EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES

http://www.ejbps.com

ISSN 2349-8870
Volume: 3
Issue: 10
306-311
Year: 2016

COMPARISON OF OBESITY MEASURES, BODY COMPOSITION AND BLOOD PRESSURE BY ETHNIC GROUPS: A CROSS-SECTIONAL STUDY FROM SANTINIKETAN, INDIA

Nilanjana Biswas and Arnab Ghosh*

Biomedical Research Laboratory, Department of Anthropology, Visva Bharati University, Santiniketan, West Bengal, India.

***Author for Correspondence: Dr. Arnab Ghosh**

Biomedical Research Laboratory, Department of Anthropology, Visva Bharati University, Santiniketan, West Bengal, India.

Article Received on 29/07/2016 **Article Revised on 18/08/2016** **Article Accepted on 07/09/2016**

ABSTRACT

Aims: The present work on young adults was aimed to compare body composition, obesity measures and blood pressure in three ethnic groups. **Methods**: Participants aged between 17-30 years were recruited from residential students and scholars living at the hostels in Visva Bharati University, Santiniketan, West Bengal, India. A total of 236 individuals including 133 males and 103 females were studied and were divided into three groups, viz. Group I comprised of Eastern Indian as represented by Bengalee young adults, Group II comprised of North-East Indians of Mongolian origin as represented by Nepalese & Bhutia young adults and Group III comprised of Proto-Australoid ethnic groups as represented by young adults of Santal tribe. Anthropometric measures were recorded using standard techniques. Body composition including obesity measures was subsequently computed. Systolic and diastolic blood pressures were also obtained and mean arterial pressure was then computed using standard equation. **Results**: It was observed that there existed significant ($p<0.001$) ethnic group differences for SF_4, TER, PBF and FM. However, no sex differences for BMI and WHR across the ethnic groups was also evident in the study. Furthermore, no significant differences for BMI categories by ethnic groups were evident too. It was also observed in the study that there existed no significant differences for central obesity status by ethnic groups and sex. It is noteworthy to mention that except cycling and walking, no other form of exercise was common amongst the participants. **Conclusion**: Ethnicity seems to play a vital role in explaining body composition including overweight and obesity and that such information is required to better comprehend the public health burden of obesity in young adults of Asian Indian origin.

KEYWORDS: obesity, body composition, metabolic syndrome, ethnic groups, Asian Indians.

INTRODUCTION

The prevalence of obesity is increasing worldwide at an alarming rate in both developed and developing countries.[1] The increasing number of obese people, especially the younger adult all over the world demands an investment in the primary and secondary prevention of overweight and obesity in this age group.[1, 2] Most individuals develop their eating and activity patterns during childhood and the adolescent years.[3] The changes in nutrition and lifestyles brought about by the popularity of fast foods, soft drinks, sedentary lifestyle, lack of exercise, and increased television watching and computer use might be responsible for overweight seen in younger adults both in rural and urban areas.[3-5]

Body composition can vary widely at any given BMI, as high- lighted recently by the debate concerning the appropriateness of BMI definitions of obesity in different ethnic groups.[6, 7] South Asians have a low mean BMI, but this low BMI masks several adverse feature so their body composition. South Asians have a lower muscle mass and a higher percentage body fat and are more centrally obese than are whites of comparable ages and BMIs.[8] These characteristics are thought to partly explain South Asians high risk of developing type 2-diabetes and CVD. Considerable interest currently exists in the associations between growth in early life (fetal life, infancy, childhood, and adolescence) and the later development of obesity and obesity- related disease.[7-9] Ethnic differences in disease morbidity and mortality have also been recognized in every racial/ethnic group, as have differences in body composition.[10-13] However, India with vast ethnic and cultural heterogeneity, information on body composition including obesity measures and blood pressure measures by ethnic groups is virtually absent. Keeping this view in mind, the present work on young adults was undertaken to compare body composition, obesity measures and blood

pressure in three ethnic groups with the *hypothesis* that there existed no difference(s) for body composition by ethnic groups and sex.

MATERIALS AND METHODS

Study Population

The present study was conducted between January and April, 2016. All participants, aged between 17-30 years, were recruited from residential students and scholars who were living at the hostels in Visva Bharati University, Santiniketan, West Bengal, India. A total of 236 young adult individuals including 133 males and 103 females were studied and were divided into three groups, viz. Group I comprised of Eastern Indians as represented by Bengalee young adults, Group II comprised of North-East Indians of Mongolian origin as represented by Nepalese & Bhutia young adults and Group III comprised Proto-Australoid ethnic groups as represented by young adults of Santal tribe. Among them Group I comprised of 100 individuals (male = 50, female = 50), Group II comprised of 71 individuals (male = 41, female = 30) and Group III comprised of 65 individuals (male = 42, female = 23). The age was ascertained using their birth certificate. Written consent was taken from each individual prior to the actual commencement of the study.

Anthropometric measures

Anthropometric measures, such as, height, weight, minimum waist circumference (MWC), maximum hip circumference (MHC) and skinfold thickness at biceps, triceps, subscapular and suprailiac were recorded using standard techniques.[14] Height and weight of lightly clothed individuals were measured to the nearest 0.1 cm and 0.5 kg, respectively. Waist and hip circumferences were measured with a non-elastic tape to the nearest 0.1 cm, in the standing position. Skinfolds thicknesses were taken on the left side of the body to the nearest 0.2 mm using a Harpenden type skinfold caliper. Body mass index (BMI) was computed accordingly. Waist-hip ratio (WHR) and Waist-height ratio (WHtR) was computed using standard equation. Percentage of body fat (PBF), fat mass (FM), fat free mass (FFM), fat mass index (FMI), fat free mass index (FFMI), mid upper arm muscle circumference (MUAMC), mid upper arm muscle area (MUAMA), arm fat area (AFA), trunk extremity ratio (TER) and sum of four skinfold (SF_4) was then calculated using standard equations.[5, 6]

Blood Pressure

Left arm systolic (SBP) and diastolic (DBP) blood pressure measurements was twice taken using sphygmomanometer and stethoscope and was averaged for analyses.[15] A third measurement was only taken when the difference between the two measurements was ≥5 mmHg. Prior to the measurements, subjects were instructed to seat in a chair and the left arm was placed on the table at the level of the heart. A 5 min relaxation period between measurements was maintained throughout the study. SBP and DBP was measured as appearance (phase I) and disappearance (phase V) of Korotkoff sound, respectively. Mean arterial pressure (MAP) was calculated by using following standard technique: [5]

MAP = DBP +1/3 (SBP - DBP).

Schedule

An open ended schedule was used to collect information on name, age, sex, family type, monthly family income and expenditure, behavioral characteristics including smoking habit, alcohol consumption, chewing of tobacco, extra salt intake etc. The workout type i.e. cycling, walking, running, jogging etc., was also obtained using same schedule.

Cut-off values

Individuals were categorized as undernourished, normal or obese according to standard BMI categories (BMI ≤ 18.4 = undernourished, 18.5 ≥ BMI ≤ 24.9 = normal, BMI ≥ 25 = obese). Furthermore, individuals were considered as centrally obese (CO), if they had WHR >0.95 (male) or WHR>0.85 (female). All other participants were considered as centrally non obese (CNO).

Statistical analyses

All statistical analyses were performed using SPSS (PC+ version 16). A statistical significance (two-tailed) was set at $p < 0.05$.

RESULTS

The socio-demographic and behavioural characteristics are presented in **Table 1**. It was observed that 73.31% participants were belongs to nuclear family with 38.98% had family income between 10,000 and 30,000 Indian rupees. Smoking was most conspicuous among male participants with no tobacco chewing habit was evident among the female participants. The mean age of male and female participants in the study was 21.63 years (SD=2.48 years) and 20.66 years (SD=1.88 years) respectively. Descriptive statistics (Mean and SD) of anthropometry, body composition, obesity measures and blood pressure by ethnic groups and sex is presented in **Table 2**. It was observed that there existed significant ($p<0.001$) ethnic group differences for SF_4, TER, PBF and FM. No sex differences for BMI and WHR across the ethnic groups was also evident (results were not shown) in the study. BMI categories by ethnic groups are presented in **Table 3**. No significant differences for BMI categories by ethnic groups were evident in the study. Central obesity status (centrally obese vs. centrally non obese) by ethnic groups and sex is presented in **Table 4**. There existed no significant differences for central obesity status by ethnic groups and sex was evident in the study. It was further observed (**Figure 1**) that cycling and walking was two most frequent workouts that young adults were opted for over other form of workouts. Moreover, about 10% participants had habitual practice of practicing traditional Indian *yoga*.

Table 1: Socio-demographic and behavioral characteristics in the study population (n=236)

Variables	%
Family type	
Nuclear	73.31
Joint	22.46
Family size	
Large (5-9)	37.71
Extra Large (≥10)	6.78
Residential area	
Rural	54.66
Urban	37.71
Monthly family income (in Indian Rupees)	
<10,000	19.51
10,000≤30,000	38.98
>30,000	41.10
Monthly family expenditure (in Indian Rupees)	
<10,000	25.42
10,000≤20,000	53.4
>20,000	21.2
Smoking status	
Male	42.85
Female	5.69
Alcohol consumption	
Male	38.54
Female	8.94
Tobacco chewing	
Male	9.02
Extra salt intake	
Male	35.33
Female	25.20

1 US$ ~ 65 Indian Rupees

Table 2. Descriptive statistics of body composition and blood pressure measures by ethnic groups and sex (n=236)

Variables	Ethnic groups	Male		Female	
		Mean	SD	Mean	SD
WC (cm) **	Gr. I	80.17	7.34	85.07	1.03
	Gr. II	78.84	5.72	83.75	8.55
	Gr. III	78.14	5.23	80.21	9.00
MUAC(mm)	Gr. I	275.64	28.97	257.74	34.08
	Gr. II	254.70	43.80	256.93	26.84
	Gr. III	270.38	23.15	257.04	30.54
BMI (kg/m^2) **	Gr. I	21.57	2.76	21.63	3.93
	Gr. II	23.04	2.75	21.35	2.94
	Gr. III	21.33	2.32	20.89	3.79
WHR*	Gr. I	0.87	0.03	0.09	0.05
	Gr. II	0.90	0.03	0.90	0.054
	Gr. III	0.88	0.03	0.87	0.05
WHtR	Gr. I	0.47	0.03	0.54	0.06
	Gr. II	0.47	0.03	0.53	0.05
	Gr. III	0.46	0.02	0.52	0.06
SF_4 (mm) ***	Gr. I	23.62	8.36	14.97	5.82
	Gr. II	15.46	3.05	13.53	3.06
	Gr. III	21.51	4.88	13.96	3.97
TER***	Gr. I	2.76	0.74	2.15	0.68
	Gr. II	1.82	0.41	1.98	0.40
	Gr. III	2.64	0.55	2.06	0.65
PBF***	Gr. I	10.14	4.10	17.15	4.01
	Gr. II	4.70	2.70	16.27	2.82

	Gr. III	9.14	3.05	16.53	3.35
FM (kg) ***	Gr. I	6.52	3.53	9.29	3.85
	Gr. II	3.04	1.85	8.60	2.47
	Gr. III	5.55	2.24	8.27	2.86
FFM (kg/m^2) *	Gr. I	55.22	7.13	43.24	6.23
	Gr. II	60.02	7.22	43.56	6.06
	Gr. III	54.01	6.39	40.83	6.66
MUAMC (mm)	Gr. I	264.90	26.86	249.56	33.03
	Gr. II	244.58	43.02	249.05	26.52
	Gr. III	260.24	22.31	249.08	30.12
MUAMA (mm^2)	Gr. I	5640.75	1163.37	5041.43	1340.03
	Gr. II	4904.20	1696.05	4990.30	1084.47
	Gr. III	5428.26	931.35	5006.12	1206.47
AFA (mm^2)	Gr. I	470.81	188.67	335.49	151.79
	Gr. II	407.40	115.24	318.40	98.47
	Gr. III	430.97	137.59	322.67	100.89
SBP (mmHg) *	Gr. I	126.60	11.70	113.82	8.95
	Gr. II	117.97	16.45	112.90	7.80
	Gr. III	123.02	8.241	116.95	7.72
DBP (mmHg)	Gr. I	81.68	8.54	73.84	8.35
	Gr. II	82.42	4.12	74.50	7.28
	Gr. III	79.26	6.30	73.47	7.68
MAP (mmHg)	Gr. I	96.65	8.95	87.16	7.80
	Gr. II	94.27	6.51	87.30	6.80
	Gr. III	93.84	6.12	87.97	6.86

Significant ethnic group differences at * p <0.05; ** p<0.01; *** p <0.001

WC = Waist Circumference; MUAC = Mid Upper Arm Circumference; BMI = Body Mass Index; WHR = Waist-Hip ratio; WHtR = Waist- Height Ratio; SF_4 = Sum of Four Skinfolds; TER = Trunk Extremity Ratio; PBF = Percentage of Body Fat; FM = Fat Mass; FFM = Fat Free Mass; MUAMC = Mid Upper Arm Muscle Circumference; MUAMA = Mid Upper Arm Muscle Area; AFA = Arm Fat Area; SBP = Systolic Blood Pressure, DBP = Diastolic blood Pressure; MAP = Mean Arterial Pressure.

Table 3: Body mass index categories by ethnic groups (n=236)

Ethnic Groups	Under nourished BMI≤18.4	Normal 18.5≥BMI≤24.9	Obese BMI≥25
Gr. I	21	62	17
Gr. II	5	53	13
Gr. III	10	45	10

$\chi_4^2 = 6.45$, p>0.05

Table 4: Central Obesity St atus by ethnic groups and sex (n=236)

4a. Female (n=103)

Ethnic Groups	Centrally Non obese WHR≤0.85	Centrally Obese WHR>0.85
Gr. I	28	22
Gr. II	18	12
Gr. III	18	5

$\chi_2^2 = 3.37$, p>0.05

4b. Male (n=133)

Ethnic Groups	Centrally Non obese WHR≤0.95	Centrally Obese WHR>0.95
Gr. I	49	1
Gr. II	40	1
Gr. III	42	0

$\chi_2^2 = 0.95$, p>0.05

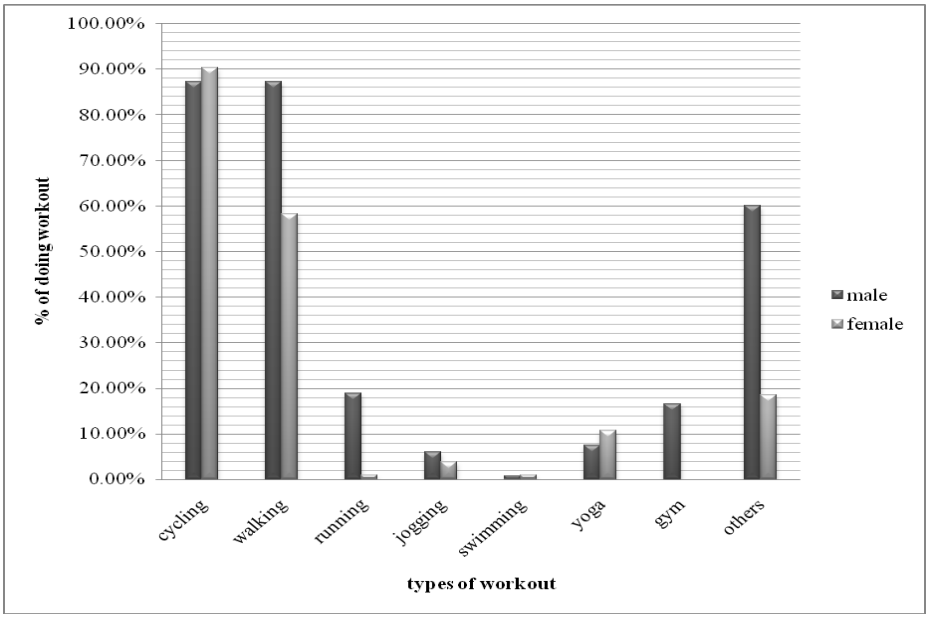

Figure 1: Frequency of daily workout types of the studied population.

DISCUSSION

Although prevalence of conventional risk factors such as smoking, hypertension and hypercholesterolemia is no higher in people of Indian origin (PIO) than in other ethnic groups however, it is seen that some risk factors for atherosclerosis are particularly prevalent among them, including high triglyceride concentration, increased level of total cholesterol to high-density lipoprotein cholesterol ratio, type 2 diabetes mellitus (T2DM) & central or visceral obesity.[15, 16] Throughout the Asia-Pacific region, there are differences in obesity prevalence as well as in body fat distribution.[8, 9] It is noteworthy to mention that in Asian Indians, morbidity & mortality from NCD is occurring in people with lower body mass index (BMI) and smaller waist circumference (WC).[11] Thus intra-abdominal visceral fat is accumulated in Asian Indians without developing generalized obesity.[16] South Asians (e.g. Indians) have a more centralized distribution of body fat & remarkably higher mean waist-hip ratio (WHR) for a given level of BMI compared with Europeans or Americans.[8, 9, 11-13]

Significant ethnic groups differences in body composition, body fat distribution and obesity measures highlighted that although participants were nurturing in the same environment (viz. almost similar lifestyle patterns including food habits) for the past five years or so yet they developed body fat distribution patterns according to their genetic origin (ethnicity). Therefore, it is noteworthy to mention that ethnicity seems to play a vital role in explaining body composition including overweight and obesity.

In the study, preponderance of female towards central obesity compared to male even at comparable physical exercise vindicated that female are no less vulnerable to cardiovascular disease risk factors compared to their male counterparts.

Some shortcomings are associated with the present study, including small sample size. Hence, it is not the representative of the three ethnic groups. Further prospective long term studies are required on other ethnic groups residing in rural as well as urban areas of India to determine whether similar phenomenon exist among them. However, our findings highlighted the importance of body composition including obesity in three ethnic groups nurtured in similar environment and thus may be useful for designing appropriate health care strategies, specially to prevent growing prevalence of obesity in young adults of Asian Indian origin.

ACKNOWLEDGMENTS

Authors are indebted to all the participants for their sincere cooperation during data collection. Authors are also thankful to Ms. Shreyashi Majumder, Mr. Milon Das and Mr. Rishikesh Thapa for their cooperation during fieldwork.

REFERENCES

1. Nag T, Ghosh A. Cardiovascular disease risk factors in Asian Indian population: a systematic review. Journal of Cardiovascular Disease Research, 2013; 4: 222-228.
2. Ghosh A, Bhagat M, Das M, Bala S K, Goswami R, Pal S. Prevalence of cardiovascular disease risk factors in people of Asian Indian origin: age and sex variation. Journal of Cardiovascular Disease Research, 2010; 1: 81-85.
3. Ghosh A. Explaining overweight and obesity in children and adolescents of Asian Indian origin: the Calcutta childhood obesity study. Indian Journal of Public Health, 2014; 58: 125-128.
4. Sachdev H S, Fall C HD, Osmond C, Lakshmy R, Biswas S K D, Leary S D, Reddy K S, Barker D. J. P, Bhargava S K. Anthropometric indicators of body composition in young adults: relation to size at birth

and serial measurements of body mass index in childhood in the New Delhi birth cohort. American Journal of Clinical Nutrition, 2005; 82:456–66.
5. Ghosh A. Comparison of anthropometric, metabolic and dietary fatty acids profiles in lean and obese dyslipidaemic Asian Indian subjects. European Journal of Clinical Nutrition, 2007; 61: 412–419.
6. Ghosh A. Effects of socio-economic and behavioural characteristics in explaining central obesity – a study on adult Asian Indians in Calcutta, India. Collegium Antropologicum, 2006; 30: 265–271.
7. Ghosh A. Comparison of anthropometric and body composition characteristics in children and adolescents of Asian Indian origin: Santiniketan maturity study. International Journal of Science and Research, 2016; 5: 796-801.
8. Ghosh A, Bhagat M. Association of television viewing time with central obesity status in rural Asian Indian women: Santiniketan women study. American Journal of Human Biology, 2014; 26: 427-430.
9. Nag T, Ghosh A. Prevalence of cardiovascular disease risk factors in a rural community in West Bengal, India. International Journal of Medicine and Public Health, 2015, 5: 259-264.
10. Bell A C, Adair L S, Popkin B M. Ethnic Differences in the Association between Body Mass Index and Hypertension. American Journal of Epidemiology, 2002; 155: 346–353.
11. Ghosh A. Comparison of Obesity Measures, Lipids Profiles, blood glucose, Lipoprotein (a) and Apolipoproteins in Lean and Obese Dyslipidaemic Subjects of Asian Indian Origin. World Journal of Pharmaceutical and Medical Research, 2016; 2: 86-91.
12. Ghosh A. Anthropometric, metabolic and dietary fatty acids profiles in lean and obese diabetic Asian Indian subjects. Asia Pacific Journal of Clinical Nutrition, 2006; 15:189–195.
13. Ghosh A. Anthropometric, metabolic and dietary fatty acids characteristics in lean and obese dyslipidaemic Asian Indian women in Calcutta. Food and Nutrition Bulletin, 2007; 28: 399-405.
14. Lohman TG, Roche AF, Martorell R. 1988. *Anthropometric Standardization References Manual*. Human kinetics Books: Chicago.
15. Nag T, Ghosh A. Framingham risk score in estimating cardiovascular disease risk factors in people of Asian Indian origin: a study on rural adult population in West Bengal, India. European Journal of Biomedical and Pharmaceutical Sciences, 2016; 3: 415-421.
16. Deurenberg P, Yap M, van Staveren WA. Body mass index and percent body fat: a meta analysis among different ethnic groups. International Journal of Obesity and Related Metabolic Disorder, 1998; 22: 1164–1171.