Original Article

Body Mass Index in Adult Jaunsari Tribe Population of Dehradun District of Uttarakhand

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Abstract

Introduction: Obesity is one of the major risk factors for cardiovascular diseases. It is one of the defining components of cardiometabolic syndrome. Several indices are there for measurement of obesity, but body mass index (BMI) is relatively better than others and can be measured by the individual himself/herself. There is lack of such study for Jaunsari tribe population of Dehradun district of Uttarakhand. These values can also be used as standard for future reference for Jaunsari population. The study was planned to study parameters related to BMI in adult Jaunsari tribe of district Dehradun, Uttarakhand. The objectives of the study were: (1) to study BMI and the parameters related to it in adult male and female population of Jaunsari tribe of Dehradun district in Uttarakhand, (2) to analyze the sex differences in these parameters, and (3) to analyze statistical significance of the difference. **Material and Methods:** The study was carried on 100 adult males and 100 adult females of >18 years of age, belonging to Jaunsari tribe, after due approval from the institutional ethical committee and informed consent. The methodology adopted for the anthropometric measurements was of Singh and Bhasin (1968), and concerned measurements were done. **Results:** The mean weight, height, and BMI are found to be 50.90 ± 9.92 kg and 59.81 ± 10.74 kg, 152.43 ± 5.63 cm and 165.39 ± 7.23 cm, and 21.90 ± 4.05 and 21.85 ± 3.65 in female and male Jaunsari population, respectively, with statistically significant variation in both weight and height across gender with little or no variation in BMI. Standing height of majority of females falls under class short (54%) or very short (39%), whereas 32% of males are tall, 21% are lower medium, and 22% are short. This means that BMI falls into the category of "normal weight". **Discussion and Conclusion:** Hence, it is concluded that the mean BMI is 21.90 ± 4.05 kg and 21.85 ± 3.65 kg in female and male Jaunsari population, respectively, which falls into the category of "normal weight." This may be attributed to their traditional lifestyle and typical geographical location. This can be used as standard for future reference for Jaunsari population.

Keywords: *Adult, body mass index, female, male, obesity*

Introduction

Body weight more than the upper limit of physiological need of body as a result of excess deposition of fat or increase in the adipose tissue is referred to as obesity.[1] There are different types of fat in the body such as white and brown fats. The constituents of white fat are precursor adipocytes, fibroblasts, macrophages, and mature adipocytes, according to their presence in different locations of the body. White fat has several functions apart from storage of energy as autocrine, paracrine, and endocrine.[2] It has been reported that values of indices and parameters such as hip circumference, waist-to-height ratio index, body mass index (BMI), postoperative body weight, waist circumference, and arm circumference were taken postoperatively than that of taken preoperatively.[3] Adipocytokines or adipokines are bioactive substances that are secreted by adipose tissues. Fatty acid oxidation, insulin sensitivity, and energy consumption can be increased by these bioactive substances, whereas fat aggregation and appetite can be inhibited by leptin.[4] Adipokines produce oxidative stress as a result of their increased production of reactive oxygen species.[5]

It has been reported that obesity is significantly associated with increase in oxidative stress markers. Intraabdominal fat accumulation is manifested externally as abdominal obesity which is significantly associated with insulin resistance and diabetes.[6-9] It can accurately be measured by magnetic resonance imaging (MRI) and

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computed tomography scanning (CT scan); in fact, MRI and CT scan are the gold standard for evaluation of accumulation of intraabdominal fat.[10] Cardiometabolic diseases are one of the important health hazards, and obesity is reported to be an important risk factor for it. Hence, many indices have been in practice to evaluate risk for cardiometabolic diseases.[11] The Adult Treatment Panel III defined the metabolic syndrome which is reported to be associated with high cardiovascular risk, on the basis of five conditions. The presence of any three, out of five of these conditions is said to be metabolic syndrome. These conditions are (1) central obesity (as defined by men waist circumference >40 inch or women waist circumference >35 inch), (2) raised triglycerides (above 150 mg/dL or on treatment), (3) reduced high-density lipoprotein (below 40 mg/dL for men or 50 mg/dL for women), (4) raised blood pressure (above 130/85 mmHg or on treatment), and (5) abnormal fasting plasma glucose (above 110 mg/dL or on treatment).[12]

Due to the requirement of ethnic- and sex-specific values, the criteria of increased waist circumference (WC) for the diagnosis of metabolic syndrome are not commonly used in general practice. Furthermore, the measurement of WC becomes more complicated because of lack of uniformity regarding anatomical reference for its measurement, which leads to increased variability and high probability of bias in the measurement. In WC measurement, patients/individuals have to be in fasting condition, empty bladder, and minimal dress for effective and authentic measurement outcome which is difficult for both patients and physicians.[13,14] A patient is unable to measure his/her WC independently. WC seems to be more intimate and considered invasive in few traditions and cultures.[15]

The Jaunsari tribe has got the highest number of people in the state of Uttarakhand. They have got the body features resembling that of both the Mongols and Indo-Aryan groups who have settled in the Himalayan provinces.[16]

They are different than other tribal community because of their minimal or no interaction with the external world. Due to this, they have relatively maintained their unique traditions and cultures which have been point of interest for researchers of different fields. The Jaunsaris with their facial features clearly distinguish from other people of Garhwal, living close by.

This study will provide BMI of adult male and female population of Jaunsari tribe of Dehradun, which is the largest tribe of Uttarakhand. These values may be used to rule out obesity and metabolic syndrome in population of Jaunsari tribe and can also be used as standard for future reference for this population.

This study can be extended further to involve other tribal population of Uttarakhand. The results of the present study could be used to compare with that of other population of India. These basic parameters related to cephalic index can be used as anthropometric standards in future to find out any changes in the existing population. Hence, the study was planned to study parameters related to BMI in adult Jaunsari tribe of District Dehradun, Uttarakhand. The objectives were: (1) to study the parameters related to BMI of adult male and female population of Jaunsari tribe of Dehradun district in Uttarakhand, (2) to analyze the sex differences in these parameters, and (3) to analyze statistical significance of the difference.

Material and Methods

This is a Cross - Sectional Type of Study, carried over 200 adult population of Jaunsari Tribe consisting of 100 male and 100 female individuals of more than 18 years of age, after due ethical clearance and their informed consent.

As per census report of 2011, available on the website of District Health and Family welfare society, Dehradun-Uttarakhand; the administrative setup of Dehradun district comprises six tehsils, namely Dehradun, Chakrata, Tauni, Kalsi, Vikasnagar, and Rishikesh. The Jaunsari tribe is located in the northern part of Dehradun district in the hilly region of the block of Chakrata and Kalsi.

The present study is based on the study of anthropometric parameters related to BMI, of 100 adult males and 100 adult females belonging to Jaunsari tribal population of Dehradun district, Uttarakhand. Two tehsils such as Chakrata and Kalsi were selected, of six tehsils of Dehradun district, because Jaunsari tribes are mainly inhabiting these two tehsils of district Dehradun. Equal numbers of randomly selected male and female individuals were taken from randomly selected villages of Chakrata (Lakhwar and Hartar) and Kalsi (Jari and Koti). Sample selection was based on the voter list available at the tehsil office of Chakrata and Kalsi.

Prior consent for this study was obtained from the participant. The methodology for anthropometric measurements is adopted from Singh and Bhasin (1968). The head of participant was put on rest without any strain in the eye-ear plane or Frankfort horizontal plane, i.e., tragion and the infraorbitale were in the same horizontal plane. The person taking measurements was standing on the right side of the participant with anthropometer in the median sagittal plane of participant, and moving crossbar was allowed to touch vertex lightly. The participant was advised not to change his position while measurement was taken.

Somatometric landmarks, measurements, and indices

1. Vertex (V): It is the highest point on the head when the head is in eye-ear plane
2. Bodyweight (W): It should be taken by means of standard weighing machine with fine accuracy
3. Stature or standing height (H): It measures the vertical distance from the vertex to floor. It is measured with anthropometer
4. The BMI is universally expressed in kg/m^2:

$$\frac{\text{Weight (Kg)}}{\text{Height (meter square)}}$$

Results

After the completion of our study, collected data of all the desired morphometric parameters mentioned in the material and method were subjected to appropriate statistical tests (mean, standard deviation, and range value) using SPSS software version 23 (IBM). Results are presented in the form of table [Table 1-3]. It is evident from Table 1 that weight (kg) and stature or standing height (cm) are significantly different in male and female Jaunsari population, whereas BMI does not show any statistically significant difference. Further, these data were used to classify Jaunsari population according to range variation of stature or standing height [Table 2] and categories of BMI [Table 3]. It is evident from Table 2 that major female Jaunsari population fall under class short (54%) or very short (39%), whereas 32% of Jaunsari males are tall, 21% are lower medium, and 22% are short. Table 3 shows that as per category of BMI, only 53% males and 47% females are normal weight. Thirty-two percent Jaunsari males and 35% Jaunsari females are underweight as per category of BMI.

Discussion

The WHO expert consultation group published a technical report in 1995 regarding the uniformity of BMI. In it, four categories were recognized based on BMI as underweight, normal, overweight, and obese if their BMI were 15–19.9, 20–24.9, 25–29.9, and 30–35 or greater, respectively.[17] 16.9 BMI in men and 13.7 in women indicate that there are no body fat stores, using linear regression.[18] A similar category was given by John S. Garrow in 1981,[18,19] with different terminology.[18,19] According to him, BMI up to 25 is desirable, 25–29.9 is Grade I obesity, 30–40 is Grade II obesity, and >40 is Grade III obesity.

Further, there was expansion of categories of BMI by the International Obesity Task Force in 1977 to accommodate varying degree of obesity, and accordingly, they changed the terminology of BMI.[20] They referred a BMI of 25–29.9, 30–34.9, 34.9–39.9, and ≥40 as overweight/preobesity, Class I obesity, Class II obesity, and Class III obesity, respectively [Table 3].[21,22]

A disadvantage of BMI in using it as a criterion for judgment of obesity is its inability to differentiate between body fat mass and body lean mass. An individual with very high BMI can have very low fat mass and an individual with very low BMI can have very high body fat mass.[23-29] Anatomically and metabolically, obesity should be referred to excessive accumulation of body fat, i.e., accumulation of triacylglycerol. Several authors have questioned the accuracy of BMI as a tool to assess body fat mass on the previous grounds because of its limitations in this respect.[23,29-33] Important variables of obesity are age, gender, leg length, and ethnic group.[28,34-40] Another point to be noted is that in population-based studies, the BMI of women is lower than men besides their high fat mass with respect to their body build.

The determination of percent of body fat by a densitometric method has clearly shown the poor correlation between BMI and percent of body fat in males.[41] According to this study, 95% confidence intervals for percent of body fat in men with BMI of 27 were found to be 10%–32% which is too little to be considered to be obese. National Institutes of Health (NIH) criterion for obesity based on percent of body fat for men and women is Q25% and Q35% respectively.[42] National Health and Nutrition Examination Study (NHANES III) database has also shown the poor correlation between BMI and percent of body fat mass based on its study of estimation of fat component of body by bioelectrical impedance method.[43] Variation of percent of body fat men and women is 14%–35% and 26%–43%, respectively, with the same BMI of 25 kg/m^2. Individuals of BMI 25 are supposed to be normal but using NIH criterion on the basis of percent of body fat, they are associated with body fat mass ranging from low normal to obese. It is also reported from NHANES cohort study that BMI is better correlated with lean body mass than with fat mass in men.[36]

In the present study, the mean weight and height are found to be 50.90 ± 9.92 kg and 59.81 ± 10.74 kg and 152.43 ± 5.63 cm and 165.39 ± 7.23 cm [Table 1] in female and male Jaunsari population, respectively, with statistically significant variation in both weight and height across gender [Table 1]. Standing height of major female Jaunsari population falls under class short (54%) or very short (39%), whereas 32% of Jaunsari males are tall, 21% are lower medium, and 22% are short [Table 2]. As per

Table 1: Comparison of parameters of male and female Jaunsari population

Parameters	Mean±SD		Range of parameters				*P*
	Male	Female	Male		Female		
			Minimum	Maximum	Minimum	Maximum	
Weight (kg)	59.81±10.74	50.90±9.92	36	111	35.00	86.00	<0.001
Stature or standing height (cm)	165.39±7.23	152.43±5.63	143	184.5	139.50	168.00	<0.001
BMI	21.85±3.65	21.90±4.05	15.58	40.77	15.77	37.03	0.9

SD: Standard deviation, BMI: Body mass index

Table 2: Range variation of stature or standing height (cm) according to Martin

Class	Range (cm)	Male	Female
Median	165	-	-
Pygmies	Under129.9	0	0
Very short	130.0-149.9	1	39
Short	150.0-159.9	22	54
Lower medium	160.0-163.9	21	3
Medium	164.0-166.9	13	3
Upper medium	167.0-169.9	10	1
Tall	170.0-179.9	32	0
Very tall	180.0-199.9	1	0
Giant	200 and above		

Table 3: Distribution of Jaunsari population according to categories of body mass index

Range	Categories of BMI	Male (%)	Female (%)
15-19.9	Underweight	32	35
20-24.9	Normal weight	53	47
25-29.9	Overweight/preobesity	12	14
30-34.9	Class I obesity	2	2
35-39.9	Class II obesity	0	2
≥40	Class III obesity	1	0

BMI: Body mass index

category of BMI, only 53% of males and 47% of females are normal weight. About 32% of Jaunsari males and 35% of Jaunsari females are underweight [Table 3]. However, their mean BMI is found to be 21.90 ± 4.05 and 21.85 ± 3.65 in female and male population, respectively [Table 1]. This BMI falls into the category of "normal weight." The mean BMI is almost the same in male and female population. This normal distribution of weight and a healthy BMI might be because of their traditional lifestyle and typical geographical location.

Conclusion

Hence, it is concluded that mean weight and height in female and male Jaunsari population are found to be 50.90 ± 9.92 kg and 59.81 ± 10.74 kg and 152.43 ± 5.63 cm and 165.39 ± 7.23 cm, respectively, with statistically significant variation in both weight and height across gender. Standing height of major female Jaunsari population falls under class short (54%) or very short (39%), whereas 32% of Jaunsari males are tall, 21% are lower medium, and 22% are short. Their mean BMI is 21.90 ± 4.05 and 21.85 ± 3.65 kg in female and male population, respectively, which falls into the category of "normal weight". This may be attributed to their traditional lifestyle and typical geographical location.

Limitations

1. It does not represent the population of Uttarakhand; so, it cannot be generalized for people of rest of the state
2. The study has just focused on the measurement of anthropometric parameters related to BMI and parameters related to it but has not focused on the factors which might be responsible for this anthropometric presentation
3. As it is not representation of whole population, it cannot be generalized, and no comparison can be made between Kumaon and Garhwal population as it has focused on a particular tribe of Garhwal.

Future recommendations

Taking the above limitations into consideration, it is recommended that there can be a robust anthropometric study taking adequate samples from both Garhwal and Kumaon region of Uttarakhand so that their specification, comparison, and generalization can be done for the state of Uttarakhand.

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Conflicts of interest

There are no conflicts of interest.

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