- ***Basic Research***

Pregnant Women's Climate Change Adaptation Practices

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Abstract

Background: Climate changes are the major threat to public health concern in the twenty-first century otherwise; pregnant women are one of the vulnerable populations who are susceptible to health problems related to climate changes. **Aim:** Assess pregnant women's adaptation practices related to climate changes. **Study design:** A descriptive cross-sectional study was utilized. **Study subjects**: A convenient sample of 822 pregnant women**. Setting:** This study was conducted at the antenatal outpatient clinic at Elmanial Hospital affiliated with Cairo University Hospital, Cairo City, Egypt. **Tools:** Two tools were used; a structured interview questionnaire consists of two parts: demographic data of pregnant women, obstetric data of pregnant women, and pregnant women's reported adaptation practices about climate changes. **Results:** revealed that 42.7%, 39.5%, 38.4% ,respectively) of the studied pregnant women reported adaptation practices concerning high temperature to climate changes as eat foods rich in water, avoid direct sunlight, and wear loose, colorful, cotton clothes & regarding excessive humidity and regarding air pollution (83.6%, 73.4%, respectively) of them reported that use sustainable ways of transportation and using natural gas instead of coal . **Conclusion:** Only one third reported satisfactory adaptation practices regarding climate changes. **Recommendations:** Awareness initiative is needed for pregnant women to increase their preventive adaptation practices about climate changes through workshops and campaigns.

Keywords: Climate Changes, adaptation practices, pregnant women,

Introduction

Climate change (CC) is a pervasive phenomenon with extensive social, economic, political, geographical, ecological, and psychological ramifications that poses a new threat to global health in the twenty-first century **(World Health Organization ,2022)** . Further extreme weather events, including storms, floods, heat waves, droughts, wildfire smoke, rising sea levels, altered precipitation patterns, and other types of air pollution, have already been brought on by climate change in a wider range of geographic locations. The occurrence and severity of these events are expected to increase over time **(Shalaby et al., 2023).**

Inadequate sanitation, widespread malnutrition, prevalent infections and chronic illnesses, poor housing conditions, and weak, unprepared healthcare infrastructures contribute to the heightened vulnerability of low-income countries to the effects of climate change (**Roos et al., 2021).** Heat waves, dust storms, storms along the Mediterranean coast, and other extreme weather occurrences are expected to grow in Egypt, making it extremely sensitive to climate change **(UNICEF/Egypt, 2022).**

Egypt is currently experiencing intense rainfall, rising sea levels, and an increasing threat of coastal flooding in areas like Alexandria and much of the agriculturally rich Nile Delta. These developments pose serious risks to the nation's food security and could lead to significant economic damage **(Chen et al., 2021).** The Intergovernmental Panel on Climate Change identifies Egypt—being both a developing nation and part of the African continent—as particularly susceptible to the effects of climate change, largely because of its location and its dependence on climate-sensitive industries **(Egypt Environmental Affairs Agency, 2021 & Jungudo, 2023).**

According to **the Intergovernmental Panel on Climate Change (IPCC) (2022),** females—particularly girls and women—face greater risks of food insecurity compared to their male counterparts, have a higher likelihood of perishing during extreme weather events, and are more prone to climate-related mental health issues **(Gabriela et al., 2022).** Since the 1970s, human-induced climate change has reportedly been responsible for over 150,000 deaths annually and the loss of 5.5 million disability-adjusted life years (DALYs) each year **(Watts, 2021).** These health threats linked to climate change tend to impact vulnerable groups the most, including the elderly, pregnant and breastfeeding women, children, marginalized ethnic groups, impoverished communities, migrants or displaced populations, and individuals with pre-existing medical conditions **(White et al., 2023).**

Climate change affects both maternal and perinatal health through various pathways. During pregnancy and the neonatal stage, physiological and anatomical changes occur that impair the body's ability to regulate temperature effectively. Pregnant women, in particular, experience a significant increase in metabolic activity and internal heat production as a result of fetal development. This is accompanied by weight gain and increased fat storage, leading to a reduced ratio of body surface area to body mass. The primary ways the body manages heat during periods of high temperature are through skin radiation via vasodilation and sweating. However, when the body fails to maintain thermal balance, heat stress triggers the release of heat-shock proteins, initiating a series of biological and physiological responses that can negatively affect both maternal and neonatal health **(Chersich et al., 2023).**

Pregnant women have poor practice regarding energy saving, green purchasing, sustainable food consumption, plastic use, and sustainable ways of transportation used, adaptation practice In the context of climate-related health risks, key areas of concern include exposure to dust and sandstorms, flooding, protection from insect bites, safe food handling practices,

and preparedness for extreme weather conditions and participating in environmental initiatives and attending awareness campaign. However, the pregnant women had moderate knowledge and practices regarding reuse, recycling and adapting with increasing in air temperature, (**Eltelt et al., 2023 & Kotb et al., 2024 & Elsayed et al., 2024).**

Significance of the study

Climate change represents an inevitable global challenge with serious implications for human health; it is predicted to cause 250,000 deaths annually between 2030 and 2050 due to high temperatures and food pollution. Climate changes pose significant risks to pregnant women and developing fetuses **(Benell et al., 2024).** The negative health impacts of climate change are particularly severe for women living in low-income and urban environments, with heightened vulnerability to risks associated with extreme heat, air pollution, excessive humidity, food-related infections, flooding, and wildfires, can cause miscarriages, preeclampsia and eclampsia, premature rupture of membranes, gestational cardiovascular disease, gestational hypertension, birth defects, neonatal mortality, low birth weight, premature birth, and anemia among pregnant women **(The U.S. National Climate and Health Assessment, 2020 &Chersich et al., 2023)**.

Egypt is considered one of five highly vulnerable countries in the world to climate changes due to the weather , low rainfall, and hot summers; the nature of the land (large desert) and densely populated cities; and geography (**Akhtar, 2024**). The crisis of the Egyptian Ministry of Health confirmed during the year (2021) that the number of deaths due to high temperature reached 95 cases and 1914 injured since the beginning of the heat wave, and most of the deaths are over the age of 60 years, and among them are pregnant women in different months of pregnancy, and most of them suffer from pathological problems due to failure or decline in the heart muscle or chronic high blood pressure (**Afifi et al., 2024**). Therefore, this study was conducted to assess pregnant women' practices regarding climate changes.

Aim of the Study: The aim of the current study was to assess pregnant women' adaptation practices related to climate changes.

Research question:

What are the pregnant women's adaptation practices regarding climate changes?

Operational definition:

Adaptation practices regard climate changes: in this study

It means what pregnant women do regarding significant changes in high temperature, excessive humidity, air pollution and food pollution.

Study design

A descriptive cross-sectional approach was employed to fulfill the study's objective. This type of observational research involves examining data on various variables that are gathered from a population sample at a single point in time **(Wang & Cheng, 2020).**

Study Setting: This study was conducted at the antenatal outpatient clinic at Elmanial Hospital which situated at Kaser Al-Aini region , affiliated to Cairo University Hospital, Cairo City, Egypt. the antenatal outpatient clinics consists of two floors include reception area, one gynecology clinic, two antenatal clinics, one ultrasound clinics, one family planning clinic , one teaching halls, a room for nursing staff and two waiting area for patients. The

Antenatal Outpatient Clinic provides services for about 130 women per day and works six days a week from Saturday to Thursday, from 9 Am to 2 Pm.

Sample type:

A convenient sample was used.

Study sample:

The study included 822 pregnant women who attended to predetermined setting.

Sample Size

According to the findings of Hamed et al. (2022), the sample size was determined using the following formula, based on a 5% absolute precision and a 5% significance level (Type I error),

$$n = \frac{(Z1-\alpha/2)\text{^}2.P(1-P)}{d\text{^}2}$$

As $Z_{1-}\alpha/2$ corresponds to 1.96 for a 5% level of significance ($p < 0.05$), *P* represents the anticipated proportion in the population derived from previous research, and *d* denotes the margin of error or the desired level of precision.

Therefore, sample size

$$n = \frac{(1.96)\text{^}2.(0.506)(1-0.506)}{(0.049)\text{^}2} = 821.6$$

Based on the formula, the total sample size required for the study is 822.

Data collection tools:

Two tools were utilized to collect data:

Tool (I): A Structured Interview Questionnaire:

It was prepared by the researcher following an extensive review of both national and international literature **(Eltelt et al., 2023).** It was composed of two main parts:

Part (I): Included demographic information about the pregnant women, such as their age, place of residence, educational background, employment status, and income level.

Part (II): Covered obstetric details, including gestational age, number of pregnancies (gravidity), number of births (parity), any complications experienced in previous pregnancies, and the count of living children.

Tool (II): Pregnant women's reported adaptation practices about climate changes:

It was developed by the researcher after reviewing the national and international relevant literatures, **(Glasgow et al., 2018 & Salem et al., 2022 &Mohammed et al., 2022)** to assess the pregnant women's adaptation practices regarding climate changes. It was consisted of four domains.

First domain: Adaptation practices regarding high temperatures included 14 items as: Stay at home during a heat wave, ventilate the place by opening the windows, and turning on the fan or air conditioning, limit the use of the stove and oven, have a shower with cold water, stay comfortable and reduce stress and wear loose, lightweight, light-colored clothes….etc.

Second domain: Adaptation practices regarding excessive humidity included 11 items as: Open windows when cooking, after showering or use hoods, open all the windows of the house to increase ventilation and refresh the air inside the house, expose mattresses, carpets and clothes to sunlight, use air conditioners and dehumidifiers when needed and use ceiling fans….etc.

Third domain :Adaptation practices regarding air pollution included 15 items as: Ventilate the house, use an air purifier, reducing energy consumption by using more efficient and less energy consuming home appliances, use indoor plants effectively, energy saving, reuse materials, reducing the use of plastic bags, wear sunglasses when going outside and use sustainable ways of transportation….etc.

Forth domain: Adaptation practices regarding food pollution included 14 items as: Wash hands right before handling food with soap and water, wash all kitchen utensils used for cooking before use with hot water and soap, use a cutting board for meat and poultry that is separate from the cutting board for vegetables and fruits, clean surface on which you prepare food, wash vegetables and fruits well before eating and observe adequate consumption of food…etc.

Scoring system: Each question will have two alternative answers: not done and done. The responder was score (0) for not done and (1) for done. The total adaptation practices score were classified as satisfactory practice ≥ (60%) and unsatisfactory practice < (60%) **(Elsayed et al., 2024 & Eltelt et al., 2023).**

Validity of the Tools:

The study tools underwent content validity assessment by a panel consisting of two experts from the Woman's Health and Midwifery Nursing Department and one expert in Community Health Nursing. This review was conducted prior to implementation to ensure that the questions were clearly expressed and effectively conveyed their intended meaning. Revisions were made as needed, including simplifying the wording of certain questions, reorganizing sentence order, and rephrasing some items to enhance comprehension for pregnant women. The finalized version was then used for data collection.

Reliability of the Tools:

The reliability of the tools was assessed using Cronbach's alpha through the Statistical Package for Social Sciences (SPSS), version 20. The resulting Cronbach’s alpha coefficient for the pregnant women's reported adaptation practices concerning climate change was 0.898, reflecting a high level of internal consistency and reliability.

Ethical Considerations:

Ethical approval for the study was granted by the Research Ethics Committee at the Faculty of Nursing, Modern University for Technology and Information. All participating pregnant women were informed that their involvement in the study was entirely voluntary. They were also made aware of their right to withdraw at any point without facing any negative consequences. Written informed consent was obtained from each participant after explaining the study's objectives. Assurance was given regarding the confidentiality, safety, and privacy of all collected data throughout the research process. Participants were also informed that the study results would be used as part of future publications and educational materials.

Field work

The process was divided into two stages: preparatory stage and operating stage.

Preparatory stage

In this stage, the researcher obtained official permission from the director of the previously mentioned setting after explaining the study's aim. Then, data collection tools were designed and translated into Arabic language after reviewing the national and international related literature.

Pilot study

A pilot study was done before initiating data collection, involving 10% of the total sample (81 pregnant women). Its purpose was to evaluate the clarity, simplicity, and practicality of the tools. Based on the findings, appropriate modifications were made, including rewording certain statements for better understanding. The participants in the pilot study were not included in the final study sample.

Operating stage

I. Data Collection Phase

Fieldwork procedures for data collection were carried out from the beginning of April 2024 until the end of June 2024. Data were gathered at the antenatal outpatient clinics of El-Manial Hospital. The researcher was present at the study site three days a week—Saturday, Sunday, and Tuesday—from 9:00 AM to 2:00 PM to conduct data collection. Prior to beginning the study, the researcher introduced herself to the head of the antenatal outpatient clinics, provided a detailed explanation of the study's objectives, and obtained written approval to proceed with the research. The researcher also introduced herself to the pregnant women, explained the purpose of the study, and obtained their written informed consent after assuring them of the confidentiality of their information.

Each pregnant woman was interviewed individually for approximately 35 to 40 minutes to collect information related to demographic and obstetric characteristics, as well as their reported adaptation practices concerning climate change. During the interviews, the researcher read each questionnaire item aloud, clarified its meaning when necessary, and recorded the participants' responses. The researcher continued attending the study site until the required sample size was achieved. Following data collection, all responses were coded, stored securely, and subsequently analyzed.

II. Data Analysis Phase

The collected data were systematically entered, organized, categorized, and transferred into specifically designed formats for analysis. Statistical analysis was conducted using SPSS for Windows, version 20.0 (SPSS Inc., Chicago, IL). Continuous variables, which followed a normal distribution, were presented as mean ± standard deviation (SD). Categorical variables were summarized using frequencies and percentages. The Chi-square test was applied to assess differences between categorical variables, with Fisher's exact test used when appropriate. To examine relationships between continuous variables, the correlation coefficient test was employed. The internal consistency of the questionnaires was evaluated to determine reliability. A p-value of less than 0.05 was considered statistically significant.

Results

Table 1. Reveals that 36.9% of the studied pregnant women were 25-30 years with Mean ± SD 28.8 ± 4.5, 80.2% of studied pregnant women live in rural areas and 45.9% of them had secondary education. As well as 81.9% of them were housewives and 74.94% of them have not enough income.

Table 2. Shows that 42.2% of the studied pregnant women had 36 or more weeks of gestational age, 53.6% of them were 2-3gravida., 50.1% of them had 1-2 of living children. Also, 32.6% of them had previous pregnancy complications.

Figure 1. reveals that 19.7% of studied pregnant women had preterm labor followed by17.9% of them had low birth weight, 16% had anemia, 14.9% had abortion, 11.9% had urinary tract infections, 4.5% had gestational hypertension, 3.7% had stillbirth, 3.3% had placenta previa and ectopic pregnancy and finally 2.2% of them had premature rupture of membrane and gestational diabetes.

Table 3. Shows that (42.7%, 39.5%, 38.4% & 36.6%, respectively) of the studied pregnant women reported adaptation practices regarding high temperature to climate changes as eat foods rich in water, avoid direct sunlight, wear loose, colorful, cotton clothes and stay at home during a heat wave. While (95.7%, 92.7%, 89.9%, 87.8%, 84.7%, 80.8%, 80.5% &75.2%, respectively) didn't keep cool by setting air condition temperature, didn't follow up on the weather regarding warnings and ways to deal with them, didn't wear sunglasses, wide-brimmed hat on sunny days when leaving the house, didn't have a shower with cold water, didn't stay comfortable, didn't stay hydrated by drinking plenty of water, didn't ventilate the place by opening the windows and turning on the fan and didn't avoid hot and spicy foods and drinks as adaptation practicesregarding high temperature to climate changes.

Table 4. Shows that (55%, 54.9%, 40.1% & 38%, respectively) of the studied pregnant women reported adaptation practices regarding excessive humidity as use ceiling fans, don't hang wet clothes inside the house, open windows when cooking, after showering or use hoods and wear cotton clothes. While (97.4%, 96.6%, 86.1%, 85.4%, 77%, 76.5% & 70.1%, respectively) didn't use air conditioners and dehumidifiers when needed, didn't decorate the house with natural plants that absorb moisture, didn't have a shower with cool water, didn't expose carpets and clothes to sunlight, didn't clean up water leaks and spills quickly, didn't open all the windows of the house to increase ventilation the house and didn't drink plenty amounts of water and cold liquids as adaptation practices regarding excessive humidity to climate changes

Table 5. Shows that (83.6%, 73.4%, 50.4% & 33.3%, respectively) of the studied pregnant women reported adaptation practices regarding air pollution to climate changes as use sustainable ways of transportation, using natural gas instead of coal and ventilate the house. While (94.4%, 91.2%, 88%, 85.3%, 84.8%, 78.6%, 77.4%, 75.3% & 71.4%, respectively) didn't use an air purifier, didn't use indoor plants effectively, didn't wear sunglasses when going outside, didn't reduce energy consumption, didn't reduce the use of plastic bags, didn't plant more trees and plants, didn't limit walking on crowded streets during rush hour, didn't energy saving, didn't eat a healthy diet that contains fruits and vegetables and didn't reuse materials as adaptation practices regarding air pollution to climate changes.

Table 6. Shows that (75.4%, 52.7%, 45%, 40.1% & 39.1%, respectively) of the studied pregnant women reported adaptation practices regarding food pollution to climate changes as wash vegetables and fruits well before eating, cooking food very well, clean surface on which

you prepare food, keep food directly in the refrigerator and observe adequate consumption of food. While (94%, 85.3%, 84.4%, 79.3%, 72.9% & 71.8%, respectively) didn't store food at the appropriate temperature, didn't use a cutting board for meat and poultry that is separate from the cutting board for vegetables and fruits, didn't go to the doctor when complaining of any abnormal symptoms after eating, didn't separate raw meat from other foods when cooking food, didn't wash hands right before handling food with soap and water and didn't pay attention to expiry dates for foods and drinks as adaptation practices regarding food pollution to climate changes.

Figure 2. Shows that Mean ±SD of the studied pregnant women reported adaptation practicesto air pollution (8.1 ±3.6), (5.9 ±2.5) for excessive humidity, (5.9 ±2.0) for food pollution, and finally (5.7 ±2.0) for high temperature.

Figure 3. Illustrate that 66.2% of pregnant women reported unsatisfactory adaptation practices regarding climate changes, while 33.8% of them reported satisfactory adaptation practices regarding climate changes

Table 7. Shows that there was a highly statistically significant association between total adaptation practices level of pregnant women regarding climate changes and level of education ($p<0.001$). In which 45% of the studied pregnant women who had satisfactory adaptation practices had university education & more . Also, there was a highly statistically significant association between total adaptation practices level of pregnant women regarding climate changes and previous pregnancy complications ($p<0.001$). In which 75.6% of the studied pregnant women who had satisfactory adaptation practices shad no previous pregnancy complications. While there was no statistically significant association between total practice level of pregnant women regarding climate changes and age, residence, & occupation $p >0.05$.

Table (1): Distribution of the studied pregnant women according to their demographic characteristics.

Items	n (822)	%
Age (Years)		
- 18 - > 25	225	27.3
- 25 - > 30	303	**36.9**
- 30 - > 35	174	21.2
- ≤ 35	120	14.6
Mean ± SD	**28.8 ± 4.5**	
Residence		
- Rural	659	**80.2**
- Urban	163	19.8
Level of education		
- Cannot read &write	14	1.7
- Basic education	134	16.3
- Secondary education	377	**45.9**
- University education or more	297	36.1
Occupation		
- Housewife	673	**81.9**
- Working	149	18.1
Type of working n= (149)		
- Employee	48	5.8
- Trades / Business	54	**6.6**
- Farmer / Manual worker	47	5.7
Income status		
- Not enough	616	**74.94**
- Enough	181	22.02
- Enough and saving	25	3.04

Table (2): Distribution of the studied pregnant women according to their obstetric data.

Items	n (822)	%
Gestational age (Weeks)		
- < 28	123	15.0
- 28 - > 32	146	17.8
- 32 - > 36	206	25.0
- 36 or More	347	**42.2**
Mean ±SD	**33.4 ± 4.4**	
Gravidity		
- Primigravida	141	17.2
- 2 – 3	441	**53.6**
- > 3	240	29.2
Number of living children		
- None	191	23.24
- 1 – 2	412	**50.12**
- 3 – 4	219	26.64
Previous pregnancy complications		
- No	554	67.4
- Yes	268	**32.6**

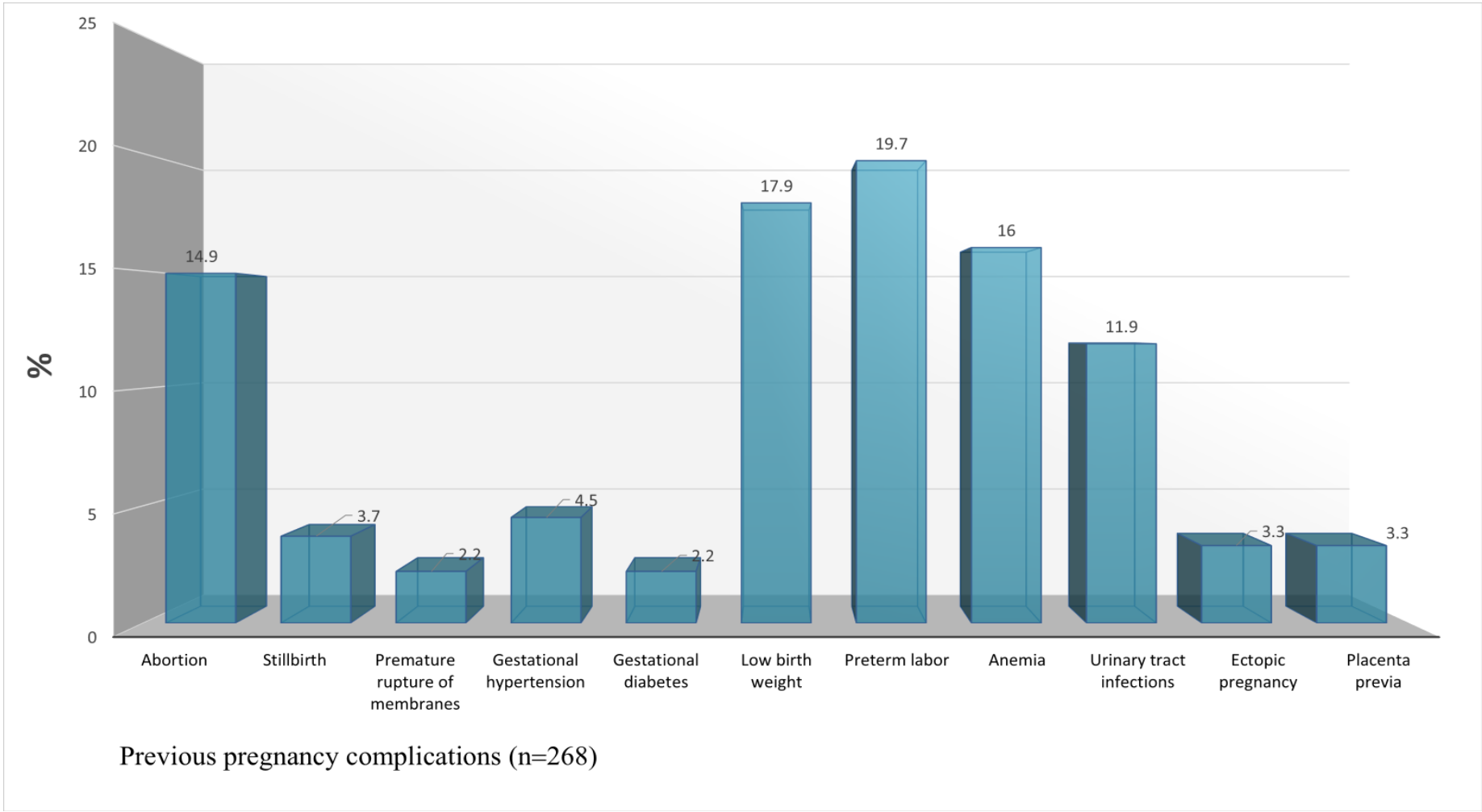

Figure (1): Distribution of the studied pregnant women according to previous pregnancy complications (n=268).

Table 3. Distribution of the studied pregnant women' reported adaptation practices regarding climate changes as high temperatures n= (822)

Items	Done		Not done	
	N	%	N	%
- Stay at home during a heat wave	301	**36.6**	521	63.4
- Ventilate the place by opening the windows, and turning on the fan or air conditioning	160	19.5	662	**80.5**
- Limit the use of the stove and oven	167	20.3	655	79.6
- Have a shower with cold water	100	12.2	722	**87.8**
- Stay comfortable and reduce stress	126	15.3	696	**84.7**
- Wear loose, lightweight, colorful, cotton clothes	316	**38.4**	506	61.5
- Keep cool by setting air condition temperature at 24°C	35	4.3	787	**95.7**
- Stay hydrated by drinking plenty of water and fluids	164	20.0	658	**80.8**
- Avoid hot and spicy foods and drinks containing caffeine	204	24.8	618	**75.2**
- Eat foods rich in water, such as vegetables and fruits	351	**42.7**	471	57.3
- Avoid foods containing high proteins	35	4.3	787	95.7
- Avoid direct sunlight	325	**39.5**	497	60.5
- Wear sunglasses, wide-brimmed hat, carry an umbrella on sunny days when leaving the house	83	10.1	739	**89.9**
- Follow up on the weather forecast via radio or television regarding warnings and ways to deal with them	60	19.5	762	**92.7**

Table 4. Distribution of the studied pregnant women' reported adaptation practices regarding climate changes as excessive humidity n= (822)

Items	Done		Not done	
	N	%	N	%
- Open windows when cooking, after showering or use hoods	330	**40.1**	492	59.9
- Open all the windows of the house to increase ventilation and refresh the air inside the house	193	23.5	629	**76.5**
- Expose mattresses, carpets and clothes to sunlight	120	14.6	702	**85.4**
- Use air conditioners and dehumidifiers when needed	21	2.6	801	**97.4**
- Use ceiling fans	452	**55**	370	45
- Wear cotton clothes	313	**38**	509	62
- Drink plenty amounts of water and cold liquids	246	29.9	576	**70.1**
- Clean up water leaks and spills quickly	189	23	633	**77**
- Have a shower with cool water	114	13.9	708	**86.1**
- Do not hang wet clothes inside the house	451	**54.9**	371	45.1
- Decorate the house with natural plants that absorb moisture	28	3.4	794	**96.6**

Table 5. Distribution of the studied pregnant women' reported adaptation practices regarding climate change as air pollution n= (822)

Items	Done		Not done	
	N	%	N	%
- Ventilate the house	274	**33.3**	548	66.7
- Use an air purifier	46	5.6	776	**94.4**
- Reducing energy consumption by using more efficient and less energy consuming home appliances	121	14.7	701	**85.3**
- Use indoor plants effectively	72	8.8	750	**91.2**
- Energy saving (switching to LED light bulbs, oil or gas furnace with an electric heat pump replacing)	203	24.7	619	**75.3**
- Reuse materials like blank back pages and used papers, water bottle	254	30.9	568	**69.1**
- Reducing the use of plastic bags	125	15.2	697	**84.8**
- Wear sunglasses when going outside	99	12.0	723	**88.0**
- Use sustainable ways of transportation (public transportation, bike, or walk)	687	**83.6**	135	16.4
- Limit walking on crowded streets during rush hour	186	22.6	636	**77.4**
- Refrain from exercising in open spaces	74	9.0	748	91.0
- Planting more trees and plants	176	21.4	646	**78.6**
- Use natural gas instead of coal	603	**73.4**	219	26.6
- Refrain from burning garbage	414	**50.4**	408	49.6
- Eat a healthy diet that contains fruits and vegetables rich in antioxidants	235	28.6	587	**71.4**

Table 6. Distribution of the studied pregnant women' reported adaptation practices regarding climate change as Food pollution n= (822)

Items	Done		Not done	
	N	%	N	%
- Wash hands right before handling food with soap and water	223	27.1	599	**72.9**
- Wash all kitchen utensils used for cooking before use with hot water and soap	274	33.3	548	66.6
- Use a cutting board for meat and poultry that is separate from the cutting board for vegetables and fruits	121	14.7	701	**85.3**
- Clean surface on which you prepare food	370	**45**	452	55
- Wash vegetables and fruits well before eating	620	**75.4**	202	24.6
- Observe adequate consumption of food (no excess)	321	**39.1**	501	60.9
- Cook food very well	433	**52.7**	389	47.3
- Pay attention to expiry dates for foods and drinks	232	28.2	590	**71.8**
- Do not buy food from street vendors	260	31.6	562	68.4
- Avoid drinking unpasteurized milk	287	34.9	535	65.1
- Keep food directly in the refrigerator and do not leave it outside	330	**40.1**	492	59.9
- Separate raw meat from other foods when cooking food	170	20.7	652	**79.3**
- Store food at the appropriate temperature	49	6.0	773	**94.0**
- Go to the doctor when complaining of any abnormal symptoms (vomiting or diarrhea) after eating	128	15.6	694	**84.4**

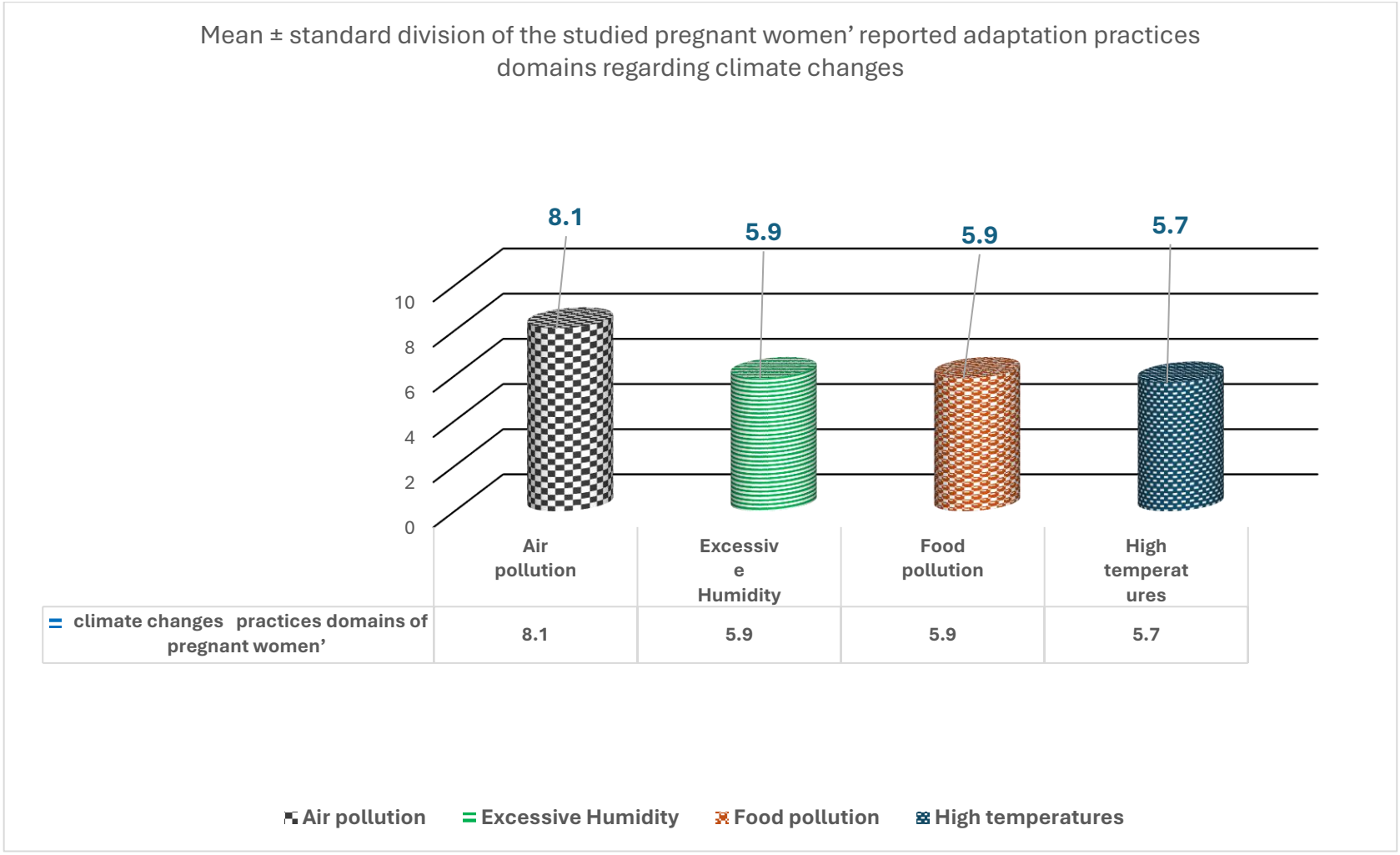

Figure (2): Mean ± standard division of the studied pregnant women' reported adaptation practices domains regarding climate changes

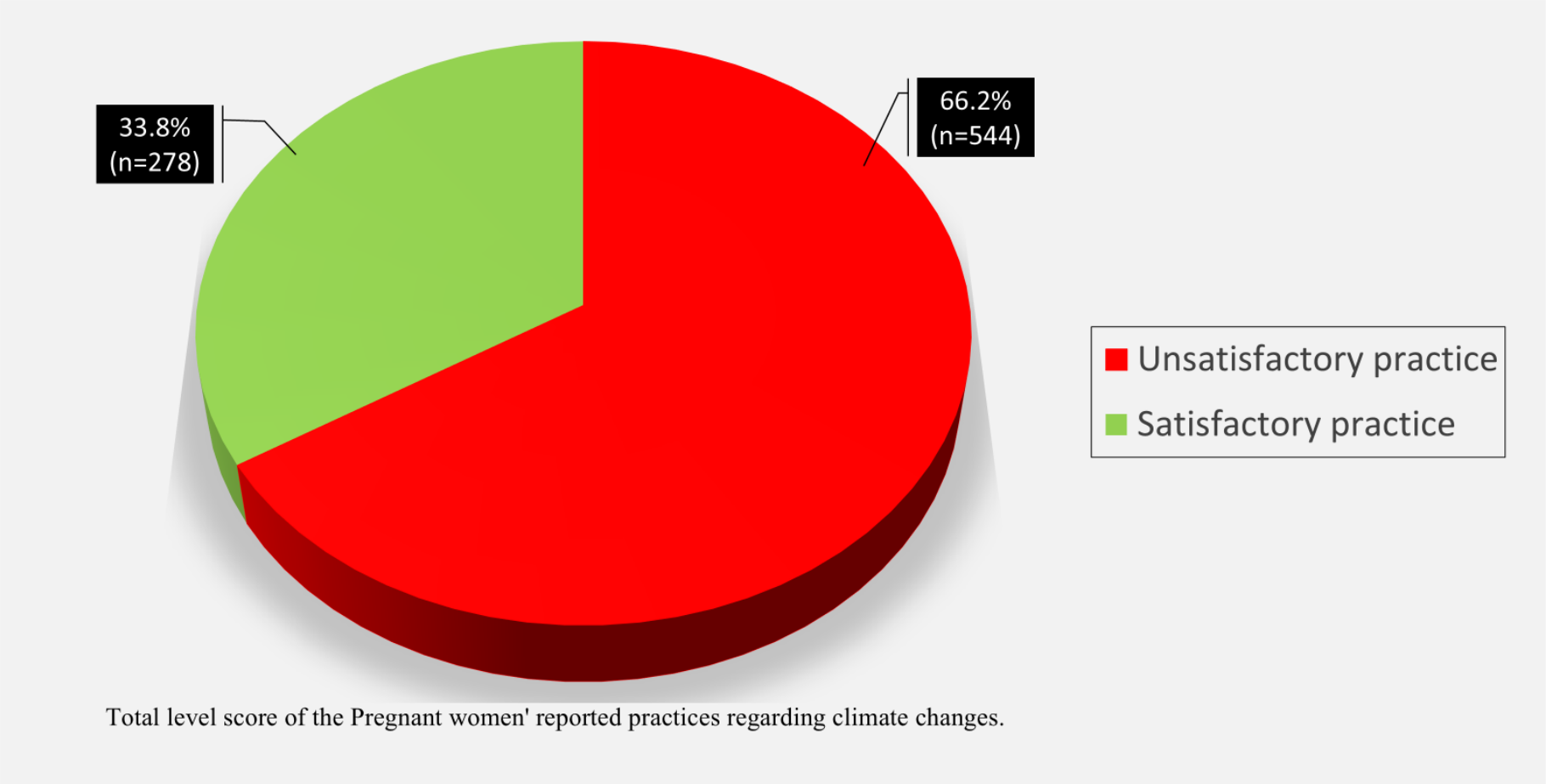

Figure (3): Distribution of the studied pregnant women according to total level score of the Pregnant women' reported adaptation practices regarding climate changes.

Table 7. Association between demographic characteristics & previous pregnancy complications of the studied pregnant women and their total adaptation practices level regarding climate changes (n=822)

Variables	Unsatisfactory practices		Satisfactory practices		Significant test	
	N	%	N	%	X^2	P
Age (Years)						
18 - > 25	142	26.1	83	29.9		
25 - > 30	206	**37.9**	97	34.9		
30 - > 35	118	21.7	56	20.1		
≤ 35	78	14.3	42	15.1	1.671	**0.643**
Residence						
Rural	446	**82.0**	213	76.6		
Urban	98	18.0	65	23.4	3.333	**0.068**
Level of education						
Cannot read &write	11	2.0	3	1.1		
Basic education	108	19.9	26	9.4		
Secondary education	253	46.5	124	44.6		
University education & more	172	31.6	125	**45.0**	22.620	**<0.001*** **
Occupation						
Housewife	450	**82.7**	223	80.2		
Working	94	17.3	55	19.8	0.778	**0.378**
Previous pregnancy complications						
No	**341**	**62.7**	**213**	**76.6**		
Yes	**203**	**37.3**	**65**	**23.4**	**16.258**	**<0.001*** **

*** Highly statistically significant (p<0.001) No statistically significant (p>0.05) Chi square **(X^2)**

Discussion

The current study aimed to assess the adaptation practices of pregnant women in relation to climate change. This objective, along with the study question, was addressed through the findings, which showed that approximately two-thirds of the participants demonstrated inadequate adaptation practices concerning climate change.

Regarding obstetric data of the studied pregnant women.

The findings of the present study indicated that fewer than 50% of the pregnant women were at 36 weeks of gestation or later. This aligns with the findings of **Abd-Elhamed et al. (2023),** who investigated the effects of narrative versus didactic methods on pregnant women's awareness, attitudes, and perceptions of climate change, and similarly noted that fewer than half of their sample were in the third trimester. However, these results contrast with those of Mohamed et al. (2024), whose evaluation of a climate change education program revealed that only 25% of the participants had reached the third trimester.

Additionally, the current study revealed that over half of the participating pregnant women had experienced 2 to 3 pregnancies (gravid) and had 1 to 2 live births. These findings align with those of Malley et al. (2019), who conducted a global, regional, and national assessment of preterm birth associated with maternal exposure to particulate matter, and reported similar reproductive patterns among the women studied and found that more than half of them had two pregnancies and more than half of them had more than one live birth. The agreement among studies results may be due to more than one third of the studied pregnant women were 25- >30 years.

Regarding studied pregnant women' reported adaptation practices regarding climate changes.

The present study indicated that the majority of the pregnant women did not engage in behaviors aimed at maintaining comfort or alleviating stress. This contrasts with the findings of Field et al. (2019), who, in a U.S.-based study on the impacts, adaptation, and vulnerability related to climate change—part of Working Group II's contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change—reported that fewer than two-thirds of participants took rest breaks to help their bodies cool down. Such differences may be influenced by cultural variations.

Also, the current study results showed that the most of the studied pregnant women didn't keep cool by setting air condition temperature at 24°c, the present study results were supported by **Ghazy &Fathy (2023)** who studied effect of awareness program regarding climate change on knowledge, attitudes and practices of pregnant women and found that the most of them didn't keep cool by setting air condition temperature at 24°c. The agreement between study results may due to about three quarters of studied pregnant women have not enough income.

Moreover, the current study results showed that majority of the studied pregnant women didn't stay hydrated by drinking plenty of water, this finding was in agreement with **Eltelt et al. (2023)** who studied the adverse effect of climate change on pregnant women worked outdoor and found that majority of participants didn't practice regarding seeking hydration drinking cup of water every 15-20 min and drinking before thirsty. While, the present study result was disagreed with **Lajinian et al. (2018**) who conducted a study in Pakistan about an association between the heat-humidity index and preterm labor and delivery and found that the majority of study sample seeking hydration by drinking 1 cup of water every 15-20 min

and drinking before thirsty. The disagreement between studies results may due to difference in cultural diversity.

In additionally, the current study results showed that more than one third of the studied pregnant women avoid direct sunlight. The present study result was supported by study of **Field et al. (2019)** who found that more than one third of them practice regarding rotating between indoor, shaded and outdoor tasks to avoid exposure to solar UV radiation for long period of time. While, the current study finding was disagreed with **Gamble et al. (2019)** who conducted a study in Washington U.S about the impact of climate change on human health in the United States and found that more than two third of study sample practice regarding seeking shade where possible. The disagreement between studies results may due to difference in cultural diversity.

The current study results showed that the majority of the studied pregnant women didn't wear sunglasses, wide-brimmed hat, carry an umbrella on sunny days when leaving the house, this study result was in agreement with **Kikstra et al. (2022)** who conducted a study in Turky about Intergovernmental program for climate change (IPCC)Sixth Assessment Report they found that the majority of women thought that it was not appliance to wear sun glasses that comply with the standard. While, the present study result was disagreed with **Fatema et al. (2019)** who assess Women's health-related vulnerabilities in nature disasters as climate change and found that two thirds of the study sample thought that it was a broad brim. The disagreement between studies results may due to these hats are expensive in Egypt, and most mothers cannot buy them due to not enough income status.

The present study results showed that more than one third of the studied pregnant women wear cotton light clothes, this study result was disagreed with **Hyatt et al. (2018)** who found that less than one quarter of the pregnant women wore cotton light clothes. The disagreement among studies result may be due to dissimilarity in the research environment between studies and cultural diversity.

Additionally, the present study findings showed that the most of the studied pregnant women didn't decorate the house with natural plants that absorb moisture, this study result was agreed with **Verweij et al. (2019)** who studied epidemiological evidence from south Indian female pregnant working the heat exposure and health linkage and found the most of the studied pregnant women didn't participate in tree plantation drives. While, this study result was disagreed with **Talavera et al. (2020)** who found less than half of the study sample didn't plant new varieties that are suitable for cold or warmer temperature. The disagreement between study result may be due to majority of pregnant women had no knowledge about action taken to control the effect of climate changes on pregnancy. The disagreement among studies result may be due to cultural diversity.

Moreover, the present study results showed that three quarters of the studied pregnant women didn't save energy, more than two third of them didn't reuse materials and majority of them didn't reduce the use of plastic bags. Also about three quarters of them didn't plant more trees and plants, these study result were agreed with **Elewa et al. (2022)** who studied mobile intervention to enhance adolescents' awareness about climate change and its adverse effect and found that three quarters of study sample didn't switching off home appliances when not in use, more than two third of them didn't use recyclable products, majority of them use plastic bags and three quarters of them didn't participate in tree plantation drives. This may due to the study samples had same culture. However, this study result was disagreed with **Talavera et al. (2020)** who studied found that majority of study sample recycle and reuse materials and plant trees. This may be due to cultural diversity.

Furthermore, the present study findings showed that majority of the studied pregnant women use sustainable ways of transportation (public transportation, bike, or walk), this study result was disagreed with **Graham et al. (2021)** who conducted a study in sub-Saharan Africa about diversity and climate change: the dynamic burden of poor maternal health and found that less than half of study sample use public transportation to save fuel before.

The findings of the present study indicated that fewer than three-quarters of the pregnant women did not wash their hands properly with soap and water before handling food. This result is consistent with the study by **Almanasrah et al. (2022),** who examined food safety knowledge and risk perception among pregnant women and found that less than three-quarters of participants followed correct hand washing practices—such as wetting hands with running warm water, applying soap, rinsing with running water, and drying thoroughly.

Moreover, the present study revealed that the majority of the pregnant women did not use separate cutting boards for meat and poultry versus those used for fruits and vegetables. This finding is consistent with the results of **Mutsu et al. (2021),** who investigated food safety practices in the home and reported that most participants used the same cutting board and knife for both raw meat or poultry and vegetables without adequate cleaning. However, these results contrast with the findings of **Osaili et al. (2022),** who studied food safety knowledge, attitudes, and practices among female food handlers operating home-based online food businesses during the COVID-19 pandemic. In their study, most participants reported using separate knives and cutting boards for meat and vegetables. The variation in findings may be attributed to differences in cultural practices.

Findings of the current study showed that above half of the studied pregnant women cook food very well, this study result was in disagreement with **Grace (2023)** who studied burden of foodborne disease in low-income and middle-income countries and opportunities for scaling food safety interventions and found that less than one quarter cooked the food according to the recommended time and temperature. The disagreement among studies result may be due to cultural diversity.

The present study findings showed that two third of the studied pregnant women had unsatisfactory adaptation practices and one third had satisfactory adaptation practices regarding climate changes, these study findings were in agreement with **Eltelt et al. (2023)** who reported that two third of pregnant women had unsatisfactory practice and more than one third had satisfactory practice about climate change. While, this study result was disagreed with **Elsayed et al. (2024)** who found that majority of pregnant women had unsatisfactory practices and less than one quarter had satisfactory observed practices. The disagreement among studies result may be due to difference in sample size.

Regarding association between demographic characteristics, previous pregnancy complications of the studied pregnant women and their total adaptation practices level regarding climate changes.

The present study findings showed that a highly statistically significant association between the total women' adaptation practices and their level of education, this study finding was agreed with **Abd-Elhamed et al. (2023)** who showed that there was significant statistically differences between participant women's demographic data among the two groups and their knowledge, attitude and perception regarding their level of education.

The present study findings showed that a highly statistically significant association between the total women' adaptation practices and their previous pregnancy complications, this study finding was agreed with **Afifi et al. (2024)** who reported that there was statistically

significant association between their adverse pregnancy outcomes and the total women' practices.

Finally, this study concluded that studied pregnant women had unsatisfactory adaptation practices regarding climate changes. so, they need to increase level adaptation practices regarding climate change, this can be achieved through improving tailor pregnant women for preventive adaptation practices regarding climate changes and its effect on mother and fetus through workshops and educational campaigns.

Conclusion

Based on the present study findings, it was concluded that two third of the studied pregnant women had reported unsatisfactory adaptation practices regarding climate changes. Additionally, there was a statistical significant relation between level of education, previous pregnancy complications and total adaptation practices regarding climate changes.

Recommendations

Based on the current study findings, the study is recommending the following:

- Awareness initiative is needed for pregnant women to increase their precaution adaptation practices about air pollution and excessive humidity through workshops and campaigns.
- Tailoring health education for pregnant women regarding preventive adaptation practices about climate changes.

Further studies:

- Explore short and the long-term health effects of climate change on pregnant women and their fetuses.
- Advocate for policies and regulations that address the specific needs and vulnerabilities of women during climate disasters.

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الملخص العربي

ممارسات التكيف مع تغير المناخ للنساء الحوامل

مقدمه: تُعدّ التغيرات المناخية التهديد الرئيسي للصحة العامة في القرن الحادي والعشرين، وتُعدّ النساء الحوامل إحدى الفئات الأكثر عُرضةً للمشاكل الصحية المرتبطة بالتغيرات المناخية. **الهدف من الدراسه**: تقييم ممارسات تكيف النساء الحوامل فيما يتعلق بالتغيرات المناخية.

تصميم الدراسة: طُوّرت دراسة وصفية مقطعية.

عينه البحث: عينة مُلائمة من 822 امرأة حامل.

مكان البحث: أُجريت هذه الدراسة في العيادة الخارجية لرعاية ما قبل الولادة بمستشفى المنيل التابع لمستشفى جامعة القاهرة، مدينة القاهرة، مصر.

الأدوات البحث: استُخدمت أداتان؛ استبيان مُهيكل للمقابلات يتكون من جزأين: البيانات الديموغرافية للنساء الحوامل، وبيانات التوليد للنساء الحوامل، وممارسات تكيف النساء الحوامل المُبلغ عنها بشأن التغيرات المناخية.

نتائج البحث: أظهرت أن 42.7٪ و 39.5٪ و 38.4٪ على التوالي) من النساء الحوامل المدروسات أبلغن عن ممارسات تكيف تتعلق بارتفاع درجة الحرارة وتغيرات المناخ مثل تناول الأطعمة الغنية بالماء وتجنب أشعة الشمس المباشرة وارتداء الملابس القطنية الفضفاضة والملونة وفيما يتعلق بالرطوبة الزائدة وفيما يتعلق بتلوث الهواء (83.6٪ و 73.4٪ على التوالي) أفادوا بأنهم يستخدمون وسائل نقل مستدامة ويستخدمون الغاز الطبيعي بدلاً من الفحم.

خلاصه الدراسه: خلصت الدراسه ان ثلث العينه فقط بممارسات تكيف مرضية فيما يتعلق بتغيرات المناخ.

التوصيات: هناك حاجة إلى مبادرة توعية للنساء الحوامل لزيادة ممارساتهن الوقائية للتكيف بشأن تغيرات المناخ من خلال ورش العمل والحملات.

الكلمات الداله: تغيرات المناخ، ممارسات التكيف، النساء الحوامل