Heliyon

Received:
23 April 2017
Revised:
27 December 2017
Accepted:
12 February 2018

Cite as: Digvijayini Bundhun, Sillma Rampadarath, Daneshwar Puchooa, Rajesh Jeewon. Dietary intake and lifestyle behaviors of children in Mauritius. Heliyon 4 (2018) e00546.
doi: 10.1016/j.heliyon.2018.e00546

Dietary intake and lifestyle behaviors of children in Mauritius

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Abstract

The purpose of the study was to explore the dietary intake, fruit, vegetable and energy intake and lifestyle behaviors among Mauritian children. A validated questionnaire was used, assessing dietary intake, mean energy intake, mean body mass index (BMI), lifestyle behaviors as well as nutritional knowledge (NK) among males and females. 336 children aged 6−12 years (165 males and 171 females) from 8 public primary schools were recruited. Statistical analyses revealed that children consumed less nutritious foods such as fruits, vegetables and whole grains and more of refined and calorie-laden foods, with no significant differences across genders. Mean energy intake of children was 1522 ± 282.4 kcal per day while mean BMI was 17.5 ± 4.03 kg/m^2. Majority of children had a low-to-moderate physical activity level (PAL), with males being more active than females on average ($P = 0.021$). 88.7% of children watched TV for more than an hour daily, with 84.8% of them reporting to be eating during the process. Females were more likely to be breakfast skippers ($P = 0.003$). Maximum frequency of snacking was twice daily (72.7%) while consumption of fast food was once or twice weekly (44.0%). Results indicate the need for intervention with aim of improving the dietary and life quality of children in Mauritius.

Keywords: Public health, Nutrition, Food science, Health sciences

https://doi.org/10.1016/j.heliyon.2018.e00546

1. Introduction

Healthy eating generally has a strong participative role in the overall state of well-being and it is the basis for health, growth and development of children [1]. A child's health is largely determined by his eating habits and health behaviors adopted during childhood are known to track into adulthood [2]. Intake of adequate macro- and micro-nutrients in the recommended amount is also the basis for healthy nutrition among children. Energy intake, however, is increasing while micronutrient consumption is declining [3]. In other words, calorie-dense, less nutritious foods are occupying large and disproportionate space of children's plate while intake of nutrient-rich, high-fiber foods such as fruits and vegetables (FV) is within suboptimal range [4].

Children are growing in an obesogenic environment where presence of FV in the diet is less appreciated [5]. FV come in a plethora of color, flavor and shape and are naturally packed with vitamins, minerals and antioxidants such as vitamin C, E, carotenoids, flavonoids and other phytochemicals, which have been found to protect against incidence of chronic diseases [6]. Fruit and vegetable consumption (FVC) also ensures high fiber consumption which is a key player in the prevention and reduction of non-communicable diseases as well as constipation, a common problem among children [7]. Evidence suggests that if FVC starts right from childhood, it will culminate into good dietary habits in the long run [8]. The United States Public Health Service has recommended that the 5-A-DAY recommendation, sponsored by the National Cancer Institute and concerned food industry representatives, be applied to children 2 years and above as well along with adults, for whom the campaign was originally designed [9].

Physical activity, a component of utmost importance which aids nutrition in the energy-balancing equation while simultaneously enhancing intellectual and motor skill of children, is equally strongly encouraged by health advocates [10]. Physical activity guidelines [11, 12] stipulate that children should get at least 60 minutes of moderate-to vigorous-intensity physical activity daily. Play, games, sports, recreation, physical education or structured exercise are essential in a child's familial, school and community life [11]. Published studies, though, have recently noted a drop in physical activity level (PAL) among children [13, 14, 15]. A rise in sedentary behavior among children has accompanied this drop in PAL [16]. A large number of children devote more time to television (TV) viewing than ever before. A close association between this sedentary activity and childhood weight gain has been reported [17]. An increase in TV viewing has equally resulted in more calorie intake through snacking before the small screen, especially those unhealthy foods which are most regularly advertised [18, 19].

https://doi.org/10.1016/j.heliyon.2018.e00546

A simultaneous rise in snacking frequency has also recently reported to be a major health concern. In particular, the increasing number of snacking episodes has not been compensated by a reduction in the size or energy density of the snacks, indicating towards additional daily caloric intake from the snacks [20]. Besides, the support and role modeling children usually receive from their family, neighborhood as well as school is declining [21, 22] and this is directly impact on their dietary behavior.

With its gradual emergence to be one of the flourishing economic hubs in the African region and with a ranking of 46 out of 140 economies in the latest edition of the World Economic Forum Global Competitiveness Report [23], Mauritius has also been observed to have one of the highest percentage prevalence of non-communicable diseases (NCDs) among children, with 7.9% and 8.5% for overweight and obese males of 5−11 years respectively and 7.5% and 7.8% correspondingly for females, according to a survey conducted in 2004 [24]. Furthermore, the same report revealed that 30.7% of children did not eat any fruit daily. Data on vegetable consumption, BMI and energy intake are almost inexistent. Latest surveys [25] reported statistics for children and adolescents 13−15 years. The objectives of this study are:

(i) To determine the dietary lifestyle of Mauritian children below 13 years and how it differs between genders.

(ii) To assess fruit and vegetable as well as energy intake among children and to determine the predicting factors.

(iii) To investigate the sedentary behavioral lifestyle of children.

2. Materials and methods

2.1. Sampling and participants

The study used a three-level stratified sampling method. Firstly, only primary school-going children were chosen. Then, only Government primary schools were chosen. Finally, among the Government ones, the Zones of educational priority (ZEP) schools were excluded. The reason for the exclusion of the private and ZEP schools lies in the fact that children are often given lunch, unlike the public schools. After a sample size was calculated using the "Small-Sample Techniques" from the research division of the National Education Association [26], 354 participants from eight schools from all four educational zones were approached and encouraged to participate to avoid bias on geographical location. Approximately equal number of males and females were chosen to avoid gender bias and allow for comparison. Participants aged between 6 and 12 years old. Children were excluded if they were wearing plasters, taking medications, suffering from diseases such as influenza or on weight-related (gain or loss) therapy.

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2.2. Setting

Data collection took place between May and July 2016. After approval was given by Ministry of Education and appropriate authorities, every school was contacted and permission was sought for sampling. Parents of every child received a detailed written letter describing the nature, purpose and procedures of the study and they were asked to indicate whether they agreed to allow their children to participate. Confidentiality of data was assured. Only 336 parent (out of 354) agreed to participate in the study and questionnaires were distributed to them. Initially, pilot testing was conducted among 17 children to ensure that participants understood the terminology used in the questionnaires. Post testing, two questions from the nutrition knowledge and three from the physical activity sections were modified. A question, based on the socio-economic status of the participants' household was removed since several participants were reluctant to answer. Furthermore, it was considered right to choose a majority of children 10 years of age, since the younger ones experienced a level of difficulty in understanding certain questions while the older ones were busy with the Certificate of Primary Education (CPE) examinations and thus, were mostly reluctant to participate.

2.3. Questionnaire design

The questionnaires, consisting of mostly close-ended questions, included demographic variables and a food frequency questionnaire (FFQ) designed and adapted from the Nutritional Epidemiology group at Leeds University [27] in order to gather data on children's dietary pattern. 58 food and beverage items were included and classified under the headings: Grains & Tubers, Beans & Pulses, Meat, poultry & eggs (processed version included), Seafood (processed version included), Soybean & soy products, Milk & dairy products, Fruits, Vegetables, Snacks high in sugar, salt and fat and finally, Sugar sweetened beverages (SSBs). Participants could select from 7 frequency categories for each FFQ item and scores were allocated as shown in Table 1 [28].

Table 1. Food frequency scores.

Frequency	Score
Never or less than once per month	0
Monthly	0.033
Twice per month	0.08
Once per week	0.14
2−3 times per week	0.5
Once daily	1
2−3 times daily	2

NHANES. 2008 [28].

https://doi.org/10.1016/j.heliyon.2018.e00546

The demographic data were related to the age, gender and residential area of children as well as parents' employment status. Questions on eating habits included breakfast, snacking and fast food frequency. Two questions on fruit intake as well as vegetable intake were incorporated to assess whether children thought they were being forced to consume fruits and vegetables by parents. Physical activity level (PAL) was assessed using questions modified from The Physical Activity Questionnaire for Older Children (PAQ-C) and Adolescents (PAQ-A) by Kowalski et al [29]. 9 items were included. An activity score between 1 and 5 for each item included in the PAL section was calculated and the final PAQ-C score was summarized by taking the mean of the 9 items. Low physical activity level was indicated by a score of 1, moderate by 2−4 while a score of 5 indicated high physical activity level. Other questions focused on the number of hours spent watching television (TV) and using electronic gadgets and the types of foods items consumed during TV viewing.

Questions on nutritional knowledge (NK) were adapted from Parmenter and Wardle [30] as well as the textbooks used in Mauritian primary schools. A score of 1 was allocated for a good answer and 0 for a wrong answer or "Not sure". A total of 26 marks were ascribed. The total score was divided into tertiles, with the lowest one receiving a "low NK", the medium one "moderate NK" and the highest one given "high NK". Anthropometric measurements (height and weight) of all participants were taken by the same investigator, using the same instruments to avoid any error bias. CDC BMI-for-age percentile growth charts [31] were used to obtain percentile ranking in order to locate the weight status of the children. BMI-for-age weight status was classified under 4 percentile ranges as shown below (Table 2).

A 24-HR diet recall, adapted from the EPIC-Norfolk nutritional methods [32] was designed and used to assess energy intake of participants. The latter were asked to report everything that they had eaten and drunk on the previous day. The amount consumed and time of the day were also noted. The second and third 24-HR recalls were taken through telephone. The total calorie consumption per day in Kcal culminating to total energy intake was calculated from data obtained in Food Composition Table, compiled from the Tanzania Food Composition Table [33] as Mauritius lacks an established Food Composition Table 3-day recalls were performed to reduce any under or misreporting errors. Mean energy intake for the three recalls was calculated and subsequently used for statistical analyses.

Table 2. BMI-for-age weight status.

Weight status category	Percentile range
Underweight	Less than the 5th percentile
Healthy weight	5th percentile to less than the 85th percentile
Overweight	85th to less than the 95th percentile
Obese	Equal to or greater than the 95th percentile

CDC. 2014 [31].

https://doi.org/10.1016/j.heliyon.2018.e00546

Table 3. Distribution of participants' profiles.

Demographic characteristics		Male (n = 165) (n)	Female (n = 171) (n)	Total (n = 336) % (n)
Age (years)	6	5	2	2.1 (7)
	7	11	7	5.4 (18)
	8	13	7	6.0 (20)
	9	17	27	13.1 (44)
	10	97	111	61.9 (208)
	11	19	16	10.4 (35)
	12	3	1	1.2 (4)
Area of residence	Urban	10	18	8.3 (28)
	Rural	153	155	91.7 (308)
Parent's employment status				
	None works	0	0	0
	Only one works	52	48	29.8 (100)
	Both work	124	112	70.2 (236)

n = number of participants.

2.4. Ethical approval

Ethical approval was granted by the University of Mauritius Research Ethic Committee.

2.5. Statistical analyses

After every questionnaire was assigned to a subject identification number, data were analyzed by the Statistical Package for the Social Science (SPSS) version 20.0. Categorical variables were expressed as percentages. Independent sample t-test were used to assess and compare food consumption of each food group from the FFQ, mean BMI and mean calorie intake between genders. Pearson's correlations were computed to show predictive relationships between different variables both by controlling and not controlling for gender. Multiple regression analysis was used to predict fruit and vegetable as well as energy intake from independent variables (demographic factors, eating habits, TV viewing and nutritional knowledge), with age being controlled for. A P-value <0.05 was considered statistically significant.

3. Results

3.1. Demographic characteristics

336 children participated in the study, of which 171 (50.9%) were females. Table 3 shows the profiles of the participants based on their age and area of residence. The

https://doi.org/10.1016/j.heliyon.2018.e00546

majorities of children were 10 years of age (61.9%) and lived in the rural region (91.7%). 70.2% of children came from households where both parents were bread-earners.

3.2. Dietary pattern

In general, there was a regular intake of grains and tubers, dairy products, fruits and vegetables as well as snacks laden with salt, sugar and fat among the participant group.

Consumption of soya beans only differed significantly between males and females ($P = 0.005$), as shown in Table 4.

3.3. Mean body mass index and calorie intake

The mean BMI of the children ranged in the normal category (55.4%) and was reported to be 17.5 ± 4.03 kg/m^2 while the average calorie intake was 1522 ± 282.4 kcal per day, with no major differences between genders for either mean BMI or calorie intake.

Table 4. Consumption frequency of food items from each food group.

Food group	Gender	Mean ± SD	Results of ISTT[a]		
			Sig (2-tailed)	*Mean difference*	*95% CI*
Grains and tubers	Male Female	3.55 ± 1.72 3.74 ± 1.76	0.875	−0.194	[−0.567, 0.180]
Beans and pulses	Male Female	0.71 ± 0.57 0.68 ± 0.57	0.904	0.024	[−0.099, 0.147]
Meat, poultry and egg (processed version included)	Male Female	0.66 ± 0.55 0.65 ± 0.57	0.796	0.014	[−0.107, 0.134]
Seafood (processed version included)	Male Female	0.42 ± 0.50 0.44 ± 0.52	0.401	−0.020	[−0.130, 0.089]
Soya beans and soy products	Male Female	0.29 ± 0.79 0.18 ± 0.24	**0.005***	0.108	[0.015, 0.232]
Milk and Dairy products	Male Female	2.59 ± 1.66 2.39 ± 1.56	0.514	0.199	[−0.146, 0.544]
Vegetables	Male Female	3.77 ± 2.00 3.86 ± 1.94	0.692	−0.091	[−0.513, 0.332]
Fruits	Male Female	2.86 ± 1.81 3.09 ± 1.84	0.479	−0.238	[−0.630, 0.154]
Snacks high in sugar, salt and fat	Male Female	3.36 ± 2.47 3.21 ± 2.67	0.557	0.157	[−0.396, 0.709]
Sugar Sweetened Beverages	Male Female	1.27 ± 0.93 1.28 ± 0.97	0.992	−0.003	[−0.207, 0.201]

*Statistically significant relationship (0.01).

[a] ISTT: Independent Sample t test Controlling for age.

https://doi.org/10.1016/j.heliyon.2018.e00546

3.4. Lifestyle behaviors

3.4.1. Physical activity level

The majority of participants had a low-to-moderate PAL (Fig. 1). Additionally, a significant difference was found between the genders, with males having a higher average PAL than females ($P = 0.021$).

3.4.2. Television (TV) viewing and electronic use

88.7% of the study population watched TV daily for more than an hour, with both males and females spending similar amount of time before the screen. Additionally, 84.8% of children reported about consuming at least something while watching TV. To determine what type of foods they usually consumed, the children were given a list of choices. The findings are presented in Table 5.

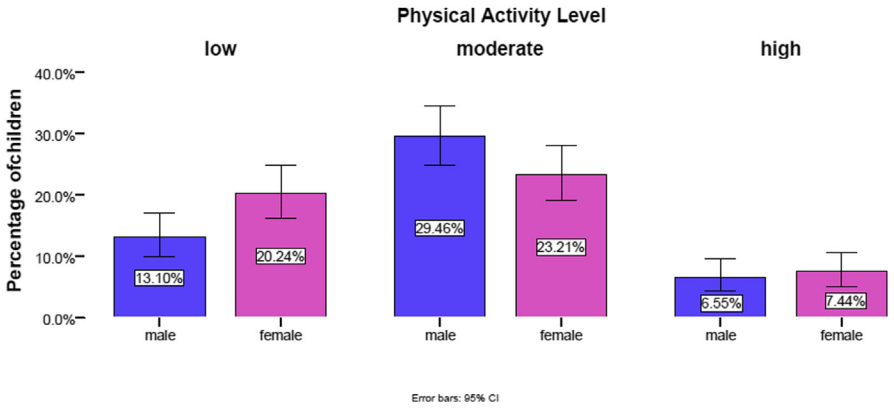

Fig. 1. Physical activity level of children.

Table 5. Types of foods consumed during TV viewing.

Types of food eaten in front of TV	Total (n = 336) %	Male (n = 165) %	Female (n = 171) %	Results of χ^2 test	
				χ^2 value	P value
Sugar Sweetened Beverages (SSBs)	68.8	66.6	70.7	0.655	0.480
Meal	59.8	57.0	62.5	1.097	0.318
Fruits	46.4	48.5	44.4	0.551	0.512
Dairy products	45.5	**52.7**	**38.5**	6.761	**0.012***
Pastries, cakes and cookies	44.3	49.1	39.7	2.595	0.100
Sweet food items	25.6	31.0	20.4	5.642	0.060
Fried foods	14.9	13.8	15.7	1.217	0.544

*Statistically significant relationship (0.05).
Numbers in bold represent the most significant difference between males and females for types of foods consumed during TV watching.

https://doi.org/10.1016/j.heliyon.2018.e00546

68.8% of children consumed sugar sweetened beverages during TV viewing while 59.8% took their meals. The sole significant difference between the genders was indicated by the consumption of dairy products which was higher among males than females ($P = 0.012$).

Contrary to TV viewing, most children were less conversant with technological devices since 82.4% spent less than an hour for no more than 4 times a week with any electronic gadget. No difference was observed between the genders.

3.4.3. Breakfast, snacking and fast-food frequency

84.2% of children were observed having their breakfast daily. Amongst the 15.8% of participants skipping the main morning meal, 11.0% were females ($P = 0.003$). Additionally, the minimum number of times children snacked everyday was none (6.5%) while the maximum frequency was thrice (20.8%). The majority of participants, however, snacked twice daily (72.7%) with no difference between males and females. 44.0% of children consumed fast foods once or twice a week while 32.7% reported to buying fast foods once or twice per month. Again, no significant difference between males and females was found.

Furthermore, a Pearson product−moment correlation found no major relationship between the breakfast and snacking frequency of children in general.

The correlation between snacking and fast food frequency on its part was significant ($P = 0.000$) and it was observed that an increase in fast food frequency among children led to a drop in the frequency of snacking ($r = -0.215$). Such was the case for both males ($P = 0.027$) and females ($P = 0.001$).

3.5. Nutritional knowledge

A high nutritional knowledge was reported in the Mauritian childhood population (53.3%). Males and females equally had a comprehensive level of knowledge pertaining to nutrition, though females were more likely to score higher than males (Fig. 2).

3.6. Fruit and vegetable (FV) consumption

The Pearson product moment correlation revealed a significant positive relationship between fruits and vegetables consumption. As the intake of fruits increased among the study population, vegetable consumption equally increased ($P = 0.000$). Both males ($r = 0.406$ and $P = 0.000$) and females ($r = 0.522$ and $P = 0.000$) who increased their fruit intake also consumed more vegetables than those who ate fewer fruits. A particular factor promoting FV consumption was the nutritional knowledge of the children. A linear regression model indicated that the higher the nutritional

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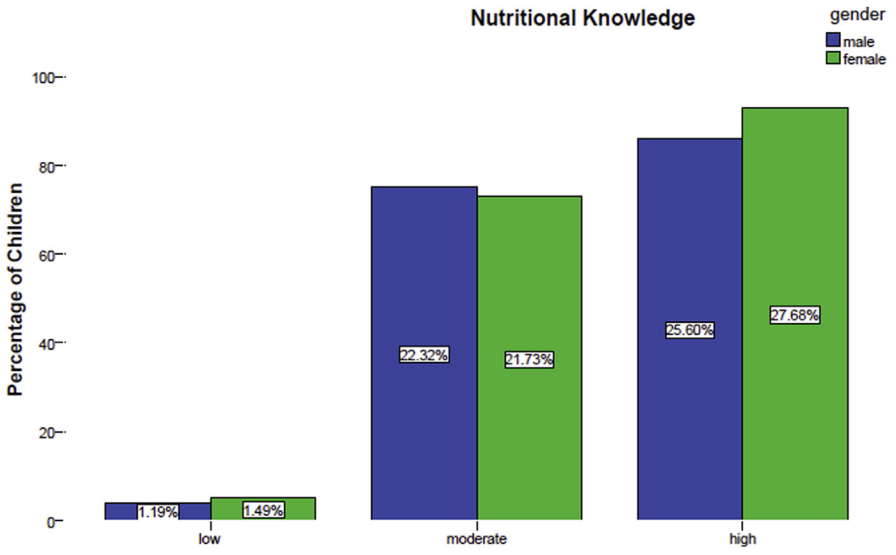

Fig. 2. Nutritional knowledge of children.

knowledge, the more children consumed fruits or vegetables, especially the fruits ($P = 0.018$) as illustrated in Table 6.

A correlation between nutritional knowledge and FV intake, differentiating between gender, found that children with higher knowledge pertaining to nutrition did consume more FV, and females tended to eat more vegetables ($P = 0.046$). The latter equally consumed lesser fast foods ($r = -0.243$ and $P = 0.001$). Moreover, when asked if parents forced them to eat FV, a higher percentage of males reported in the affirmative contrary to females (Table 7). A peculiar finding noted was that males who ate more FV also had a higher BMI (fruits, $P = 0.05$ and vegetables, $P = 0.043$). Other factors such as age, breakfast, snacking or fast food frequency as well as TV viewing did not have any significant effect on FV intake among children (Table 6).

Table 6. Influences on FV consumption.

		Variables						
		Gender	**Age**	**Breakfast frequency**	**Snacking frequency**	**Fast food frequency**	**Nutritional knowledge**	**TV viewing**
Fruits	B	0.224	−0.155	0.191	0.065	0.098	0.434	0.214
	P value[a]	0.269	0.093	0.493	0.442	0.312	**0.018***	0.503
Vegetables	B	0.143	−0.134	−0.352	−0.077	−0.028	0.327	0.353
	P value[a]	0.514	0.180	0.241	0.400	0.788	0.099	0.307

*Statistically significant relationship ($p < 0.05$).

[a] Multiple linear regression controlling for age.

https://doi.org/10.1016/j.heliyon.2018.e00546

Table 7. Forced to eat FV by parents.

		Yes (%)	No (%)	*P value*
Forced to eat fruits by parents	Male	**29.5**	19.6	0.125
	Female	26.2	24.7	
	Total	55.7	44.3	
Forced to eat vegetables by parents	Male	**31.8**	17.3	0.368
	Female	30.4	20.5	
	Total	62.2	37.8	

Numbers in bold represent % of males reporting about being forced to consume fruits and vegetables by parents, being higher than that of females, even if not significantly different.

3.7. Calorie consumption

An increase in calorie intake among the childhood populace occurred as children grew older ($P = 0.011$) as shown in Table 8. Then, both a Pearson correlation and multiple linear regression model revealed a significant negative relation between snacking frequency and calorie consumption (Pearson correlation: $r = -0.149$, $P = 0.006$; Regression: $P = 0.013$) while a significant positive one between TV viewing and calorie intake (Pearson correlation: $r = 0.152$, $P = 0.005$; Regression: $P = 0.006$). Such observations were primarily made in the female population. The higher amount of time females spent before the screen, a further rise in calorie intake occurred ($r = 0.234$ and $P = 0.002$). Interestingly, in the same population, a higher calorie consumption did not occur due to or result in higher snacking frequency ($r = -0.184$ and $P = 0.016$). Additionally, the higher the BMI of the children, equally was the calorie consumption ($r = 0.114$ and $P = 0.037$) and it did not differ between gender. Calorie intake was not affected by gender, FV consumption, breakfast intake or NK (Table 8).

4. Discussion

The present study attempted to assess the dietary pattern, fruit and vegetable consumption status and current energy intake as well as cross-behavioral practices

Table 8. Influences on calorie intake.

Variables	B	P value[a]
Gender	−53.942	0.079
Age	35.559	**0.011***
Fruit intake	−1.925	0.838
Vegetable intake	−7.517	0.388
Breakfast intake	26.915	0.523
Nutritional Knowledge	27.975	0.313
TV viewing	133.159	**0.006****
Snacking frequency	−31.513	**0.013***

*Statistically significant relationship (0.05); **Statistically significant relation (0.01).
Numbers in bold represent the significant p values.
[a] Multiple linear regression Controlling for age.

https://doi.org/10.1016/j.heliyon.2018.e00546

among children in Mauritius and how they varied across gender. On average, dietary pattern of children was indicative of an unsatisfactory lifestyle. Children regularly consumed foods from all food groups but not in the recommended amount. In addition, males were found to consume more food of protein sources, including soya beans and soy products ($P = 0.005$, Table 4). Which nutrients nourish the body depends on the food choices of people and these, in turn, are highly influenced by gender differences [34]. Females, as compared to their male counterpart, have often been observed to naturally choose a dietary lifestyle consisting of real and healthy foods, while equally making an effort to follow it [35]. Contemporary societies are, however, exaggerating the importance of ideal body image, pushing this same population to start opting a strict dietary pattern for thinness [36] while, surprisingly at the same time, forcing males to become more muscular [37].

Both males and females, who consumed fruits in the study, also consumed vegetables more regularly than those who did not. Such observation was primarily made in those children having a higher nutritional knowledge (Table 6). The more the children were conversant with information pertaining to nutrition, the higher the intake of fruits and vegetables in their diet. Our result corroborates those of Grosso *et al.* [38] as well as Slavin and Llyod [7] who equally reported a higher intake of fruits and vegetables among children with higher nutritional knowledge. However, in our study, participants with higher nutritional knowledge also had greater preference for fruits. This most likely indicates that taste may be a stronger determining factor than nutritional knowledge [39]. Fruits are naturally sweeter than vegetables. Children find them 'sweet', 'juicy' or 'fun to eat' contrary to vegetables which are 'bitter', 'ugly', 'boring' or 'horrible' to eat [40]. Vegetable consumption was higher only among females who also ate their fruits and vegetables without coercion from parents as compared to their male counterparts (Table 7).

The mean energy intake of children in the present study was 1522 kcal per day. Males had a mean intake of 1547 kcal, while females consumed 1498 kcal daily. This mean intake of calorie among both genders was close enough to the dietary recommendation set by the American Heart Association [41] which recommends an energy intake of 1400−1800 kcal per day for males 4−13 years and 1200−1600 kcal for females of similar age group daily. An average energy consumption of 1970 Kcal/per for males and 1740 kcal/day for females has been estimated by the European Food Information Council [42]. Hebestreit *et al.* reported that European children had a daily mean intake of 1511 kcal, with the foods having an energy density of 1.3 kcal/g [43]. American children have on their part, recently increased their energy intake according to national data, with males consuming 2422 kcal and females, 2118 kcal daily [44]. Furthermore these studies as well as our study also observed that as children grow older, their mean energy intake increases (Table 8). An increase in calorie intake among older children may be natural since as children grow, they require additional calories to cater for their

https://doi.org/10.1016/j.heliyon.2018.e00546

physiological needs [45]. However, another possible explanation for this rise in energy intake could have been a change in the diet composition. An increasing age is often accompanied by the consumption of more energy dense and nutrient poor foods [46]. Boylan et al [47], however, reported a gradual improvement in the intake of healthier foods such as fruits and vegetables by older children over the years. Further observation in our study revealed an inverse relationship between the snacking frequency and mean calorie intake, especially among the females (Table 8). This could imply that when children snacked more, they did not consume calorie-dense foods or their frequent snacking episodes caused a drop in the calorie intake during main meals [48]. The amount of time spent in TV viewing, nevertheless, was associated with a rise in mean energy intake among children in the study as shown in Table 8.

Majority of the children (88.7%) in the present study watched TV for more than an hour daily and a high percentage of them reported to regularly consume at least something during this lapse of time (Table 5). Sugar sweetened beverages (SSBs) and meal intake topped the list of dietary items consumed. This may imply that children usually watch TV during mealtime, which may be accompanied by a regular intake of SSBs. Eating meals before the small screen has already been associated with an increase in BMI in children [49]; accompanying the meals with SSBs only increases the risk of weight complications further because of their high caloric load. It was equally observed, gender-wise, that males consumed dairy products at a higher frequency than females ($P = 0.012$). Our findings corroborate with those of other studies [50, 51] where males consumed dairy products more regularly than females. This may have resulted from promotional messages disseminated by the media [52, 53], which suggest that males are easily influenced by food commercials, especially if male characters are used as models in the promotional strategy [54]. Overall, TV viewing has time and again been reported to mislead children into making unwise decisions [55, 56], indulge into higher calorie intake which eventually lead to a rise in BMI [57].

The mean BMI of most of the children (55.4%) in the current study tracked on the normal BMI-for-age percentile. According to Baker and co-authors [58], however, even a slight weight gain which could not yet have placed children above the cutoff point for overweight or obesity on growth charts (that is, BMI is between 50th and 85th percentile), increased the risk for metabolic complications. Therefore, BMI and the growth pattern of children need to be closely monitored.

Breakfast, snacking and fast food frequency have been known as strong influencers of dietary behaviors. More than 80% of children took their breakfast daily and among those who skipped this meal, females ranked first ($P = 0.003$). This behavior was quite contradictory for a female population who had a higher nutritional knowledge than males (Fig. 2). Such observation indicates that children are not always

https://doi.org/10.1016/j.heliyon.2018.e00546

successful in connecting food choice with health and that they possess more declarative knowledge (they are aware of things) than procedural understanding (they do not know how to apply the knowledge gained) [59]. Omission of breakfast is often associated with a deterioration of diet quality since such children put on to snacking episodes and the foods they eat are in accordance to taste rather than nutrition, implying that sweet, salty and fatty foods are chosen in preference to healthier ones [60]. In our study, most of the children consumed two snacks per day. In both cases, the snacks were of poor quality as demonstrated by the FFQ. A plausible reason for such poor snacking behaviors could be attributed to the environment surrounding the children. A home environment with exposure of unhealthy foods [61] as well as the most available competitive calorie-ladden products [53] in school canteens and at sales points near schools, which are within financial reach of children do not give the latter the opportunity to make healthier snack choices [62]. Intake of fast food is another growing issue around the world for all age groups [63, 64]. In our study, most children (44.0%) consumed fast foods once or twice weekly. Besides, a negative relationship was found between snacking and fast food frequency among the participants. This plausibly infers that the amount and quality of fast food consumed could potentially displace snacking episodes on the day children consumed them. The increasing portion size as well as high amount of carbohydrates and fats found in fast foods could have induced satiety in children, who, in turn, may have not felt hungry enough for a snack [65], thereby, reducing the chance of having some healthier alternatives.

Findings also revealed that children fail to abide by the recommended level of physical activity for their age (Fig. 1), with reasons plausibly being the growing outdoor insecurity [66] and homework load of children [67]. Gender-based analysis showed that males had higher average PAL than their female counterparts ($P = 0.021$). Males are usually more keen than females to participate in both structured (physical education classes at school) and unstructured (extracurricular) activities [68]. While structured exercises may significantly improve PAL of females [69], often, their low participation rate may be associated with levels of comfort. In Mauritius for instance, most schools do not have separate changing rooms for PE classes. Females are required to change into their sports clothing either in their classes or restrooms. This might not be encouraging for them. Besides, PE classes are not examinable in Mauritian public primary schools, which may have been another reason for low interest in physical education and activity not only among females, but the study population in general. Another yet important consideration vis-à-vis PAL among children is their home environment [70]. A more sedentary atmosphere is less likely to encourage children into increasing their PAL and consequently, this may potentially result in weight gain over time [71]. Moreover, the finding that males eating more fruits had higher BMI may be accounted by the fact that they may have come from families with higher socio-economic status

https://doi.org/10.1016/j.heliyon.2018.e00546

which required them to complement their academic studies with private tuitions, thereby, spending less of their time in physical activities [72]. Finally, the results obtained on the physical activity behavior eliminated any assumption that children having a normal weight were active enough. Normal and underweight children may, similar to the overweight or obese ones, not engage in sufficient activity [73]. Normal weight status for the children may thus have been accounted for by other factors.

Major limitations of the current study are as follows: (i) the sample of children chosen may not represent the whole Mauritian childhood population since the majority of participants were 10 years of age; (ii) usual and long term dietary habits may not be represented by a 3-Day food recall; (iii) total energy expenditure, resting metabolic rate and thermal energy were not considered while calculating energy intake of children.

5. Conclusions

Results of this study agree with the fact that nutrition transition over the past years has encouraged the consumption of foods with poor nutritional quality, even among children, who equally do not adhere by the recommended level of physical activity. Overall, no major difference was found between males and females in the context of dietary and sedentary lifestyle. Our results are of practical relevance. Outcomes of this study may help health professionals into tailoring interventions so that desired health-related outcomes are achieved. Future studies can implement nutrition education among children and involve parents as well as schools since both play crucial roles in shaping children's lifestyle.

Declarations

Author contribution statement

Rajesh Jeewon, Digvijayini Bundhun: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Sillma Rampadarath, Daneshwar Puchooa: Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Funding statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

https://doi.org/10.1016/j.heliyon.2018.e00546

Competing interest statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

Acknowledgements

The University of Mauritius and the Department of Health Sciences are acknowledged for sponsoring this project and providing necessary research support.

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