

Snack foods and beverages for children: Eat or not to eat?

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Abstract.

BACKGROUND: Snack foods; crisps and biscuits, and beverages; fruit juices and soft drinks, are some of the most commonly consumed products by children of school age worldwide.

OBJECTIVE: The aim of this study is to investigate if snack foods and beverages are suitable for consumption by children of school age through recording and comparing the nutritional information presented on the nutrition panel such as energy, protein, total carbohydrates and total fat for these products.

METHODS: The nutritional information from 56 products sold in different supermarket outlets across Muscat, the capital city of Oman, was collected and statistically analysed using the mean and the percentage of Recommended Daily Intake.

RESULTS: Based on the percentage of Recommended Daily Intake of energy and nutrients, crisps offer higher amounts of energy and total fat for children when compared to biscuits. Meanwhile, biscuits offer lower amount of energy than crisps but offer a higher amount of total carbohydrates for children. Regarding fruit juices and soft drinks, the former offer higher amount of energy than the latter but both, however, offer comparable amounts of total carbohydrates.

CONCLUSION: Upon comparing the nutritional information of the products studied and considering their nutritional benefits and health risks, it seems that biscuits are suitable choice for children.

Keywords: Snack foods, beverages, nutrition panel, nutritional information, recommended daily intake

1. Introduction

Diet is defined as the total specific intake of nutrients by an individual for maintenance and management of health [1]. Proper nutrition involves the intake of micronutrients (sodium, calcium, vitamins, fibers etc) and macronutrients (protein, carbohydrates and fat) to provide the body with energy (kilocalorie; kcal) required per day [1]. With globalization and fast-paced lifestyles, there has been a dramatic change in proper nutrition and eating behaviors which are considered as risk factors for the onset and high incidence of non-communicable diseases such as obesity, diabetes, cardiovascular diseases and cancer. Among children of school age (4–18 years of age) snack foods (also known as savory snacks) such as crisps and biscuits, and beverages such as fruit juices and soft drinks are some of the most commonly consumed products by this age group worldwide [1]. A number of surveys conducted in Oman found that only 45% of school children had breakfast on a daily basis. Moreover, it was noticed that fast foods, fruit juices, crisps and biscuits as well as carbonated drinks were the preferred sources of nutrition among Omani children in most Omani households [2–4]. Children are often associated with the term *hedonic hyperphagia* which is given to “eating to excess for pleasure, rather than hunger”. This type of recreational overeating continues to be a major problem in the development of childhood obesity [5, 6]. Poor dietary choices and food consumption patterns have contributed to an increase in the prevalence of obesity among children in the Middle East region including Oman.

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Table 1
The Recommended Daily Intake (RDI) of energy (kcal; in brackets) and nutrients (g) for children of school age (4–18 years) per day [2]

Age group in years (Energy)	RDI of Nutrients			
	Protein [15%]	Carbohydrates [55%]	Fat [30%]	Sodium
4–8 (1400 kcal)	52.5 g (210)	192.5 g (770)	46.7 g (420)	<1900 mg/day
9–13 (1950 kcal)	73.13 g (292.5)	268.13 g (1072.5)	65 g (585)	<2200 mg/day
14–18 (M) (3000 kcal)	112.5 g (450)	412.5 g (1650)	100 g (900)	<2300 mg/day
14–18 (F) (2400 kcal)	90 g (360)	330 g (1320)	80 g (720)	<2300 mg/day

Furthermore, it is alarming to say that there is a clear upwards trend in childhood obesity in the region compared to a decade ago [3, 4, 7]. Parents, especially mothers, are directly involved in providing healthy suitable diet for their children to follow. Consequently, the level of a mother's education and nutritional knowledge proved to have an influence on their children's eating behaviors and preferences at home as well as at school [4, 8].

A nutrition panel is one of most useful tools that can help parents identify a healthy food products for their children [9]. A nutrition panel (sometimes called 'nutrition facts panel' or 'nutrition information panel') is a panel on which nutritional information about a food product is presented. It is found on the back or side of a food package and comprises a list of nutrients (macronutrients and micronutrients) with their amounts and some form of numerical quantifier [10]. For an effective utilization of the nutrition panel and to ensure that their children receive the appropriate amounts of energy and nutrients, parents should be familiar with the Recommended Daily Intake (RDI), as well as its synonyms: Reference Daily Intake (RDI) and Recommended Dietary Allowance (RDA). Each of these terms refers to the average daily dietary intake levels of energy and nutrients considered sufficient to meet the requirements of nearly all healthy children as illustrated in Table 1.

The aim of this study is to investigate if two categories of products widely consumed by children: snack foods and beverages are suitable for them to consume. This can be achieved by recording and comparing the nutritional information presented on the nutrition panel such as energy, protein, total carbohydrates and total fat for each category and based on the Recommended Daily Intake of energy and nutrients for this age group.

2. Methods

The nutritional information from 56 selected products; 17 crisps, 18 biscuits, 17 fruit juices and 4 soft drinks sold in different supermarket outlets across Muscat city were collected (see Appendix). The selection was based on brands (local; made in Oman and international brands) that are widely sold in the supermarket outlets and affordable in terms of price for most families and popular among children whether they are at home or school (Table 2).

The data were collected in October and November 2014, and data analysis using the mean \pm SD and percentage (%) of RDI was performed subsequently.

2.1. Statistical analysis

The data were evaluated using SPSS 19.0 package program. Nutritional information (energy, protein, carbohydrate and fat) of each group; snack foods and beverages, were compared using student's *t*-test and ANOVA. A criterion *p* level of <0.05 was used to determine statistical significance.

3. Results

The format of the nutrition panel displayed on each of the selected products is a boxed table which clearly present the nutrients found in the food item along with their quantities. It shows the following nutritional information; energy

Table 2
The local (Omani) and international brand names of products selected for this study

Snack foods category		Beverages category	
Crisp products brand names	Biscuit products brand names	Fruit juice brand names	Soft drink brand names
Local: Sohar, Oman, Sara, Taha, Tortilla, Suroor, Minoman, Almudhish	Local: Nabil (biscuit and wafer varieties).	Local: A'Safwah fruit juice varieties, Melco fruit juice varieties.	International *brands produced in Oman (PEPSICO Oman): Pepsi and 7Up.
International: Pringles (original), Kitco, Bugles, Lay's, Cheetos	International: Nutro (wafers), Ritz (original), Orio (original), McVeties (Marie and Digestive)	International: Almarai fruit juice varieties, Sun Top orange juice	*brands produced in the United Arab Emirates: Coca cola and Sprite

Table 3
The percentage (%) of Recommended Daily Intake (RDI) of energy and nutrients offered by each type of snack foods (crisps and biscuits) for children of school age

Age group in years	% of RDI				
	Protein	Total Carbohydrates	Total Fat	Sodium	Energy
<i>Crisps</i>					
4–8	10.9	24.6	67.6	40.4	37.6
9–13	7.8	20.6	48.5	34.9	27
14–18 (M)	5.1	13.4	31.5	33.4	17.6
14–18 (F)	6.4	16.7	39.4	33.4	22
<i>Biscuits</i>					
4–8	12.5	33.7	48.2	16.6	34.3
9–13	9	24.2	34.6	13.6	24.6
14–18 (M)	5.8	15.7	22.5	13.1	16
14–18 (F)	7.3	19.7	28.1	13.1	20

(kilocalorie/kilojoule), protein (g), total carbohydrates (g) and total fat (g) which are provided for every 100 g or 100 ml of the product consumed. There is however a few products provided the information for every 100 g or 100 ml and per serving. Moreover, there are 32 of the selected products (15 crisps; 11 biscuits; 4 fruit juices and 2 soft drinks) showed sodium content either in (g) or (mg) units as an extra additional information on the panel.

Children usually consume snack foods and beverages randomly as they tend to eat a variety of these products per day. Hence, the nutritional information for each category were represented using the mean and should be viewed along with Table 1.

3.1. Category one: *Snack foods*

The mean values of the nutritional information for crisps were as follows: energy (527.1 kcal \pm 40.4), protein (5.7 g \pm 2.1), total carbohydrates (55.1 g \pm 7.9), total fat (31.5 g \pm 6) and sodium (768.3 mg). Whereas for biscuits, they were as follows: energy (480.1 kcal \pm 40.1), protein (6.6 g \pm 1), total carbohydrates (65 g \pm 8.2), total fat (22.5 g \pm 7) and sodium (315.5 mg). These mean values were subsequently used to calculate the % of RDI of energy and nutrients offered by each type of snack foods for children as shown in Table 3.

Table 4
The percentage (%) of Recommended Daily Intake (RDI) of energy and nutrients offered by each type of beverages (fruit juices and soft drinks) for children of school age

Age group (years)	% of RDI	Protein	Total Carbohydrates	Total Fat	Energy
<i>Fruit juices</i>					
4–8		<0.1	6.8	0	3.8
9–13		<0.1	4.8	0	2.8
14–18 (M)		<0.1	3.2	0	1.8
14–18 (F)		<0.1	3.9	0	2.2
<i>Soft drinks</i>					
4–8		0	5.8	0	3.1
9–13		0	4.2	0	2.3
14–18 (M)		0	2.7	0	1.5
14–18 (F)		0	3.4	0	1.8

3.2. Category two: Beverages

As few beverage products report sodium contents, the mean values of the nutritional information were only calculated for four elements. For fruit juices the mean values were as follows: energy (53.7 kcal \pm 7.7), protein (<1 g), total carbohydrates (13 g \pm 2.1) and total fat (<0.1 g). Whereas for soft drinks, they were as follows: energy (43.8 kcal \pm 2.9), protein (0 g), total carbohydrates (11.2 g \pm 0.5), total fat (0 g). As shown in Table 4, the percentage (%) of RDI of energy and nutrients offered by each type of beverages for children were calculated from the mean values obtained.

4. Discussion

In the 1980s, food manufacturers introduced the nutrition panel on their food products in response to the world wide trend of healthy eating as a way for healthy life [11, 12]. Upon the global widespread use of this label on most food products, governments have found it necessary to develop regulations and standards on nutrition labeling. These rules determine if and when nutrition panel should be applied, their category and format, the type of nutrients must be listed and most importantly to ensure that it displays accurate information [10]. Oman, as a member of the Cooperation Council of the Arab States of the Arabian Gulf; also known as GCC, is following GCC standard guidelines regarding nutrition labelling which was issued in 2007 and is regulated by the GCC Standardization Organization (GSO) under the GSO 9/2007 standard (replacing GSO 9/1995) [10]. Consequently, all food products in the Omani market are required to have the nutrition panel displayed on the product's package listing clearly the nutritional information. Hence, the information presented in the nutrition panel of snack foods and beverages is used to achieve the aim set for this current study.

4.1. Category one: Snack foods

4.1.1. Crisp products

The main ingredient of the selected crisp products can be one of four main items: fresh potatoes, dehydrated potatoes, corn grits or starch. They come in different form: ripples, puffs, sticks or chips and presented in a range of pack sizes from as small as 15 g to as large as 175 g. The mean energy value obtained from consuming 100 g of crisps is 527.1 kcal \pm 40.4 which is comparable to the energy obtained from a McDonald's happy meal beef burger (270 kcal) and small french fries (340 kcal). Analysis of the results show that crisps offer significantly high amounts

($p < 0.05$) of energy, fat and salt as well as a significantly low amount ($p < 0.05$) of total carbohydrates when compared with biscuits. This is reflected in the % of RDI of energy and nutrients for children (Table 3).

4.1.2. *Biscuit products*

The main ingredients of the selected biscuit products are wheat flour and sugar. They come in different forms: crackers, cookies, wafers, biscuits or cream biscuits and presented in a range of pack sizes from as small as 35 g to as large as 150 g. When compared to crisps, biscuits offer a significantly low amount ($p < 0.05$) of energy, fat and salt and a significantly high amount ($p < 0.05$) of total carbohydrates. This is reflected in the % of RDI of energy and nutrients for children (Table 3). Regarding protein content, both crisps and biscuits offer similar amounts ($p > 0.05$).

As nutrition panel displays accurate nutritional information, it was unexpected to notice some errors on the packaging of some of the selected products. For example, one of the crisp products reported offering 590 kcal of energy, however when the energy was calculated from the nutrients (proteins (4 kcal/g), carbohydrates (4 kcal/g) and fat (9 kcal/g)) presented in the nutrition panel the amount of energy that could be derived was only 537 kcal. This is 53 kcal less than the 590 kcal printed on the package. A similar error was observed with a biscuit product, the printed energy value (kcal) on the package is 405 kcal, however when the energy was calculated from the nutrients presented in the nutrition panel the amount of energy that could be derived was 566.2 kcal. Therefore, this product is actually offering an additional 161.2 kcal of energy to the energy value printed on the package. This kind of errors in printed energy values on these products should be reported to local food regulation authorities as these values deceive people who follow certain diet.

4.2. *Category two: Beverages*

4.2.1. *Fruit juice products*

The main ingredients of the selected fruit juice products are fruit concentrate and sugar. Four of these products are 100% pure fruit juice (apple and orange) with no added sugar and total carbohydrates of: 11 g, 13 g, 12.8 g and 11.7 g. The remaining juice selections were comprised of several flavor varieties; cocktail, mango, orange and carrot, orange mix, apple mix, mixed berry, pure apple and pure orange and presented in bottles and packs ranging between 125 ml to 1.75 L. Fruit juices tend to contain a slightly higher, but not significant, amount of total carbohydrates than soft drinks due to the fact that they contain natural fruit sugars in addition to the added sugar.

4.2.2. *Soft drink products*

The main ingredients of the selected soft drink products are carbonated water, sugar and flavor. These products are presented in cans and bottles ranging between 150 ml to 2.25 L.

Each 100 mls of soft drinks and fruit juices offer a comparable amount of total carbohydrates, which demolish the common belief that soft drinks contains more sugar than fruit juices. Furthermore, soft drinks offer significantly low amount ($p < 0.05$) of energy when compared with fruit juices. This is reflected in the % of RDI of energy and nutrients for children (Table 4).

4.3. *Snack foods vs beverages: A choice dilemma*

Food companies spend billions of dollars marketing snack foods and beverages, with a significant portion of marketing aimed directly at children of school age [13]. Each year, children watch hundreds of television advertisements for these products which often accused of being responsible for children's food preferences and wrong perceptions of nutrition which results in excess consumption of calories since most of these products are predominantly high in sugar and fat [5]. A study done by Ogden and coworkers in the United States [14] showed that on any given day, half the people in the United States consume sugary drinks with 1 in 4 of them consuming at least 200 kcal from these drinks. The highest consumption occurs among the age group 12–19 years. In Oman, a study done by Al-Shookri and coworkers [4] showed that young Omani children (2–5 years of age) consume an average of 263.2 ml/day of fruit juices and an average of 29.3 g/day of biscuits, which are approximately equivalent to 125 kcal/day and 140 kcal/day respectively.

The decision regarding which of these categories is better off as a suitable choice for children, requires careful consideration of the nutritional benefits and health risks in consuming such products. In terms of nutritional benefits, snack foods and beverages are generally low in nutritional value (low contents of fibers and unsaturated fat). On the other hand and by interpreting the % of RDI presented in Tables 3 and 4, these products under investigation can pose a health risk on children of all age groups, especially 4–8 years of age. The long term excessive consumption of crisps may increase the risk of childhood obesity, high cholesterol levels and cardiovascular diseases due to the fact that crisps offer high amounts of energy, total fat and salt. Meanwhile, the long term excessive consumption of biscuits may also increase the risk of childhood obesity as well as diabetes due to the fact that biscuits offer high amount of total carbohydrates. Regarding beverages, fruit juices offer higher amount of energy than soft drinks but both fruit juices and soft drinks offer comparable amounts of total carbohydrates.

When comparing the snack foods and beverages, it is clear that 100 g of snack foods offer higher amounts of energy, total carbohydrates and salt than that obtained from 100 ml beverages. However, when comparable solids and liquids are consumed the solid food leads to a greater sense of satiety and reduced hunger as the food form seems to greatly affect hunger and satiety [15, 16]. Studies showed that people consuming sugary beverages in large quantities don't compensate for their high caloric intake by eating less food. Moreover, sweet-tasting beverages might also stimulate the appetite for other sweet, high-carbohydrate foods which can eventually lead to weight gain and obesity over time [17].

In addition to the common health risks associated with the excess consumption of snack foods and beverages by children as discussed above, there are some hidden substances found in these products that can cause further damage to health upon high consumption. Reports discussed the dangerous effect of acrylamide found in crisps and biscuits [2, 18]. Acrylamide is a carcinogen and a neurotoxin presents in high quantities in crisps (as much as 1250 μ g/kg; 6 times more than in biscuits), and is formed when crisps are baked or fried at temperatures equal or more than 100°C due to the interactions between asparagines and sugar [18, 19]. Children are much more attracted to high fat salty snacks such as crisps than any other types of food that are also rich in carbohydrates and fat [20, 21]. Excessive frequent consumption of crisps might overload the body with acrylamide through its accumulation within the tissues thus contributing to the onset of diseases [2]. A recent study published by Walker and co-workers [22] in 2014 has shown that fructose is found in high amounts in fruit juices (including 100% pure juice) and soft drinks. A growing body of clinical evidence suggests that fructose consumption has been linked to fatty liver disease due primarily to the way in which fructose is specifically metabolized by the liver [23, 24].

By weighing the nutritional benefits and health risks of the products studied, it seems that biscuits can be a suitable choice for children. Never the less, parents should guide their children to follow healthy suitable eating behavior, which includes a balanced diet, and the nutrition panel can be used as a tool to achieve this.

5. Conclusion

This unique study showcased useful information for parents who are undecided on which type of snack foods and beverages is suitable for their children to consume, suggesting that biscuits is a suitable choice. Parents should have sufficient nutritional knowledge, which include knowledge about nutrition label use and RDI, to ensure that their children receive the appropriate amounts of energy and nutrients. Therefore, further research is required to assess the nutritional knowledge and attitude of parents towards food products consumed by children especially snack foods and beverages, which will ultimately going to improve the awareness of nutritional benefits and health risks of such foods.

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Appendix

Appendix A:
Nutritional information for each crisp and biscuit products

Product	Nutritional information				
	per 100 g				
	Proteins (g)	Total Carbohydrates (g)	Total Fat (g)	Sodium (mg)	Energy (kcal)
<i>Crisps</i>					
A	5	47	36	–	550
B	6	47	36	–	550
C	8.86	59.18	20.61	1420	442.86
D	6.53	60.72	31.71	390	523
E	1.13	76.81	16.64	1480	442.32
F	5	46	37	500	590
I	10	60	25	600	505
J	2.68	54.28	37.2	360	564
K	4.52	57.4	35	680	563
L	6.8	48.4	34	480	524
M	6.56	47.6	35.6	600	536
N	6.8	48	34	872	524
O	5.1	55.2	36	732	564
P	6.8	60	29.2	800	530.8
Q	3.8	51	34	522	540
R	6.7	60	30	1033	528.2
S	5.2	58.7	28.3	1056	482.6
<i>Biscuits</i>					
I	6.2	61.3	23.7	300	483.5
II	6.8	53.4	32.7	120	535.9
III	6.8	54.8	31.8	106	533.2
IV	8	75	11	–	430
V	8	65	24	–	508
VI	7	60	25	–	490
VII	6.5	75	13.5	–	440
VIII	5.3	80	25	–	405
IX	8.2	71.3	14.6	–	449
X	6.8	70.5	17	–	450
XI	5.4	61.1	25.3	300	470
XII	6.3	61.6	25.4	156	515.8
XIII	4.2	50.6	35.7	80	547.3
XIV	6.1	62.2	25	158	515.8
XV	5.5	72	15.5	580	455
XVI	6.9	62.5	21.8	600	481
XVII	7.2	72.5	14.3	400	448
XVIII	7.2	60.5	23.5	670	485

Appendix B:
Nutritional information for each fruit juice and soft drink products

Product	Nutritional information				
	per 100 ml				
	Proteins (g)	Total Carbohydrates (g)	Total Fat (g)	Sodium (mg)	Energy (kcal)
<i>Fruit juices</i>					
1	0.1	12.3	0.1	1.1	52
2	0	13.6	0	16.1	55.5
3	0.75	15	0.07	–	64
4	0.2	11	0	3.3	49
5	0.75	13	0.07	–	54
6	0.07	13.4	0	8	55.8
7	0.01	9.8	0	–	42
8	0.01	9.8	0	–	42
9	0.01	9.8	0	–	42
10	0	15.2	0	–	61
11	0.15	16	0	–	65
12	0	13.4	0	–	54
13	0	12.7	0	–	51
14	0	12.8	0	–	51
15	0.7	11.7	0	–	50
16	0	16.8	0	–	67
17	0	14	0	–	57
<i>Soft drinks</i>					
I	0	10.6	0	10	42
II	0	11.8	0	10	48
III	0	11.1	0	–	41.8
IV	0	11.2	0	–	43.5