Prevalence of Undernutrition, Overweight and Obesity among Nyishi tribal women of Arunachal Pradesh, Northeast India

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ABSTRACT

Background: The concurrent prevalence of undernutrition, overweight and obesity is a creation of a double burden of malnutrition on the populations of several developing countries including India. The anthropometric measure, the Body mass index (BMI) is most widely used indicator because its investigation is inexpensive, non-invasive, and suitable for large-scale epidemiological and clinical investigations. The objectives of the present study are to determine and compare the prevalence of undernutrition, overweight and obesity in Nyishi tribal women of reproductive ages of Arunachal Pradesh, Northeast India. Subject and Methods: The present community-based cross-sectional study was undertaken among 543 Nyshi tribal women aged 15-44 years residing in rural areas of Kemin and Kakoi Block of Papum Pare district, Arunachal Pradesh, Northeast India. The anthropometric measurements of height and weight were collected using the standard procedure. The BMI (weight/height, kg/m^2) was calculated and undernutrition (BMI<18.50 kg/m^2), overweight (≥BMI 23.00 kg/m^2) and obesity (≥BMI 25.00 kg/m^2) were determined using the proposed BMI classification for Asia-Pacific population (WHO, 2000). Results: The overall mean weight, height and BMI observed to be 51.00 ±6.29 kg, 154.73±5.91 cm and 21.30 ±2.44 kg/m^2, respectively. The overall prevalence of undernutrition, overweight and obesity observed to be 10.50%, 9.94% and 9.57%, respectively. Conclusion: The present study indicates the simultaneous existence of the double burden of malnutrition among Nyishi tribal women. An appropriate intervention programme and strategies are necessary to eradicate the prevalence of undernutrition, as well as to reduce the risk related to overweight and obesity prevalent in the population.
Keywords: Anthropometry, BMI, Underweight, Obesity, North-East India, Public Health, Nyishi tribe.

INTRODUCTION

The prevalence of malnutrition still considered a serious public health problem in developing countries, causes susceptibility to infectious diseases, ill-health condition, premature mortality and morbidity in the population (Nandy et al., 2005). There is a high prevalence of malnutrition and infectious disease associated with scarcity of food and essential nutrients, and contrary a vast population is suffering from several health problems related to the non-communicable diseases include cardiovascular disease, metabolic disorders, hypertension and diabetes in India (ICMR 2010; Kapil and Sachdev, 2012; Varadharajan et al., 2013; Mondal and Sen, 2014). The rapid economic development and urbanization have given rise to a nutrition transition, preventable non-communicable diseases, reduced physical activity and sedentary lifestyle, where energy-dense diets replace traditional diets (WHO Expert Consultation, 2004; Subramanian et al., 2007; Wang et al., 2009; Popkin et al., 2012; Mondal and Sen, 2014; Mondal et al., 2015). This has led to an increase the prevalence of obesity and diet-related chronic diseases in the Indian population, especially urban areas (Kapil and Sachdev, 2012; Varadharajan et al., 2013; Subramanian et al., 2013). Currently, India has achieved a positive economic development, but a substantial economic disparities still remaining and nutritional insufficiencies (e.g., malnutrition) continue to affect several vulnerable segments (e.g., children and women) in population (Subramanian and Smith, 2006; Subramanian et al., 2007; Wang et al., 2009; Sen and Mondal, 2012; Sengupta et al., 2014). Recent studies have suggested that this 'double-burden' of malnutrition is becoming increasingly apparent in addition to the burden of non-communicable diseases affecting developing countries such include India (Kapoor and Anand 2002; Stein and Thompson, 2005; Wang et al., 2009; Kapil and Sachdev, 2012 Mondal et al., 2015; Rengma et al., 2015). The simultaneous occurrence of both under- and over-nutrition (e.g., overweight-obesity) within a population is likely to reflect the differential distribution of resources at the individual or household level, i.e. some people do not have sufficient resources to meet their caloric requirements, while others have the resources to purchase their calorie requirements and more (Subramanian and Smith, 2006; Subramanian et al., 2007). Several investigations have already demonstrated that the prevalence of undernutrition still remains a significant public health problem among the vulnerable segments (e.g., children and women), and a vast proportion of the population belongs to the underprivileged and undernourished segments in India (Som et al., 2007; Bose et al., 2007; Mondal and Sen,

2010; Kapil and Sachdev, 2012; Sharma and Mondal, 2014; Varadharajan et al., 2013; Mondal et al., 2015).

Body mass index (BMI) is widely used non-invasive, inexpensive anthropometric indicator to determine the nutritional status (both under and over-nutrition) across the populations for the large-scale epidemiological and clinical investigations (Griffiths and Bentley, 2001; WHO Expert Consultation, 2004; Khongsider, 2005; Bhadra et al., 2005; Das and Bose, 2006; Bose et al., 2006; Subramanian and Smith, 2006; Bharati et al., 2007; Mungreipy and Kapoor, 2010; Dutta Banik, 2011; Sen et al., 2013; Sengupta et al., 2014; Mondal et al., 2015; Rengma et al., 2015; Girdhar et al., 2016). The presence of excessive adiposity (e.g., overweight/obesity) results from an imbalance in energy, i.e. energy intake either has been or is greater than energy expenditure. Previous research studies have reported that the prevalence of obesity to be higher among women as compared to the male counterparts in India (Dudeja et al., 2001; Sinha and Kapoor, 2005; Das and Bose, 2006; Subramanian et al., 2007; Sarkar et al., 2009; Sen et al., 2013; Rengma et al., 2015). The prevalence was observed to be higher among the individuals belonging to the economically better–off segments of the population (Griffiths and Bentley, 2001; Subramanian and Smith, 2006; Subramanian et al., 2007; Kapil and Sachdev, 2012; Varadharajan et al., 2013). The recent nutritional trends have also indicated that the prevalence of overweight and obesity also increasing among women belongs to lower socio-economic status in India (Subramanian et al., 2007, 2013; Kapil and Sachdev, 2012; Sengupta et al., 2014). The nutritional trends have shown that the prevalence of overweight and obesity was observed to be greater among the individuals residing in the urban than rural regions in India (Dudeja et al., 2001; Bhadra et al., 2005; Das and Bose, 2006; Subramanian et al., 2007; Sarkar et al., 2009; Sen et al., 2013). Several researchers have already advocated that several socio-economic, demographic and lifestyle variables found to have greater associations on the prevalence of overweight/obesity (Subramanian et al., 2007; Mungreipy and Kapoor, 2010; Sen et al., 2013; Rengma et al., 2015; Sen et al., 2015). Therefore, it is evident that the individual belonging to the above-mentioned vulnerable segments and residing in the rural regions are nutritionally more susceptible in India. Therefore, it becomes imperative to understand the actual magnitude of malnutrition among the nutritionally vulnerable segments (e.g., women/rural habitat) of the population in India. The objectives of the present study are to determine and compare the prevalence of malnutrition (both under-and over nutrition) among adult Nyishi tribal women belonging to reproductive ages (15-44 years) residing in rural

regions of Arunachal Pradesh, Northeast India. Moreover, the results of the present study might be helpful to the Government agencies and policy makers to formulate appropriate strategies for overall development of health situations in India.

MATERIALS AND METHODS

The present community-based cross-sectional study was undertaken among 543 women aged 15-44 years residing in rural areas of Kemin and Kakoi Block of Papum Pare district (latitude 26°55′N and 28°40′N and longitude between 92°40′E and 94°21′E) of Arunachal Pradesh, Northeast India. According to National Census (2011), the district has a total population is estimated to be 1,76,573 individuals (males: 89,182 females: 87,391, and sex ratio 980) and the overall literacy rate was 79.85% (males 86.06%; females 73.72%). The community block consists of predominant tribal ethnic communities include Nyishi, Hill Miri and Adi ethnic populations. The data of the present study were collected from 15 homogenous villages of the above-mentioned studied area. The villages were identified based on the homogeneity of the population and easy road accessibility. Initially, subjects were identified in the present study are belonging to the major dominant tribal population of the above-mentioned study region (i.e., Nyishi tribe). Ethnically, they are belonging to the Sino-Tibetan family and showing a close ethnic affinity with the quasi-Tibetan origin populations (Taid, 1987). Age of the subjects was obtained from the birth certificates and relevant official records issued by the local government officials. All the subjects were free from any physical deformities, diseases and previous histories related to medical and surgical episodes. A verbal consent was obtained from the local village level authorities and subjects prior to the data collection. The participation on of the subject in this study was purely voluntary in nature, and the study was undertaken in accordance with the ethical guidelines for human experiments as laid down in the Helsinki Declaration (Touitou et al., 2004). The data of the present study were collected from October 2013 to February 2014.

Collection of socio-economic and demographic data

The socio-economic and demographic data on age, sex, monthly family income, sanitation, dependent children and education and occupation were recorded for each subject/household prior to the collection of anthropometric measurements. A pre-structured schedule was completed through the personal interview by household visits and interviewing the Nyishi tribal women. The socio-economic status (SES) was evaluated using a modified version of the scale of Kuppuswamy's was proposed by Mishra and Singh (2003). The scale determines the SES based on a score calculated from education, occupation and monthly

income. It was subsequently observed that all the participated women were belonged to a lower-to-middle SES group in the present study. In order to elicit valid responses, ample care was taken into consideration while briefing the questions to the respondents at the time of the investigation.

Anthropometric measurements obtained:

The anthropometric measurements of height and weight were obtained using the standard procedure (Hall et al., 2007). The height was measured using the standard anthropometer rod nearest to 0.1 cm head oriented in the Frankfort horizontal plane. The weight of the subjects, wearing minimum clothing and with bare feet was taken using a portable weighing scale (Libra, Edryl-India, Tiswadi, Goa) to the nearest 0.5 kg. The checking on the scale was performed routinely before recording the weight of each subject and the pointer was adjusted to zero using the screw provided.

The differences in anthropometric measurements were calculated for testing the co-efficient of reliability [$R = \{1 - (TEM)^2/SD^2\}$, the SD= standard deviation of all measurements] using the technical error measurement {$TEM = \sqrt{(\Sigma D^2/2N)}$, D=difference between the measurements, N= number of individuals measured} following the standard method (Ulijaszek and Kerr, 1999). Very high values of R (>0.976) were obtained for height and weight using the TEM analysis and values were found within the cut-off values (0.95) (Ulijaszek and Kerr, 1999). Hence, the recorded anthropometric measurements in the present investigation were considered reliable and reproducible. The subject covered in the present study was measured with ample precision to avoid any possible systematic errors in the process of anthropometric data collection (Harris and Smith, 2007).

Assessment of nutritional status

The nutritional status of adult Nyishi tribal women was assessed using the BMI. The BMI was calculated using the standard equation of the WHO (WHO Expert Consultation, 2004):

BMI (kg/m^2) = Weight (kg)/ Height^2 (m^2).

Nutritional status was determined by using the internationally accepted BMI guidelines as suggested by the WHO (WHO, 2000; WHO Expert Consultation, 2004). Studies have indicated the BMI values <18.50 kg/m^2 as the cut-off point to determine the nutritional status of different target populations, both in India and abroad (Khongsdier, 2005; Bose et al., 2006; 2007; Subramanian et al., 2007). The recently proposed BMI cut-off points

for the Asia pacific populations were used to assess the prevalence of overweight and obesity (WHO, 2000; WHO Expert Consultation, 2004). Where, the individual with the BMI ≥23.00-24.99 kg/m^2 and ≥25.00 kg/m^2 was considered overweight and obesity, respectively. Several studies have utilised these newly proposed BMI cut-offs to assess the overweight and obesity in Indian population (e.g., Sen et al., 2013; Rengma et al., 2015).

Statistical Analysis

The data collected for the present study were compiled in MS Excel and analyzed using the Statistical Package for Social Sciences (SPSS, Inc., Chicago, IL; version 17.0). The collected anthropometric data were depicted in terms of descriptive statistics (mean ± standard deviation). The one-way analysis of variance (ANOVA) using the Scheffe procedure was done to assess the age-specific mean differences in the anthropometric variables. Chi-square analysis was done to determine the differences in the prevalence of undernutrition, overweight and obesity among Indian populations with the present study. A p-value of less than 0.05 and 0.01 was considered statistically significant.

RESULTS

The age-specific descriptive statistics (mean and standard ±deviation) and 95% confidence interval of the mean of the collected anthropometric variables of weight, height and BMI among Nyishi tribal women of Kimin and Kakoi area of Arunachal Pradesh is presented in Table 1. The overall descriptive statistics of weight, height and BMI were observed to be 51.00 ±6.29 kg, 154.73±5.91 cm and 21.30 ±2.44 kg/m2, respectively. The age-specific mean weight and BMI (22.19±2.74 kg/m^2) were observed to be higher in 25-34 years. The age-specific height was observed to be higher (155.79±7.19 cm) and lower (152.87±4.88 cm) among 15-24 years. The age-specific lower mean values were observed to be weight 49.18±5.90 kg (in weight) and 20.22±1.69 kg/m^2 (in BMI) among 15-24 years. The age-specific mean differences were observed to be statistically significant (p<0.01) in weight (F-value=8.19), height (F-value=8.23) and BMI (F-value=23.28) using ANOVA (Table 1).

Table 1: Age-specific descriptive statistics (95% confidence Interval) of anthropometric variable among Nyishi Tribal women

Age groups	Weight (kg)	Height (cm)	BMI (kg/m^2)
15-24 years	49.18±5.90 (48.19-50.18)	155.79± 7.19 (154.57 157.00)	20.22± 1.69 (19.94- 20.51)
25-34 years	52.00±7.96 (50.52 -53.48)	152.87± 4.88 (151.97-153.78)	22.19± 2.74 (21.68-22.70)
35-44 years	51.46±5.52 (50.83-52.10)	154.95±5.44 (154.32-155.57)	21.46±2.44 (21.18-21.74)
15-44 years	51.00±6.29 (50.47 -51.53)	154.72±5.90 (154.22-155.22)	21.30±2.44 (21.10-21.51)
F-Value	8.19*	8.23*	23.28*

*p<0.01

Assessment of nutritional status among Nyishi women

The results of the prevalence of malnutrition among adult Nyishi tribal women were evaluated by utilizing recently proposed BMI classification for the Asia-specific population are presented in Table 2. The overall prevalence of undernutrition or CED (BMI<18.50 kg/m^2) and normal nutritional (BMI 18.50-22.99 kg/m^2) status was observed to be 10.50% and 69.85%, respectively. The overall prevalence of overweight (≥BMI 23.00 kg/m^2) and obesity (≥BMI 25.00 kg/m^2) was observed to be 9.94% and 9.57% among tribal women, respectively.

Table 2: Assessment of nutritional status among the Nyishi tribal women

Nutritional status	BMI (kg/m^2)*	Prevalence	Percentages
Undernutrition	<18.50	57	10.50
Normal	18.50-22.99	380	69.98
Overweight	23.00-24.99	54	9.94
Obesity	≥25.00	52	9.57

* Asia Pacific cut-off (WHO, 2000)

DISCUSSION

The assessment of nutritional status among the population (e.g., children and women) belonging to the nutritionally vulnerable segments of the developing countries should be

emphasized, not only for the nutritional risk identification, but also to implement an intervention programme for the improvement of the overall health condition. Such assessments are important for the improvement of the health condition and overall development of the concerned individual and/or population. It is generally believed that the women are found to be nutritionally vulnerable segments (i.e., undernourished) in the developing countries including India (Griffith and Bentley, 2001; Subramanian and Smith, 2006; Subramanian et al., 2007; Chakraborty and Bharati, 2010; Dutta Banik, 2011; Sengupta et al., 2014). Recent research studies on nutritional status assessment have clearly indicated that a sizable proportion of the population (e.g., women) are found to be affected by overweight and obesity in India (Griffith and Bentley, 2001; Subramanian and Smith, 2006; Bharati et al., 2007; Subramanian et al., 2007; Mungreipy and Kpoor, 2010; Sen et al., 2013; Majumder et al., 2014 Sengupta et al., 2015; Rengma et al., 2015; Giridhar et al., 2016). Therefore, the co-existence of the 'double burden' of malnutrition (both under and over-nutrition) representing opposite sides of the energy balance equation presents a unique difficulty for public health policy and interventions in population. The present study was undertaken to assess the magnitude of the double burden of malnutrition (e.g., under and over-nutrition) among the Nyishi tribal women (aged 15-44 years) of Arunachal Pradesh, which could lead to the development of several nutrition-related manifestation in the foreseeable future (WHO, 2000; WHO Expert Consultation, 2004). Several researchers have already reported a higher amount of undernourishment among various Indian populations indicates a major public health issue (Bharti et al., 2007; Subramanian and Smith, 2006; Subramanian et al., 2007; Dutta Banik, 2011; Sengupta et al., 2015; Kshatriya el al., 2016). Such nutritional burden will increase the disease prevalence and morbidity, poor reproductive performances (e.g., low birth weight), less physical productivity and per-capita economic development in population. In the present study, the result showed that the prevalence of a double burden of nutrition in both undernutrition (10.50%) and combined overweight-obesity (BMI ≥ 23.00 kg/m^2) (19.51%) utilizing the recently proposed BMI reference for the Asia-Pacific population (WHO, 2000; WHO Expert consultation, 2004) among the Nyshi tribal women (Table 2). The prevalence of undernutrition (i.e., CED) is considered to be a serious problem among the adult population of Northeast India (Khongsider, 2002; Gogoi and Sengupta, 2002; Mungreipy and Kapoor, 2010; Mahanta et al., 2012). Khongsider (2001) using the data from 12 populations of 18-60 years of North-East India reported that the prevalence of was found to be significantly lower in the tribal (19.00%) than in the Hinduized

(49.00%) and caste (52.00%) populations. The prevalence of CED was found to be 21.43% among Dibongiya Deoris of Assam (Gogoi and Sengupta, 2002). When the population-specific comparison of prevalence of undernutrition (e.g. CED) was taken into consideration, the data showed a significantly (p<0.01) lower prevalence was observed than the Indian tribal populations (47.40%) (Kshatriya et al., 2016), Dhimal (47.20) (Banik et al., 2007), Indian women (45.00%) (Griffiths and Bentley, 2001), Oraon tribe (62.50%) (DuttaBanik, 2011), Sarak women (46.36%) (DuttaBanik, 2011) (Table 3). The prevalence of CED was reported to be higher in the Hinduized Mongoloid groups like Ahom (52.00%), Koch (50.00%) and Rajbanshi (42.00%) (Khongsider, 2002).The comparison with the present study showed that the prevalence of CED is a serious nutritional problem (≥40.00%) among the Indian women requires immediate nutritional intervention. Therefore, appropriate nutritional intervention programmes are necessary to improve the actual magnitude of undernutrition without increasing the actual burden of overweight and obesity of the concern population.

Several developing countries are currently undergoing rapid socio-economic, demographic transition, which leads to the acceleration of several preventable, non-communicable diseases and higher prevalence of overweight-obesity and slightly lower prevalence of undernutrition in population (Wang et al., 2009; Popkin et al., 2012; Subramanian et al., 2013; Varadharajan et al., 2013; Mondal and Sen, 2014). A comparison of the overweight and obesity with Nyshi tribal women is depicted in Table 4. The results of the present study showed that the prevalence of overweight and obesity was observed to be 9.94% and 9.57% among Nyishi tribal women, respectively. Griffiths and Bentley (2001) conducted a study on Andhra Pradesh among the Indian women reported overweight and obesity 12.00% and 2.00%, respectively. Mungreiphy and Kapoor (2010) reported that trend of overweight and obesity among the adult Tangkhul Naga women of Manipur and reported the prevalence of overweight and obesity is 25.10% and 2.00% respectively. Bharati et al., (2007) on Indian population covering 26 states and 6 zones where overweight and obesity was reported to be 9.40% and 2.60%. Majumdar et al., (2014) stated the prevalence of overweight (31.80%) and obesity (19.10%) among Indian women (p<0.01). A recent study has also reported a relatively lower prevalence of overweight (10.90%) and obesity (1.50%) of Indian Tribal women (Kshatriya el al., 2016). A high prevalence of overweight (20.33%) and obesity (29.33%) has reported among the Bengalee ethnic group of West Bengal (Sen et al., 2013) (p<0.05). Furthermore, the burden of overweight-obesity has shifted progressively from the wealthy to the poorer groups with rising country income (Subramanian et al., 2007).

The existence of excess adiposity levels is generally considered to increase the higher risk for non-communicable diseases (e.g., hypertension, diabetes, cardio-metabolic and cardio-vascular disorders) (WHO, 2000; WHO Expert Consultation, 2004). Therefore, the prevalence of overweight-obesity among women in reproductive ages could be a challenge for the healthcare providers and certainly contribute to the related mortality and morbidity in the near future. There are substantial evidences suggested that socioeconomic, demographic, diet and increasing sedentary lifestyle and subsequent decrease in physical activity changes have triggered such prevalence in populations (Subramanian et al., 2007; Mungreiphy and Kapoor, 2010; Mondal et al., 2015). The major shift was noticed towards increased reliance upon processed foods, increased away-from-home food intake, and increased use of edible oils and sugar-sweetened beverages (Popkin et al., 2012).

Conclusion

The results of this study indicate that the prevalence of undernutrition exists among the Nyishi tribal women of Arunachal Pradesh, Northeast India. The existence of CED among the Nyishi women also seems to be one of the nutritional concerns of the population. This will trigger the vicious cycle of malnutrition in the population. There appears to have the substantial amount of excess adiposity (e.g., obesity) among women. This would increase the risk of several preventable non-communicable diseases in the population. This also indicates that the double burden of malnutrition prevailed among Nyishi tribal population. Given-above, due to the small sample size and the cross-sectional design of this present study, it is very difficult to draw a major conclusion regarding the cause and effect, advantage and disadvantage relationships. However, the results of the present study might be helpful for the policy makers and government agencies to formulate appropriate strategies to improve the overall nutrition and health situation of the population concern. Moreover, the dissemination of nutrition-related knowledge and awareness among parents and community members could be helpful to reduce the future possibility of overweight-obesity prevalence and related consequences of mortalities and morbidities among populations.

Table 3: Comparison of undernutrition (CED) prevalence among Indian women and the present study

Population	Area	Sample	Age (years)	Undernutrition		Source
				Prevalence (%)	**Chi-square**	
Indian Women	Andhra Pradesh	4032	15-49	45.00	112.44*	Griffiths and Bentley, 2001
Tangkhul Naga	Manipur	346	20-70	16.20	4.72**	Mungreipy and Kapoor, 2010
Indian	26 Indian state	81712	15-49	31.20	67.29*	Bharati et al., 2007
Punjabi Women	Jalandhar, panjab	65	17-80	18.50	2.76	Singh and Kirchengast, 2011
Indian Women	India	77220	15-49	32.10	71.20*	Subramanium and Smith, 2006
Orang women	Jharkhand	216	39-60	62.50	115.28*	Dutta Banik, 2011
Sarak women	Jharkhand	110	39-60	46.36	51.27*	Dutta Banik, 2011
Indian Tribes	India	1090	20-60	47.40	116.69*	Kshatriya el al., 2016
Dhimal	West Bengal	146	≥18	46.20	58.62*	Banik et al., 2007
Kora-Mudi	West Bengal	250	18-65	56.40	104.46*	Bose et al., 2006
Savar	Orissa	300	≥18	49.00	89.30*	Bose et al., 2006
Rural women	Assam	285	≥18	48.00	89.31*	Mahanta et al., 2012
Bathudi	Orissa	183	≥18	64.50	113.00*	Bose and Chakraborty, 2005
Nyshi Women	**Arunachal Pradesh**	**543**	**15-49**	**10.50**	**-**	**Present study**

*p<0.01, **p<0.05

Table 4: Comparison of overweight and obesity prevalence among Indian women and the present study

Population	Area	Sample	Age	Prevalence of excess adiposity				Source
				Overweight (%)	**Chi-square**	**Obesity (%)**	**Chi-square**	
Indian Women	Andhra Pradesh	4032	15-49	12.00	1.57	2.00	86.78**	Griffiths and Bentley, 2001
Tangkhul Naga	Manipur	346	20-70	25.10	25.92**	27.10	33.27**	Mungreipy and Kapoor, 2010
Indian	Indian 26 state and 6 zones	81712	15-49	9.40	0.16	2.60	90.95**	Bharati et al., 2007
Punjabi Women	Jalandhar, Panjab	65	17-80	9.20	0.02	24.60	9.56**	Singh and Kirchengast, 2011
Indian Women	India	77220	15-49	9.60	0.06	2.70	84.71**	Subramaniam and Smith, 2006
Indian Women	Puducherry	184	≥30	19.10	7.93**	31.80	36.26**	Majumdar et al., 2014
Urban women	Ludhiyana,Panjab	324	20-60	12.70	1.22	29.60	39.40**	Girdhar et al., 2016
Indian Tribes	India	1090	20-60	10.90	0.29	1.50	53.61**	Kshatriya el al., 2016
Bangalee Hindu caste	Jalpaiguri West Bengal	300	20-60	20.33	13.13**	29.33	37.37**	Sen et al., 2013
Regma Naga	Karbi Anglong, Assam	404	20-49	25.50	28.55**	11.63	0.85	Rengma et al., 2015
Nyshi Women	**Arunachal Pradesh**	**543**	**15-49**	**9.94**	**-**	**9.57**	**-**	**Present study**

*p<0.05, **p<0.01

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