Human Biology Review
www.humanbiologyjournal.com

Human Biology Review (ISSN 2277 4424) 11(1) 2022
Original scientific paper (Tripathi and Gautam, 20-42)
Revised and Accepted on December 16, 2021

Body age and its determinants among the overweight and obese: A cross sectional study among students and employees of a university campus in Central India

H. Tripathi[1] and R. K. Gautam[2]

Citation: Tripathi H and Gautam RK. 2022. Body age and its determinants among the overweight and obese: A cross sectional study among students and employees of a university campus in Central India. Human Biology Review, 11 (1), 20-42.

[1]Harshit Tripathi, PG Student, Department of Anthropology, Dr. Hari Singh Gour Vishwavidyalaya (A Central University), Sagar (M.P.). Email: harshit1439@gmail.com
[2]Rajesh K. Gautam, Professor, Department of Anthropology, Dr. Hari Singh Gour Vishwavidyalaya (A Central University), Sagar (M.P.). Email: goutamraj2006@gmail.com
Corresponding author: R.K. Gautam, Department of Anthropology, Dr. Hari Singh Gour Vishwavidyalaya (A Central University), Sagar (M.P.).

ABSTRACT

The chronological age and body age is not always same. Most of the individuals may be elder by point of view of their body age as compared to chronological age. Further, this difference of body age and chronological age is higher among overweight and obese individuals. But there is no information about it. Hence, this study was planned to understand the proximate of body age and its determinants among the overweight and obese respondents who had BMI ≥25 Kg m^{-2}. They belong to 18-43 years of age. The data were collected from a university campus of central India. A total of 95 respondents were recruited for the purpose. Along with anthropometer rod, Omron bi-electrical impedance was used to find out body age, along with body fat percentage, skeletal muscle percentage, body mass index, resting metabolic rate and visceral fat level. The findings indicate that the prevalence of obesity increases with age. Elder respondents are found more obese as compared to younger counterparts; whereas the younger respondents are more overweight than the elder one. The mean BMI of the respondents was found 27.17±2.04 Kg m^{-2}. The body age of the respondents was found higher as compared to their current age and the mean difference in the current age and body age was +18.72 years.

Keywords: *Body mass index (BMI), Overweight, Obesity, Chronological age, visceral fat, skeletal fat, body fat, regression.*

INTRODUCTION

Aging is a natural process. Each organism passes through different phases of aging. It has been observed that it varies from individual to individual. The process of aging determines intrinsically as well as extrinsically. The intrinsic factors are genes and DNA, one inherits from parents; simultaneously nutrition, physiology and metabolism also plays important role in the process of aging. The extrinsic factors include environmental constituents viz. geography, climate, altitude, latitude, pollution, population etc.

In the present study, age of the respondents were assessed traditionally from birth records, simultaneously their body age is assessed using anthropometric parameters by a device known

as Omron bi-electrical impedance. This instrument provides body age, along with body fat percentage, skeletal muscle percentage, body mass index, resting metabolic rate and visceral fat level.

Anthropometry is considered to be an important tool for assessment nutritional status of individuals or of the community. Hence, measurements like stature, weight and indices based on these measurements developed by different scholars have been extensively used to define the extent of overweight and obesity (Adak et al., 2006). It is the universally applicable, inexpensive and non-invasive technique available to researchers for the assessment of the size and proportion of the human body (WHO 1995) and is a very useful tool in the assessment of growth and nutrition (Hamieda and Billot 2002). The technique of anthropometry has been successfully utilized by different researchers to assess and document the growth and nutritional status of various human communities, including those from India (Marjan et al. 1998; Dang et al. 2004; Adak et al. 2006, Gautam et al. 2006, Mitra et al. 2007; Som et al. 2006; Gautam 2007a, 2007b, 2007c and 2008; Bisai et al. 2008; Nandy and Miranda 2008; Chesire et al. 2008; Mondal and Sen 2009 and 2010; Gautam and Thakur 2009; Thakur and Gautam 2014). Assessing body age is a recent innovation and being practiced by some of the investigators (Malhotra et al., 2016).

The nutritional assessment of the population is done by various measures. Body Mass Index (BMI) is one of them. According to the World Health Organization (WHO), Body mass index (BMI) is a simple index of weight-for-height that is commonly used to classify undernourished, normal, overweight and obese in adults. It is defined as a person's weight in kilograms divided by the square of his height in meters (kg/m^2) (WHO 2016).

The World Health Organization (WHO) defines overweight and obesity as abnormal or excessive fat accumulation that presents a risk to health (WHO, 2016a). A body mass index (BMI) $\geq$25 kg/m^2 is generally considered overweight, while obesity is considered to be a BMI $\geq$ 30 kg/m^2. It is well known that obesity and overweight are a growing problem globally with high rates in both developed and developing countries (Capodaglio & Liuzzi, 2013; WHO, 2016a, 2016b).

The term obesity is referred to a “chronic condition that develops when energy intake exceeds energy expenditure, resulting in excessive body fat”. Obesity is one of the risk factors of non-communicable disease and fifth leading cause of death around the globe (Tiwari et al., 2014).

It is well documented that obese child becomes obese adults and increases the risk of hypertension, cardiovascular disease and type II diabetes, dyslipidaemia in future (Booth F 2000 and Kamath & Souza, 2013). Adolescent obesity is also responsible for several disorders like metabolic syndrome, cardiovascular disease and certain types of cancer. It is associated with high morbidity and mortality in the later life (Centers for Disease Control and Prevention, 2019).

According to WHO (2004), the prevalence of obesity is 4.8% in developing countries, 17.1% in transitional countries and 20.4% in developed countries (WHO 2004). The causes of overweight and obesity are multifactor including genetic, biological, social, and environmental determinants either collectively or independently affecting weight gain by acting through the mediators of energy metabolism and physical activity (Ebbeling et al., 2002).

Worldwide among adults the prevalence of overweight and obesity has risen from approximately 27.5% in 1980 to 39% in 2016. Although, the prevalence of overweight/obesity is comparatively lower among older adults than the 18–55 age groups, the increasing trend in the prevalence of overweight/obesity over the past four decades is similar among both age groups (Ng et al., 2014). There is a substantial increase in prevalence of overweight and obesity among adolescents, in both developed and developing countries. Obesity in children and adolescents is gradually becoming a major public health problem in many developing countries, including India (Ng et al., 2014).

The fundamental cause of obesity and overweight is an energy imbalance between calories consumed and calories incurred. Globally, there has been an increased intake of energy-dense foods that are high in fat and sugars and an increase in physical inactivity due to the increasingly sedentary nature of many forms of work, changing modes of transportation, and increasing urbanization (WHO 2016).

There is prevalence of high blood pressure in children and adolescents from 2%-24%. It is an important contributor to increased cardiovascular diseases in later life, such as atherosclerosis. Blood pressure and hypertension prevalence rates are much higher in men than in women, demonstrating gender dichotomy in blood pressure (Ashwani 2012).

A large population-based study, which avoided the risk of collider bias, found that having a body-mass index (BMI) of 30 kg/m² or higher was associated with a slightly greater risk of death from COVID-19 than a BMI of less than 30 kg/m² (Gao et al., 2021 and Williamson et al., 2020).

Many research literatures mentioned that there is direct relationship between obesity and socioeconomical status, sedentary lifestyle, sleep patterns and parental obesity (Flegal et al., 2013). It has been also suggested that physical inactivity and excessive dietary fat, salt intake is also responsible for weight gain. Furthermore, environmental, behavioural and genetic factor also play important role in overweight and obesity (Deotale et al., 2015). Therefore, some preventive measures are required to alter the current scenario of obesity (Rao et al., 2021).

It is very difficult to compare prevalence of overweight and obesity in adolescent of different countries due to paucity in obesity screenings and research in adolescent as well as lack of standard method of measurement and cut-off points (Rao et al., 2021), still an attempt was made by Gautam et al. (2018).

The college-aged years, often known as emerging adulthood (18–25 years), are a risky period for the development of obesity, unhealthy dietary intake and poor physical activity which can contribute to the development of an eating disorder (Nelson, Story, Larson, Neumark-Sztainer, & Lytle, 2008). Moreover, the prevalence of co-occurring overweight/obesity and eating disorders (Eds) in university students is increasing, which is concerning as each of these conditions can have significant negative impacts on physical and mental health (Galmiche et al., 2019 and Peltzer et al., 2014).

The novel anthropometric parameters defining obesity identified in a study showed correlation with obesity and/or related metabolic risk factors. Owing to the absence of studies comparing most novel anthropometric parameters with direct measurements of body fat, further research is required in order to determine their accuracy and precision (Ranil Jayawardena et al., 2019).

Country like India is facing "double burden of malnutrition". There is epidemiological and nutritional transition, they are still dealing with communicable diseases and under nutrition. Simultaneously, noncommunicable diseases like overweight and obesity are also prevalent (Mondal et al., 2018). Hence, this study is focused on the respondents who had BMI ≥25 kg/m^2 and who are either student or employee of the University. The objectives of the study was to find out the determinants of the obesity as well as body age.

MATERIAL AND METHODS

The present study was conducted in a university campus known as Dr. Hari Singh Gour Vishwavidyalaya (A Central University) Sagar, Madhya Pradesh of Indian Union. Basic anthropometric data was collected on adult males, age 18–43 years who were living in the university premises (different boy's hostels of university campus) and some of them were day scholars who were phenotypically overweight and obese. Undernourished and normal individuals were excluded from the study. Out of 100 samples, 5 were excluded, as they do not fulfil the requirements of the present study. So, the final sample of the study was 95 adult males. The samples were mainly students of under-graduation, post-graduation, research scholars and non-teaching staff.

In the present study the respondents were first informed about the purpose of the study and then interviewed to elicit general information containing their personal details (like- the family history, dietary habits, Date of birth, address, etc.). Thereafter anthropometric measurements were taken. The data was collected during January 2020 to February 2020.

Measurements like height and weight were taken of each respondent by following the standard procedure as described by Gibson (1990) with all possible caution maintaining uniformity and accuracy in the techniques, after undergoing extensive training.

Anthropometer rod and Omron Bielectrical Impedance were used to measure the various anthropometric measurements. Body fat percentage (Body fat percentage (%) = {Body fat mass (kg)/ Body weight (kg)} x 100), Skeletal muscle percentage, Body Mass Index (BMI = weight (kg) / [height (m)]^2), Resting metabolic rate, Body age, Visceral fat level were recorded using Omron Bielectrical Impedance. A semi-structured schedule was used to collect the information about socio-demographic status and dietary habits of the respondents.

Measuring height and weight

The subject stands comfortably barefooted with chin parallel to ground (or FH Plane) then height was measured with the help of Anthropometer rod. Then, the details of actual age in years, sex, height are entered in the OMRON machine. The subject is asked to stand on the OMRON machine for weighing. The machine scans the person for visceral fat, Body fat percentage, Skeletal muscle percentage, body mass index, resting metabolic rate and calculates body age. MS-Excel and SPSS (Trial version) software were used for the tabulation and analysis of the data.

Ethical Consideration: The study was part of a degree program; hence the concerned department has approved it. The present study did not impose any financial burden to the participants. They were informed about the study before conducting it. Consent from the respondents were taken before they were considered for inclusion in the study. Helsinki declaration (1964) was followed for the recruitment of the subjects.

RESULTS

It is evident from the Table-1 that out of total respondents 89.5% were overweight and 10.5% were obese. Here it is essential to clarify again that BMI $\geq$ 25 Kg m^{-2} was the criteria for the recruitment of the sample. The sample was classified on the basis of age. A total of 18.9% belonged to age group (18-20 years), 41.1% were between 21-25 years, 31.6% were from 26-30 years and 8.4% were $\geq$31 years.

Age wise prevalence of overweight and obese is not uniform. In early age 18-20 years, the prevalence of obesity was found less, a total of 94.44% individuals of 18-20 years were overweight and only 5.56% were obese. In the age group 21-25 years, the prevalence of obesity was found three times higher (15.38%), whereas the overweight was 84.61%. In the age group 25-30 years, the prevalence of obesity is less than early age groups which is 3.33%, where as overweight was 96.66%. Further, In the age group $\geq$31 years, the prevalence of obesity was found nearly 5 times higher (25%) as compared to early age groups, where as overweight was 75%.

The sample was also classified on the basis of visceral fat level. A total of 71.6% individuals were in the range of 1-9, similarly 24.2% were from (10-14) whereas 4.2% individuals were classified for visceral fat level 15-30.

The obese individuals have high level of visceral fat as compared to overweight. It can be seen from the Table 1 that in the category of individuals with 1-9 visceral fat level cent-percent were overweight, none of them were obese. In the next level of visceral fat i.e. 10-14, the prevalence of overweight was 73.91% whereas the prevalence of obese was 26.08%. Further, in next level of visceral fat, i.e., 15-30 cent-percent were obese.

According to dietary behaviour, the prevalence of overweight and obesity was not uniform. It is evident that a total of 6.3% individuals consider breakfast as their main meal of the day, 41.1% individuals consider lunch as their main meal and 52.63% individuals consider dinner as their main meal of the day.

It is apparent that those who consider breakfast as main meal are more obese (33.33%) as compared to those who consider lunch and dinner as main meal (12.82% and 8%) respectively. The reverse was found for overweight.

As per the source of the meal it is apparent that 18.9% of the sample opted tiffin, 4.2% had restaurant meal and 76.8% eat freshly cooked food.

It is clearly seen in Table 1 that the category of individuals opted tiffin as a source of meal and those who taking meal from restaurant were cent-percent overweight, none of them were obese; whereas those were cooking fresh food 13.69% of them were obese and the prevalence of overweight among them was 86.30%.

The sample was classified on the basis of academic program, a total of 31.57% individuals were Under graduate students, 24.21% were Post graduate students, 23.15% were Ph.D. students whereas a total of 21.05% were non-teaching staff.

The prevalence of obesity among the different academic category was found different. A total of 10%, 13.04%, 9.09% UG, PG and Ph.D. students respectively were found obese. Similarly, among non-teaching staff also the prevalence of obesity was found 10%. The reverse was found for overweight. It is apparent that the PG students are more obese than the others.

The analysis of the housing type showed that a total of 70.52% of individuals were living alone (single seated hostel), 12.63% lived in shared housing with their friend and rest of them 16.84%, lived with their own families.

The prevalence of obesity on the basis of housing type is not uniform. The students living alone (Single seated hostel) are less obese 5.97% as compared to those who are living with friend (25%) and family (18.75%).

Table 1. Distribution of sample as per age, visceral fat, meal type, level of education and type of housing.

	OVERWEIGHT		OBESE		Total
	N	%	N	%	N
Age (years):					
18-20 years	17	94.44	1	5.56	18
21-25 years	33	84.61	6	15.38	39
26-30 years	29	96.66	1	3.33	30
≥31 years	6	75	2	25	8
Total					95
Visceral Fat Level:					
1-9	68	100	0	0	68
10-14	17	73.91	6	26.08	23
15-30	0	0	4	100	4
Total					95
Main meal will be considered as:					
Breakfast	4	66.66	2	33.33	6
Lunch	34	87.17	5	12.82	39
Dinner	46	92	4	8	50
Total					95
Main meal belongs to:					
Mess/Tiffin	18	100	0	0	18
Restaurant Meal	4	100	0	0	4
Freshly/Home Cooked Food	63	86.30	10	13.69	73
Total					95
Academic Grade:					
Under graduate	27	90	3	10	30
Post graduate	20	86.95	3	13.04	23
Ph.D. students	20	90.90	2	9.09	22
Employee (Non-teaching)	18	90	2	10	20
Total					95
Living/housing:					
Alone (Single seated hostel)	63	94.02	4	5.97	67
With friend	9	75	3	25	12
With family	13	81.25	3	18.75	16
Total					95

Table 2. Distribution of the sample on the basis of dietary behaviour and awareness about obesity.

	OVERWEIGHT		OBESE		Total
	N	%	N	%	N
Breakfast daily					
YES	51	60	7	70	58
NO	34	40	3	30	37
Total	85	100	10	100	95
Snacks in breakfast					
YES	29	34.11	1	10	30
NO	56	65.88	9	90	65
Total	85	100	10	100	95
Healthy diet					
YES	41	48.23	3	30	44
NO	44	51.76	7	70	51
Total	85	100	10	100	95
Sprouts in meal					
YES	26	30.58	3	30	29
NO	59	69.41	7	70	66
Total	85	100	10	100	95
Lunch and Dinner on time					
YES	57	67.05	7	70	64
NO	28	32.94	3	30	31
Total	85	100	10	100	95
Tea or coffee					
YES	62	72.94	8	80	70
NO	23	27.05	2	20	25
Total	85	100	10	100	95
Non-veg					
YES	48	56.47	7	70	55
NO	37	43.52	3	30	40
Total	85	100	10	100	95
Milk					
YES	42	49.41	5	50	47
NO	43	50.58	5	50	48
Total	85	100	10	100	95
Fast food					
YES	48	56.47	9	90	57

NO	37	43.52	1	10	38
Total	85	100	10	100	95
Any food allergy					
YES	6	7.05	2	20	8
NO	79	92.94	8	80	87
Total	85	100	10	100	95
Chew tobacco					
YES	14	16.47	2	20	16
NO	71	83.52	8	80	79
Total	85	100	10	100	95
Liquor/alcohol					
YES	20	23.52	2	20	22
NO	65	76.47	8	80	73
Total	85	100	10	100	95
Energy drink					
YES	17	20	1	10	18
NO	68	80	9	90	77
Total	85	100	10	100	95
Smoke					
YES	16	18.82	3	30	19
NO	69	81.17	7	70	76
Total	85	100	10	100	95
Health check-up in a year					
YES	17	20	1	10	18
NO	68	80	9	90	77
Total	85	100	10	100	95
Any special diet					
YES	21	24.70	2	20	23
NO	64	75.29	8	80	72
Total	85	100	10	100	95
Aware about BMI					
YES	26	30.58	1	10	27
NO	59	69.41	9	90	68
Total	85	100	10	100	95

It is evident from the Table-2 that a total of 60% overweight individuals were taking breakfast daily whereas 40% overweight individuals were not taking breakfast daily in the same way

70% obese individuals were taking breakfast daily whereas 30% obese individuals were not taking breakfast daily.

It is clear that a total 34.11% overweight individuals responded that they take snacks in breakfast, and 62.35% overweight individuals responded that they did not take snacks in breakfast, whereas 10% obese individuals responded that they take snacks in breakfast and 90% obese individuals responded that they did not take snacks in breakfast.

Further, a total 48.23% overweight individuals stated that they take healthy diet and 51.76% overweight individuals stated that they were not taking healthy diet whereas 30% obese individuals stated that they take healthy diet and 70% obese individuals stated that they were not taking healthy diet.

It is apparent that a total 30.58% overweight respondents take sprouts in their meal, whereas and 69.41% were not taking; similarly, 30% obese respondents take sprouts in their meal and 70% were not taking.

It is clear that a total 67.05% overweight respondents take lunch & dinner on time and 32.94% overweight respondents were not having lunch & dinner on time. Similarly, 70% obese respondents take lunch & dinner on time and 30% were not having lunch & dinner on time.

It is evident that a total 72.94% overweight individuals stated that they prefer tea or coffee and 27.05% overweight individuals stated that they did not prefer tea or coffee whereas 80% obese individuals stated that they prefer tea or coffee and 20% obese individuals stated that they did not prefer tea or coffee.

It is apparent that a total 56.47% overweight individuals stated that they eat non-veg and 43.52% overweight individuals stated that they did not eat non-veg whereas 70% obese individuals stated that they eat non-veg and 30% obese individuals stated that they did not eat non-veg.

It is analysed that a total 49.41% overweight individuals responded that they were taking milk in their diet and 50.58% overweight individuals responded that they were not taking milk in their diet whereas 50% obese individuals responded that they were taking milk in their diet and 50% obese individuals responded that they were not taking milk in their diet.

It is clear that a total 56.47% overweight individuals stated that they eat fast-food and 43.52% overweight individuals stated that they didn’t eat fast-food whereas 90% obese individuals stated that they eat fast-food and 10% obese individuals stated that they didn’t eat fast-food.

It is evident that a total 7.05% overweight individuals responded that they were having food allergy and 92.94% overweight individuals stated that they were not having any food allergy whereas 20% obese individuals responded that they were having food allergy and 80% obese individuals stated that they were not having any food allergy.

It is analysed that a total 16.47% overweight individuals responded that they chew tobacco and 83.52% overweight individuals stated that they did not chew tobacco whereas 20% obese individuals responded that they chew tobacco and 80% obese individuals stated that they did not chew tobacco.

It is apparent that a total 23.52% overweight individuals responded that they consume liquor/alcohol and 76.47% overweight individuals stated that they were not consuming alcohol/liquor whereas 20% obese individuals responded that they consume liquor/alcohol and 80% obese individuals stated that they were not consuming alcohol/liquor.

It is evident that a total 20% overweight individuals responded that they take energy drink and 80% overweight individuals stated they were not taking energy drink whereas 10% obese individuals responded that they take energy drink and 90% obese individuals stated they were not taking energy drink.

It is analysed that a total 18.82% overweight individuals stated that they smoke and 81.17% overweight individuals responded that they didn't smoke whereas 30% obese individuals stated that they smoke and 70% obese individuals responded that they didn't smoke.

It is clear that a total 20% overweight individuals responded that they take health check-up and 80% overweight individuals stated that they did not take health check-up in a year whereas 10% obese individuals responded that they take health check-up and 90% obese individuals stated that they did not take health check-up in a year.

It is apparent that a total 24.70% overweight individuals stated that they take special diet and 75.29% overweight individuals responded that that they were not taking any special diet in their meal whereas 20% obese individuals stated that they take special diet and 80% obese individuals responded that that they were not taking any special diet in their meal.

It is evident that a total 30.58% overweight individuals responded that they knew about BMI (Body Mass Index) and 69.41% overweight individuals stated that they did not know about the body mass index whereas 10% obese individuals responded that they knew about BMI (Body Mass Index) and 90% obese individuals stated that they did not know about the body mass index.

Body age: It is based on resting metabolism of an individual. It is calculated by using the weight, body fat percentage and skeletal muscle percentage. It is either above or below the current age.

So, with its assessment it is clear that out of the 95 samples, most of the individuals had higher body age than their current age. The average (mean) difference of the current age and Body age was +18.72 years, which indicate that on average the respondents are ~18 years aged than their current age.

It is evident from Table 3 that 5.3% respondents have age difference of 5-10 years means they are 5-10 years elder than their chronological age. Similarly, 25.3% respondents are 11-15 years elder as per body age. Further 38.9%, 15.8% and 10.5% respondents were found 16-20, 21-25 and 26-30 years elder respectively as per their body age and 4.2% respondent were found 31+ years elder from their chronological age.

The minimum difference was found +5 years, whereas maximum difference was found +43 years.

Table 3: Distribution of sample as per grouping differential body age

Differential body age (in years)	Frequency	Percent
5-10	5	5.3
11-15	24	25.3
16-20	37	38.9
21-25	15	15.8
26-30	10	10.5
31+	4	4.2
Total	95	100.0

Table 4: Central tendencies of current age, body age and differential of body age

	Current age	Body age	Difference in current age and body age
Mean	24.58	43.29	18.72
Median	24.00	42.00	18.00
Mode	24	48	15
Std. Deviation	4.68	6.92	6.03
Minimum	18	29	5
Maximum	43	69	43

It is clear from the Table 4 that the mean current age was 24.58±4.68 years with the median value and mode of 24.00 years. The minimum age was 18 and the maximum was 43; whereas the mean body age was 43.29±6.92 with the median of 42.00, the mode was 48 years; although it varies from 29-69 years.

It is evident that the difference in current age and body age is very high with a mean value of 18.72±6.03 years the median of difference is 18 years and mode is 15 years and it varies from 5-43 years.

To understand the variation in current age, body age and the difference of current age and body age one-way-ANOVA was performed in SPSS, the findings are displayed in Table 5. It is evident that there is no significant variation in the current age of the respondents as F-value ($F=0.757$; $p=0.387$) is insignificant; whereas there is significant variation in body age as well as the difference of current age and body age of the respondents, the F-value is very high ($F=49.13$ and 53.67, $p<0.001$).

Table 5: ANOVA of age, body age and its difference.

		Sum of Squares	df	Mean Square	F	Sig.
Age **(Current age)**	Between Groups	16.664	1	16.664	0.757	0.387
	Within Groups	2048.494	93	22.027		
	Total	2065.158	94			
Body age	Between Groups	1557.600	1	1557.600	49.13	0.000
	Within Groups	2948.147	93	31.701		
	Total	4505.747	94			
Difference in current age and body age	Between Groups	1252.050	1	1252.050	53.67	0.000
	Within Groups	2169.276	93	23.326		
	Total	3421.326	94			

There is positive correlation between current age and the body age. The obese respondents are more aged as compared to overweight. The difference in their current age and body age is higher as evident from scattered plot diagram (Fig.1. a). The regression coefficient R^2= 0.267 is significant ($p<0.001$).

Further, to understand the correlation of BMI and body age the data is plotted in scattered plot diagram (Fig.1. b). It is evident from the diagram that the body age is highly determined by the BMI (R^2= 0.542, $p<0.001$).

Here we can clearly see in the scattered plot graph that the individuals classified on the basis of their BMI category (i.e., overweight and obese) were having major differences in the chronological age and body age. As compared to overweight, obese respondents were elder in body age in respect of their current age (chronological age).

There is positive correlation between body fat percentage and the body age. The obese respondents are more aged as compared to overweight (Fig.1. c) the regression coefficient R^2= 0.685 is significant ($p<0.001$).

Negative correlation is found between skeletal muscle percentage and the body age (Fig.1. d). The regression coefficient R^2= 0.750 is significant ($p<0.001$).

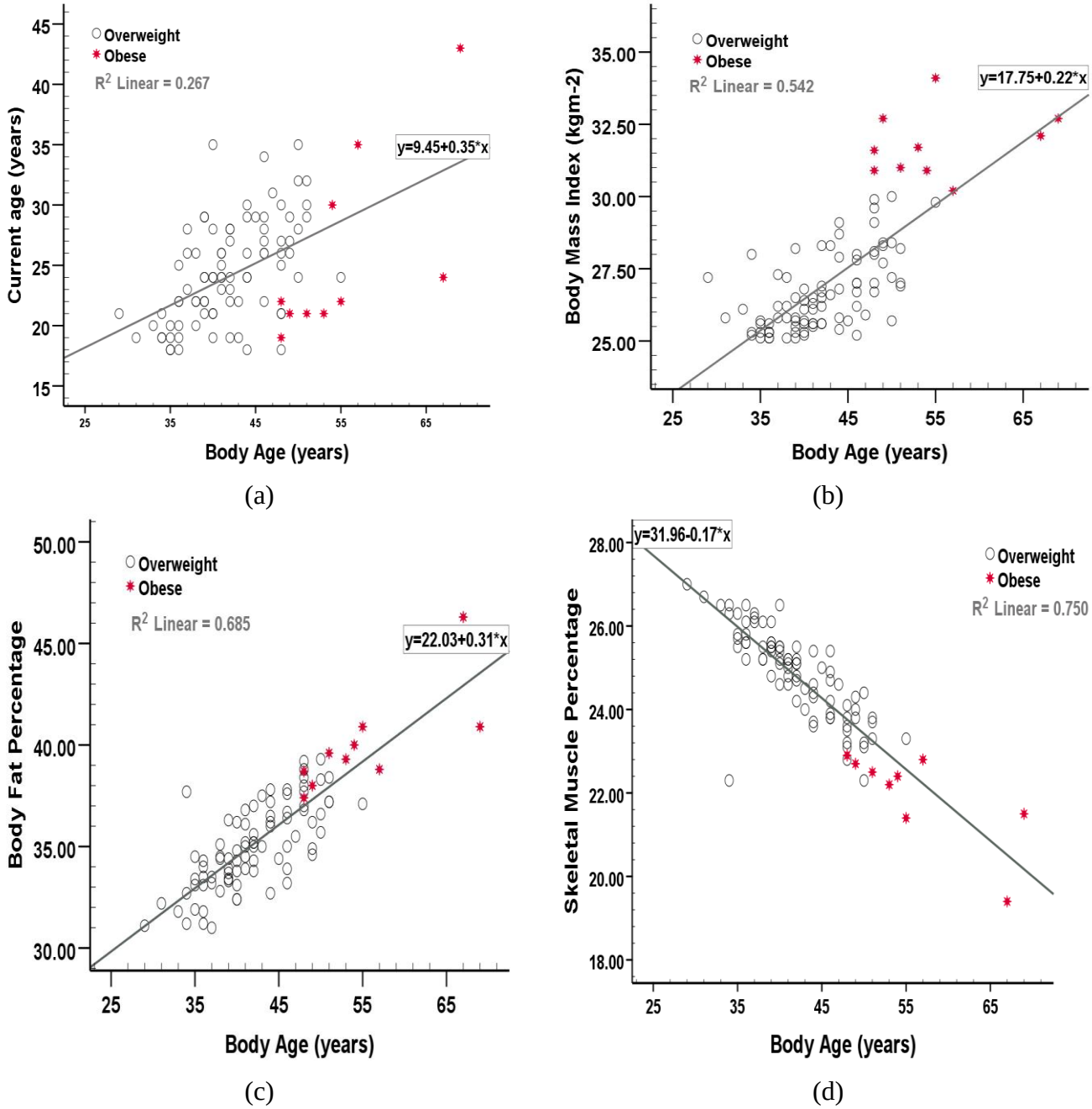

Fig.1. Scattered plot diagrams (a),(b),(c) and (d) showing correlation between body age and (a) current age, (b) BMI, (c) body fat percentage and (d) skeletal muscle percentage.

To understand the role of different determinants regression analysis was computed keeping body age as a dependent variable in SPSS. It is evident from Table 6 that the regression coefficient of BMI ($r^2 = 0.542$), body fat percentage ($r^2 = 0.685$), skeletal muscle percentage ($r^2 = 0.750$) and visceral fat level ($r^2 = 0.683$) were positive and highly significant ($p<0.001$); whereas regression coefficient of the skeletal muscle percentage was highly negative and significant ($r^2 = 0.750$, t value=-16.69, β=-4.39).

Table 6: Regression Coefficient and F Statistics of Anthropometric Parameters keeping body age as dependent variable.

Anthropometric Parameters	Coefficients of Regression				F Statistics		
	R	r^2	β	SE	t-value	F Change	p- value
BODY WEIGHT	0.663	0.440	0.548	0.064	8.541	72.95	0.001
BMI	0.736	0.542	2.493	0.237	10.499	110.221	0.001
AGE	0.516	0.267	0.736	0.131	5.81	33.79	0.001
BODY FAT PERCENTAGE	0.828	0.685	2.198	0.154	14.233	202.569	0.001
SKELETAL MUSCLE PERCENTAGE	0.866	0.750	-4.39	0.263	-16.69	278.835	0.001
VISCERAL FAT LEVEL	0.826	0.683	1.979	0.140	14.149	200.194	0.001
RESTING METABOLIC RATE	0.331	0.109	0.008	0.002	3.379	11.419	0.001

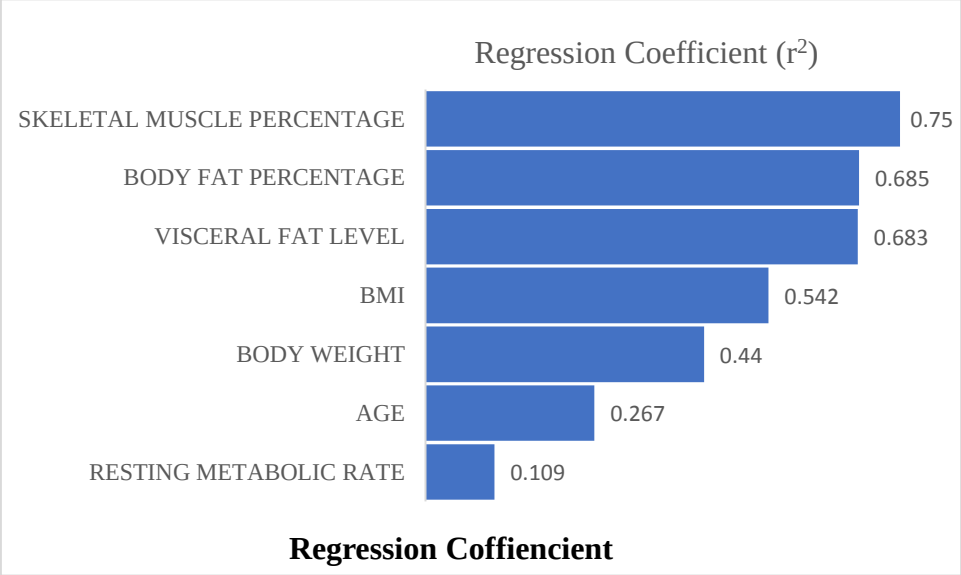

Fig.2. Graph representing regression coefficient of different determinants of body age.

It can be inferred that the body age is independently determined by skeletal muscle percentage (75%), body fat percentage (68.5%), visceral fat level (68.3%), BMI (54.2%) and resting metabolic rate (10.9%). For further elucidation of facts scattered plot diagram were plotted (Fig. 1).

DISCUSSION

The present study was conducted to know the determinants of body age among the overweight and obese adults of aged 18-43 years. The assessment of overweight and obesity is based on Anthropometric measurements and nutritional assessment.

It is evident from the findings that the prevalence of obesity increases with age. Elder respondents are found more obese as compared to younger counterparts; whereas the younger respondents are more overweight than the elder one.
However, participants aged between and above 21-25 years old were at risk of obesity. Present findings corroborate the results of several studies conducted among young (Suleiman et. al., 2005) and older adults as the fat deposit in the abdomen increases with age (Díaz Sánchez et al., 2009). As the present study was focused on overweight and obese respondents, who had BMI $\geq$25 Kg m^{-2}, hence a total 89.5% of respondents were overweight and 10.5% were obese.

To understand the determinants of obesity comparative analysis was done among obese and overweight respondents and it was found that the prevalence of obesity was higher (13.69%) among those who were taking freshly/home cooked food daily. Mills et al. (2017) also reported that more frequent consumption of home cooked meals was associated with greater likelihood of having normal range BMI and normal percentage of body fat. Those consuming home cooked meals more than five times, compared with less than three times per week, were 28% less likely to have overweight BMI (99% CI 8 to 43%), and 24% less likely to have excess percentage body fat (99% CI 5 to 40%). Hence the present findings are contrary. Here it can be inferred that eating at home provoke excess eating from two point of view- one it is as per your preferable taste. Second reason, there is no fear of paying for excess food.

In the present study, it was found that respondents who were living with their friends were more likely to be obese (25%) as compared to the respondents those who were stay in hostel (5.47%) and with their family (18.75%). In a previous study it was stated that there is no association between place of stay and overweight/obesity (M. et al., 2017). Similarly, no association was seen with hostel stay in one of the study from Pune (Fernandez et al., 2014).

A meta-analysis confirmed that skipping breakfast is associated with overweight/obesity, and skipping breakfast increases the risk of overweight/obesity. The results of cohort studies and cross-sectional studies are consistent. There is no significant difference in these results among different ages, gender, regions, and economic conditions (Ma et al., 2020).
A total of 30% obese and 40% overweight respondents had skipped their breakfast daily. In this context, a previous study stated that skipping breakfast is associated with overweight/obesity, and skipping breakfast increases the risk of overweight/obesity (M. et al., 2017 and Ma et al., 2020). Similar observation was also reported by a study carried out in Mumbai and Bangladesh (Madan et al., 2014 and Bipasha & Goon, 2014).

In the present study it was found that the respondents consuming junk food had high prevalence of overweight (56.47%) and obesity (90%). A significant relation between obesity/overweight and consumption of junk food was established in a study conducted among medical students of Malaysia (Gopalakrishnan et al., 2012). In their study, the prevalence of obesity was 15.2% and that of overweight was 21.8%. This increased prevalence was attributed to their increased

junk food consumption. Furthermore, some other studies showed the same relationship between obesity/overweight and consumption of junk food (Anitha et al., 2016).
However, a study conducted in Bangladesh reported that the prevalence of overweight/obesity and fast-food consumption is higher among male students which may explain the increased risk of disordered eating attitudes and behaviours among males (Bipasha & Goon, 2014).

It is apparent from the current study that those respondents who were not aware about overweight and obesity, they were more likely to be found overweight (69.41%) and obese (90%). In this context Alasmari et al. (2017) had reported that that 25.4% of the participating students were considered to be aware about obesity according to the ORK-10 scale results.

In present study, it is reported that smoking is closely linked with the prevalence of obesity (30%). In previous studies, it is recognized that obesity influences smoking behaviour (Terry et al., 2020 and Carreras-Torres et al., 2018).

Some studies have reported a higher prevalence of overweight and obesity among adolescents (Ogden et al., 2014 and Muhihi et al., 2013). The increase can be attributed to the changes in life style, reduced physical activity and faulty dietary patterns in adolescents of different regions of the world. Additionally, the prevalence of overweight and obesity was seen to be higher in urban area as compared to rural area. This could be due to improved access to governance, health care, education, employment and income, in addition to increased availability of packed foods high in saturated fats and sugars and increased sedentary behaviour, all of which are more accessible and affordable for those individuals living in urban areas. Similar findings are also shown by a few studies (Mohar et al., 2013 and Goyal et al., 2020).
In the present study, it was observed that the prevalence of obesity was less among those individuals who were vegetarian, semi-vegetarians, lactovegetarians, and vegans. This finding is similar to the study conducted by Newby et al. (2005) in central Sweden.
Some study reported that there is no association between the type of diet consumed and overweight/obesity. In a similar study from Pune no significant association was seen between the type of diet (whether mixed or pure vegetarian) and also with the amount of non-vegetarian items consumed (as calculated by once/twice/thrice or more non-vegetarian items) with overweight/obesity (M. et al., 2017 and Ma et al., 2020).
The body age was found higher in most of the respondents. To find out its determinants a linear regression analysis was done using SPSS which shows that it is largely determined by skeletal muscle percentage (75%), followed by body fat percentage (68.5%), visceral fat level (68.3%), BMI (54.2%) and resting metabolic rate (10.9%). Although, a negative correlation was found between body age and skeletal muscle percentage (t value = -16.69, β = -4.39).
In a previous study, Malhotra et al., (2016) analysed the BMI, Body age, visceral fat, total and subcutaneous fat using an OMRON Machine by bioelectrical impedance. In their study about 60% of students whose body age was more than their actual age were counselled to eat rightly and exercise regularly.

CONCLUSION

The present study was conducted purposively on overweight and obese adult males of a university campus among 18-43 years old respondents who had BMI ≥25 Kg m^{-2} to find out the determinants of aging.
The mean BMI of the respondents was found 27.17±2.04. It was found that the prevalence of obesity was increasing with the increment of the ages of the respondents.

As per dietary behaviour, it is reported that the respondents who were skipping their breakfast were more obese. Those respondents who prefer freshly/home cooked food were more likely to be obese as compared to those respondents who were taking tiffin/mess food and restaurant meal in their diet.

Those respondents who take non-veg in their diet were more obese and those respondents who eat junk food or fast-food were more likely to be obese.

The respondents staying with their family were more likely to be obese as compared to the respondents who were living alone (single seated hostel) and with their friends.

In the present study it was found that there is difference in the current age and body age of the respondents. Here, the minimum difference was found +5 years, whereas maximum difference was found +43 years and the average (mean) difference of the current age and body age was +18.72 years, which indicate that on average the respondents are ~18 years aged than their current age.

The regression analysis led to conclude that the body age is positively determined by body fat percentage, visceral fat level, BMI (body mass index), body weight, current age and resting metabolism, whereas it was found to be determined negatively by the skeletal muscle percentage.

In present study, it was found that respondents were not at all aware about the body age. As obesity is a global problem, the WHO has designated it as a pandemic. All section of the society despite of developed or developing region are prone to be obese. Simultaneously, awareness about it is minimal. Hence it is required that awareness campaign is needed to rid of the problem.

ACKNOWLEDGEMENT

The authors express their gratitude to the Department of Anthropology, Dr. Hari Singh Gour Vishwavidyalaya (A Central University), Sagar (M.P.), for providing the opportunity and logistics to conduct the research. They also express their gratitude to the study participants for their participation in the study.

CONFLICT OF INTEREST: There is no conflict of interest.

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