Prevalence and influencing factors of BMI and effect of school based intervention among the Grade 8 Schoolchildren in Jaffna district

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Abstract

Overweight and obesity are becoming a global issue. In contrast, children living in developing countries like Sri Lanka are having problems with wasting . Understanding the status of wasting, overweight and obesity and underlying factors may help to address the issue.

The study aimed to determine the prevalence of wasting, overweight and obesity and the underlying socio-demographic and school-related correlate and effect pf school-level intervention to manage wasting, overweight and or obesity among Sri Lankan school children

A school based descriptive cross-sectional study was conducted among 836 students aged between 13-15 years studying at government schools in Jaffna district from June 2016 to November 2017. Anthropometric measurements obtained using electronic height weight machine with the precision of the instrument for height is $\leq\pm0.1$cm, and for weight is $\leq\pm0.1$kg, and the Body Mass Index (BMI) for age calculated and compared with WHO (2007) standards. Chi-square analyses performed, and odds ratios calculated in SPSS 21.

Results

Slightly males students (51.4%) were more than the female students. Majority of the students were Hindus (91.1%), and living with both parents (87.2%). The prevalence of wasting, overweight and obesity was 38.6%, 6.8% and 2.4% respectively. Having abnormal BMI was not significantly affected the participation in extracurricular activities.

High prevalence of abnormal BMI observed, and none of the school-level interventions for abnormal BMI were not useful. Hence, periodical assessment and monitoring of the school-based program might improve the outcome.

Introduction

As a transition period of the child to become adult, adolescence is a decisive period of development. The changes that happening also affect the amount and type of food intake, which has an impact on lifetime nutritional status. As and Body mass index (BMI) is the recommended simple method for diagnosing wasting, overweight and obesity. It is a measure of general health based on height and weight ratio (1). Globally, the prevalence of overweight and obesity among children and adolescents aged 5-19 has risen dramatically from just 4% in 1975 to just over 18% in 2016. The similar trend observed among the boys and girls (3).

Wasting affects more children and adolescents than obesity. The underweight population had 19.7% greater risk of cardiovascular diseases than did the normal-weight (4).

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Several factors influence the level of health in children, such as social environment, their education, personal health practices, healthy child development, and culture (3). The overweight and obese population had 50 and 96% greater risk of Cardiovascular Diseases respectively than did the normal weight (4). Schools are considered as the easy and primary platform to conduct health and nutrition intervention programs. Unfortunately, school-based programs are struggling to achieve the expected outcomes due to various constraints. Sri Lankan school-based health programs introduced in early 1918 in Colombo Municipality area and further expanded with the development of public health services of Sri Lanka. Several new components added based on the need. Limited evidence is available about the outcomes of the programme (5).

Jaffna is one of the districts Northern Province of Sri Lanka which was severely affected by the protracted ethnic conflict and recovering from the effect of the war. New developments that are taken place in the district, mostly open to the world market create new opportunities to change the behaviour and eating habits of the children, which could affect the nutritional status of the children. The aim of the study is to determine the prevalence of wasting overweight and obesity and the underlying socio-demographic and school-related correlate and effect school-level intervention to manage wasting, overweight and or obesity among Sri Lankan.

Methods

A school based descriptive cross-sectional study was conducted among 871 adolescents aged between 13-15 years studying in Grade 8, 9 & 10 at government schools in Jaffna district of Sri Lanka during June 2016 to November 2017. There are four types of school in Sri Lanka, i. e: 1

AB, 1C, 2 and 3 (1AB - school having advanced level science stream classes, 1C - school having advanced level Arts and /or Commerce streams but no science stream, 2 - schools having classes only up to grade 11, 3 - schools having classes only up to grade 8. Height and weight were measured using an electronic height weight machine. This instrument measured height between the range of 70-200cm and the weight value between the ranges of 5-250 kg. The precision of the instrument for height measurement is $\leq \pm 0.1$cm, and for weight is $\leq \pm 0.1$kg. Self-administrated questionnaire was used to collect socio-demographic factors, school level interventions and details of students' performances. Data entered to SPSS 21 for analysis purpose. The Body Mass Index (BMI) for age calculated and compared with WHO (2007) standards: Overweight: >+1SD (equivalent to BMI 25 kg/m2 at 19 years), Obesity: >+2SD (equivalent to BMI 30 kg/m2 at 19 years), wasting: <-2sd> . The bivariable analysis was done by including the Wasting, overweight and obesity as abnormal BMI category and compared with the normal BMI category (6). Chi-square test performed, and the odds ratios calculated. P-value < 0.05 considered as statistically significant, and 95% confidence intervals calculated. Ethical approval was obtained from the ethical committee of Faculty of Medicine, University of Jaffna J/ERC/15/65/NDR/0132.

Results

Socio-demographic factors of the study participants

Among the study participants, the gender ratio was almost equal to Males (51.4%) and Females (48.6%). All the children were Tamils, and the majority (91.1%) were Hindus. More than 85% of the children were living with both parents. Nearly 32% of both parents of the children had education up to G.C.E (O/L). Majority of the mothers were

housewives (77.2%), and fathers were in elementary occupation (62.7%). Majority of the children were living in a nuclear family (75.0%), living with both parents (87.2%), and living with 4- 8 nos. of family members (70.6%) (Table 1).

Table 1: Details of socio demographic factors of study participants

Socio demographic factors	Number (%)
Gender, male	430 (51.4)
Religion, Hinduism	762 (91.1)
Father's educational level	
Up to G.C.E O/L	265 (31.7)
Up to G.C.E (A/L)	154 (18.4)
Degree/diploma	92 (11.0)
Not reported	325 (38.9)
Mother's educational level	
Up to G.C.E O/L	257 (30.7)
Up to G.C.E (A/L)	224 (26.8)
Degree/diploma	108 (12.9)
Not reported	247 (29.5)
Father's occupation	
Officer & administrative	83 (9.9)
Technicians & clerk	26 (3.1)
Skilled workers	85 (10.2)
Elementary occupation*	524 (62.7)
Not identified	118 (14.1)
Mother's occupation	
Officer & administrative	96 (11.5)
Technicians & clerk	22 (2.6)
Skilled workers	4 (0.5)
Elementary occupation	69 (8.3)
House wife	645 (77.2)
Living in nuclear family	627 (75.0)
Living in home/ children's' home	729 (87.2)
Living with both parents	14 (1.7)
Living in Children's home	
Number of family members	
4	221 (26.4)
5-8	590 (70.6)
>8	25 (3.0)

Elementary occupations consist of simple and routine tasks which mainly require the use of hand-held tools and often some physical effort.

Description of facilities available in schools and students' performance

Majority of the children (94.0%) were studying in 1 AB school, and almost all the students reported that they received vitamin C (95.3%), iron (93.7%), followed by vitamin A (69.0%) and then folic acid (65.8%). More than ninety percent of the schools had school health club (94.7%) and counselling health teachers (93.1%), further majority of the students (76.6%) involved in extracurricular activities. (Table 2).

Table 2. Description of school facilities and performance of the students

School facilities and performance of the students	Number (%)
Type of school	
1 AB	786 (94.0)
1 C	37 (4.4)
2	13 (1.6)
Received iron supplementation	783 (93.7)
Received Vitamin C supplementation	797 (95.3)
Received Vitamin A supplementation	577 (69.0)
Received Folic acid supplementation	550 (65.8)
Had counseling teacher	778 (93.1)
Had a school health club	792 (94.7)
Participated in Extracurricular activities	640 (76.6)
Participated in sports meet	335 (40.1)
Participated in school sports team	404 (48.3)

Nutritional status distribution among the students

Among the study participants, the prevalence of wasting, overweight, and obesity was more than fifty percent (52.2%), while 38.6, 6.8 and 2.4% of the students were of respectively (Table 3).

Table 3. Distribution of obesity status among the study participants

Obesity Status	Frequency	Percentage
Thinness	323	38.6
Normal	436	52.2
overweight	57	6.8
Obese	20	2.4

Relationship between level of BMI and the socio-demographic factor

Table 4 shows the relationship between the socio-demographic factors and level of BMI among the participants. Among 400 students of having underweight, overweight and or obesity, males had the chance of having abnormal BMI as 1.402 times than females (odds ratio= 1.402, CI 95% 1.210-1.623) and gender got a statistically significant influence on BMI level (p< 0.001).. Almost 50% of the students from Hindu and Christian religion had abnormal BMI.

Further, the students of both parents (Father-OR1.033, 95% CI: 0.883- 1.209), (Mother-OR1.096, 95% CI:0.945-1.270) had education up to G.C.E. (O/L), had high chance of having abnormal BMI. In contrast, chance of having irregular BMI of students of fathers and mothers who were elementary workers and housewives respectively was low. Regarding rearing pattern, chance of getting underweight, overweight, and obesity had not been decreased even though the students were living with both parents, and living in nuclear families, while the student living with less than five family members had low chance of getting such abnormal BMI as mentioned in table 4.

Table 4. Relationship between the level of BMI and socio demographic factors

Socio-demographic factor	Variable	Normal BMI	Abnormal BMI	P value	Odd ratio	CI (95%)
Sex	Male	191 (44.4)	239 (55.6)	**0.000***	1.402	1.210- 1.623
	Female	245 (60.3)	161 (39.7)			
Religion	Hindu	399 (51.0)	383 (49.0)	0.698	0.980	0.771- 1.244
	Christianity	37 (50.0)	37 (50.0)			
Both parents living together	Yes	375 (51.4)	354 (48.6)	0.165	1.130	0.897- 1.423
	No	61 (57.0)	46 (43.0)			
Father's education status	Up to G.C.E (O/L)	305 (51.7)	285 (48.3)	0.369	1.033	0.883- 1.209
	Above G.C.E (O/L)	131 (53.2)	115 (46.8)			
Mother's education status	Up to G.C.E (O/L)	254 (50.5)	249 (49.5)	0.124	1.096	0.945- 1.270
	Above G.C.E (O/L)	182 (54.8)	150 (45.2)			
Type of Family	Nuclear	329 (52.4)	298 (47.6)	0.405	1.159	0.990- 1.357
	Extended	107 (51.1)	102 (48.9)			
Number of members in the family	<5	117 (52.9)	104 (47.1)	0.423	0.819	0.699- 0.959
	≥5	319 (51.9)	296 (48.1)			
Father's occupation	Officers	110 (56.7)	84 (43.3)	0.086	0.880	0.735- 1.052
	Elementary workers	326 (50.8)	316 (49.2)			
Mother's occupation	Working mothers	108 (56.5)	83 (43.5)	0.097	0.884	0.739- 1.058
	Housewives	328 (50.8)	317 (49.2)			

*- statistically significant (p< 0.050)

Relationship between level of BMI, school level interventions, and performance of students

Table 5 illustrates the relationship between BMI distribution and school type, students' performance and school-level interventions to protect the students from getting abnormal BMI. Among the students studying in 1 AB school, a majority (52.8%) were having average weight and bivariate analysis illustrated that syllabus available in Science subjects of G.C.E (A/L) in 1 AB schools protect from experiencing abnormal BMI among students as 0.814 times (Table 4). Abnormal BMI distribution was high among the students who were provided with vitamin C (OR 1.457, 95% CI: 0.929- 2.284) and folic acid (OR 1.021, 95% CI: 0.878- 1.186), while iron and vitamin A supplementation reduces the chance of getting abnormal BMI (Table 5). However, availability of school health club and counselling facility did not protect the students from getting wasting , overweight or obesity. Regarding the performance of students in school, even though the students with slightly more percentage of abnormal BMI students (48.2%) could take part in extracurricular activities compare to the participation in sports meet (47,2%) and sports team (47.5%). None of the observed difference was not significant at p-value 0.05.

Table 5. Relationship between the level of BMI, school level interventions, and students' performance.

School-related factor	Variable	Normal BMI	Abnormal BMI	P value	Odd ratio	CI (95%)
Type of school	1AB	415 (52.8)	371 (47.2)	**0.091**	0.814	0.636- 1.042
	1C & 2	21 (42.0)	29 (58.0)			
Provision of iron supplementation	Yes	404 (51.6)	379 (48.4)	0.216	0.997	0.900- 1.104
	No	32 (60.4)	21 (39.6)			
Provision of Vitamin C supplementation	Yes	410 (51.4)	387 (48.6)	0.063	1.457	0.929- 2.284
	No	26 (66.7)	13 (33.3)			
Provision of Vitamin A supplementation	Yes	301 (52.2)	276 (47.8)	0.991	0.999	0.857- 1.164
	No	135 (52.1)	124 (47.9)			
Provision of Folic acid supplementation	Yes	285 (51.8)	265 (48.2)	0.788	1.021	0.878- 1.186
	No	151 (52.8)	135 (47.2)			
Having a school health club	Yes	408 (51.5)	384 (48.5)	0.078	1.333	0.896- 1.984
	No	28 (63.6)	16 (36.4)			
Availability of Counselling teacher	Yes	401 (51.5)	377 (48.5)	0.123	1.222	0.882- 1.692
	No	35 (60.3)	23 (39.7)			
Extracurricular activities	Yes	340 (51.8)	316 (48.2)	0.392	0.940	0.78 to 1.39
	No	96 (53.3)	84 (46.7)			
Participation in sports meet	Yes	177 (52.8)	159 (47.2)	0.400	1.040	1.041- 1.366
	No	259 (51.7)	242 (48.3)			
Participation in a school sports team	Yes	212 (52.5)	192 (47.5)	0.890	1.03	0.77 to 1.36
	No	224 (51.9)	208 (48.1)			

Discussion

In this study 28.6 (n= 239) and 19.3% (n= 161) male and female students were having abnormal BMI: Overweight: >+1SD (equivalent to BMI 25 kg/m2 at 19 years), Obesity: >+2SD (equivalent to BMI 30 kg/m2 at 19 years), wasting: <-2SD, i.e. the prevalence of abnormal BMI is high among male students than females. It might be due to the self-perception of female students' body weight may influence their weight management in a healthy range. However, the finding was not supported by another study carried out among 319 nos. of Colombo school children aged 5- 15 years, 10.7 and 13.0% of male and female students were having abnormal BMI (7). However, in another study carried out in 2018 among 14 to 15-year-old schoolchildren in the Colombo education zone shared that prevalence of overweight and obesity among adolescents was revealed as 10.8% (CI 9.3-12.5) and 3.9% (CI 3.1-5.0) respectively, with no gender difference (8). Further, in another study carried out among girls aged between 14 and 19 years studying in a national school of Batticaloa, the prevalence of obesity and overweight were 5.5% and 9.4% (9). Anyhow, obesity was more prevalent in females than males and females are more vulnerable to develop obesity-related adverse health outcomes in future (10).

Living in small house, a large number of family members, low monthly income and maternal employment were significantly associated with undernutrition among school children (11). But in this current study, the living style of the students did not have a statistically significant association with BMI.

Further, Science stream students have the chance to be provided with adequate knowledge regarding healthy body weight maintenance. In this study also, the prevalence of normal BMI was high among the students who were studying in schools having advanced level science stream classes. However, the type of school did not have a statistically significant association with BMI of the students. Facilities available in schools such as counselling and health club may help the students and their parents to diagnose and treat obesity earlier. But in this study, such facilities were not sufficient to protect the students from becoming obese .

Nutrient deficiencies may contribute to fat deposition, and vitamin A and C are significantly lower in obese persons when compared to healthy individuals. In this current study, More abnormal BMI was recorded among the students who received vitamin C. Further, iron deficiency is a common finding among obese patients (12) and folate levels might be influenced by metabolism alteration, which can occur in obesity (13). But in this study, iron supplementation was effective for protection from abnormal BMI distribution, while folic acid supplementation was not useful to reduce abnormal BMI among students. However, no statistical significant association was found between supplementation of nutrients and obesity status.

Having abnormal BMI is one of the factors that could affect the performance of school-aged students (14). However, in this current study, among the students took part in extracurricular activities and sports meet, the incidence of abnormal BMI was high.

It's agreed with one of the study carried out among students aged 5- 15 years studying in Negombo schools where prevalence of obesity identified by body fat content was high and reported that as validity of internationally developed anthropometric cut- offs in South Asian children is unsatisfactory; locally regionally developed anthropometric tools should be used for screening of obesity (15). Further, South Asian countries face a double burden of malnutrition characterized by high prevalence of underweight, overweight, and obesity. Understanding the distribution of this public health problem is important to tailor targeted interventions for communities (16)

Conclusion

Nearly 47.2% of the children in the schools have abnormal BMI. None of the school-based interventions was adequate to change the problem. Hence, relevant stakeholders should take appropriate inter-

ventions at the school level to reduce the prevalence of thinness, overweight and or obesity among the school students for their better future.

Abbreviations: (G.C.E O/L)- General Certified Examination/ Ordinary Level, (G.C.E A/L)- General Certified Examination/ Advanced Level, SPSS- Statistical Package for Social Sciences, CI- Confidence Interval, BMI- Body Mass Index

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Conflicts of Interest

There are no conflicts of interest

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