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Journal of Nutritional Health & Food Engineering

Research Article

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Diet quality, social determinants and weight status among Mauritian children aged 10 to 12years

Abstract

Diet quality may be influenced by social determinants and by weight status. The cross-sectional study investigated whether diet quality as assessed by Healthy-Eating Index-2010 differs by social determinants (gender, ethnicity, socio-economic status, parent's level of education, geographical area of residence and school type) and by weight status among children in Mauritius. A convenient sample of 212 participants was involved in the study from 6 different schools. Dietary assessment was done via a single 24HR dietary recall and diet quality was assessed by using the HEI-2010. BMI was calculated using anthropometric measurements. The overall mean HEI score was 68.6 and the majority of children were found to be undernourished though having a normal weight. Higher scores for Dairy and Empty calories were reported and lower score for Total Fruit. Geographical area of residence was the only social determinant found to affect diet quality (p=0.027) with rural residents having higher mean HEI score as compared to urban residents as per the results of an Independent Sample t-test. Weight status was not affected by any social determinants. Obese children had significantly lower HEI score than normal weight children (p=0.001). Unhealthy eating habits are highly prevalent among Mauritian children and their overall diet needs improvement.

Keywords: diet quality, social determinants, weight status, HEI, children mauritius

Volume 5 Issue 2 - 2016

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Received: October 19, 2016 | **Published:** November 08, 2016

Abbreviations: HEI, healthy eating index; BMI, body mass index; SE, socio-economic; C-PAQ, physical activity questionnaire for older children; FAS, family affluence scale; SD, standard deviation

Introduction

Childhood is a critical stage characterized by rapid growth and development and is highly influenced by nutrition. Childhood obesity is the most common form of malnutrition and is a strong predictor of adult obesity and risk factors for many chronic diseases such as cardiovascular diseases, cancers and premature death.[1]The increasing prevalence of childhood obesity is caused by multiple factors such as the complex interactions between genetic and environmental factors.[2] 8.5% of boys and 7.8% of girls aged between 5 to 11years have been found to be obese (National Plan of Action for Nutrition 2009-2010, p2). Undernutrition affects 24.3% of children from the same age group indicating that the young Mauritian population is afflicted by the double burden of malnutrition.

Unhealthy eating habits during childhood hinder optimal growth and development.[3,4] Children tend to eat foods that are readily available and easily accessible. Current eating pattern do not correspond to the usual, habitual pattern of consuming at least breakfast, dinner and a single snack at home with lunch carried to school.[5] There is a decline in breakfast consumption and an increase consumption of energy-dense foods.[6–8] In addition, social determinants may play significant role in understanding diet-related behaviours. Viswanath & Bond[6] reported that residents living in areas with poor access to healthy foods have more fat in their diet and are more prone to be overweight. Relative to socio-economically advantaged families, children from socio-economically disadvantaged families were more likely to be overweight,[7] cited Simen-kapeu and Veugelers.[8] Similarly there is also evidence showing that lower educational status of parents is related to lower diet quality including higher fat and lower micronutrients intake in children.[6,4] Thus the study determined whether diet quality differs by social determinants and by weight status in Mauritian children aged 10 to 12years.

Methods and materials

Using a convenient sampling method a total of 212participants were involved in the study comprising of roughly equal number of boys and girls. Students aged between 10 to 12years were included in the study, belonging to both urban and rural regions and children suffering from any acute diseases or disabilities were excluded. Data were collected during the academic year 2014-2015 in 6educational institutions which were based on the 4 educational zones of Mauritius. A sample of about 40students was taken from each school and only those who returned a signed parental consent forms were allowed to participate in the study.

Socio-demographic data, physical activity level and anthropometric measurements

Gender, age, ethnicity, parent's level of education, type of school and geographical area of residence were self-reported. Socio-economic level was obtained by using the Family Affluence Scale II which is a valid and reliable indicator of family wealth that can be easily reported by the youth. A composite FAS score is calculated for each student based on his or her responses to 4 items (car, bedrooms, vacation and computers). Low socio-economic (SE) group was classified as having scores 1, 2, and 3, medium SE group of 3, 4 and 5 and high SE group of 6, 7, 8 and 9.[9]

The Physical Activity Questionnaire for older children (PAQ-C) was used as a measure of physical activity level since it is more appropriate and measures moderate to vigorous physical activity

levels during the schoolyear and uses small indices such as lunch and evening cues to enhance the recall ability of children.[10] The PAQ-C used during the course of this study was a modified version of the original one comprising of 5 questions based on the regular physical activity of the children. An activity score between 1 and 5 is assigned for each item. Once a value from 1 to 5 is obtained for each of the 5 items used in the physical activity composite score, the mean of these 5 items is simply taken resulting in the final PAQ-C activity summary score. A score of 1 indicates low physical activity while a score of 5 indicates high physical activity.[11]

Children's weight was measured without shoes, with all pockets emptied, wearing only light clothing nearest 0.5Kg using an electronic balance. Their height was measured with a measuring tape and a ruler while standing straight against a wall perpendicular to the floor. BMI was then calculated to one decimal place and classified according to the cut-off points of BMI percentile distribution published by the CDC and Prevention.

Dietary assessment

Dietary intake was obtained using a single 24hr-dietary recall whereby children were asked to list all foods and beverages consumed for the past 24 hours, starting with the most recent meal. Estimation of portion sizes was done using standard measuring cups.

Diet quality assessment

Food groups and nutrient intake data obtained from the recall were used to assess diet quality using the Healthy Eating Index-2010 (HEI-2010) which is a measure of diet quality in terms of conformance to the Dietary Guidelines for Americans. The HEI-2010 has 12 components comprising of 9 adequacy components and 3 moderation components. Most components are weighed equally at 10points. Fruits and vegetables and protein foods have 2 components (a total and a subgroup) that are allocated 5points each. Empty calories is allotted 20 points because the added sugars, solid fats and alcohol that make up this component contribute to excess calories and may displace nutrient dense foods from the diet. For all components, higher scores indicate closer conformance with dietary guidance. The further intakes are from the standards, the lower the score.[12] The total HEI score is a set on a standard scale from 0-100 with diet quality increasing with numerical value. A total score greater than 80 is considered "good", a score ranging from 51-80 indicated as "needs improvement" and a score less than 51 is considered "poor".[13]

Energy intake was calculated by referring to the different food groups from the USDA National Nutrient Database for Standard Reference. Classification of energy intake based on the different physical activity level of the children was estimated by comparing with the guidelines set by the AHA for daily estimated calories, Table 1.[14]

Statistical analyses

All statistical analyses were conducted using the statistical packaged for social sciences (SPSS) version 20. Statistical tests used as follows:

i. Chi-square test for independence ($\chi 2$ test) (non-parametric) to determine the relationship between social determinants and weight status, influence of social determinants on PAL and dietary habits

ii. Pearson correlation (parametric) to investigate the relationship between diet quality and energy intake

iii. Independent-sample t-test (ISTT) (parametric) to determine the relationship between diet quality and social determinants and diet quality and weight status.

Table 1 shows the mean±standard error for the HEI-2010 total and components scores for Mauritian children aged 10-12yrs (n=212)

HEI components	Maximum score
Mean HEI score	68.6±14.5
Total Fruit (5pt)	1.78±3.11
Whole Fruit(5 pt)	2.09±3.73
Total Vegetables (5pt)	2.13±2.27
Greens and Beans (5pt)	1.33 ±2.58
Whole Grains(10pt)	6.75 ±2.78
Dairy (10pt)	9.65±5.85
Total Protein Foods (5pt)	4.83±2.08
Sea-Food and Plant Proteins (5pt)	0.612±1.94
Fatty Acids (10pt)	3.07±5.42
Refined Grains (10pt)	5.06±7.90
Sodium (10pt)	0.578±1.39
Empty Calories (20pt)	7.22±8.49

Results and discussion

Out of the 212 participants, the majority aged 10years old and there were more females (54.2%) than male (45.8%). The majority of participants came from public school, lived in rural areas and was from middle SE group. Lower scores for Total Fruit, Whole Fruit, Total Vegetables, Greens and Beans and Seafood and Plant Proteins were reported. Mauritian children's mean scores met the maximum levels for Dairy (9.65±5.85) and Total Protein Foods (4.83±2.08). Both food groups are among the most popular food consumed by children. Every child's breakfast comprised of dairy products and meat and pulses as Total Protein Foods either as lunch or dinner as disclosed by the 24hr dietary recall. Scores for empty calories were below half of the maximum score which means higher intake. Empty calories in the form of junk foods and fizzy drinks were highly consumed by the children. Maximum score was obtained for Dairy and the mean HEI score were 68.6 implying that the diet of Mauritian children needs improvement.

No significant differences were found between diet quality and the social determinants analyzed except for geographical area of residence. The differences in diet quality between male and female participants were found to be insignificant (p=0.693).[15] Pointed that sex differences in diet may be related to weight issues that may arise during preadolescence. One possible explanation for the negative relationship among Mauritian children could be that the majority aged 10years (75.9%) and might not have reached the period of preadolescence.

Citation: Bahadoor BA, Toorabally BZ, Subratty AH. Diet quality, social determinants and weight status among Mauritian children aged 10 to 12years. *J Nutr Health Food Eng.* 2016;5(2):600–604. DOI: 10.15406/jnhfe.2016.05.00168

According to the results of an ISTT, differences in diet quality and geographical area of residence were significant (p= 0.027, two tailed) clearly showing that participants living in rural areas had a higher mean HEI score (mean=70.0) than those living in urban areas (mean=65.1). In addition, differences in the HEI components such as Greens and Beans, Fatty Acids, Refined Grains and Empty calories were also noted and it was observed that urban residents had a higher mean score of Refined Grains that rural residents as shown in Table 2:

One possible explanation for the difference in diet quality could be that food in rural areas is no longer a problem of availability and accessibility, supermarkets and grocery stores are found in every region of the island.

Table 2 Differences in diet quality as seen by geographical area of residence

Components	Geographical area	Mean±SD	Sig.(2 tailed value)	Mean difference	95% C.I
Greens and Beans	Urban	0.805±2.05	0.064	-0.734	-1.51 to 0.420
	Rural	1.54±2.74			
Fatty Acids	Urban	1.69±4.22	0.021	-1.91	-3.53 to -0.291
	Rural	3.61±5.74			
Refined Grains	Urban	7.37±8.19	0.008	3.19	0.842 to 5.55
	Rural	4.17±7.62			
Empty calories	Urban	4.33±5.76	0.002	-4.02	-6.54 to -1.51
	Rural	8.35±9.11			

No relationship was established between the type of school and diet quality. On the other hand, conforming to a study conducted by Yabanci,[16] it was observed that children from public schools had higher scores for Total Vegetables, Total Fruits but lower scores for Whole grains and milk compared to children from private schools. They also explained that the differences in diet could be related to SES since parents with low and middle incomes send their children to public schools.[16] To our findings, it can be deduced that irrespective of their type of school, Mauritian children bear the same dietary pattern Insignificant differences were found between mother's level of education and diet quality in terms of total HEI score and the score for each component. It goes undenying to the fact that mothers are role models and help in shaping their children's eating behavior.[17] Stated that educational status of the mother is known to influence children's eating behavior since it is believed that mothers with a high level of education have a good nutritional knowledge which is positively related to the diet of their children.

Ethnicity does not influence diet quality (p=0.803 for comparison between Indo-Mauritian and Afro-Mauritian, p=0.202 for comparison between Indo-Mauritian and Sino-Mauritian). One possible explanation could be that the eating pattern of almost all Mauritian children are the same since they follow the typical Mauritian diet comprising of rice as staple food, for a higher score for Whole Grains was reported. However differences in the way of eating among different cultures do exist such as the prohibition of the consumption of pork among Muslims and beef among the Hindus which is not investigated by the current study. To date, there is no available published study pertaining to diet quality and ethnicity in Mauritius and no comparison could be made with other studies since Mauritius is a multi-ethnic country. Similarly, the social determinants analyzed did not influence weight status. Any statistical difference could be reported between gender and BMI (p=0.139). However, Children aged 11 and 12years were more likely to be overweight than children aged 10years. One possible explanation could be attributed to the beginning of biological growth and development which is signified by the onset of puberty. Multiple biological changes occur during puberty including sexual maturation, increases in height and weight, increase in skeletal mass as well as changes in body composition which could not be determined by BMI.[18]

Deshmukh, et al.,[19] Hypothesized that early maturing girls are more likely to be obese than non-early maturers and according to her results, early sexual maturation was positively associated with overweight and obesity but the associations for boys were reverse. Early maturing boys were thinner whereas early maturing girls were fatter. . Hence, maturation status should be taken into consideration when assessing childhood obesity.

SES does not influence PAL according to the results of the study (p=0.764). On the other hand, it is reported that PAL among rural participants is higher than their urban counterparts (p=0.012).

Relationship between diet quality and weight status

Results from an ISTT revealed significant differences in the total HEI scores between participants of normal weight and obese participants. Obese participants had a lower HEI score (60.7±11.3) than participants having normal weight (70.2±14.4), (p=0.001). Differences could be observed in different components of the HEI such as Total Fruit and Empty Calories, with obese participants having a lower score for Total Fruit than normal ones but on the contrary, normal weight participants had a higher score for Empty Calories than obese participants as shown in Table 3. Breakfast skipping was common among the low SE group (42.6%) as compared to high SE group (13.2%) and the differences were statistically significant (p=0.046). The strength of association between the variable is high (phi=0.170, Cramer's V=0.170).

Breakfast skipping has been shown to affect diet quality (p <0.001) with 77.8% of participants who skipped breakfast having a poor diet as compared to diet of non-breakfast skippers (22.2%). In addition, breakfast skipping has been shown to affect diet quality

with the majority of breakfast skippers having a poor diet (77.8%) as compared to non-breakfast skippers (22.2%). Pearson et al.,[14] argued that breakfast consumption is important to overall diet quality and nutritional adequacy in school-aged children. Children reporting to eat breakfast on a regular basis tend to have better nutritional profiles than their breakfast skipping peers[20] cited Deshmukh et al.,[15] also pointed that breakfast skippers were less likely to meet the daily recommendations for food groups such as vegetables and fruits[20] or may tend to eat more foods low in nutrients or with higher energy density[21] or may consumed increased numbers of discretionary energy at other meals during the day.

Of the participants who completed the recall, 2 participants whose energy intake was below 500Kcal were excluded since only 1 meal was reported. Similarly there were many cases of over-reporting whereby some of the children ate 5 cups of fried noodles as breakfast. Some children had difficulty in remembering what they ate during the past 24hr while others feel shy to reveal their food consumption. Some were even bullied by peers while revealing their intake though the study was conducted discretely. The majority aged 10years since children aged 11years were not available most of the time for the survey due to the preparation for CPE exams. Self-reporting of physical activity might have introduced bias. In addition, Single 24HR recall does not provide a true estimation of dietary intake due to day-to-day variation. Hence, it does not represent the usual habitual intake of children.

The study design could have been improved by increasing sample size by involving more schools per educational zone, widening the age groups of participants for better comparison between the variables, recording the birth weight as well as parents' weight which could give an indication about stunting or wasting and use of multiple 24hr recall to have better estimation of energy intake.

Table 3 Differences in HEI components among normal and obese participants

Components	BMI classification	Mean±SD	Sig.(2 tailed value)	Mean difference	95% C.I
Total fruit	Normal	2.35±3.47	0.017	1.61	0.291 to 2.93
	obese	0.738±1.89			
Empty calories	Normal	8.12±8.53	0.003	5.04	1.78 to 8.30
	obese	3.08±4.99			

Conclusions

The majority of Mauritian children was found to be undernourished but had normal weight. Their diet need improvement since the consumption of junk food was highly prevalent. Among the series of social determinants analyzed, geographic locale had an influence on diet quality. SES appeared to induce major differences in diet quality and weight status as noticed in other studies but in this context, SES fail to establish any relationship in dietary pattern and BMI. Regular visits of nutritionists at schools are vital in order to constantly monitor the diet of children. Furthermore, talks should be conducted regularly on health and nutrition education, highlighting on the importance of the consumption of fruits and vegetables and breakfast. Though the sales of sweetened beverages have been banned at schools, constant monitoring of the sale of food sold at the school canteen is important, focusing mainly on hygiene and the sale of fried and fatty foods. Healthy alternatives for junk foods should be available. Physical activity should be highly promoted though it forms part of the school curriculum. Children should be helped on how to make effective time management so as to include physical activity as part of their daily routine. Additional research is needed to better understand influences of social determinants on diet quality and weight status during childhood and adolescence.

Acknowledgements

None.

Conflict of interest

Author declares that there is no conflict of interest.

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Citation: Bahadoor BA, Toorabally BZ, Subratty AH. Diet quality, social determinants and weight status among Mauritian children aged 10 to 12years. *J Nutr Health Food Eng.* 2016;5(2):600–604. DOI: 10.15406/jnhfe.2016.05.00168