AJMS *Al Ameen J Med Sci (2011)4(4):379-385*
(A US National Library of Medicine enlisted journal) ISSN 0974-1143
CODEN: AAJMBG

SHORT COMMUNICATION

Status of Obesity in Terms of Body Mass Index among Indian Air Force Personnel

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Abstract: *Introduction:* This paper investigates the prevalence of obesity (BMI >30 kg/m^2) among five geographical groups of Indian Air Force personnel of different age. *Purpose of study:* To observe the status of obesity among IAF and see whether there is age-wise and regional difference in obesity among the different geographical groups. *Results:* Gradual increase in mean BMI is seen as age of the population increases. There is an overall marked increase in BMI level among all the three age groups for all the other four zones. F-ratio test of normal range BMI does show significant difference among the zones. There is a statistically significant difference in normal BMI (18.5–24.9 wt/ht^2) among all the age groups (F-ratio=11.561, $p < 0.05$). BMI correlated positively with age in the 20-25 age groups ($r = 0.119$, p= 0.000) and 26-30 age groups ($r = 0.075$, p= 0.009) respectively, but BMI did not show any statistically significant correlation with age in the 31-35 age group. *Observations:* A marked increase in overweight and pre-obese prevalence is seen both age and region wise in the IAF personnel if the Asian BMI cut off levels are applied.
Keywords: Overweight, Obesity, Indian Air Force, Age, Regional Variation.

Introduction

Obesity is increasing at an alarming and is estimated that there are more than 250 million obese people world-wide [1]. The National Family Health Survey report shows that 12.1% of men and 14.8% of women in India are either overweight or obese [2]. Obesity is no longer just a concern for developed countries, but it is becoming an increasing health problem in many developing countries.

Obesity has been linked to an increased risk of numerous co-morbidities, including high blood pressure, high blood cholesterol, type 2 diabetes mellitus, coronary heart disease, osteoarthritis, asthma, and gallbladder disease [3-4]. A number of factors have been linked to obesity, including age. It has also been recently reported that even if an individual is considered healthy, he can still be obese and obesity in such cases may reduce chances of fatherhood in such individuals [5]. Besides the general population, overweight and obesity is an emerging concern in the defence sectors as well. In the US and Department of Defense, overweight and obesity are increasing rapidly and studies reports that prevalence of overweight/obesity increased nearly 24%, from 14.8% in AF1996 to 18.3% in AF2000. The increase in overweight/obesity was particularly large among male recruits ages 25–29 (i.e., from 36.4% to 44.5%) between 1996 and 2000. In short, overall rates of overweight and obesity are increasing among young recruits in the USAF at a fairly marked rate [6].

A recent review of literature in military populations reported that the major significant correlates of obesity included being enlisted personnel, male, ≥35 years of age and married [7]. Obesity in the Armed Forces has also been linked to depression. Prevalence of depressive symptoms among U.S. Military active duty service personnel ranged from approximately 16% of overweight men to 49% of obese women. Obese men and women and underweight men had increased odds of depressive symptoms as compared with normal-weight individuals [8]. In the context of the Indian Armed Forces, studies on obesity based on BMI are far and few. In one pilot study on 121 volunteers from a naval hospital staff in the age range of 18 to 47 years, the prevalence of overweight/obesity was 20.66%. Of the 25 overweight/obese by BMI one had Grade II and three had Grade-I obesity, while the remaining 21 were overweight [9].

In another study consisting of 902 healthy Armed Forces personnel between 28 to 52 years, BMI ranged from 14.67 to 27.90 kg/m^2 with a mean of 20.52 Kg/m^2. No individual was categorized as obese using the current international cut-off of BMI >30 kg/m^2 [10]. In light of ethnicity also being a feature associated with the variation in levels of obesity [11-14], Indian defence population comprises of personnel characterized by vast and different background. This diversity is based on ethnic, geographical and cultural subgroups, degrees of urbanization, social and economic conditions and nutritional beliefs and practices. Keeping this view in mind, the present study was undertaken to see the age and regional differences in BMI among the IAF personnel.

Objectives:

(i) To see the prevalence of overweight and obesity in terms of BMI among the Indian Air Force personnel below 35 years.

(ii) To see the age and geographical group wise variation in BMI levels among the IAF.

Material and Method

The present study is based on the anthropometric data of 3927 IAF male personnel [15]. The subject population was divided into three age groups eg. 20-25 years, 26-30 years and 31-35 years and into five geographical regions of the country depending on the origin of these personnel. Age and region wise difference in BMI have been compared using SPSS (version 11.5). We have also compared the differences between the means and derived the *F*-ratio value of the age wise and zone wise distribution of BMI. Pearson's Product Moment Correlation between BMI and age was also seen. Level of significance was observed at p-value < 0.05. Following World Health Organization conventions for BMI (in kg/m^2) were adopted: 18.5 (underweight), 18.5 – 24.9 (normal weight), 25 – 29.9 (overweight) and >30 (obese) to assess the level of obesity of the IAF personnel [16].

Zone Distribution: The country was divided into five geographical zones i.e., Northern, Southern, Central, Eastern and Western zones. The states included in the zones were on the basis of geographical contiguity viz. [17].

Northern zone	: Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Uttar Pradesh, Haryana, Delhi, Punjab.
Eastern zone	: West Bengal, Bihar, Orissa, Jharkhand, Assam, Manipur, Nagaland, Tripura, Mizoram, Sikkim, Arunachal Pradesh
Western zone	: Maharasthra, Gujarat, Goa, Rajasthan.
Central zone	: Madhya Pradesh, Chattisgarh
Southern zone	: Tamil Nadu, Andhra Pradesh, Kerala, Karnataka.

Result and Discussion

Table-1: Age wise distribution of mean BMI of IAF personnel

Age grades (years)	Mean BMI ± SD	Range (min – max)
20-25	23.37 ± 2.42	15.99 - 37.35
26-30	23.80 ± 2.19	23.80 - 31.31
31-35	24.06 ± 2.32	24.06 - 32.04
(20-35)	23.71 ± 2.34	15.99 - 37.35

Table 1 shows the distribution of mean BMI values in three age groups (20-25, 26-30 and 31-35) of the IAF personnel [15]. It is observed from the table that BMI increases with the increase of age of these personnel.

Table 2: BMI values of IAF Personnel in different geographical zones of India.

Zones	BMI (kg/m^2)		
	(20-25 years) Mean ± SD	(26-30 years) Mean ± SD	(31-35 years) Mean ± SD
North	23.74 ± 2.36	24.01 ± 2.05	23.78 ± 2.50
South	23.37 ± 2.38	23.54 ± 2.18	23.66 ± 2.20
Central	23.61 ± 2.58	23.84 ± 2.22	24.25 ± 2.31
East	23.12 ± 2.36	23.82 ± 2.27	24.16 ± 2.23
West	23.93 ± 1.58	23.52 ± 2.06	24.57 ± 2.58
ANOVA *F*-ratio	3.967 df=4, $p < 0.05$	1.421 df=4, $p>0.05$	3.157 df=4, $p<0.05$

Table 2 shows the zone wise distribution of mean BMI of IAF personnel among the three age groups (20-25, 26-30 and 31-35) and there was a significant difference among the five regional zones for the first and third age groups. ie. 20-25 years and 31-35 years as indicated by the *F*-ratio of 3.967 and 3.157 respectively. Among the five zones, post hoc analysis showed a significant difference ($p<0.05$) between the North and East zones for the 20-25 years group. There was also a significant difference ($p<0.05$) between Central and West zones for the 30-35 years group.

Table 3 shows the BMI according to the regional variation of the IAF personnel. For the normal range of BMI group, the eastern zone shows the highest BMI of 23.73 while the lowest was seen among the southern zone with a BMI of 22.65. The difference among the five zones show a statistically significant difference (2.974, df=4, $p < 0.05$).

Table 3: Status of Obesity as par BMI in different zones of IAF personnel.				
Zones	Under-Nourished	Normal	Overweight	Obese
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
North	17.26 ± 0.75	22.92 ± 1.55	26.31 ±1.09	30.33 ± 1.34
South	17.95 ± 0.61	22.65 ± 1.46	26.21 ± 0.96	30.39 ± 1.65
Central	17.65 ± 0.73	22.86 ± 1.50	26.28 ± 0.93	30.72 ± 2.06
East	17.67 ± 0.71	23.73 ± 1.55	26.29 ± 1.03	29.93 ± 1.50
West	0.00 ± 0.00	22.99 ± 1.35	26.27 ± 1.07	29.71 ± 1.50
ANOVA *F*- ratio	1.301 df=3, p > 0.05	2.974 df=4, p < 0.05	0.232 df=4, p > 0.05	0.574 df=4, p > 0.05

Table 4 shows the level of obesity in different age group of the IAF population. For the normal range of BMI group, all the three age groups show more or less similar mean values. This difference in mean between the age groups, however small, shows that there is a statistically significant difference among the age groups (11.561, df=2, $p < 0.05$). Post hoc analysis showed that there was a significant difference ($p<0.05$) between the (26-30) and (31-35) age group and also between the (20-25) age group and (31-35) years age group.

Table 4: Level of Obesity as par BMI in different age groups of IAF personnel				
Age (years)	Undernourished	Normal	Overweight	Obese
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
20-25	17.78 ± 0.70	22.60 ± 1.53	26.38 ± 1.03	31.00 ± 2.19
26-30	17.71 ± 0.62	22.86 ± 1.50	26.20 ± 0.94	30.58 ± 1.90
31-35	17.30 ± 0.85	22.91 ± 1.50	26.28 ± 0.99	29.84 ± 0.77
ANOVA *F*- ratio	1.894 df=2, p > 0.05	11.561 df=2, p < 0.05	2.341 df=2, p > 0.05	3.183 df=2, p > 0.05

Table 5: Correlation coefficient of BMI with age		
		AGE
BMI	Pearson Correlation	0.145 **
	Sig. (2-tailed)	0.000
** p< 0.00		

Correlation of BMI with age for pooled data i.e. (20-35 years) is given in Table 5, and it revealed that BMI correlated positively with age (r =0.145, p=0.000).

Table 6: Correlation coefficient of BMI with age in various age groups				
AGE		20-25yr	26-30yr	31-35yr
BMI	Pearson Correlation	0.119**	0.075**	0.055
	Sig. (2-tailed)	0.000	0.009	0.060
** p< 0.05				

Correlation of BMI with various age groups was further seen in Table 6, and it revealed that BMI correlated positively with age for the 20-25 age group (r = 0.119, p = 0.000) and 26-30 age group (r = 0.075, p =0.009) respectively, but BMI did not show any statistically significant correlation with the 31-35 age group (r = 0.055, p = 0.060).

It has been observed that India's population is characterized by the development and nutrition transition that may contribute to the risk of overweight and obesity, especially in urban areas [18]. The present study has revealed that there is an increase of mean BMI level among the three age groups. A marked difference in BMI was observed among the different age groups than for BMI changes among the zones. In one study on the relationship between BMI and age, it was reported that BMI increasing with age was more prominent in women than in men [19], and while it may be levelling off in women, there is an increase in body weight among men, children and adolescents [20].

Some studies reported that larger BMI values are associated with increased morbidity and mortality in adulthood [21-22]. Though the present study did not consider the association of BMI and morbidity, high BMI values (35.9% overweight) could be a cause for concern as it have been reported that the relative risk associated with greater body weight was higher among younger subjects [22]. Moreover, the age group of the present study (20 to 35 years) is a young age group where the percentage of those having normal BMI (35.3%) constituted only one-third of the total population. WHO has suggested BMI 23 kg/m^2 as a public health cut-off point for risk of obesity in Asian populations [1, 16], and the emerging evidence suggests that lower cut-off points are appropriate for populations from the Indian subcontinent [14,19]. The normal range of BMI could be 18.5 –22.9 kg/m^2 instead of 18.5–24.9 kg/m^2.

If we classify the present population according to the BMI cut off levels suggested for Asians, percentage of those falling under normal BMI grade decreases drastically from 71.3% to 35.3% and the percentage of overweight population increases from 25.7% to 35.9%.

Conclusions

When the new BMI classification by WHO for Asian was used in the present population, there was an increase in percentage of overweight and pre-obese BMI group, both region and age-wise, which is an important disclosure in light of the fact that analysis of the same population even with the 'old' BMI classification also revealed high percentage of overweight personnel. More in-depth study on the Armed Forces population using other indices of predicting obesity like waist-hip ratio, body fat percentage and different body composition techniques should be undertaken.

Acknowledgment

The authors would also like to thank Director, DIPAS for giving necessary permission while writing this paper.

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