times higher odds of being protected from having inadequate weight gain. Younger age group (17-32 y) were more likely to gain inadequate weight relative to women 41 y. Being from village and having only one baby and pregnancy were associated with gaining excessive weight. Eating more carbohydrates and proteins increased weight gain. Having higher BMI, older age and more intake of carbohydrates and proteins protect from inadequate weight gain.

Keywords: Weight gain, pregnancy, diet, Palestine.

INTRODUCTION

Adherence to healthy weight gain guidelines during pregnancy sets the standards for achieving healthy pregnancy outcomes and preventing future inappropriate weight gain [1]. Only 33-40% of pregnant women in United States of America (USA) gained weight in accordance with institute of medicine (IOM) recommendation [2]. However, in Palestine, the pattern of weight gain during pregnancy is not clearly described. According to IOM guidelines in the year 2009, women with normal body mass index (BMI) are recommended to gain 12.5-18 Kg, women who are overweight are recommended to gain 11.5-16 Kg and obese women are recommended to gain only 5-9 Kg. The IOM recommendations were modified in the year 2009 to reduce maternal morbidity and mortality that can result from excessive weight gain, whereas older recommendations in 1990 aim was to reduce small birth weight among born infants [3].

Excessive weight gain during pregnancy is becoming more common and is associated with higher pregnancy complications, macrosomia in born infants and cesarean section in delivering mothers [4] . Excessive weigh gain increases the risk of breast cancer and obesity in the in mothers after delivery [5, 6]. In a study among Palestinian women from Gaza, 57% of women were overweight or obese. On the other hand, inadequate gain especially in third trimester of pregnancy is associated with low birth weight, preterm birth and intrauterine growth restriction, whereas other studies suggest that weight gain during second trimester also affect infant outcomes [7]. Hence it is important to understand weight gain patterns to try to establish nutritional programs that encourage appropriate gain [8].

Many factors are linked to excessive weight gain during pregnancy mainly; BMI, physical activity, smoking status and diet [9]. Women who are obese or overweigh prior to pregnancy tend to be at higher risk of gaining extra-weight [10]. On the other hand, socio-economic status factors such as income and education may have varying effects on gestational weight gain based on ethnicity [10]. In one study among pregnant women, iron stores in mother increased weight gain, whereas birth order decreased weight gain. At the same time, women with lowest BMI tended to be at higher risk of inadequate weigh gain [11].

In a meta-analysis by international weight management in pregnancy collaborative group, healthy diet and physical activity were associated with reduced excessive weight gain. This relationship was consistent even after adjustment for factors such as maternal BMI, parity and health conditions [12]. Palestinian cuisine is an example of Mediterranean diet that is characterized by high intake of fibers and carbohydrate and low intake of red meat [13]. However, westernization of dietary habits is now taking on in many developing countries including Palestine [14]. One of the main manifestations of nutrition transition is consumption of fast food [15]. Although consumption of fast food is more common in some racial groups than white population in study in US [16]. This dietary patterns are not well studied among Palestinian pregnant women.

Anemia during pregnancy is common among Palestinian pregnant women [17] and may be exacerbated by rapid weight gain during pregnancy [18]. It is well known that anemia is likely to affect pregnancy outcomes especially on infants [19]. Anemia in context of weight gain was not studied before among Palestinian women in Nablus, hence the aims of the study were: 1) to study the pattern of weight gain among a group of Palestinian women in Nablus city in the Northern West Bank. 2) to study the factors associated with excessive weight gain and inadequate weight gain 3) to study the relationship between weight gain and diet.

METHODS

Study Sample

Utilizing a quantitative cross sectional study design, 387 pregnant women were randomly selected using stratified proportional sampling method from the total population who were registered for antenatal care at major Ministry of Health (MOH) four clinics (Balata, Al Markazi, Al Makhafia and Raas Alaein clinics) for the year 2017 as per Table 1.

Table (1): distribution of population number and sample size according to clinics

Clinic	Balata	AlMarkazia	AlMakhafia	RaasAlaein	Total
Population	204	403	100	189	896
Sample size	89	174	43	81	387

Data Collection

The data were collected using a self-administered questionnaire that included questions about demographic data, dietary data, obstetric history, physical activity performance, knowledge about weight gain during pregnancy. Data regarding anthropometric height and weight to calculate the BMI and weight gain each trimester were collected from the women' files using data collection form. Both questionnaire and data collection form were developed by study authors based on previous literature with details published elsewhere [20] .

To ensure the validity and reliability of the tool, it was reviewed by experts, and piloting on about 5% of the sample size (n=19) was conducted and Cronbach alpha was computed with a result of (0.90, 95% CI (0.82-0.95)

The study was approved by the Institutional review board (IRB) committee from An-Najah National University and by MOH that permitted access to antenatal clinics and hospitals. In addition, a signed written consent form was used to ensure the conformity of pregnant women participating in the study.

Field work

The data was collected over a period of 10 months from the end of September 2017 to the end of July 2018 during the workdays of MOH from Sunday to Thursday. Five visits were made to each clinic, where in the first one the purpose of the study was explained to pregnant women who met the inclusion criteria. In addition, the height and weight were measured and the questionnaire was filled. The second, third and fourth visits were held at the end of each trimester to measure the weight using the file registration number to avoid doubling of any women.

The last visit was conducted to hospitals where women registered to have the delivery, to collect the maternal and fetal outcomes from files and registration book to identify the potential related complications.

Statistical method s and data analysis

The Statistical Package for Social Science (SPSS) was used to analyze the data. Gestational Weight Gain (GWG) was calculated and classified according to the IOM recommendations as Inadequate GWG, Adequate GWG, and Excessive GWG. BMI was calculated and classified according to WHO recommendations as per Table 2

Table (2): IOM recommendation for weight gain during pregnancy.

Category	BMI	Weekly gain Gram per week (range)	Total weight gain Range
Under weight	<18.5	453 g (453 -589)	28-40 Ibs (12.5 -18kg)
Ideal weight	18.5- 24.9	453g (362 -453)	25 -30Ibs (11.5-16 kg)
Over weight	25-29.9	276 g (226 -317)	15-25 Ibs (7-11.5 kg)
Obese	>30	226 g (181 -272)	11-20 Ibs (5-9 kg)

BMI; body mass index. Ibs; pound. Kg; kilogram

The relationship between various study factors including dietary factors and weight gain patterns were analyzed using logistic regression models, with binary outcomes being inadequate weight gain versus normal weight gain as outcome 1 and normal weight gain versus excessive weight gain as outcome 2. For outcome 1 we had n=301 participants included in analysis with data for all variables, when we included dietary factors data was available for only n=300 participants. For outcome 2 we had data available for n=213 participants when we included dietary factors data were available for only n=211 participants.

RESULTS

This study included 380 women from villages, refugee camps and city of Nablus. Table 3 provides description of study variables. More than 77% of our study participants were younger than 32 y and only 5% were 41y and more. Women from refugee camps were underrepresented in this study. Only 28% of the study participants had only one pregnancy and the rest had more than 1, with 24% having more than 4. Concerning weight gain. More participants gained adequate and inadequate weight than excessive. At the same time, almost 45% of the study participants had BMI more than 25 Kg/m^2.

Table (3): A sumary of study participants charachteristics, (n=380).

Variable	Category	No	%
Age	(17-25 y)	83	21.8
	(26-32 y)	209	55.0
	(33-41 y)	72	18.9
	(≥ 41 y)	16	4.2
Place of residence	Camp	16	4.2
	Village	120	45.6
	City	244	50.2

Variable	Category	No	%
Gravidity number	First	109	28.7
	2	76	20.0
	3	54	14.2
	4	50.0	13.2
	More than four	91	23.9
Body mass index	(>18.5	12	3.2
	(18.5-24.9)	198	52.1
	(25-29.9)	100	26.6
	More than 30	70	18.4
Weight gain	Inadequate	166	34.7
	Adequate	137	36.1
	Excessive	77	20.3
Smoking	Smoking	145	38.2
	Not smoking	235	61.8

Y; year

Table 4 describes various associations between study variables and normal versus inadequate weight gain using logistic regression models. Being overweight and obese was associated with 9 times and 3 times higher odds of being protected from having inadequate weight gain. Younger age group (17-32 y) were more likely to gain inadequate weight relative to women 41 y or more.

Table (4): Multiple logistic regression association between various study factors odds of having normal to inadequate weight gain.

Variables	B± S.E.	p-value	95% CI
Age Categories			
> 41 y (Reference group)		0.178	
17-25 y	-1.70±0.86	0.049	0.18 (0.03,0.99)
26-32 y	-1.77±.83	0.033	0.17 (0.03, 0.87)
33-41 y	-1.32±.83	0.110	0.27 (0.05, 1.35)
BMI Categories			
18-25 Kg/m2 **(Reference group)**		0.000	
< 18 Kg/m2	1.18±.079	0.134	3.26 (0.69, 15.30)
25-30 Kg/m2	2.16±0.36	0.000	8.68 (4.26, 17.66)
> 30 Kg/m2	1.21±.36	0.001	3.36 (1.61, 1.70)
Place of Residence			
City **(Reference group)**		0.293	
Village	0.39±0.34	0.250	1.47 (0.76, 2.83)
Camp	-0.36±.44	0.418	0.70 (0.30, 1.66)
Education			
Bachelors **(Reference group)**		0.582	
Less than Tawjihi	-0.04±0.47	0.934	0.96 (0.39, 2.40)
Tawjihi	-0.18±0.43	0.681	0.84 (0.36, 1.94)
Bachelors	0.38±0.39	0.325	1.47 (0.68, 3.15)
More than Bachelors	0.99±1.06	0.349	2.71 (0.34, 21.72)

Variables	B± S.E.	p-value	95% CI
Occupation (No work versus work)	0.41±0.38	0.285	1.50 (0.71, 3.16)
Income			
3000 NIS-4000 NIS **(Reference group)**		0.574	
Less than 1000 NIS	-1.36±1.30	0.293	0.26 (0.02, 3.25)
More than 4000 NIS	-0.01±0.31	0.984	0.99 (0.54, 1.83)
Gravida (first versus more than one)	.020±0.56	0.971	1.02 (0.34, 3.04)
Parity			
No one **(Reference group)**		0.468	
1-3	0.38±0.62	0.537	1.47(0.43, 4.96)
4-6	0.55±0.44	0.219	1.73 (0.72, 4.12)
Anemia (No versus yes)	-0.50±0.29	0.087	0.610 (0.35, 1.07)
Smoking (yes versus no)	0.18±0.29	0.524	1.20 (0.69, 2.10)
Constant	0.30±0.90	0.740	1.344

BMI; body mass index. Kg; kilogram. M; meter. y; year.

Table 5 describes various association between study variables and excessive versus normal weight gain during pregnancy. Being from village and having only one baby and pregnancy were associated with gaining excessive weight. Other factors including pre-pregnancy BMI, education level, occupation and income were not related to weight gain during pregnancy.

Table (5): Multiple logistic regression association between various study factors odds of having excessive to normal weight gain.

Variables	B± S.E.	P-value	OR (95% CI)
Age Categories			
> 41 y (Reference group)		0.09	
17-25 y	0.55±0.77	0.47	1.74 (0.38, 7.85)
26-32 y	0.08±0.71	0.91	1.09 (0.27, 4.39)
33-41 y	-0.99±0.74	0.18	0.37 (0.09, 1.58)
BMI Categories			
18-25 Kg/m2 **(Reference group)**		0.78	
<18Kg/m2	0.11±0.88	0.90	1.11 (0.20, 6.20)
25-30Kg/m2	0.39±0.39	0.31	1.48 (0.70, 3.14)
>30Kg/m2	0.11±0.47	0.82	1.11 (0.45, 2.79)
Place of Residence			
City **(Reference group)**		0.07	
Village	0.70± 0.36	0.05	2.01 (0.99, 4.07)
Camp	-0.58±0.66	0.38	0.56 (0.15, 2.06)
Education			
Bachelors **(Reference group)**		0.88	
less than Tawjihi	0.50±0.56	0.37	1.65 (0.55, 4.96)
Tawjihi	0.04±0.49	0.94	1.04 (0.40, 2.69)
Diploma	-0.06±0.47	0.90	0.94 (0.38, 2.35)
More than bachelors	$-20.56\pm2.84 \times 10^4$	0.99	.00
Occupation (No work versus work)	0.21±0.43	.631	1.23 (0.53, 2.89)
Income			

Variables	B± S.E.	P-value	OR (95% CI)
3000-4000 shikel **(Reference group)**		0.83	
Less than 1000 shikel	$-21.198 \pm 4.02 \times 10^4$	1.00	
More than 4000 Shikel	-0.22 ± 0.35	0.54	.81 (0.41, 4.61)
Gravid (First versus more than one)	2.35 ± 1.16	0.04	10.50(1.09, 101.46)
Para			
No one **(Reference group)**		0.04	
1-3	-2.97 ± 1.24	0.02	0.05 (0.00, 0.59)
4-6	-0.84 ± 0.53	0.11	0.43 (0.16, 1.21)
Anemia(No versus yes)	-0.01 ± 0.34	0.98	0.99 (0.35, 1.07)
Smoking(yes versus no)	-0.18 ± 0.33	0.59	0.84 (0.44, 1.60)
Constant	$-0.13 \pm .92$	0.89	0.88

BMI; body mass index. Kg; kilogram. M; meter. y; year.

Table 6 and 7 describe weight gain in association with dietary intake. Eating meat and carbohydrate more often were associated with protection from inadequate weight gain and increase in excessive weight gain relative to normal weight gain. Eating vegetables or fast food were not related to patterns of weight gain.

Table (6): Multiple logistic regression association between dietary factors odds of having inadequate to normal weight gain.

Variables	B± S.E.	P-value	OR	95% CI
Eating meat per week				
Never**(Reference group)**		0.07		
1-2 times	$1.77 \pm .81$	0.03	5.84	(1.19,28.73)
3-4 times	$0.73 \pm .84$	0.39	2.08	(0.40,10.86)
5-6 times	1.83 ± 1.08	0.09	6.22	(0.75,51.85)
daily	$1.58 \pm .88$	0.07	4.83	(0.87,26.85)
Eating carb and bread per week				
Never**(Reference group)**		0.19		
1-2 times	2.50 ± 1.07	0.02	12.20	(1.50,98.99)
3-4 times	2.39 ± 1.07	0.03	10.91	(1.34,88.78)
5-6 times	2.21 ± 1.22	0.07	9.11	(0.84,98.87)
daily	$1.91 \pm .97$	0.05	6.76	(1.0,45.49)
Eating Fast food				
Never**(Reference group)**		0.549		
1-2 times	0.58 ± 0.39	0.14	1.79	(0.83,3.86)
3-4 times	0.12 ± 0.57	0.83	1.13	(.37,3.44)
5-6 times	1.05 ± 1.25	0.40	2.86	(0.25,33.48)
daily	1.55 ± 1.95	0.43	4.72	(0.10,215.33

Model was adjusted for age, BMI, place of residence, occupation, income, parity, gravida, anemia, education level and smoking

Table (7): Multiple logistic regression association between various dietary factors odds of having excessive to normal weight gain.

Variable	B± S.E.	p-value	OR	95% CI
Eating vegetables per week				
Never eat (**Reference group**)		.499		
1-2 times	-0.49±1.05	.638	.611	(0.08,4.76)
3-4 times	-1.06±1.02	.296	.346	(0.05,2.54)
5-6 times	-1.34± 1.11	.232	.263	(0.03,2.35)
daily	-1.15±0.99	.242	.316	(0.05,2.18)
Eating meat per week				
Never eat (**Reference group**)		.030		
1-2 times	0.39±0.44	.380	1.480	(0.62,3.55)
3-4 times	1.03±0.47	.030	2.803	(1.11,7.10)
5-6 times	1.14±0.81	.158	3.121	(0.64,,15.14)
daily	1.54±0.55	.005	4.668	(1.58,13.84)
Eating carbohydrate and bread				
never(**Reference group**)		.033		
1-2 times	-1.01±0.81	0.21	0.37	(0.07,1.79)
3-4 times	-1.42±0.82	0.08	0.24	(0.05,1.20)
5-6 times	-0.33±0.97	0.74	0.72	(0.11,4.80)
daily	-0.16±0.74	0 .86	0.85	(0.20,3.61)
Eating fast food per week				
Never eat (**Reference group**)		.684		
1-2 times	-0.32±0.33	.326	.725	(0.38,1.38)
3-4 times	0.39±0.48	.425	1.469	(0.57,3.78)
5-6 times	0.02±1.01	.984	1.020	(0.14,7.39)
daily	0.14±1.25	0.91	1.16	(0.10,13.49)

Model was adjusted for age, BMI, place of residence, occupation, income, parity, gravida, anemia, education level and smoking

DISCUSSION

In this study, we aimed to describe the weight gain patterns among Palestinian women from Northern West Bank and factors associated with this pattern. In this study, 34.7% women gained inadequate weight and 20.3% gained excessive weight. Women from 17-32y age category, obese and over-weight women seemed to be protected from inadequate weigh gain, whereas anemia was common among women with inadequate weight gain. On the other hand, being from village and having one baby increased the risk of achieving excessive weight gain. However, other factors including education, occupation, gravida and smoking were not related to weight gain. Dietary habits that involved intake of meat and carbohydrate seemed to be linked to increase in weight gain during pregnancy. Education and income were not related significantly to study outcomes probably because of lack of variation or adequate numbers to identify statistical relationships.

The rate of excessive weight gain was lower than what was seen in previous study (53%) from Europe, whereas inadequate weigh gain was higher than the percentage in the same study (14%) [21]. Also, the rate of weight gain in study was lower than what was reported in a study from the USA and Canada (42.6%) [22]. The low prevalence of excessive weight gain could be related to the fact that almost half of our study participants had normal BMI, although BMI itself was not related to excessive weight gain in our

study. Also, in our study more than 50% of our group completed high school or more education which may have been an important factor that is linked to better attitudes towards food intake.

High pre-pregnancy BMI was related to excessive weight gain and consequent delivery of infant with weight more than 4000 g (macrosemia) [22] Consequently achieving healthy weight prior to pregnancy should be recommended to women of childbearing age. In our study, having higher BMI was not linked to excessive weight gain, this could be related to high nutritional awareness in our study group as almost 47% of our study group believed that healthy nutrition does not necessarily indicate increasing the amount of food consumed. The findings in this study seems to contradict a study among pregnant Australian women, where higher BMI was associated with excessive gestational weight gain despite high nutrition awareness [23], whereas a study among Egyptian women showed that nutrition counseling protected pregnant women from excessive weight gain which could be applicable to this study [24].

Parity indicates number of pregnancies reaching viable gestational age including live birth and still birth [25], whereas gavidity means the number of times a female has been pregnant regardless of the outcomes [26]. First pregnancy seems to be linked to less possible weight gain. In other studies firstborn children are always lighter, but this might not protect these children from having bigger fat mass as adolescence and children [27]. Nonetheless, another study indicated that pregnant women with multiple pregnancies might benefit from programs that aim at reducing excessive weight gain [28].

Older age group in our study seems to be protected from inadequate weight gain relative to women younger than 41 y. Older women may be already with higher BMI, gravida and parity all of these factors were linked previously to inadequate food intake but we could not assess total food intake in this study [29, 30]. Infants born to mothers with inadequate gestational weight gain had 2.23 times risk of death relative to women with normal weight gain [31].

Anemia during pregnancy is very common among Palestinian women [17]. Anemia during pregnancy is related to having anemia in infant, delivering low birth infant and having anemia in the child during the first year. Similar to another study excessive weight gain did not seem to protect from anemia, but anemia in our study was linked to inadequate weight gain [32]. Contrary to our study, women from North Carolina with higher BMI were at increased risk of anemia [33].

Our study has shown that higher intake of meat and carbohydrates was associated with protection from inadequate weigh gain, but may lead to excessive weight gain. Other dietary patterns were not related to weight gain. In a clinical trial among white obese women nutritional education to improve dietary habits were not related to patterns of weight gain [34]. In another study in USA, healthy eating that considered adherence to appropriate calorie intake was associated with achieving optimal weight gain [35]. The diet questionnaire in this study did not allow capturing the quality of diet besides high consumption of fast food which we were unable to adjust for total calorie intake that was not available for this study.

This study was not without limitation including its cross sectional design and inclusion of only pregnant women from Nablus in northern West Bank with low representation of women from refugee camps. We did not have data on total calories intake and macronutrients composition of women diet. Moreover, we used categorical variables often. At the same time, we for the first time studied weight gain pattern among Palestinian women from Northern West Bank, in addition to studying many factors that could be related to weigh gain patterns. We performed two separate analyses for excessive weight gain and inadequate weight gain among studied women and we adjusted for many variables in our analysis.

In conclusion, in this study of women from Nablus we show a modest prevalence of excessive weight gain during pregnancy and higher prevalence of inadequate weight gain. Having high BMI was protective from gaining inadequate weight and did not predict excessive weight gain. At the same time hav-

ing one pregnancy was related to excessive weight gain. Diet protected from inadequate weight gain, but high intake of meat and carbohydrate seems to be linked to excessive weight gain. Consequently, nutritional education programs are encouraged in this group of women from Nablus.

CONFLICT OF INTEREST

Authors declare that they have no conflict of interests.

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REFERENCES

1) Council NR. Weight gain during pregnancy: reexamining the guidelines: NAP; 2010.

2) Olson CM. Achieving a healthy weight gain during pregnancy. Annu Rev Nutr. 2008;28:411-423.

3) Simas TAM, Curiale DKD, Hardy J, Jackson S, Zhang Y, Liao X. Efforts needed to provide Institute of Medicine–recommended guidelines for gestational weight gain. Obstet Gynecol. 2010;115(4):777-783.

4) Abrams B, Altman SL, Pickett KE. Pregnancy weight gain: still controversial. Am J Clin Nutr. 2000;71(5):1233S-1241S.

5) Kinnunen T, Luoto R, Gissler M, Hemminki E. Pregnancy weight gain from 1960s to 2000 in Finland. Int J Obes. 2003;27(12):1572-1577.

6) Siega-Riz AM, Evenson KR, Dole N. Pregnancy-related weight gain—a link to obesity? Nutr Rev. 2004;62(suppl_2):S105-S111.

7) Hasan ST, Khan MA, Ahmed T. Inadequate maternal weight gain in the third trimester increases the risk of intrauterine growth restriction in rural Bangladesh. Plos One. 2019;14(2).

8) El Kishawi RR, Soo KL, Abed YA, Muda WAMW. Obesity and overweight: prevalence and associated socio demographic factors among mothers in three different areas in the Gaza Strip-Palestine: a cross-sectional study. BMC Obesity. 2014;1(1):7.

9) Samura T, Steer J, Michelis LD, Carroll L, Holland E, Perkins R. Factors associated with excessive gestational weight gain: review of current literature. Glob Adv Health Med. 2016;5(1):87-93.

10) Suliga E, Rokita W, Adamczyk-Gruszka O, Pazera G, Ciesla E, Gluszek S. Factors associated with gestational weight gain: a cross-sectional survey. BMC Pregnancy Childbirth. 2018;18(1):465.

11) Kheirouri S, Alizadeh M. The contribution of prenatal maternal factors to maternal gestational weight gain. Health Care Women Int. 2017;38(6):544-555.

12) Ewelina Rogozińska NM, Ana Pilar Betrán et al. Effect of diet and physical activity based interventions in pregnancy on gestational weight gain and pregnancy outcomes: meta-analysis of individual participant data from randomised trials. BMJ. 2017;358.

13) Husseini A, Abu-Rmeileh NM, Mikki N, Ramahi TM, Ghosh HA, Barghuthi N, et al. Cardiovascular diseases, diabetes mellitus, and cancer in the occupied Palestinian territory. Lancet. 2009;373(9668):1041-1049.

14) Ghattas H, El Asmar K, Assi MJ, Obermeyer CM. Prevalence and predictors of double burden of malnutrition in Palestinian children younger than 5 years: analysis of data from the Multiple Indicator Cluster Surveys round four. Lancet. 2017;390:S7.

15) Sajjad K, Qureshi MSH. Fast food, nutrition transition and obesity in Pakistan: policy and programs to address this issue. J Dow Univ Health Sci. 2018;12(2):71-73.

16) Harris A, Chilukuri N, West M, Levine D, Henderson J. Obesity-related Dietary Behaviours among Racially and Ethnically Diverse Pregnant and Postpartum Women. J Preg Child Health. 2016;3(238):2.

17) Srour MA, Aqel SS, Srour KM, Younis KR, Samarah F. Prevalence of Anemia and Iron deficiency among Palestinian

pregnant Women and its association with pregnancy outcome. Anemia. 2018;2018.

18) Tan J, Qi Y-N, He G-L, Yang H-M, Zhang G-T, Zou K, et al. Association between maternal weight indicators and iron deficiency anemia during pregnancy: a cohort study. Chin Med J. 2018;131(21):2566.

19) Patel A, Prakash AA, Das PK, Gupta S, Pusdekar YV, Hibberd PL. Maternal anemia and underweight as determinants of pregnancy outcomes: cohort study in eastern rural Maharashtra, India. BMJ Open. 2018; 8(8): e021623.

20) Abo-Alrob AO. Weight gain pattern among pregnant women, associated factors, maternal and fetal outcomes in Nablus district: An-Najah National University; 2019.

21) Brawarsky P, Stotland N, Jackson R, Fuentes-Afflick E, Escobar G, Rubashkin N, et al. Pre-pregnancy and pregnancy-related factors and the risk of excessive or inadequate gestational weight gain. Int J Gynecol Obstet. 2005; 91(2): 125-131.

22) Kabali C, Werler MM. Pre-pregnant body mass index, weight gain and the risk of delivering large babies among non-diabetic mothers. Int J Gynecol Obstet. 2007; 97(2): 100-104.

23) Bookari K, Yeatman H, Williamson M. Australian Pregnant Women's Awareness of Gestational Weight Gain and Dietary Guidelines: Opportunity for Action. J Pregnancy. 2016; 2016: 8162645.

24) Abdel-Aziz S, Hegazy I, Mohamed D, Kasem MAE, Hagag S. Effect of dietary counseling on preventing excessive weight gain during pregnancy. Public Health. 2018; 154:172-181.

25) Opara E, Zaidi J. The interpretation and clinical application of the word 'parity': a survey. Int J Gynecol Obstet. 2007; 114(10): 1295-1297.

26) Santow G, Bracher M. Do gravidity and age affect pregnancy outcome? Soc Biol. 1989; 36(1-2): 9-22.

27) Reynolds RM, Osmond C, Phillips DI, Godfrey KM. Maternal BMI, parity, and pregnancy weight gain: influences on offspring adiposity in young adulthood. J Clin Endocrinol Metab. 2010;95(12):5365-5369.

28) Olson G, Blackwell SC. Optimization of gestational weight gain in the obese gravida: a review. Obstet Gynecol Clin North Am. 2011;38(2):397-407, xii.

29) Wells CS, Schwalberg R, Noonan G, Gabor V. Factors influencing inadequate and excessive weight gain in pregnancy: Colorado, 2000-2002. Matern Child Health J. 2006;10(1):55-62.

30) Kowal C, Kuk J, Tamim H. Characteristics of weight gain in pregnancy among Canadian women. Matern Child Health J. 2012;16(3):668-676.

31) Davis RR, Hofferth SL. The association between inadequate gestational weight gain and infant mortality among U.S. infants born in 2002. Matern Child Health J. 2012;16(1):119-124.

32) de Sá SA, Willner E, Pereira TAD, de Souza VR, Boaventura GT, de Azeredo VB. Anemia in pregnancy: impact on weight and in the development of anemia in newborn. Nutr Hosp. 2015;32(5):2071-2079.

33) Bodnar LM, Siega-Riz AM, Cogswell ME. High prepregnancy BMI increases the risk of postpartum anemia. Obes Res. 2004;12(6):941-948.

34) Guelinckx I, Devlieger R, Mullie P, Vansant G. Effect of lifestyle intervention on dietary habits, physical activity, and gestational weight gain in obese pregnant women: a randomized controlled trial. Am J Clin Nutr. 2010; 91(2): 373-380.

35) Chuang CH, Stengel MR, Hwang SW, Velott D, Kjerulff KH, Kraschnewski JL. Behaviours of overweight and obese women during pregnancy who achieve and exceed recommended gestational weight gain. Obes Res Clin Pract. 2014; 8(6): e577-e583.