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Double burden of malnutrition among Sonowal Kachari preschool children (<5 years) of North Lakhimpur District of Assam, India

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ABSTRACT

Background: *Many developing countries now are facing the problem of double burden of malnutrition, defined as the coexistence of undernutrition and overweight/obesity within the same household/population. Malnutrition among under-five children is an important public health problem causes premature morbidity and mortality in developing countries including India.* ***Objectives****: The present investigation assesses the prevalence of thinness and at risk of overweight, overweight and obesity among tribal pre-school children (<5 years) of Assam, Northeast, India.* ***Material and Methods****: This cross-sectional investigation was conducted among 360 (170 boy and 190 girls) Sonowal Kachari tribal pre-school children aged <5 years of North Lakhimpur district of Assam, India. Anthropometric measurements of length/height and weight were recorded using standard procedures and age-sex specific BMI-for-age z-score (BMIAZ) were calculated using WHOAnthro Software. A child found to be <−2.00 BMIAZ was classified as thinness and BMIAZ>+1.00, >+2.00, >+3.00 are used to define at risk of overweight, overweight and obese, respectively.* ***Results:*** *The overall prevalence of thinness, risk of overweight, overweight, and obese were found to be 11.66%, 12.22%, 6.66% and 3.00%, respectively. However, sex-specific prevalence was found 7.05%, 10.58%, 8.23% and 1.76% (in boys) and 23.07, 11.57%, 5.26% and 4.21% (in girls).* ***Conclusion:*** *This investigation confirms a coexistence of under- and over-nutrition among the Sonowal Kachari population. There is a need for an urgent target-specific intervention program for improvements of nutritional status, contributing to reduce the burden of child undernutrition and planned strategies to overcome the double risk factor of overweight and obesity in the population.*

Keywords: Anthropometry; Double burden, Malnutrition, Thinness, Body Mass Index, Overweight, Obesity, Children

INTRODUCTION

Many developing countries are now facing the nutritional problem of the double burden of malnutrition (DBM) which is defined as the coexistence of both undernutrition and overnutrition (e.g., overweight/obesity) within the same individual/household/community (Kennedy et al., 2006; Ravishankar, 2012; Ene-Obong et al., 2012; Mondal et al., 2015; Kulkarni et al., 2017; Yang et al., 2019). Several researchers have reported that this phenomenon within

the same country and/or population (Sengupta et al., 2014; Mondal et al., 2015; Kulkarni et al., 2017). The research findings of these investigations have highlighted the importance of considering the co-existence of undernutrition and overweight/obesity when implementing any nutrition intervention and treatment programmes in the population (e.g., Mondal et al., 2015; Sahoo et al., 2015; Ranjani et al., 2016). India is known for the existence of a high prevalence of undernourishment (Pathak and Shing, 2011; Bhutta et al. 2017; Kulkarni et al., 2017), but a significant proportion of the population is now suffering from the overweight-obesity and DBM both in children and adult population (Subramanian et al., 2009; Sengupta et al., 2014; Mondal et al., 2015; Kulkarni et al., 2017; Varghese and Stein, 2019).

The anthropometry is a single most used non-invasive, inexpensive and easy-to-use technique to assess the physical growth and nutritional status assessment utilise in epidemiological, clinical and field investigations (WHO, 1995, 2007; Hall et al., 2007). The high prevalence of undernutrition is considered being the major cause of morbidity and mortality in Indian children (Nandy et al., 2005; Mondal, 2014; Mondal et al., 2015; Bhutta et al., 2017). The prevalence of undernutrition and over-nutrition (Ranjani et al., 2016; Bhutta et al., 2017; Kunwar et al., 2018) among under-five children is an important public health problem in developing countries including India. The prevalence of non-communicable disease risk factor collaboration reported that today one in three persons are suffering from at least one form of malnutrition: wasting, stunting, thinness, vitamin and mineral deficiency, overweight or obesity and diet-related disorders (Development Initiatives, 2018). Therefore, the identification of overall magnitude of DBM is considered being the important concern to reflect the nutritional problem (e.g., non-communicable diseases) because it's showing the negative sides of energy balance and increase the economic burden in the individual/population. Therefore, the aim and objective of the present research investigation is to assess the prevalence of DBM of thinness, overweight and obesity among Sonowal Kachari pre-school (< 5 years) children of Assam, Northeast India.

MATERIAL AND METHODS

The present research investigation was carried out among the Sonowal Kachari-an indigenous Assamese community of Assam North East, India which belongs to Tibeto-Mongoloid population and Tibeto Burman linguistic group (Das et al., 2008). The Sonowal Kachari is an endogamous group of Kachari tribe practiced gold washing and agriculture as their traditional occupation in Assam. This community-based cross-sectional investigation was carried out among 360 (170 boys; 190 girls) tribal pre-school children (<5 years) of Lakhimpur district of Assam, Northeast India. Sonowal Kacharies are mainly situated in districts of North Assam, India. The Sonowal Kacharies are one of the sub-groups of the great Kachari groups of

Assam. The studied area is Lakhimpur District of North Assam and its total area covered 2,277 km² and having a population of 1,042,137 (Male- 512,463, Female-529,674) and Literacy Rate of 77.20% (Male- 83.52%, Female- 70.62%). A total of seven Sonowal Kachari dominated villages situated near the river Subansiri of Lakhimpur, Assam Northeast India were covered druing the present investigation. The households of those individuals belonging to the Sonowal Kachari population were identified based on the surnames and cultural features. The ethnicity of the children was verified from official documents issued by the government. Each informant (e.g., parents or guardians) and subject was interviewed for the collection of data and children belonging to age group of 0-5 years were measured in the respective household. Permission to conduct the research was taken from the village headmen and informed consent was obtained from the parents before conducting this investigation. This research investigation was conducted in accordance with the ethical guidelines for human experimental research as laid down in the Helsinki Declaration (Portaluppi et al., 2010).

Assessment of nutritional Status

Anthropometric measurements of weight and length/height were taken using the standard anthropometric procedures (Hall et al., 2007). The age-sex specific Body Mass Index (BMI=weight/height^2, kg/m^2) was calculated. The age-sex specific z-score value of BMI-for-age (BMIAZ) was calculated by using WHO-Anthro (v 3.2.2). A child having the BMIAZ value <−2.00 is categorised as thinness and BMIAZ value between +1.00 to +2.00 were categorized as at risk of overweight, BMIAZ value between +2SD to +3.00 were categorized overweight and BMIAZ more than+3SD were categorized as obese (WHO, 2007; Anderson et al., 2017). The statistical analysis was done using the Statistical Package for Social Sciences (SPSS) for Windows (Version 16.0). The anthropometric variable was depicted in descriptive statistics (mean± standard deviation) and age-sex specific mean differences were done using one-way analysis of variance (ANOVA). The chi-square (χ^2) analysis was done to assess the age-sex specific prevalence in different nutritional categories. A p-value of <0.05 and <0.01 were considered to be statistically significant.

RESULTS

Age-sex specific subject distribution, descriptive statistics and prevalence of thinness, overweight and obesity among Sonowal Kachari preschool children is presented in Table 1. The age-sex specific overall mean BMI z-score value was observed to be higher among boys than the girls (−0.06 vs. −0.29; p>0.05). The result of age-sex specific mean BMI-for-age z-score were found to be greater among the age group of 1 year, 3 years and 4 years (in boys), whereas it was found to be higher in 2 years and 5 years (in girls). The age-specific mean BMIAZ in boys

ranged from −0.76±1.42 (in 2 years) to 0.82±1.52 (in 1 year) and ranged from -0.54±2.16 (in 2 years) to 0.13±1.16 (in 5 years) in girls. The age specific mean differences were found to be statistically significant in boys (F=2.56, df=4, 169, $p<0.05$) and in girls (F=3.299, d.f=4, 189, $p<0.05$) using ANOVA. However, the sex-specific mean differences was found to be statistically not significant among boys and girls (F=1.624, d.f=1, 359, $p>0.05$). The overall prevalence of thinness, risk of overweight, overweight, and obese were found to be 11.66%, 12.22%, 6.66% and 3.00%. The sex-specific prevalence of thinness (23.07% vs. 7.05%), at risk of overweight (11.57% vs. 10.58%) and obese (4.21% vs. 1.76%) was observed to be higher among girls than among boys, except in overweight category (5.26% vs. 8.23%). Using chi-square analysis, the sex-specific difference in overall prevalence of thinness was observed to be statistically significant (χ^2=5.281; $p<0.05$) but not significant in at risk overweight, overweight and obesity groups ($p>0.05$). However, the age-specific differences were found to be statistically significant in 1 year (χ^2=4.573; $p<0.05$) (in thinness) and 3 years (χ^2=4.603; $p<0.05$) (Table 1).

DISCUSSION

The present research investigation is the first to directly compare the magnitude of thinness and at risk of overweight, overweight and obesity to determine the DBM among Sonowal Kachari tribal pre-school children (<5 years) of Assam, Northeast India. The results of the present investigation showed that overall malnutrition is high in children belonging to<5 years. The four different categories of malnutrition includes preschool children in the category of at risk of overweight, overweight, and obese as 12.22%, 6.66% and 3.00%, respectively whereas the prevalence of thinness (low BMI-for-age) was found to be as low as 11.66% (Table 1). The prevalence of overweight (including at risk of overweight, obesity) in the present investigation was found quite high compared to global average reported by de Onis et al., (2010). Accordingly, overweight including obesity globally was 8.50% in Africa, 4.90% in Asia and 6.90% in America in 2010 and it is slightly getting higher yearly. This is lower than that reported by Anderson et al. (2017) in Toronto, Canada as 13.8% in the category of at risk of overweight 3.40% (in overweight) and 1.00 % (in obese) categories. Whereas, the prevalence of overweight-obesity (i.e., 9.66%) was also found to be significantly lower in present investigation than earlier reported studies in Indian (19.3%) (Ranjani et al., 2016) and Northeast Indian (overweight-10.98%, obese-14.19%) (Kunwar et al., 2018). The prevalence of thinness was found to be lower than that reported in Nigeria as 15.5% (Ene-Obong et al. (2012) and in North-East India as 49.10% (Mondal, 2014). It has been noted that thinness prevalence was less frequent than overweight including obesity and at risk of overweight among Sonowal Kachari pre-school children (Table 1). It seems that the prevalence of thinness is already, exiting nutritional issue;

however, the prevalence of overweight and obesity are getting introduced as a new trend of health or nutritional misfortune in preschool children. The prevalence of overweight and obesity in the present Sonowal Kachari tribal population could be attributed to higher socio-economic background (Sengupta et al., 2014; Ranjani et al., 2016; Mondal et al., 2015), changing dietary habits (Sahoo et al., 2015; Chudasama et al., 2017) and genetic factors (Anderson and Butcher, 2006).

CONCLUSION

The findings of the present investigation, however, are important for the effective implementation of any public health programme (e.g., maternal and child health programme or nutritional intervention programme). The assessment of nutritional status (e.g., DBM) will have potential to enhance the efficacy of the various ongoing nutritional intervention programmes. The results indicate the existence of DBM (e.g., thinness and overweight-obesity) among Sonowal Kachari tribal preschool children. The implementation of appropriate nutritional intervention program is necessary in order to maintain the nutritional status by reducing undernutrition (thinness) by proper food and nutrient intake, improving health condition and reducing overweight/obesity by controlled food habits, maintaining balanced diet intake and lifestyle to reduce the relative mortality and morbidities (i.e., non-communicable diseases).

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Table 1: Age-sex specific subject distribution, descriptive statistics (mean ±SD) and prevalence of thinness, overweight and obesity among Sonowal Kachari preschool children of North Lakhimpur district of Assam

Age group	N		BMIAZ		Thinness (<-2SD)			At risk overweight (<+1SD to +2SD)			Overweight (> +2SD)			Obesity (>+3SD)		
	Boys	Girls	Boys	Girls	Boys	Girls	χ^2	Boys	Girls	χ^2	Boys	Girls	χ^2	Boys	Girls	χ^2
1 year	37 (21.76)	46 (24.21)	0.82 ±1.52	-0.03 ±2.30	2 (5.40)	12 (26.08)	4.573*	4 (10.81)	10 (21.73)	1.258	5 (13.51)	4 (8.69)	0.394	0 (0.00)	4 (8.69)	3.103
2 years	36 (21.17)	41 (21.57)	-0.76 ±1.42	-0.54 ±2.16	6 (16.66)	13 (31.70)	1.426	2 (5.55)	4 (9.75)	0.404	3 (8.33)	4 (11.11)	0.039	0 (0.00)	2 (9.52)	1.718
3 years	24 (14.11)	30 (15.78)	0.46 ±2.63	-1.19 ±0.72	2 (8.33)	3 (10.0)	0.037	1 (4.16)	0 (0.00)	1.222	4 (16.66)	0 (0.00)	4.603*	2 (8.33)	0 (0.00)	2.393
4 years	21 (12.35)	27 (14.21)	0.10 ±1.70	-0.08 ±1.47	0 (0.00)	0 (0.00)	25.5	2 (9.52)	0 (0.00)	2.446	0 (0.00)	2 (9.52)	1.509	1 (4.16)	2 (9.52)	0.125
5 years	52 (30.58)	46 (24.21)	-0.06 ±1.15	0.13 ±1.16	2 (8.33)	2 (4.34)	0.014	9 (17.30)	12 (26.08)	0.721	2 (3.84)	0 (0.00)	1.738	0 (0.00)	0 (0.00)	49.73
Total	170 (47.22)	190 (52.77)	-0.06 ±1.65	-0.29 ±1.77	12 (7.05)	30 (23.07	5.281*	18 (10.58)	22 (11.57)	0.071	14 (8.23)	10 (5.88)	1.113	3 (1.76)	8 (4.21)	1.707

Values are in parenthesis indicate percentage; *p<0.05