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Anthropometric Assessment of Nutritional Status of Children and Adolescents in Henanigala Indigenous Group, Sri Lanka

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ABSTRACT

The prevalence of undernourishment, is often higher among indigenous than non-indigenous children in many countries. However, lesser is known about the nutritional status of the Indigenous (the Veddas) children and adolescents in Sri Lanka. The present study was conducted to assess the nutritional status of the Henanigala Vedda children and adolescents through anthropometric measurements. Stature and weight of a total of 169 children and adolescents (90 girls and 79 boys between 5-18 years of age) were measured and calculated the Body Mass Index (BMI). Subjects were categorized into three age groups, 5-8 years (n = 28), 9-11 years (n = 52) and 12–18 years (n = 89). According to the National Health and Nutrition Examination Survey (NHANES) subjects who were falling below the age and sex specific fifth percentile (< 5th %ile) of the BMI Cut off Points were defined as undernourished. SPSS, MS Excel and BMI metric calculator for children, were used for data analysis. In order to test the level of significance, student t-test was performed (P<0.05). Mean BMI of the girls of 5-8, 9-11 and 12-18 age categories were 13.22 ± 1.06, 13.39 ± 1.59 and 18.66 ± 3.42 respectively, boys were 14.78 ± 3.18, 14.76 ± 3.39 and 18.01 ± 3.38 respectively. The difference in stature was significant only between the boys and girls of the 12-18 age group. According to the BMI cut off points 67% of the girls and 60% of the boys of the 5-8 age group and 69% of the girls and 54% of the boys in the 9-11 age groups belonged to underweight category (critical). When compared with other age groups lower prevalence of underweight was found among 12-18 years age group which were 22% of girls and 35% of boys (but still at health risk). Higher prevalence of underweight among children could be due to the lower socioeconomic and educational status of their parents. In addition, sudden cultural transformations due to the resettlement which had an adverse effect on their traditional lifestyle including food practices would account for the lower nutritional status observed among the majority of the indigenous children and adolescents in Henanigala.

KEYWORDS*: Anthropometrics, BMI, Vedda, Henanigala, Underweight*

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1. INTRODUCTION

Anthropometrics were used as indicators of health, growth and development in children and adolescence in many contexts related to nutritional status (WHO, 2006; Mukhopadhyay et al., 2005). Better nutrition in early life is essential for optimal growth, cognitive development, optimal health and for the prevention of chronic diseases later in life. Globally, approximately 151 million children are undernourished and more than half of them are from Asia (Rice et al., 2000). Inadequate diet and unfavorable environmental conditions in developing nations adversely affect the growth and nutrition of its citizens (Singh et al., 2014). Sri Lanka which is considered as a developing nation, nutrition is still a major public health issue according to the data presented by the annual Demographic and Health Survey (DHS). Especially, marginalized populations with low income and education are reported to have lower nutritional and health statuses when compared with urban areas. Therefore more effort and strategies are needed to improve their nutritional and health conditions (Demographic and Health Survey, 2016).

Indigenous people of the country; the Veddas are one of the highly marginalized and vulnerable group of people who have not yet been considerably studied to access their nutritional status. With the hypothesis of the positive effect of resettlement on the nutritional status of the Vedda people in the late 19th century, few studies had been conducted focusing on this respective field (Stoudt, 1961; Wikramanayake et al., 1994; Chandimal & Wijesuriya, 2010; Ananda, & Nahallage, 2018a; 2018b). Concerning the need for more validated data on the nutritional status of these indigenous people present study was carried out among children and adolescents, as they play a main role in the demographic structure of the population.

Henanigala C zone situated in Ampara District, Eastern province of the country was populated in 1982 by the indigenous groups that were relocated from Kandeganivila, Dambana and Kotabakiniya areas, under the Mahaveli Development Project. One of the initial studies on these specific people was conducted by Wikramanayake et al during 1971/73 and 1993/94; before and after the resettlements to access their nutritional status through the calculation of BMI (Wikramanayake et al., 1994). Although the sample size of 1971/73 was small, with no representation of male adolescents, the results of this study had highlighted the fact that the Henanigala Veddas in general, were undernourished than when they were at Kandeganvila (Wikramanayake et al., 1994, p. 15). Further, resettlement was suggested as the major reason for their lower nutritional and health statuses (Wikramanayake et al., 1994, p. 13). Apparently there is a necessity of more new, validated and reliable data on the nutritional status of these remaining Vedda groups in order to take necessary action towards the protection of these people for the tomorrow's world as they are at the edge of diminishing. This study will provide

new insight in to the nutritional status of the indigenous children and adolescents in Henanigala.

2. METHODOLOGY

The present study was conducted among indigenous children and adolescents residing in Henanigala C zone, situated in Ampara District, Eastern Province. Total of 169 children and adolescents (90 girls and 79 boys aged 5–18 years) were included for the present study. Study subjects were divided into three age groups: 5–8 years age group (n = 28) and 9-11 years age group (n = 52), considered to be children and 12–18 (n = 89) years age group, considered to be adolescents (Table 1). Anthropometric measurements were collected on each subject by purposive sampling method (ensuring the affinity to indigenous people of the country) through house-to-house visit during 2016 and 2018.

Anthropometric measurements including stature, and body weight were measured according to the 'Anthropometric Procedure Manual-National Health and Nutritional Examination Survey' (2009). Prior to data collection, both written consent and assent was obtained from the parents/guardians and from the children. Ethical clearance for the study was obtained by the Ethics review committee of the Faculty of Medical Sciences, University of Sri Jayewardenepura (Ref No-18/18).

The anthropometric measurements were as follows.

Weight (In kg): Weight was measured to the nearest 0.1 kilograms using a standard digital scale. Subjects were asked to wear light cloths as much as possible and to remove shoes and heavy objects in pockets and is instructed to stand still in the centre of the weight scale facing the recorder, hands at side, and looking straight ahead (Anthropometry Procedures Manual, 2009, p 20).

Stature (Standing Height): Standing height is an assessment of the maximum vertical size of a person. Subjects were instructed to remove hair ornaments, corn rolls etc. from the top of the head in order to measure stature properly (Anthropometry Procedures Manual, 2009, pp. 20-24).

To assess nutritional status through body mass index (BMI) and Children's tentative health categories internationally accepted BMI metric calculator (for children ≤ 18 years) provided by the 2000 National Centre for Health and Statistics was used (NCHS, 2000). Graphs were also generated by this metric calculator (Anthropometry Procedures Manual, 2009). Further statistical analysis was performed using MS EXCEL and SPSS software (15.0 Version). The student t-test was performed to trace gender base differences in each parameter and BMI. Statistical significance was set at P <0.05.

3. RESULTS

Overall (irrespective of the age) and age-based mean and standard deviation (SD) of Stature, Weight and BMI of

Henanigala children and adolescents are indicated in table 1 and 2 respectively. Table 3 represents the results of t-test performed to test gender-based differences in stature, weight and BMI.

Table 1. Range, Mean and SD of Stature (in cm and ft), Weight (in kg) and BMI of Henanigala Children and Adolescents

Gender	N	Stature (cm, ft)		Weight (kg)		BMI	
		Mean ± SD	Sig. Value	Mean ± SD	Sig. Value	Mean ± SD	Sig. Value
Girls	90	137.24 ± 14.9 (4.5 ± .48ft)	0.014*	31.63 ± 12.95	0.038*	16.04 ± 3.75	0.399
Boys	79	144.16 ± 20.27 (4.7 ± .7ft)		36.28 ± 15.58		16.53 ± 3.69	
Total	*169*	*140.47* ± 17.9 *(4.6* ± .6 *ft)*		33.8 ± 14.39		16.27 ± 3.72	

**Difference Significant at the p-value 0.05*

Table 2. Age-based distribution of mean and SD of Stature, Weight and BMI of Henanigala Children and Adolescents

Age Cat.	Girls				Boys			
	N	Stature	Weight	BMI	N	Stature	Weight	BMI
		Mean ± SD	Mean ± SD	Mean ± SD		Mean ± SD	Mean ± SD	Mean ± SD
5-8	**18**	116.9 ± 7 (3.8 ± .31 ft)	18.17 ± 2.69	13.22 ± 1.06	**10**	116.42 ± 4.5 (3.8 ± .1 ft)	20.20 ± 5.94	14.78 ± 3.18
9-11	**26**	129.4 ± 6.1 (4.2 ± .2 ft)	22.46 ± 3.36	13.39 ± 1.59	**26**	129.04 ± 7.8 (4.2 ± .3 ft)	25.35 ± 9.27	14.76 ± 3.39
12-18	**46**	149.6 ± 6.5 (4.9 ± .2 ft)	42.08 ± 9.47	18.66 ± 3.42	**43**	159.73 ± 12 (5.2 ± .4 ft)	46.63 ± 12.12	18.01 ± 3.38

Table3. Age-Based Comparative Analysis of Stature, Weight and BMI between Henanigala Girls and Boys

Age Cat.	Stature			Weight			BMI		
	t	df	*Sig. (2-tailed)*	t	df	*Sig. (2-tailed)*	t	df	*Sig. (2-tailed)*
5-8	.21	25.38	*.83*	-1.03	11.09	*.33*	-1.6	10.14	*.16*
9-11	.19	50	*.85*	-1.49	31.45	*.15*	-1.87	35.52	*.07*
12-18	-4.8	63.04	*.00**	-1.98	87	*.05*	.89	87	*.37*

**Difference Significant at the p-value 0.05*

Regardless of the gender the mean stature, weight and BMI of the Henanigala children and adolescents were 140.47 ± 17.9 cm (4.6 ± .6 ft.-), 33.8 ± 14.39 kg, and 16.27 ± 3.72, respectively. According to the t-test performed without considering the age variable, statistically significant differences in stature and weight were found between girls and boys ($p<0.05$) (Table1).

However, when the age variable was considered, statistically significant difference was found only in the stature between girls and boys that belong to the 12-18 age group ($p<0.05$). Accordingly, stature seems to be the only parameter that signifies sexual dimorphism which also occurs during the adolescent period (12-18 years) (Table 3).

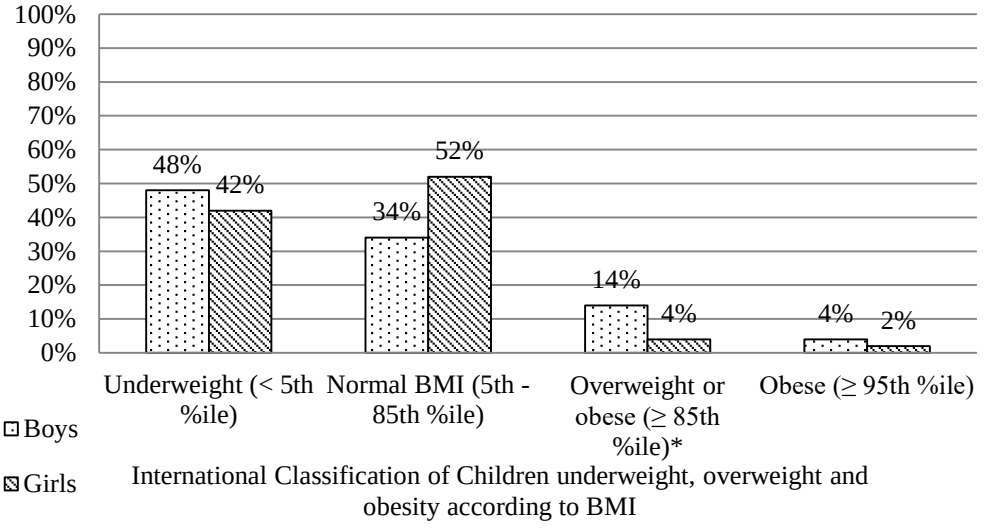

Figure 1. BMI Summary of Henanigala Children and Adolescents

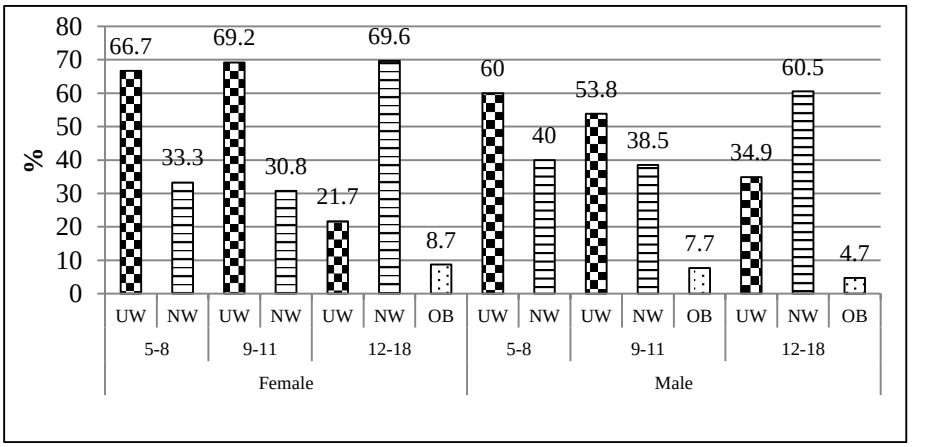

Figure 2. Age group based prevalence of Under Weight (UW), Normal Weight (NW), Overweight (OW) and Obese (OB) among Henanigala Children and Adolescents

4. DISCUSSION

Stature and weight are significant anthropometrics used in the evaluation of body mass index, which is one of the first screening methods of nutrition status of a person. Children and adolescents who have lower BMI have the risk of vitamin

deficiencies/anemia, osteoporosis due to deficiency in vitamin D and calcium, decreased immune function, fertility issues caused by irregular menstrual cycles, growth and development (mental and physical) issues etc. (Rice et al., 2000).

According to the Demographic & Health Survey (DHS) 2016 data (national context), among children under 5 years of age, 20.5% are underweight, 17% are stunted, and about 15.1% under 5 are wasted (DHS: 2016). These data indicate higher health risk which would increase with the development of age. On the other hand, the rise of the prevalence in the overweight among children and adolescents is also apparent with the development of age, which causes most of the non-communicable diseases. According to the WHO data (on Sri Lanka), nearly 5% of children aged 5-19 years are obese (WHO, 2018; Weerahewa et al; 2018). This may be due to the changing patterns of foods mostly addictions to popular foods at a young age.

However, this situation is completely differing for the Indigenous people: lives in Sri Lanka and other countries. Research conducted based on the children and adolescent indigenous people of India (tribes of the Nilgiris), Brazil etc. have shown a higher prevalence of stunting, underweight, and wasting (Reddy & Reddy, 2000; Horta et al., 2013).

Data on the stature and weight on Sri Lankan indigenous children and adolescents are scanty and only the calculated mean BMI values are available. Wikramanayake et al. has calculated Quetelet's BMI of the Vedda children of the age between 1 - 9.9 years and 10 - 18.9 years during 1971/73 (Kandeganwila) and 1993/94 (Henanigala), before and after the resettlement. BMI below 13.5 was reported for the children between 5 - 9 years of age and BMI below 15.0 for children between 13 - 18 years of age. These levels were considered as low BMI levels with chronic energy deficiencies and lower nutritional levels (Wikramanayake et al., 1994). In 1971/73, before the resettlement only 20% of the boys between the ages 1 - 9.9 years had low BMI (BMI less than 13.5) levels and the percentage with low BMI levels increased up to 63% in 1993/94; after their resettlement in the present Henanigala area. 50% of the girls in the same age group had low BMI (BMI less than 13.5) levels in 1971/73 and it had increased up to 69% in 1993/94. It was reported that Vedda children in Henanigala were in nutritionally poor condition as estimated by their BMI levels than when they were at Kandeganvila. It was suggested that resettlement to a new environment and restricted access to the forest; their prime mode of food acquisition, as the main reasons for the observed low nutritional levels (Wikramanayake et al., 1994).

In spite of having a better hygienic environment at Henanigala than at Kandeanwila, children and adolescents reported low BMI values after their relocation to Henanigala (Wikramanayake et al., 1994). At present, after many years

of their relocation into Henanigala, no visible improvement of their nutritional status could be seen even with better access to health facilities such as hospital services, village midwives and other responsible officials. Still, a higher percentage of children and adolescents in Henanigala found to be underweight. Resettlement to Henanigala during 1993/94 cause a sudden shift of their subsistence pattern from hunter-gatherer to paddy cultivation which the Vedda community was not accustomed to (which is also apparent at present), and the restricted access to forest; their main food source (mainly protein source) could account for the nutritional imbalance seen among these people (Wikramanayake et al., 1994). Adaptation and transition from hunter-gatherer to sedentary farming (from traditional lifestyle to new socioeconomic status) in between at about ten years could not enough (Wikramanayake & Wikramanayake, 1992; Wikramanayake et al., 1994). High prevalence rate of lower nutritional level currently seen among children and adolescents 38 years after resettlement demonstrate their incapability in the adaptation to new socio-economic, cultural contexts, to new subsisting patters and nutritional transition. This transition involves a shift in the diet of the population towards high protein intake to low protein intake including dairy products, fruits, vegetables and more carbohydrate meals coupled with a sedentary lifestyle. Compared to other ethnic groups of the country, cultural factors seem to have a major influence on the nutritional conditions of the Vedda people. Changing from a forest-based lifestyle and shifting to a sedentary lifestyle incorporating new religious, socio-cultural, agricultural base lifestyle must have been a cultural shock to these people (Ananda & Nahallage, 2018c). Their long isolation had not given them the adaptive strategies into rapid socio-cultural changes by the evolutionary basis.

In addition, reasons for the higher prevalence of underweight among children and adolescents were due to the poor economic status of the parents, low dietary/nutritional intake, and unawareness, low education and lesser attention of the responsible governing bodies. Most of the parents of the village are young adults between the ages of 17-25 years (some of the mothers of this study were adolescents), that got married during their adolescent period. Therefore, they were not aware of the proper dietary practices that they should follow in order to maintain their children's health status. On the other hand, though these younger mothers participate in awareness programs conducted by respective villages midwife, they do not seem to follow their advice. In addition, due to their low- income status it is not possible for the parents to provide a healthy, nutritionally balanced diet to the children. As most of the younger mothers are engaged in labor work, the grandparents look after children and infants. Thus, children are allowed to spend the day as they want and sometimes they skip staple meals.

In general, the prevalence of high rate of underweight among children and adolescents in Henanigala could directly affect their growth, mental health, education as well as their day to day activities. Undernourishment and underweights among children and adolescents have become one of the serious public health problems internationally, especially in developing countries (Singh et al., 2014). People of low socioeconomic status living in rural and remote areas were most vulnerable to being undernourished. Other factors that contribute to undernourishment are individual variation (genetic factors) and exposure to different environmental conditions. In addition, poor nutritional status among lactating mothers or pregnant females directly influences the low birth weight and nutritional deficiency in children which finally contributes to shaping the demographic structure of the population (Rice at al., 2000). Continuous observation and guidance, awareness programs, intervention of responsible governing bodies, guidance on nutritional rich foods and easy to prepare healthy meals using available food sources, providing dry food subsidies especially focusing on children and adolescents, increase the responsibility of the school over nutrition and health of children (long term) could be used to reduce high prevalence rate of underweight among children and adolescents of Henanigala.

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