Double burden of malnutrition among Bengalee Kayastha women of Siliguri town, Darjeeling district, West Bengal, India

S. Debnath[1], S. Bhowmik[2], J. Sen[3]

[1]Sampriti Debnath, UGC-Senior Research Fellow, Department of Anthropology, University of North Bengal, Darjeeling-734013, West Bengal, India. Email: sampritidebnath@gmail.com.
[2]Sutapa Bhowmik, Ex-Post Graduate Student, Department of Anthropology, University of North Bengal, Raja Rammohunpur, Darjeeling-734013, West Bengal, India.
[3]Jaydip Sen, Professor, Department of Anthropology, University of North Bengal, Darjeeling-734013, West Bengal, India. e-mail: jaydipsen@rediffmail.com.

Corresponding Author: Dr.Jaydip Sen, Professor, Department of Anthropology, University of North Bengal, Raja Rammohunpur, Darjeeling-734013, West Bengal, India.

ABSTRACT

Poor nutritional status as well as excess adiposity levels are the major public health concerns in the developing country such as India. The aims of the present cross-sectional study were to assess prevalence of under-nutrition and overweight/obesity among women belonging to the BengaleeHindu KayasthaPopulation (BHKP). The study was carried out among 200 adult women belonging to the BHKP, aged 20-24 years and residing in the sub-divisional town of Siliguri, located in Darjeeling district, West Bengal, India. Anthropometric measurements of height and weight were recorded using standard procedures and body mass index was calculated. Prevalence of under-nutrition (BMI<18.50 kg/m^2) and overweight (BMI=23.00-24.99 kg/m²) and obesity (BMI≥25.00 kg/m²)were determined using the World Health Organization (WHO) BMI cut-offsfor Asian Indians. The statistical analysis were performed using SPSS, Inc., Chicago, IL USA; version 17.0. Prevalence of under-nutritionamong the women was 10.00%. Prevalence of overall over-nutrition was observed to be 38.00% (overweight: 17.00%; obesity: 21.00%).The present study indicates existence of double burden of malnutrition (i.e., both under- and over-nutrition) among the BengaleeHindu Kayastha women of Siliguri town, Darjeeling district, West Bengal, India. Appropriate intervention programmes are necessary to improve their overall nutritional condition.

KEYWORDS: Anthropometry, Body Mass Index (BMI), Under-nutrition, Obesity, Overweight, Public health

INTRODUCTION

The double burden of malnutrition (DBM)is an importantpublic health challenge of recent decades contributing to high mortality and morbidities in populations worldwide (Subramanian et al. 2007; Popkin et al. 2012; Mondal et al. 2017; Debnath et al. 2018). The DBM is defined as simultaneous co-existence of under-nutrition and over-nutrition (overweight and obesity)within a population.Prevalence of severe to moderate under-nutritionin rural India is a major health issue and is associated with low socio-economic status (SES) of the individuals. Due to socio-economic shifts occurring in last two decades in India,prevalence of overweight and obesityhave become an emerging public health threat in the country (Bhadra et al. 2005; Das and Bose 2007; Subramanian et al. 2007; Sarkar et al. 2009; Sen et al. 2013; Rengma et al. 2015; Mondal et al. 2017).High rates of urbanization and economic development have given rise to nutritional transitions, reduced physical activity and sedentary lifestyle which in turn has given rise to deposition of excess body fat. These led to increase in the prevalence of overweight and obesity (Subramanian et al. 2007; Wang et al. 2009; Popkin et al. 2012; Debnath et al. 2018).Recent trends in the prevalence of overweight and obesity suggests thatIndian women belonging to lower to middle socio-economic status were also affected byoverweight and obesity (Subramanian et al. 2007; Mungreiphy and Kapoor 2010; Kapil and Sachdev 2012;Rengma et al. 2015; De and Kundu 2016). Obesity is disease condition associated with impaired functions related to alterations in the metabolism of steroid hormones, including lipid and glucose levels and insulin resistance syndrome (Shrimpton and Rokx 2012; Debnath et al. 2018). Carrying extra fat has the potential to give rise to non-communicable disorders such as type-2 diabetes, cardiovascular disease, polycystic ovary syndrome (PCOS) and musculoskeletal disorders(Diamanti-Kandarakis et al. 2007; Hayman et al. 2007; Debnath et al. 2018).

The Body Mass Index (BMI) is a proxy anthropometric index used to assess under- and over-nutrition among both children and adults (WHO 1995; Wells 2000). It is considered to be the most widely used derived surrogate, noninvasive and inexpensive anthropometric measure that also provides a simple numeric measure of overweight and obesity (WHO 2000; Mascie-Taylor and Goto 2007; Iriart et al. 2011).The relationship between overweight-obesity and BMI has been established in a number of epidemiological and clinical investigations (Bhadra et al. 2005; Subramanian and Smith 2006; Subramanian et al. 2007; Sarkar et al. 2009; Wang et al. 2009).

One of the major caste groups of the state of West Bengal, India is the Bengalee Hindu Kayastha Population (BHKP). The BHKPis a general Hindu caste, also believed to be the fifth 'varna' of the Hindu caste system. They are of an Indo-Caucasoid origin. In the history of India, since pre-Mughal times, representatives of this caste were highly educated and engaged in administrative posts. The Bengali Kayasthas form one of the regional Kayastha populationsresiding in West Bengal and are also known as the 'writing caste' due to their good education, intellect and success in administrative occupations. Presently, they are involved in various different types ofprofessions.

Studies on the assessment of nutritional status among BHKP are rare in northern part of West Bengal (North Bengal). Considering the importance of health studies among women, the present study will provide a helpful insight for further research. The objectives of the present study were to determine and compare the prevalence of under- and over-nutrition among unmarried women belonging to the BHKP residing in Siliguri town of West Bengal.

MATERIAL AND METHODS

The northern part of West Bengal, India is popularly known as North Bengal and comprises of seven districts. The region is inhabited by a number of indigenous tribal (e.g.,Rabha, Meche, Toto, Oraon, Santal and Munda) and non-tribal (e.g., Rajbanshi, Bengali caste and Bengali Muslim)populations.The present cross sectional study was carried out among 200 unmarriedwomen belonging to the BHKP, aged 20-24 years and residing in Siliguri town, located in Siliguri sub-division, district Darjeeling, West Bengal, India. The Siliguri sub-division (Latitude 26.71°N, Longitude 88.43°E) covers an area of 1711 km^2.

The individuals in the present study were selected using a two stage sampling method. In the first stage, the households of individuals belonging to the BHKP were identified. In the second stage, purposive sampling has been utilized. Unmarried women individuals belonging to the BHKP in the age group 20-24 years were identified. Ages of the women were recorded from their birth certificates and relevant official records issued by the local government officials. The minimum number of individuals required for reliably estimating the prevalence of overweight and obesity in the present study was calculated following a standard method of estimating sample size.In this method, the anticipated population proportion of 50%, absolute precision of 5% and confidence interval of 95% were taken into consideration. The study was conducted in accordance with the ethical guidelines for human experiments, as laid down in the Helsinki Declaration of 2000.The individuals were free from any physical deformities,

previous histories of medical and surgical episodes and not suffering from any disease at the time of data collection. Data has been collected from January 2018 to May 2018.

Anthropometric measurements obtained

Anthropometric measurements were recorded using standard anthropometric procedures. Height of the individuals was recorded to the nearest 0.1 cm with help of an anthropometer rod with the head held in the Frankfort Horizontal plane. Weight of the individuals was measured wearing minimum clothing and with bare feet using a portable weighing scale to the nearest 100 gm. The individuals were measured with ample precision for avoiding any possible systematic errors of anthropometric data collection (e.g., instrumental or landmarks).

Intra-observer and inter-observer technical errors of the measurements (TEM) were calculated to determine accuracy of the anthropometric measurements (Ulijaszek and Kerr 1999). For calculating TEM, height and weight were recorded from different data set of 50 adults other than those selected for the study by two of the authors (SD and SB). The coefficient of reliability (R) of the measurements was calculated for testing the reliability of the measurements. Very high values of R (>0.97) were obtained for height and weight and these values were observed to be within the recommended cut-off of 0.95. Hence, the measurements recorded by SD and SB were considered to be reliable and reproducible. All the measurements in the present study were subsequently recorded by SB.

Assessment of Nutritional Status

Nutritional status has been assessed in terms of BMI. The BMI was calculated using the following standard equation of WHO (WHO 1995):

$$BMI = Weight/Height^2 \ (kg/m^2)$$

The BMI cut-off points proposed by WHO (2004) for Asian Indians have been utilized for the assessment of under-nutrition, overweight and obesity.

Statistical analysis

The data were statistically analyzed using the Statistical Package for Social Sciences (SPSS, Inc., Chicago, IL; version 17.0). The descriptive statistical analysis of the data obtained was depicted in terms of mean and standard deviation ($\pm$SD). One-way ANOVA has been performed to test the age-specific mean differences in anthropometric variables of the age groups. The p values of <0.01 and <0.05 were considered to be statistically significant.

RESULTS

Descriptive statistics of anthropometric variables

The age specific distribution of means and standard deviation (±SD) of height, weight and BMI are depicted in Table 1. The age specific mean height of the women ranged from 149.03±4.30 cm (in 21 years) to 151.56±3.87 cm (in 24 years). The overall mean value of height was 150.05±3.94 cm. The age and sex specific mean weight of the women ranged from 48.17±7.16 kg (in 21 years) to 51.94±9.80 kg (in 24 years). The overall mean value of weight was observed to be 50.32±8.07 kg. The overall mean BMI was observed to be 22.30±3.17 kg/m^2. Age specific mean BMI ranged from 21.67±2.91kg/m^2(in 21 years) to22.60±3.46 kg/m^2 (in 22 years).The results showed statistically insignificant differences between the age specific mean values of the anthropometric variables among the women (p>0.05) (Table 1).

Assessment of nutritional status

The prevalence of under-nutrition, overweight and obesity among the women are depicted in Table 2. The overall prevalence of under-nutritionwas 10.00%. The highest prevalence of under-nutritionwas observed among women aged 21 years and 22 years. The overall prevalence of overweight (BMI≥23.00-24.99 kg/m²) and obesity (BMI≥ 25.00 kg/m²) were 17.00% and 21.00%, respectively. The overall prevalence of over-nutritionwas observed to be 38.00% (overweight and obesity). The highest prevalence of overweight (22.45%) was observed among those aged 22 years. The highest prevalence of obesity (27.27%) was observed among womenaged 20 years.

DISCUSSION

The present study has documented a low prevalence of under-nutrition among the BHKP (10.00%) (Table 2). Prevalence of overall over-nutrition was observed to be 38.00% (overweight: 17.00% and obesity: 21.00%) (Table 2). This simultaneous occurrence of under-nutrition and over-nutrition proves the existence of DBM among the BHKP women. Prevalence of overweight and obesity has reached epidemic proportions globally and here also among the BHKP women, the prevalence was observed to be high when compared to the prevalence of under-nutrition. The rising prevalence of over-nutrition in developing countries is largely due to rapid urbanization and changes in energy expenditure. Individuals belonging to the developing countries were observed to be particularly vulnerable to obesity-related diseases along with co-morbidities (Sen et al. 2013; Bhurosy and Jeewon 2014; Jésus et al. 2017; Tremmel et al. 2017).

In India there is an increasing trend of DBM that needs to be controlled. It also requires the assessment and establishment of the socio-economic, educational, environmental and cultural factors involved in determining the weight of the populations (Sen et al. 2013; Rengma et al. 2015; Biernat and Tomaszewski 2015; Bagordo et al. 2017; Nienaber Rousseau et al. 2017). Majority of the Indian states have prevalence of under-nutrition among adults to vary between 20% and 29% (Ramachandran 2014). Several studies have also reported high undernourishment among various Indian populations (Subramanian and Smith 2006; Subramanian et al. 2007; Sengupta et al. 2014; Kshatriya and Acharya 2016). Recent studies havedocumented that different populations of the country exhibit high prevalence of overweight and obesity(Mungreiphy and Kapoor 2010; Sen et al. 2013; Sengupta et al. 2014; Tigga et al. 2018). This has been also observed in the present study. The prevalence of under-nutrition is also a serious problem among adult populations of Eastern and North-eastern India (Khongsidier 2002; Gogoi and Sengupta 2002; Mungreiphy and Kapoor 2010; Rengma et al. 2015; Bharali et al. 2017). Therefore, the coexistence of the 'double burden' of malnutrition (both under and over-nutrition) presenting a unique difficulty for public health policy makers.

A comparative evaluation of under-nutrition (Figure 1) has been done among different ethnic populations of India as reported by different studies which showed that the prevalence observed in the present investigation was lower than those reported for most of the populations such as Ahom, Koch, Bhatudi, Savar, Oraon and Rajbanshi. The comparative evaluation of overweight and obesity (Figure 2) among different ethnic Indian populations showed that the prevalence observed in the present investigation was lower than those reported for Bengali Kayastha and Rengma Naga populations. The prevalence of overweight or obesity in the present study was observed to be higher than the adults belonging to Tangkhul Naga, Karbi, Nyishi and Santal.6).

Recent socio-economic transitions which are taking place rapidly lead to the acceleration of several preventable, non-communicable diseases along withhigher prevalence of overweight-obesity and slightly lower prevalence of under-nutritionamong populations (Wang et al. 2009; Popkin et al. 2012; Subramanian et al. 2013; Varadharajan et al. 2013). The NFHS-3 and NFHS-4 data clearly showsthat overall nutritional status of adults declining in terms of chronic energy deficiency (CED) (BMI <18.5 kg/m^2) in males (34.2%−20.2%) and females (35.5%−22.9%). On the other hand, an increase in the prevalenceof overweight or obese in men (9.3%−18.6%) and women (12.6%−20.7%)has been

observed (Misra 2017). There are several factors (i.e., socio-economic, demographic, diet, increasing sedentary lifestyle and decrease in physical activity) which have triggered the prevalence of overweight-obesity among populations (Subramanian et al. 2007; Mungreiphy and Kapoor 2010; Mondal et al. 2015). Moreover, middle-aged individuals who are more prone to being overweight and obese mainly belong to higher socio-economic groups and live in urban-affluent societies (Sen et al. 2013; Sengupta et al. 2014; Mondal et al. 2017).

LIMITATIONS

A major limitation of the present study is that it did not take into account the socio-economic, demographic and lifestyle factors and so could not establish any relationship with nutritional status with these factors. The present study has included only women belonging to the BHKP residing in Siliguri town. Inclusion of BHKP individuals residing in different areas of West Bengal could have given clearer picture of the situation.

CONCLUSIONS

The findings of the present study prove that even though under-nutrition still remains a cause of concern for the BHKP women, the prevalence of overweight and obesity is also becoming a major threat to the population. The utility of the present study is that it provides an insight on the present nutritional condition of theBHKP women. They need proper caring measures to control the occurrence of DBM. Intervention studies are needed to formulate suitable healthcare strategies and intervention programmes to combat such prevalence of DBMamong the women. The results of the present study might be helpful to the Governmental agencies and policy makers to initiate further studies on this issue of DBM.

Table 1: Descriptive statistics (mean ±standard deviation) of the anthropometric variables among the BHKP women

Age	Sample Size	Height (cm)	Weight (kg)	BMI (kg/m^2)
20 years	**44**	149.63±4.01	50.38±7.56	22.46±2.93
21 years	**41**	149.03±4.30	48.17±7.16	21.67±2.91
22 years	**49**	150.53±3.59	51.30±8.73	22.60±3.46
23 years	**45**	150.16±3.77	50.38±7.69	22.31±3.04
24 years	**21**	151.56±3.87	51.94±9.80	22.55±3.80
Total	**200**	150.05±3.94	50.32±8.07	22.30±3.17
F- value		1.81	1.12	0.52
p- value		0.13	0.35	0.72

Table 2: Prevalence of under-nutrition, overweight and obesity among the BHKP women

Age	Under-nutrition (BMI<18.50kg/m^2)	Overweight (BMI=23.00-24.99kg/m²)	Obese (BMI≥25.00 kg/m²)	Combined Over-nutrition(BMI≥23.00 kg/m²)
20 years	4(9.09)	7(15.91)	12(27.27)	19 (43.18)
21 years	5(12.19)	7(17.03)	5 (12.19)	12 (29.22)
22 years	5(10.20)	11(22.45)	11(22.45)	22 (44.90)
23 years	4(8.89)	8(17.78)	8 (17.78)	16 (35.56)
24 years	2(9.52)	1(4.76)	6(28.57)	7 (33.33)
Total	20(10.00)	34(17.00)	42(21.00)	76 (38.00)

Values are parenthesis indicates percentage

Bengalee Kayastha women (11) — 10
Nyishi (9) — 10.5
Boro Kachari (1) — 11.22
Mech (7) — 13.2
Dibongiya (8) — 21.43
Bengali Muslim (10) — 22.86
Rajbanshi (7) — 23.56
Bhumij (5) — 28.2
Santal of Odisha (5) — 29.6
Mishing/Miri (1) — 34
Lalung (1) — 34.69
Dhimal (6) — 36.4
Santal (5) — 37.6
Rajbanshi North-Eastern India (1) — 42
Savar (3) — 43.5
Oraon (5) — 49.6
Koch (1) — 50
Ahom (1) — 52
Kora-Mudi (4) — 52.2
Bhatudi (2) — 64.5

1. Khongsdier 2001
2. Bose and Chakraborty 2005
3. Bose et al. 2006a
4. Bose et al. 2006b
5. Kshatriya and Acharya 2016
6. Datta Banik et al. 2007
7. Datta Banik et al. 2009
8. Gogoi and Sengupta 2002
9. Bharali et al. 2017
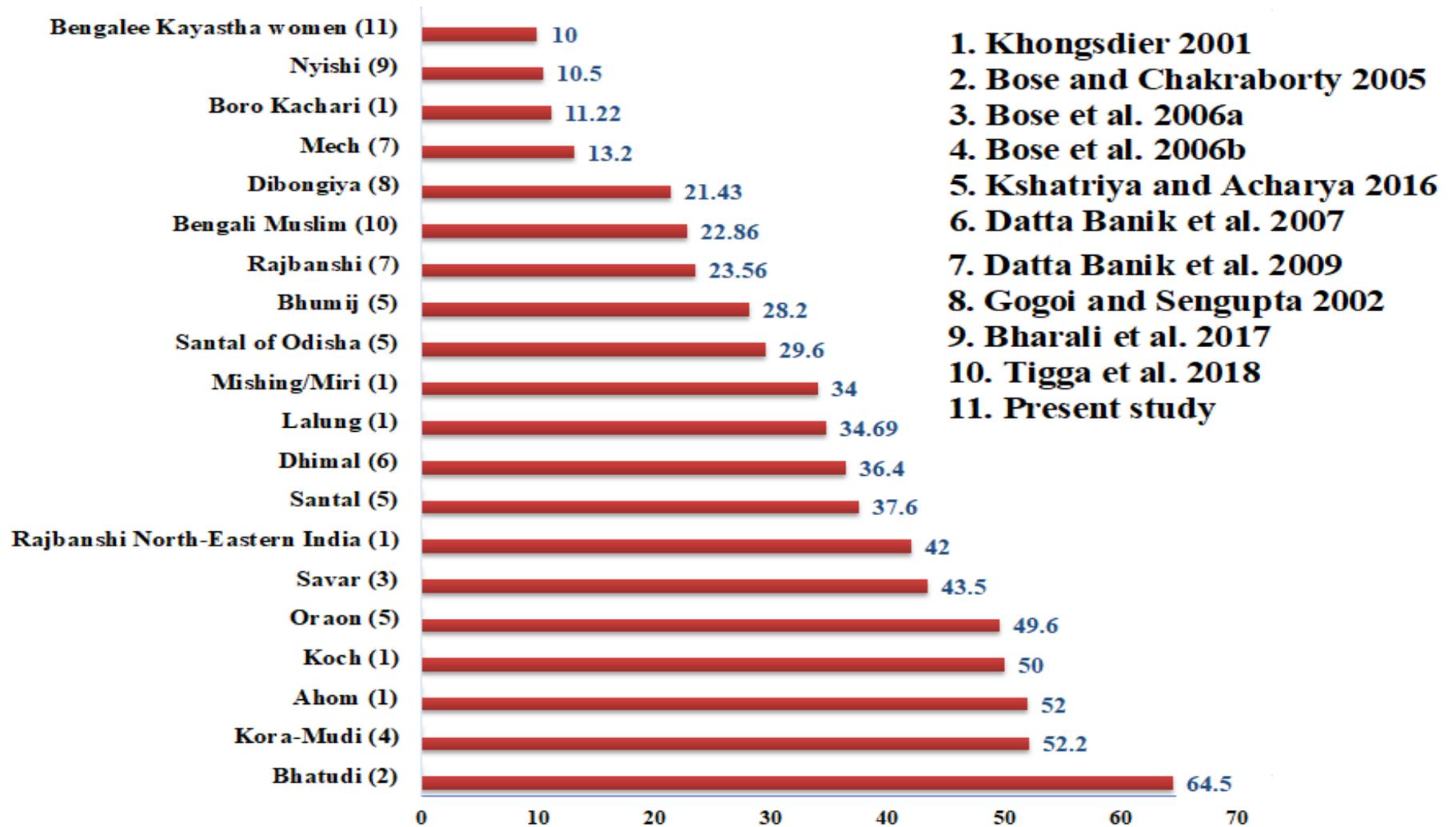10. Tigga et al. 2018
11. Present study

Figure 1: Comparison of prevalence of under-nutrition among other populations of India with that of the present study
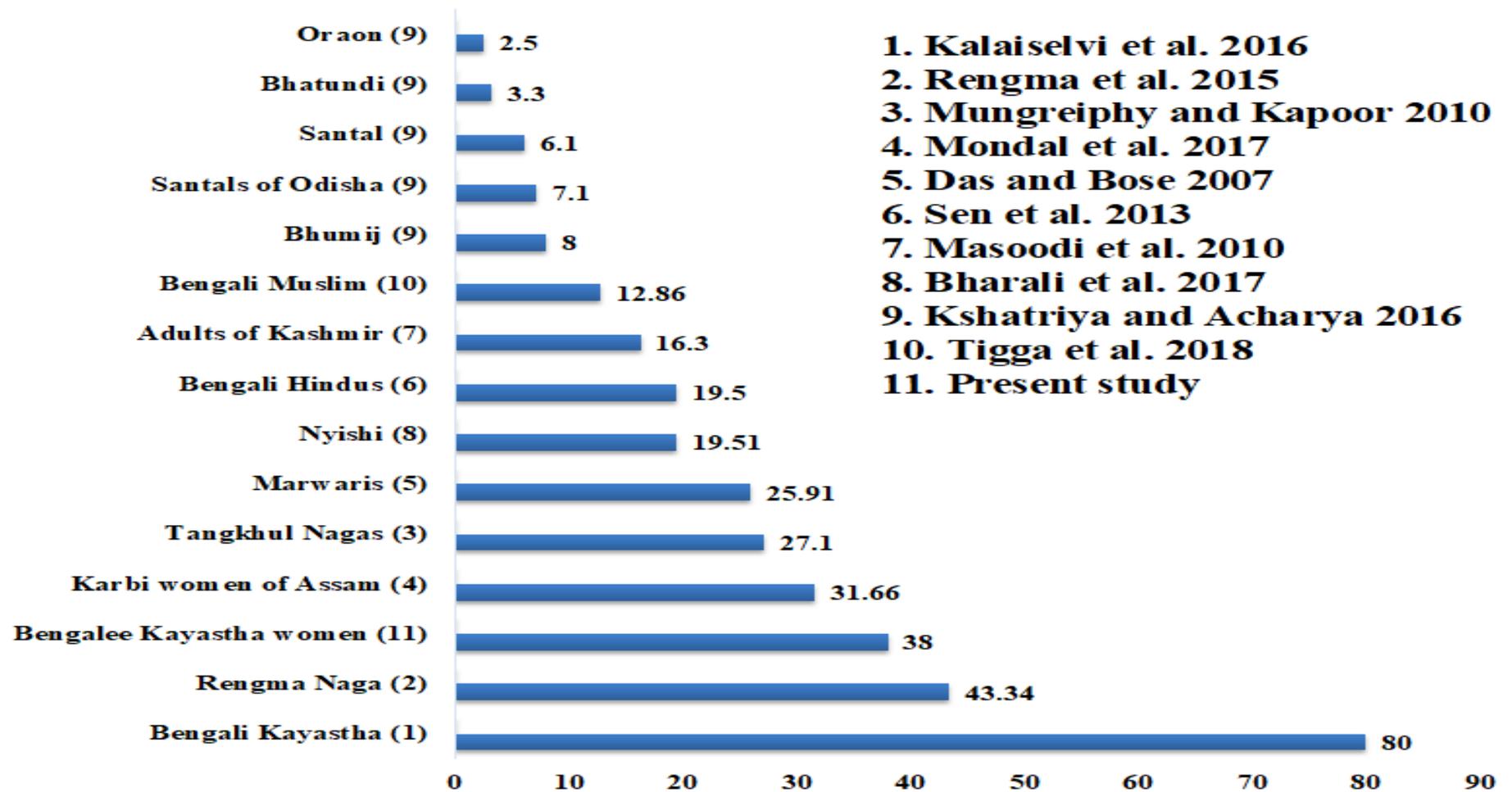
Figure 2: Comparison of prevalence of overweight-obesity among other populations of India with that of the present study

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