Effect of Applying Centered Pregnancy Model versus Individual Prenatal Care on Maternal and Neonatal Outcomes

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Abstract

Background: Centered pregnancy model is the most well-known and evidence-based approach of group prenatal care which has been recognized to improve maternal and neonatal outcomes. **Aim of research**: The research aimed to investigate the effect of applying centered pregnancy model versus individual prenatal care on maternal and neonatal outcomes. **Research design:** A quasi-experimental (non-equivalent groups) research design was used to fulfill the aim of the study. **Setting:** The research was conducted at the obstetrics and gynecology outpatient clinic in Benha University Hospital. **Sample:** A purposive sample of 140 pregnant women divided randomly into centered pregnancy group comprised (70) women and individual prenatal care group comprised (70) women. **Tools of data collection:** Four tools were utilized for collecting data; a structured interviewing questionnaire, health promotion lifestyle profile-II, birth outcomes assessment sheet and patient participation and satisfaction questionnaire. **Results:** There was a statistically significant difference between centered pregnancy and individual prenatal care groups in relation to items of maternal and neonatal birth outcomes ($P \leq 0.05$); there were lower rates of preterm labor and cesarean section delivery, shorter length of maternal hospital stay and early initiation of breast feeding. Also, decreased rates of low birth weight and neonatal admission to intensive care unit in centered pregnancy group compared with individual prenatal care group. **Conclusion:** Centered pregnancy model had a positive effect on improving health behaviors during pregnancy, positive maternal and neonatal outcomes as well as most of the woman in centered pregnancy group had high participation and satisfaction with centered pregnancy model. **Recommendation:** Implementation of centered pregnancy model as a standard practice for improving maternal and neonatal outcomes.

Keywords: *Centered Pregnancy model, Individual Prenatal Care, Maternal and Neonatal Outcomes.*

Introduction

Prenatal care is one of the four pillars of world health organization's safe motherhood program and is considered as the entry point into the health system for many women and offers a unique opportunity to provide life-saving monitoring by a comprehensive health supervision during pregnancy ***(Habte et al., 2024).***

The individual prenatal care provides limited contact with women, typically does not provide support services and is often too fragmented to address the complex needs of pregnant women. Individual prenatal care was designed with the primary objective of preventing complications of pregnancy. It includes one-on-one office visits that typically last 10 to 15 minutes with long waiting times and if time permits, answer questions or provide counseling regarding health behaviors with limited opportunities for women to make social contact with other pregnant women ***(Crockett et al., 2023).***

Thus, revealing that individual prenatal care alone is not sufficient to improve birth outcomes for both mothers and neonates. This led the World Health Organization to call for

group prenatal care programs to address some limitations of individual prenatal care by emphasizing more respectful care as a key component of high-quality care for women ***(Kinra et al., 2024).***

Centered pregnancy model is known as a transformative approach to prenatal care. It combines a clinical prenatal visit, education, and peer support into one session generally lasting 90 to120 minutes. Thus, allowing extended face to face time about 15-20 hours with the same care provider that prioritizes peer to peer learning and support compared to approximately 2 hours in traditional individual prenatal care with a care provider who may not always be the same ***(Duncan et al., 2023).***

According to ***Kettrey et al., (2024),*** the group members stay together for the whole duration of pregnancy. After an initial visit in which history, physical examination and laboratory testing are done on a one-to-one basis, subsequent visits consist of group educational sessions, each group session typically has 6–12 women of similar gestational age attend according to a standard prenatal visit schedule**.**

Centered pregnancy model is an important contributor of positive maternal and neonatal outcomes. Centered pregnancy improves maternal birth outcomes in terms of early breastfeeding initiation and better duration of exclusive breastfeeding. Decreased length of maternal hospital stay. Improved psychosocial outcomes and decreased maternal anxiety/stress. Also, increased maternal self-efficacy and confidence for parenting and satisfaction ***(Ayers et al., 2023).***

Additionally, centered pregnancy model can capitalize rates of vaginal birth versus caesarean section. The centered pregnancy model contributes to fewer labor complications, decreasing maternal mortality and spontaneous abortion as well as positive impacts on prenatal and postnatal care attendance rate. Furthermore, more family planning uptake and increasing birth spacing (***Gresh et al., 2022).***

Centered pregnancy model has demonstrated a decreased risk of preterm birth and low birth weight, small for gestational age , large for gestational age , stillbirth, neonatal death and other adverse neonatal birth outcomes are greatly reduced ***(Maghalian et al., 2024; Salow et al., 2022).***

Nurses play a crucial role in the development and implementation of centered pregnancy, educating the pregnant women to identify threats to safety created by lifestyle or behavioral factors and highlighting ways to modify which can positively affect the health of pregnant women to avoid adverse maternal and neonatal outcomes ***(Jafaru, 2022).***

Significance of the research

The United Nation's Sustainable Development Goals call for decreasing the global maternal mortality rate to below 70 per 100,000 live births and the newborn mortality rate to below 12 newborn deaths per 1000 live births by the year 2030 ***(UNICEF and WHO, 2023)***

Globally, around 223 women/ 100.000 live births die annually from pregnancy-related causes and 86% of these maternal deaths happen in developing countries. In Egypt, the maternal mortality rate is 17/100.000 live births and approximately three quarters of them are considered avoidable. This underscores the importance of implementing measures to improve maternal and newborn outcomes ***(WHO, 2024).*** Additionally, most clinical sites provide prenatal care in an individual approach with centered pregnancy is little known. Therefore, the present study was conducted to investigate the effect of applying centered pregnancy model versus individual prenatal care on maternal and neonatal outcomes.

Aim of the research

The study aimed to investigate the effect of applying centered pregnancy model versus individual prenatal care on maternal and neonatal outcomes.

Research hypotheses

H 1: Pregnant women who receive centered pregnancy model will engage in healthy behaviors than those in individual prenatal care.

H 2: Pregnant women who receive centered pregnancy model will have positive birth outcomes than those in individual prenatal care.

H 3: Pregnant women who receive centered pregnancy model will exhibit higher participation and satisfaction with the model.

Operational definitions:

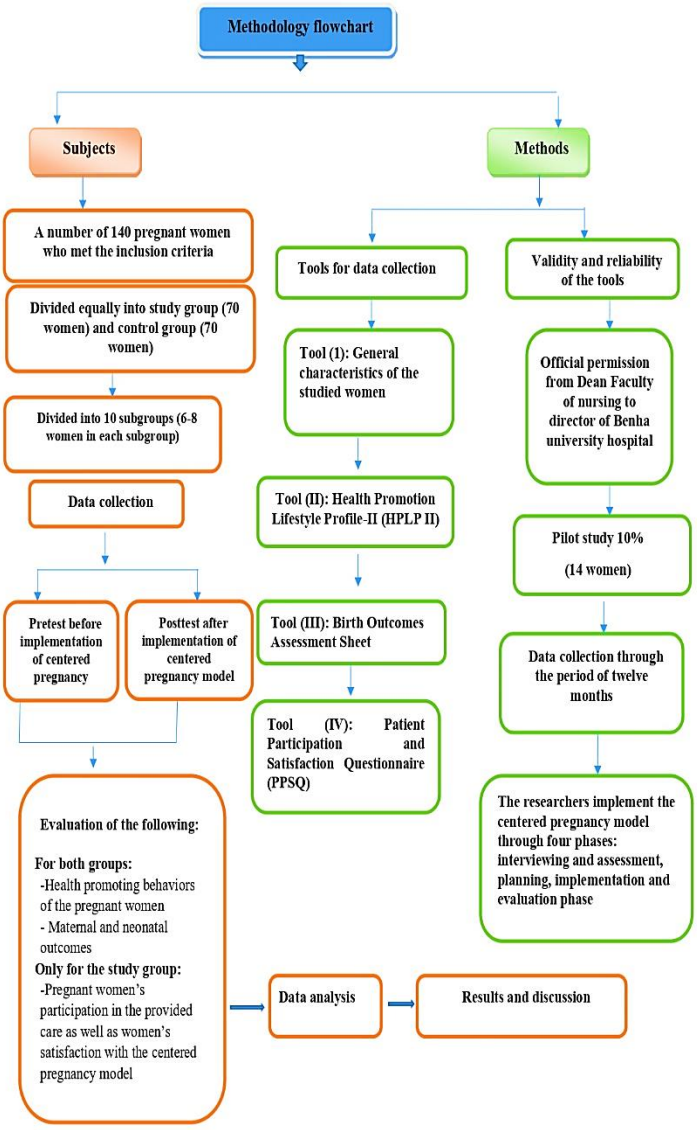
Centered Pregnancy (CP) model: centered pregnancy is a group prenatal care model composed of pregnant women divided into subgroups with similar gestational age who would receive ten educational sessions on healthy behaviors related to pregnancy.

Maternal and Neonatal Outcomes: refers to maternal outcomes after applying centered pregnancy model and including (occurrence of preterm labor, mode of delivery, occurrence of complications during labor or immediate postpartum complications, early initiation of breast-feeding and length of maternal hospital stay) as well as neonatal outcomes including (low birth weight, neonatal admission to intensive care unit or stillbirth baby) and would be monitored after delivery to identify effect of centered pregnancy model.

Subjects and method:

Research design:

A quasi-experimental (non-equivalent groups) study design was used to fulfill the aim of the study. Quasi-experimental studies involve manipulation of independent variables to observe the effect on dependent variables referred to pre-post intervention designs and often used to explore casual relationships. Quasi-experiments may lack the randomization and/or the control group characteristics of true experiments ***(Sharma, 2022).***



Setting:

The research was conducted at the obstetrics and gynecology outpatient clinic in Benha University Hospital. This setting was considered the main governmental hospital at Qaliobeya governorate and surrounding governorates. The clinic included 2 rooms located in the ground floor and provided obstetrics health care services that included antenatal care, care for high-risk pregnancy, family planning counseling and gynecological

checkups. Working hours from 9 Am to 1 Pm except Friday and official holidays.

Sample type:

A purposive sample was used from the above-mentioned research setting.

Sample Size:

A total number of 140 pregnant women were recruited in the current study. Which represented 10 % of the total pregnant women (1400 pregnant women) according to Benha university hospital statistical center in the year of 2022 ***(Benha university hospital statistical center, 2022).*** The centered pregnancy group included 70 women who received the centered pregnancy model in addition to the routine hospital care, the individual prenatal care group included 70 women who received the routine hospital care only.

Inclusion criteria:

Primigravida, singleton pregnancy with gestational age between the 12^{th} and 16^{th} week, low-risk pregnant women without any medical or obstetric complications, can read and write and willing to participate in the study.

Tools of data collection:

Four tools were utilized for collecting data;

Tool (I): A structured interviewing questionnaire: It was constructed by researchers after reviewing a related literatures ***(Ahrne et al., 2023; Gebremariam et al., 2023; Afulani et al., 2021)*** and was written in Arabic language in the form of close-ended questions. It was included general characteristics of the studied women; (age, level of education, occupation and residence) as well as gestational age at enrollment.

Tool II: Health Promotion Lifestyle Profile-II (HPLP II): It was developed by ***Walker et al., (1987),*** and was adapted by the researchers and was translated into Arabic language to assess pregnant women's health promoting behaviors related to pregnancy in the past 2 weeks. The HPLP II was consisted of 43 items divided into five dimensions as follows; health responsibility (9 items), physical activity (7 items), nutrition (11 items), interpersonal relations (8 items) and stress management (8 items).

Scoring system:

Each item was rated based on a three-point Likert scale varying between 3 = often, 2= sometimes and 1 = never. The total HPLP II was scored by summing all items of the dimensions and ranged from 43 to 129 and was measured by the mean score of the responses to all 43 HPLP II items with a higher score indicated a greater engagement in health promoting behaviors. The total HPLP II score was further classified into two levels:

- Healthy behaviors: when the total score was ≥ 60% (77 ≤ 129).
- Unhealthy behaviors: when the total score was < 60% (43 < 77).

Tool III: Birth Outcomes Assessment Sheet:

It was designed by the researchers after reviewing the related literatures (***Crockett et al., 2023; Jones et al., 2023; Moyett et al., 2023)*** to assess the maternal and neonatal birth outcomes. Maternal outcomes included six items (occurrence of preterm labor, mode of delivery, occurrence of complications during labor or immediate postpartum complications, early initiation of breast-feeding and length of maternal hospital stay). Neonatal outcomes included three items (low birth weight, neonatal admission to intensive care unit and stillbirth baby).

Tool IV: Patient Participation and Satisfaction Questionnaire (PPSQ):

The PPSQ is a self-reported questionnaire that was developed by ***Littlefield et al., (1987)*** and was adapted by the researchers and translated into an Arabic language to assess the women’s participation in the provided care as

well as women's satisfaction with the centered pregnancy model. This tool was composed of 16 items divided into two subdimensions. Participation in the provided care (4 items) and satisfaction with the centered pregnancy model (12 items).

Scoring system:

Responses were rated based on a 3-point Likert scale ranging from 3= agree, 2 = neutral and 1 = disagree. The total score was scored by summing all items of the two dimensions and ranged from 16 to 48 with higher scores indicating greater participation and satisfaction with the centered pregnancy model. Total score was classified into:

-High participation and satisfaction when total score was ≥ 75 % (36 ≤ 48).

-Moderate participation and satisfaction when total score was 60% < 75% (29 < 36).

-Low participation and satisfaction when total score was < 60% (16 < 29).

Validity and Reliability of tools:

Tools of data collection were reviewed by a panel of three experts in obstetrics and gynecology nursing to ensure its validity for comprehensiveness, accuracy and relevance. Reliability of the tools was assessed by using Cronbach's alpha coefficient test which indicated that the three tools consisted of relatively homogenous items and were moderate to high reliability. Internal consistency for HPLP II was 0.846, internal consistency for birth outcomes evaluation sheet was 0.811 and internal consistency for PPSQ was 0.875.

Ethical considerations:

Ethical aspects were considered before starting the study as the following: approval of the faculty ethics committee for scientific research was obtained for the fulfillment of the study (code:REC-OBSN-P71). An official permission from the selected study settings was obtained for the fulfillment of the study. The aim of the study was explained to each woman before applying the study. The researchers took oral consent from women to participate in the study and confidentialities were assured. The data was collected and treated confidentially. All women were given the freedom to withdraw from the study at any time without any reason. The study didn't have any physical or psychological risk on pregnant women and the educational booklet was provided to pregnant women in the control group at the end of the study to benefit in subsequent pregnancies.

Pilot Study

The pilot study was conducted on 10% of the total sample (14 women, 7 from each group) to test the clarity, objectivity, feasibility, relevance and applicability of the tools and to find out the possible obstacles and problems that might face the researcher and interfere with data collection. Also, it helped to estimate the time needed for data collection. No modifications were done. So, pregnant women who shared in the pilot study were included in the main study sample.

Field work

The research was carried out throughout the period from beginning of September 2023 till the end of August 2024, covering twelve months. The researchers visited the previously mentioned research setting two days/week (Sunday and Thursday) from 9 Am to 1 Pm. This research was conducted through the following sequential phases:

Interviewing and assessment phase:

At the beginning of the interview the researchers greeted each pregnant woman. The researcher distributed a pre-test of structured interviewing questionnaire to assess general characteristics of women and health promotion lifestyle profile-II to assess health promoting behaviors of the pregnant women.

Planning phase:

Based on the results obtained from pretest assessment of pregnant women and review of relevant literature, the researchers identified the actual needs for pregnant women accordingly, set goals and objectives. An educational booklet with colorful pictures in an Arabic language was constructed by the researchers to improve the pregnant women's health behaviors regarding pregnancy that consequently improved maternal and neonatal outcomes.

Implementation phase:

The individual prenatal care group: was received the routine individual prenatal care with a healthcare provider, there was no a structured plan for the education or skill building. Otherwise, answering any women's questions about pregnancy care as needed.

The centered pregnancy group: implementation of the CP model was carried out at the pre-mentioned setting in an adjacent room prepared with adequate number of seats, data show and supportive materials for providing educational sessions. The pregnant women were divided into ten subgroups, each group included 6-8 women in similar gestational age. The overall sessions were conducted through ten sessions for each subgroup.

First session: the researchers started by an overview of pregnancy and pregnancy trimesters, meaning of antenatal care, importance, types and schedule of antenatal care in addition to routine antenatal investigations.

Second session: the researchers provided the pregnant women with knowledge about physiological changes during pregnancy and minor discomforts in the 1^{st}, 2^{nd} and 3^{rd} trimester.

Third session: the researchers provided the pregnant women knowledge about danger signs during pregnancy that necessitate medical supervision.

Fourth session: this session included knowledge about preparation of delivery with highlighting the advantages and disadvantages of each type.

Fifth session: the researchers trained pregnant women regarding physical assessment such as (measuring blood pressure, blood glucose, weight, fundal height, auscultate fetal heart tones and calculate the expected delivery date using the gestational wheel calculator and check urine for glucose or protein).

Sixth session: in this session the women were trained to count daily fetal movement as well as the practical skills for lifestyle changes during pregnancy such as healthy eating habits, proper weight gain during pregnancy, regular physical activity, enough rest and sleep.

Seventh session: the researchers demonstrated procedures for breast care, appropriate skills for preparing breasts for lactation, breastfeeding technique and positions with highlighting importance of breastfeeding for both mother and newborn.

Eighth session: this session included skills for stress management and effective coping for positive birth outcomes. Some of these skills included positive thinking, re-framing, good assertiveness skills, developing a social support network, humor, relaxation techniques such as (meditation, massage, yoga and imagination) as well as skills for sexual adaptation during pregnancy.

Ninth session: the researcher demonstrated procedures of perineal care as well as parenting skills included eye and cord care for newborn.

Tenth session: this session included skills for facilitating vaginal birth during pregnancy and measures to alleviate labor pain.

Evaluation phase:

For both groups, the researchers used the same format of tools; tool II to assess health promoting behaviors of the pregnant women and was used 2 weeks after applying the centered pregnancy model. Tool III to assess

birth outcomes and tool IV to assess women's participation and satisfaction with the centered pregnancy model were used after delivery to evaluate the effect of the centered pregnancy model. The follow-up care included telephonic contacts to identify the birth outcomes (for women in which the researchers was not able to attend labor).

Statistical design:

Data was verified prior to computerized entry. The Statistical Package for Social Sciences (SPSS version 25) was used followed by data analysis and tabulation. Descriptive statistics were applied (e.g., mean, standard deviation, frequency and percentages). Also, tests of significance, independent t-test, Chi-square test (X^2), Fisher Exact Test (FET) and Pearson correlation coefficients (r) were used to test the study hypotheses.

- No statistically significant difference was considered when P> 0.05.
- A statistically significant difference was considered when P≤0.05.
- A highly statistically significant difference was considered when P≤0.001.

5. Results

Table (1) clarifies that 50% of the centered pregnancy group were in age group 25 < 30 years, while 64.2% of the individual prenatal care group were less than 25 years with a mean age of 25.11 ± 1.84 years and 24.71 ± 1.42 years in the centered pregnancy and individual prenatal care groups, respectively. Concerning level of education, it was clear that 44.3% of the centered pregnancy group had secondary education, while 40% of the individual prenatal care group had university education. According to occupation 55.7% and 68.6% of the centered pregnancy group and individual prenatal care group respectively were working women. Moreover, 51.4% of centered pregnancy groups were lived in urban areas, while 57.1% of the individual prenatal care group were lived in rural areas, respectively. Additionally, there was no statistically significant difference between both groups regarding general characteristics (p > 0.05).

Figure (1) clarifies that there was no statistically significant differences between both groups regarding gestational age with a mean score of 13.73 in centered pregnancy group compared with 14.24 in individual prenatal care group.

Table (2) shows that there was no statistically significant difference in the mean scores of the total health promoting behaviors and related dimensions with a mean score of 65.87 ±10.12 in the centered pregnancy group compared with 63.85 ± 11.07 in the individual prenatal care group before applying centered pregnancy model (p > 0.05). However, after applying the centered pregnancy model there was a highly statistically significant difference of the total health promoting behaviors and related dimensions with a mean score of 112.65 ± 5.65 in the centered pregnancy group compared with 70.40 ± 11.33 in the individual prenatal care group (P ≤ 0.001).

Figure (2) shows that before applying centered pregnancy model 81.4% and 70% in the centered pregnancy and individual prenatal care groups respectively had unhealthy behaviors in relation to total health promoting behaviors. Meanwhile, after applying centered pregnancy model 87.1% of the centered pregnancy group compared to 22.9% of the individual prenatal care group had healthy behaviors in relation to total health promotion lifestyle behaviors.

Table (3) shows that there was a statistically significant difference between centered pregnancy and individual prenatal care groups in relation to all items of maternal birth outcomes with the highest percentages (95.7%, 90.0%) in the centered pregnancy group compared with (84.3%, 77.1%) in the individual prenatal care group in relation to vaginal delivery and early initiation of breastfeeding, respectively after applying centered pregnancy model (P ≤ 0.05). Additionally, the mean score of maternal hospital stay was 3.31 ± 0.79 hours in centered pregnancy group compared with 4.12± 0.91 hours in individual prenatal care group.

Table (4): displays that there was a statistically significant difference between centered pregnancy and individual prenatal care groups in relation to all items of neonatal birth outcomes (low birth weight, neonatal admission to intensive care unit) after applying centered pregnancy model (P ≤ 0.05) except

there was no statistically difference related to item of (stillbirth baby) ($p > 0.05$).

Figure (3): represents that 94.3% of the centered pregnancy group had high participation and satisfaction with the centered pregnancy model.

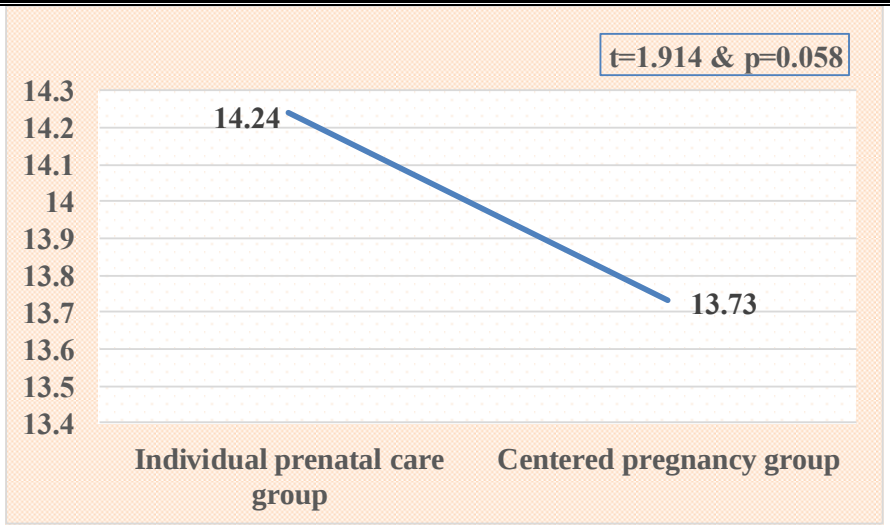
Table (5): clarifies that there was a highly statistically positive correlation between total health promotion lifestyle profile II scores and total patient's participation and satisfaction score after applying centered pregnancy model in the centered pregnancy group ($P \leq 0.001$).

Table (1): Distribution of the studied pregnant women in the individual prenatal care and centered pregnancy groups according to general characteristics (n=140).

Variables \ Groups	Individual prenatal care group n=70		Centered pregnancy group n=70		X^2/ FET	P-value
	No.	%	No.	%		
Age (years)						
< 25	45	64.2	34	48.6		
25 < 30	23	32.9	35	50.0	4.348€	0.114
30 < 35	2	2.9	1	1.4		
Mean ± SD	24.71 ± 1.42		25.11 ± 1.84		t=1.443	0.151
Educational level						
Read and write	6	8.6	4	5.7		
Primary	10	14.3	13	18.6	1.950€	0.583
Secondary	26	37.1	31	44.3		
University	28	40.0	22	31.4		
Occupation						
Working	48	68.6	39	55.7	2.459€	0.117
House wife	22	31.4	31	44.3		
Residence						
Urban	30	42.9	36	51.4	1.032€	0.310
Rural	40	57.1	34	48.6		

€ Fisher Exact Test

t= independent t-test



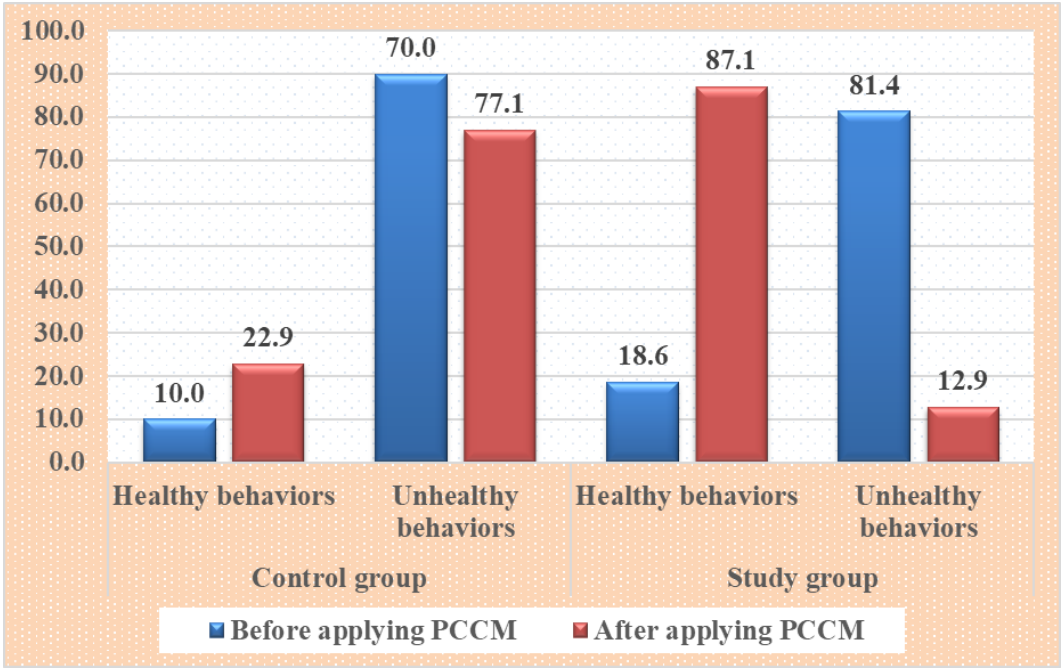
t= independent t-test

Figure (1): Mean gestational age of the studied pregnant women in the individual prenatal care and centered pregnancy groups (n=140).

Table (2): Comparison of mean subtotal and total health promotion lifestyle behaviors scores before and after applying centered pregnancy model in the individual prenatal care and centered pregnancy groups (n=140).

Dimensions	Possible score	Phases	Centered pregnancy group n=70	Individual prenatal care group n=70	Independent t-test	P-value
			Mean ± SD	Mean ± SD		
Health responsibility	27	Before applying CPM	12.51 ± 2.10	12.23 ± 1.97	0.829	0.409
		After applying CPM	13.27 ± 2.16	25.10 ± 1.87	34.550	0.000**
Physical activity	21	Before applying CPM	9.07 ± 1.75	9.61 ± 1.85	1.733	0.085
		After applying CPM	10.00 ± 1.94	16.38 ± 1.56	21.387	0.000**
Nutrition	33	Before applying CPM	18.17 ± 4.46	19.31 ± 5.21	1.394	0.165
		After applying CPM	20.08 ± 5.47	29.75 ± 2.93	13.022	0.000**
Interpersonal relations	24	Before applying CPM	12.56 ± 2.51	12.81 ± 2.76	0.576	0.565
		After applying CPM	13.82 ± 2.61	20.15 ± 1.98	16.228	0.000**
Stress management	24	Before applying CPM	11.53 ± 2.04	11.91 ±1.99	1.136	0.258
		After applying CPM	13.22 ± 2.53	21.26 ± 1.54	22.634	0.000**
Total	129	Before applying CPM	63.85 ± 11.07	65.87 ±10.12	1.124	0.263
		After applying CPM	70.40 ± 11.33	112.65 ± 5.65	27.899	0.000**

**A high statistical significance difference (P ≤ 0.001). CPM: Centered Pregnancy Model



CPM: Centered Pregnancy Model

Figure (2): Distribution of the studied pregnant women according to total health promotion lifestyle behaviors score in the individual prenatal care and centered pregnancy groups (n=140).

Table (3): Distribution of the studied pregnant women in the individual prenatal care and centered pregnancy groups according to maternal outcomes (n=140).

Groups / Variables	Individual prenatal care group n=70		Centered pregnancy group n=70		X^2/ FET	P-value
	No.	%	No.	%		
Preterm labor						
Yes	8	11.4	2	2.9	3.877€	0.049*
No	62	88.6	68	97.1		
Mode of delivery						
Vaginal delivery	59	84.3	67	95.7	5.179€	0.024*
Cesarean section delivery	11	15.7	3	4.3		
Occurrence of any complications during labor						
Yes	13	18.6	5	7.1	4.080	0.043*
No	57	81.4	65	92.9		
Complications during labor						
Prolonged labor	7	53.8	1	20.0		
Abnormal uterine contraction	4	30.8	0	0.0	6.992€	0.030*
Perineal lacerations	2	15.4	4	80.0		
Occurrence of any complications during postpartum						
Yes	9	12.9	1	1.4	6.892€	0.009*
No	61	87.1	69	98.6		
Complications during postpartum						
Postpartum hemorrhage	6	66. 7	1	100.0	0.760€	0.383
Deep venous thrombosis	3	33.3	0	0.0		
Early initiation of breastfeeding						
Yes	54	77.1	63	90.0	4.214	0.040*
No	16	22.9	7	10.0		
Length of maternal hospital stay (hours)						
Mean ± SD	4.12± 0.91		3.31 ± 0.79		t=2.903	0.006*

*A statistically significant difference (P ≤ 0.05) € Fisher Exact Test t= independent t-test

Table (4): Distribution of the studied pregnant women in the individual prenatal care and centered pregnancy groups according to neonatal outcomes (n=140)

Groups / Variables	Individual prenatal care group n=70		Centered pregnancy group n=70		X^2/ FET	P-value
	No.	%	No.	%		
Low birth weight						
Yes	6	8.6	1	1.4	4.150€	0.042*
No	64	91.4	69	98.6		
Neonatal admission to intensive care unit						

Yes No	4 66	5.7 94.3	1 69	1.4 98.6	1.867[€]	0.172
Stillbirth baby						
No	70	100.0	70	100.0	-	-

***A statistical significance difference (P ≤ 0.05)** **[€] Fisher Exact Test**

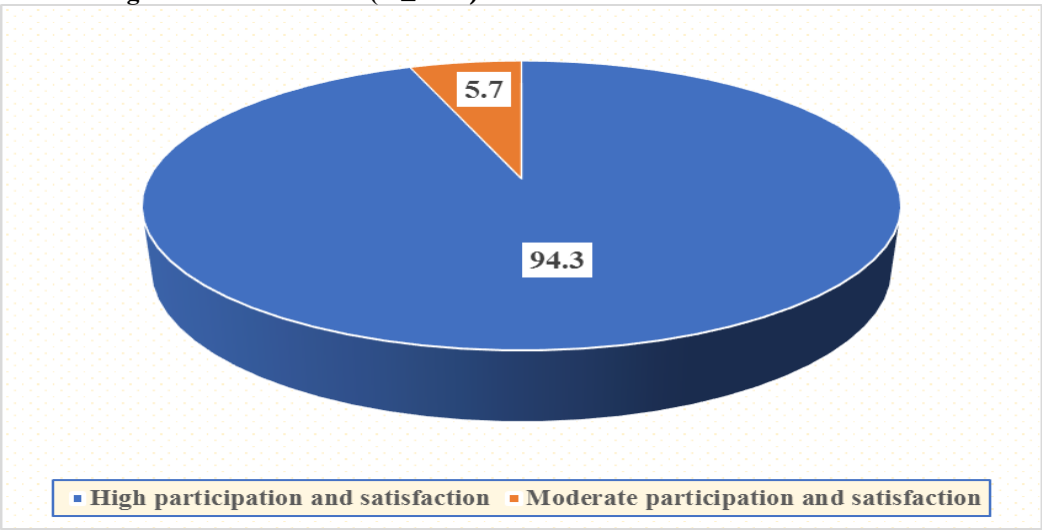


Figure (3): Percentage distribution of the pregnant women in the centered pregnancy group according to woman's participation and satisfaction with the centered pregnancy model (n=70).

Table (5): Correlation coefficient between health promotion lifestyle behaviors scores and patient's participation and satisfaction with the provided care after applying centered pregnancy model in the centered pregnancy group (n=70)

Variables	Total patient's participation and satisfaction score	
	r	p
Total Health Promotion Lifestyle behaviors score	**0.538**	**0.000****

****A high statistically significant correlation (P ≤ 0.001)** **r: Pearson correlation coefficient**

Discussion

Centered pregnancy model is the most popular group prenatal care model which seeks to address the shortcomings of traditional prenatal care by bringing women out of examination rooms into care groups as an attempt to bring the focus from the caregiver to the women (***Masters et al., 2024).***

Centered pregnancy model focuses on increasing contact time with the care provider, providing unique opportunities for expanding knowledge, building skills, receiving reassurance, developing relationships with other expecting mothers and health care providers ***(Wiseman et al., 2024).***

According to general characteristics of the studied sample, the results of the current study showed that half of centered pregnancy group were in age group 25 < 30 years and less than two thirds of individual prenatal care group were less than 25 years with a mean age of 25.11 ± 1.84 years and 24.71 ± 1.42 years in the individual prenatal care and centered pregnancy groups, respectively. Concerning level of education, it was clear that more than

two fifths of centered pregnancy group had secondary education and two fifths of the individual prenatal care group had university education.

According to occupation more than half and more than two thirds of the centered pregnancy and individual prenatal care groups were employee, respectively. Moreover, more than half of centered pregnancy groups were lived in urban areas, while slightly less than three fifths of the individual prenatal care group were lived in rural areas. Additionally, there was no statistically significant difference between both groups regarding general characteristics ($p > 0.05$) that reflected groups homogeneity.

This result is similar to ***Momodu et al., (2024)*** in Carolina, United States and reported that nearly third of study and control groups were in the age group 25–29 years. These results also come in the same line with ***Chen et al., (2024)*** in China and stated that more than half of pregnant women had university education.

These results are nearly similar to ***Hamza et al., (2022)*** in Egypt and found that majority of women aged >20 - < 35, more than half lived in rural areas and more than three fifths had university education. Additionally, this result is nearly similar to a study carried out in Egypt by ***Khalil et al., (2023)*** and revealed that almost two thirds of pregnant women live in rural communities with no statistically significant difference regarding general characteristics.

In relation to gestational age there was no statistically significant differences between centered pregnancy and individual prenatal care groups regarding gestational age with a mean score of 13.73 in centered pregnancy group compared with 14.24 in individual prenatal care.

This result is nearly similar to ***Swift et al., (2021)*** in Iceland, Europe and showed that there was no statistically significant differences between study and control groups regarding gestational age with a mean score of 17.9 in study group compared with 14.3 in control group.

Concerning health promotion lifestyle behaviors, the results of the current study revealed that the majority and more than two thirds of centered pregnancy and individual prenatal care groups respectively had unhealthy behaviors during pregnancy before applying centered pregnancy model. While, the majority of the centered pregnancy group compared to more than one fifth of the individual prenatal care group had healthy behaviors during pregnancy in relation to (health responsibility, physical activity, nutrition, interpersonal relations and stress management) after applying centered pregnancy model.

This result may be due to the centered pregnancy model tailored education which included sessions specifically focused on the health behaviors during pregnancy. Combination of knowledge, skills, motivation, and social support contributed to the observed significant improvements in health behaviors.

This result is supported by ***Tsiamparlis-Wildeboer et al., (2023)*** in Netherlands and proved that centering pregnancy support health responsibility and women exhibit autonomy on health behaviors changes than women in individual appointments with a statistically significant difference ($p \leq 0.05$). This result also in the same line with ***Lazar et al., (2021)*** in London and clarified that centered pregnancy increased health responsibility and improved health-promoting behaviors of pregnant women.

Moreover, this result is nearly similar to the study carried out by ***Wagijo et al., (2023)*** who revealed that women participating in centered pregnancy have an increased healthy eating, drinking enough fluids and

regular physical activity, consume less coffee, alcohol and lower smoking rates at six weeks postpartum compared to women in the individual prenatal care.

This result is congruent with a study carried out by ***Wagijo et al., (2022)*** who reported that most women undergo centered pregnancy model had higher scores on healthy lifestyle including healthy eating habits and regular physical activity. Also, these results are supported by ***Wiseman et al., (2022)*** in London and concluded that centered pregnancy offers opportunities for emotional support and stress management as the most effective elements of the model.

In relation to maternal birth outcomes, the results of the current study showed that there was a statistically significant difference between centered pregnancy and individual prenatal care groups in relation to all items of maternal birth outcomes after applying centered pregnancy model with lower rates of preterm labor, cesarean section delivery, complications during labor, complications during postpartum, shorter length of maternal hospital stay as well as early initiation of breast feeding in centered pregnancy group compared with individual prenatal care group.

These results are in accordance with ***Wagijo et al., (2024)*** in Netherlands and stated that primigravida women participating in group prenatal care at lower risk of having adverse maternal outcomes and have higher breastfeeding rates compared with women receiving individual prenatal care.

As well as, the findings of the current study are agreed by ***Short et al., (2024)*** in America and showed that increased rates of early breastfeeding initiation and postpartum visit attendance at 1–2 weeks and 4–8 weeks with fewer postpartum depression symptomatology were observed in the study group compared with control group.

The results of current study are also accepted by ***Chen et al., (2024)*** who found that the group prenatal care model enabled the majority of study group to maintain early initiation and exclusive breastfeeding rates at 6 weeks and 6 months postpartum.

In addition, the result of a study conducted by ***Gray et al., (2024)*** in Florida, United States also reported that maternal outcomes, breastfeeding intention, competence and motivation was higher among women receiving group antenatal care than control group.

These results are congruent with ***Heberlein et al., (2020)*** in United States and proved that centered pregnancy model is associated with decreased rates of cesarean section delivery and higher breastfeeding rates at hospital discharge for women in study group compared to control one.

Additionally, these results agreed with ***Moyett et al., (2023)*** in United States and demonstrated that centered pregnancy model improved maternal, neonatal, perinatal and postpartum outcomes compared with traditional care.

According to neonatal birth outcomes, the results of current study showed that there was a statistically significant difference between centered pregnancy and individual prenatal care groups in relation to all items of neonatal birth outcomes after applying centered pregnancy model with decreased rates of low birth weight and neonatal admission to intensive care unit, except there was no statistically significant difference related to item of (stillbirth baby).

This result may be due to the centered pregnancy model encouraged active participation making women more likely to monitor important health indicators during antenatal care visits such as blood pressure,

weight gain and identify risks early for timely interventions of issues such as anemia or inadequate weight gain which helped to prevent adverse neonatal outcomes.

This result is in accordance with ***Crockett et al., (2023)*** in California, United States and found that increased participation in group prenatal care was associated with improved birth outcomes especially lower rates of preterm birth and low birth weight neonates.

Moreover, these results are congruent with ***Heberlein et al., (2024)*** in Europe and stated that women in group prenatal care was associated with a lower risk of neonatal intensive care unit admissions and reduced risk of preterm birth. Also, ***Moyett et al., (2023)*** mentioned that centered pregnancy improved perinatal outcomes for preterm birth and low birth weight.

In addition, the findings of the current study are supported by a study carried out in Nigeria by ***Peterkin et al., (2024)*** and reported that centered pregnancy was effective strategy to improve maternal and neonatal birth outcomes. Also, this result is congruent with ***Heberlein et al., (2020)*** who reported decreased rates of neonatal intensive care unit admission, preterm and low birth weight neonates.

In relation to participation and satisfaction with the centered pregnancy model, the results of the current study showed that most of the centered pregnancy group had high participation and satisfaction with the centered pregnancy model. *This may be due to* the group sessions encouraged active involvement in care, empowered women to voice own preferences and opinions and fostered collaboration with healthcare providers. Also, the combination of enjoyable group dynamics, increased knowledge and preparedness, strong peer support, trust and a comprehensive approach which addressed women's expectations and needs likely contributed to the high levels of satisfaction reported by the centered pregnancy group.

These results come in the same line with ***Spiby et al., (2022)*** in England and proved that group prenatal care increased women's satisfaction level, higher confidence, enabled women to feel well prepared for labor and more reassured, also increased social support alleviated women's fears. Additionally, this result is in accordance with ***Martens et al., (2022)*** in Netherlands and showed that increased satisfaction level, greater empowerment, increased social support and increased self-efficacy**.**

Concerning correlation between total health promotion lifestyle behaviors scores and patient's participation and satisfaction with the model, the findings of the current study clarified that there was a highly statistically positive correlation between total health promotion lifestyle behaviors scores and total patient's participation and satisfaction score after applying centered pregnancy model in the centered pregnancy group.

This result may be due to better understanding of health behaviors, empowering women to take an active role in health promoting behaviors related to pregnancy. This active engagement leading to higher participation and satisfaction levels.

This result is approximately similar to the results of ***Masjoudi et al., (2022)*** in Iran and showed that there was a significant positive correlation between health-promoting behaviors with social support ($r = 0.427$, $p < 0.001$) and satisfaction ($r = 0.246$, $p = 0.001$). Also, social support had a significant positive association with satisfaction ($r = 0.184$, $p < 0.001$).

Also, this result is nearly similar to ***El Sayed and Abd-Elhakam (2018)*** in Egypt and pointed that there was a highly statistically significant positive correlation between total prenatal health behaviors and pregnancy-related empowerment scores between the centering pregnancy and individual prenatal care groups pre and after intervention ($P \leq 0.001$).

Conclusion:

Based on the results of the current study, it was concluded that; centered pregnancy model was effective on improving health behaviors during pregnancy and positive maternal and neonatal outcomes. Maternal birth outcomes there were; lower rates of preterm labor and cesarean section delivery, shorter length of maternal hospital stay and early initiation of breast feeding. As well as neonatal birth outcomes there were; decreased rates of low birth weight and neonatal admission to intensive care unit in centered pregnancy group compared with individual prenatal care group. Moreover, most of women in the centered pregnancy group had high participation and satisfaction with the centered pregnancy model. Therefore, the study hypotheses were supported and the study aim was achieved.

Recommendations:

- Implementation of centered pregnancy model as a standard practice for improving maternal and neonatal outcomes.
- Dissemination of the booklet and posters regarding centered pregnancy to educate pregnant women about the benefits of centered pregnancy care to improve health behaviors and birth outcomes.

Further studies:

- Future research is crucial to conduct a similar study on a larger sample size in different clinical settings for generalization of the findings**.**
- Promoting interdisciplinary collaboration between nurses and obstetricians to enhance the overall quality of care in centered pregnancy model.

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