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Impact of Supportive Information-Based Guidelines in Gaining the Recommended Gestational Weight among Low-risk Women: A Quasi-Experiment

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Abstract: Better adherence to dietary guidelines during pregnancy is supposed to result in healthier perinatal outcomes. We aimed to examine the impact of supportive information-based guidelines in gaining the recommended gestational weight among low-risk pregnant women in Egypt. The main objectives were to; 1) modify pregnant women's lifestyle behavior to achieve optimal weight gain in pregnancy, 2) add evidence to the utilization of the ACOG & WHO dietary pregnancy guidelines in the antenatal care, and 3) establish clear antenatal routine care strategy for gaining an optimal gestational weight among low-risk pregnant women. The analysis included 60 first trimester primiparous pregnant women with normal pre-pregnancy weight with a BMI between 18.5 and 24.9 kg/m^2. The total sample was divided into the intervention and control groups. The intervention group received an educational session; the content mainly included supportive information based on WHO dietary pregnancy guidelines and the American College of Obstetricians and Gynecologists, followed by text messages twice a week during the second and third trimesters antenatal follow-up of gestational weight. At the same time, women in the control group received standard outpatient antenatal follow-up. This study's findings shed light on gained gestational weight in the second and third trimesters, with observable differences between both groups related to the second-trimester weight gain. Our study adds to the existing body of knowledge and fills an important gap by investigating the implementation of international guidelines in Egypt's maternal health care practice. In addition, we innovatively used a simple and cost-effective method, namely supportive information, to enhance weight gain management during pregnancy. Further studies are needed to validate the effectiveness of adopting the guidelines as a part of antenatal follow-up.

Keywords: quasi-experiment, supportive information, gestational weight, behavior change, Low-risk pregnancy.

基于支持性信息的指南对获得低危女性推荐孕期体重的影响：一项准实验

摘要：。在怀孕期间更好地遵守饮食指南应该会带来更健康的围产期结果。我们旨在研究支持性信息为基础的指南对埃及低危孕妇获得推荐孕期体重的影响。主要目标是： 1) 改变孕妇的生活方式行为以实现孕期最佳体重增加， 2) 为在产前保健中使用美国妇产科医师大会和世界卫生组织饮食怀孕指南增加证据，以及 3) 建立明确的产前常规保健在低风险孕妇中获得最佳妊娠体重的策略。该分析包括 60 名孕前体重正常、体重指数在 18.5 至 24.9 公斤/平方米 之间的孕早期初产孕妇。将总样本分为干预组和对照组。干预组接受了教育课程；内容主要包括基于世界卫生组织饮食怀孕指南和美国妇产科学院的支持性信息，其次是在孕中期和孕晚期的产前随访期间每周两次短信。同时，对照组的女性接受了标准的门诊产前随访。这项研究的结果揭示了孕中期和孕晚期体重增加的情况，两组之间的明显差异与孕中期体重增加有关。我们的研究通过调查埃及孕产妇保健实践中国际指南的实施情况，增加了现有的知识体系并填补了一个重要空白。此外，我们创新性地使用了一种简单且具有成本效益的方

法，即支持性信息，来加强孕期体重增加管理。需要进一步的研究来验证采用该指南作为产前随访的一部分的有效性。

关键词：准实验、支持性信息、妊娠体重、行为改变、**低危妊娠。**

1. Introduction

Key Messages:

-The educational intervention is an important factor in improving pregnant women's behaviors related to weight gain.

-Clinically significant weight loss has been achieved at a lower cost during antenatal follow-up using information-based recommended guidelines.

-New modalities of antenatal care should be practiced to promote the ideal gestational weight gain in low-risk pregnant women.

Excessive gestational weight gain (GWG) is considered one of the most common concerns for pregnant women [1]. Although excessive GWG is common, no country has an evidence-based intervention to prevent it that can be used in routine care [2]. From a medical point of view, excessive GWG carries high risks for women during pregnancy and the puerperal period and the fetus, leading to neonatal complications [3]. Although the World Health Organization (WHO) and the Global Burden of Disease study provided data on overweight rates among adults, those data have not been fully used to explore the prevalence of overweight among pregnant women.

Chen et al. [4] conducted a useful estimation that being overweight is common in about 38.9 million pregnant women globally. In Egypt, few studies have investigated and documented the pattern of GWG. In their study conducted in Assuit, Egypt, among 300 pregnant women, Eledressy et al. [5] found that 32% of the women had abnormal total weight gain related to pregnancy. Further, Othman [6] investigated 350 high-risk pregnant women in Qena, Egypt, and reported that the majority (57.4%) were classified as obese. Pregnant women, who gain weight by the US Institute of Medicine (IOM) guidelines, have the lowest risk of pregnancy and birth-related complications [7]. Their infants are also at reduced risk of incurring a chronic disease during their adult lives. Despite these guidelines, far from all OB/GYNs and family practice residents report being aware of IOM's GWG guidelines [8].

Translating the guidelines into effective healthcare practices has not yet been achieved. Further, existing service processes and care delivery do not always support women to adhere to best practice guidelines to achieve these outcomes. Even when good evidence is available to support maternal behavioral change, health professionals do not necessarily adopt it or disseminate it to women [9]. Further, there is evidence that interventions promoting a healthy lifestyle change lead to a reduction in excessive GWG [10-12], and the educational interventions have a positive effect on improving behaviors related to weight gain, physical activity levels, and diet during pregnancy [13]. No studies that evaluated face-to-face interventions addressed the barriers to using this approach. Combining lifestyle, behavioral changes, education, and technology may solve the barriers and the lack of interventions to control GWG. Clinically significant weight loss has been achieved at a lower cost using technology-based interventions [14]. The short message service (SMS) delivered by midwives as part of the antenatal care is of low cost to both the sender and the recipient, carries a low participant burden, and allows for easy participant response. There is no global consensus about whether continuous instruction-based guidelines delivered by messages during pregnancy help prevent excessive GWG. Pregnancy may be when weight control slips, and preventive interventions are needed for these women to reduce long-term health risks and potential adverse effects for the infant. Supportive information-based guidelines prepared under multi-professional teams' supervision and delivered by the SMS may decrease logistical restrictions and burden through weight management interventions.

2. Aim

This study aimed to examine the impact of supportive information-based guidelines in gaining the recommended gestational weight among low-risk women. We hypothesize a positive relationship between providing supportive information-based guidelines and gaining the recommended gestational weight among low-risk pregnant women in Egypt.

2.1. Objectives

1. Modify pregnant women's lifestyle behavior to achieve optimal weight gain in pregnancy.
2. Add evidence to the utilization of the ACOG & WHO pregnancy dietary guidelines in antenatal care.
3. Establish a clear antenatal routine care strategy for gaining an optimal gestational weight among low-risk pregnant women.

3. Methods

3.1. Design

A quasi-experimental design was chosen to examine our hypothesis. The present study was grounded in the trans-theoretical model (TTM) to understand individuals' behavioral changes. We try to describe people's dynamic movement through the five stages of behavioral change [15]. Explaining factors are the four core constructs of TTM: stages of change, self-efficacy, decisional balance, and change processes. The model states that individuals usually perceive more benefits from adopting positive behavior changes when moving through the later stages [16]. That is supported by Prochaska and Velicer [17], who indicated that the negative effects are usually greater than the positive effects in the pre-contemplation stage of change [15]. Both positive and negative effects in decisions referred to the benefits of encouraging women to adopt healthy behavior for appropriate gestational weight through diet and physical activity. Barriers, on the other hand, could be factors that prevent women from changing. We aimed for the intervention to make minimal demands on midwives' time, as this would be key to future implementation in routine care. The IOM guideline was the only one available for healthy pregnancy weight gain at the time of the study, and we used it to set the limits for weight gain for the intervention group.

3.2. Setting

The present study was conducted at Kasr El-Aini, Cairo University Maternity Hospital, at the outpatient antenatal clinic for eight months (June 2019 to January 2020). Established in 1837 and featuring the first childbirth school in Egypt in 1838, this hospital is now a governmental hospital providing specialized and advanced maternal health care. The hospital's outpatient antenatal capacity covers the needs of about 100 to 120 low- and high-risk pregnant women from different regions daily.

3.3. Study Population

A purposive sample consisted of 60 first-trimester primiparous pregnant women with a single fetus, able to read and write, owned mobile phones, aged between 18 and 35 years, had a normal pre-pregnancy weight with a BMI between 18.5 and 24.9 kg/m2. Subjects were at gestational week 8–10, self-reported they were sedentary (i.e., had no physical activities in their daily routines). They were willing to participate in the study were recruited. Women with pregnancy-related complications or any medical disorders were excluded from the study. The sample was divided into two groups of 30 women each: a study group and a control group. An equation calculated the sample size based on the proposed intervention's effect size of 0.87, a normal standard deviation for $\alpha = Z\alpha = 1.96$, a normal standard deviation with the power of 80.0%, a confidence interval of 95%, and a type I error probability on a 0.05 level.

$$n=\frac{2(Z_{1-\alpha/2}+Z_{1-\beta})^2}{\Delta^2}+\frac{Z^2_{1-a/}}{2}$$

$$n=2\frac{(1.96+1.28)^2}{00.87}+\frac{1.96^2}{2}=30 \quad (1)$$

3.4. Tools

Data were collected using 1) an interview structured scheduled questionnaire and 2) anthropometric measurements.

3.4.1. Interview Structured Scheduled Questionnaire

This questionnaire was designed to gather the following data: 1) socio-demographic data; 2) initial and baseline assessment, data on obstetric history, and gestational age; and 3) follow-up data related to weight, blood pressure, and abdominal examination.

3.4.2. Anthropometric Measurements

Body mass (to the nearest 0.1 kg) and body height (to the nearest cm) were measured using the available facilities in the clinic, which included a calibrated medical scale and measuring tape. BMI for the baseline data was then calculated to ensure the inclusion criteria were met.

3.5. Procedure

Pregnant women who visited the antenatal clinic for routine follow-up were recruited. After their routine dating scan at 8–10 weeks gestation, they were approached. They were assessed for eligibility based on BMI category at recruitment (normal weight/overweight/obese). Weight gain at 10 weeks was calculated as weight at 10 weeks minus the pre-pregnancy weight. All pregnant women were weighed in light clothing at baseline by the research team using calibrated scales, and they also had their height measured. Eligible women were interviewed first in the waiting room at the antenatal clinic and informed about the purpose of the study. If they agreed to participate, they signed an informed consent form. The second interview was conducted at 12 weeks gestation in one educational session of 60 minutes for a group of 10 pregnant women. The content of this educational session was revised by six experts (three in the maternity nursing field and three physical medicine doctors) prior to the implementing phase for content validity. The content mainly included supportive information-based guidelines, i.e., the nutritional recommendations based on the WHO pregnancy dietary guidelines [18] and the American College (now Congress) of Obstetricians and Gynecologists (ACOG) [19], and focused on the discussion of why appropriate weight gain is important, including an overview of the adverse outcomes and the importance of physical

activity and a well-balanced diet in the prevention of excessive GWG. It targeted four weight-related behaviors: 1) increasing daily walking steps, 2) avoiding sweetened drinks, 3) eating at least five fruits and vegetables per day, and 4) eliminating fast-food intake.

The supportive information was provided to the study group, while the control group received the standard care from the antenatal health care providers. Further, women in the study group received messages through SMS or social media (WhatsApp). Messages varied in lengths (35–250 characters), form, and content regarding healthy eating and physical activity (i.e., "want to spend less on snacks? Choose seasonal fruit. It is a healthy, low-cost snack that you can easily find at your neighborhood market"). According to the publication, these messages were adopted from [20] after obtaining permission from the corresponding author, although the material was available for scientific use [20]. The statements were then translated into Arabic and revised for content validity by three nutritionists in the family medicine field. The messaging frequency was applied twice per week throughout the second and third trimesters and conducted by two clinical instructors and the principal investigator. In addition, all women in both groups followed their antenatal schedule follow-up. Women were weighed at each antenatal appointment using calibrated portable weighing scales. The research teams recorded the women's weight on their weight chart at recruitment. The chart was attached to the woman's handheld pregnancy notes and outlined a maximum weight gain limit for the next appointment. The research teams gave the women feedback on weight gain at subsequent appointments, set a new limit for the next appointment, and reinforced the value and importance of healthy weight gain. The research teams never asked the women to lose weight. The impact of the supportive information and the delivered SMS messages was evaluated by measuring the women's total weight gain during pregnancy at the end of the third trimester.

3.5.1. Primary Outcome

The primary outcome was GWG at 37 weeks gestation, defined by the women's BMI-appropriate weight chart.

3.5.2. Secondary Outcome

The secondary outcome was birth weight.

3.6. Statistical Analysis

Statistical Package of Social Science (SPSS) for data analysis, version 21, was utilized. Descriptive analyses were conducted on the characteristics of the women in both the study and control groups (means, standard deviations, and proportions). Further, our hypothesis was tested using the student's t-test (continuous data) and chi-square tests (categorical data). The significance level was set to <0.05, and the statistical indication was set to <0.1.

4. Results

4.1. Characteristics of Pregnant Women

Women in both the study and control groups had a similar mean age (27.03 ±3.77 SD and 26.23±3.96 SD, respectively). Most of the women had a secondary educational level. They were employees, with no statistically significant differences between the groups regarding their age, gestational age, BMI, educational level, or occupational status (Table 1).

Table 1 Characteristics of pregnant women among the study and the control groups (n=60; Level of significance at p ≤0.05; [a] Data presented as mean±SD, [b] Data presented as *n* (%), [c] *t*-test, [d] Chi-square test; BMI: Body mass index, SD: Standard deviation)

Variables	Study group (n=30)	Control group (n=30)		*P*
Age [a]	27.03±3.77	26.23 ±3.96	0.80 [c]	0.42
Gestational age (weeks) [a]	9.36±1.12	9.26 ±1.11	0.34 [c]	0.73
BMI at study entry [a]	24.73±2.67	24.45 ±2.63	0.41 [c]	0.68
Education level [b]				
Primary	4 (13.3)	4 (13.3)	0.10 [d]	1.00
Preparatory	4 (13.3)	9 (30.0)	2.45 [d]	0.11
Secondary	18 (60.1)	15 (50.0)	60.0 [d]	0.43
University	4 (13.3)	2 (6.7)	0.74 [d]	0.38
Occupation [b]				
Housewife	15 (50.0)	11 (36.7)	1.08 [d]	0.29
Employee	15 (50.0)	19 (63.3)	1.08 [d]	0.29

4.2. Maternal and Newborn Weight among the Study and the Control Groups

Regarding maternal and neonatal weight for both the study and control groups, data denoted statistically significant differences between the groups regarding the mean of gained gestational weight in the second gestational trimester (p=0.03), and total GWG measured at the end of 37 weeks gestation (p=0.05). Furthermore, no significant difference was found between the groups during the third trimester and weekly weight gain (p=0.06 and 0.07, respectively). Further, there was no GWG recorded above or below the recommended IOM guidelines in both groups. In addition, the weights of the newborns of the women in the study group were lower than the weights of the newborns of the women in the control group, while still within the normal range of newborn weight, with no adverse perinatal outcomes in terms of being large or small for gestational age, preterm birth, or low birth weight (Table 2).

Table 2 Maternal and newborn weight among the Study and the Control Groups (n=60; Level of significance at p ≤0.05; [a] Data presented as mean±SD, [c]*t*-test; GWG: gestational weight gain; SD: Standard deviation)

Variables	Study group (n=30)	Control group (n=30)		*P*
Maternal outcome [a]				
GWG from 12 to 25 weeks of gestation	5.89 ±3.44	6.07 ±2.27	-2.26[c]	0.03
GWG from 26 to 37 weeks of gestation	5.86 ±3.34	6.02 ±2.26	-1.85[c]	0.06
Gestational weight gain (GWG) per week (kg/week)	0.45 ±1.03	0.46 ±1.02	-1.78[c]	0.07
Total GWG (kg)	11.79 ±3.65	12.08 ±3.511	-1.95[c]	0.05
Neonatal outcome [a]				
Birth weight (g)	3216.66 ±252.34	3353.00 ±208.41	-2.18[c]	0.02

5. Discussion

Behavior change is considered a challenging and time-consuming process that requires readiness, planning, continuous assessment, and patience. The current study results may be due to the inclusion criteria, in which all participants were primiparous women with normal pre-pregnancy BMI. Wen et al. [21] reported that the weight gain rate increased with increasing BMI and the trimester for all four BMI categories. Voerman et al. [22] reported that inadequate GWG was mainly observed in underweight and normal-weight mothers, while excessive GWG was observed in 40.7% of normal-weight mothers. However, the choice of the inclusion criteria was to enhance the implementation of a feasible intervention and test its effectivity with minimum influence of other factors.

Results demonstrated statistical differences between the study and control groups in the mean of gained gestational weight in the second trimester and total GWG at the end of 37 weeks gestation. Further, there was no GWG recorded above or below the recommended IOM guidelines in both groups. In addition, the weight of the newborns of women in the study group was lower than the weight of the newborns of the women in the control group, while still within the normal range of newborn weight, with no adverse perinatal outcomes in terms of being large or small for gestational age, preterm birth, or low birth weight.

There was no clear evidence of the intervention of supportive information-based guidelines being effective in gaining the recommended gestational weight among low-risk women. They were delivered through SMS advice messages and regular weighing and feedback delivered by research teams as part of routine antenatal care, effective. However, three previous trials investigated the effectiveness of behavioral interventions based on regular weighing to prevent excessive GWG, and none of them was effective [23-25]. While the results from the most recent meta-analyses of randomized controlled trials found that lifestyle interventions predicted decreased GWG, they did not affect neonatal outcomes. In addition, a meta-analysis of intervention studies showed that change in diet and physical activity was effective in reducing GWG [26, 27]. Further, Phelan et al. [28] and Cahill et al. [29] concluded that a lifestyle intervention delivered through text messaging and health coach telephone calls could decrease GWG among women with overweight or obesity.

Additionally, using mobile technology tends to modify certain behaviors, such as increasing the antenatal care attendance, resulting in improved utilization of preventive health services and identification of pregnancy-related complications [30-32]. Aşcı & Rathfisch [33] noted that their lifestyle intervention successfully improved the lifestyle behavior during pregnancy and gained appropriate gestational weight. Further, Farquharson et al. [34] reported that women not adhering to the 2009 IOM/NAM GWG recommendations were subsequently outside of the recommended weight, ending their pregnancy as overweight (35.8%) or obese (14.4%). Further, additional evidence is increased physical activity [26, 35, 36], particularly if combined with dietary counseling and weight monitoring [37-39], can reduce total GWG. Specific counseling of pregnant women based on the week-specific cut-offs provided by the IOM/NRC impacts the risk of small- or large-for-gestational-age babies.

5.1. Limitations

Behavioral intervention studies are considered difficult. One of this study's limitations is the change of mothers' behaviors which required change in their beliefs, attitudes, and practices. For achieving these changes, efforts in terms of time and strict follow-up were planned and implemented. However, the accuracy and the extent to which the pregnant women followed the instructions were not measured, which calls for a need to assess the compliance further and validate if women were concerned to practice the given instructions or if the weight management was a product of confounding factors.

6. Conclusions

The present study examined the impact of supportive information-based guidelines in gaining the recommended gestational weight among low-risk women. The results give no clear evidence that supportive information-based guidelines offered within the scope of antenatal care could be an effective strategy for ensuring optimal GWG and developing healthy lifestyle behaviors. Additional studies with a longer duration of follow-up are needed to assess, for

instance, subsequent maternal postpartum weight change and the long-term effectiveness of the education-based intervention. Policy-makers in both the health and public health sectors need to be involved in policy development to enhance and sustain the healthy lifestyle choices of pregnant women.

6.1. Scientific Novelty

Gestational weight gain is a modifiable risk factor associated with adverse maternal and neonatal outcomes. The ACOG recommends motivational interviewing, a patient-centered counseling style for eliciting behavior change by having patients explore and resolve ambivalence about behavior change, to achieve positive health outcomes for weight management issues patients. The present study used an innovative, important option for health behavior management in the Egyptian maternal health care context (i.e., supportive information) to achieve optimal weight gain in pregnancy by implementing the worldwide physical activity recommendations and guidelines into the maternal health care practice. Further, highlighting the importance of monitoring the weight at the beginning of the pregnancy raises the awareness and the proper documentation of it as important factors to maintain and promote both short- and long-term health outcomes for the mother and the newborn.

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