

Determining the Knowledge about Hazards of Heat Exposure and Prevalence of Heat Illnesses among Elderly and pregnant pilgrims attending primary health care Center, Makkah Al-Mokarrama, Saudi Arabia

Jamaludeen Othman¹, Abdalkareem Saad Maqbul Alyasi², Ranaa Abdulmohsen Bin Jaman Alharbi³, Maha Sulaiman Malehyani², Aml Saeed N Aldosari², Huda Ahmed H Alhebshi², Latifah Motoq Aziz Aldadai², Noura Hamad Basheer Fairaq⁴, Rasha Abdulmohsen Jaman Alharbi⁵, Ahlam Yahya Bakhsh⁶, Fahad Helal Alomairy², Muhammed Musa Yahya Sufyani⁷, Eman Hameed Humaid Allugmani⁸, Khalid Mohammed Saad Alzahrani⁹

¹Senior registrar, Jazan university, Saudi Arabia.

²Nursing technician, Fourth Health Cluster, Al-Hajlah Health Center, Saudi Arabia.

³Nursing and Midwifery, Fourth Health Cluster, Al-Hajlah Health Center, Saudi Arabia.

⁴General Nurse, Makkah Health Cluster - Public Health, Saudi Arabia.

⁵Nursing specialist, Health Cluster, Preventive Medicine, Saudi Arabia.

⁶Dental Assist Technician, The Fourth Health Cluster, Jarwal Health Center, Preventive Medicine, Saudi Arabia.

⁷Nursing technician, El Eskan Health Centre, Saudi Arabia.

⁸Nursing specialist, The Fourth Health Cluster, Jarwal Health Center, Saudi Arabia.

⁹Technician pharmacist, The Fourth Health Cluster, Jarwal Health Center, Saudi Arabia.

Background

Hajj, annually hosted by Saudi Arabia, every year 3-5 million pilgrims with different background and most of them are elderly also pregnant pilgrims from 184 countries in the world congregate in the holy place 'Haram' at Makkah in Saudi Arabia to perform Hajj. During the pilgrimage, they come across a great deal of rough and tough environment, physical hassle and mental stress. Due to the hardship of travel, fluctuation of weather, continuous walking during religious rites at specific time and sites, many pilgrims injury, feel tired, sick, exhausted, heat exposure and heat illnesses. These may also create complications and overburden the physiological functions including heart, chest, abdominal, and kidney of those who suffer from chronic diseases. Besides the problem of the diseases also found dental inflammation and the appearance of toothache and infections could cause some other significant problems, it should be borne in mind that this figure included elderly hajjis that wished to die in the holy cities as well as pregnant mothers and newborn infants.

Aim of the study: To determine the Knowledge about Hazards of Heat Exposure and Prevalence of Heat Illnesses among Elderly and pregnant pilgrims attending primary health care Center, Makkah Al-Mokarrama, Saudi Arabia 2022.

Methods: Across sectional descriptive study conducted among pilgrims who attending at primary Health care Center Makkah city during July, 2022 to October 2022 Hajj 2022, Our total Sample size of pilgrims participants were (700)

Results: show distribution of the relation of participant to knowledge about Hazards of Heat Exposure and Prevalence of Heat Illnesses regarding the knowledge the most of participants average knowledge were (45.0%) followed by weak were (34.0%) but high were (21.0%) and total were (100.0%) while have a significant relation were P-value <0.001 and X^2 60.62, regarding the score Mean+ SD (9.44±3.254), while Range (5-15).

Conclusion: Both hazards of heat exposure, heat illnesses, communicable and non-communicable health issues are the most common health problems encountered by pilgrims during Hajj, especially elderly and pregnant pilgrims, need necessity of new research's to find solutions to pilgrims' health problems during Hajj.

Keywords: determine, Knowledge, Hazards, Heat Exposure, elderly, pregnant, Pilgrims , Makkah .

Introduction

Human exposure to a hot environment may result in various heat-related illnesses (HRIs), which range in severity from mild and moderate forms to life-threatening heat exposure, heat illnesses and heatstroke, heat-related illnesses presenting to the emergency department are associated with high mortality and morbidity, especially in the elderly and pregnant pilgrims also Patients with dental infections , the Hajj is one of the largest annual mass gatherings globally and has historically been associated with heat exposure, heat illnesses. (1) Hajj attracts over two million Muslim pilgrims from more than 180 countries to the holy city of Makkah, Kingdom of Saudi Arabia.(2) Several modifiable and non-modifiable factors render Hajj pilgrims at increased risk of developing heat exposure, heat illnesses during Hajj.(3) These include characteristics of the Hajj, its location, population, and rituals, as well as pilgrims' knowledge of HRIs and their attitude and behavior. Makkah is characterized by a hot desert climate and fluctuating levels of relative humidity. (4) Pilgrims are very diverse ethnically and geographically, with different adaptations to heat. Significant proportions of the Hajj population are elderly, obese, and with low levels of fitness and pregnant pilgrims. In addition, many have underlying health conditions and are on multiple medications that can interfere with thermoregulation. (5) Other factors are inherent in the Hajj and its activities, including crowding, physically demanding outdoor rituals, and a high frequency of infection and febrile illness. (6) Pilgrims generally lack awareness of HRIs, and their uptake of preventive measures is variable. In addition, many engage in hazardous behaviors that increase their risk of heat exposure, heat illnesses. These include performing rituals during the peak sunshine hours with no sun protection and with suboptimal sleep, nutrition, and hydration, while neglecting treatment for their chronic conditions. (7) Heat exposure, heat illnesses preventive plans for Hajj should incorporate measures to address the aforementioned factors to reduce the burden of these illnesses in future Hajj seasons . Lessons from the Hajj can be used to inform policy making and HRIs preventive measures in the general population worldwide. (8)

Obstetricians have long known that heat exposure and heat illnesses natural gestational changes in thermoregulations also heat exposure can make pregnant pilgrims vulnerable hazards group, weight gained during pregnancy lowers the ratio of body surface area to body mass, which may make it harder for pregnant women to dissipate internal heat.(9) The metabolic demands of the growing fetus may create heat, leading to a slight increase in a pregnant woman's core body temperature.(10) Pregnant women nares also more susceptible to dehydration, which in the late stages of pregnancy could trigger uterine contractions and, potentially, early labor.(11) However ,beyond these basics histological changes, exactly how maternal heat exposure might contribute to birth defects or adverse obstetrical out comes is not yet clear.(12) The mechanism would likely differ for different outcomes, say researchers. Animal studies suggest that heat exposure during early pregnancy could interfere with normal protein synthesis through the production of heat-shock proteins .(13)

When Hajj comes during the summer months, pilgrims are then exposed to harsh, hot, desert climate with outdoor temperatures which might exceeds 45°C and humidity might reach up to about 80%. Hajj rituals at Mina, Arafat, and Muzdalifah include a minimally-clothed, moving grouping , stays adding to

waste of care fuel come out from vehicles for Bajaj transport, and the heat upright resulted from Bajaj gatherings (metabolic heat)(14). Temperatures at Makkah may increase to higher than 45°C. Lack of acclimatization, intense physical exertion, reduced physical fitness, and exposed spaces produce heat sicknesses in many pilgrims.(15) Heat illness, which is attributed to high temperatures in summer season, might be presented with mild symptoms like "heat cramps, edema, prickly heat and syncope or more severe conditions like heat exhaustion or heatstroke". Senility, chronic disease, overloading, physical exertion, lack of accommodation, and dehydration all are factors which determine the fate of heat exposure and illness (16).

The atmospheric temperatures during the months June through September in these areas reach an average of 49°C (118°F). In 1443H (2022), the Haj coincided with the midsummer month of August, when the average high temperatures reached 54°C (130°F) during the first ten days. The most common medical emergency among the pilgrims is heat exposure and heat stroke, which is characterized by hyperpyrexia (core temperatures of 40°C), anhydrase's (absence of sweating), and central nervous system disturbances ranging from confusion to coma.(17) A few cases of heat exposure and heat stroke have been reported in Saudi Arabian pilgrims, who generally are well acclimatized to the local extremes of temperature, but there are a significant number of cases in pilgrims who come from other parts of the world.(18) It has been assumed that lack of knowledge of the precautionary protective measures against the heat, severity of the sun, and extremely strenuous demands placed upon the physical endurance of the pilgrims are predisposing factors for heat exposure and heat stroke. (19)

Literature Review

study by (Layton et al (2020) reported showed that out of 267 patients 80 (29%) patients had heatstroke, the most severe form of heat illnesses, with mortality of 6.3%. , the mean age of the patients was 54.0 ± 16 years, with a predominant proportion of males. Moreover, diabetes mellitus was the most common comorbidity among both heatstroke and heat exhaustion patients. Previous epidemiological studies have shown that the elderly and those with comorbidities have an increased risk of hospitalization due to heatstroke (20).

Almuzaini, at el (2021) report that more than half of the responders suffering from heat exposure and heat illnesses were from the elderly population. Residents of Saudi Arabia suffering from heat exposure were a minority in this study, accounting for 11.1% of patients with HE and only 2.4% of patients with HS (21)

One of the important findings in this study is that almost 40% of the heat exposure and heat illnesses cases were pregnant and overweight, suggesting that this population is particularly vulnerable. This concurs with an early study showing that young pregnant woman with obesity but not healthy are at an increased risk of heat stress, indicating that obesity and pregnancy per se is the main cause for heat intolerance (22). Obesity with pregnancy increases heat production and subcutaneous fat layer insulates the body from heat exchanges and thereby hinders the cooling process (23). A fatal heat exposure and heat illness occurs 3.5 times more frequently in pregnancy overweight and obese adults than in people of average body weight (24). Other identified comorbidities associated with heat exposure, included hypertension and diabetes. The prevalence of hypertension among heat exposure cases was similar to that reported for the general Hajj population (12.1% vs. 12.2%), whereas diabetes was much more prevalent in heat exposure cases (16.2% vs. 5.0%) (25) This agrees with previous reports that showed an increased risk of heat exposure in people with virtually most chronic conditions and medications used to manage them also dental patient (20).

Fewer studies have investigated extreme heat with respect to risk of stillbirth. Part of the reason may be that stillbirth is a less-common outcome than premature birth or LBW, says Elaine Symanski, an epidemiologist and director of the Southwest Center for Occupational and Environmental Health at UT Health School of Public Health in Houston. (26)

Nevertheless, at least four studies have reported associations between stillbirth and higher temperatures during the week before delivery for warm-weather births. (27,28,29). During Hajj, participants are educated to stay in shelters for protection, use sunblock (30), perform proper hand washing, and ensure adequate water intake(31). Also, participants are encouraged to be flexible with time, if possible, and perform rites during the night especially in the elderly and Patients with dental infections (21)

Since the central nervous system is sensitive to heat stress, its dysfunction is a major symptom of hyperthermia (30). In early period of heat illness, the common symptoms include anxiety, dizziness, fainting, dental infections and headache (19). With progression to a pathological condition that leads to decreased cerebral blood flow and increased intracranial pressure, patients commonly experience delirium, convulsions, and coma (28). Similarly, in other study results of showed that patients with heatstroke had hyperthermia, altered mental status, tachycardia, convulsions, high creatinine level, and electrolyte imbalances. To prevent the unfavorable consequences of a delay in starting treatment, measurement of body temperature and consciousness level are simple but important indicators of the severity of heat illness.

In other study reported the Diarrhea and food poisoning Traveller's diarrhea is common during the Hajj especially in the elderly, although few studies have documented its incidence and etiology. The last study was done in 2020 showing that heat exposure and Prevalence of heat illnesses was the third most common cause for hospitalization during Hajj. also in elderly, Cholera and heat exposure and Prevalence of heat illnesses an acute bacterial enteric disease caused by *Vibrio cholera* accounted for several outbreaks after the Hajj (31).

Rationale:

Hajj presents a unique challenge that impacts the international public health as an increasing number of humans become more mobile. Hajj, the annual pilgrimage to Makkah (Mecca), is one of the largest global gatherings of its kind. Both of these events specific risks for heat exposure and heat illnesses, crowded conditions increase the risk of exposure to heat exposure and heat illnesses among Elderly and pregnant pilgrims. Now researchers are investigating the potential effects of heat exposure in elderly, pregnant woman and fetus. Several epidemiological studies over the past five years have reported associations between high temperatures and adverse pregnancy outcomes; including preterm birth, still birth, and low birth weight (LBW). The government of Saudi Arabia, through its various health and ancillary services, has taken precautions against proliferation of diseases and in particular against heat exposure and heat illnesses, which is the most challenging problem faced by the Pilgrims.

Aim of the study: To determine the Knowledge about Hazards of Heat Exposure and Prevalence of Heat Illnesses among Elderly and pregnant pilgrims attending primary health care Center, Makkah Al-Mokarrama, Saudi Arabia 2022.

Objectives:

➤ To determine the Knowledge about Hazards of Heat Exposure and Prevalence of Heat Illnesses among Elderly and pregnant pilgrims attending primary health care Center, Makkah Al-Mokarrama, Saudi Arabia 2022.

- To assess the Knowledge about Hazards of Heat Exposure and Prevalence of Heat Illnesses among Elderly and pregnant pilgrims attending primary health care Center, Makkah Al-Mokarrama, Saudi Arabia 2022.

Methodology:

Study design:

This study is a cross-sectional study design was used in carrying out of this study.

Study Area

The study has been carried out in the city of Makkah. Makkah is the holiest spot on Earth. It is the birthplace of the Prophet Mohammad and the principal place of the pilgrims to perform Umrah and Hajj. It is located in the western area in Kingdom of Saudi Arabia and called the Holy Capital. Contains a population around 2.580 million. This study was conducted to pilgrims who resident in Makkah city during, during July, 2022 to October 2022 Hajj 2022 Hajj 2022 , the Saudi government provides free health services during Hajj rituals through hospitals and primary health centers (PHCs), including seasonal health facilities during the pilgrimage. Patients included in our survey were male and female adult pilgrims (>40 years of age) who were diagnosed with heat Exposure and heat Illnesses attending at Primary Health care Center, during the study period. Data were collected for the (700) pilgrims' attending at Primary Health care Center. A team of two was deployed at primary Health care Center to collect data through a pathway checklist questionnaire. We excluded pilgrims below 40 years, patients not attending at PHC , and patients who were not diagnosed with heat exposure and heat illnesses, the study has been conduct on a convenience sample of 700 pilgrims' residents in Makkah city matching the inclusion criteria and exclusion.

Selection criteria:

This difference translates into biological, socioeconomic and lifestyle differences

Inclusion criteria:

- hajj pilgrims who agree to participate in the study
- Residency hajj at Makkah city .
- Over 40 years of age
- Able and willing to participate in the study.
- Diagnosed with heat exposure and heat illnesses

3.3.3Exclusion criteria:

- Residency outside Makkah city .
- > 80
- Pilgrims that refusing sign Informed consent .

The sample size

The sample size has been calculated by applying Raosoft sample size calculator based on (The margin of error: 5%, Confidence level: 95%, and the response distribution was considered to be 20%) accordingly to sample size from hajj pilgrims by the required sample size; (700). (Male and female) and adding 10 more to decrease margin of error. After adding 5% oversampling, the minimum calculated

sample has been 700. Computer generated simple random sampling technique was used to select the study participants. Data collection was done by the researcher during the 2022

Data collection tools of the study:

To collect data to determine the Knowledge about Hazards of Heat Exposure and Prevalence of Heat Illnesses among Elderly and pregnant pilgrims attending primary health care Center, Makkah Al-Mokarrama, Saudi Arabia 2022. structured questionnaire was used. It was developed by the researcher after reviewing of current national and international related literature. It composed of 30 questions. This included the following parts:

Part one: biosocial demographic characteristics: as name, pilgrim number, age, sex, phone number, leader name, frequency of hajj, years of education, area of residence, and presence of chronic diseases as diabetic mellitus.

Part two: this part including questions to determine knowledge about hazards of heat exposure and prevalence of heat illnesses among elderly and pregnant pilgrims such as signs and symptoms of hazards of heat exposure , mode of transmission, methods of prevention, high risk groups, and line of treatment. Questions community reaction toward people with heat exposure, and sources of information about heat exposure .

Following a short briefing about the study, informed consent will obtain from each participant who agreed to join the survey. Ethics approval will obtain from primary health center. The study tool was developed by the researcher and checked for validity and reliability. Pilot study was done on 10 pilgrims Hajj to check and ensure the clarity, applicability and feasibility of tools. Pilgrims completed the surveys themselves; however, research team members helped those who were unable to complete the questionnaires themselves.

Data entry and analysis:

The Statistical Package for Social Sciences (SPSS) software version 24.0 has be used for data entry and analysis. Descriptive statistics (e.g., number, percentage) and analytic statistics using Chi-Square tests (χ^2) to test for the association and the difference between two categorical variables were applied. A p-value ≤ 0.05 will be considered statistically significant

Pilot study:

A pilot study has be conducted in hajj pilgrims the same sector due to the similarity to the target group using the same questionnaire to test the methodology of the study. As a feedback, the questionnaire will be clear and no defect has be detected in the methodology

Ethical considerations

Permission from the Makkah joint program Family Medicine program has be obtained. Permission from the Directorate of hajj, verbal consents from all participants in the questionnaire were obtained. All information was kept confidential, and a result has be submitted to the department as feedback .

Budget: Self-funded

Results :

Table 1: distribution of participants according to socio demographic characteristics (Age, Sex, Hajj for, Level of education, Chronic diseases)

	N	%
Age		
<40	133	19
41-50	126	18
51-60	168	24
61-70	70	10
71-80	112	16
>80	91	13
Sex		
Male	427	61
Female	273	39
Marital status		
Married	427	61
Single	126	18
Divorced	100	14.28
Widow	74	6.71
pregnancy status		
Pregnant Female	96	35.16
Non- pregnant Female	177	64.84
Hajj for		
First time	518	74
Second time	112	16
Third time	42	6
More than three	28	4
Level of education		
Illiterate	175	25
Primary School	77	11
Intermediate School	161	23
Secondary School	133	19
University School	84	12
Postgraduate	70	10
Chronic diseases?		
No	224	32
Yes	476	68
Dental patient		
Yes	189	27
No	511	73
Residency		

Outside Saudi Arabia	553	79
Within Saudi Arabia	147	21

Regarding socio demographic characteristics, this table shows that the highest proportion of participants age 51-60 years (24.0%) and <40 years of age (19.0%), while 41-50 were (18.0%) regarding the sex the majority of participant male were (61.0%), but female were (39.0%) , regarding the marital status the majority of participant married were (61.0%) but Single were (18.0%), regarding the pregnancy status the majority of participant Non- pregnant Female were (64.84%) but the pregnant were (35.16.0%), regarding the Hajj for the first time (74.0%), but the Second time were(16.0%), regarding the level of education the majority of participant (25.0%) illiterate, while intermediate School were (23.0%) but the secondary school were (19.0%) regarding the have chronic diseases the majority of participant answer Yes (68.0%) while No were (32.0%), regarding the Dental patient the majority of participant answer No were(73.0%) while Yes were(27.0%), regarding the Residency the majority of participant outside Saudi Arabia were(79.0%) but within Saudi Arabia were (21.0%)

Table 2: distribution of the participants' knowledge about Hazards of Heat Exposure and Prevalence of Heat Illnesses

	N	%
What are the Comorbidities of patients with Heat Exposure and Heat Illnesses		
Cardiovascular disease		
Yes	399	57
No	301	43
Diabetes mellitus		
Yes	602	86
No	98	14
Hypertension		
Yes	518	74
No	182	26
Fever without clear cause that lasts more than days		
Yes	434	62
No	266	38
What are the signs of Hazards of Heat Exposure and Heat Illnesses		
Ongoing fatigue		
Increased Systolic blood pressure	245	35
Increased Respiratory rate	84	12
Increased Pulse rate	133	19
All of them right	147	21
Do not know	91	13
Heat Exposure and Heat Illnesses effect Obstetrics and gynecological diseases		
Yes	539	77
No	161	23
Heat Exposure and Heat Illnesses effect diabetes mellitus in pregnancy		
Yes	469	67

No	84	12
Do not know	147	21
How Heat Exposure and Heat Illnesses Management		
Patient moved to a cooler place	497	71
Patient placed in supine position and elevate legs and hips	231	33
Patient clothes lightened up	364	52
Patient started oral hydration	343	49
Patient moved to a cooler place	238	34
All of them	182	26
Do not know	147	21
What an Advanced Case Management		
Intravenous fluid given when patient nauseated	336	48
Cooling and transferring the patient to health facility	322	46
If no improvement of signs and symptoms, other diagnosis considered	231	33
All of them	518	74
Do not know	175	25
Heat Exposure and Heat Illnesses effect the dental patient		
Yes	469	67
No	231	33

Regarding knowledge about Hazards of Heat Exposure and Prevalence of Heat Illnesses, the table shows the Comorbidities of patients with Heat Exposure and Heat Illnesses regarding the cardiovascular disease the majority of participant answer Yes were (57.0%), but No were (43.0%), regarding the diabetes mellitus the majority of participant answer Yes were (86.0%) but No were (14.0%), regarding the hypertension the majority of participant answer Yes were (74.0%) but the No were (38.0%), regarding fever without clear cause that lasts more than days the majority of participant answer Yes were (62.0%), but answer No were (38.0%), regarding what are the signs of Hazards of Heat Exposure and Heat Illnesses the majority of participant answer ongoing fatigue (35.0%), All of them right were (21.0%) but Increased Pulse rate were (19.0%) regarding the have chronic diseases the majority of participant answer Yes (68.0%) while No were (32.0%), regarding heat Exposure and Heat Illnesses effect Obstetrics and gynecological diseases the majority of participant answer Yes were (77.0%) while No were (23.0%), regarding heat Exposure and Heat Illnesses effect diabetes mellitus in pregnancy the majority of participant answer Yes were (67.0%) but No were (12.0%) while do not know were (21.0%), regarding How Heat Exposure and Heat Illnesses Management the majority of participant answer Patient moved to a cooler place were (71.0%) but answer Patient clothes lightened up were (52.0%), but answer Patient started oral hydration were (49.0%), while Patient moved to a cooler place were (34.0%) and answer Patient placed in supine position and elevate legs and hips were (33.0%) while all of them were (26.0%)

Table 3 : distribution of the Signs and symptoms of patients with Heat Exposure and Heat Illnesses.

Signs and symptoms of patients with Heat Exposure?	Vital signs	
	N	%
Altered mental status	406	58

Tachycardia	462	66
Tachypnea	490	70
Hypotension	448	64
Convulsions	385	55
Diarrhea	413	59
Dizziness	469	67
Vomiting	385	55
Headache	469	67
Irritability	420	60
Nausea	434	62
Postural hypotension	126	18

Regarding Signs and symptoms of patients with Heat Exposure and Heat Illnesses, the table shows the majority of participant answer Tachypnea were (70.0%), but Dizziness and Headache were respectively (67.0%) while Tachycardia were (66.0%) but Hypotension were (64.0%) and Nausea were (62.0%) but Irritability were (60.0%) While diarrhea were (59.0%) but altered mental status were (58.0%) while Convulsions and Vomiting were respectively (55.0%) but the Postural hypotension were (18.0%)

Table 4: distribution of the participants' general knowledge about Hazards of Heat Exposure and Prevalence of Heat Illnesses

	N	%
Can Heat Exposure and Heat Illnesses be cured?		
Yes	539	77
No	161	23
How can someone with Heat Exposure and Heat Illnesses be cured?		
Cooling continued	126	18
Skin and rectal temperature continuously monitored	84	12
Skin temperature maintained > 30 C	70	10
Cooling stopped when rectal temperature is 39 C	224	32
All of them	70	10
Do not know	126	18
Do you can Heat Exposure and Heat Illnesses effect in diabetes mellitus pregnant Female		
Yes	266	38
No	154	22
Do not know	280	40
Do you feel well informed about Heat Exposure and Heat Illnesses?		
Yes	462	66
No	238	34
Who would you talk to about your illness if you had Heat Exposure and Heat Illnesses?		
Doctor or another medical worker	462	66

Spouse	133	19
Close friend	63	9
No one	42	6
What would you do if you thought you had symptoms of Heat Exposure and Heat Illnesses?		
Go to health facility	476	68
Got to traditional healer	175	25
Pursue other self-treatment options (herbs, etc.)	49	7
Do you can Heat Exposure and Heat Illnesses effect in Elderly pilgrims		
Yes	476	68
No	147	21
Do not know	77	11
What are the sources of information about general knowledge about Hazards of Heat Exposure and Prevalence of Heat Illnesses		
Newspapers and magazines	100	14.2
Radio	112	16
TV	61	8.7
Billboards	29	4.1
Brochures, posters and other printed materials	12	1.7
Health workers	180	25.7
Doctor	200	28.5
Religious leaders	6	0.8

Regarding general knowledge about Hazards of Heat Exposure and Prevalence of Heat Illnesses the table shows the regarding Can Heat Exposure and Heat Illnesses be cured the majority of participant answer Yes were (77.0%), but No were (23.0%) , regarding can someone with Heat Exposure and Heat Illnesses be cured the majority of participant answer cooling stopped when rectal temperature is 39 C were (32.0%) but Cooling continued and do not respectively were (18.0%), while Skin and rectal temperature continuously monitored were (12.0%), regarding can Heat Exposure and Heat Illnesses effect in diabetes mellitus pregnant Female the majority of participant answer not know were (40.0%) but the Yes were (38.0%) but No were (22.0%), regarding feel well informed about Heat Exposure and Heat Illnesses the majority of participant answer Yes were(66.0%), but answer No were(34.0%), regarding would you talk to about your illness if you had Heat Exposure and Heat Illnesses the majority of participant answer doctor or another medical worker (66.0%), but Spouse were (19.0%) but No one were (6.0%) regarding would you do if you thought you had symptoms of Heat Exposure and Heat Illnesses the majority of participant answer go to health facility were (68.0%) While got to traditional healer were (52.0%), regarding you can Heat Exposure and Heat Illnesses effect in Elderly pilgrims the majority of participant answer Yes were(68.0%) while No were(21.0%) but not know were (11.0%) regarding the sources of information about general knowledge about Hazards of Heat Exposure and Prevalence of Heat Illnesses the majority of participant answer doctor were(28.5%) but health workers were (25.7%) while Radio were (16.0%) but newspapers and magazines were (14.2%).

Table 5 Distribution of the relation of participant to knowledge about Hazards of Heat Exposure and Prevalence of Heat Illnesses

	Knowledge		Score	
	N	%	Range	Mean+ SD
Weak	238	34	5-15.	9.44±3.254
Average	315	45		
High	147	21		
Total	700	100		
X²	60.62			
P-value	<0.001*			

Table 5 show distribution of the relation of participant to Table 2 Distribution of the relation of participant to knowledge about Hazards of Heat Exposure and Prevalence of Heat Illnesses regarding the knowledge the most of participants average knowledge were (45.0%) followed by weak were (34.0%) but high were (21.0%) and total were (100.0%) while have a significant relation were P-value <0.001 and X² 60.62, regarding the score Mean+ SD (9.44±3.254), while Range (5-15).

Figure (1) Distribution of the relation of participant to knowledge about Hazards of Heat Exposure and Prevalence of Heat Illnesses

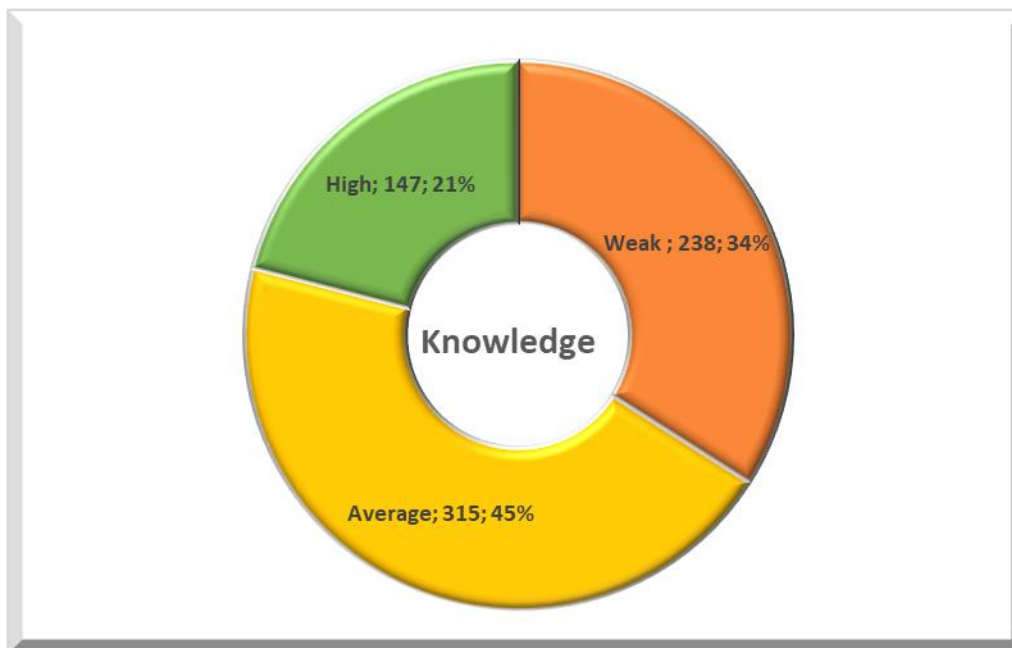


Table 6 Distribution of the relation of participant to knowledge about Hazards of Heat Exposure and Prevalence of Heat Illnesses and demographic data .

Demographic data		N	Knowledge		For T	ANOVA or T-test	
			Mean	± SD		Test value	P-value
Age	<40	133	11.376	± 3.079	F	119.939	<0.001*
	40-50	126	12.127	± 3.121			
	50-60	168	10.208	± 1.535			
	60-70	70	8.629	± 1.299			
	70-80	112	7.241	± 1.832			
	>80	91	6.385	± 0.489			
Sex	Female	427	9.513	± 2.711	T	-1.467	0.143
	Male	273	9.853	± 3.397			
pregnancy status	Pregnant Female	96	9.625	± 3.103	T	-0.818	0.414
	Non pregnant Female	177	9.977	± 3.548			
Hajj for	First time	520	8.531	± 2.469	F	203.268	<0.001*
	Second time	112	11.688	± 0.616			
	Third time	42	14.500	± 1.419			
	More than three	26	15.308	± 1.594			
Level of education	Illiterate	175	6.383	± 1.500	F	451.560	<0.001*
	Primary School	77	7.831	± 1.681			
	Intermediate School	161	9.286	± 1.551			
	Secondary School	133	10.835	± 1.074			
	University School	84	13.024	± 1.552			
	Postgraduate	70	14.314	± 1.399			
Chronic diseases	No	224	9.580	± 2.995	T	-0.395	0.693
	Yes	476	9.676	± 3.004			
Dental patient	Yes	189	9.624	± 3.029	T	-0.115	0.909
	No	511	9.654	± 2.991			
Residency	Outside Saudi Arabia	553	8.637	± 2.441	T	-22.784	<0.001*
	Within Saudi Arabia	147	13.442	± 1.476			

Table (6) show that is a significant relation between knowledge about Hazards of Heat Exposure and Prevalence of Heat Illnesses and demographic data regarding age increase in 40-50 years were (Mean± SD 12.127±3.121), follow by <40 age were (Mean± SD, 11.376±3.079) while 50-60 years were (Mean± SD 10.208±1.535), were P-value=0.001, F= 119.939. Regarding the gender is no significant relation between knowledge and gender increase in Female were (Mean± SD 9.513±2.711), follow male were (Mean± SD, 9.853±3.397) also P-value=0.143, T= -1.467. Regarding the pregnancy status is no significant relation between knowledge and pregnancy status increase in Pregnant Female were (Mean± SD 9.625±3.103), follow Non- pregnant Female were (Mean± SD, 9.853±3.397) also P-value=0.414, T= -0.818.

Regarding the Hajj a significant relation between Knowledge and Hajj increase in More than three were (Mean± SD 15.308 ±1.594), follow by Third time were (Mean± SD, 14.500±1.419) but Second time were (Mean± SD, 11.688 ± 0.616) also P-value=0.001, F= 203.268. Regarding the Educational level a significant relation between Knowledge and Educational level increase in Postgraduate were (Mean± SD 14.314 ±1.399), follow by University school were (Mean± SD, 13.024 ±1.552) but Secondary School were (Mean± SD 10.835±1.074) also P-value=0.001, F= 451.560. Regarding the Chronic diseases is no significant relation between Knowledge and Chronic diseases increase in Yes were (Mean± SD 9.676±3.004), follow No were (Mean± SD, 9.580± 2.995) also P-value=0.693, T= -0.395. Regarding dental patient is no significant relation between Knowledge and dental patient increase in No were (Mean± SD 9.654 ±2.991), follow by Yes were (Mean± SD, 9.624 ±3.029) also P-value=0.909, T= -0.115. Regarding residency is a significant relation between Knowledge and residency increase in within Saudi Arabia were (Mean± SD 13.442 ± 1.476), follow by outside Saudi Arabia were (Mean± SD, 8.637 ± 2.441) also P-value=0.001, T= -22.784.

Discussion:

The results of the present study provide extensive data regarding the determining the Knowledge about Hazards of Heat Exposure and Prevalence of Heat Illnesses among Elderly and pregnant pilgrims attending primary health care Center, Makkah, laboratory profiles, morbidity, medical management, and mortality due to heat illness among pilgrims. Heat illness can be prevented with strategic planning and preventive measurements. A systematic review of weather and environmental hazards at mass gatherings showed that a one-degree increase in temperature, from 20°C to 21°C, resulted in an 11% increase in the number of individuals requiring medical attention. Moreover, temperatures exceeding 48°C resulted in an increase in the incidence of patient presentations (32). Thus, the government of Kingdom of Saudi Arabia, in collaboration with the Ministry of Hajj, is taking measures to prevent health problems during the event (33). However, the results of the present study showed that determining the Knowledge about Hazards of Heat Exposure the Comorbidities of patients with Heat Exposure and Heat Illnesses regarding the cardiovascular disease the majority of participant answer Yes were (57.0%), the diabetes mellitus the majority answer Yes were (86.0%), the hypertension answer Yes were (74.0%), fever without clear cause that lasts more than days answer Yes were (62.0%), signs of Hazards of Heat Exposure and Heat Illnesses answer ongoing fatigue (35.0%), Increased Pulse rate were (19.0%), have chronic diseases answer Yes (68.0%), heat Exposure and Heat Illnesses effect Obstetrics and gynecological diseases answer Yes were (77.0%), heat Exposure and Heat Illnesses effect diabetes mellitus in pregnancy the majority of participant answer Yes were (67.0%) while do not know were

(21.0%), heat exposure and heat illnesses management answer Patient moved to a cooler place were(71.0%) Patient started oral hydration were (49.0%), (See table 2)

Heat exposure and heat illnesses are regularly reported during the Hajj pilgrimage, resulting in significant morbidity and mortality among pilgrims (34). Adequate primary health care and pre-hospital management is the cornerstone to ensure optimal outcomes in patients with heat exposure and heat illnesses. Regarding general knowledge about hazards of heat exposure and Prevalence of heat illnesses shows the regarding can heat exposure and heat illnesses be cured answer Yes were (77.0%), can someone with heat exposure and heat illnesses be cured answer cooling stopped when rectal temperature is 39 C were (32.0%), skin and rectal temperature continuously monitored were (12.0%)(See table 4)

Actually, during Hajj, extra physical activities are performed and subsequently oxygen demand is augmented. The increase in minute volume supplies this oxygen at the beginning, therefore hyperventilation is considered as one of the "respiratory clinical manifestations" in heat-induced illness. On the other hand, hypoxia is not recorded or observed before the use of pulse oximetry. If hypoxia occurs, its severity will be depends on age and the comorbidities. Investigation of blood gases during heat stroke revealed great alternation in acid-base status in addition to increased level of serum creatinine and electrolyte disturbances (36) (See table 6)

Conclusion

Hajj season which is a good guide to all needed precautions to ensure safe Hajj for all pilgrims . This year, Hajj recommendations were published in the Journal of Infection and Public Health. Increasingly, international collaboration has become essential. Planning and supporting Hajj has become a forum for collaboration crossing any political considerations Although authorities of the government of Saudi Arabia are working on research and forming interdisciplinary teams to prevent health problems during the Hajj, the mortality rate from hazards of heat exposure's high and the majority of the patients had hazards of heat exposure and Heat Illnesses, must be planned that more emphasis will be placed on educating the pilgrims about prevention of heat exhaustion prior to their arrival in the Kingdom. It is also hoped that with the improvement in the services and immediate availability of first aid in the Haj sites will witness better and safer Haj seasons in the future

Reference:

1. Wondmagegn, B. Y., Xiang, J., Dear, K., Williams, S., Hansen, A., Pisaniello, D., ... & Bi, P. (2021). Impact of heatwave intensity using excess heat factor on emergency department presentations and related healthcare costs in Adelaide, South Australia. *Science of The Total Environment*, 781, 146815.
2. Saeed, F., Schleussner, C. F., & Almazroui, M. (2021). From Paris to Makkah: heat stress risks for Muslim pilgrims at 1.5° C and 2° C. *Environmental Research Letters*, 16(2), 024037.
3. Alkassas, W., Rajab, A. M., Alrashood, S. T., Khan, M. A., Dibas, M., & Zaman, M. (2021). Heat-related illnesses in a mass gathering event and the necessity for newer diagnostic criteria: a field study. *Environmental Science and Pollution Research*, 28, 16682-16689.
4. Ridha, I., Mansoor, S., Briggs, R., Gishe, J., & Aatmn, D. (2021). Preparedness for mass gathering during Hajj and Umrah. *Handbook of healthcare in the Arab World*, 1215-1235.
5. Yezli, S., Khan, A. H., Yassin, Y. M., Khan, A. A., Alotaibi, B. M., & Bouchama, A. (2023). Association of ambient temperature with mortality in resident and multiethnic transient

- populations in a desert climate, 2006–2014. *Environmental Health Perspectives*, 131(4), 047004.
6. Al Ruwaithi, A. A. (2021). *The emergency medical services delivery in mass gathering events: a case study of the Hajj*. University of Delaware.
 7. Albaqami, N. (2020). Exploring Paramedic Students' Level of Preparedness for Disaster Response in Hajj 2019.
 8. Mack, A., & Choffnes, E. R. (Eds.). (2015). *Emerging Viral Diseases: The One Health Connection: Workshop Summary*. National Academies Press.
 9. Sinclair, M. (2020). *Hydrotherapy for Bodyworkers: Improving outcomes with water therapies*. Jessica Kingsley Publishers.
 10. Konkel, L. (2019). Taking the heat: potential fetal health effects of hot temperatures.
 11. Auer, S. K., Agreda, E., Chen, A. H., Irshad, M., & Solowey, J. (2021). Late-stage pregnancy reduces upper thermal tolerance in a live-bearing fish. *Journal of Thermal Biology*, 99, 103022.
 12. Smallcombe, J. W., Puhenthirar, A., Casasola, W., Inoue, D. S., Chaseling, G. K., Ravanelli, N., ... & Jay, O. (2021). Thermoregulation during pregnancy: a controlled trial investigating the risk of maternal hyperthermia during exercise in the heat. *Sports Medicine*, 51(12), 2655-2664.
 13. Ebi, K. L., Capon, A., Berry, P., Broderick, C., de Dear, R., Havenith, G., ... & Jay, O. (2021). Hot weather and heat extremes: health risks. *The lancet*, 398(10301), 698-708.
 14. Ncongwane, K. P., Botai, J. O., Sivakumar, V., & Botai, C. M. (2021). A literature review of the impacts of heat stress on human health across Africa. *Sustainability*, 13(9), 5312.
 15. Burton, R. F. (2022). *The Pilgrimage to Al-Madinah & Meccah*. DigiCat.
 16. Volkert, D., Beck, A. M., Cederholm, T., Cruz-Jentoft, A., Hooper, L., Kiesswetter, E., ... & Bischoff, S. C. (2022). ESPEN practical guideline: Clinical nutrition and hydration in geriatrics. *Clinical Nutrition*, 41(4), 958-989.
 17. Mechem, C. C. (2021). Severe nonexertional hyperthermia (classic heat stroke) in adults. *UpToDate*, April.
 18. Nizami, A. S., Rehan, M., Waqas, M., Naqvi, M., Ouda, O. K., Shahzad, K., ... & Pant, D. (2017). Waste biorefineries: Enabling circular economies in developing countries. *Bioresource technology*, 241, 1101-1117.
 19. Springer, B. (2016). Exertional Heat Illness. *Sports Medicine for the Emergency Physician: A Practical Handbook*, 2, 390.
 20. Layton, J. B., Li, W., Yuan, J., Gilman, J. P., Horton, D. B., & Setoguchi, S. (2020). Heatwaves, medications, and heat-related hospitalization in older Medicare beneficiaries with chronic conditions. *PLoS one*, 15(12), e0243665.
 21. Almuzaini, Y., Abdulmalek, N., Ghallab, S., Mushi, A., Yassin, Y., Yezli, S., & Khan, A. A. (2021). Adherence of Healthcare Workers to Saudi Management guidelines of heat-related illnesses during Hajj Pilgrimage. *International Journal of Environmental Research and Public Health*, 18(3), 1156.
 22. Chersich, M. F., Pham, M. D., Areal, A., Haghghi, M. M., Manyuchi, A., Swift, C. P., ... & Hajat, S. (2020). Associations between high temperatures in pregnancy and risk of preterm birth, low birth weight, and stillbirths: systematic review and meta-analysis. *Bmj*, 371.
 23. Hanna, E. G., & Tait, P. W. (2015). Limitations to thermoregulation and acclimatization challenge human adaptation to global warming. *International journal of environmental research and public health*, 12(7), 8034-8074.

24. Quandt, S. A., & Arnold, T. J. (2020). The health of children in the Latinx farmworker community in the eastern United States. *Latinx farmworkers in the Eastern United States: Health, safety, and justice*, 163-195.
25. Meade, R. D., Akerman, A. P., Notley, S. R., McGinn, R., Poirier, P., Gosselin, P., & Kenny, G. P. (2020). Physiological factors characterizing heat-vulnerable older adults: a narrative review. *Environment international*, 144, 105909..
26. Konkell, L. (2019). Taking the heat: potential fetal health effects of hot temperatures.
27. Rammah, A., Whitworth, K. W., Han, I., Chan, W., Hess, J. W., & Symanski, E. (2019). Temperature, placental abruption and stillbirth. *Environment international*, 131, 105067.
28. Ha, S., Liu, D., Zhu, Y., Soo Kim, S., Sherman, S., Grantz, K. L., & Mendola, P. (2017). Ambient temperature and stillbirth: a multi-center retrospective cohort study. *Environmental health perspectives*, 125(6), 067011.
29. Basu, R., Sarovar, V., & Malig, B. J. (2016). Association between high ambient temperature and risk of stillbirth in California. *American journal of epidemiology*, 183(10), 894-901.
30. Auger, N., Fraser, W. D., Smargiassi, A., Bilodeau-Bertrand, M., & Kosatsky, T. (2017). Elevated outdoor temperatures and risk of stillbirth. *International journal of epidemiology*, 46(1), 200-208.
31. Lin, S., Lin, Z., Ou, Y., Soim, A., Shrestha, S., Lu, Y., ... & Browne, M. (2018). Maternal ambient heat exposure during early pregnancy in summer and spring and congenital heart defects—a large US population-based, case-control study. *Environment international*, 118, 211-221.
32. Abdelmoety, D. A., El-Bakri, N. K., Almowalld, W. O., Turkistani, Z. A., Bugis, B. H., Baseif, E. A., ... & Abu-Shaheen, A. (2018). Characteristics of heat illness during Hajj: a cross-sectional study. *BioMed Research International*, 2018.
33. Jokhdar, H., Khan, A., Asiri, S., Motair, W., Assiri, A., & Alabdulaali, M. (2021). COVID-19 mitigation plans during Hajj 2020: a success story of zero cases. *Health security*, 19(2), 133-139.
34. Elgammal, I., & Alhothali, G. T. (2021). Towards green pilgrimage: a framework for action in Makkah, Saudi Arabia. *International Journal of Religious Tourism and Pilgrimage*, 9(1), 5.
35. Memish, Z. A., Zumla, A., Alhakeem, R. F., Assiri, A., Turkestani, A., Al Harby, K. D., ... & Al-Tawfiq, J. A. (2014). Hajj: infectious disease surveillance and control. *The Lancet*, 383(9934), 2073-2082.
36. Khan, I. D., Khan, S. A., Asima, B., Hussaini, S. B., Zakiuddin, M., & Faisal, F. A. (2018). Morbidity and mortality amongst Indian Hajj pilgrims: A 3-year experience of Indian Hajj medical mission in mass-gathering medicine. *Journal of infection and public health*, 11(2), 165-170.