

The Special Dietary Needs of Pilgrims and Practices of Agencies Regarding Food Quality and Safety During the Hajj

Arwa Mohammed Shukri Turkistani

Department of Food and Nutrition, King Abdulaziz University, Jeddah, Saudi Arabia.

<http://dx.doi.org/10.13005/bbra/3028>

(Received: 23 July 2022; accepted: 22 September 2022)

It is necessary to take the pilgrims' dietary needs into consideration to avoid the complication of health especially chronic diseases, which will lead to reduce expenditure on health services. This study aimed to explore the availability of special meals that are provided to pilgrims according to their health condition, highlight the Hajj agencies' practices with regard to food quality and safety for pilgrims and investigate the prevalence of the diseases requiring special diets among pilgrims. A cross-sectional study design was used. The data was collected via an online questionnaire. This study included 394 pilgrims who attended Hajj at least once from 2015-2019. About 20% suffered from chronic diseases; the most common: hypertension, diabetes and allergy. 15.7% required a special diet. There was an increase in the healthy method of meal preparation, the amount of water and vegetables/fruit, however, unhealthy sweets too. About 82% were overall satisfied with services; there were significant associations between it and some parameters: such as specified meal times, cleanness of eating place, utensils and hygiene of workers. In conclusion, most agencies did not provide special meals. It is important to take into consideration the calorie, nutrients and safety of food. This study recommends pre-Hajj electronic orders of meals due to health condition and using meal vending machines.

Keywords: Calorie; Chronic Diseases; Dietary; Food Quality; Hajj; Pilgrims.

In Islam, Hajj is an annual religious duty for Muslims to Makkah; its rites are performed in five to six days at Dhu al-Hijjah month¹. Saudi Arabia pledged to serve about 2-3 million pilgrims yearly from 2000 to 2019 and this number is expected to increase over the years^{2,3}. Thus, Hajj is one of the largest human gatherings worldwide^{4,5}.

Pilgrims come to Makkah from 160 countries over the world with variation in ethnic, age, and health status^{4,6}. Therefore, it is important for healthcare to be aware of that variation and

focus on pilgrim's health needs during the Hajj. Studies showed there were a high number of elderly people ($\approx 25 - 39\%$ age ≥ 65 years old), who often suffer from chronic diseases, among the pilgrims^{7,8,9,10,11,12,13}. In a recent study, out of 401 Umrah visitors, there was 41.4%, 31.9%, 18.5%, and 6.5% suffered from diabetes mellitus, hypertension, chronic respiratory disease, and cardiovascular diseases, respectively¹⁴. These non-communicable diseases are a major cause of 41 million deaths yearly that may contribute to the mortality of Hajj pilgrims^{15,16}. Although the Hajj is a short period,

*Corresponding author E-mail: arwaturkistani@kau.edu.sa



it can have a negative impact on the health of those pilgrims due to physical stressors, and changes in sleeping and nutrition habits during Hajj^{10, 17, 18, 19, 20}.

Saudi Ministry of Hajj and Umrah and Ministry of Health provide free health services to pilgrims via teams of doctors, pharmacists and nurses in hospitals and healthcare centers^{5, 21, 22}. It also is necessary to take the pilgrims' dietary needs into consideration to avoid the complication of health, especially for those with chronic diseases including diabetes, blood pressure, cardiovascular diseases, and celiac diseases. In addition, digital transformation in providing nutritional care is important, especially during the Corona pandemic. Thus, that will lead to reduces expenditure on health services.

Although the importance of providing pilgrims with their special dietary needs, there are limited studies. Thus, the results will help the Ministry of Hajj and Umrah to improve health management of the Hajj since improving the services provided for the pilgrims is one of the Saudi Arabian government priorities. The study aimed to explore the availability of special meals that are provided to pilgrims according to their health condition and highlight the Hajj agencies' practices with regard to food quality and safety for pilgrims. Also to investigate the prevalence of the diseases requiring special diets among pilgrims.

METHODS

Participants

A questionnaire was conducted online between 1 February and 27 April 2021. According to the General Authority for Statistics, the average pilgrims' number from 2015-2019 was ~2,203,400². Thus, the sample size needed to achieve sufficient statistical power is 385, allowing for a 5% margin error, with a 95% confidence level, and a response distribution of 50%²³. The inclusion criteria included Muslim participants, who attended Hajj at least once between 2015 and 2019, comprising both males and females within the age of d"18 years old. The exclusion criteria were participants >18 years and those who attended Hajj 2020 since it was an exceptional Hajj season, due to the outbreak of the Corona pandemic. Initially, the total number of

responses was 419, however, only a total of 394 responses were included in this research since 25 participants did not complete the questionnaire.

Study design and data collection

A cross-sectional study design was used. The study used a self-administered questionnaire that consisted 38 questions in both Arabic and English. For content validity, questions had pretested for accuracy and clarity. Then, it was distributed online through the social media applications WhatsApp and Twitter. The questionnaires, which were shared with the participants after their consent to participate in the study, were divided into three sections: demographic characteristics, health status with dietary requirements, and Hajj agencies' practices regarding food quality and safety. The study design was reviewed and approved by the Unit of Biomedical Ethics Research Committee at King Abdulaziz University, Jeddah, Saudi Arabia (Ref.384-22). The anonymous and voluntary participation was ensured and collected information would be kept confidential.

A scoring system was used to score the participants' health complications and satisfaction with agencies' practices regarding food quality and safety. Briefly, "No" responses were given a 1 score, while a score of 2 was given for choosing "Yes" responses. Overall mean scores, ranging from 1 to 2, for the satisfaction and health complications sections were calculated and were then further divided into 2 categories to reflect the satisfaction and health complications during Hajj among pilgrims. These were: unsatisfied or with no health complications (score ≤ 1.5) and satisfied or faced health complications (score > 1.5).

Statistical Analysis

Statistical analysis for the study variables was performed using the SPSS software (version 24, SPSS, Inc). Descriptive analysis was conducted including frequency, percentages, means, and standard deviations (Mean \pm SD). Pearson's chi-squared test was used to investigate the association between demographic differences in health conditions among pilgrims. One-way ANOVA and independent samples t-tests with a 95% confidence level were used for statistical tests. All tests were considered statistically significant at *P value* < 0.05 .

RESULTS

Most of the participants were female (73.4%), married (60.7%), with bachelor's degree (65.6%), Hajj in 2015 (48.5%), and Saudi (87.3%). Only 12.2% and 0.5% were residents and visitors, respectively; from different countries including Emirates, Bahrain, Oman, Lebanon, Egypt, Indonesia, Malaysia, and Brunei. Concerning the

age groups, 27.6% of the participant were aged between 20 and 29 years old, followed by 40-49, ≤ 50 , 30-39, and the least were in 18-20 years old. Study participants (30.5%) were employees and students, while 13.7% were retired. Approximately half of the participants' income was less than 5,000 SR/month (Table 1).

The majority of the study participants reported having no diseases (80.2%). Of the 394 participants, only 78 (19.8%) had at least one chronic disease (Table 2) including hypertension, diabetes, food allergy, gastric ulcer and colon, liver diseases, cardiovascular, renal diseases, and cancer, with the percentage of 10.7, 9.1, 6.4, 2.8, 2, 1.8, 1.8 and 0.5%, respectively. Table 2 represents the association between pilgrims' health conditions with their demographic characteristics. Pilgrims' health condition was found to be associated with gender, age, social and employment status, nationally and income ($p < 0.05$).

62 (15.7%) participants required a special diet due to their health conditions. In addition, 11 (2.8%) participants followed a diet, not for health reasons. Both groups did not receive nutritional care. Regarding the health complications during Hajj, 20% of the participants faced health problems including flatulence (3.8%), followed by constipation (2.8%), drowsiness/satiety (2.5%), nausea/vomiting (2.3%), diarrhea (1.5%), upset stomach/abdominal pain (1.5%), dehydration (1.3%), and other such as dizziness, fatigue and tiredness. Moreover, there were 2.8% of the participants were infected with foodborne illness. However, 13.5% of them had health complications during Hajj irrespective of their chronic illnesses.

Table 3 shows that there were significant ($P < 0.05$) associations between health complications during Hajj relative to providing high water, while the other meals' quality factors included high-fat meals, high fresh vegetables and fruits, high carbohydrates such as rice, bread, and pasta, high sweets such as cake, and healthy cooking showed no significant association. Participants who had drunk a higher amount of water with/between meals were less likely to have health complications.

Table 4 presents participants' responses to the agencies' food practices questions measuring their satisfaction with food practices during Hajj. 81.5% of the participants were overall satisfied with the agencies' practices regarding food.

Table 1. Demographic characteristics of the study participants

Characteristics	N (%)
Gender	
Female	289 (73.4)
Male	105 (26.6)
Age	
18-20	45 (11.4)
20-29	109 (27.7)
30-39	75 (19)
40-49	82 (20.8)
≤ 50	83 (21)
Educational level	
> High school	15 (3.8)
High school	80 (20.3)
Bachelor	259 (65.7)
Postgraduate	40 (10.1)
Social status	
Married	293 (60.7)
Single	137 (43.8)
Divorced	8 (2)
Widow	10 (2.5)
Employment status	
Employed	120 (30.5)
Unemployed	100 (25.4)
Student	120 (30.5)
Retired	54 (13.7)
Nationally	
Saudi	344 (87.3)
Residents	48(12.2)
Visitor	2(0.5)
Monthly income (SR)	
>5000	180 (45.7)
5000-10,000	85 (21.6)
<10,000-20,000	95 (24.1)
< 20,000	34 (8.6)
Year of Hajj	
2019	85 (21.6)
2018	30 (7.6)
2017	34 (8.6)
2016	54 (13.7)
2015	191 (48.5)

There were significant associations between the satisfaction of food practices and some parameters including serving meals at specified times, eating place cleanness, using appropriate, clean and dry utensils, and hygiene of workers. Providing meals with clean and dry utensils at specified times in an appropriate place that free from insects and unpleasant odors, and hygiene of workers such as washing hands and wearing gloves were the focus of pilgrims' attention to gain their satisfaction with the food practices. However, there was no

statistical significance regarding the style of serving meals, food temperature, safety and packaging, and the availability of special meals at agencies or food stores/restaurants; the results showed low availability of special meals in holy sites. In addition, only 24.1% of the participants had a clear nutrition plan based on the provided guidance to the pilgrims.

Participants were asked their preferences of using digital solutions for providing food and nutrition services during the Hajj, 67.8% answered

Table 2. Association of pilgrims' health conditions with their demographic characteristics (N = 394)

Characteristics	N (%)	No chronic diseases 316 (80.2)	Chronic diseases 78 (19.8)	Pearson chi (p-value)
Gender				
Female	289(73.4)	241(61.2)	48(12.2)	0.008*
Male	105 (26.6)	75(19)	30(7.6)	
Age				
18-20	45 (11.4)	41(10.4)	4(1)	0.000*
20-29	109 (27.7)	99(25.2)	10(2.5)	
30-39	75 (19)	67(17)	8(2)	
40-49	82 (20.8)	65(16.5)	17(4.3)	
≤ 50	83 (21)	44(11.2)	39(9.9)	
Educational level				
> High school	15 (3.8)	12(3)	3(0.7)	0.901
High school	80 (20.3)	66(16.8)	14(3.6)	
Bachelor	259 (65.7)	205(52)	54(13.7)	
Postgraduate	40 (10.1)	33(8.4)	7(1.8)	
Social status				
Married	293 (60.7)	185(46.9)	54(13.7)	0.003*
Single	137 (43.8)	121(30.7)	16(4.1)	
Divorced	8 (2)	5(1.3)	3(0.7)	
Widow	10 (2.5)	5(1.3)	5(1.3)	
Employment status				
Employed	120 (30.5)	92(23.4)	28(7.1)	0.000*
Unemployed	100 (25.4)	88(22.3)	12(3)	
Student	120 (30.5)	107(27.1)	13(3.3)	
Retired	54 (13.7)	29(7.4)	25(6.4)	
Nationally				
Saudi	344 (87.3)	269(68.3)	75(19)	0.032*
Residents	48(12.2)	45(11.4)	3(0.7)	
Visitor	2(0.5)	2(0.5)	0	
Monthly income (SR)				
>5000	180 (45.7)	156(39.6)	24(6.1)	0.001*
5000-10,000	85 (21.6)	72(18.3)	13(3.3)	
<10,000-20,000	95 (24.1)	64(16.2)	31(7.9)	
< 20,000	34 (8.6)	24(6.1)	10(2.5)	

* Statistically significant ($p < 0.05$).

“agree”. While 24.6% answered “neither agree nor disagree”. However, only 7.6% respondents disagreed.

DISCUSSION

The findings indicate that 19.8% of the participants need special diets due to their health

conditions. Similarly, a cross-sectional study found that 20.2% of 4136 patients suffered from multiple diseases including diabetes, asthma and hypertension in Hajj 2008 ²⁴. In a cohort study, they reported that 31.9% of 689 pilgrims admitted to ER had diabetes ²⁵. Other studies found that 37.3% and 63.6% of patients admitted to ICU had cardiovascular diseases ^{7, 26}. 12.3% and 2% of

Table 3. Relationship between meals quality and health complications during Hajj among the participants

Meals quality	N (%)	Health complications (Mean ± SD)
High-fat fried foods		
<i>Always</i>	60 (15.2)	1.25±0.44
<i>Often</i>	79 (20.1)	1.16±0.37
<i>Sometimes</i>	147 (37.3)	1.21±0.41
<i>Rarely</i>	88 (22.3)	1.18±0.39
<i>Never</i>	20 (5.1)	1.20±0.41
High fresh vegetables and fruits		
<i>Always</i>	120 (30.5)	1.22±0.41
<i>Often</i>	136 (34.5)	1.16±0.37
<i>Sometimes</i>	95 (24.1)	1.22±0.42
<i>Rarely</i>	34 (8.6)	1.24±0.43
<i>Never</i>	9 (2.3)	1.22±0.44
High rice, bread and pasta		
<i>Always</i>	159 (40.4)	1.22±0.42
<i>Often</i>	156 (39.5)	1.17±0.37
<i>Sometimes</i>	65 (16.5)	1.22±0.41
<i>Rarely</i>	11 (2.8)	1.27±0.47
<i>Never</i>	3 (0.8)	1.33±0.57
High sweets		
<i>Always</i>	119 (30.2)	1.19±0.40
<i>Often</i>	123 (31.2)	1.17±0.39
<i>Sometimes</i>	108 (27.4)	1.22±0.42
<i>Rarely</i>	37 (9.4)	1.22±0.42
<i>Never</i>	7 (1.8)	1.43±0.54
High water		
<i>Always</i>	269 (68.3)	1.19±0.40*
<i>Often</i>	85 (21.6)	1.18±0.38*
<i>Sometimes</i>	31 (7.9)	1.32±0.48*
<i>Rarely</i>	6 (1.5)	1.33±0.52*
<i>Never</i>	3 (0.7)	1.0±0*
Using healthy cooking		
<i>Always</i>	68 (17.3)	1.22±0.42
<i>Often</i>	92 (23.4)	1.17±0.38
<i>Sometimes</i>	133 (33.7)	1.23±0.42
<i>Rarely</i>	69 (17.5)	1.19±0.39
<i>Never</i>	32 (8.1)	1.16±0.37

* Statistically significant ($p < 0.05$).

Table 4. Relationship between agencies' food practices and the participants' satisfaction during Hajj

Food practices	N (%)	Satisfaction (Mean \pm SD)
Availability of special meals due to chronic diseases		
<i>Always</i>	78 (19.8)	1.78 \pm 0.42
<i>Often</i>	57 (14.5)	1.89 \pm 0.31
<i>Sometimes</i>	97 (24.6)	1.81 \pm 0.39
<i>Rarely</i>	85 (21.6)	1.79 \pm 0.41
<i>Never</i>	77 (19.5)	1.82 \pm 0.39
Family or buffet style of Serving meals		
<i>Always</i>	173 (43.9)	1.79 \pm 0.40
<i>Often</i>	99 (25.1)	1.81 \pm 0.39
<i>Sometimes</i>	68 (17.3)	1.88 \pm 0.33
<i>Rarely</i>	40 (10.6)	1.75 \pm 0.44
<i>Never</i>	14 (3.6)	1.93 \pm 0.27
Serving meals at specified times		
<i>Always</i>	201 (51)	1.87 \pm 0.34*
<i>Often</i>	130 (33)	1.76 \pm 0.43*
<i>Sometimes</i>	49 (12.4)	1.78 \pm 0.42*
<i>Rarely</i>	8 (2)	1.5 \pm 0.54*
<i>Never</i>	6 (1.5)	2 \pm 0*
Eating place cleanness		
<i>Always</i>	155 (39.3)	1.86 \pm 0.39*
<i>Often</i>	117 (29.7)	1.83 \pm 0.38*
<i>Sometimes</i>	83 (21.1)	1.75 \pm 0.44*
<i>Rarely</i>	28 (7.1)	1.68 \pm 0.48*
<i>Never</i>	11 (2.8)	1.91 \pm 0.30*
Appropriate food temperature		
<i>Always</i>	153 (39)	1.82 \pm 0.39
<i>Often</i>	131 (33.2)	1.85 \pm 0.36
<i>Sometimes</i>	79 (20.1)	1.75 \pm 0.44
<i>Rarely</i>	25 (6.3)	1.8 \pm 0.41
<i>Never</i>	6 (1.5)	2 \pm 0
Leave food at room temperature for more than 4 hours		
<i>Always</i>	62 (15.7)	1.90 \pm 0.29
<i>Often</i>	87 (22.1)	1.77 \pm 0.42
<i>Sometimes</i>	91 (23.1)	1.78 \pm 0.42
<i>Rarely</i>	95 (24.1)	1.82 \pm 0.39
<i>Never</i>	59 (15)	1.83 \pm 0.38
Packaging food		
<i>Always</i>	168 (42.6)	1.84 \pm 0.37
<i>Often</i>	117 (29.9)	1.82 \pm 0.38
<i>Sometimes</i>	79 (20.1)	1.77 \pm 0.42
<i>Rarely</i>	22 (5.6)	1.68 \pm 0.48
<i>Never</i>	8 (2)	2.0 \pm 0.0
Appropriate, clean and dry utensils		
<i>Always</i>	168 (42.6)	1.85 \pm 0.36*
<i>Often</i>	134 (34)	1.84 \pm 0.37*
<i>Sometimes</i>	68 (17.3)	1.69 \pm 0.47*
<i>Rarely</i>	17 (4.3)	1.82 \pm 0.39*
<i>Never</i>	7 (1.8)	1.86 \pm 0.38*
Hygiene of workers		
<i>Always</i>	158 (40.1)	2 \pm 0*
<i>Often</i>	131 (33.2)	1.91 \pm 0.30*
<i>Sometimes</i>	78 (19.8)	1.72 \pm 0.45*
<i>Rarely</i>	21 (5.3)	1.9 \pm 0.30*
<i>Never</i>	6 (1.5)	2 \pm 0*
Availability of food stores provide special meals		
<i>Always</i>	49 (12.4)	1.79 \pm 0.41
<i>Often</i>	76 (19.3)	1.86 \pm 0.35
<i>Sometimes</i>	87 (22.1)	1.87 \pm 0.33
<i>Rarely</i>	99 (25.1)	1.75 \pm 0.44
<i>Never</i>	83 (21.1)	1.81 \pm 0.39

* Statistically significant ($p < 0.05$).

hospital admissions also were due to cardiovascular and nephrological diseases, respectively^{20, 27, 28}. Moreover, a significant proportion of various nationalities pilgrims are elderly who mostly suffer from chronic diseases^{9, 10, 11, 12, 13, 25, 29}, those who need special care including diet to avoid aggravated during the Hajj period; thus, decreasing their access to specialist medical care facilities.

Regarding the diets, 18.5% of this study participants did not receive the required nutritional care that may lead to health problems during the Hajj. Increasing physical activity and changing diet routines that expose diabetic pilgrims to hypoglycaemia and hyperglycaemia. Therefore, food intake should be increased and organizing main meal times and taking mid-morning snacks is important for them since the insulin pump allows more flexibility around meal times³⁰. High temperature during summer exposes diabetic and nephropathy pilgrims to dehydration; in addition, drinking enough water is required to continue taking insulin⁸. Hypertensive pilgrims also need to control their blood pressure during Hajj performance. Previous studies showed that following the Dietary Approaches to Stop Hypertension (DASH) or Mediterranean diet could manage diabetes and hypertension, and reduce the risks of kidney and cancer diseases among patients^{31, 32, 33, 34, 35}. Hence, pilgrims who suffer from any chronic diseases should follow an appropriate diet for their health status which is agencies responsibility.

Regarding the quality of the meals, there were significant differences between health complications during Hajj relative to high provided water to participants ($P < 0.05$), while there were no significant differences between high-fat meals, high fresh vegetables and fruits, high carbohydrates such as rice, bread, and pasta, high sweets such as cake, and healthy cooking relative to health complications among the study participants during Hajj ($P < 0.05$). Providing high drinking water to pilgrims, who may lose up to 5 liters of water/day³⁶, resulted in lower health complications. Drinking 2-3 liters of water daily is important during Hajj to avoid health complications such as dehydration, electrolyte imbalance, hyperglycemia, hypoglycemia and constipation^{8, 37, 38}. The low level of health complications in this study could be explained by the fact that the Ministry of Hajj and Umrah in Saudi Arabia always emphasized

public health promotional campaigns and continue in providing nutritional information to the pilgrims^{38, 39}. However, nutritional information is not sufficient; thus, providing nutritional care and a plan is preferable with a consideration of the quality of meals in terms of calories and type of nutrients to pilgrims by agencies. Such findings are consistent with the findings of⁴⁰ who reported that low numbers of agencies had nutritional supervision, while the Ministry of Health provides free nutritional services that were mostly limited to hospitals⁴¹.

Concerning the relationship between agencies' food practices and overall satisfaction. The data of the current study showed that there were significant differences between agencies' food practices in terms of timing of the meal which is especially important for patients with chronic diseases, cleanness of eating place and utensils, and hygiene of workers relative to the satisfaction of food practices ($P < 0.05$). Although the importance of the style of serving meals, the availability of special meals at agencies or food stores/restaurants, temperature, safety and packaging of food; these parameters were non-significant differences relative to overall satisfaction of the study participants.

In the present study, the results revealed that only 19.8% of the Hajj agencies and 12.4% of food stores/restaurants at the holy places always provided special meals. Moreover, 43.9% of the agencies always served meals at family or buffet style without considering calorie counting for each pilgrim. The results of the research are inconsistent with a previous study which demonstrated that agencies were required to consider pilgrims' quantities⁴² and the health condition of food consumed⁴⁰. The main risk factors for chronic diseases such as cardiovascular disease and diabetes are dietary components that have recently been demonstrated to play a crucial role^{19, 20, 43}.

Based on the results, there were 2.8% of the participants infected by food poisoning. Before 2006, the cases of food poisoning ranged from 44 - 132 in each Hajj season⁴⁴. The occurrence of foodborne illnesses comprising food poisoning during Hajj is incoming after taking affected meal^{8, 5, 22, 45, 46}. Thus, maintaining food safety must be the agencies' priority; only 15% of the participants responded that agencies never left food at room

temperature for more than 4 hours, which is an unsafe and poor practice of keeping food⁴⁵. Food exposure to bacterial growth which may lead to foodborne illnesses,^{37, 47} contributing to diarrhea^{48, 49}. Bacteria were the predominant infectious agents including *E. coli*, *Salmonella* and *Shigella*⁵⁰. On the other hand, the current results showed that 39% of the participants found the food always served at an appropriate temperature and 42.6% of the participants found the food always was well packaged; although food cooked outside the agencies since it is not allowed at Mina to reduce the risk of fires⁴¹. With regard to food temperature, the researcher also found that 35% of the pilgrims accepted the temperature of served meals during Hajj 1436H⁴².

Although improvement in Hajj was observed throughout the years, the findings indicate that 67.8% of the participants preferred the idea of using digital solutions and providing electronic food and nutrition services during the Hajj. However, using digital solutions may have some drawbacks like gatherings of people and technical malfunctions.

CONCLUSION

The current study revealed that most Hajj agencies provide meals to pilgrims with disregarding special dietary needs. Moreover, it is important to take into consideration the calorie and nutrient quality of food such as avoiding buffet style and decreasing fat and sugar that are provided to pilgrims. Furthermore, enforcement of regulations on food safety must be the agencies' priority and there was a difference in pilgrims' satisfaction with the agencies' food practices.

Recommendation

This study recommends pre-Hajj electronic orders of meals to collect pilgrims' data according to their health condition. Providing separate meals considering calculated calories and special dietary for each pilgrim. Distributing vending machines throughout the holy places that include special meals for pilgrims with chronic diseases, well packed in order to ensure the safety and quality of the meals. Educational and training interventions are needed to improve the knowledge and practice of food handlers. In addition, accurate data on the prevalence of chronic diseases among

pilgrims is needed to ensure effective planning, management and delivery of health services.

ACKNOWLEDGMENTS

I would like to thank Yara Sait and Ghada Albahiji for their collaboration of collecting data and all participants in this study.

Conflict of Interest

The author has declared no potential conflict of interest.

Funding Source

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

REFERENCES

1. Saidovna V. F. The Functional Essence of Some Pilgrimage Terms in The English Language. *Eurasian Res. Bulletin*. 2021;3: 1–6.
2. General Authority for Statistics, Kingdom of Saudi Arabia. Hajj Statistics 2019. <https://www.stats.gov.sa/en/28> (Accessed on January 2, 2021).
3. Yezli S., Yassin Y., Awam A., Attar A., Al-Jahdali E., Alotaibi B. Umrah An opportunity for mass gatherings health research. *Saudi Med. J.* 2017;38:868–871.
4. Memish Z. A. The Hajj: communicable and non-communicable health hazards and current guidance for pilgrims. *Euro Surveill.* 2010;15(39).
5. Aldossari M., Aljouidi A., Celentano D. Health issues in the Hajj pilgrimage: a literature review. *East Mediterr Health J.* 2019;25(10):744–753.
6. Memish Z. A., Venkatesh S., Ahmed, Q. A. Travel epidemiology: the Saudi perspective. *Int. J. Antimicrob. Agents.* 2003;21(2): 96-101.
7. Madani T. A., Ghabrah T. M., Albarrak A. M., Alhazmi M. A., Alazraqi T. A., Althaqafi A. O., Ishaq A. Causes of admission to intensive care units in the Hajj period of the Islamic year 1424 (2004). *Ann Saudi Med.* 2007;27(2): 101–5.
8. Alsafadi H., Goodwin W., Syed, A. Diabetes care during Hajj. *Clinical Med.* 2011;11(3): 218-221.
9. Ebrahim S. H., Memish Z. A., Uyeki T. M., Khoja T. A., Marano N., McNabb S. J. Public health. Pandemic H1N1 and the 2009 Hajj. *Science.* 2009;326:938–940.
10. Yezli S., Mushi A., Almuzaini Y., Balkhi B., Yassin Y., Khan A. Prevalence of Diabetes and Hypertension among Hajj Pilgrims: A Systematic Review. *Int. J. Environ. Res. Public Health.* 2021;18(3):1155.

11. Gautret P., Bauge M., Simon F., Benkouiten S., Valero R., Parola P., Brouqui P. Overweight and obesity in French Hajj pilgrims. *J. Immigr Minor. Health*. 2013;15:215–218.
12. Razavi S. M., Sabouri-Kashani A., Ziaee-Ardakani H., Tabatabaei A., Karbakhsh M., Sadeghipour H., Mortazavi-Tabatabaei S. A., Salamati P. Trend of diseases among Iranian pilgrims during five consecutive years based on a Syndromic Surveillance System in Hajj. *Med. J. Islam Repub. Iran*. 2013;27:179–185.
13. Deris Z. Z., Hasan H., Wahab M. S. A., Sulaiman S. A., Naing N. N., Othman N. H. The association between pre-morbid conditions and respiratory tract manifestations amongst Malaysian Hajj pilgrims. *Trop. Biomed*. 2010;27:294–300.
14. Ahmed O. B., Al Malki T. A., Al Malki A. A., Dablood A. S. Nutrition and Chronic Diseases among Makkah Visitors. *Glob. J. Med. Res*. 2019;19(1): 31-36.
15. Global Burden of Diseases (G. B. D.). Causes of Death Collaborators Global, regional, and national age-sex-specific mortality for 282 causes of death in 195 countries and territories, 1980–2017: A systematic analysis for the Global Burden of Disease Study 2017. *Lancet*. 2018;392:1736–1788.
16. Kodim N. SP3-31 Determinant factors contribute to the death of Indonesian Hajj pilgrims for the ages of > 40 years in Mecca, Saudi Arabia. *J. Epidemiol. Community Health*. 2011;65(1):A417.b
17. Shafi S., Dar O., Khan M., Khan M., Azhar E. I., McCloskey B., Zumla A., Petersen E. The annual Hajj pilgrimage-minimizing the risk of ill health in pilgrims from Europe and opportunity for driving the best prevention and health promotion guidelines. *Int. J. Infect. Dis*. 2016;47:79–82.
18. Algeffari M. Diabetes and Hajj pilgrims: A Narrative review of literature. *J. Pak. Med. Assoc*. 2019;69:879–884.
19. Khogeer Z., Alnifae R., Alyamani S., Alharbi K., Hanbzaza S., Mashhor A., Alfelali M., Barasheed O. Acute Complications of Diabetes Among Pilgrims During Hajj 2017: A Brief Report. *Diabetes*. 2020:741–751.
20. Al Shimemeri A. Cardiovascular disease in Hajj pilgrims. *J. Saudi Heart Assoc*. 2012;24:123–127.
21. Sindy A. I., Baljoon M. J., Zubairi N. A., Dhafar K. O., Gazzaz Z. J., Deiab B. A., Hothali F. A. Pattern of patients and diseases during mass transit: The day of Arafat experience. *Pak. J. Med. Sci*. 2015;31:1099–1103.
22. Hollisaz M. T., Pourheidari G., Saghafeina M., Khanipour-Roshan S., Assari S. Hospital admission due to nephrological conditions during Hajj. *Iran J Kidney Dis*. 2010;4(1): 71–3.
23. Raosoft Sample Size Calculator. 2004. <http://www.raosoft.com/samplesize.html> (Accessed on January 2, 2021).
24. Alzahrani A., Choudhry A. J., Al Mazroa M. A., Turkistani A. H., Nouman G. S., Memish Z. A. Pattern of diseases among visitors to Mina health centers during the Hajj season, (2008 G). *J. Infect. Public Health*. 2012;5(1):22–34.
25. Khan N. A., Ishag A. M., Ahmad M. S., El-Sayed F. M., Bachal Z. A., Abbas T. G. Pattern of medical diseases and determinants of prognosis of hospitalization during 2005 Muslim pilgrimage Hajj in a tertiary care hospital. A prospective cohort study. *Saudi Med. J*. 2006;27: 1373–80.
26. Mandourah Y., Ocheltree A., Al Radi A., Fowler R. The epidemiology of Hajj-related critical illness: lessons for deployment of temporary critical care services. *Crit. Care Med*. 2012;40(3): 829–34.
27. Madani T. A., Ghabrah T. M., Al-Hedaithy M. A., Alhazmi M. A., Alazraqi T. A., Albarrak A. M. Ishaq A. H. Causes of hospitalization of pilgrims in the Hajj season of the Islamic year 1423 (2003). *Ann. Saudi Med*. 2006; 26(5):346-351.
28. Khan S. A., Bhat A. R., Khan L. A. Hypoglycaemia in diabetes during Hajj. *Saudi Med. J*. 2002; 23: 1548.
29. Alzahrani A. S., Alhumaidi F., Altowairqi A., Al-Malki W., AlFadhli I. Screening for cognitive impairment in Arabic-speaking Hajj pilgrims. *Egypt. J. Neurol. Psychiatry Neurosurg*. 2019;55:1–7.
30. La Vecchia C. Mediterranean diet and cancer. *Public Health Nutr*. 2007;7(7): 965-968.
31. Bazzano L. A., Green T., Harrison T. N., Reynolds K. Dietary approaches to prevent hypertension. *Curr. Hypertens. Rep*. 2013;15(6): 694–702.
32. Giacosa A., Barale R., Bavaresco L., Gatenby P., Gerbi V., Janssens J., Johnston B., Kas K., La Vecchia C., Mainguet P., Morazzoni P., Negri E., Pelucchi C., Pezzotti M., Rondonelli M. Cancer prevention in Europe: the Mediterranean diet as a protective choice. *Eur. J. Cancer Prev*. 2013;22(1): 90-95.
33. Rysz J., Franczyk B., Cia³kowska-Rysz A., Gluba-Brzóka A. The Effect of Diet on the Survival of Patients with Chronic Kidney Disease. *Nutrients*. 2017;9(5): 495.
34. Schulze M. B., Martínez-González M. A., Fung T. T., Lichtenstein A. H., Forouhi N. G. Food based dietary patterns and chronic disease

- prevention. *BMJ*. 2018;361: k2396.þ
35. Gatrada R., Sheikh A. Hajj: journey of a lifetime. *BMJ Clinical research ed.* 2005;330(7483): 133-137.
 36. Ibrahim M., Abdelaziz S. I., Almagd M. A., Alarouj M., Annabi F. A., Armstrong D. G., Ba-Essa E., Ben Nakhi A., Boudjenah N., Fischl A. H., Hassan A., Masood S. N., Misha'el A. A., Shera A. S., Tuomilehto J., Umpierrez G. E. Recommendations for management of diabetes and its complications during Hajj (Muslim pilgrimage). *BMJ Open Diabetes Res. Care.* 2018;6(1): 2-5.
 37. Ministry of Hajj and Umrah. General Guide for Health of Hajj and Umrah Pilgrims 2019. <https://www.haj.gov.sa/en> (Accessed on September 21, 2021).
 38. Hamdan S. M. S., Albliwi S. A. Food Management During Hajj Using Lean Methodology to Fulfill The Pilgrims' and Umrah Performers' Food Needs, Rationalize Consumption and Preserve the Environment. *Biosci. Biotech. Res. Comm.* 2020;13(3).
 39. Memish Z. A., Zumla A., Alhakeem R. F., Assiri A., Turkestani A., Al Harby K. D., Alyemni M., Dhafar K., Gautret P., Barbeschi M., McCloskey B., Heymann D., Al Rabeeah A. A., Al-Tawfiq J. A. Hajj: infectious disease surveillance and control. *Lancet*. 2014;383(9934):2073–82.
 40. Alsebaei A. F. Studying Organic Waste Resulting from Catering Service in Pilgrims' Hotels in Makkah and the Ways to Reduce the Waste of Food. *Conference: Scientific Forum for the Research of Hajj, Umrah and Madinah Visit.* 2017;17th: 292-301.
 41. Shivappa N. Diet and Chronic Diseases: Is There a Mediating Effect of Inflammation? *Nutrients*. 2019;11(7): 1639.
 42. Al-Mazrou Y. Y. Food poisoning in Saudi Arabia. Potential for prevention? *Saudi Med. J.* 2004;25(1):11-4.
 43. Al-Joudi A. S. An outbreak of foodborne diarrheal illness among soldiers in mina during hajj: the role of consumer food handling behaviors. *J. Fam. Community Med.* 2007;14(1): 29-33.
 44. Ahmed Q. A., Arabi Y. M., Memish Z. A. Health risks at the Hajj. *Lancet*. 2006;367(9515):1008-1015.þ
 45. Emamian M. H., Mohammadi G. M. An Outbreak of Gastroenteritis Among Iranian Pilgrims of Hajj during 2011. *Iran Red. Cres. Med. J.* 2013;15(4): 317-9.
 46. Shujaa A., Alhamid S. Health response to Hajj mass gathering from emergency perspective, narrative review. *Turk. J. Emerg. Med.* 2015;15(4): 172-176.
 47. World Health Organization. Food safety. 2020. <http://www.who.int/en/news-room/fact-sheets/detail/food-safety> (Accessed on September 27, 2021).
 48. Al-Tawfiq J. A., Gautret P., Memish Z. A. Expected immunizations and health protection for Hajj and Umrah 2018 -An overview. *Travel Med. Infect. Dis.* 2017;19:2-7.
 49. Gautret P., Benkouiten S., Sridhar S., Al-Tawfiq J. A., Memish Z. A. Diarrhea at the Hajj and Umrah. *Travel Med. Infect. Dis.* 2015;13(2):159-166.þ
 50. Abd El Ghany M., Alsomali M., Almasri M., Padron Regalado E., Naeem R., Tukestani A., Asiri A., Hill-Cawthorne G. A., Pain A., Memish Z. A. Enteric Infections Circulating during Hajj Seasons, 2011-2013. *Emerg. Infect. Dis.* 2017; 23(10): 1640–1649.