PROTECTIVE BEHAVIORS OF PREGNANT WOMEN TOWARDS CLIMATE CHANGE

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Abstract:

Background: Climate change considered one of the most important issues in Egypt and worldwide. It represents a significant worldwide health issue that has rapidly moved to the forefront of the global health agenda. It is essential to use carefully designed narrative messages to inform expectant mothers about their vulnerabilities to the adverse health effects of climate change, and help encourage and enable women to take proper protective behaviors**. Aim of the study**: Evaluate the effect of narrative information on knowledge, and protective behaviors of pregnant women toward climate change. **Research design:** Quazi experimental design was adopted to conduct this study. **Setting:** The study was carried out at family planning and antenatal care unit in outpatient clinic, at Zagazig University Hospital. **Subjects:** Purposive sample of 60 pregnant women. **Tools of data collection**: Five tools were used for data collection. **Tool I**: A structured interviewing questionnaire, **Tool II**: The women's Knowledge questionnaire about climate change, **Tool III**: Protective behaviors related to climate change scale, and **Tool IV**: Narrative information for pregnant women toward climate change. **Results**: A highly statistically significant difference was found regarding the total mean scores for protective behaviors of pregnant women related to climate change across two domains: mitigation of exposure to heat waves and air pollution, before and after a study intervention. The total mean score for all adaptive behaviors increased from 48.98 ± 6.23 before the intervention to 78.16 ± 3.82 after the intervention. In addition, there was a positive correlation coefficient, with a statistically significant between knowledge and Preventive behavior in pre- & post-intervention with (r =0.275), p (0.033*). **Conclusion:** It was concluded that, narrative information significantly improves the knowledge, and protective behaviors scores of pregnant women towards climate change throughout the study phases. **Recommendations:** Educational training and communication activities about climate change and its effect on pregnancy should be conducted for pregnant women using narrative messages

Keywords: ***Narrative, Knowledge, Health Beliefs, Protective Behaviors, Climate Change***

Introduction

Climate change is arguably the biggest global health crisis that affects the health of women and has implications for the health of future generations. It is recognized as one of the greatest health threats and global challenges in the 21st century, according to the World Health Organization (WHO). Currently, the rhetoric is changing from climate change to the climate crisis, as it is causing multiple health challenges ***(Yeboah, et al., 2024).***

One of the biggest worldwide health concerns of the twenty-first century, it has both short-term and long-term effects on the most vulnerable groups, particularly in the least developed nations that are least able to adapt to climate change ***(Roos, et al.,2021).***

It affects maternal and perinatal health via several mechanisms as the pregnancy and neonatal periods are characterized by physiological and anatomical changes which decline the ability to thermoregulation ***(Pandipati et al., 2023).*** Gestational heat exposure is a well-established teratogen in human pregnancies. It can cause dehydration and kidney failure in pregnant women. They are also more prone to heat exhaustion and heat

stroke. In addition, it has been associated with intrauterine growth restrectin, preterm birth, and infant mortality **(*Lusambili, & Nakstad, 2023).***

Moreover, Severe heat can cause high blood pressure and even preeclampsia, which can reduce blood supply to the placenta by rerouting blood flow for more urgent needs. Fetal development may be impacted as a result of this as the fetus's oxygen levels may drop ***(Moffett et al., 2022).***

The dangerous chemical substances in the air that a pregnant woman breathes in are extremely dangerous to the growing fetus. Through the pulmonary alveoli, hazardous substances found in PM2.5 (particulate matter less than 2.5 μm in diameter) enter the exposed woman's bloodstream, travel to the placenta, and enter the fetal circulation, where they have a harmful effect on the fetal cells ***(UNEP 2022).***

To prevent un favorable health consequences, more research is essential to define vulnerable populations, fill knowledge gaps, and implement strategies for heat prevention and mitigation. Clinicians mostly evaluate women during periods of climate exposure, with a significant opportunity for timely education that can decrease morbidity and mortality. ***(Atwoli et al., 2023).***

Through There is a wealth of study in the humanities and health fields that examines the rhetorical use of storytelling in environmental narratives and the rising interest in how they may serve as forms of evidence in climate change research. Stories encourage experiential processing rather than analytical processing ***(Ma, et al 2024).***

While knowledge may be important for elevating concern about climate change, narratives may be particularly suited because they may reduce counterarguing. Providing educational materials to pregnant women in this format may yield improved communication of clinically important climate information ***(Sbiroli, et al 2022).***

The goal of heat wave adaptation is to lessen the negative effects on human health by making people less susceptible to the extremes of heat waves. Certain health adaptation strategies, such raising women's knowledge and awareness of the negative health effects of heat waves and reflecting this information in their actions and practices during heat waves, can forecast and avoid these negative health outcomes ***(Sayili, et al, 2022).***

Significance

Climate communication research suggests that climate change messages can affect risk perceptions, and behavioral intentions ***(Ashley et al., 2022).*** Thus, educating expectant mothers about their and their unborn child's susceptibilities to the detrimental health impacts of climate change through the use of narrative messages that are well-formatted ***(Shaffer et al., 2018).*** Only one study until now tests educational methods intended to improve pregnant women's understanding of their risk and give them risk-protective behaviors using the narrative approach ***(Adebayo et al., 2020).*** For that the current study will be conducted to fill this gap by evaluating the effect of narrative information on knowledge, and protective behaviors of pregnant women towards climate change.

Aim of the study:

The present study aims to evaluate the effect of narrative information on knowledge, and protective behaviors of pregnant women towards climate change.

Such aim will be achieved through the following objectives:

1. Assess pregnant women's knowledge of climate change.
2. Identify the narrative information effect on protective behaviors of pregnant women towards climate change.
3. Design, implement and evaluate the narrative information effect on knowledge, and protective behaviors of pregnant women towards climate change.

Research hypothesis:

Knowledge, and protective behaviors of pregnant women towards climate change will be improved after the application of a narrative information.

Subjects and Methods:

A-Technical Design

It involved the description of the research design, setting, sample, and data collection tools.

Research design:
Quazi experimental design (pre & posttest) applied to investigate the current research problem.

Study Setting:
This study was carried out at Zagazig University Hospital's family planning and prenatal care section at the outpatient clinic. The location was selected because it served as Zagazig's primary health facility, where women went to get ANC treatments and education. This facility is located at the outpatient clinic's second level. This unit is located next to the gynecological unit and is open every day from 9 am to 1 pm. It has a big room for examinations and a small room for the nurse.

Study Subject
60 pregnant women from the above-mentioned setting eligible for this study who fulfilled the following criteria:

- Pregnant women who free of any medical or psychiatric disorders.
- Women who can read & write.
- Women who are willing to participate in the study.

Calculation of the sample size:
The sample size needed was 60 women plus 10% of women for the pilot study. The pilot study is excluded so the total sample size was 60 women. Sample size calculated using G*power free software. We estimated an effect size of 0.66 on the knowledge mean score in the intervention group compared with the control. Thus, with the power of 95% at α error 0.05. the required sample size is 60 pregnant women ***(Adebayo et al., 2020).***

Tool for data collection:
Five tools were used to collect the necessary data in order to fulfill the objectives of the study:

Tool I: A structured interviewing questionnaire sheet. The researcher created it in Arabic to gather the information required to meet the study's goals. It was consisting of two parts:

Part 1: Demographic characteristics of the study sample: It composed of 4 questions (Question 1-4) (Age of subjects, education level, residence and occupation).

Part 2: This part included questions that cover the obstetric history which include (present and previous obstetric history)

Present obstetric history: it composed of 1 questions(Question5) which includes the gestational age of the present pregnancy

Previous obstetric history is composed of 3 questions (Questions 6-8) number of gravida, number of parity, and mode of delivery.

Tool II: The pregnant women's Knowledge questionnaire about climate change and its effect on the pregnancy and the fetus
The researcher developed it in simple Arabic language to collect the necessary data to assess the women's knowledge about climate change and its effect on the pregnancy and the fetus. It is composed of 13 questions (Questions 9-22) divided into 2 types of questions as the following:

1. Yes, no, and I don't know question: it involved 3 questions (9-11), related to the heat waves and their effect on the fetus and pregnancy and another 3 questions (12-14) about the impact of the air pollution on the fetus and pregnancy.
2. MCQ question: it involved 7 questions (15-22), about the definition of climate change, the risk of heat waves on pregnant women, the risk of heat waves on the fetus, the negative effects of exposure to air pollution on pregnancy, long-term effects on offspring resulting from maternal exposure to heat stress, adaptive behavior to mitigate the maternal and fetal risk of exposure to air pollution, and the adaptive behavior to mitigate the risk of exposure to extreme heat.

Scoring system of women knowledge
Each item was assigned: a score (1) given when the answer was correct, while a score (0) was given when the answer was wrong or don't know.

Total knowledge regarding climate change and its effect on the pregnancy was calculated as:
Total degrees=13
Satisfactory score ≥ 60%
Unsatisfactory <60%

Tool III: Protective behaviors related to climate change scale The scale measured how often the Participants undertook several behavioral adaptations during a heat wave. Adapted from ***(Derick et al 2013)***, and modified by the researcher. The entire scale includes 30 items and is divided into 2 parts, the first part includes 20 statements assessing the protective behaviors of the women related to the heat waves for example: Drinking plenty of water to stay hydrated, listening to daily weather forecasts, etc.

The second part includes statements assessing the protective behaviors of women related to air pollution for example download a free air quality app on the phone to check the air quality, and stay indoors as much as possible when the air quality is bad outside.

Scoring system of pregnant women's protective behaviors:

The statements related to protective behaviors have the scores and response choices (1 = Never, 2 = Sometimes, 3 = Always).

Total score of Protective behaviors related to climate change scale

Total degrees=93

positive score ≥ 60%

negative score <60%

Tool IV: Supportive material (Narrative information book for pregnant women towards climate change).

Developed by the researcher from the recent related literature and after reviewing the Environmental Protection Agency's (EPA) brochure (**EPA Climate Change and Health Fact Sheets, 2019).** It developed in a simple Arabic language. After reviewing the brochure to identify the important factual information conveyed in the modified brochure. It designed in a form of a full-color image book. The characters in the book are a pregnant woman (the main character), her nurse, her child, and one of her friends. The story presents her interactions with other charchters. During these interactions, she learns about the maternal and fetal health risks of climate change from the nurse and shares the information with her child and friend thereby it effect modeling the recommended behavior, which should increase the reader's sense of self-efficacy.

B) Operational design:

The operational design of this study includes the description of the preparatory phase, the validity of the tools, reliability, pilot study, fieldwork, and ethical considerations.

Preparatory phase:

Using books, papers, the internet, journals, and scientific publications, a survey of relevant material from the past and present as well as theoretical understanding of different research components was conducted. This was necessary for the research problem to develop the structured interview questionnaire and the educational narrative book.

Content of validity and reliability:

Validity of the tools:

Three experts—one from the nursing administration department, one from the community health nursing department, and one from the gynecological and obstetric health nursing department—formed a jury to evaluate the tools' content validity. These professionals evaluated the tool's comprehension, application, comprehensiveness, clarity, and relevance. Every suggested change to the tools was made. The guidebook was rewritten and verified by the same specialists who validated the instrument. All suggested changes were implemented.

Reliability of the tools:

Scale	Cronbach's Alpha	No. of tems
pregnant women's Knowledge questionnaire about climate change and its effect on pregnancy and the fetus	.735	3
Health Beliefs Model for pregnant women about climate change	.944	49
Protective behaviors related to climate change scale	.755	30

Pilot study

Prior to conducting the main study, a pilot study was conducted to evaluate the tools' viability and clarity. Ten percent (6) of the sample size used in the primary study met the requirements. A month before the data collection, this pilot research was carried out. It was useful in estimating how long

it would take women to complete the study's instruments. Following the pilot research, it was discovered that the tool's questions were pertinent and understandable, however certain wording needed to be changed for clarity. The primary study sample did not include the pilot sample participants.

Fieldwork:

To fulfill the aim of the study, the following phases were adopted and carried out: assessment, planning, implementation, and evaluation.

The data collection was done first using the interview questionnaire sheet, the researcher explained the purpose of the study to the pregnant women, and their agreement to participate was obtained orally, the activity took place in the mentioned setting in the waiting area. The sample was selected from the antenatal care unit from 9 am to 1 pm. The questionnaire sheets were filled out by the researcher by asking the women. The time spent with each participant to be interviewed is approximately 30 minutes. The study was done during the period from May 2024 to October 2024. An educational narrative book was developed based on an actual educational needs assessment of the subjects. It was developed by a researcher in light of available research and literature. It covers the relevant theoretical aspects of climate change overview, management, and control. It was applied as follows:

Assessment phase:

It was the first phase that achieved after obtaining consent in the study setting. Women were given plenty of time to answer questions in the questionnaire if they intended to take part in the study. The questionnaire took an average of 15 to 20 minutes to be completed. The replies that each participant provided were only accessible to the researcher. where the pregnant woman needs of knowledge, health beliefs, and protective behaviors regarding climate change were identified in (pre-test). This helped the researcher to become acquainted with the magnitude of the issues and guided them in developing the appropriate data collection tools. Thus the development of the program was partially built.

Planning phase:

Based on the findings from the assessment phase, the researcher created the intervention program and the session content to address the requirements of the women who were identified and to take into consideration relevant literature. Identified needs, and deficiencies in knowledge, health beliefs and protective behaviors regarding climate change were translated into aim and objectives of the narrative book.

Description of the program:

Determine the main aim and objectives was the first step in developing this program. These objectives were derived from the assessed needs of the sample. The program was set in one main session.

General objective of the program:

To improve pregnant women's knowledge and protective behaviors toward climate change.

Specific objectives:

At the end of the self-reading of the narrative book, the women should be able to

- Define climate change
- Enumerate the causes of climate change
- Explain how climate change (heat waves/ air pollution affect pregnant women.
- List the adverse effects of (heat waves/ air pollution) on the fetus.
- Identify the adaptive behavior against the heat waves
- Enumerate the adaptive behavior against air pollution.

Note: The program consisted of two session

Initial session: After finishing the pretest, the researcher sat with each woman separately and briefly introduced the research using a narrative teaching technique to ensure comprehension and engagement.

Second session: Facilitate a discussion then address any questions or concerns.

- Deciding whether to give the study sample a narrative book to read themselves or to read it to them or even use the hybrid approach depends on several factors related to the research objectives, the characteristics of the study women, and the context in which the study is conducted. Here are some considerations to help the researcher decide the best approach:
- **Factors to Consider**

Literacy Levels and Reading Ability

Comprehension and Engagement

Time Constraints

Hybrid Approach

The researcher used the hybrid approach, it considered a combination of both: For example, the researcher started with a reading session to introduce the material and ensure the woman understands the key points, then allow her to continue reading on her own with the option to ask questions in follow-up sessions.

- **The researcher implements this approach as the following:**

1. Initial Session:

- Read the first few pages aloud.
- Facilitate a discussion to ensure comprehension and engagement
- Address any questions or concerns.

2. Individual Reading:

- Provide the rest of the book for the participant to read on her own.
- Provide supplementary materials like glossaries or summaries if the text is complex.
- Set a timeline for completion and offer support if needed.

3.Follow-Up Session: Reconvene the women to discuss the book for discussion and clarification.

Implementation phase

This study included pregnant women who went to the prenatal clinic for a check-up during their pregnancy to manage their pregnancy issues. - The researchers conducted two or three interviews per day with women who met the inclusion criteria (two days per week). Two to three women were interviewed daily (4-6 women per week). The women received a narrative information book from the researcher in the antenatal care unit, the researcher met each woman separately. The average length of this conversation was about 30 minutes per each woman. The interview started with, a kind greeting, a brief introduction of the researchers and a clarification of the objectives of the study and the teaching strategy that will be used. Before providing information about climate change and its effects using the narrative method, the researchers evaluated the pregnant women's understanding of the topic and its impact on their developing fetus. The researcher started with reading, to introduce the material and ensure the woman understood the key points, then allowed her to continue reading on their own and allow her to ask questions .

The comic book's main characters were a pregnant woman, her husband, their child, and her friend. The narrative illustrated the interactions with the nurse, her child, her friend, and her husband. The nurse informed her about the risks that climate change poses her and her fetus health through these encounters, and she shared this knowledge with her kid and friend. The mother also counseled her child to avoid engaging in risky activities.

N.B: Narration, is a time-honored technique for oral conveyance of knowledge, aided pregnant women in learning rapidly by making the subject matter attractive and simple to understand. The researchers use narrative teaching to present stories about climate change and its impact on pregnant women and their growing fetus. It involves integrating narratives or stories into lessons to make content more engaging and relatable. Here are some key aspects:

1. Engagement: Stories capture women's attention and make learning more interesting, which can increase motivation and participation.
2. Relatability: Narratives can help subjects connect new information to their own experiences, making it easier to understand and remember.
3. Context: Stories provide a context for facts and concepts, helping women see how information fits together and applies in real-world situations.
4. Memory: Humans are naturally inclined to remember stories better than isolated facts. Using narratives can improve retention of information.
5. Emotional Connection: Stories often evoke emotions, which can deepen learning and make it more meaningful.
6. Critical Thinking: Analyzing stories can develop critical thinking skills as subjects interpret, question, and draw conclusions from the narrative.

- After the session, the narrative book has been kept with the pregnant women and the researcher remained in touch with her, to

answer her quires and obtain the posttest in her next visit.

Evaluation phase

Data regarding the knowledge, health beliefs, and protective behaviors of pregnant women towards climate change were collected from the women at two points the first is in the assessment phase (pretest). The second at the evaluation phase at her next visit in order to evaluate the effect of the narrative information program, the post-test was administered after women finished the reading of the narrative book. to determine women's familiarity with the recommendations and evaluate how well the pregnant women understood climate change and how it affected the development of their fetuses. The same tools used in the pre-test were re-used.

Ethical consideration and administration: -

***Ethical consideration:**

The Zagazig University Faculty of Nursing's scientific and ethics committee was the driving force behind ethical clearance (M.D.ZU.NUR/130/13/7/2023). Before using the instruments, each lady was shown the purpose of the research. Each woman who consented to participate in the study gave her oral agreement after being assured that the information gathered would be kept private. The women were made aware of their freedom to leave the study at any moment and without explanation.

Administrative design.

An official letter from the dean of Zagazig University's Faculty of Nursing to the dean of the Faculty of Medicine and subsequently the Institutional Review Board (IRB) unit was sent in order to gain formal approval to gather data and carry out the educational program. The researcher met with the participants and had conversations with them to inform them about the objective of the educational program, concerning the ethical considerations.

Statistical design

By using SPSS 20.0 for windows (SPSS Inc., Chicago, IL, USA 2011)) all data were collected, tabulated and statistically analyzed. Quantitative data were expressed as the mean ± SD and qualitative data were expressed as absolute frequencies (number) & relative frequencies (percentage). Marginal homogeneity or Mc nemar test was adopted to compare between two dependent groups of categorical data. Usage of Paired t-test to compare between two dependent groups of normally distributed variables. While, usage of Wilcoxon Signed Ranks Test to compare between two dependent groups of not normally distributed variables. Percent of categorical variables were compared using Chi-square test or Fisher's exact test appropriately. Person correlation coefficient was calculated to assess relationship between study variables, (+) sign indicate direct correlation & (-) sign indicate inverse correlation. To predict factors which affect knowledge, heath beliefs and attitude scores Multiple linear regression (step-wise) was also used. Cronbach alpha coefficient was calculated to assess the reliability of the scales through their internal consistency. P-value < 0.05 was considered significant statistically, p-value < 0.01 was considered highly statistically significant, and p-value ≥ 0.05 was considered statistically non-significant

❖ **Results:**

Table 1 illustrates that 45% of the studied women their age was 25-<30 years and the mean of age was 26.74±3.93 years, as regards to the educational level it was obvious that 53.3% of the studied women have Secondary school. The same table reveals that 66.7% of the studied women were house wife..

Table 2 demonstrates that 55.0% of the studied women were ≤24 weeks of gestation. As for the number of gravidity, it was found that 65.0% of the studied women were multigravida, meanwhile 43.3% of the studied women were primipara.

Table 3 Distribution of the studied pregnant women regarding adaptive behavior to mitigate the risk of exposure to heat weaves throughout study phases (n=60)

Table 4 shows a distribution of pregnant women regarding adaptive behaviors to mitigate air pollution exposure risks, both before (“pre”) and after (“post”) the study intervention. the intervention resulted in a marked improvement in the adaptive behaviors of pregnant women, significantly reducing their exposure to air pollution risks, as evidenced by

the highly significant p-values($p < 0.01$) across all behaviors.

Table 5 presents the total mean scores for protective behaviors of pregnant women related to climate change across two domains: mitigation of exposure to heat waves and air pollution, before and after a study intervention. The total mean score for all adaptive behaviors increased from 48.98 ± 6.23 before the intervention to 78.16 ± 3.82 after the intervention. The paired t-test for this total score is also highly significant (-32.622, p=0.001).

Table 6 highlights the total positive scores of protective behaviors for pregnant women related to mitigating the risks of climate change, overall, only 11.7% of participants had positive scores for protective behaviors before the intervention, compared to a dramatic increase to 88.3% afterward and the p-values (using the McNemar test) for both adaptive behaviors—heat waves and air pollution—are 0.001, showing that the changes are statistically highly significant ($p < 0.01$).

Figure I demonstrates that only 11.7% of participants had positive scores for protective behaviors before the intervention, compared to a dramatic increase to 88.3% afterward

Table 7 reflects a positive correlation coefficient, with a statistically significant between knowledge and Preventive behavior in pre& post intervention with (r =0.275), p (0.033*) and (r =0.549), p (0.001**), respectively

❖ Discussion:

Climate change represents a significant global health issue that has rapidly moved to the forefront of the worldwide health agenda, As pregnant women are vulnerable to climate impacts, high ambient temperatures are associated with pregnancy complications and adverse fetal and neonatal complications and outcomes ***Wright et al.(2023)***.Research has shown that the presentation of well-crafted education information can increase women understanding of climate change risks which, in turn, can lead to meaningful behavioral responses ***Adebayo et al. (2020).***

This study was conducted in light of the study hypotheses: knowledge, and protective behaviors of pregnant women towards climate change will be improved after implementing narrative information. The study findings indicated improving of the women's knowledge, and protective behaviors, which led to acceptance of the research hypotheses.

Regarding demographic characteristics, the present study displayed that two-thirds of the studied women were 25-<35 years and the mean of age was 26.74±3.93 years. It is the same with ***Afifi et al. (2024)*** Quazi experimental study which reported that it was about two third of the pregnant women aged between 25 - < 35 with a mean age of 25.80 ± 3.43 years. This finding was inconsistent with ***(Verweij et al., 2020)*** who noticed that 35 % of the women's mean age was 36.8 ± 12.6. in addition, this result was not completely comparable to the finding of ***Eltelt et al. (2023)*** who brought up that the studied pregnant women were < 20 years old, with a mean age (of 19.8 ± 7.3 years).The researcher explained the variation of the women's age between the studies because the sample was selected randomly and the age isn't considered inclusion criteria.

Concerning subjects occupation and residence, the current study found that the majority of studied women were housewives and half of them lived in rural areas it may be due to the study siting provide unaffordable medical services so many rural women do their antenatal visits there. This finding is in agreement with the results reported by ***Afifi et al. (2024)*** This research was conducted at obstetrics and gynecological outpatient clinic at Benha University Hospital in Qaliobya governorate, Egypt, which concluded that about half of the studied women lived in rural areas.

As regards obstetrical history, in terms of the number of gravidities, the findings of current research indicated that more than one-third was prim gravida and approximately two-thirds was multigravida, this result agrees with ***Afifi et al. (2024)*** which reflects that one-third of the study group were prim gravida and two third were multi para.

A main objective of the current study was to assess the knowledge of pregnant women about climate change. Regarding the total satisfactory score, the current study displayed that most women had unsatisfactory scores about knowledge and its domains in the pre-intervention phase. This result might be due to the nature of the women's life as two-thirds of them were unemployed which made them unable to exchange information and knowledge about the existing global events with other knowledgeable and updated colleges like climate change, also, being unemployed helped them to be away somewhat from the heat, sunburn and other bad effects of climate changes that made them uninterested in the climate issues.

It is in line with ***El-Kurdy et al. (2024*)**, a research on how motivational interviewing affects pregnant women's perceptions of risk and health awareness in relation to climate change demonstrated that the majority of pregnant women had strong awareness of climate change after the intervention, as compared to the majority exhibiting poor knowledge pre-intervention. Moreover, this agreed with the finding of a study done by ***Morris et al. (2019)*** a study about stories vs. facts: triggering emotion and action-taking on climate change who stated that more than half of the sample had an unsatisfactory knowledge level about climate change pre-intervention.

However, these results contradicted with ***Ngwenya & Mukwada (2024)*** who reported that the majority of the studied sample had a satisfactory knowledge level about climate change while the minority had an unsatisfactory knowledge level

Additionally, the current study demonstrated a statistically highly significant differences between the pre and post-intervention results of all the items of knowledge regarding climate change and its effect on pregnant women at ($p<0.001$). From the researcher point of view this is due to the usage of the useage of the narrative method in teaching the women, which make the information easy in comprehension and recalling.

The same in the study of ***Abd-Elhamed et al. (2023)*** which about impact of narrative versus didactic information on pregnant women's knowledge, attitude and perception regarding climate change, which discovered that material with a narrative focus performed much better than material with a didactic focus which influencing pregnant women's actual information as well as increasing women's knowledge; this could be observed through the results post intervention implementation, as more than half of the women in narrative group had satisfactory knowledge level about climate changes with significant differences between both the narrative and deductive groups.

In the current study the majority of pregnant women showed had positive scores for protective behaviors related to mitigating the risks of climate change. This may be due to narrative structure influencing engagement with climate change through emotional arousal, to maximize the likelihood of action-taking.

According to ***Adebayo et al. (2020)*** Pregnant women's intentions to undertake preventative behavior were increased by narratively based information, which was also considerably more successful than didactic material at influencing their actual information-seeking activity later on.

This result aligns with the research conducted by Morris et al. (2019) on stories vs facts: evoking emotion and climate change action. which show that the majority of post-stimulus pro-environmental behaviors were influenced by story form. Pro-environmental conduct was continuously more likely to be displayed by participants in a story condition than by those in the information condition, according to the results.

The current study highlighted the total positive scores of protective behaviors for pregnant women related to mitigating the risks of climate change, overall, only one-tenth of participants had positive scores for protective behaviors before the intervention, compared to a dramatic increase to most of them afterward and the p-values (using the McNemar test) for both adaptive behaviors—heat waves and air pollution—are 0.001, showing that the changes are statistically highly significant ($p < 0.01$).

Regarding ***Mohamed et al. (2024)*** study about the effect of climate change awareness programs on pregnant women knowledge, attitude, and preventive practices. It revealed a

highly statistically significant difference between pre and post-tests, where only one-fourth of the women had a satisfactory level of practice before implementation of the program and improved to two-thirds of the women after implementation of the program indicating that climate change awareness programs significantly influenced pregnant women's practices regarding climate change.

Additionally, this result agrees with ***Elsayed et al. (2024)*** who studied the effect of the nursing instructional module on knowledge and practice of pregnant women's regarding climate change and reported that only a few women had a satisfactory level of practice before the implementation of the nursing instructional module and improved to two-thirds of the women after implementation of nursing instructional module.

Moreover, this result is supported by the study carried out in Australia by ***Lykins et al. (2024)*** which about the effect of climate change anxiety positively predicts antenatal distress among expectant female parents. it demonstrated that structured awareness programs not only increase knowledge but also empower women to make informed decisions about their health and environmental practices during pregnancy.

However, ***Fan & Zlatnik (2023*)** pointed out that while knowledge gains are evident, the long term impact on behavior change remains less clear, suggesting a need for ongoing support and resources beyond initial awareness efforts. From researcher' point of view, Climate change knowledge programs can have a positive impact on improving preventive practices among pregnant women by increasing knowledge and promoting a better understanding of the potential maternal and fetal health risks associated with climate change, this program can empower pregnant women to take proactive steps to protect themselves and their unborn fetuses. Heightened awareness and the knowledge level may lead to changes in lifestyle habits, such as reducing exposure to pollutants or adopting sustainable practices, which can contribute to healthier pregnancies and better birth outcomes.

Considering the Correlation between study variables, the current study illustrated that there is a positive correlation (r =0.549), with statistically significant p (0.001**) between women knowledge and Preventive behavior.

A similar finding was showed in ***Afifi et al. (2024)*** the research results clarified that there was a highly positive statistical correlation between total studied women knowledge and total health-related behaviors scores in both groups before and after intervention ($p \leq 0.001$). This means that; with an increase in knowledge, there is a concurrent increase in health-related behaviors, and vice versa.

This finding demonstrated consistency with the findings of ***(Mahmoud et al. (2023)*** who revealed that knowledge and practices were positively correlated. A statistically significant difference was found between the overall knowledge score and overall practices score (r = 0.220, P = < 0.001 between total knowledge score level and total daily life practices & attitudes at the post-program.

❖ Conclusion:

In the light of the results of this study and verified research hypothesis, it was concluded that There was a highly statistically significant improvement regarding the total knowledge, and protective behaviors of the studied pregnant women's towards climate change at pre and post-intervention of narrative information. Moreover, there was a positive correlation between knowledge and health beliefs with preventive behavior in post-intervention at (r = 0.658), P(0.001**) .

❖ Recommendation:

1. Educational training and communication activities about climate change and its effect on pregnancy should be conducted for pregnant women using narrative messages. To increase their level of information which will be reflected in their level of knowledge, perception, and healthy attitude to lessen the detrimental health effects induced by climate change on pregnancy.
2. Nurses should provide counseling for pregnant women about climate change and its effect on pregnancy outcomes.
3. Conduct prenatal motivational interviewing sessions to educate expectant mothers on ways

to lessen the negative consequences of climate change.

❖ **Further research**

1. Further research is needed to increase expectant mothers' understanding of how climate change and its environmental consequences affect the health of pregnancy and fetus.
2. Future studies should be done to evaluate the effect of the application of this narrative information on the pregnancy outcome.
3. Future studies should be done to explore the long-term health effects of climate change on pregnant women and their fetuses.

Limitation of the study

1. Some participants were experiencing time constraints and anxiety that may have limited their attention span.
2. Deficient in the resources about this research.

Table (1): Demographic Characteristics of the studied pregnant women (n=60).

Characteristics	No.	%
Age		
20-<25	23	38.3
25-<30	27	45.0
30-35	10	16.7
Mean± SD	26.74±3.93	
Educational level		
Primary school	1	1.7
Preparatory school	3	5.0
Secondary school	32	53.3
University	24	40.0
Occupation		
Worker	20	33.3
Housewife	40	66.7
Residence		
Rural	30	50.0
Urban	30	50.0

Table (2): Present and past obstetric history of the studied pregnant women (n=60).

History	No.	%
Gestational age		
≤24	33	55.0
>24	27	45.0
Mean± SD	23.38±5.44	
No. of Gravidity		
Primigravida	21	35.0
Multigravida	39	65.0
No. of parity		
Nullipara	21	35.0
Primipara	26	43.3
Multipara	13	21.7
Mode of last delivery		
None	21	35.0
NVD	17	28.3
C.S	22	36.7

Table (3): Distribution of the studied pregnant women regarding adaptive behavior to mitigate the risk of exposure to heat weaves throughout study phases (n=60)

Items	Pre						Post						MHp-value
	Never		sometimes		Always		Never		sometimes		Always		
	No	%	No	%	No	%	No	%	No	%	No	%	
Adaptive behavior to mitigate the risk of exposure to heat weaves													
Drink plenty of water to stay hydrated, even when not thirsty.	14	23.3	36	60.0	10	16.7	5	8.3	28	46.7	27	45.0	0.001**
Avoid sugary drinks, alcohol, and caffeine.	28	46.7	29	48.3	3	5.0	4	6.7	27	45.0	29	48.3	0.001**
Use cooking techniques that do not release as much heat or steam and avoid using the oven.	30	50.0	25	41.7	5	8.3	4	6.7	25	41.7	31	51.7	0.001**
Wear loose-fitting, lightweight, and light-colored clothes when going outside.	23	38.3	30	50.0	7	11.7	1	1.7	31	51.7	28	46.7	0.001**
Listen to the daily weather forecast.	37	61.7	22	36.7	1	1.7	2	3.3	25	41.7	33	55.0	0.001**
Check local news, weather, and health services for heatwave alerts and tips.	40	66.7	19	31.7	1	1.7	3	5.0	29	48.3	28	46.7	0.001**
Moisten skin with water and use a fan to increase skin evaporation	20	33.3	29	48.3	11	18.3	5	8.3	25	41.7	30	50.0	0.001**
Sleep as cool as possible with cotton, bamboo, or linen sheets. Sleep low to the ground if	19	31.7	33	55.0	8	13.3	4	6.7	20	33.0	36	60.0	0.001**

Items	Pre						Post						MHp-value
	Never		sometimes		Always		Never		sometimes		Always		
	No	%	No	%	No	%	No	%	No	%	No	%	
possible													
Open windows during cool times of the day and close windows during warm times of the day.	24	40.0	33	55.0	3	5.0	2	3.3	22	36.7	36	60.0	0.001**
Use external shade to reduce heat in the home and keep blinds closed.	36	60.0	20	33.3	4	6.7	9	15.0	24	40.0	27	45.0	0.001**
Seek protection of shady areas when outdoor	25	41.7	32	53.3	3	5.0	2	3.3	23	38.3	35	58.3	0.001**
Use an umbrella when walking outside	29	48.3	28	46.7	3	5.0	3	5.0	17	28.3	40	66.7	0.001**
seek alternative cooling locations, If it is difficult to access cooling at work or home, such as official cooling centers	28	46.7	29	48.3	3	5.0	4	6.7	28	46.7	28	46.7	0.001**
Cool as much of the body's surface as possible with cold baths or showers and cold towels, with a priority.	39	65.0	19	31.7	2	3.3	3	5.0	18	30.0	39	65.0	0.001**
Wear a hat when going outside	28	46.7	30	50.0	2	3.3	5	8.3	26	43.3	29	48.3	0.001**
Speak with health care providers about managing heat-related risks in extreme-age	25	41.7	29	48.3	6	10.0	1	1.7	24	40.0	35	58.3	0.001**

Items	Pre						Post						MHp-value
	Never		sometimes		Always		Never		sometimes		Always		
	No	%	No	%	No	%	No	%	No	%	No	%	
pregnancies													
During extreme heat, limit outdoor activities	37	61.7	21	35.0	2	3.3	2	3.3	24	40.0	34	56.7	0.001**
Increase fluid intake on hot days , associated with a lower risk for heatstroke.	29	48.3	29	48.3	2	3.3	5	8.3	21	35.0	34	56.7	0.001**
Avoid being in the sun for long periods seek shade, take breaks.	27	45.0	28	46.7	5	8.3	2	3.3	20	33.3	38	63.3	0.001**
Electric fans not be used when dry-bulb temperatures exceed (35°C), as circulating hot air can worsen heat stress.	17	28.3	35	58.3	8	13.3	3	5.0	9	15.0	48	80.0	0.001**
Electric fans should be turned off above (35°C), and air conditioning should be used if available.	29	48.3	28	46.7	3	5.0	8	13.3	22	36.7	30	50.0	0.001**

MH: marginal homogeneity, **: statistically highly significant (p<0.01).

Table (4): Distribution of the studied pregnant women regarding adaptive behavior to mitigate the risk of exposure to air pollution throughout study phases (n=60).

Items	Pre						Post						MHp-value
	Never		sometimes		Always		Never		Sometimes		Always		
	No	%	No	%	No	%	No	%	No	%	No	%	
Adaptive behavior to mitigate the risk of exposure to air pollution													
Keep an eye on air quality reports and avoid outdoor activities when pollution levels are high.	41	68.3	19	31.7	0	0.0	3	5.0	23	38.3	34	56.7	0.001 **
Ensure good indoor air quality by using air purifiers.	37	61.7	22	36.7	1	1.7	8	13.3	24	40.0	28	46.7	0.001 **
Keeping windows closed during peak pollution hours.	35	58.3	23	38.3	2	3.3	2	3.3	28	46.7	30	50.0	0.001 **
Avoid using harsh chemicals such as chlorine, phenol, or strong cleaning agents used in laundry detergent and kitchen cleaners.	32	53.3	25	41.7	3	5.0	3	5.0	25	41.7	32	53.3	0.001 **
Downloaded a free air quality app on my phone so I can check the air quality	43	71.7	17	28.3	0	0.0	3	5.0	20	33.3	37	61.7	0.001 **
Stay indoors as much as possible when the air quality is bad outside	22	36.7	35	58.3	3	5.0	2	3.3	24	40.0	34	56.7	0.001 **

Continue table (4)

Items	Pre						Post						MHp value
	Never		sometimes		Always		Never		Sometimes		Always		
	No	%	No	%	No	%	No	%	No	%	No	%	
Plan outdoor activities wisely: If outdoor activities cannot be avoided, try to schedule them as the early morning or late evening.	28	46.7	30	50.0	2	3.3	4	6.7	23	38.3	33	55.0	0.001 **
Take care of respiratory health: Consult with healthcare professionals about wearing masks specifically designed for filtering out pollutants if necessary.	28	46.7	28	46.7	4	6.7	5	8.3	20	33.3	35	58.3	0.001 **
Maintaining overall respiratory health through regular exercise and avoiding smoking is beneficial.	25	41.7	33	55.0	2	3.3	3	5.0	19	31.7	38	63.3	0.001 **
Consult with the healthcare provider for personalize advice based on specific circumstances.	14	23.3	34	56.7	12	20.0	0	0.0	15	25.0	45	75.0	0.001 **

MH: marginal homogeneity, **: statistically highly significant (p<0.01).

Table (5): Total mean scores of protective behaviors for pregnant women related to climate change and its domains throughout study phases (n=60).

Scores	Pre	Post	Paired t-test	p-value
	Mean± SD			
Adaptive behavior to mitigate the risk of exposure to heat weaves	33.58±4.29	52.76±2.79	-30.047	0.001**
Adaptive behavior to mitigate the risk of exposure to air pollution	15.40±2.43	25.40±1.77	-26.824	0.001**
Total	48.98±6.23	78.16±3.82	-32.622	0.001**

**: statistically highly significant (p<0.01).

Table (6) : Total positive scores of protective behaviors for pregnant women related to climate change and its domains throughout study phases (n=60).

	Pre		Post		MCp-value
	No.	%	No.	%	
Adaptive behavior to mitigate the risk of exposure to heat weaves	10	16.7	51	85.0	0.001**
Adaptive behavior to mitigate the risk of exposure to air pollution	6	10.0	54	90.0	0.001**
Total	7	11.7	53	88.3	0.001**

MC: McNemar test, **: statistically highly significant (p<0.01).

Table (7): Correlation matrix between study variables throughout study phases.

Pre	Knowledge		Heath beliefs		post	Knowledge		Heath beliefs	
	R	P	r	p		r	P	r	P
Knowledge									
Preventive behavior	0.275	0.033*	0.052	0.694		0.549	0.001**	0.770	0.001**

r: correlation coefficient, non significant(p>0.05), *: statistically significant (p<0.05), **: statistically highly significant (p<0.01).

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