Effect of Hybrid Education Based on Health Belief Model on Nutritional Performance and Lifestyle among Mothers and Infants

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Abstract:

Background: In order to achieve sustainable development in terms of maternal and child quality of life, continued work to enhance healthcare systems is essential. Although maternal nutrition impacts fetal development and gestational outcome, tracking maternal nutrition in outpatient practice is still complex and involves proper technical capitation in Egypt. **Aim:** This study **aimed** to evaluate the impact of a hybrid health education based on the health belief model on the nutritional performance and lifestyle of mothers and infants.

Methods: Quasi-experimental design was utilized The study was conducted at the MCH in Mansoura city. A purposive **sample** of 100 pregnant women and infants was included in the current study. Four **tools** were used for data collection; the structured interviewing questionnaire, knowledge assessment questionnaire, Health-Promoting Lifestyle Profile II, and the HBM.

Results: The participants' mean age was 29.96 ±4.19 years, 58% of the women were between five and seven months of pregnancy. Mild discomfort during pregnancy reported by 58% of them. Additionally, there was an improvement from 90% of them who had inadequate knowledge to 86% of them had satisfactory level of knowledge regarding nutritional performance and a healthy lifestyle post-intervention with a highly significant difference (p-values 0.001). Furthermore, 75.3 percent of newborns that were delivered had normal body weights. There was a positive highly statistically significant correlation between total knowledge, total HBM constructs and total HPLB. Likewise, there was a positive highly statistically significant correlation coefficient between total HBM and Total HPLB among study subjects in post-test assessment.

Conclusion and recommendation: Hybrid education was effective in improving nutritional performance and lifestyle in maternal and infant health through regular health educational program based on HBM.

Keywords: Hybrid Education, Health belief model, Pregnant women, Lifestyle

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I. Introduction

Having a baby is an exciting time that often inspires women to make healthier lifestyle choices. Despite encouraging improvements in the world's general health, many pregnant still have worse health than the majority of the population. The prevalence of modifiable risk behaviors and bad lifestyle choices are both driving up healthcare costs globally. Women in pregnancy are more likely to experience diabetes, hypertension, and obesity as a result of bad lifestyle choices (Jiang et al., 2022; National Center for Health Statistics, 2022). Having a high body mass index (BMI) during pregnancy can have a major impact on the pregnant health and the baby's health.

Recent research in the field of preventative health programs has highlighted the need of upholding healthy lifestyle practices (Gurusamy et al., 2022). It's crucial to develop and influence the individual's culture, accordingly change requires a strong motivation that outweighs the discomfort and instability involved in letting go of long-standing practices (Ortiz, 2022). Preventative wellness initiatives must motivate participants to improve their health-related behaviors and make them more willing to do so (Pratt, 2022). Health Belief Model (HBM) was the first widely used model to be created. It seeks to comprehend the motivations behind people's health behavior decisions. It concentrates on the person's incentive to engage in a healthy habit and is broken down to individual perceptions, altering behaviors, and the likelihood of action (Maartensson & Loi, 2022). One does this by identifying oneself as perceived susceptibility, perceived seriousness, perceived advantages of acting, barriers to taking action, and cues to action (Setyaningsih et al., 2022).

Hybrid assistive technologies are designed to help people with activities of daily living. They can be used to help those with physical limits, pregnant, those with cognitive impairments to remember tasks and medications, those with vision impairments to detect obstacles, and those with hearing impairments to communicate. Hybrid assistive technologies provide a wide range of products, services, and resources to support the healthcare and personal needs of patients. Examples of Hybrid assistive technologies include smart home devices, robotic assistive devices, virtual assistants, and wearable devices. These devices can help provide monitoring, reminders, communication assistance, and more (Patel & Erickson, 2022). Hybrid learning is an educational approach that combines face-to-face classes and online learning. Through hybrid learning, some pregnant attend the class in person, while others join virtually remotely. Health educators utilize various tools for health lifestyle improvement such as video conferencing to teach both of these pregnant groups. Hybrid coaching sessions that use the health belief model (HBM) may help practitioners better understand and predict the health behaviors of their clients. It mostly depends on the mothers to choose the way they wish to attend the sessions. The HBM combines health education with targeted interventions to advance healthy nutrition and lifestyles (Du et al., 2022). The HBM is a combination of health education and specific treatments that are aimed to encourage nutrition and change to healthy lifestyles. So, This study aimed to evaluate the effects of a hybrid health education based on the health belief model on the nutritional performance and lifestyle of mothers and infants.

1.2 Significance of the study:

The incidence of nutritional trouble and unhealthy lifestyle during pregnancy varies between 33% and 50% over the world (Agarwal, 2022). There is little information available about the countrywide incidence of poor nutritional performance and unhealthy lifestyles in Egypt. This scant information might give this undiscovered issue additional weight. Additionally, no nursing research about adopting an HBM based program to raise awareness of such a hidden issue has been discovered in Egypt (Elshobary & Elhomosy, 2022).

Various unfavorable maternal and perinatal outcomes such as miscarriage, fetal growth restriction, stillbirth, neonatal and puerperal sepsis, preterm birth, neonatal encephalopathy, and neonatal and maternal mortality, have

been strongly linked to maternal malnutrition and unhealthy lifestyle choices. By altering pregnant women's ideas about self-care, early detection, and treatment, HBM based interventions can aid to enhance nutritional performance and enhance lifestyle (Elmwafie & Abdelaziz, (2022).

All community, obstetric and pediatric health nurses encouge the pregnant women to become more capable of taking care of themselves and her infants. Beside, support their ability to do so. Hybrid learning activities accompanied by nursing care will assist pregnant women in becoming familiar with a healthy diet and way of life. The health education based on HBM can assist the nurse in enhancing pregnant women's knowledge, altering their health beliefs, and improving their behavior regarding nutritional performance and lifestyle since changing the belief is the milestone for behavior transformation.

1.3 Aim of the study:

This study aimed to evaluate the impact of a hybrid health education based on the health belief model on the nutritional performance and lifestyle of mothers and infants.

Research hypothesis:

Pregnant women who received hybrid health education based on HBM will have better nutritional performance and healthy lifestyle, health beliefs, and healthy infants.

II. Subjects and Method

2.1 Research design: A quasi-experimental design was used to accomplish this study (pre/post-test). Pre-test and post-test designs are used to gauge participants' attitudes or views about an event, as well as their comfort with using the knowledge covered in a training session or when a new topic is discussed (Stratton, (2019).

2.2 Setting: The study was conducted at the maternal and child health center (the gynecologic and obstetric clinics, infant clinics, and family health clinics) at Talkha city and Elsalakawy maternal and child health center at Mansoura city belonging to Dakhahlia Governorate, Egypt.

2.3 Sample:

A sample of 100 pregnant women who were recruited in the previously chosen setting were chosen using a purposive sampling technique. The participants were initially chosen based on inclusion criteria; they must be educated, or at least be able to read and write, between (18 – 40) years old, second month of gestation and ongoing follow-up 6 months after giving birth and are enrolled in the previous environment, reachable by phone call, familiar with Whats App groups, free from mental or chronic illness, and willing to take part. They were then invited to take part in an inside the center or online survey of health lifestyle a written or Google Forms spreadsheet that was distributed over Whats App groups.

The sample size was estimated using the EPI info 7.0 programs based on these parameters: population size: 4950, expected frequency: 7%, acceptable error: 5%, confidence coefficient: 95%, design effect: 1, the minimum sample size was 99 reached to 100.

2.4 Tools: Four tools were used for data collection.

2.4.1 First tool: structured interviewing questionnaire: After evaluating pertinent literature, the researchers created an interview questionnaire in Arabic. There were three primary components:

Part I: The socio-demographic characteristics of women and infants, including their age, place of residence, religion, level of education, occupation, number of phone lines, number of family members, number of rooms in the house, family income, familial genetic diseases, exercise, smoking, and gender.

Part II: Obstetric and gynecologic history, including issues with conception, the length of pregnancy, illnesses linked with pregnancy, mild discomforts during pregnancy, and prior gynecologic conditions or surgeries,

Part III: body mass index (BMI) and mid-upper arm circumference (MUAC)scale.
Second tool: Knowledge assessment questionnaire: Knowledge of the studied

women regarding nutritional performance and healthy lifestyle, health beliefs. This part was used before and after the implementation of the HBM (pre/ post-test format). It included five open-ended questions; which include what is good nutrition?, what are healthy lifestyle during pregnancy and lactation period?, what is your type of nutrition?, what are obesity complications?, what is breastfeeding?

Scoring system of knowledge: A correct answer scored "two", an incomplete answer was scored "one" and the incorrect or unknown answer scored "zero". The knowledge score was calculated by adding the scores for the correct answers. The total possible score ranged from 0 to 10 and means and standard deviations were calculated. The women's knowledge was considered unsatisfactory when the score was less than 70%, while ≥ 70%, the women's level of knowledge was considered a satisfactory level.

2.4.2 Third tool: Health-Promoting Lifestyle Profile II

Walker et al., developed this instrument in 1987 to assess lifestyle choices that promote health (HPLBs). Physical activity, nutrition, spiritual development, interpersonal relationships, stress management, and health responsibility were among the fifty-two components that made up its six aspects. Higher scores indicate greater levels of adherence to better lifestyle habits. The overall results ranged from (52 to 208). From one (never) to four, it employed "a four-point Likert scale". The overall score was divided into three categories: low level of HPLP adherence (30% to 60%), High degree of HPLP adherence (80%-100%), and moderate level of HPLP adherence (60-80%). The reliability of HPLP II tool was 0.939 for the total scale.

2.4.3 Fourth tool: Health Belief Model questionnaire

This tool was created by Rosenstock, (1974) to clarify and predict preventative health behavior. Modifications were done by the researchers on the Arabic language. Adapted

from the HBM questionnaires predicting nutrition performance and healthy lifestyle during pregnancy, the questionnaire contained 16 Likert scale items assessing perceived barriers, benefits, susceptibility, and severity of nutrition performance and healthy lifestyle.

Four statements assessed perceived barriers to nutrition and healthy lifestyle for the mother and her infant; five statements evaluated the perceived severity of the malnutrition and unhealthy lifestyle for the mother and her newborn; Six statements assessed perceived susceptibility to the nutrition and healthy lifestyle; and finally, one question measured perceived benefits of the good (e.g., I think the excellent nutrition and healthy lifestyle protects me).

All items for these scales score were assessed using a Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). The personal questions in each category were totaled, and the scores ranged as follows:

(1) Perceived barriers to nutrition and a healthy lifestyle have a score ranging from 4 to 20.
(2) Perceived benefits to nutrition and healthy lifestyle have a score ranging from 1 to 5.
(3) Perceived susceptibility to nutrition and healthy lifestyle has a score ranging from 6 to 30.
(4) Perceived severity of malnourishment and unhealthy lifestyle has a score ranging from 5 to 25.

Higher scores indicated higher levels of perceived susceptibility to nutrition and healthy lifestyle, higher perceived severity of nutrition and healthy lifestyle, higher perceived barriers to a good healthy lifestyle, and higher perceived benefits. These individual sub-scale scores were used as the primary predictor variables in the model. The HBM was selected because it has been one of the field theories of health behavior and remains one of the most widely recognized in the health promotion field.

2.4.3 Tools validity and reliability:

Five specialists in obstetrics and gynecology, pediatric nursing, and community health nursing examined the tools for completeness, relevance, and intelligibility. The panel evaluated the instruments' face and content authenticity. The tools were modified in accordance with the panel's assessment of the appropriateness of the content and the simplicity of the sentences. The Cronbach's Alpha coefficient test was used to determine the reliability, and the results showed that each of the two tools had a moderate to high level of reliability and contained generally homogenous items. Knowledge had an internal consistency of 0.86, the 18-item HBM four main construct had an internal consistency of 0.91.

2.5 Ethical considerations:

Before data collection, oral agreement was obtained after each pregnant woman had been told of the study's objectives. Throughout the whole study, strict confidentiality was maintained. The women were given the assurance that all information would only be healthy lifestyle for study. They were made aware that they could end the study at any point before it was finished.

2.6 Pilot study:

To test the viability and application of the tools and to gauge the time required for data collection, a pilot study was conducted on ten pregnant women or 10% of the total sample. Identify any challenges that can arise during data collecting for the researchers. Women who participated in the pilot study were not included in the study sample because changes were made.

2.7 Field work:

The nursing faculty dean provided a formal official agreement, which was then given to the director of the MCH Center in Mansoura. After outlining the study's objectives, a written official letter was taken and given to the director of the obstetrics and pediatric outpatient clinic, in order to acquire their clearance to conduct the study. Four phases were used to carry out the study: assessment, planning, implementation, and evaluation.

These phases were completed during a 15-months period, commencing at the beginning of MRCH 2021 and ending at the end of May 2022. The researchers spent two days every week (Sunday and Wednesday) from 9.00 am to 1.00 pm in the previously indicated setting.

2.7.1 Assessment phase:

After receiving official authorization to carry out the study, the researchers approached and interviewed each woman separately, outlining the purpose and methods of the investigation and soliciting their involvement. After receiving permission to participate, the woman underwent an interview to determine her demographics, understanding of malnutrition and unhealthy lifestyles, and health practices. Data collected during this phase served as the baseline for subsequent comparisons to determine the program's influence.

2.7.2 Planning and implementation phase:

Every woman's interview took about the same time to complete on average (10-15 minutes). Averaging 6 to 8 ladies were questioned each week.

During infant check-ups, routine of breastfeeding was recorded in the hybrid assist counseling tool. Participants in the study fulfill a modified version of the Mansoura MCH Interview and Examination Survey for Infants and Mothers (KIGGS) food frequency questionnaire between the ages of 4 and 7 months. It determined the frequency and serving sizes of the primary food groups ingested by newborns during the previous four weeks. Additionally, the Comprehensive Feeding Habits Questionnaire (CFPQ) single questions used for analyzing parental feeding practices. Recruited participants respond to a number of questions about the infants' physical activity habits that were designed by the research team.

Regular prenatal visits and baby check-ups include lifestyle advice. This has less of an impact on participants than add-on methods and offers a low-threshold approach for engaging with the expectant women and their delivered babies.

Second, lifestyle counseling is customized for each person in an intervention. Because one-

size-fits-all approaches have been demonstrated to be less effective in preventing overweight and obesity, a personalized strategy that acknowledges individual differences in motivation, knowledge, needs, and circumstances is advised. Regular prenatal visits and baby check-ups include lifestyle advice. This has less of an impact on participants than add-on methods and offers a low-threshold strategy for interacting with expectant women and their babies.

2.7.3 Evaluation phase: Following hybrid education-based HBM, the program's effectiveness was assessed using the same pretest methodology two months later. The study researcher detect which elements of the lifestyle intervention are being modified and which elements are being implemented as intended to acquire insight into the implementation process. Focus groups and interviews with multi-professional research participants was conducted for this reason.

The hybrid -assist counseling tool's data were examined. The research team investigated a variety of factors, including counseling content, provider characteristics, intervention characteristics for expectant mothers and infants, and the overall volume of lifestyle counseling sessions delivered. The final step was the analysis of documents, including minutes from the implementation training. A timeline to measure lifestyle-related risk factors in expecting mothers and their infants, see table (a)

Table (a): A timeline to measure lifestyle-related risk factors in expecting mothers and their infants

	Pregnancy			Infant's first half year				
	2-4 months	5-6 months	7-9 months	At birth	3-10 Days	4-5 weeks	3-4 months	6-7 months
Pregnant weight	★	⬭	★				⬭	★
Pregnant smoking	★		★					★
Pregnant physical activity	★		★					★
Pregnant diet	★		★					★
Pregnant knowledge	★		★					★
Breastfeeding						★	★	★
Infant weight and length				★			★	★
Infant physical activity					★			★
Infant nutrition					★		★	★

2.8 Statistical analysis:
SPSS version 20.0, a piece of software from the Statistical Package for Social Sciences, was used to carry out statistical analysis. The use of descriptive statistics (such as mean, standard deviation, frequency, and percentages) was made. Chi-square, and independent, as well as other tests of significance were employed to see whether there were any significant differences between the groups. Paired sample t-test and Pearson correlation coefficients were used. At a p-value of 0.05, a difference was regarded statistically significant, and at a p-value of 0.01 it was considered highly statistically significant.

III. Results
Table (1) represents socio-demographic characteristics of the studied sample. It was clear that 76% of the sample under study was between the ages of 18 and 40 with mean age of 29.96 ± 4.19. Additionally, 89% of the women were residents of rural areas. In

addition, 55% had completed secondary schooling. Insufficient monthly income reported by 27% of the women. Moreover that, 12% of the women were housewives, and 88% of them were free from familial genetic conditions.

Table (2) displays that more than half (58%) of the women were in the 5-7 month of their pregnancy. Furthermore, 66% of them are free from conception problems. Mild discomfort during pregnancy discovered among 58% of them. Moreover, 20% of women had a previous history of gynecological disorders.

Fig. (1) exhibit that, 85% of the women were free from medical disorders at the end of the intervention compared to 74% at before. Additionally, anemia in women decreased from 20% at baseline to 16% at follow-up. There is a significant differences from pre-test to post-test (p-values < 0.001).

Fig. (2) displays that, pre-intervention knowledge levels regarding nutritional performance and a healthy lifestyle were inadequate for 90% of pregnant women, but these levels increased to 86% after the intervention. Significant variations exist between the pre-test and post-test highly significant differences p-values < 0.001).

Table (3) shows that there was no statistically significant difference was observed between the women in the four main HBM constructs (perceived susceptibility, perceived severity, perceived barriers, and perceived benefits) before program implementation. However, two months after program implementation, there was a highly statistically significant difference (p-values < 0.001) was observed in the four main HBM constructs. By the side, a general improvement in the four main HBM constructs was observed among women two months pregnancy after program implementation as compared to before it.

Table (4) detect the differences between level of pregnant woman's knowledge regarding nutrition and lifestyle domains pre and post of hybrid education program implementation. There was a highly significant difference between pre and post of hybrid education program implementation (p-values < 0.001).

Figure (3) Demonstrates the distribution of the newborns under study by weight. More than three quarters (75.3%) of them that were delivered had normal body weight.

Table (5) clarifies that, there was a positive highly statistically significant correlation between total knowledge, total HBM constructs, and total HPLB for pregnant women during post-test (p-values < 0.001).

Table (6) state a positive highly statistically significant correlation coefficient between total HBM and Total HPLB among study subjects during post-test of hybrid education program implementation (p-values < 0.001).

Table 1: Socio-demographic characteristics for the studied pregnant clients (n= 100).

Characteristics	N(%)
Age in years: Mean ± SD	29.96 ± 4.19
Place of residence:	
Rural	89 (89)
Urban	11 (11)
Level of education:	
Elementary	18 (18)
Secondary education	55 (55)
Bachelor's degree	27 (27)
Family income:	
Insufficient	27(27)
Partially sufficient	59(59)
Sufficient	14(14)
Religion:	

Moslem	92(92)
Christine	8 (8)
Occupation:	
Worker	88 (88)
House wife	12(12)
Number of family members:	
>3	86 (86)
<3	14(14)
Rooms Number of house:	
One room	
2 room	20(20)
3 room	69(69)
	11(11)
Genetic diseases:	
Yes	12(12)
No	88(88)
Exercise:	
Yes	11(11)
No	89(89)
Smoking:	
Yes	98(98)
No	2(2)
Sources of knowledge:	
Doctor	30(30)
Nurses	50(50)
Others	20(20)
BMI categories:	
Under weight	0(0)
Normal	20(20)
Overweight	60(60)
Obese	20(20)

Table (2) Distribution of the studied subjects according to their obstetric and gynecologic history.

| Obstetric and gynecologic history	N (%)
Length of pregnancy:	
2-4 month	42 (42)
5-7 month	58(58)
Problems in conception:	
Free from problem in conception	66(66)
Delayed pregnancy	20(20)
High prolactin level	10(10)
Polycystic ovary	4(4)
Mild discomforts during pregnancy:	
Yes	58(58)
No	42 (42)
Previous history of gynecological disorders:	
Yes	20 (20)
No	80(80)

Fig. (1) Distribution of the study subjects according to the their medical history during the current pregnancy (n=100)
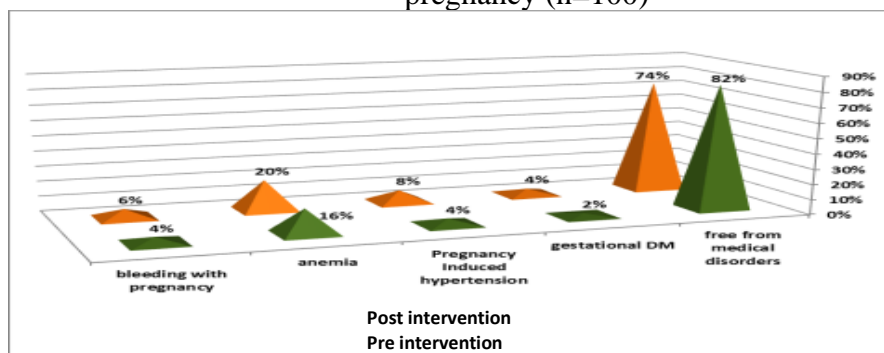

Figure (1) Comparing Pre-test and Post-test health data of Participants the their medical history during the current pregnancy. (n=100).

Figure (2): Distribution of the studied women according to their knowledge level about nutritional performance and healthy lifestyle pre/post intervention.
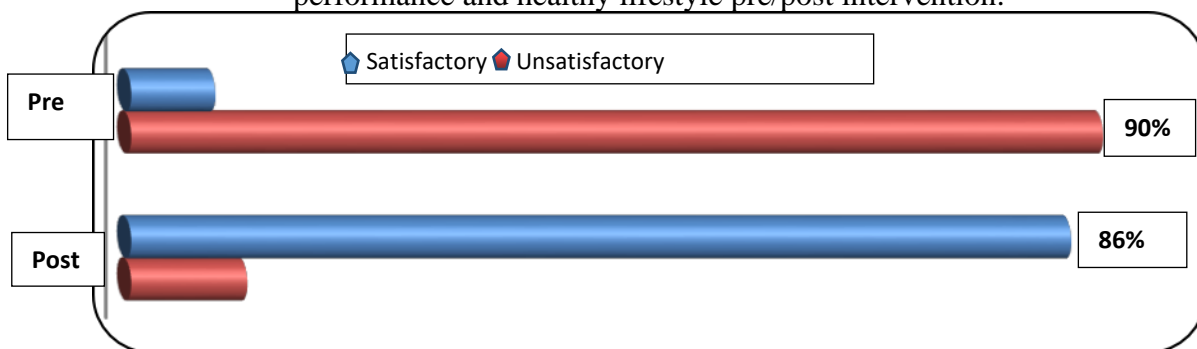
Figure (3): Distribution of the studied delivered infants according to their body weight.
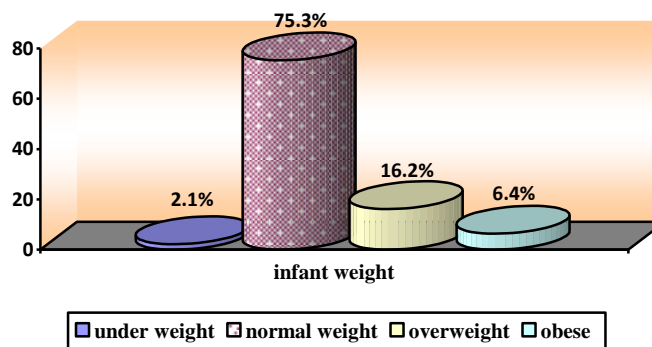
Table (3) Mean differences between pre-test and post-test regarding women's health belief model (n=100).

Health Promoting Lifestyle Profile	Pre-test Mean ±SD	Post-test Mean ±SD	t	P-value
Total Perceived Benefits (5)	10.07 ±3.65	12.77±2.57	11.220	0.000**
Total Perceived Barriers (20)	16.18±3.14	22.22±1.92	8.917	0.000**
Total Perceived Susceptibility(30)	12.60±3.52	16.84±1.95	11.602	0.000**
	17.72±2.99	22.98±1.34	11.341	0.000**
Total Perceived Severity(25)	56.98±12.37	78.38±5.71	11.102	0.000**
Total score (80)				

Table (4) Differences between knowledge level of pregnant women regarding nutrition and lifestyle at pre and post-test (n=100).

Variables	Knowledge						P-value
	Pre-test			Post-test			
	Low (%)	Moderate (%)	High (%)	Low (%)	Moderate (%)	High (%)	
Physical activity	68	15	17	50	8	42	10.23 <0.01**
Nutrition	50	30	20	25	30	45	20.23 <0.01**
Spiritual growth	30	40	30	30	10	60	12.23 <0.01**
Interpersonal relations	20	30	50	10	20	70	13.35 <0.01**
Stress management	10	10	80	5	15	80	9.81 <0.01**
Health responsibility	35	29	36	22	18	60	15.65 <0.01**

Table (5) Correlation coefficient between the total knowledge, total HBM constructs and health behavior regarding total HPLB of the study participants during post-test (n=100).

Variables	Total knowledge	
	r	P- value
Total HBM four main constructs	0.393	0.005**
Total HPLB	0.312	0.027*

- **A highly statistical significant correlation (p≤0.01)
- *statistical significant correlation (p≤0.05)

Table (6) Correlation coefficient between total HBM and Total HPLB postintervention among study subjects (n=100).

Variables	Total HBM four main constructs	
	r	P-value
Total HPLB	0.404	0.004**

- **A highly statistical significant correlation (p≤0.01)

IV discussion

Inherent to the healthcare system is nursing, and nurses focus their efforts on promoting, maintaining, and restoring health. Therefore, consistent instruction based on HBM appears to encourage preventative practices related to nutrition, HPLB, and its incidence (Bazaz et al., 2022).

Evidence from across the globe points to maternal education as a key factor in determining a child's health. The association between maternal education and a child's health is moderated by the health system. Due to the scarcity of data, especially in underdeveloped countries, it is unclear which way the health system moderates this link. We investigate this issue in the context of Egypt, where the healthcare system is still undergoing change, in order to fill up this evidence gap.

So, This study aimed to evaluate the impact of a hybrid health education based on the health belief model on the nutritional performance and lifestyle of mothers and infants.

Regarding age, educational level, domicile, monthly income, and employment, there were no appreciable variations between the study subjects' pre-test and post-test of the hybrid education program implementation, according to the study's findings. This is comparable to Elmwafie & Abdelaziz, (2022). They carried out their research to determine the effects of educational interventions based on HBM on various health behaviors among pregnant women. They emphasized that there were no appreciable differences in terms of age, educational attainment, monthly income, and occupation between the intervention and control groups.

The findings of the present study revealed a highly significant variation regarding pregnant women's knowledge about healthy practices after the intervention. Furthermore, the women's post-intervention scores significantly improved. At least three additional studies have found similar outcomes to the results of the current study. First, Marquez, (2022) who had investigated how self-care habits of pregnant women with unhealthy lifestyles were affected by intervention guidelines. He discovered that pregnant women's understanding of all topics related to unhealthy lifestyles significantly improved both before and after program implementation. Second and third, Motlagh et al., (2022) and Arefi et al., (2022) both assessed the impact of health education on pregnant women based on several theories of healthy lifestyle preventive behavior. This outcome reported more than half of the study participants who were interested in hybrid learning to learn more about HPLB and its preventive measures which may explain their ability to pick up new material fast.

In line with the findings from around the world, we discover that mother education is still a significant factor in determining the health of children in Egypt. In the presence of a subpar healthcare system, the link between maternal education and child health outcomes deteriorates. In the context of Egypt, improvements to the healthcare system are initially beneficial to the wealthy. However, it shouldn't interfere with the policy efforts aimed at enhancing the medical care system or the education of women.

Prenatal lifestyle treatments given by medical professionals may lower excessive GWG, which could lead to better health outcomes for both mother and child. The findings of this study demonstrate that a brief lifestyle intervention administered by prenatal healthcare professionals as part of standard prenatal care resulted in a significant reduction in the proportion of women who gained excessive weight.

The four primary HBM constructs are as follows: The current study's findings revealed a significant improvement in the women's post-intervention perceived susceptibility scores. This outcome is consistent with research by Wang et al., (2022) and Sanaeinasab et al., (2022). Both of them have investigated how education-based HBM could encourage women's obesity prevention actions. Following the execution of the program, they found that the intervention group's mean ratings for perceived vulnerability to obesity increased more than those of the control group. Also, EL Sayed & Sarhan, (2022) explored how a health belief model-based teaching program affected COVID-19 preventative behaviors. He demonstrated discernible variation between the intervention and control groups in the perceived susceptibility after the education.

In the present study, the perceived severity score was found to be significantly higher among the women two months after program implementation. In line with the current study findings, recent study implemented by Dehosta et al., (2022). They had studied the effect of education based HBM on physical activity of obese women. They indicated that the score of the perceived severity in the intervention group was meaningfully increased, compared to the control group, after the program.

The current results showed that once the program began, the women's post-intervention scores for perceived barriers dramatically increased. This conclusion is in line with at least two studies. Wang et al., and Agarwal, (2022). They examined how education-based HBM improved the healthy eating intentions and behaviors of Chinese residents. They discovered that as compared to the control group, the intervention group's mean ratings

for perceived barriers dramatically rose after the intervention. The effectiveness of a health education program based on HBM on how successfully women preventive obesity was examined by Sasanfar et al., (2022). They claimed that both before and after the intervention, the perceived barrier mean score for the intervention group had dramatically dropped. The difference between the current study result and Sasanfar et al., (2022) study may be attributed to the scoring system difference regarding the perceived barrier construct. While in the present study the high barrier perceived scored one however the low barrier perceived scored five.

Findings of the current study demonstrated that the intervention group's mean ratings of perceived advantages to HPLB increased following the program's implementation, with a highly statistically significant difference between the pre and post-test. This is in line with the earlier reported findings of the investigations. In 2022, Sasanfar et al., found that the perceived benefits of long-term health were considerably greater in the intervention group than in the control group after the intervention.

According to the study's findings, after program implementation, the intervention group's mean valuation of perceived advantages to HPLB increased. This concurs with the preceding research that was mentioned. According to Maas et al., (2022), the intervention group's judgment of the advantages to their health compared to the control group after the intervention improved significantly.

In the current experiment, both internal and external information acted as triggers for taking action. A history of HPLB is one internal stimulation. One of the external triggers was the knowledge on HPLB that was gathered from many sources, such as health teams, educational programs, friends, family, and the media. The study participant's most frequent external motivator to engage in HPLB preventative behavior was the health team. This result is in line with Du et al., (2022) concluded that, a history of bad health and information from the media, educational pamphlets, books, friends, and family served as the catalysts for taking action.

The study by EL Sayed and Sarhan, (2022) showed that education based on the HBM, which takes into consideration participants' attitudes and beliefs, can be useful and effective in encouraging preventive behaviors of the healthy lifestyle. The results of the current study agree with a few other more recent studies. Maas, V. et al. (2022) investigated the effects of education based on HBM on a number of a healthy behaviors. They emphasized that in order to change one's behavior, one must first change their attitudes about health.

Research hypothesis was accepted: Pregnant women who received hybrid health educational program based on HBM will have better nutritional performance and healthy lifestyle, health beliefs, and healthy infants.

Conclusion

The disparities in pregnant women's knowledge levels about the nutrition and lifestyle domains before and after the implementation of the hybrid education program showed that there was a highly significant difference between the two times (p-values 0.001). There was a strong positive association between total knowledge, total HBM constructs, and total HPLB for pregnant women during post-test hybrid education program deployment. During the post-test of the hybrid education program's implementation, there was a positive, highly statistically significant correlation coefficient between total HBM and total HPLB among the study's participants. Lastly, the majority of newborns had normal body weight.

Recommendations

Based on results of the present study, the following recommendations can be suggested:
- Nurses should increase pregnant women awareness about the nutrition and lifestyle through regular educational program based on HBM.
- Nurses should provide pregnant women with instructional booklets about the nutrition and lifestyle based on HBM to

improve their knowledge and health believe.

- Replication of this study on a large sample and in different settings is recommended for generalization of results.

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All authors made a substantial contribution to the writing of the paper draft. All Authors contributed equally to this manuscript; conceptualization, preparation, and implementation of the program, methodology, investigation of formal and administrative procedures, data entry and analysis, writing-original draft, writing-manuscript, editing, and revision.
All authors read and approved the final manuscript.

Conflict of interest:
The authors declare that there is no conflict of interest regarding the publication of this paper.

Availability of supporting data:
The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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