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Dietary Diversity among Adolescents Aged 11 – 13 in the City of Colombo, Sri Lanka

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ABSTRACT

Dietary diversity is considered a key indicator in assessing access, utilization and quality of diet and lack of dietary diversity is strongly associated with an inadequate intake of essential micronutrients. A cross-sectional study was conducted to determine the dietary diversity among adolescents aged 11-13 in the city of Colombo. A sample of 634 subjects was recruited using the multistage stratified cluster sampling technique. A three-day diet diary was used to collect types and quantities of food items consumed. The dietary diversity score was determined based on Food and Agriculture Organization nine (9) food groups and the food variety score was calculated by a simple count of the number of food items consumed in a single day. Socio-demographic data were gathered using a general questionnaire and height, weight and waist circumference were measured. Household food security status data were gathered using the United States Department of Agriculture 18-item questionnaire. The mean (±SD) dietary diversity score was 4.36 (±1.28) and the mean food variety score was 9.69 (±2.82). Dietary diversity score and food variety score were high among boys and adolescents in national schools who were food secure. Percentages of adolescents who consumed Vitamin A and Iron rich foods were 41.1 % and 78.2 % respectively. The dietary diversity of adolescents aged 11-13 years in the city of Colombo is adequate and categorized as medium dietary diversity.

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INTRODUCTION

Micronutrient malnutrition remains a public health problem in most developing countries, including Sri Lanka, partly due to monotonous, cereal-based diets that lack diversity (Malkanthi *et al*., 2009). Dietary diversity is considered a key indicator in assessing the access, utilization and quality of diet and is also a proxy for nutrient adequacy of the diet of individuals (Hailemariam *et al*., 2018). Studies have also shown that an increase in dietary diversity is associated with household food security (Hoddinott and Yisehae, 2002) and lack of diversity in the diet is strongly associated with inadequate intake and risk of deficiencies of essential micronutrients such as Vitamin A, Iron and Zinc (Wiesmann *et al*., 2010). Adolescents are more prone to micronutrient malnutrition as they are in the phase of accelerated growth and development.

In Sri Lanka, the use of dietary diversity as an indicator of adequate nutrient intake remains under evaluation. The city of Colombo, the capital of the country is in rapid urbanization and nutrition transition in which the diet has changed to an energy-dense diet lacking micronutrients. Thus, it is vital for studying the dietary diversity of adolescents to understand the nutrient adequacy of their diet. Even though the energy intake of adolescents had been studied in the city of Colombo, no previous study has been conducted to assess the diversity of their diet. Therefore, this study was conducted in the city of Colombo to determine the dietary diversity of adolescents.

METHODOLOGY

Study sample

A cross-sectional study was conducted in the city of Colombo using a sample of 634, 11-13 year adolescents. Subjects were recruited using the multistage stratified cluster sampling technique. The first stage was the administrative district (1, 2A, 2B, 3, 4 and 5), the second stage was the type of school (national and provincial schools) and the third stage was the school category (Sinhala, Tamil, Sinhala & Tamil and Muslim). A proportionate sample of subjects in each stratum was drawn for the study and all the adolescents in a randomly selected single classroom were selected. Subjects who were unhealthy and living away from the house were excluded from the study.

Data collection

Dietary diversity

A self-administered three-day diet diary was used to collect types, quantities and methods of preparation of foods consumed by the subjects during three consecutive days, including two week days and one weekend day.

Socio-demographic characteristics

A general questionnaire was self-administered to the mother or guardian of the subject, which included information on ethnicity, gender, date of birth, family size, level of education of mother, occupation of parents, household monthly income and living area of the household.

Household food security status

The household food security status of the subjects was measured using the translated form of the validated 18-item scale of the USDA Household Food Security/ Hunger Survey Module questionnaire (Gary *et al*., 2000). The translated questionnaire was self-administered to the mother or guardian of the subject with a reference period of the past 12 months from the date of administration of the questionnaire.

Anthropometric data

Standing height, weight and waist circumference were measured according to the standard procedures. Height was measured using a Seca portable stadiometer 217 (SECA, Hamburg, Germany) to the nearest 0.1 cm of accuracy and the weight was measured to the nearest 0.01 kg of accuracy using a Seca 874 electronic weighing scale (SECA, Hamburg, Germany). Further, waist circumference was measured to the nearest 0.1 cm of accuracy using a Seca 201

circumference tape (SECA, Hamburg, Germany).

Ethical clearance

Ethical clearance for the study was obtained from the Ethical Review Committee of the National Institute of Health Sciences. Written consent was obtained from the mother or guardian of each subject in the study setting before data collection.

Data analysis

Dietary diversity

The dietary diversity was determined using two indicators of dietary diversity, i.e. dietary diversity score and food variety score. Three-day self-administered diet diaries were used to calculate the dietary diversity score of the subjects. The dietary diversity score was determined using Food and Agriculture Organization (2013) 09 food groups specified for children and adolescents. The 09 food groups were 1. Starchy staples 2. Dark green leafy vegetables 3. Other Vitamin A-rich fruits and vegetables 4. Other fruits and vegetables 5. Organ meat 6. Meat and fish 7. Eggs 8. Legumes, nuts and seeds 9. Milk and milk products (FAO, 2013). A simple count of the number of food groups among the above nine (9) food groups consumed in a single day was calculated and the mean value of three days was used as the dietary diversity score. The food variety score was calculated using a simple count of food items consumed in a single day and the mean value of three days was used as the food variety score.

Socio-demographic data

All the socio-demographic characteristics of the subjects were converted into percentage values.

The family size was categorized into three levels as "below 5", "between 5-8" and "above 8"; household living area was categorized into three levels as "below 126.46 m^2", "126.46-252.90 m^2" and "above 252.90 m^2". In addition, parental occupation was categorized into six as "No", "Labourer", "Self-employment", "Non-Executive", "Executive" and "Abroad".

Nutritional status

Body Mass Index (BMI) was calculated using the current standing height and body weight of the subject (BMI = Weight (kg)/Height^2 (m^2). Height–for-Age and BMI– for–Age of the subjects were determined using age and sex-specific WHO growth charts developed for children aged 5-19 years in Sri Lanka (Family Health Bureau, 2014) and following WHO cut-off values were used to determine the current nutritional status of the subjects. Height–for–Age ≤ -2 SD as "stunted"; Height–for–Age > -2 SD as "normal height"; BMI– for– Age ≤ -2 SD as "wasting"; BMI–for–Age between -2 SD to +1 SD as "normal weight"; BMI–for–Age between +1 SD to +2 SD as "overweight" and BMI –for–Age > +2 SD as "obese" (WHO, 2020). The Waist-to-Height ratio was calculated (waist/height) and if the ratio ≥ 0.5, classified as "abdominal obesity present" and if the ratio < 0.5, classified as "abdominal obesity absent."

Household food security status

According to the USDA Household Food Security/ Hunger Survey Module, affirmative responses were assigned as "1" and negative responses were assigned as "0". The summation of all the affirmative responses was used to determine the household food security status of the subjects. Household food security status was categorized into four levels based on affirmative responses as follows: 0-2 - "food secure"; 3-7 - "food insecure without hunger"; 8-12 - "food insecure with moderate hunger" and 13-18 - "food insecure with severe hunger."

Statistical analysis

Mean values of dietary diversity score and food variety score were determined. The differences in mean dietary diversity score and food variety score of the subjects by gender, type of school, administrative district, nutritional status and household food security status were compared using the 2-independent sample t-test and ANOVA (analysis of variance) at the significant level of 0.05. All the statistical analyses were performed using statistical software, SPSS version 21 (SPSS Inc., Chicago, IL) statistical package.

RESULTS AND DISCUSSION

Socio-demographic characteristics of the subjects

The study cohort consisted of 336 boys (55.4 %) and 270 girls (44.6 %) and the socio-demographic characteristics of the subjects are summarized in Table 1.

The majority of the cohort represented the ethnic group, Sinhalese (55.4 %). The mean (±SD) age was 12.13(±0.36) years. Further, the majority of the subjects had a household monthly income of LKR 25,000-LKR 50,000 (32.3 %) representing a family size of 5-8 (56 %) members and the mean (±SD) household living area of 232.27 (±362.42) m^2 with the majority were below the living area of 126.46 m^2 (50.5 %). The majority of the mothers of the subjects had gone through Advanced Level (28.9 %) and were not occupied (68.2 %), whereas the majority of fathers were self-employed (38.8 %).

Table 1. Socio-demographic characteristics of the subjects

Characteristic		[n]	Percentage (%)
Ethnicity	(n=513)		
Sinhalese		284	55.4
Tamil		77	15.0
Muslim		149	29.0
Other		03	0.6
Family size	(n=384)		
Below 5		142	37.0
Between 5-8		215	56.0
Above 8		27	7.0
Household monthly income	(n=387)		
Below LKR 25 000		101	26.1
Between LKR 25 000 – 50 000		125	32.3
Between LKR 50 001 – 75 000		67	17.3
Between LKR 75 001 – 100 000		50	12.9
Above LKR 100 000		44	11.4
Household living area	(n=325)		
Below 126.46m^2		142	50.5
Between 126.46 m^2 - 252.90 m^2		73	26.0
Above 252.90 m^2		66	23.5
Maternal occupation	(n=390)		
No		266	68.2
Labourer		09	2.3
Self-employment		18	4.6
Non - Executive		66	16.9
Executive		26	6.7
Abroad		05	1.3
Maternal education	(n=388)		
No schooling		07	1.8
Grade 1 - 5		23	5.9
Grade 6 - 10		80	20.6
Ordinary Level		87	22.4
Advanced Level		112	28.9
Diploma / Degree		79	20.4
Paternal occupation	(n=390)		
No		15	4.2
Labourer		55	15.2
Self-employment		140	38.8
Non - Executive		61	16.9
Executive		83	23.0
Abroad		07	1.9

Dietary diversity score

The mean (±SD) dietary diversity score of the subjects was 4.36 (±1.28) out of the total score of 9.0 (n=313) and subjects were categorized as medium dietary diversity (FAO, 2013). Further, dietary diversity was adequate (above dietary diversity score - 4). The mean dietary diversity score of the subjects by gender, type of school, administrative district, nutritional status, and household food security status is summarized in Table 2.

The daily diet of boys was more diverse than girls and subjects studying in national schools had a significantly higher mean dietary diversity score (4.85±1.01) compared to that of subjects studying in provincial schools (3.65±1.30) ($p<0.05$). Further, the diet was less diverse and inadequate in diversity in adolescents who were food insecure with hunger compared to food secure adolescents ($p<0.05$). There was no significant difference in dietary diversity scores among subjects in different administrative districts and different categories of nutritional status ($p>0.05$).

Table 2. Mean dietary diversity score of the subjects by gender, type of school, administrative district, nutritional status and household food security status

Difference	[n]	Mean	± SD
Gender[1]			
Boys	177	4.57	± 1.26
Girls	136	4.10	± 1.27
School type[1]			
Provincial	127	3.65	± 1.30
National	186	4.85	± 1.01
Administrative district[2]			
1	38	3.78	± 1.40
2A	44	3.52	± 1.16
2B	23	3.09	± 1.42
3	121	4.94	± 1.04
4	13	4.45	± 1.01
5	74	4.60	± 0.98
Height – for – Age[3]			
Stunting	9	4.04	± 1.48
Normal height	267	4.34	± 1.23
BMI – for - Age[2]			
Wasting	38	4.34	± 1.36
Normal weight	155	4.32	± 1.24
Overweight	53	4.31	± 1.25
Obese	31	4.58	± 1.11
Waist : Height ratio[3]			
Abdominal obesity present	129	4.38	± 1.29
Abdominal obesity absent	163	4.35	± 1.25
Household food security status[4]			
Food secure	174	4.61	± 1.14
Food insecure without hunger	70	4.17	± 1.23
Food insecure with moderate hunger	21	3.92	± 1.34
Food insecure with severe hunger	5	3.27	± 0.98

[1] Significantly different by 2- independent sample t test ($p< 0.05$); [2] No significant difference by analysis of variance ($p>0.05$); [3] No significant difference by 2- independent sample t test ($p>0.05$)+[4] Significantly different by analysis of variance ($p< 0.05$)

Hence, the diet was more diverse in 11-13 year adolescents in the city of Colombo compared to children 5–18 years from farming households in Sri Lanka. This could be due to the high affordability of foods in 11-13 year adolescents in the city of Colombo compared to this rural farming community. Our study had higher dietary diversity among girls compared to adolescent girls in Ethiopia (Handiso *et al*., 2020). In contrast, the current study had lower dietary diversity than Indian adolescents, irrespective of gender (Nithya and Bhavani, 2017). The diet consumed by boys was more diverse compared to that of girls in our study and it was similar to the findings of an Indian study in which adolescent boys were more likely to consume nutritious foods compared to girls (Aurino, 2017). This could be due to the cultural effect of better feeding of the male gender in the Sri Lankan society and their higher affordability of foods due to higher household monthly income compared to girls. Further, the majority of provincial school adolescents represented low-income households, in contrast, the majority of national school adolescents represented affluent society. This may cause higher dietary diversity among adolescents in national schools than in provincial schools.

Consumption of food groups

The consumption of food groups by adolescents aged 11-13 years in the city of Colombo is shown in Figure 1.

More than half of the adolescents consumed starchy staples, other fruits and vegetables, meat and fish, legumes, nuts and seeds as well as milk and milk products. The food groups consumed by below 30 % of the adolescents were eggs, Vitamin A-rich fruits and vegetables, dark green leafy vegetables and organ meat.

The percentages of adolescents who consumed Vitamin A and Iron rich foods were 41.1% and 78.2% respectively. The low intake of Vitamin A leads to Vitamin A deficiency and therefore, 11-13 year adolescents in the city of Colombo are at risk of developing night blindness, bitot spots, infections and xerophthalmia (WHO, 2021).

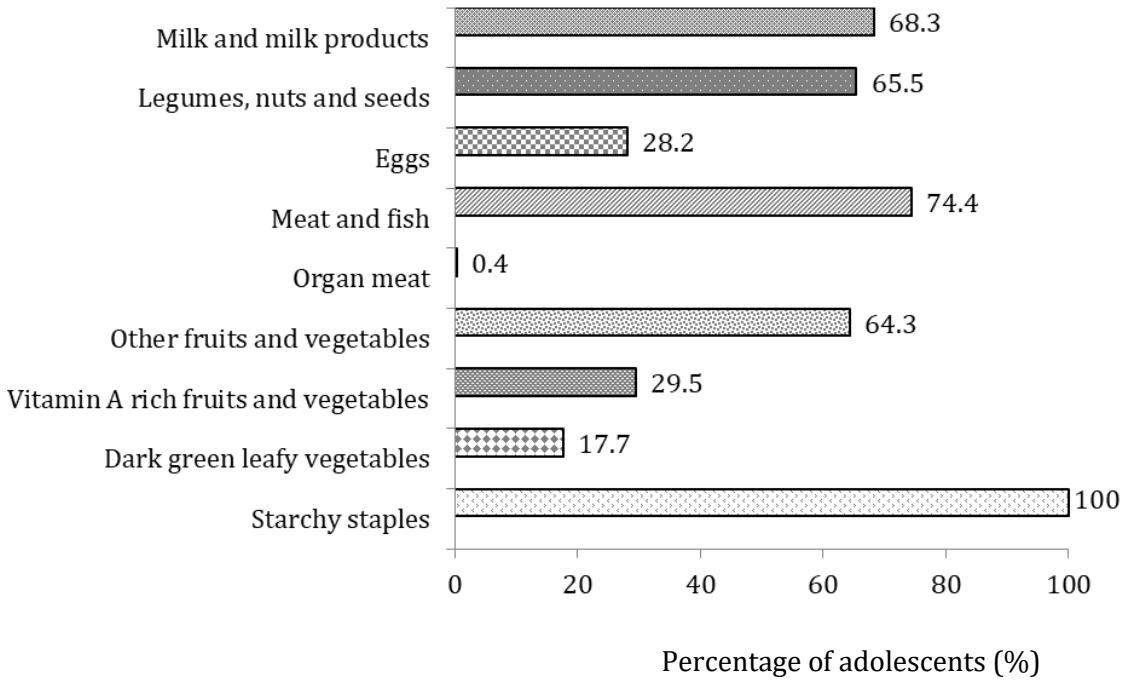

Figure 1. Consumption of food groups by adolescents aged 11-13 years in the city of Colomb0

In our study, consumption of Vitamin A-rich foods was relatively low and the consumption of dark green leafy vegetables (17.7 %) and yellow color fruits and vegetables (29.5 %) were lower than the national figure (dark green leafy vegetables - 37.7 %; yellow color fruits and vegetables – 40.1 %) of adolescents aged 10-18 years (Jayatissa *et al*., 2019). Consumption of eggs by adolescents aged 11-13 years in the city of Colombo (28.2 %) was greater than that of the national value (19.4 %) of adolescents aged 10-18 years (Jayatissa *et al*., 2019). Whereas, consumption of milk and milk products (68.3 %) and legumes, nuts and seeds (65.5 %) by 11-13 year adolescents in the city of Colombo were below the national values (milk and milk products – 73.8 %; legumes, nuts and seeds – 68.6 %) of adolescents aged 10-18 years (Jayatissa *et al*., 2019). This could be due to the low affordability of fruits, vegetables, milk and legumes as they are relatively high in cost and the majority had 5-8 members in the family.

Food variety score

The mean (±SD) food variety score of the subjects was 9.69 (±2.82) per day (n=313). The mean (±SD) food variety score of the subjects by gender, type of school, administrative district, nutritional status, and household food security status is summarized in Table 3.

Table 3. Mean food variety score of the subjects by gender, type of school, administrative district, nutritional status and household food security status

Difference	[n]	Mean	± SD
Gender[1]			
Boys	177	10.16	± 2.85
Girls	136	9.08	± 2.66
School type[1]			
Provincial	127	8.60	± 2.71
National	186	10.44	± 2.65
Administrative district[2]			
1	38	8.04	± 2.67
2A	44	8.42	± 2.81
2B	23	9.81	± 2.77
3	121	10.53	± 2.84
4	13	9.42	± 2.22
5	74	9.93	± 2.39
Height – for – Age[3]			
Stunting	9	9.00	± 3.39
Normal height	267	9.54	± 2.79
BMI – for – Age[4]			
Wasting	38	10.04	± 3.00
Normal weight	155	9.52	± 2.80
Overweight	53	9.41	± 2.76
Obese	31	9.52	± 2.90
Waist : Height ratio[3]			
Abdominal obesity present	129	9.75	± 2.77
Abdominal obesity absent	163	9.60	± 2.90
Household food security status[2]			
Food secure	174	10.13	± 2.78
Food insecure without hunger	70	9.16	± 2.65
Food insecure with moderate hunger	21	9.20	± 2.71
Food insecure with severe hunger	5	6.62	± 1.13

[1] Significantly different by 2 - independent sample t test ($p< 0.05$); **[2]** Significantly different by analysis of variance ($p< 0.05$); **[3]** No significant difference by 2 - independent sample t test ($p>0.05$); **[4]** No significant difference by analysis of variance ($p>0.05$)

Boys had significantly higher mean (±SD) food variety score (10.16±2.85) than girls (9.08±2.66) and adolescents studying in provincial schools had significantly lower mean (±SD) food variety score (8.60±2.71) than adolescents studying in national schools (10.44±2.65) ($p<0.05$). Moreover, considering the household food security status, the lowest food variety score was reported among adolescents who were food insecure with severe hunger (6.62±1.13) ($p<0.05$). The highest food variety in the diet was reported in administrative district 3 (10.53±2.84), while the lowest was reported in administrative district 1 (8.04±2.67) ($p<0.05$). There was no significant difference in food variety score by nutritional status ($p>0.05$).

In our study, adolescents in the city of Colombo had higher food variety score than children aged 5-18 years (7.7±2.3) in a rural farming community in Sri Lanka (Malkanthi *et al*., 2009) and the food variety score of South African children (5.5±2.5) (Steyn *et al*., 2006). The highest food variety score was reported among boys, in national schools, in administrative district 3 and among food secure adolescents. This could be due to the influence of the male gender and greater household food expenditure on higher food variety score (Badari *et al*., 2012). According to our study, the lowest food variety was observed among adolescents who were food insecure with severe hunger and this could be due to greater family size and lower household monthly income (Abu and Soom, 2016).

CONCLUSIONS

The diversity of the diet consumed by adolescents aged 11-13 years in the city of Colombo is adequate and categorized as medium dietary diversity.

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