

## Climate Change and Health: Effect of Awareness Program on Knowledge, Attitudes and Practices of Community Dwelling Elderly

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### Abstract

**Background:** Climate change is the biggest global health threat of the 21<sup>st</sup> century with both direct and indirect effects on human health especially for vulnerable groups as elderly. So, it's important to raise their awareness about climate change to reduce its adverse effect on health. **Aim:** To evaluate the effect of awareness program on knowledge, attitudes and practices of community dwelling elderly regarding climate change and health. **Method:** A quasi-experimental, pre and post intervention research design was implemented. A convenience sample of 72 community dwelling elderly attending El-Amal elderly club in Mansoura city. **Tools:** Five tools were used for data collection; Demographic and Health profile structured interview sheet, Climate change knowledge questionnaire, Elderly's attitude toward climate change self-rating scale, Elderly's self-reported practices about their adaption towards climate change checklist and Elderly's awareness level about climate change and its effect of health questionnaire. **Results:** There were significant improvement in elderly's total mean score of knowledge, practices, attitudes and awareness after 3 months from implementation of the awareness program than before ( $P=0.000^{**}$ ). Also, a statistically significant strong positive correlation was found between the total knowledge score of the studied elderly and both total practices scores, total attitudes scores and total awareness score after implementation of the awareness program **Conclusion:** The awareness program improved knowledge, attitudes and practices of community dwelling elderly about climate change and health. **Recommendations:** Dissemination of developed illustrated awareness program booklet about climate change and health to all elderly at Mansoura City should be done.

**Key words:** Attitudes, Awareness Program, Climate Change, Elderly, Health, Knowledge, Practices

### Introduction

Climate change is considered the biggest global health threat of the 21<sup>st</sup> century <sup>(1)</sup> and a universal problem that have wide-ranging economic, geographical, social, psychological and political consequences <sup>(2)</sup>. The reasons of climate change are anthropogenic in nature via lifestyles, choices and consumption which pollute and exploit resources in an unjustifiable way <sup>(3)</sup>. According to the united nation framework convention on climate change (UNFCC), climate change is “a change

of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over a comparable period time” <sup>(4)</sup>.

Worldwide, by 2030, more than 100 million persons could have health problems related to climate change as well. Mostly, low and middle income countries will be the worst affected since they are excessively exposed, and in

addition because of their weaker adaptive abilities as health systems and other infrastructure<sup>(5)</sup>.

Climate change is triggering increased transmission of infectious disease, elevating sea levels, water and food insecurity and individuals and governments financial inadequacy; all of the above damage person's physical, mental, and social health<sup>(6)</sup>. By the year 2030-2050, approximately 250,000 additional deaths per year are expected as a consequence of climate change from heat stress, malnutrition, and malaria. By the late twenty-first century, climate change is likely to increase intensity and frequency of drought at global scale. The increase of temperature and variable precipitation decrease food production and increase the prevalence of under nutrition and malnutrition<sup>(7)</sup>.

Climate change is a problem that affects all human beings, but it will affect the most vulnerable population groups to a greater extent, including the elderly. Especially, since elderly, which can be viewed as a vulnerable group, are usually more sensitive to any change in surrounding environment, their health are more likely to be negatively affected by climatic factors rather than younger. Understanding which health outcomes are likely to be affected by external climatic factors is significant for enhancing elderly's overall health status<sup>(8)</sup>. Additionally, elderly are more likely to experience detrimental physical impacts like dehydration and symptoms worsening of existing health problems as heart and respiratory diseases during a heat wave which make the process of temperature regulation less efficient because of biophysical differences between elderly and others, something which is important in terms of people's ability to cope with extremes of cold as well as heat<sup>(9)</sup>. Coping

difficulties in heat waves can be particularly marked when older people have other health problems which also affect thermo-regulation, such as diabetes, chronic cardiovascular and respiratory illness<sup>(10)</sup>.

Basic prerequisites for wellbeing can be threatened by Climate change, including clean air and water, food supply and security of shelter. Its effects on elderly are particularly deleterious. Elderly yield much more readily to climate adversities with high incidence of mental and physical health conditions resulting in significant mortality from exposure to extreme conditions such as heat or hurricanes<sup>(11)</sup>. Therefore, Education is an essential element of the global response to climate change. Climate change education helps elderly comprehend and address the impact of global warming especially on health. Furthermore, it encourages change in their attitudes and practices that help them adapt to climate change<sup>(12)</sup>. Moreover, adaptive elderly practices towards climate change are any actions that lessen the risk of climate change impacts. Health-related adaptive practices are focus on practices that related to health and disease prevention such as wearing a hat when going outside on hot days<sup>(13)</sup>.

Climate change knowledge, attitudes and practices are unevenly varying all over the world. The awareness level in respect to climate change is reported to be better in developed countries than in developing countries. Moreover, educational attainment is the strongest predictor of climate change awareness in developed countries, while the perception of local temperature change is the strongest one in developing countries. On the other hand, those in developing countries perceive climate change as a more serious threat than those in developed countries<sup>(14)</sup>.

To increase public awareness of climate change issues, there is a need to increase public sensitivity to the environment as well as to increase public motivation and commitment to sustainable development. Education is a critical agent in addressing the issue of climate change through public participation in programs. Education can change attitudes and behaviors of people including helping them to make informed decisions; people can be taught the impacts of global warming and how to adapt to climate change. Education also can empower all people especially motivates the young to act. Knowing the facts helps eliminate the fear of an issue that is frequently catastrophized in the public arena <sup>(15)</sup>.

Based on the above and to meet Egypt 2030 Sustainable Development Goals specifically Goal thirteen, Target three: “Improving environmental education and awareness”, Gerontological nurse must provide elderly with the knowledge about the health risks posed by climate change and how to prevent these problems via awareness program to improve elderly knowledge, attitudes and self-reported practices within primary preventive strategies for vulnerable groups <sup>(16)</sup>. Therefore the study aimed to evaluate

the effect of awareness program on knowledge, attitudes and practices of community dwelling elderly regarding climate change and health.

#### **Significance of the study**

According to World Health Organization, (2021) <sup>(17)</sup> climate change is responsible for a minimum of 150,000 deaths every year worldwide, a number that is expected to double by 2030. In Egypt, the heat wave of 2018 has killed about 65 people within 3 days when the temperature reached about 47°C <sup>(18)</sup>.

Climate change increases the temperature, affects air quality, drinking water, food, and increases vector-borne diseases, and these affect elderly's health. Elderly are more vulnerable to climate change due to normal changes in the body associated with aging and the presence of chronic health conditions, such as diabetes <sup>(19)</sup>. In Egypt, the number of older adults is about 6.8 million, representing 6.7% of the total population, and this percentage is expected to rise to 17.9% in 2052 <sup>(20)</sup>.

To address these risks, Egypt has made a public commitment in the Sustainable Development Strategy and some sectoral plans to integrate climate change into national development policies <sup>(21)</sup>. Egypt's National Climate Change Strategy 2050 asserts the importance of integrating climate issues into the educational process, scientific research, technology transfer, and awareness-raising. Climate change has similarly received attention from Egyptian universities and research centers, which have issued publications, conducted scientific research and studies, and organized various events to raise awareness about climate change among the wider community <sup>(22)</sup>.

Education is crucial to promote climate action that helps people understand and address the impacts of the climate crisis, empowering them with the knowledge, skills, values and attitudes needed to act as agents of change <sup>(23)</sup>. Nevertheless, a review of government efforts to spread climate change education in Egypt shows that they are still in their infancy, and some of them lack coordination and integration <sup>(22)</sup>.

#### **Operational Definition**

**Climate change** is defined as change in climate attributed directly or indirectly to

human activities that alter the composition of the global atmosphere, in addition to natural climate variability observed over comparable time.

**Aim of the study:** The aim of the present study was to evaluate the effect of awareness program on knowledge, attitudes and practices of community dwelling elderly regarding climate change and health.

**Research hypothesis:** knowledge, attitudes and practices of community dwelling elderly regarding climate change and health will be improved after implementation of awareness program.

**Sample size calculation:** The sample size was estimated using G\* Power software for Windows (version 3.1.9.2) based on the results of a similar previous study<sup>(24)</sup> that demonstrated a difference in attitude toward climate change among study subjects.

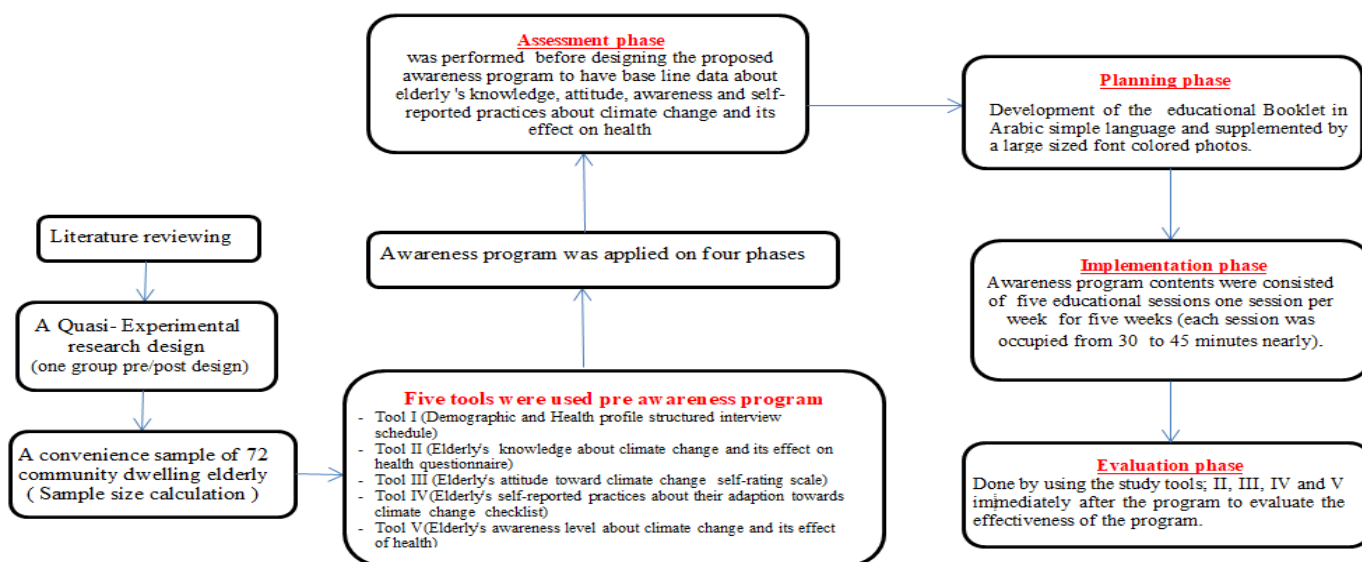


Figure (1): Conceptual research framework of the study

## Subjects and method

### Subjects

**Design:** A Quasi- Experimental research design (one group pre/post design) was used in this study.

**Setting:** The study was carried out El-Amal elderly club in Mansoura city affiliated To Ministry of Social Solidarity.

**Subjects:** A convenience sample of 72 community dwelling elderly visiting the above mentioned setting and fulfilling the following criteria; Able to communicate, willing to participate in the study and available at the time of data collection.

**Tools:** Five tools were used in this study

### Tool I: Demographic and Health profile structured interview sheet:

This tool was developed by the researchers after reviewing the relevant literatures<sup>(25-27)</sup> and it was divided into three parts:

- **Part 1: Demographic characteristics of the elderly:** as age, sex, marital status, level of education, residence and income.
- **Part 2: Health profile of the elderly:** as presence of chronic diseases, type of chronic disease.

- **Part 3: Elderly's previous information about climate change** and its effect on health and source of information if present.

**Tool II: Climate change knowledge questionnaire:** This tool was developed by the researcher after reviewing the relevant literatures <sup>(28-32)</sup> to assess baseline knowledge of elderly about climate change and related health impact. It included 32 true & false questions and divided into two parts:

- **Part 1: Elderly's knowledge about climate change:** It was consisted of 13 true & false questions to assess elderly's knowledge about definition of climate, elements of climate, difference between climate and weather and the definition, causes, & consequences of climate change.

- **Part 2: Elderly's knowledge about effect of climate change on human health:**

It included 19 true & false questions to assess elderly's knowledge about consequences of climate change on health, health conditions that deteriorated due to climate change, most common health conditions triggered due to climate change as dehydration & sunstrokes & heat exhaustion with their signs and symptoms, causes and complications.

**Scoring systems:** The correct answer was scored (1) and the incorrect answer or don't know was scored (zero). These scores were summed and converted into a percentage score. Total responses were classified into three categories <sup>(33)</sup>

Categories	Scores (The total score 32)	Percentage
<b>Good</b>	24 score or more	If scores $\geq 75\%$
<b>Fair</b>	From 16 to less than 24	If scores from 50 to less than 75%
<b>Poor</b>	Less than 16	If scores $< 50\%$

**Tool III: Elderly's attitude toward climate change self-rating scale:** This tool was developed by the researchers after reviewing the relevant literatures <sup>(34-36)</sup>. It included 10 statements to assess elderly's attitude toward climate change and its effect on health. It was

rated by bipolar likert scale that measure two opposed forces as agree versus disagree. In all statements the elderly's response to each questions was scored as 1 if agree and zero if disagree except the following statements;

- Number (1) about if the elderly think that climate change is just propaganda.
- Number (6) if the elderly think that it is already too late to do anything about climate change and its effect on health.

These statements were with reversed answers if the elderly response was agree take zero and if disagree take 1. Total attitude score of elderly was summed up and converted into a percent. Total responses were classified into two categories <sup>(37)</sup>:

Categories	Scores (total score 10)	Percentage
<b>Positive</b>	If score 6 or more	If score $\geq 60\%$
<b>Negative</b>	If score less than 6	If score less than 60%

**Tool IV: Elderly's self-reported practices about their adaption towards climate change checklist:**

This tool was developed by the researchers after reviewing the relevant literatures <sup>(38-41)</sup> to assess self-reported practices of elderly about their adaption towards climate change and its effect on health. It included 40 questions and divided into two parts

**Part 1: Elderly's self-reported practices to decrease human causes of climate change:**

It was consisted of 23 questions as the following; 10 questions concerned to practices related to saving energy, 4 questions related to green procurement practice, 4 questions associated with practices related to reuse, 2 questions associated with recycling practices and 3 questions related to dealing with waste allied practices.

- **Part 2: Elderly's self-reported preventive practices:** it was included 17 questions to assess elderly's self-reported preventive practices about dealing with health problems

associated with climate change: as preventive practices that elderly must take during high temperature weather, through severe cold waves, during high rate of air pollution in the atmosphere and practices that elderly must practice against infectious diseases.

**Scoring systems:** If the practice point always done was scored (2), if sometime done was scored (1) and if not scored (zero). These scores are summed and converted into a percentage score. Total responses were classified into two categories<sup>(33)</sup>:

Categories	Scores (Total score 80)	Percentage
Satisfactory	If score 48 or more	If score $\geq 60\%$
Unsatisfactory	If score less than 48	If score less than 60%

#### **Tool V: Elderly's awareness level about climate change and its effect of health:**

This tool was developed by the researchers after reviewing the relevant literatures<sup>(42- 45)</sup>.

It included 10 questions to assess elderly's level of awareness toward climate change and its effect on health. Using a 3-point Likert-type scale with such category as agree, uncertain, disagree to competently provoke the exact responses from the elderly. Scoring responses to each statement by score 2 if answer was

Agree, score 1 if answer was uncertain and score zero if answer was disagree. Total awareness score of elderly was summed up and converted into a percent. Total responses were classified into three categories<sup>(37)</sup>:

Categories	Scores (The total score 20)	Percentage
High	15 score or more	If score $\geq 75\%$
Medium	From 10 to less than 15	If score from 50 to less than 75%
Low	Less than 10	If score $< 50\%$

#### **Method**

- Official approval for conducting the study was obtained from the responsible authorities.
- **Developing study tools:** Tool I (Demographic and Health profile structured interview schedule) ,Tool II (climate knowledge questionnaire) ,Tool III (Elderly's attitude toward climate change self-rating scale) ,Tool IV(Elderly's self-reported practices about their adaption towards climate change checklist) and Tool V(Elderly's awareness level about climate change and its effect of health) were developed in English by researchers after reviewing the relevant literatures
- Two language experts translated the study tools into Arabic and then back translated them into English by another two language experts in English language from Faculty of Education, English Department, Mansoura University
- **Content validity:** the content validity index (CVI) was used to calculate the degree of agreement among the experts to analyze the study tools and the entire set of items. Content validity was determined by seven experts (three Gerontological nursing professionals, and two Community health nursing professors from the Faculty of Nursing, Mansoura University and two Public health medicine professors from the Faculty of Medicine, Mansoura University). Each expert valued each item according to the relevance using a four-point Likert scale (1 = not relevant, 2 = somewhat relevant, 3 = quiet relevant and 4 = very relevant). The CVI was applied, and the accepted value was  $\geq 0.80$ <sup>(46)</sup>.
- As a result, the suggested modifications necessary were made as simplifying certain words to be more understood, restating and removing of some statements. CVI for tool



II, III, IV, & V was 94, 92, 95, 93, & 92 respectively.

- **A pilot study** was performed on ten percent of the studied sample equal 8 elderly who visiting El Amal elderly club at Mansoura city before data collection to determine the study tools applicability and clarity and the suggested modifications
- were done and they were excluded from the study sample.
- **Content reliability:** Cronbach's alpha coefficient test was used to measure the study tools internal consistency; for tool II (parts 1, 2)  $r = (0.88, 0.89)$  respectively); for Tool III  $r = 0.80$ ; for Tool IV (parts 1, 2)  $r = 0.79, 0.73$  respectively) and for Tool V  $r = 0.86$ .
- **Ethical considerations:** An ethical approval from the Faculty of Nursing, Mansoura University Research Ethics Committee on the study proposal (**Ref.No.p.0430**) was obtained. After being informed of the study's objectives, each studied elderly provided written consent to participate in the study. The privacy of the studied elderly and the confidentiality of the obtained data's was conserved. The elderly participated in the study were informed that they had right to leave the study any time without penalty.

#### **The awareness program was conducted through four phases:**

**A. Assessment phase:** It was performed before designing the proposed awareness program through using all study tools (pre/test) to have base line data about elderly's knowledge, attitude, self-reported practices and awareness of climate change and its effect on health.

#### **B. Planning phase**

- Based on the assessment findings of the studied elderly (pre/test) and after reviewing the most relevant literatures, an educational booklet was prepared in Arabic simple language and

supplemented by a large sized font colored photos to fit age-related visual changes and improve elderly's learning ability that involved concise simple information about climate, its elements, difference between climate and weather, climate change, its causes, consequences of climate change, effect of climate change on elderly health, the practices that must done to lessen human reasons for climate change and dealing with health problems associated with different climate change events.

- The awareness program arrangements was done; the program time and sessions were decided, additional facilities as ability to use laptop with PowerPoint presentations was checked in addition, teaching time was decided rendering to elderly clubs' time table and elderly available time.
- El Amal elderly clubs' hall in the second floor was arrangement to be used as teaching place during program sessions in coordination with the director of the club and the responsible employee.

#### **C. Implementation phase**

- Awareness program contents were consisted of five educational sessions one session per week for five weeks (each session was occupied from 30 to 45 minutes nearly).
- **First session (Introduction about climate):** At beginning; the researchers introduced themselves, explained the aim of the program. It comprised information about climate, elements of climate, difference between climate and weather. Elderly allowed to ask any questions for more clarification.
- **Second session (Introduction about climate change):** It included the following outlines; climate change definition, elements, difference from

weather, causes and its consequences in all fields.

- **Third session (Effect of climate change on health 1):** It covered the next things; Health problems that deteriorated by climate changes, most common health conditions that occurred due to climate change and its common signs and symptoms.
- **Fourth session (Prevent Practices regarding climate change's health problems):** This session consisted of practices to serve health and prevent health problems in case of different climate change events as hot weather , cold weather and dealing with them if occurred.
- **Fifth session (Practices to reduce human causes of climate change):** It included possible practices that may lessen the human causes of climate change as practices to saving energy in our homes, practices related to green procurement, practices related to reuse of the materials and dealing with wastes practices.
- Throughout the program sessions, the researchers used PowerPoint presentation through their lap top. Also, the prepared booklet was assumed to all the studied elderly to refresh their knowledge. Moreover, at the end of each sessions, the researchers were given concise summary about most important items.
- Before starting the next session, the researcher was inquire questions related go the previous the topic.
- The researcher used to meet the studied elderly in groups (5-7 elderly person) in the El Amal elderly clubs' hall.
- The researchers were in contact with the studied elderly periodically by telephone call or through whatsapp messages if possible for any questions.

- The researchers visited the elderly club three days per week for four months according to time available for elderly.

- The field work was carried over a period of 6 months from the first of April, 2023 to the end of September, 2023.

**D. Evaluation phase:** Evaluation phase was done firstly before the program implementation (pre/test) using all study tools, then after 3 months from the program implementation (post/test)<sup>(37)</sup> to evaluate the effect of awareness program on knowledge, attitudes and practices of community dwelling elderly regarding climate change and its effect on health using tools; II, III, IV and V.

**Statistical analysis:** The Statistical Package for Social Sciences (SPSS) version 22 was used to organize, categorize, tabulate and analyze the collected data. Descriptive statistics in the form of Means and standard deviations were used for continuous variables and frequencies and percentages were used for categorical variables. Normality of the study variables was tested by using Kolmogorov Smirnov test. A paired (t) test was used to compare the mean score between both studied variables and to compare the non-parametric qualitative ordinal variables Wilcoxon signed-rank paired t-test (Z) was used. In addition, Pearson correlation coefficient (r) was used for measuring the correlation between numerical variables. The p-value  $\leq 0.05$  was considered significant, and less than 0.001 as highly significant.

## Results

**Table (1)** revealed that **88.9 %** of the study participants aged from 60 to 75 years old with the mean age **66.86 $\pm$  4.86** years, **55.6 %** of them were female, **62.5%** were married, **55.6%** had secondary education , **52.8%** have enough income monthly. Also, **90.3%** lived in urban areas and **70.8 %** lived with their family. The table also illustrated that **90.3%** of the studied elderly suffered from



chronic diseases. Diabetes mellitus was prevailing among **43.1%** followed by hypertension (**36.1%**).

**Table (2)** showed that **41.7 %** of the studied elderly reported they had previous information about climate change; **56.7%** of them reported that social media was the primary source of information followed by friends & relatives and finally radio &TV by **46.7%**.

**Table (3)** indicated that there was statistically improvement of the studied elderly responses to knowledge questions about climate and climate change and its effect on human health items after implementation of the awareness program.

**Figure 1** showed that only **13.9 %** the studied elderly had good knowledge about climate change and its effect on health before implementation of awareness program, which improved to **41.7%** after the program implementation (**p=0.000\***).

**Table (4)** stated that there was statistically improvement of the studied elderly attitude about climate change items as climate change is just propaganda , indicators of climate change , climate change is a global phenomenon , willing to participate in any activities of the climate change, It is already too late to do anything about climate change and its effect on health, human activities have no significant impact on global temperatures and climate change is a very big problem (**P=0.000\*\***, **P=0.002**, **P= 0.023**, **P=0.005**, **P= 0.000\*\***, **P=0.000\*\***, **P=0.004** and **P= 0.000\*\*** respectively).

**Figure (2):** showed that **83.3%** of the studied elderly had negative attitude toward climate change and its effect on health before implementation of the program, while **87.5%** had positive attitude after the program implementation.

**Table (5)** reported that there was statistically improvement of the study participants practices to reduce anthropogenic causes of

climate change as practices related to saving energy , green procurement practice, practices related to reuse, practices related to recycling and practices related to dealing with waste after implementation of awareness program than before (**P=0.000\***).

**Table (6)** showed that there was statistically improvement of the self-reported preventive practices of the study participants about the following items ; Drinking enough water throughout the day, Eat fruits and vegetables, Wearing loose, light clothing, Protecting the body when going outside from sunburn, Wearing mask before leaving the house, especially in the event of winds and dust storms, Hand washing regularly, and Sleeping enough hours at night after the implementation of the awareness program than before (**P=0.000\*\***).

**Figure (3)** showed that **79.2%** of the studied elderly had unsatisfactory level of practices before implementation of the awareness program, while **94.4%** had satisfactory level of practices after the program implementation.

**Table (7)** revealed that there was statistically improvement of awareness level among the study participants about the following items; the manifestations of climate change differ from one climatic region to another ,Climate change affects personal health and safety, Overall, climate change is bad; it is more harmful than beneficial, People are experiencing the effect of climate change now, Climate change is an unbreakable process, Climate change is the cause of new diseases , Excessive heat and cold is possibly increase by climate change, Elderly are concerned about preventing the effect of climate change on health and Climate change poses a serious threat to elderly and family after the implementation of the program than before the program implementation (**P=0.031**, **P=0.003**, **P=0.000\*\***, **P=0.002**, **P=0.002**, **P=0.000\*\***, **P=0.000\*\***, **P=0.001**, **P=0.049** respectively).

**Figure(4)** showed that **87.5%** of the studied elderly had low awareness level toward climate change and its effect on health before implementation of the program, while an improvement was occurred after the program implementation as **65.3%** of the studied elderly had high level of awareness ( $P=0.000^*$ ).

**Table (8)** displayed that there was a statistical significant improvement in the elderly' total knowledge mean score ( $13.83 \pm 5.87$  v  $24.47 \pm 5.73$ ), total attitudes mean score ( $4.11 \pm 1.52$  v  $7.17 \pm 1.59$ ), total practices mean

score ( $41.44 \pm 9.98$  v  $78.89 \pm 10.65$ ), and total awareness mean score ( $9.14 \pm 4.52$  v  $13.22 \pm 5.72$ ) with  $P$  value =  $0.000^{**}$  for all.

**Table (9):** showed that a statistically significant strong positive correlation was found between the total knowledge score of the studied elderly and all of total practices scores, total attitudes scores and total awareness score after implementation of the program. As, the total practices, attitudes and awareness scores were higher among participants who had high level of knowledge.

**Table (1): Distribution of the study participants according to their demographic characteristics and health data**

Items	N=72	%
<b>Age (in years)</b>		
• 60 to less than 75 years	64	88.9
• 75 to less than 85 years	8	11.1
<b>Mean <math>\pm</math> SD = 66.86 <math>\pm</math> 4.86</b>		
<b>Sex</b>		
• Male	32	44.4
• Female	40	55.6
<b>Marital status</b>		
• Married	45	62.5
• Widow	19	26.4
• Divorced	8	11.1
<b>Level of education</b>		
• Illiterate & read and write	4	5.6
• Basic education	9	12.5
• Secondary education	40	55.6
• University education and above	19	26.4
<b>Income</b>		
• Not enough	34	47.2
• Enough	38	52.8
<b>Residence</b>		
• Urban	65	90.3
• Rural	7	9.7
<b>Living condition</b>		
• With family	51	70.8
• Alone	21	29.2
<b>Presence of Chronic diseases</b>		
• Yes	65	90.3
• No	7	9.7
<b>If yes type of other diseases<sup>#</sup></b>		
	<b>N =65</b>	<b>%</b>
• Diabetes Mellitus	31	43.1
• Hypertension	26	36.1
• Respiratory Diseases	17	23.6
• Heart Diseases	15	20.8
• Musculoskeletal Diseases	15	20.8

<sup>#</sup> More than one response

**Table (2): Distribution of the study participants according to their previous information about climate change and the information source**

Items	N=72	%
<b>Previous information about climate change</b>		
• No	42	58.3
• Yes	30	41.7
<b>If yes source of information #</b>		
• Social media	17	56.7
• Friends & relatives	16	53.3
• Radio and TV	14	46.7

# More than one response

**Table (3): Distribution of the study participants according to their knowledge about climate change pre and post awareness program (n=72)**

First: Elderly's knowledge about climate and climate change#	Pre Program	Post Program	Test of Significance
	N (%)	N (%)	Z (P value)
Q1: Climate is the average measure of temperature and rain place over a long period of time up to 30 years.	37(51.4)	71 (98.6)	5.252 (0.000**)
Q2: Weather is generated by the atmosphere during a short atmospheric period.	29 (40.3)	54 (75.0)	5.470 (0.000**)
Q3: The weather directly affects people's daily lives in terms of feeling hot and cold.	27(37.5)	54 (75.0)	5.269 (0.000**)
Q4: Humidity, wind and rain are elements of the climate?	27(37.5)	52 (72.2)	5.270 (0.000**)
Q5: Humidity is not affected by temperature changes.	30(41.7)	51 (70.8)	5.027 (0.000**)
Q6: The higher the water vapor in the atmosphere, the lower the humidity and vice versa.	39(54.2)	45 (62.5)	2.650 (0.008*)
Q7: Climate change is a disturbance in the Earth's climate with an increase in the planet's temperature.	37(51.4)	49 (68.1)	2.711 (0.007*)
Q8: Human activity is one of the causes of climate change.	34(47.2)	67 (93.1)	5.320 (0.000**)
Q9: Global warming is one of the causes of climate change.	3 (45.8)	58 (80.6)	5.328 (0.000**)
Q10: Temperature is the most important element of the climate because it dominates and controls the rest of the elements.	25(34.7)	70 (97.2)	6.132 (0.000**)
Q11: Wind is the movement of air above the earth's surface that travels in all directions and reaches every place on the earth's surface.	33(45.8)	64 (88.9)	3.643 (0.000**)
Q12: Among the phenomena that occur due to moisture are clouds, dew, rain, fog, snow, and clouds.	33(45.8)	59 (81.9)	4.352 (0.000**)
Q13: Climate change leads to a rise in temperatures and changes in precipitation and consequent results such as melting of polar ice and sea level rise.	46(63.9)	56 (77.8)	2.746 (0.006*)

Z= Wilcoxon Signed Ranks Test, # Only true answers were presented, \* p&lt;0.05, \*\* p&lt;0.001

**Cont. Table (3): Distribution of the study participants according to their knowledge about climate change pre and post awareness program (n=72)**

Second : Elderly's knowledge about effect of climate change on human health#	Pre Program	Post Program	Test of Significance
	N (%)	N (%)	Z (p value)
Q14: Climate change is already affecting health in many ways, including causing disease and death as a result of extreme weather events	22 (30.6)	39 (54.2)	4.602 (0.000**)
Q15: Cardiovascular disease is one of the diseases associated with climate change	20 (27.8)	46 (63.9)	5.894 (0.000**)
Q16: The risk of heart attacks increases in the winter	11 (15.3)	52 (72.2)	6.600 (0.000**)
Q17: The risk of asthma and bronchitis increases as a result of climate changes	28 (38.9)	62 (86.1)	5.625 (0.000**)
Q18: Floods are an ideal environment for the spread of a number of epidemic diseases, such as cholera	18 (25.0)	36 (50)	3.162 (0.002*)
Q19: Water scarcity leads to spread of intestinal parasitic diseases as Ascaris or skin parasites as lice	40 (55.6)	51 (70.8)	2.085 (0.037*)
Q20: Blurred vision and lack of concentration are symptoms of dehydration in the elderly	29 (40.3)	60 (83.3)	5.154 (0.000**)
Q21: Signs and symptoms of heat strokes in the elderly are severe headaches, vomiting, dizziness, imbalance, tremors, sometimes convulsions and fever	11 (15.3)	58 (80.6)	6.520 (0.000**)
Q22: Heatstroke in the elderly leads to a serious coma leading to death	29 (40.3)	58 (80.6)	4.819 (0.000**)
Q23: Untreated, heat exhaustion can lead to heatstroke that is a life-threatening condition that occurs when the body temperature reaches 40°C or more	18 (25.0)	50 (69.4)	5.891(0.000**)
Q24: A dark color of urine is a symptom of dehydration in the elderly	22 (30.6)	52 (72.2)	5.599(0.000**)
Q25: One of the symptoms of dehydration in the elderly is constipation	38 (52.8)	46 (63.9)	2.483 (0.013*)
Q26: Heat exhaustion and heatstroke is a state of profuse sweating, with increased heart rate, heat cramps	28 (38.9)	47 (65.3)	3.639 (0.000**)
Q27: Heavy sweating, fatigue, and dizziness are symptoms of heat exhaustion in the elderly	45 (62.5)	50 (69.4)	0.507 (0.612)
Q28: Hot weather and dehydration are among the causes of heat exhaustion in the elderly	21 (29.2)	54 (75.0)	4.879 (0.000**)
Q29:Excessive physical activity is one of the causes of heat exhaustion in elderly	50 (69.4)	62 (86.1)	2.268 (0.023*)
Q30: Overdressing is one of the causes of heat exhaustion in the elderly	46 (63.9)	63 (87.5)	3.819 (0.000**)
Q31: Some medications as diuretics and tranquilizers, increase elderly's sensitivity to heat exhaustion	36 (50.0)	66 (91.7)	4.884 (0.000**)
Q32: Obesity increases a elderly's sensitivity to heat exhaustion	40 (55.6)	64 (88.9)	4.204 (0.000**)

Z= Wilcoxon Signed Ranks Test, # Only true answers were presented, \* p≤0.05, \*\* p≤0.001

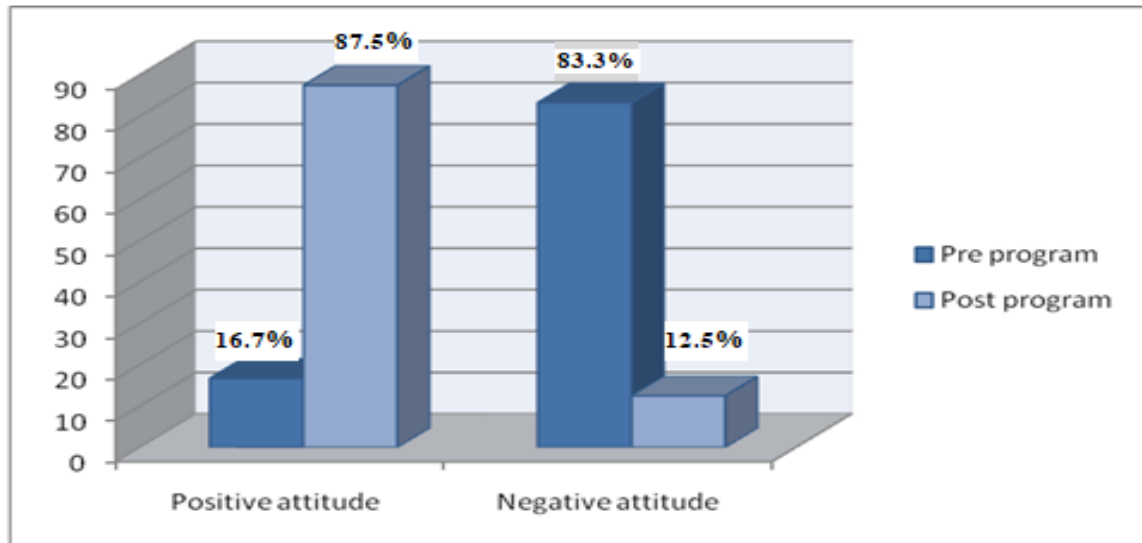


Figure (1): Percentages of total climate change knowledge pre and post awareness program

Table (4): Distribution of the study participants according to their attitudes about climate change pre and post awareness program

Items	Pre Program		Post Program		Test of Significance	
	Agree	Disagree	Agree	Disagree	Z	(P value)
	N (%)	N (%)	N (%)	N (%)		
Q1: Do you think climate change is just propaganda?	42 (58.3)	30 (41.7)	10 (13.9)	62 (86.1)	5.657	(0.000**)
Q2: Do you think that indicators of climate change are convincing?	29 (40.3)	43 (59.7)	48 (66.7)	24 (33.3)	3.042	(0.002)*
Q3: Do you think that climate change is a global phenomenon?	35 (48.6)	37 (51.4)	47 (65.3)	25 (34.7)	2.268	(0.023)*
Q4: Are you willing to participate in any activities of the climate change?	35 (48.6)	37 (51.4)	52 (72.2)	20 (27.8)	2.795	(0.005)*
Q5: Are you afraid of climate change?	41 (56.9)	31 (43.1)	51 (70.8)	21 (29.2)	1.826	(0.068)
Q6: It is already too late to do anything about climate change and its effect on health	44 (61.1)	28 (38.9)	7 (9.7)	65 (90.3)	6.083	(0.000**)
Q7: Climate change is inevitable	25 (34.7)	47 (65.3)	41 (56.9)	31 (43.1)	2.667	(0.008)*
Q8: Human activities have no significant impact on global temperatures	20 (27.8)	52 (72.2)	46 (63.9)	26 (36.1)	3.833	(0.000**)
Q9: I believe climate change is a very big problem	29 (40.3)	43 (59.7)	48 (66.7)	24 (33.3)	2.897	(0.004)*
Q10: I am preparing myself for the effects of climate change	22 (30.6)	50 (69.4)	47 (65.3)	25 (34.7)	3.904	(0.000**)

Z= Wilcoxon Signed Ranks Test, \* p<0.05, \*\* p<0.001



**Figure (2): Percentages of attitudes about climate change and its effect on health pre and post awareness program**

**Table (5): Distribution of the study participants according to their practices about climate change pre and post awareness program (n=72)**

Part I: Practices to reduce anthropogenic causes of climate change	Pre program			Post program			Z test
	Always	Sometime	Never	Always	Sometime	Never	
<b>First: Practices related to saving energy</b>							
Q1: Turning off devices such as televisions, electric irons, and kettles when not needed	32 (44.4)	31 (43.1)	9 (12.5)	66 (91.7)	6 (8.3)	0 (0)	5.405**
Q2: Buying energy-saving appliances such as dry irons instead of steam irons	12 (16.7)	30 (41.7)	30 (41.7)	67 (93.1)	5 (6.9)	0 (0)	6.693**
Q3: The refrigerator should not be opened continuously without a purpose	17 (23.6)	28 (38.9)	27 (37.5)	66 (91.7)	6 (8.3)	0 (0)	6.412**
Q4: Remove the accumulated snow on the walls of the refrigerator from the inside	20 (27.8)	33 (45.8)	19 (26.4)	66 (91.7)	6 (8.3)	0 (0)	6.164**
Q5: Avoid placing hot foods directly in the refrigerator	22 (30.6)	33 (45.8)	17 (23.6)	62 (86.1)	10 (13.9)	0 (0)	5.618**
Q6: Turn off the lights in the room when daylight is sufficient	16 (22.2)	26 (36.1)	30 (41.7)	62 (86.1)	10 (13.9)	0 (0)	6.405**
Q7: Turn off the lights when leaving the room	14 (19.4)	24 (33.3)	34 (47.2)	66 (91.7)	6 (8.3)	0 (0)	6.670**
Q8: Buy energy efficient light bulbs	16 (22.2)	28 (38.9)	28 (38.9)	67 (93.1)	4 (5.6)	1 (1.4)	6.604**
Q9: Fix any leaks in the water pipes so that it is not wasted	23 (31.9)	27 (37.5)	22 (30.6)	54 (75.0)	4 (5.6)	14 (19.4)	4.388**
Q10: Do not leave the water tap running unnecessarily	13 (18.1)	23 (31.9)	36 (50.0)	45 (62.5)	14 (19.4)	13 (18.1)	4.648**
<b>Second: Green Procurement Practice</b>							
Q11: Use rechargeable batteries	24 (33.3)	26 (36.1)	22 (30.6)	34 (47.2)	28 (38.9)	10 (13.9)	4.485**
Q12: Buy locally made goods and locally grown food products	15 (20.8)	32 (44.4)	25 (34.7)	31 (43.1)	28 (38.9)	13 (18.1)	4.174**
Q13: Buy environmentally friendly products such as organic food	11 (15.3)	34 (47.2)	27 (37.5)	36 (50.0)	24 (33.3)	12 (16.7)	4.152**
Q14: Use cloth/cartoon bags in shopping not plastic	33 (45.8)	27 (37.5)	12 (16.7)	57 (79.2)	14 (19.4)	1 (1.4)	4.071**
<b>Third: Practices related to reuse</b>							
Q15: Reuse empty containers in kitchen cupboard to store foodstuffs as sugar	18 (25.0)	21 (29.2)	33 (45.8)	61 (84.7)	10 (13.9)	1 (1.4)	6.185**
Q16: Use washable cloth napkins and placemats instead of disposable napkins.	17 (23.6)	28 (38.9)	27 (37.5)	61 (84.7)	10 (13.9)	1 (1.4)	6.211**
Q17: Save the plastic and paper bags.	30 (41.7)	15 (20.8)	27 (37.5)	55 (76.4)	15 (20.8)	2 (2.8)	4.935**
Q18: Use a plastic shopping bag for small trash cans around the house instead of buying small trash bags	22 (30.6)	32 (44.4)	18 (25.0)	54 (75.0)	17 (23.6)	1 (1.4)	5.166**



**Fourth : Practices related to recycling**

Q19: Do you recycle old clothes that are still in good condition?	27 (37.5)	28 (38.9)	17 (23.6)	46 (63.9)	25 (34.7)	1 (1.4)	4.056**
Q20: Do you sell paper or scrap metal to scrap collectors who come to the house?	21 (29.2)	32 (44.4)	19 (26.4)	42 (58.3)	30 (41.7)	0 (0)	4.463**

**Fifth: Practices related to dealing with waste**

Q21: Separate the wet & dry household waste	22 (30.6)	38 (52.8)	12 (16.7)	60 (83.3)	12 (16.7)	0 (0)	5.394**
Q22: Do you collect hazardous waste such as syringe teeth and scalpels separately?	24 (33.3)	32 (44.4)	16 (22.2)	60 (83.3)	11 (15.3)	1 (1.4)	5.843**
Q23: Sealing the trash container Take care not to overfill the bin	20 (27.8)	35 (48.6)	17 (23.6)	56 (77.8)	16 (22.2)	0 (0)	5.575**

Z= Wilcoxon Signed Ranks Test, \*\* p≤0.001

**Table (6): Distribution of the study participants according to their self-reported preventive practices about climate change pre and post awareness program (n=72)**

Items	Pre program			Post program			Z test
	Always	Sometime	Never	Always	Sometime	Never	
Q1: Drink enough water and fluids continuously throughout the day	13 (18.1)	34 (47.2)	25 (34.7)	51 (70.8)	21 (29.2)	0 (0)	5.937**
Q2: Make sure to eat fruits and vegetables	19 (26.4)	40 (55.6)	13 (18.1)	56 (77.8)	16 (22.2)	0 (0)	5.557**
Q3: Avoid consuming caffeinated beverages as tea and coffee as much as possible.	13 (18.1)	26 (36.1)	33 (45.8)	56 (77.8)	15 (20.8)	1 (1.4)	6.404**
Q4: Wear loose, light clothing	12 (16.7)	42 (58.3)	18 (25.0)	55 (76.4)	16 (22.2)	1 (1.4)	6.141**
Q5: Protect the body when going outside from sunburn by wearing a wide-brimmed hat and sunglasses	5 (6.9)	41 (56.9)	26 (36.1)	60 (83.3)	11 (15.3)	1 (1.4)	6.801**
Q6: Avoid strenuous activities during the hottest hours of the day	16 (22.2)	36 (50.0)	20 (27.8)	60 (83.3)	11 (15.3)	1 (1.4)	6.103**
Q7: Walk in the shade and out of direct sun	9 (12.5)	34 (47.2)	29 (40.3)	55 (76.4)	16 (22.2)	1 (1.4)	6.471**
Q8: Eat foods contain nutrients strengthen immune system as green leafy vegetables, carrots and sweet potatoes	12 (16.7)	30 (41.7)	30 (41.7)	56 (77.8)	14 (19.4)	2 (2.8)	6.205**
Q9: Wear mask before leaving the house, especially in the event of winds and dust storms	15 (20.8)	21 (29.2)	36 (50.0)	56 (77.8)	14 (19.4)	2 (2.8)	5.904**
Q10: Wash hands with soap and running water regularly, especially after returning home	21 (29.2)	30 (41.7)	21 (29.2)	50 (69.4)	20 (27.8)	2 (2.8)	6.495**

Q11: Paying attention to enough hours of sleep at night to strengthen the immune system	18 (25.0)	32 (44.4)	22 (30.6)	49 (68.1)	21 (29.2)	2 (2.8)	6.575**
Q12: You can cancel outdoor activities when weather forecast warns of dust or sand storm and in hot weather days	6 (8.3)	40 (55.6)	26 (36.1)	52 (72.2)	18 (25.0)	2 (2.8)	5.929**
Q13: Make sure to take a cold shower to help cool your body on very hot days	12 (16.7)	42 (58.3)	18 (25.0)	61 (84.7)	9 (12.5)	2 (2.8)	6.109**
Q14: On very hot days, do not wait in closed places that do not have good ventilation	16 (22.2)	35 (48.6)	21 (29.2)	56 (77.8)	14 (19.4)	2 (2.8)	6.446**
Q15: Stay away from direct sunlight, especially during the period from 10 am to 3 pm	19 (26.4)	25 (34.7)	28 (38.9)	56 (77.8)	14 (19.4)	2 (2.8)	6.503**
Q16: I eat light meals and stay away from heavy meals on very hot days	10 (13.9)	30 (41.7)	32 (44.4)	57 (79.2)	13 (18.1)	2 (2.8)	5.514**
Q17: During periods of extreme heat, close windows and curtains during the day	10 (13.9)	38 (52.8)	24 (33.3)	60 (83.3)	10 (13.9)	2 (2.8)	5.319**

Z= Wilcoxon Signed Ranks Test, \*\* p<0.001

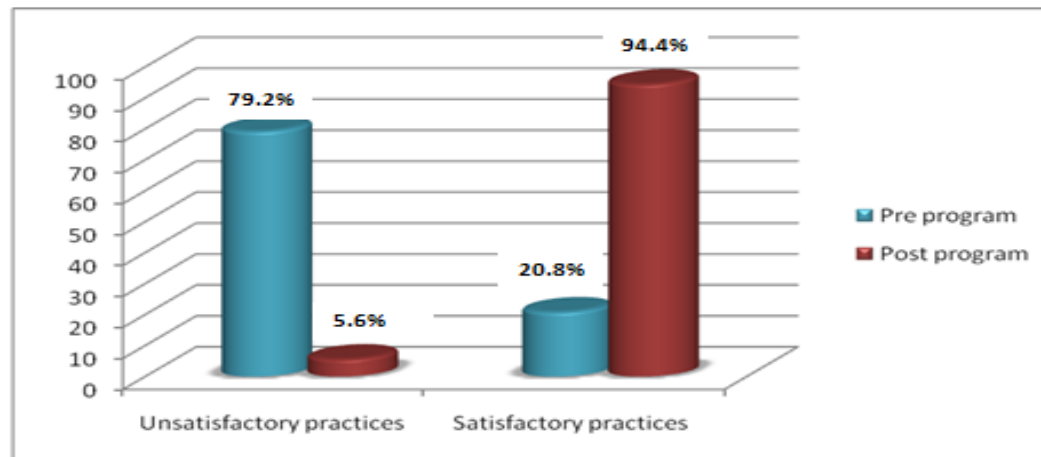


Figure (3): Percentages of total practices of climate change and its effect on health pre and post awareness program

**Table (7): Distribution of the study participants according to their awareness about climate change pre and post awareness program**

Items	Pre Program		Post Program		Test of Significance	
	N(72)	%	N(72)	%	Z	P value
<b>Q1: Manifestations of climate change differ from one climatic region to another</b>						
• Disagree	21	29.2	11	15.3	2.155	0.031*
• Neutral	16	22.2	14	19.4		
• Agree	35	48.6	47	65.3		
<b>Q2: Climate change affects your personal health and safety</b>						
• Disagree	32	44.4	15	20.8	2.921	0.003*
• Neutral	19	26.4	18	25.0		
• Agree	21	29.2	39	54.2		
<b>Q3: Overall, climate change is bad; it is more harmful than beneficial</b>						
• Disagree	48	66.7	13	18.1	4.715	0.000**
• Neutral	5	6.9	12	16.7		
• Agree	19	26.4	47	65.3		
<b>Q4: People are experiencing the effect of climate change now</b>						
• Disagree	31	43.1	17	23.6	3.084	0.002*
• Neutral	16	22.2	4	5.6		
• Agree	25	34.7	51	70.8		
<b>Q5: Climate change is an unbreakable process</b>						
• Disagree	35	48.6	19	26.4	3.113	0.002*
• Neutral	11	15.3	3	4.2		
• Agree	26	36.1	50	69.4		
<b>Q6: Climate change is the cause of new diseases</b>						
• Disagree	39	54.2	16	22.2	3.664	0.000**
• Neutral	10	13.9	4	5.6		
• Agree	23	31.9	52	72.2		
<b>Q7: Excessive heat and cold is possibly increase by climate change</b>						
• Disagree	42	58.3	20	27.8	3.798	0.000**
• Neutral	12	16.7	5	6.9		
• Agree	18	25.0	47	65.3		
<b>Q8: You are concerned about preventing the effect of climate change on health</b>						
• Disagree	43	59.7	21	29.2	3.391	0.001**
• Neutral	5	6.9	5	6.9		
• Agree	24	33.3	46	63.9		

Q9: Climate change poses a serious threat to you and your family						
• Disagree	37	51.4	26	36.1	1.970	0.049*
• Neutral	11	15.3	9	12.5		
• Agree	24	33.3	37	51.4		
Q10: I see climate change to be of immediate and urgent concern						
• Disagree	20	27.8	19	26.4	0.297	0.766
• Neutral	9	12.5	17	23.6		
• Agree	43	59.7	36	50.0		

Z= Wilcoxon Signed Ranks Test, \* p<0.05, \*\* p<0.001

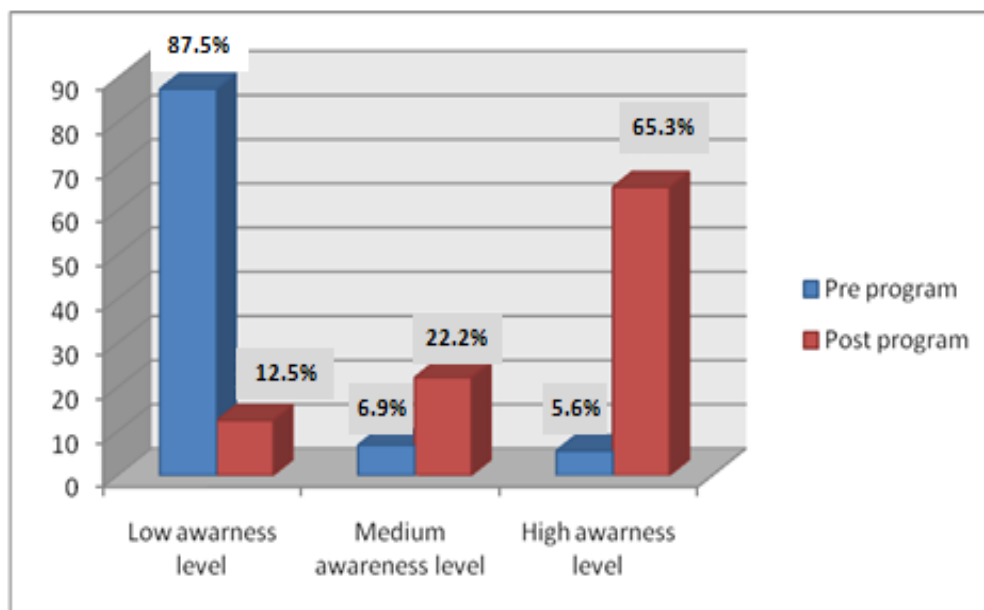


Figure (4): Percentages of awareness about climate change and its effect on health pre and post awareness program

Table (8): Effect of the Awareness Program about Climate Change and Health on Total Score Knowledge, Attitudes, Practices, and Awareness of the study participants

Item	Pre Program (Mean ± SD)	Post Program (Mean ± SD)	t-test (p value)
Knowledge	13.83 ±5.87	24.47±5.73	15.151 (0.000)**
Attitudes	4.11±1.52	7.17±1.59	13.401 (0.000)**
Practices	41.44±9.98	78.89±10.65	26.390 (0.000)**
Awareness	9.14±4.52	13.22±5.72	14.409 (0.000)**

(\*) Statistically Significant at p≤ 0.05

Paired t-test (P)= Comparing before and 3months after awareness program in study group

**Table (9): Correlation between the study variables**

Items	Total Attitudes scores		Total practices scores		Total Awareness scores		
	Pre program	Post program	Pre program	Post program	Pre program	Post program	
Total Knowledge scores	r	0.597	0.936	0.095	0.879	0.606	0.985
	P	0.000**	0.000**	0.427	0.000**	0.000**	0.000**
Total Attitudes scores	r			0.132	0.903**	0.170	0.967
	P			0.270	0.000**	0.220	0.000**
Total practices scores	r					0.052	0.879
	P					0.663	0.000**

\*\*Correlation is significant at the 0.01 level (2-tailed)

### Discussion

Globally, climate change is considered as inescapable problem which exacerbate significant risk to human health. Climate change affects the social and environmental determinants of health such as clean air, safe drinking water, sufficient food and secure shelter. Climate Change has numerous negative effects on human health at all ages especially for vulnerable groups as elderly and extend health hazards as, asthma, heat-related health problems and mental health disorders<sup>(47)</sup>. During the period from 2030 to 2050, of awareness program on knowledge, attitudes and practices of community dwelling elderly about climate change and its effect on health. an additional 250,000 deaths caused by climate change is expected to happen annually. By the late twenty-first century, climate change is likely to increase frequency and intensity of drought at global scale<sup>(13)</sup>.

Nowadays, Egypt is dealing with a number of environmental issues as climate change.

Since the relation between climate change and human practices is not obviously recognized, the Egyptian people have

knowledge deficiencies about the exact causes of climate change<sup>(48)</sup>. As a result, Gerontological Nurses should apprehend the effects of climate change and promote practices that will lessen the climate change and dangerous effect on health<sup>(49)</sup>. Consequently, increase elderly awareness about climate change have essential circumstantial to deal with climate change and health related effects<sup>(32)</sup>. Therefore, the aim of this study was to evaluate the effect At the present time, Social media can play a vigorous role in the broadcasting of climate change related information<sup>(50)</sup>. The present study showed that, social media was the primary source of information about climate change. The same finding was reported by other studies done in Egypt by **Ibrahim et al., (2018)**<sup>(51)</sup> and by **Ahmed et al., (2023)**<sup>(52)</sup> who noticed that social media was the main respondents' source of information on climate change and health. While, another studies done in Kenya by **Wetiba et al., (2021)**<sup>(53)</sup> and in China by **Wang et al., (2022)**<sup>(54)</sup> showed that about half of the both studied sample got their information about climate through televisions. On the other

hand, this result was in disagreement with study performed by **Barreda, (2018)** <sup>(55)</sup> in Indonesia who stated that the primary source of information about climate change is from family. From our opinions, this may be due to availability of television and social media tools to everyone and are considered the fastest and easiest means of communication and main sources of information.

Understanding climate change and its health impacts can exacerbate elderly to comprehend their role in climate change alleviation by modifying their practices and decrease health impacts of climate changes on their health <sup>(56)</sup>. As regards to the studied elderly's knowledge score about climate change and its effect on health throughout the study phases, the results of the current study shown that it was significantly improved in knowledge after implementation of awareness program than before implementation. This is congruent with a previous studies done in Brazil by **Tibola da Rocha et al., (2020)** <sup>(57)</sup> and in Egypt by **Ebrahim, et al., (2022)** <sup>(58)</sup> who stated that the majority of studied respondents had insufficient knowledge climate change at before the program. While, after the program revealed a highly significant improvement of knowledge on climate change and sustainability developments.

A bigger emphasis on holistic education leads to the development of climate change attitudes that can eventually foster persons' willingness to act <sup>(59)</sup>. The present study showed that there was a statistically significant improvement in elderly attitude overall mean score after the program implementation. This finding assured the valuable effect of our awareness program through increase elderly knowledge, attitudes and practices regarding the climate change and its effect on their health. Another study reported similar results done

at Brighton by **Dunne et al., (2022)** <sup>(60)</sup> revealed that the respondents' attitudes increased after implementation of a climate-change and sustainability online module. Similarly, this result is in agreement with the studies conducted in China by **Tang, (2022)** <sup>(61)</sup> and in Spain by **Álvarez-Nieto et al., (2022)** <sup>(6)</sup> who revealed that significant improvement in attitudes toward the importance of climate change and sustainability after educational interventions occur.

Readiness for climate change consequences is one of the most important challenges for communities nowadays. As climate change education is an integral element in the increasingly urgent global approach to solving the problem of climate change, understanding and performing practices that reduce climate change and its effects in different situations could play a significant role in decreasing climate change harm effects <sup>(62)</sup>. The present study stated that about two third of the studied elderly had unsatisfactory level of practices before implementation of the awareness program, while there was an improvement in practices score after the program implementation. In the same line, study conducted in Northern Malaysia by **Tiong et al., (2021)** <sup>(63)</sup> who observed that to more than half of studied subjects' practices were improved after teaching program than before. In the same direction, another studies done in USA by **Lavey, (2018)** <sup>(64)</sup>, in Brazil by **Tibola da Rocha et al., (2020)** <sup>(57)</sup> and in United Kingdom by **Kurup et al., (2021)** <sup>(65)</sup> who confirmed that educational interventions had a significant effects in improving self-reported practices related to climate change and its effect on health of the study subjects than before. In addition, a study done in Egypt by **Abdallah & Farag, (2022)** <sup>(66)</sup> showed that self-reported behaviors regarding climate change of the study

respondents' significantly increased after the teaching program implication.

Furthermore, climate change awareness is a chief step in attaining adaptation and alleviation approaches as increasing awareness would change behavior towards strengthening the environment and help to face climate change adverse impacts <sup>(55)</sup>. Meanwhile our study results confirmed there was a statistical significant increase in awareness level of the studied elderly after implementation of awareness program than before. In similarity, studies done in the United Arab Emirates by **Abuelgasim & Daiban., (2017)** <sup>(67)</sup> and in Nigeria by **Onuoha et al., (2021)** <sup>(68)</sup> reported that climate change play an effective role in increasing awareness levels of the studied subjects .

This result in the same line with a study done in Saudi Arabia by **Almulhim ,(2021)** <sup>(69)</sup> who stated that more than one quarter of the studied subjects had good awareness level about climate change at posttest. Also, **Ghazy & Fathy, (2023)** <sup>(37)</sup> in Egypt reported that significant improvement in most aspects of studied sample' awareness about climate change after the program application. Additionally another studies conducted in Italy by **Mebane et al., (2023)** <sup>(70)</sup> and in Philippines by **Adlit et al., (2023)** <sup>(71)</sup> who stated that climate change education intervention improve the studied sample awareness level.

In addition, the current study presented that statistically significant strong positive correlation was found between the total knowledge score and all of total practices scores, total attitudes scores and total awareness score of the studied elderly after awareness program implementation. This result was accordance with studies conducted by **Karami et al., (2017)** <sup>(23)</sup> in Iran; **Kolenatý et al., (2022)** <sup>(72)</sup> in Czech by **Sambath et al., (2022)** <sup>(40)</sup> in India who

displayed that significantly positive correlation between climate change knowledge, attitude and practices were found among the studied sample. The same opinion was found in another study performed in Turkey by **Tuna et al., (2022)** <sup>(73)</sup> who stated that there was strong positive correlation between knowledge, practices and attitude of the studied participant .The previous results also were supported by a study done by **Abdel Nabi et al., (2023)** <sup>(31)</sup> in Egypt by who indicated that, there was a highly statistically significant positive correlation between total knowledge, reported practices and attitudes related to climate change among studied subjects.

Also, the same result was reinforced by **Amin et al., (2023)** <sup>(74)</sup> in Egypt who revealed that study subjects with satisfactory knowledge were four times more likely to perceive danger as higher than participants with insufficient knowledge ( $P = 0.000^*$ ). Last but not least, A study conducted by **Ghazy, and Fathy, (2023)** <sup>(37)</sup> in Egypt who revealed that there was a highly positive correlation between total participants' knowledge score level &attitudes and total daily life practices (at  $p < 0.001$ ). This result can be justified by that the greater the knowledge regarding climate change , the more the elderly demonstrate satisfactory practices and having positive attitude toward adaptation with climate change and its effects on their health.

**Conclusion:** The awareness program has a significant positive effect on improving elderly's knowledge, attitudes, practices and awareness about climate change and health. Furthermore, There was strong positive correlation was found between the knowledge , attitudes , practices and awareness level of community dwelling elderly regarding climate change and health after implementation of the awareness program.



### Recommendations

- Dissemination of developed illustrated awareness program booklet about climate change and health to all elderly at Mansoura City should be done.

- Establish educational program for elderly with chronic diseases how to deal with climate change.

- The implementation of various initiatives that work in harmony to combat climate change as training workshops, educational campaigns, and studies, that take the advantage of the prominence of the internet, social media, and television channels for announcing and disseminating valid and credible information about climate change and promoting positive change in behavior.

### Acknowledgment:

The authors would like to express thankfulness to all studied elderly who participated in the study for their time, effort, and contributions. In addition, many thanks for employee in El-Amal elderly club for their agreement to conduct this study and their cooperation throughout the study.

### Conflicts of interest disclosure:

The authors declare that they have no conflict of interest. All data including statistics are available from the corresponding author and will be made available upon reasonable request.

**Financial support:** No funding was received

### References

1. **Kinay P., Morse A. P., Villanueva, E. V., Morrissey K., & Staddon P. L. :** Direct and indirect health impacts of climate change on the vulnerable elderly population in East China. *Environmental Reviews*. 2019; 27(3), 295-303.
2. **Campbell-Lendrum D., & Prüss-Ustün A. :** Climate change, air pollution and noncommunicable diseases. *Bulletin of the World Health Organization*. 2019; 97(2), 160.
3. **Iira T., Ruth, M. L., Hannele, T., Jouni J., & Lauri K. :** Finnish nurses' perceptions of the health impacts of climate change and their preparation to address those impacts. *Nursing Forum*. 2021, April: 56 (2) : 365-371
4. **Gazzaz N. M., & Aldeseet B. A. :** Assessment of the Level of Knowledge of Climate Change of Undergraduate Science and Agriculture Students. *World Journal of Education* . 2021; 11(5), 41-60.
5. **Torres M. A. O., Kallas Z., & Herrera S. I. O. :** Farmers' environmental perceptions and preferences regarding climate change adaptation and mitigation actions; towards a sustainable agricultural system in México. *Land use policy* . 2020: 99, 105031.
6. **Álvarez-Nieto C., Álvarez-García C., Parra-Anguila L., Sanz-Martos S., & López-Medina I. M. :** Effectiveness of scenario-based learning and augmented reality for nursing students' attitudes and awareness toward climate change and sustainability. *BMC nursing*, 2022: 21(1), 245.
7. **World Health Organization.:** Climate change and health. Geneva. 2018 available at <http://www.who.int/en/news-room/fact-sheets/detail/climate-change-and-health>. Accessed on 22 December 2022.
8. **Zeng, Y. & Zheng X. :** How does climate environment affect middle-aged and elderly people's health performances: Evidence from China. 2022. *Research Square*. <https://doi.org/10.21203/rs.3.rs-1896516/v1>
9. **McDermott-Levy R., Kolanowski A. M., Fick D. M., & Mann M. E.:** Addressing the health risks of climate change in older adults. *Journal of gerontological nursing*, 2019: 45(11), 21-29.

10. **Singer M., Shoreman-ouimet E., & Graham A. L.** : Climate change and health: Anthropology and beyond. A companion to medical anthropology, 2022: 429-441.
11. **Ayalon L., Keating N., Pillemer K., & Rabheru K.** : Climate change and mental health of older persons: A human rights imperative. *The American Journal of Geriatric Psychiatry*, 2021: 29(10), 1038-1040.
12. **Sulistiyawati S., Mulasari S. A., & Sukei T. W.** : Assessment of knowledge regarding climate change and health among adolescents in Yogyakarta, Indonesia. *Journal of environmental and public health*, 2018. doi.org/10.1155/2018/9716831.
13. **Gautam B., Mandal P. K., & Yangden N.** : Students' awareness towards climate change: a study of climate change effects on human health in Nepal. *Prithvi Academic Journal*, 2021: 4, 18-26.
14. **Uwisunzemariya O.** : Knowledge, Attitude and Practices Regarding Climate Change among Immigrants Who Live in Gothenburg, Sweden. Master Thesis. 2021, available at: [https://studentportal.gu.se/digitalAssets/1792/1792594\\_odile-isunzemari\\_reviderad.pdf](https://studentportal.gu.se/digitalAssets/1792/1792594_odile-isunzemari_reviderad.pdf). Accessed on 12 August 2023.
15. **Ead H., Fahmy S., Fadallah S., Elhalwany F., Fahmy H., & Kapiel T.** : How Can Climate Change Education Contribute to Awareness And Action in Egypt? Cairo University as A Case Study. *Journal of the International Academy for Case Studies*, 2022: 28(4).
16. **Butterfield P., Leffers J., & Vásquez M. D.** : Nursing's pivotal role in global climate action. *BMJ* , 2021 : 373. <https://doi.org/10.1136/bmj.n1049>.
17. **World Health Organization (WHO):** WHO Health and Climate Change Survey Report, 2021. Available at [Climate Change Survey Report \(who.int\)](https://www.who.int/news-room/fact-sheets/detail/who-health-and-climate-change-survey-report-2021). Accessed on 15 March, 2023.
18. **United Nations: Climate Change:** Glasgow Climate Change Conference 2021 available at <https://unfccc.int/conference/glasgow-climate-change-conference-october-november-2021>. Accessed on 3 March ,2023.
19. **Patella V., Florio G., Magliacane D., Giuliano A., Crivellaro M. A., Di Bartolomeo D., Genovese A., Palmieri M., Postiglione A., Ridolo E., Scaletti C., Ventura T., & Zollo A.** : Urban air pollution and climate change:“The Decalogue: Allergy Safe Tree” for allergic and respiratory diseases care. *Clinical and Molecular Allergy*, 2018 : 16(1), 1-11.
20. **Central Agency for Public Mobilization and Statistics (CAPMAS).** : Press Release. On The Occasion of the International Day of Elderly Persons 74.3 Years Life Expectancy at Birth in Egypt 2021. [https://www.capmas.gov.eg/Admin/News/PressRelease/2021930125042\\_666%20e.pdf](https://www.capmas.gov.eg/Admin/News/PressRelease/2021930125042_666%20e.pdf). Accessed on 10 August, 2023.
21. **Egypt Vision. (2030).** Available at <https://www.presidency.eg/ar> accessed on 25 January, 2023.
22. **Mohamed, S.:** Education and Climate Change in Egypt. 2023 Available at: <https://aps.aucegypt.edu/en/articles/1147/education-and-climate-change-in-egypt>. Accessed on 20 September, 2023.
23. **Karami S., Shobeiri S. M., Jafari H., & Jafari H.** : Assessment of knowledge, attitudes, and practices (KAP) towards climate change education (CCE) among lower secondary teachers in Tehran, Iran. *International Journal of Climate*

- Change Strategies and Management. 2017: 9(03): 402-415.
24. **McCright A. M.** : Enhancing students' scientific and quantitative literacies through an inquiry-based learning project on climate change. *Journal of the Scholarship of Teaching and Learning*, 2012: 12(4), 86-101.
25. **Jeong J. S., González-Gómez D., Conde-Núñez M. C., Sánchez-Cepeda, J. S., & Yllana-Prieto F.** : Improving climate change awareness of preservice teachers (Psts) through a university science learning environment. *Education Sciences*, 2021: 11(2), 78.
26. **Montoro-Ramírez E. M., Parra-Anguita L., Álvarez-Nieto C., Parra G., & López-Medina I.**: Effects of climate change in the elderly's health: a scoping review protocol. *BMJ open* , 2022: 12(4), 058063.
27. **Adetayo A. J., Abata-Ebire B. D., & Oladipo Y. O. (2023)**: Climate Change Information Sources: Fact-Checking and Attitude. In *Climate Change, World Consequences, and the Sustainable Development Goals for 2030* (pp. 73-88). IGI Global.
28. **Cruz J. P., Felicilda-Reynaldo R. F. D., Alshammari F., Alquwez N., Alicante J. G., Obaid K. B., Rady A.H. E., , Qtait M., J, Ben T. J. P., & Silang J. P. B. T.**: Factors influencing Arab nursing students' attitudes toward climate change and environmental sustainability and their inclusion in nursing curricula. *Public Health Nursing*, 2018: 35(6), 598-605.
29. **Kinay P., Morse A. P., Morrissey K., Yücel M. R., & Staddon P. L.** : Risk perception of Chinese elderly: An urban study on adaptation to climate change. *Sustainable Environment*, 2021: 7(1), 1988384.
30. **Guihenneuc J., Ayraud-Thevenot S., Roschnik S., Dupuis A., & Migeot V.** : Climate change and health care facilities: A risk analysis framework through a mapping review. *Environmental Research*, 2022: 114709.
31. **Abdel Nabi E., Shafik S. A., & Saad A. M.** : Assessment of Nursing Students' Awareness regarding Climate Change. *Helwan International Journal for Nursing Research and Practice*, 2023: 2(1), 69-82.
32. **Anu A., Sonia G. L., & Ismail K.** : Effect of Climate Change on Health in Older Persons. *Wits Journal of Clinical Medicine*, 2023: 5(2), 79-84.
33. **Mohammed Abdullah K., Mohammad Esmat O., Thabet Hasaneen S., & Khalil Ibrahim W.** : Health Risks Related to Climate Changes among Older Adults. *Egyptian Journal of Health Care*, 2022: 13(3), 678-690.
34. **Paavola J.** : Health impacts of climate change and health and social inequalities in the UK. *Environmental Health*, 2017: 16(1), 61-68.
35. **Amerson R. M., Boice O., Mitchell H., & Bible J.** : Nursing Faculty's Perceptions of Climate Change and Sustainability. *Nursing Education Perspectives*, 2022:43(5), 277-282.
36. **Okon U. A., Usman R., Katchy U. I., & Salam S.** : Community perception and adaptation to climate change in Benue State, Nigeria, 2021. *Pan African Medical Journal One Health*, 2022: 7.
37. **Ghazy K. H., & Fathy M. D.** : Effect of Awareness Program Regarding Climate Change on Knowledge, Attitudes and Practices of University Students. *International Egyptian Journal of Nursing Sciences and Research*, 2023: 3(2), 186-203.

38. **Leyva E. W. A., Beaman A., & Davidson P. M.** : Health impact of climate change in older people: an integrative review and implications for nursing. *Journal of Nursing Scholarship*, 2017: 49(6), 670-678.
39. **Samuelson O. E., Endurance E. O., Pharm B., Ohikhuare O., Raphael U. O., Michael O. O., & Osaruyi O. E.** : Climate Change; Our Impact on the Climate and its Consequences; A Cross-sectional Study. *International Journal of Scientific Advances*: 2022: 3(3). DOI: 10.51542/ijscia.v3i3.23.
40. **Sambath V., Narayan S., Kumar P., Kumar P., & Pradyumna A.** : Knowledge, attitudes and practices related to climate change and its health aspects among the healthcare workforce in India—A cross-sectional study. *The Journal of Climate Change and Health*, 2022: 6, 100147.
41. **Abbas A., Ekowati D., Suhariadi F., & Fenitra R. M.**: Health implications, leaders societies, and climate change: a global review. *Ecological footprints of climate change: Adaptive approaches and sustainability*, 2023: 653-675.
42. **Hathaway J., & Maibach E. W.** : Health implications of climate change: a review of the literature about the perception of the public and health professionals. *Current environmental health reports*, 2018: 5, 197-204.
43. **Deveci S. E., Kurt O., Pirinçci E., & Oğuzöncül A. F.** : Knowledge and awareness of a medical faculty students in Turkey about global warming, climate change and their consequences. *Journal of Human Sciences*, 2019: 16(2), 679-689.
44. **Lee L. J., Tung S. E. H., Gan W. Y., & Kaur S.** : Knowledge, Attitude and Perception on Climate Change and Dietary Choices in A Predominantly Chinese University Students Population in Klang Valley. *Malaysian Applied Biology*, 2022: 51(3), 37-45.
45. **Malgwi P. G., & Joshua W. K.** : Assessment of the perception and awareness of climate change and the influence of information amongst tertiary education students in north-east Nigeria. *Library and Information Science Digest*, 2021: 14, 14-24.
46. **Yusoff M. S. B.** : ABC of content validation and content validity index calculation. *Education in Medicine Journal*, 2019: 11(2), 49-54.
47. **Rahman M. S., Karamehic-Muratovic A., Baghbanzadeh M., Amrin M., Zafar S., Rahman N. N., Shirina U., & Haque U.** : Climate change and dengue fever knowledge, attitudes and practices in Bangladesh: A social media-based cross-sectional survey. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 2021: 115(1), 85-93.
48. **Salem M. R., Hegazy N., Thabet Mohammed A. A., Mahrous Hassan E., Saad Abdou M. M., & Zein M. M.** : Climate change-related knowledge and attitudes among a sample of the general population in Egypt. *Frontiers in Public Health*, 2022: 10, 1047301.
49. **Harkness G. A., & DeMarco R. F. (2016)**: *Community and public health nursing: Evidence for practice*, 2<sup>nd</sup> ed. Wolters Kluwer. P 397.
50. **Ghanem A.** : Assessment knowledge, perception, and behaviors towards climate change among universities youth in Egypt. *Athens J Mediterr Stud*, 2022: 8, 1-16.
51. **Ibrahim A. A., Fahmy H. D., & Mahmoud S. R.** : Knowledge and attitude regarding global warming phenomenon among Assiut University Students. *Assiut Scientific Nursing Journal*, 2018: 6(14), 1-11.

52. **Ahmed A. H. A. A., Zaki N. A. E., Khalaf S. A., Abd-elsalam N. A. A. A., & Ahmed W. H. A. A.** : Effect of Didactic Program about Health Care Providers' Role in Facing Climate Changes and Its Effects on Children Health. *Tanta Scientific Nursing Journal*, 2023: 29(2), 200-215.
53. **Wetiba W. M., Tsingalia M., Pili N. N., & Kakembo V.** : Assessment of Climate Change Awareness in the Kakamega-Nandi Forest Complex in the Western Region. *Asian Journal of Environment & Ecology*, 2021: 15(1), 33-48.
54. **Wang Y., Zhang X., Li Y., Liu Y., Sun, B., Wang Y., Zhou Z., Zheng L., Zhang L., Yao X., & Cheng Y.** : Knowledge, Attitude, Risk Perception, and Health-Related Adaptive Behavior of Primary School Children towards Climate Change: A Cross-Sectional Study in China. *International journal of environmental research and public health*, 2022: 19(23), 15648.
55. **Barreda A. B.** : Assessing the level of awareness on climate change and sustainable development among students of Partido State University, Camarines Sur, Philippines. *Journal of sustainability education*, 2018: 17, 1-17.
56. **Nina L., Kyu-Yeon S., Milsom O., Shelby B., & Buckley L.** : Teaching about Climate Change Impacts on Health: Capturing the Experience for Educators. *Case Studies in the Environment*, 2023:7(1).
57. **Tibola da Rocha V., Brandli L. L., & Kalil R. M. L.** : Climate change education in school: knowledge, behavior and attitude. *International Journal of Sustainability in Higher Education*.2020: 21(4):649-670.
58. **Ebrahim E. S., Mohamed Shokry, W., & Samir Darwish, S.** : The effectiveness of educational interventions about sustainability development among nursing students. *Egyptian Journal of Health Care*, 2022: 13(1), 294-310.
59. **Hermans M., & Korhonen J.** : Ninth graders and climate change: Attitudes towards consequences, views on mitigation, and predictors of willingness to act. *International Research in Geographical and Environmental Education*, 2017: 26(3), 223-239.
60. **Dunne H., Rizan C., Jones A., Bhutta M. F., Taylor T., Barna S., Taylor J., & Okorie M.** : Effectiveness of an online module: climate-change and sustainability in clinical practice. *BMC Medical Education*, 2022: 22(1), 682.
61. **Tang K. H. D.** : Climate change education in China: A pioneering case of its implementation in tertiary education and its effects on students' beliefs and attitudes. *International Journal of Sustainability in Higher Education*, 2023:24(5), 1058-1081.
62. **Harth N. S.** : Affect, (group-based) emotions, and climate change action. *Current opinion in psychology*, 2021: 42, 140-144.
63. **Tiong C. S., Lean Q. Y., Ming L. C., Abdullah A. H. B., Mahalingam S. R., Arshad K., & Hock L. S.** : Knowledge, perceptions of risks, attitudes and practices of environmental health among university students in northern Malaysia. *International Journal of Health Promotion and Education*, 2021:59(1), 23-34.
64. **Lavey W. G.** : Teaching the health impacts of climate change in many American higher education programs. *International Journal of Sustainability in Higher Education*, 2019: 20(1), 39-56.
65. **Kurup P. M., Levinson R., & Li X.** : Informed-decision regarding global warming and climate change among high

- school students in the United Kingdom. *Canadian Journal of Science, Mathematics and Technology Education*, 2021: 21, 166-185.
66. **Abdallah Z. A., & Wagdy Farag A. A. :** Impact of Awareness Program Regarding Health Consequences of Climate Change on Knowledge, Perception and Daily Life practices among Nursing Students. *Egyptian Journal of Nursing and Health Sciences*, 2022: 3(1), 367-390.
67. **Abuelgasim A., & Daiban S.:** Levels of climate change awareness in the United Arab Emirates. *Horizons in Humanities and Social Science: An International Refereed Journal*, 2017: 2(2), 42-53.
68. **Onuoha J., Eze E., Ezeaputa C. M. C., Okpabi J. U., & Onyia J. C. :** Does learning geography increase climate change awareness? A comparison of school subjects' influence on climate change awareness. *Journal of Geography*, 2021: 120(4), 140-151.
69. **Almulhim A. I. :**Public knowledge and perception of climate change and global warming in the context of environmental challenges and policies in Saudi Arabia. *WIT Transactions on Ecology and the Environment*, 2021:253, 577-589.
70. **Mebane M. E., Benedetti M., Barni D., & Francescato D. :** Promoting climate change awareness with high school students for a sustainable community. *Sustainability*, 2023: 15(14), 11260.
71. **Adlit M. F., Adlit M. F., Rama J. M., Dineros M. J., & Lim-Barrozo D. :**Effects of Learning Action Cells among Elementary Teachers' Level of Awareness on Climate Change Education. *Puissant*, 2023: 4, 1113-1134.
72. **Kolenatý M., Kroufek R., & Činčera J. :** What triggers climate action: The impact of a climate change education program on students' climate literacy and their willingness to act. *Sustainability*, 2022:14(16), 10365.
73. **Tuna H., Tuna P., Molu B., and Keskin A. :** Determination of Nursing Students' Awareness of the Health Effects of Climate Change. *International Journal of Caring Sciences*. 2022:15(2):1149 -1156.
74. **Amin S. M., Eldeeb A. M., & Elbially A. A. :** Predictors of Climate Change Knowledge and Risk Perception among the Adults in El Beheira Governorate. *Assiut Scientific Nursing Journal*, 2023:11(34), 41-51.