Maternal and fetal outcomes of pregnant females after a nutritional health education program. An interventional study

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Summary. *Background:* Nutrition during pregnancy is an important element for the pregnant women and their fetus, they must take enough calories and nutrients to provide the essential requirements for both themselves and their fetus and to prevent complications of abnormal weight gain in pregnancy. *Objectives:* To determine the effect of the nutritional health education on changing knowledge, attitude and practice towards healthy pregnancy, obtaining optimal weight and its effect on obstetric outcome. *Subjects and Methods;* An interventional study (pre-posttest) was conducted in Zagazig university antenatal care clinic and included 135 pregnant female. *Methods:* Data collection was done through a semi-structured questionnaire about females' socio-demographic characteristics, obstetric, family and clinical history. Health education sessions were applied on the pregnant females and their knowledge, attitude and practice about healthy nutrition were assessed before and after the intervention. Ultrasound was performed, obstetric outcomes were detected. *Results:* This study was conducted on 135 pregnant female. After the nutritional education program, the proportion of adequate knowledge, attitude and practice was increased from (28.2% to 77.3%-8.2% to 75.5% and 32.7% to 77.3%) respectively (p-value <0.001). There was statistically significant higher cesarean section, intra and post-partum complications (85.7% vs 42.9%p<0.001), (71.4% vs17.2% p<0.001) and (25.7%vs7.1% p=0.008) (Odds (C.I 95%); 8(2.7-23.1), 12.1(4.6-31.6) and 4.5(1.4-14.7)), higher neonatal weight and blood glucose (p<0.001& 0.009) in over-weight versus optimal weight gain groups respectively. *Conclusion:* The intervention was effective on improving pregnant females' knowledge, attitude and practice towards healthy nutrition during pregnancy, getting optimal weight gain and consequently maternal and fetal outcome.

Key words: Gestational weight gain, nutritional education, obstetric outcome.

Introduction

The nutrition in pregnancy has a great influence on subsequent maternal and offspring health, inadequate intake increase the risk of preterm delivery and low birth weight (1) while excess intake is associated with having larger babies and postpartum weight retention (2). Moreover, adequate nutrition during pregnancy is important for the development of the placenta, for a healthy delivery and for future lactation (3). The recommended weight gain for obese women during pregnancy is up to 6.8 kilograms; for overweight women, gain would be from 6.8 to 11.2 kilos and for non-obese women, between 11.2 to 15.9 kilos (3). Maternal obe-

sity during pregnancy is a wide spread problem and related to several comorbidities for both mother and child (4). Excessive gestational weight gain (GWG) using the Institute of Medicine, Washington, criteria increases maternal risks for preeclampsia, gestational diabetes, Caesarean section and weight retention postpartum with associated long-term health consequences (1) and fourfold increased risk of large-for-gestational-age (LGA) infants (2). Although the great role of nutritional health education intervention on improving maternal and fetal outcomes through improving knowledge, attitude and practice, there little reports on this issues were done before.

So the objectives of this study were to improve maternal and neonatal outcomes through raising knowledge attitude and practice of pregnant females towards healthy lifestyle and obtaining optimal weight gain using nutritional health education program.

Materials and methods:

Study design and settings: an interventional study (pre-posttest) was conducted in the Antenatal Care Clinic of Obstetrics and Gynecology Department at Zagazig University Hospitals in the period from May 2017 to June 2019.

Target group: pregnant females in the first trimester attended the Antenatal Care Clinic at Zagazig University Hospitals, aged 18-35 years, Nonsmokers, take no medication and didn't have any chronic medical disorder with Body mass index (BMI) between 18.5 and 24.9 kg/m².

Sample size: Calculated through Open-EPI (version 3.01), according to the following collected data: Assuming that the knowledge of pregnant female about healthy nutrition during pregnancy was changed from 9% before intervention to 31% after intervention, the power of precision was 80%, and the confidence interval was 95%, so the sample size was 112 pregnant women. Twenty percent (23 women) were added to overcome the drop-out rate so the total number was 135 pregnant female.

Sample technique: systematic random selection of the sample population from all pregnant women was carried out. Total number of registered women was

570 and the needed sample size was 135 so we took every 4th women (K-interval) beginning by the 5th one chosen by lottery. Nearly sample collection persisted for seven months.

Data collection: All study participants took part in individual face-to-face interviews and completed the questionnaires to collect socio-demographic data about age, marital status, level of education, income, residence, sources of health information and service delivery (5). Family history of obesity and clinical data were detected. Females' knowledge about healthy food, supplements, iron, calcium, effect of anemia and obesity on pregnancy, their attitude and practice about healthy nutrition were detected before and after the intervention using (pretest) and (posttest) through face to face interview, the differences in body weight, fasting blood glucose, blood pressure, urine analysis were assessed before and after intervention.

After intervention, Ultrasonography was done at time of birth to detect any cause of cesarean section. Mode of delivery, intrapartum complications (prolonged, obstructed and precipitate labor, shoulder dystocia, labor and anesthetic complications) were assessed, neonatal weight and blood glucose were measured and follow up for 24 hours postpartum to detect atonic complications in the form of postpartum haemorrhage and traumatic complications in the form of traumatic injury to the genital tract.

Field work;
A) *First session*, the nutritional education session persisted for 20 minutes for each women individually, after collection of data and filling questionnaires, using (Health education message) in a face to face interview using posters and booklet which covered;
   1. Knowledge about healthy foods, importance of calcium intake, importance of iron intake and the foods decrease absorption of iron, anemia during pregnancy, importance of folic acid intake, importance of supplementation intake, knowledge about ideal gestational weight gain during pregnancy and consequences of abnormal weight gain.
   2. Attitude: positive attitude about importance of getting enough calcium, iron, folic acid and supplementation during pregnancy.

3. Definition of obesity in pregnancy, its risk factors (modifiable and non-modifiable) and its complications.

B) *Follow up monthly visits along the pregnancy period* ranged in time from 15 to 20 minutes for each female one session per month at antenatal care unit done by the researcher using posters and booklet, the females were taught about the healthy balanced diet, habits and their weight gain was followed up.

C) *Activities during last visit before delivery:* Ultrasononography to assess the fetal conditions and to exclude any indication for cesarean section (malpresentation and fetal abnormalities), body weight, blood pressure, fasting blood glucose, urine analysis, convulsion and deciding mode of delivery were assessed.

D) *The pregnant women were followed till 24 hours* after delivery to detect any intra or post-partum complications (atonic complications in the form of postpartum Hge and traumatic complications in the form of traumatic injury to the genital tract), detect neonatal weight and blood glucose.

Data management: The collected data were entered, checked and statistically analyzed using SPSS program (Statistical Package for Social Science) version 22.0 (SPSS, Chicago, IL, USA). For the statistical calculations, data coding was done, and qualitative data were represented as frequencies and percentages, Chi-square test ($\chi 2$), Fischer exact test and McNemar test were carried out for testing the association between the qualitative data. Quantitative data were presented as mean, SD and median and compared using independent t-test, paired t-test and Wilcoxon signed rank test. Binary regression analysis was conducted to identify the predictors of maternal outcome. The test results were considered significant when p-value ≤ 0.05.

Scoring of socio-economic status:
- Socio-economic level was classified into low, moderate, high level depending on the score calculated (39).
  • score less than 50% (low) ≤19.5
  • score 50%- less than 75% (moderate)= 19.6-29.25
  • score 75% and more (high) ≥ 29.25
- This is the updated scale for assessing the socio-economic status (5)

Scoring of knowledge, attitude and practice:

Total knowledge score about healthy foods types was (23), Importance of calcium and vitamin D intake was (18), Importance of iron intake was (21), Anemia was (34), Folic acid was (16), Supplementations intake was (18) and knowledge about weight gain in pregnancy was (16). So the grand total score of all items of knowledge about healthy nutrition during pregnancy was (146), total attitude toward importance of healthy foods was (12), while total practice towards health habits was (8).

Adequacy level of Knowledge, attitude and practice:

Cut off point (70%) (6) Whereas: >70% was considered as satisfactory, while ≤ 70 % was considered as unsatisfactory knowledge attitude and practice levels.

Weight gain classification:

According to Institute of Medicine ((IOM), 2009) (7), Gestational weight gain in pre-pregnancy normal weight women (with BMI from (18.5 to 24.9) was classified as follow; women with gestational weight gain <11.2 kg (subnormal weight gain),women with gestational weight gain from 11.2 to 15.9 kg (optimal weight gain) and women with increased gestational weight gain >15.9 kg (overweight gain) (Fig. 1).

Results

Socio-demographic characteristics of the studied group;

The age of the studied group was 27.1±4.4 (ranged from 20-37 years old), about half of them (48.2%) were of low social class and (40.9%) had positive family history of obesity (mainly first degree relatives). After the
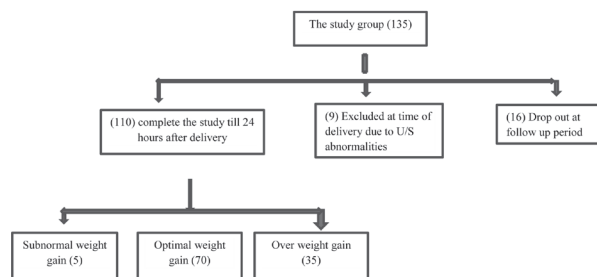
Figure 1. Flow chart of the studied group

intervention, most of the study group (63.6%) had optimal weight gain and (31.8%) had over weight gain, while only (4.5%) had subnormal weight gain.

Knowledge, attitude and practice improvement after the nutritional health education program;

There was statistically significant improvement in total knowledge, attitude and practice scores of pregnant females about healthy lifestyle during pregnancy from (53(33-125), 3(0.0-11) & 4(2-7)) before the health education sessions to (127(44-146), 11(1-12) & 6(3-8)) respectively after the intervention. With statistically significant higher adequacy levels of knowledge, attitude and practice after than before the intervention (77.3%, 75.5% and 77.3%), (28.2%, 8.2% and 32.7%) respectively (p-value <0.001) Table 1.

Characteristics of the subnormal weight gain group;

In regard to the five subnormal weight gain females, weight gain was (9±1.6) ranged from (7-11) kg, the adequate levels of knowledge, positive attitude and healthy practice were (60.0%, 20.0% and (0.00%) respectively. All of them (100.0%) had normal fasting blood glucose and blood pressure levels with no one (0.0%) had neither convulsion nor proteinuria. Twenty percent of them had cesarean sections and majority of them (80.0%) had intra-partum complications mainly

traumatic injury to the genital tract (60.0%) followed by precipitate labor (50.0%) then prolonged labor and shoulder dystocia (20.0%) with no post-partum complications between them.

Binary logistic regression for prediction of the role of knowledge, attitude and practice improvement on gestational weight gain;

For detection of the effective change in knowledge, attitude and practice as explanatory (independent) factors for the gestational weight gain as a dependent factor in the studied group, Binary logistic regression proved that practice followed by attitude then knowledge were statistically significant explanatory variables for gaining optimal weight after the intervention (Odds (C.I 95%); 21.1(5.5-80.0), 10.7(3.4-29.3) and 4.5(1.7-11.9)) respectively (P-value <0.001). Table 2.

Maternal and neonatal outcome after the intervention;

Concerning maternal outcome, there was statistically significant difference between optimal and over-weight gain groups regarding maternal weight gain, BMI, maternal fasting blood glucose and presence of proteinuria (14.3±0.9 VS 21.3±2.8), (23.1±2.3 VS 27.1±1.4), (1.4% VS 14.3%) and (0.00% VS 5.7%) (P-value <0.001, 0.001, 0.007 and 0.04) respectively. But regarding blood pressure and convulsions, there was

Table 1. total knowledge, attitude and practice of the studied group about health nutrition during pregnancy before and after the intervention.

Variables	Pre intervention	Post intervention	p-value
–Total Knowledge score Median (interquartile range)	53 (33-125)	127 (44-146)	**0.001****^
–Total attitude score Median (interquartile range)	3 (0.0-11)	11 (1-12)	**0.001****^
–Total practice score Median (interquartile range)	4 (2-7)	6 (3-8)	**<0.001****^
Total Knowledge adequacy NO (%)	31 (28.2)	85 (77.3)	**<0.001****^^
Total adequacy of positive attitude NO (%)	9 (8.2)	83 (75.5)	**<0.001****^^
Total practice and healthy habits well done NO (%)	36 (32.7)	85 (77.3)	**<0.001****^^

^= Wilcoxon signed rank test, ^^= Mc Nemar test and **statistically highly significant difference (P ≤ 0.001).

Table 2. Binary logistic regression for the effect of knowledge, attitude and practice as explanatory (independent) factors for the weight gain as a dependent factor in the studied group.

Variable	Regression coefficient	S.E	Wald test	p-value	Odds (C.I 95%)
Knowledge	*2.2*	*0.65*	*11.5*	***0.001*****	*4.5(1.7-11.9)*
Attitude	*0.05*	*0.01*	*14.6*	***<0.001*****	*10.7(3.4-29.3)*
Practice	*2.3*	*0.6*	*15.2*	***<0.001*****	*21.1(5.5-80.0)*

Table 3. Maternal and neonatal outcomes between females with optimal and over weight gain after the intervention

Items	Optimal weight gain (N=70)	Over weight gain (N=35)	p-value^	
Weight gain (kg) mean ± SD (Range)	14.3±0.9 (11.5-15.6)	21.3±2.8 (16.7-25)	**0.001****	
-BMI (kg/m2) mean ± SD (Range)	22.3±0.3 (18.8-24.9)	27.1±1.2 (25-29.8)	**<0.0001****	
-Neonatal weight (grams) mean ± SD (Range)	3611±400 (2150-4050)	4102±501 (2200-4950)	**<0.0001****	
-Neonatal blood glucose level at birth	121±7 (110-130)	128±13 (105-140)	**0.009***	
	NO (%)	**NO (%)**	**p-value^^**	**OR (C.I 95%**
-Fasting blood glucose *(mg/dl)*				
Normal	69 (98.6)	30 (85.7)	**0.007***	11.5
Abnormal	1 (1.4)	5 (14.3)		(1.3-102.7)
-Blood pressure				
Normal	69 (98.6)	32 (91.4)	0.07	6.4
Abnormal	1 (1.4)	3 (8.6)		(0.6-172.5)
-Convulsions				
Normal	70 (100.0)	34 (97.1)	0.15	NA
Abnormal	0.0(0.00)	1(2.9)		
- Proteinuria				
Normal	70 (100.0)	33 (94.3)	**0.04***	NA
Abnormal	0.0 (0.00)	2 (5.7)		

^=independent t-test, ^^=Fischer Exact test, OR = Odds ratio (C.I 95%), NA= not applicable, *= significant p-value and **= highly significant p-value.

no statistically significant difference (p-value 0.07 and 0.15) respectively. Table 3.

In regard fetal outcome, there was statistically significant increased neonatal birth weight and blood glucose level at birth (4102±501 VS 3611±400)gm and (128±13 VS 121±7) (p-value <0.001 and 0.009) respectively in over-weight gain group than optimal weight gain group. Table 3.
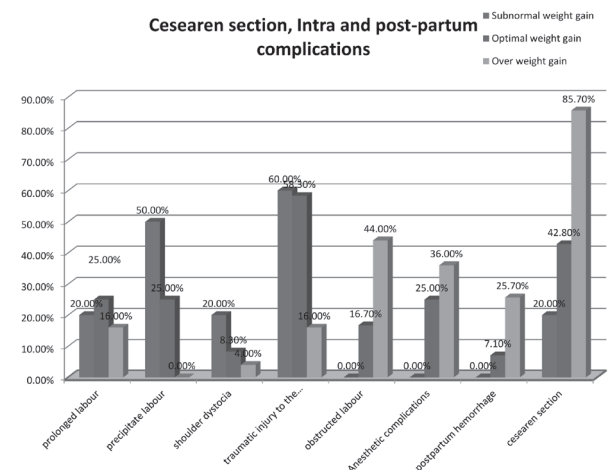
Cesarean section, intra-partum complications and post-partum hemorrhage were statistically significant higher in over-weight gain group than optimal one (85.7% VS 42.9%), (71.4% VS 17.2%), and (25.7% VS 7.1%) (Odds (C.I 95%); 8(2.7-23.1), 12.1(4.6-31.6) and 4.5(1.4-14.7)) (P-value <0.001, <0.001and 0.008) respectively. Figure 2.

Discussion

Nutrition counseling is a cornerstone of prenatal care for all women during pregnancy as woman's nutritional status not only influences her health, but also pregnancy outcomes and the health of her fetus and neonate (8).

Abnormal GWG, whether excessive or inadequate, is associated with a series of maternal and neo-

natal complications and even life-threatening diseases (9). Excessive GWG is associated with postpartum weight retention, obesity, abnormalities in maternal prenatal blood glucose level, hypertension during pregnancy, cardio-metabolic problems in women, and macrosomia and later childhood obesity in children (10). While poor maternal weight gain during pregnancy is associated with SGA infants if mothers didn't

Figure 2. Bar chart for intra-partum complications, postpartum hemorrhage and cesarean section between subnormal, optimal and over weight gain groups.

gain more than 20 pounds, miscarriage, preterm births, LBW infants and gastroschisis (11).

This study included 135 pregnant women in the 1st trimester of pregnancy attending antenatal care clinic at Zagazig University Hospitals. Body weights, FBG, blood pressure, urine analysis were assessed. Nutrition education was applied and the pregnant females were followed up till 24 hours after delivery. At the time of delivery, Ultrasonography was done for all women to exclude any fetal abnormalities (mal-presentation was detected in 5 cases, three women had macrocosmic infants and one woman had cephalo-pelvic disproportion so these nine women were excluded from the final statistical analysis).

The present study showed that there was statistically significant improvement in total knowledge score of pregnant women about healthy nutrition during pregnancy, this attributed to the health education intervention, and this finding was in consistent with Girard & Olude (12) who conducted meta-analyses for the effect of NEC on maternal, neonatal and infant health outcomes including gestational weight gain, maternal anaemia, birthweight, low birthweight and preterm delivery and reported that nutrition education resulted in an increase in the level of nutritional knowledge also, similar results by Fallah et al. (6), found significantly increase in the awareness level of pregnant women about healthy nutrition from 3% before intervention to 31% after the nutritional education intervention (P < 0.001). However, the present results were in contrast with some Turkian studies which found that NE did not provide women with adequate knowledge about nutrition during the pregnancy period (13). The difference between the current study and studies which didn't have effect might be due to the fact that more positive outcomes could be gained if nutrition education was given by a dietitian (nutritional health care practitioner) not by midwives, this justification was supported by studies carried out in USA which stated that as a result of nutrition education provided by a dietitian, unhealthy food was decreased, and healthy food consumption were increased during the pregnancy period (14).

Regarding attitude and practice of pregnant women towards health nutrition during pregnancy, the current study demonstrated statistically significant im-

provement. This finding was in concomitant with Aşcı and Rathfisch (15), who found that the lifestyle interventions had a significant effect on improving attitude in the form of increased calcium, magnesium, iron, zinc, and vegetable intakes. Also a NE programs conducted by Dunneram and Jeewon (16), had been effective in positive behavior modification measured in terms of eating pattern and health quality and the pregnancy specific healthy dietary practice of the pregnant women increased from 46.8% to 83.7% after the nutritional education sessions applied by Zelalem et al. (14).

Regarding the increased adequacy levels of on knowledge, attitude and practice, the significant improvement in this study concise with Zelalem et al. (14), where the proportion of pregnant women with proper knowledge, attitude and practice towards nutrition during pregnancy increased from 53.9 to 97% and another study revealed that the percent of the pregnant women who had correct information after the intervention was (78.6%) (17).

After the intervention, most of the study group (63.6%) had optimal weight gain (31.8%), had over weight gain, while only (4.5%) had subnormal weight gain. this good outcome regarding gestational weight gain was statistically significant explained by the improvement in practice, attitude and knowledge after the NHEP which was supported by Walker et al. (18), who found that traditional face to face delivery of weight management interventions during pregnancy could be successful in obtaining optimal weight gain.

Considering weight gain and maternal complications, the present study was in agreement with Fallah et al. (6), whose study resulted in (41%, 28%, 26% and 5%) were normal, overweight, obese and underweight depending on BMI. Only (1%) had an abnormal blood pressure, diabetes, nephropathy, also the present study was coincided with Whitaker et al. (19), whose study was ended by 79 % within the normal range, 9 % below and 11 % above.

The statistically significant decrease in C.S, intra and post-partum complications and neonatal birth weight and blood glucose level in this study was similar to the results of Stang and Huffman (20) who concluded that lifestyle interventions that moderate gestational weight gain may reduce the risk of poor pregnancy outcomes, such as gestational diabetes, gestational hy-

pertension, large for gestational age, and macrosomia, as well as lower the risk for significant postpartum retention. Consistently, Denison et al. (21), noted that obese pregnant women were at increased risk of complications, including shoulder dystocia (OR 2.9, 95% CI 1.4–5.8), shoulder dystocia (OR 2.9, 95% CI 1.4–5.8), gestational diabetes, pre-eclampsia, venous thrombo-embolism (VTE), dysfunctional or prolonged labour and anaesthetic complications. Also Fukami et al. (22), reported that risk factors for postpartum hemorrhage among the deliveries were fetal macrosomia (over 4000 g), pregnancy-induced hypertension, severe vaginal or perineal lacerations and all these factors can be caused if weight gains over 15 kg during pregnancy. Such high weight gain significantly increased the incidence of PPH compared with women showing less than 10 kg weight gain during pregnancy. Finally Butwick et al. (23), had an increased risk of postpartum hemorrhage which was atonic especially as a consequence of less postoperative movement and more congested vessels among excess weight gain pregnant women.

Conclusion

Nutritional education program to pregnant women can improve their knowledge, attitude, habits and practice towards healthy nutrition during pregnancy and optimize their weight gain, which in role, succeeded to improve maternal and fetal outcome.

Ethical Considerations and Consent to Participate

An official permission was taken from Zagazig University, Faculty of Medicine, obstetrics and gynecology department. The title and objectives of this study were explained to the participants to ensure their cooperation and informed consent was obtained. Institutional Review Board (IRB) of the Faculty of Medicine, Zagazig University approved the study protocol (No. 3168).

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Availability of data

Data are available with coauthor at any time of request.

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