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ORIGINAL ARTICLE

Body Mass Index Influences on Exertional Heat Stroke Risk in Young Healthy Males and Females

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ABSTRACT

Objective: To find the influence of body mass index on exertional heat stroke risk in young healthy males and females.
Study Design: Retrospective case control study
Place and Duration of Study: Department of Neurology, Sharif Medical & Dental College, Lahore from 1st April 2022 to 30th September 2022.
Methodology: Two hundred patients who came with exertional heat stroke and compared it with the normal healthy control's information were enrolled. Exertional heat stroke (EHS) cases were placed in Group A while normal controls in group B. The information regarding heat illness, body size, gender, was documented in addition to their other demographic details was compared in the groups.
Results: The mean age of the EHS cases in group A was 25.5±7.2 years while of controls in group B was 26.1±6.5 years. There was higher number of males within both groups. The BMI of group A was higher than group B having a mean value as 26.9±3.2 in group A. The odds ration showed that EHS cases with a higher BMI had an increased risk of heat stroke which has a significant association with age but not with the gender.
Conclusion: There is a significant association between the higher body mass index and exertional heat stroke formation in young adults.
Keywords: Body weight, Outcome, Military, Influence, Marker

INTRODUCTION

Exertional heat stroke can be caused by elevated core body temperature due to prolonged stay in hot weather or extreme physical activities in hot temperatures. It could prove to be a fatal condition that affects people of many domain and disciplines such as athletes, military and emergency service personnel. Recent data showed that approximately 500 US military personnel are affected due to heat stroke every year.[1] Various factors for EHS progression have been identified by number of studies.[2,3] Body mass index (BMI) is widely used index for body weight and size estimation by measuring body height and weight ratio. It is used for predicting health problems by many health practitioners and considered an important marker.

Body mass index is a value derived for mass and height of an individual. The BMI is also termed as body mass in division with square of the height of a body and further is expressed in form of kg/m^2 units. This is resulted as mass in kilogram with height represented in meters. The categorization of BMI is as underweight, normal weight, overweight, or as obese based on tissue-mass. Underweight is classified as <18.5 kg/m^2 while, normal as weight 18.5-24.9 kg/m^2, overweight as 25-29.9 kg/m^2 and finally obese as 30 kg/m^2 or greater than it.[5]

Body mass index is also used for measuring health outcomes and for prescribing any medicinal drugs to the patient. Age could be another important determinant in estimation of BMI as older patients with higher BMI would have higher chances of health problems as compared to the younger individuals. Likewise, BMI is also considered an important causative factor which could influence exertional heat stroke both in younger and older individuals.[4-6] Through biophysical point of view, living objects which have large size will have lower surface area to mass ratio. Metabolic heat is released on the basis of body mass and it is dissipated on the basis of body surface area (BSA). Therefore, lesser BSA to mass ratio will make the situation more difficult by dissipating lower body heat in most cases.

Higher BMI is considerably associated with exertional heat stroke.[7,8] Although BMI itself not predict body composition and body fitness status but it might influence the body to dissipate heat especially during heat stress condition and physical exercise.[9-11] Obesity is also becoming frequent and common problem faced mostly by younger population. Present study was designed to determine the influence of body mass index and weight on incidence and development of exertional heat stroke on young individuals.

MATERIALS AND METHODS

This retrospective case control study was conducted at Department of Neurology, Sharif Medical & Dental College Lahore from 1st April 2022 to 30th September 2022. This study gathered information of patients who came with exertional heat stroke and compared it with the normal healthy control's information. Patients suffering from exertional heat stroke were included. Exertional heat stroke (EHS) cases were placed in Group A while normal controls in group B. The information regarding heat illness, body size, gender, was documented in addition to their other demographic details on a well-structured questionnaire. The BMI of the participants from both groups was recorded through measuring the weight in kilograms and height in inches. The body size was measured through using of inches tape around the waist circumference of a participant. All height and weight measurement found recorded in medical files were based on digital weight and height measuring instrument. Clinical history regarding exertional heat stroke was completely detailed in the medical files with all the signs and symptoms found and comprised 200 participants. Patients having known clinical history of comorbididties or any related ailment were not included in this study. For clinical assessment purpose blood tests including lipid profiling and fasting blood sugar was conducted through 3cc blood withdrawal and stored as serum (2cc) and EDTA blood (1cc) until analysis in -20 degree celcius. The lipid profiling was performed through calorimetric method while column method was used to analyse HbA1C. All the information was compared within group A and group B. Data was analyzed using SPSS version 25.0 through odds ratio, mean, standard deviation, frequency and percentages. P value <0.001 was taken as significant.

RESULTS

The age of the Group A cases was within 18-48 years while of group B participants within 17-47 years. There was higher number of males within both groups with a percentage of 60% and 66% in group A and group B respectively. The BMI of group A was higher than group B having a mean value as 26.9± 3.2 in group A (Table 1).

The odds ration showed that EHS cases with a higher BMI had an increased risk of heat stroke which has a significant association with age but not with the gender. A high BMI has a significantly raised risk of developing EHS than cases with normal BMI (Table 2).

There was a linked between higher BMI values and EHS development score. The linearity of the relation could be clearly observed where increase in BMI was directly linked with the exertional heat stroke (Fig. 1).

Table 1: Demographic characteristics of group A and Group B participants

Demographic Variables	Group A (n=100)	Group B (n=100)
Gender		
Females	40 (40%)	34 (34%)
Males	60 (60%)	66 (66%)
Age(years)	25.5±7.2 (18-48)	26.1±6.5 (17-47)
BMI (kg/m^2)	26.9 ± 3.2 (15.5-40.1)	25.4 ± 3.7 (14.1-43.5)
Average time (days) since last weigh	78 (0–180)	88 (0-180)

Table 2: Association of BMI with the development of EHS

Group A	Odds Ratio	P value
Age (years)	1.02 (1.01,1.07)	0.01
Females n(%)	1 REF	--
Males n(%)	1.02 (0.78,1.37)	0.85
BMI (kg/m^2)	0.97 (0.94,0.97)	<0.001

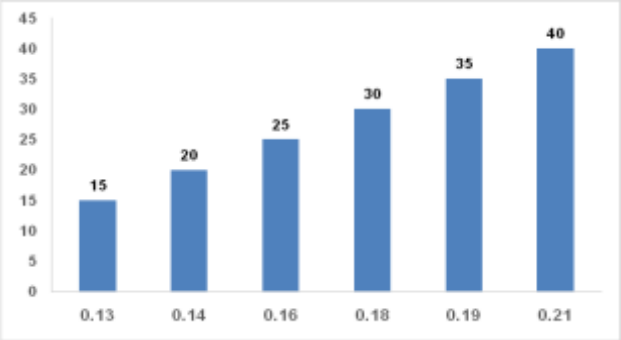

Fig. 1: Association of BMI and EHS

DISCUSSION

The present study showed that an increase in BMI was significantly associated with the EHS in young males and females. The results are in coordination with the previous findings which showed that young adults having an increased BMI have a high risk of developing exertional heat stroke. However no such study has presented a detail data from this part of the world. In our understanding this is the first such study which elaborated this issue in detail in Pakistan. A study reported an increase of risk up to 3% of EHS with every unit increase in BMI.[12] The females with higher BMI to have an increase risk of EHS development than males.[13] However, in the present study there was no significant association seen of EHS with gender.

The current research analysis was adjusted for age, gender and BMI with only age and BMI impact been observed. Impact of gender has been previously detailed in various studies in addition to that of age and BMI with EHS.[14-16] There are substantial evidences which show that fitness and aerobics have a positive role in thermoregulation of the heat to avoid the exertional heat stroke.[17-19]

The body size as well as body mass composition is also a strong variable in causing EHS in many cases. More body fat reduces the regulation of heat and dissipation through skin. In places where there is a dry environment there is a high risk of body with high mass index to store heat and cause EHS.[20] Previous studies have documented a direct association between the body mass composition and exertional heat stroke formation due to retention of heat in the body and less dissipation.[21,22]

CONCLUSION

There is a significant association between the higher BMI and exertional heat stroke formation in young adults.

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