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## Heatstroke prevention behavior by pilgrims from Lumajang, East Java, Indonesia

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**Abstract.** Lately, heatstroke gets more attention because of the number of patients, and the death rate increased sharply. In the pilgrimage season, heatstroke also occurs on the pilgrims, even be one cause of the high number of death in pilgrims. This study aimed was to investigate the preventive behavior of heatstroke by pilgrims from Lumajang in 2016. The results showed, of 205 pilgrims, only 8.3% take action to prevent heatstroke well, and 39.51% demonstrate improper preventive behavior. Nobody using an umbrella, and only slightly using sunglasses, sunscreen, bring some drinks, carry water spray and used it when hot time. They also demonstrate less fluid intake, do not avoid caffeine, and less consume fresh fruit. From these results, comprehensive health education should give to the candidate of pilgrims before their fleet to Holy land, to increase pilgrim's awareness to avoid heatstroke.

### 1. Introduction

Lately, heatstroke much great attention because of the number of patients, and the death rate rose sharply [1]. Heatstroke occurs more frequently during the summer with a prolonged heatwave. During the heatwave in 1980 (a record hot year in the United States), 1,700 deaths occurred, relating to heat, increased compared with 148 deaths attributed to heat the previous year.

The incidence of heatstroke in Japan in 2010 ranged from 105.4 to 536.9 patients per one million people [1]. The research on the epidemiology during heatwaves in urban areas in the United States shows the incidence of heatstroke, approximately 20 cases per 100,000 population, and caused at least 240 deaths each year [2]. In Saudi Arabia, the incidence of heatstroke varies, ranged from 22 to 250 cases per 100,000 people, depending on the season. The death rate associated with heatstroke that occurred in Saudi Arabia is estimated at 50% [3].

Heatstroke is rare in subtropical climates. This condition is recognized increasingly in countries that were rarely experiencing a heatwave. Heatstroke also usually affected people who make the pilgrimage to Mecca, especially the pilgrims who come from a cold environment. In the pilgrimage season, heatstroke is one cause of the high number of death in pilgrims from Indonesia: Data from the Indonesian Ministry of Health shows, as many as 629 pilgrims died while performing the pilgrimage in 2015, and 125 pilgrims died due to heatstroke [4].

The classic clinical manifestations of heat stroke are high fever, lack of sweat, and loss of consciousness. Heat stroke onset is closely related to three environmental factors: high temperature, high humidity, and windless environment [5]. The risk of heatstroke in Indonesian pilgrims, in addition to these three factors is also due to more of pilgrims were elderly. The elderly have a heatstroke incidence more elevated than in healthy young adults. Older people are also at higher risk for heat-related illnesses because they have a limited cardiovascular reserve, preexisting diseases, and the use of many drugs that affect the ability to sweat. Also, the elderly who are unable to care for themselves are at a higher risk of developing heat stroke. The elderly have decreased function and



physical abilities, psychological, and immunological to adapt to the environment. Heatstroke occurs in the elderly and people with a high risk of so-called Classic Heatstroke [2].

In addition to the age factor, there is also an activity factor. The Hajj requires more physical activity compared with other worship. Worshipers shall perform physical activity (Tawaf, Sa'i, Palm Jumeirah, and the standing at Arafat) that cannot be replaced by another. High physical activity on pilgrims could reduce the resilience of the heart, respiratory, or bones, muscles causing fatigue [6]. Besides, there is much more worship that requires outdoor activity. If this is carried out in hot weather, supported by a lack of acclimatization, it will trigger the EHS (Exertion Heat Stroke) in young adults [7,8]. Without a good recognition of the signs and symptoms of heatstroke, and proper handling of people who have heatstroke, both classic and exertional heatstroke can be fatal [9] and even can cause death.

In each group of pilgrims, there are about 445 worshiper, accompanied by one doctor and two nurses. Prevention of heat stroke is not only the responsibility of health personnel. Therefore, to prevent the occurrence of heatstroke and its complications in the group of pilgrims, it requires the efforts of all members to take action to avoid heatstroke. These efforts include: not being in direct sunlight, if going out of the lodge or hotel during the day must use umbrellas, dark glasses, carry a drink, drink every day at least 5-6 liters or 1 glass every hour without waiting for thirst, not holding back bowel movements and urinating, getting enough rest and sleeping 6-8 hours a day overnight, wearing loose-fitting and white or light-colored clothing, avoiding caffeine, eating fresh fruits, and acclimatization [9,10].

## 2. Methods

We performed a descriptive study of randomly selected worshipers (205 people) in the group of pilgrims from Lumajang, observing pilgrim's behavior to prevent heatstroke, and administering a comprehensive questionnaire with both closed and open-ended questions, in the first week of pilgrims on the Holy land.

## 3. Results and Discussion

### 3.1 General Data

#### 3.1.1 Age

Table 1 show that the respondents were an overall majority in the age group <60 years old, while the age group over 60 years amounted to 25.8%. The Indonesian Ministry of Health, included pilgrims over 60 years old as a high-risk group, even though they did not have any harmful disease, and in this group will be given a green wristband. For the age group below 60 years with the disease will be given yellow wristbands, while the pilgrims over the age of 60 years with the disease will get red bracelets.

**Table 1.** Distribution of the respondent's age

Age (years)	Frequency	Percentage (%)
26-30	3	1.46
31-35	6	2.92
36-40	9	4.39
41-45	20	9.75
46-50	24	11.71
51-55	46	22.44
56-60	44	21.46
61-65	27	13.17
66-70	14	6.83
71-75	5	2.44
76-80	4	1.95
81-85	3	1.46
Total	205	100

In conjunction with a heat injury, advanced age group is also the group that has the risk of heat injury. One of which is a classic heatstroke, even in a condition not accompanied by severe illness and inactivity. Although high-risk groups of respondents are only 25.8%, when multiplied by the number of pilgrims in the group could be more than 100 people. If illness and strenuous activities accompany this age group during the pilgrimage series, the risk of heatstroke will increase. This condition needs serious attention, especially by health personnel in each group of pilgrims.

### 3.1.2 Gender

Table 2 show that 50.2% were men. Men have a higher risk of heatstroke because of the activity of the male more outdoors. But in a string of Hajj pilgrimage, according to the researcher, this risk will be the same. The average pilgrims go to the Holy land with the couple. When the husband came out quarters well into the place of worship or to another site, then the wife will follow, so that the risk of heatstroke will divide equally between men and women.

**Table 2.** Distribution by gender

Gender	Frequency	Percentage (%)
Man	103	50.2
Woman	102	49.8
Total	205	100

### 3.1.3 Education

In terms of education level, the average educated respondents were an elementary school. Several factors influence this, such as age, socio-cultural, and economy. Table 3 show that the majority of elderly respondents in this study are primary education. The state of education in their childhood (years 1930-1950) is limited. It is supported by the local socio-cultural factors that consider education not essential and need not be high because they have established an economy.

In connection with heatstroke or other heat injuries, a lack of knowledge will affect the precautions taken.

**Table 3.** Distribution of respondents' education

Education	Frequency	Percentage (%)
SD / MI	86	41.95
SMP/ MTs	24	11.71
SLTA / MA	44	21.46
Diploma I / II / III	10	4.88
Bachelor	38	18.54
Post graduate	3	1.46
Total	205	100

### 3.1.4 Profession

Table 4 show that the majority are farmers and government employees (PNS), followed by housewives and private employees. Of the 21 districts in Lumajang, pilgrims who came from the district town and six other regions near the subdistrict town dominated by government employees. Pilgrims in 14 areas remain dominated by the farmer and his wife as housewives, traders, and private employees.

**Table 4.** Distribution of respondent's profession

Profession	Frequency	Percentage (%)
Farmer	53	25.85
Trader	18	8.78
BUMN employees	4	1.95
Private employees	36	17.56
Government employees	53	25.85
Retired	5	2.44
Indonesian Army	3	1.46
Housewife	32	15.61
Student	1	0.49
Total	205	100

### 3.2 Custom Data (Heatstroke Prevention Behavior)

#### 3.2.1. Not being in the direct sun

Table 5 show that the average respondent to be in the sun during the first week in the Haramain (Holy Land). It happens because of the arrival of this group in the Haramain only 8 (eight) days before the standing at the peak of the hajj pilgrimage in Arafah. The departure to the Haramain has long-awaited by respondents, resulting in compassion and extraordinary excitement. Many pilgrims wanted to utilize the time available to as many worshipers in the Haram Mosque, as a result of activities outside the lodgment more done, without considering the physical condition and exhaustion that happened. As described above, the most significant percentage of respondents are farmers and weather conditions outside lodging, which stood at temperature 45°C, regarded as a commonplace by them. Exposure to sunlight is everyday for farmers. Even when in the Haramain also happens something like that, there is no need to worry about it.

**Table 5.** Distribution of the behavior of the respondents were not in the sun

Not being in the sun	Frequency	Percentage (%)
Yes	87	42.4
Not	118	57.6
Total	205	100

This opinion quite dangerous because the degree of heat between Haramain and the place of origin was different. The humidity factor also plays an essential role in the occurrence of heatstroke but was never considered by the respondent. Heatstroke is closely associate with the heat index is a combination of relative humidity and air temperature [11]. Humidity 60% or more can inhibit the evaporation of sweat, which ultimately inhibits the body's ability to cool itself. Moisture in Mecca in August-September range from 56-57%, whereas in Medina 58- 60% [10]. Vigorous exercise in a hot-humid environment, lack of heat acclimatization, and poor physical fitness are factors leading to EHS [12]. Related to that, the time when the study is taking part, relative humidity approaching the limit, so needs to calculate the risk of heat stroke or other heat injuries.

#### 3.2.2. Pilgrim's behavior when out of lodgment.

Table 6 show that when out of the lodge:

- a. Nobody was using an umbrella. It occurs because, since the departure, the respondents did not plan to take an umbrella that was considered inconvenient. The use of a wide-brimmed hat

instead of an umbrella is used only by some female pilgrims only.

- b. Only slightly pilgrims use sunglasses and sunscreen. Only women and young respondents that use sunglasses and sunscreen. While another group states do not need, and the other was stating brought but not used because of embarrassment.
- c. Almost all respondents (99%) brought some drinks but in a limited number of one- size bottle of 330-600 ml. Most respondents said that in the Haram can drink Zamzam water as much, so no need to bring supplies drinks too much. The additional burden would be quite troublesome when doing Tawaf, looking for a place to pray in the Hijr Ismail and the area around the Kaaba, mainly unidirectional with Multazam. At the time of the study (one week before the standing in Arafah) almost entirely pilgrims have arrived in Mecca. Conditions in the Haram so dense that the pilgrims had to crowd while performing the ritual sequence, and it further increased the risk of heatstroke.
- d. Only slightly (10.7%), which brought spray water and used it when hot. The shape of water spray that too big is considered inconvenient. Therefore the majority of respondents leave the spray bottle in the room, even some pilgrims left in the hajj dormitory when the tool packages distributed.

**Table 6.** Distribution of pilgrim's behavior when out of lodgment

Action	Frequency	Percentage (%)
using an umbrella	0	0
using dark glasses	36	17.56
bring some drinks	203	99.02
bring water spray and use when hot time	22	10.7

### 3.2.3. Wear lightweight, light-colored, loose-fitting clothing

Table 7 show that all respondents wear lightweight, light-colored, loose-fitting clothing. When going to the Haram, general respondents use KBIH (The hajj guidance group) uniform or ihram cloth for not returning to lodging after Umrah activities by KBIH.

**Table 7.** Distribution of the behavior of respondents wear lightweight, light-colored, loose-fitting clothing

Wear lightweight, light-colored, loose-fitting clothing	Frequency	Percentage (%)
Yes	205	100
Not	0	0
Total	205	100

### 3.2.4. Drink every day for at least 5-6 liters or 1 cup every hour without waiting for thirst

Table 8 showed that 82.93% of pilgrims consume fluid in an amount of less than 4L. Most of them said they had increased fluid intake, but not more than 4 liters or 1 cup every hour. They reduce amounts of fluid consumption when outside the lodging, even a few respondents consume ice. Consume too cold water can cause stomach cramps [13,14]. They drink additional fluid after Tawaf. When the waiting period of prayer in the Haram, they were not too much to drink because they were concerned that a lot of drinking would stimulate urination. Besides, the cold atmosphere inside the Haram reduces their thirst felt. Similarly, when in lodging, they stay in an air-conditioned environment. This condition makes them did not feel too thirsty, so their total liquid consumption not more than 4 liters but remain in the range 2-3 liters.



**Table 8.** Distribution of consumed fluid behavior

Drink 1 cup / hour (5-6L / day)	Frequency	Percentage (%)
Yes	35	17.07
Not	170	82.93
Total	205	100

### 3.2.5. Do not hold back defecation and urination

Table 9 showed that between holding and not holding defecation (chapters) and urination (tubs) nearly as much. They said not to hold defecation and urination when in the lodging, but at the exit of the quarters, especially when in the Haram mosque partially restrain chapters and tubs. They do this because finding a place to pray in the Haram mosque is very difficult, and the location of the bathroom is far away. If they leave the site for chapter or tubs, they will lose place of worship when they returned, and probably will get a place of worship outside the Haram mosque. With these considerations, the majority of respondents hold chapters and tubs, and consequently, the stomach will feel full, so they reduce fluid consumption, which will increase the risk of heatstroke.

**Table 9.** Distribution of respondents' behavior in hold defecation and urination

Do not hold chapters and tub	Frequency	Percentage (%)
Yes	103	50.2
Not	102	49.8
Total	205	100

### 3.2.6. Get enough rest and sleep 6-8 hours a day and night

Table 10 showed that 72.2% of respondents get enough rest and sleep 6-8 hours a day and night during sleep as much as 5.85% <6 hours. As explained previously, the majority of respondents want to worship as much as possible and spend time in the Haram mosque. Even KBIH still took 1-2 times Umrah during the wait before staying in Arafah. Umrah conducted from 11 p.m. until 3 a.m. Most respondents did not leave the Haram Mosque until completed morning prayers or until Dhuha, followed by a break in the quarters. So that the amount of sleep still met 6-8 hours, although some respondents returned to the Haram Mosque just before Dhuhr or Asr. While respondents with the amount of sleep more than 8 hours, mostly elderly or ill, so that activity outside the lodging not too much, and respondents get enough time to rest.

**Table 10.** Distribution of the amount of sleep

The amount of sleep	Frequency	Percentage (%)
> 8 hours	45	21.95
6-8 hours	148	72.2
<6 hours	12	5.85
Total	205	100

### 3.2.7. Avoiding caffeine

Table 11 showed only 27.32% of respondents who avoid caffeine, while 72.68% of respondents consume caffeine that is tea and coffee. They have a habit of eating breakfast with a cup of tea or coffee or drink it in leisure. According to DerSarkissian (2016), to prevent heatstroke are advised to avoid caffeine because it can make the body loses more fluid and aggravate disease that occurs due to heat.

**Table 11.** Distribution of the behavior of do not consume caffeine

Do not consume caffeine (tea, coffee)	Frequency	Percentage (%)
Yes	56	27.32
Not	149	72.68
Total	205	100

The lack of knowledge of the respondents also affects this behavior. In its development, after stayed in Arafah, the respondents who did not consume caffeine eventually were drinking tea and coffee. It occurs because, before departure to Muzdalifah, every pilgrim gets a package of consumption, such as contain tea and coffee. This package is considered justification, so pilgrims think that they don't need to avoid tea and coffee. This opinion not fully erroneously. Because caffeine has a diuretic effect, caffeine consumption should be balanced with enough liquid and avoid it when the temperature outside is excessively hot as in Mina at 50<sup>o</sup>c.

#### 3.2.8. Eating fresh fruits

Table 12 showed that 60.5% of respondents consume the fruit, but not the fruit that contains a lot of water as recommended, and only the fruit is in the meal package. Among the fruit in the food package, banana is the most widely consumed by the respondents, while the orange much avoided by the respondent because of inducing cough. Elderly respondents are generally not consumed apple because it was hard to chew. A small portion of respondents has added fresh fruits such as pears, melons, grapes, or plums in daily consumption.

**Table 12.** Distribution of the behavior to consume fresh fruit

Consuming fruit	Frequency	Percentage (%)
Yes	124	60.5
Not	81	39.5
Total	205	100

#### 3.2.9. Prevention of Heatstroke

Of the various explanations above, Table 13 showed that 52.19% of respondents prevent heatstroke in the category enough, which perform actions 5-7 of 11 recommended actions. Even 39.51% only do 2-4 actions. Some factors that could affect these results include the level of education, employment, and information received by the respondent.

**Table 13.** Heatstroke Prevention by Respondents

Prevention	Frequency	Percentage (%)
Well	17	8.3
Enough	107	52.19
Less	81	39.51
Total	205	100

## 4. Conclusions

Of 205 pilgrims, 74.2% were aged <60 years, 50.2% were men, 41.95% have an elementary school, 25.85% as farmers, and 25.85% are government employees (PNS). In the case of heatstroke prevention behaviors, 57.6% of respondents were in the blazing sun. When out of the lodging, pilgrims no use umbrellas, 17.56% using dark glasses, bring lunch drinks 99.02%, 10.7% carry a water spray, and use when hot. All respondents wear lightweight, light-colored, loose-fitting clothing when

out of lodgment. 82.93% of respondents consume fluids in an amount of fewer than 4 liters; 49.8% hold chapter and tubs, 72.2% adequate rest and sleep 6-8 hours a day and a night, 72.68% consume caffeine, and 60.5% consumed fruits. The overall behavior, only 8.3% who do prevention well, 52.19% take action to prevent heatstroke in enough categories, and 39.51% less.

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