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Salt content of processed food products available in Dh. Kudahuvadhoo, Maldives

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ABSTRACT *Some of the processed food are junk food which are unhealthy when consumed in excess amount. Commonly used junk food include fast food, chips, candy, gum, sweets, desserts as well as fizzy drinks. These food types consist of salt, sugar, fat and are high in calories. Junk food are easy to make and are easily accessible for consumption making this the main reason people use junk food even though it is not healthy. Consumption of salty junk food regularly increases the amount of salt intake which is undesirable for a healthy life. High amount of salt intake increases blood pressure and other adverse effect to health. A market survey at Dh. Kudahuvadhoo grocery shops (5 shops) was conducted. A convenient sampling was used to collect 30 processed food products. Nutritional values of these products were recorded and analyzed using Microsoft Excel 2016. The salt levels in the products were compared to that of WHO recommended level of salt (< 5g/day). The highest amount of salt among the 30 items was found in Amexicana flour tortillas (2.6g salts per 100g). Cotton candy had zero amount of salt. The mean value of salt in the 30 types of food products was 0.324 g. The salt content processed food products varied, by types, production company, and the country of the production. Although the amount of salt was less than the WHO recommendation level in the selected junk food, daily meals, and intake in high quantity may lead to exceed the WHO recommended level of salt intake.*

Keywords: salt, junk food, food type, Maldives, Kudahuvadhoo. Dhaalu atoll

One of the crucial criteria for a long life is to consume nutritious food and live a healthy lifestyle. The world has modified the patterns of substituting healthier diets by consuming foods that have many harmful impacts on people's health (Ashakiran & Deepthi, 2012). Some of the processed food are fast or junk food. The word junk food was invented in 1972 by Michael Jacobson as a slang for items with worthless or poor nutritional value such as High fat, Sugar or Salt (HFSS) food. Commonly used junk food includes biscuits, chips, candy, gum, sweets, desserts and fizzy drinks. These food type consist of salt, sugar, fat and are high in calories. The appealing taste, decent shelf life and fast transportation makes junk food more popular. Advertisements also play a significant part in the success of junk food trade (Bhaskar, 2012). Good taste influence people to prefer junk food to an extent. The good taste or flavor come from oil, sugar and salt. Advertisements drives people to consume more junk food. Fast-food diets from restaurants and other food outlets have a great appeal to food fans. There is a raising concern for advertisements specifically targeted for children due to the vulnerability of easily being lured to junk food. Junk foods are packaged generally in a way that makes it easy for transport and supply and it is cheaper compared to

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nutritious eating. Thus, prevalence of junk food maybe due to low cost and being readily available to a wider population (Smith, 2012). As a result of unhealthy eating habits, consumption of different types of junk food has increased among all age groups in developed and developing countries.

The reasons to reduce or consume junk food moderately are to minimize the short and long-term adverse effect of it. List 1 states adverse effects caused by high intake of junk food. For example, fat content in food could elevate cholesterol level, the high calorie from sugar contributes to obesity, and the high salt intake may increase blood pressure, stroke, heart disease and affect kidney functions. As junk food has insufficient energy, people feel weak but it suffices for short-term. Junk food consumption also lowers a person's concentration level. Since junk food is oily, it loses essential oxygen, nutrients, and proteins and the prolonged consumption of such food can stall the brain cells. Elevated cholesterol level is another short-term adverse effect of junk food. Among the long term adverse effect of prolong consumption of salty food products include accumulation of plaque as liver is unable to metabolize excess cholesterol, resulting in plaques and constriction of arteries (Ashakiran & Deepthi, 2012).

Consumption of junk food also lead to heart disease (myocardial infarction) due to the accumulation of plaque in arteries that allows the heart to bring more effort into pumping blood downstream, there is a loss of returning blood to the heart on the upstream, which causes heart damage, heart exhaustion due to constant extra effort and oxygen supply. Some salty food products are poor in nutritional value as it contains synthetic vitamins and minerals rather than from natural sources (Bhaskar, 2012). As junk food is generally high in fat, salt and sugar it is easily addictive just like heroin and cocaine which activate the same brain receptors that make a person feel good due to the elevated amount of dopamine. To make junk food more irresistible it is postulated that secret sugar and fat types are added. Finding these detailed added components in the food products is difficult to obtain due to traders' right to protect their secret recipes (Bhaskar, 2012). Since processed food products' main target is to preserve food, it is created in a way to be consumed later. To maintain a long term shelf life, chemical additives are added such as preservatives and artificial colouring such as monosodium glutamate (MSG) and tartrazine (Bhaskar, 2012).

MSG may cause obesity and may trigger cancer (Bhaskar, 2012). Food processing steps such as canning, dehydrating and freezing kill food taste. Thus, other chemicals such as natural flavoring and colouring agents are added to keep the food fresh and appealing. Prolong high consumption of junk food may cause respiratory diseases as high fat in it build up with bronchioles and the supply of oxygen to the body declines (Bhaskar, 2012).

Obesity is a global concern and is defined as an accumulation of body fat or body weight that is 20% above the optimum. In developing countries, the prevalence of obesity has reached alarming rates also leading to chronic non-communicable diseases. Obesity is a multi-factorial energy metabolism condition in which the recurrent consumption of calories is greater than the production of energy (Falagas & Kompoti, 2006). Diabetes mellitus is one of the non-communicable diseases that has adverse effects caused by high consumption of junk food such as hyperglycemia, glycosuria, hyperlipidemia, negative nitrogen balance and ketonemia. Diabetes mellitus has two types; Type 1 and Type II. Hypertension results when eating high

amount of salty junk food as these food contain excess salt that leads to increased blood pressure and hypertension which can elevate the risk of coronary thrombosis if hypertension is not treated successfully. Heart diseases are also caused by the consumption of junk food which results in myocardial infarction and extreme heart damage due to accumulation of plaque in the arteries (Anand, 2015). It takes a long time and tremendous determination to win both the onset and cure. Consumption of excess junk food also leads to plaque production as there is a tendency to get food debris deposited in teeth spaces. Similarly, kidney dysfunction such as polyuria, hyperuricaemia and renal failure may occur due to high sugar, fat and salt consumption via excess consumption of junk food. Neurological disorders may occur due to heavy consumption of junk food, psychiatric disorders such as drowsiness, laziness, dyslexia, attention deficient hyperactivity disorder [ADHD], loss of control and lack of focus occur.

List 1
Adverse Effects of Junk Food Consumption

Lack energy
Poor concentration
Elevate cholesterol
Overweight and obesity
Elevate blood pressure
Trigger cancer
Easily addictive
Stroke
Heart disease
Kidney dysfunction
Hypertension
Hypoxia
Asthma
Diabetes mellitus
Dental cavities
Neurological disorders
Skin rashes
Behavioral problems

Source: Ashakiran & Deepthi, 2012; Bhaskar, 2012; Fortin & Yazbeck, 2011

Skin rashes result due to hypersensitivity disorder because of high consumption of junk food as additives and chemicals added in junk food. There are studies which show that cancers such colon, prostate, breast, gallbladder, skin, uterine and ovarian, cancer is associated with obesity (Basen-Engquist, 2011). Prevalence of obesity as previously stated may increase due to excess consumption of junk food.

Hypoxia is caused by a lack of oxygen in the bloodstream is caused by fat deposits in the arteries due to consumption of junk food.

Asthma is a chronic obstructive pulmonary disease that can elevate due to artificial flavoring and colouring agents that are abundantly found in junk food. Behavioral disorders such as hyperactivity and aggressiveness also can be caused by junk food consumption in early childhood (Falagas & Kompoti, 2006).

Consumption of food products with high salt content is a concern in modern society (Fortin & Yazbeck, 2011). Regular consumption of excess amount of salty processed food increases the amount of salt intake which is undesirable for a healthy life. Moderate or minimum consumption of processed food, eating balanced diet and regular physical activities may reduce the harmful effects caused by processed food (Bhaskar, 2012).

Reducing the consumption of salt has been described as one of the most cost-effective steps that countries can take to boost health conditions for the population Bjoernsbo et al., 2019). Key salt mitigation initiatives would deliver an additional year of healthier life at a price below the estimated annual income or gross domestic product per person (Bjoernsbo et al., 2019). Salt level in processed food products available in the Maldives is not studied to date. Thus, the aim of this research was to identify the salt level in processed foods products available in Dh. Kudahovadhoo, Maldives, by recording the nutritional information from food labels.

Method

A descriptive survey was carried out to evaluate the salt content in processed food products at Dh. Atoll Kudahovadhoo, Maldives. A convenient sample was used to collect 30 processed food products at Dh. Kudahuvadhoo grocery shops (5 shops). The collected food products' nutritional values were recorded from the labels. Some of the nutritional information labels are as shown in figure 1.

The information was recorded in Microsoft Excel sheets where samples were categorized into three main types; salty snacks, other salty food and sugary food. The data were analyzed using Microsoft Excel 2016. Also, data were coded and analyzed using the statistical package SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) version 22. Data was summarized using One Way ANOVA. Significant difference of salt level between products were tested and probability (P) values <0.05 were considered statistically significant. The salt levels in the selected junk food labels were compared to that of WHO recommended level of salt (<5 g/day).

Results

The salt content of the 30 processed food products surveyed is illustrated in Table 1. As shown in Table 1, initially the food products were categorized into 5 groups; chips, fast foods, sugary foods, biscuits, salty snacks, cream and sauces. Then the food products were categorized into salty snacks, other salty food and sugary food. The highest amount of salt among the 30 items surveyed in this study was in Amexicana flour tortillas (2.6g salts per 100g). The lowest amount was cotton candy which has 0 salt level. There were differences in the salt content of selected types of junk food products which ranges from (0 to 2.6g). The mean value of salt among all the products was 0.754 g. The salt content in processed food varied, by

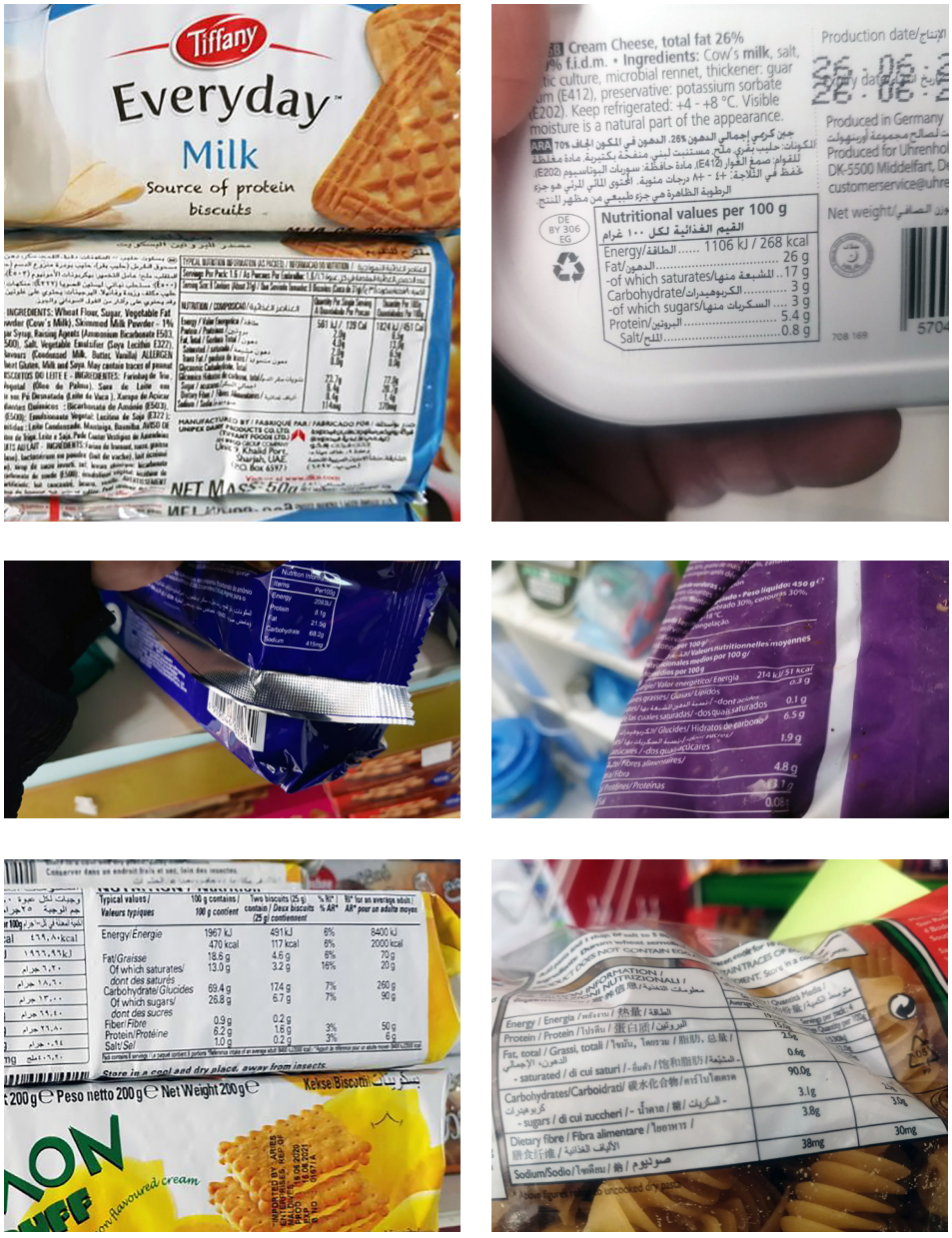

Figure 1. Some of the nutritional information labels of the surveyed food products.

types, production company, and the country of the production. Eating too many junk foods per day will excess the WHO recommended value of salt (< 5g/day). Salt level on average daily meals per day differs in countries. As shown in Figure 2 salt level above 1g/100g were in seven products and remaining 23 products contained less than 1g/100g. Only two products contained above 2 g/100g salt level.

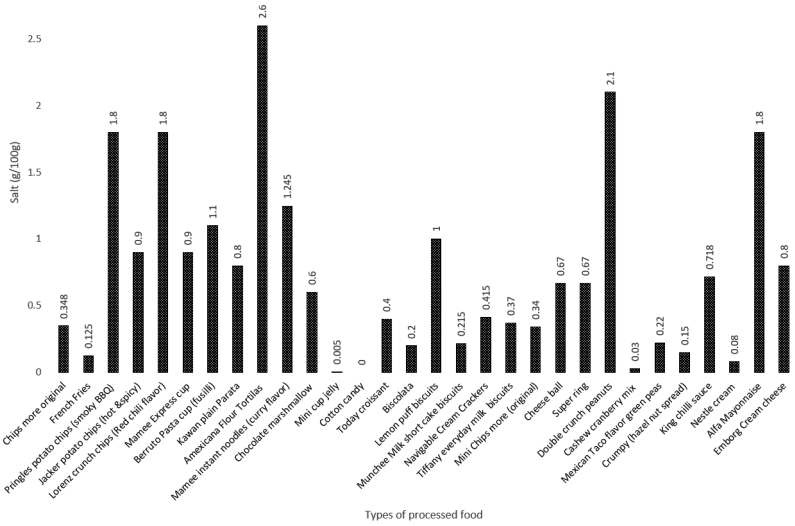

Figure X. Amount of salt in processed food products available in Dh. Kudahuvadhoo.

Table 1
Processed Food Products Categorized into 5 Groups

No	Product	Amount of salt (g/100g)
Chips		
1	Chipsmore original	0.348
2	French Fries	0.125
3	Pringles potato chips (smoky BBQ)	1.8
4	Jacker potato chips (hot & spicy)	0.9
5	Lorenz crunch chips (Red chilli flavor)	1.8
Fast foods		
6	Mamee Express cup	0.9
7	Berruto Pasta cup (fusilli)	1.1
8	Kawan plain Parata	0.8
9	Amexicana Flour Tortilas	2.6
10	Mamee instant noodles (curry flavor)	1.245
Sugary foods		
11	Chocolate marshmallow	0.6
12	Mini cup jelly	0.005
13	Cotton candy	0
14	Today croissant	0.4
15	Biscolata	0.2
Biscuits		
16	Lemon puff biscuits	1
17	Munchee Milk short cake biscuits	0.215
18	Navigable cream crackers	0.415
19	Tiffany everyday milk biscuits	0.37
20	Mini chips more (original)	0.34
Salty snacks		
21	Cheese ball	0.67
22	Super ring	0.67
23	Double crunch peanuts	2.1
24	Cashew cranberry mix	0.03
25	Mexican taco flavor green peas	0.22
Creams and Sauces		
26	Crumpy (hazelnut spread)	0.15
27	King chilli sauce	0.718
28	Nestle cream	0.08
29	Alfa mayonnaise	1.8
30	Emborg cream cheese	0.8

As shown in Figure 3 the highest amount of salt present in the salty snack food was above 1.5 g/100g, but below 2g/100g. Only Pringles potato chips (smoky BBQ) and Lorenz crunch chips (red chili flavor) contain salt level above 1g/100g. Salty food products (Americana flour tortilas, double crunch peanuts and alfa mayonnaise) in Figure 4 contain above 1.5 g/100g of salt. Sugary food products also had added salt content and the highest amount found was in lemon puff biscuits, (1 g/100g), and the remaining sugary products contain below 1 g/100g of salt (Figure 5). It was noted one sugary product, cotton candy, was labelled as zero salt.

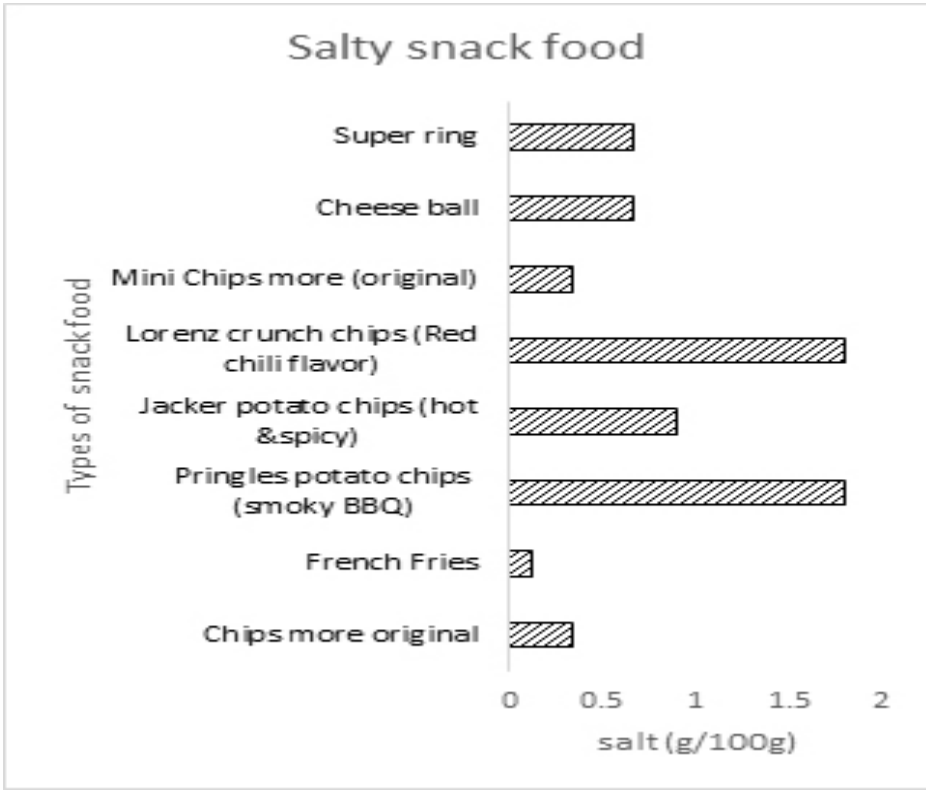

Figure 3. Amount of salt content found in food products available at Dh. Kudahuvadhoo supermarkets

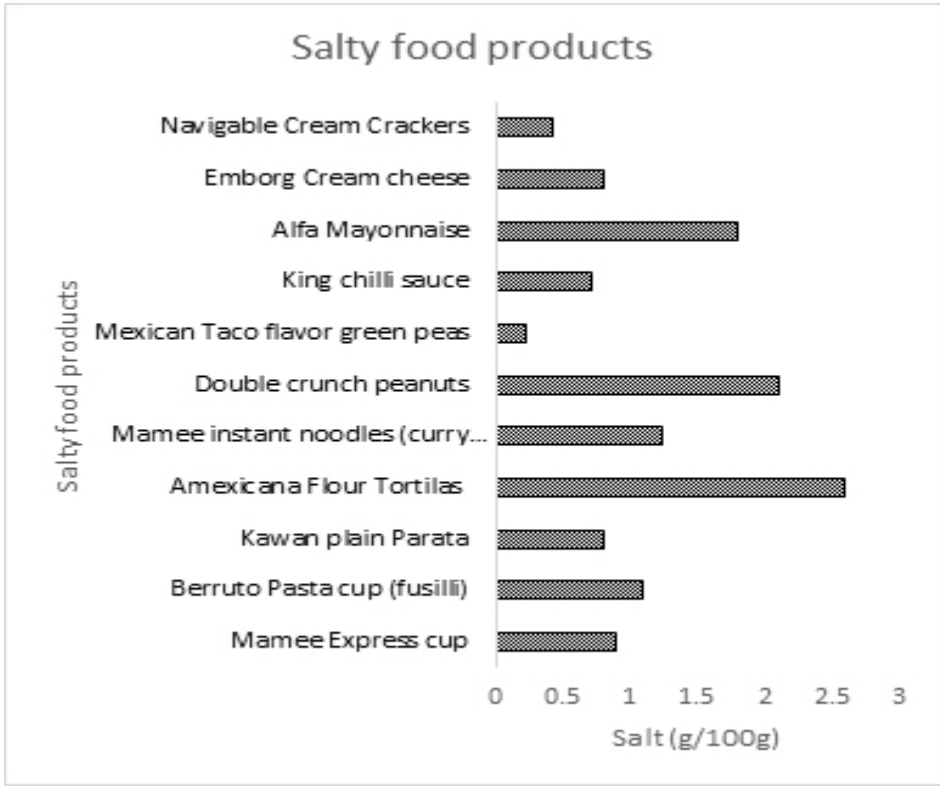

Figure 4. Amount of salt content found in food products available at Dh. Kudahuvadhoo supermarkets

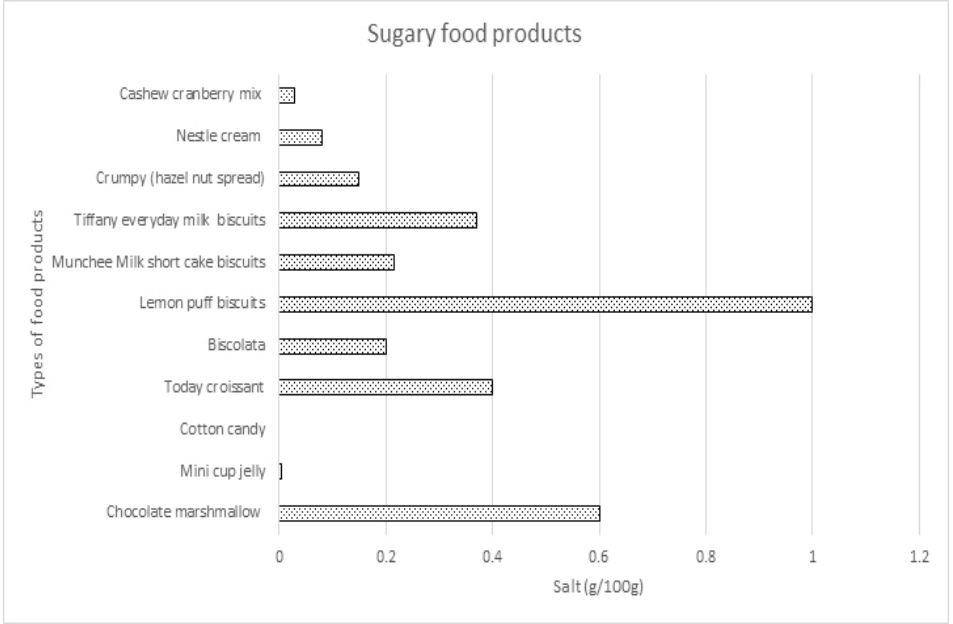

Figure 5. Amount of salt content found in food products available at Dh. Kudahuvadhoo supermarkets

Table 3 shows the comparison of salt level in 5 groups of processed food products.

Table 3
Comparison among Studied Processed Food Categories

Category	No of products	Mean value	SD*	SE**	F-statistic value	P-value
Chips	5	0.9946	0.7875	0.3522	1.79311	0.1524
Fast foods	5	1.329	0.7312	0.327		
Sugary foods	5	0.241	0.2596	0.1161		
Biscuits	5	0.468	0.3037	0.1358		
Salty snacks	5	0.738	0.8115	0.3629		
Cream and sauce	5	0.7096	0.6904	0.3088		

Sd* - Standard deviation SE** - Standard error

There were no statistically significant differences between group means as determined by one-way ANOVA F (1.79311) = 1.397, p = 0.1524. Although the items which have the highest amount of sugar have lower salt level in them, for instance cotton candy which has high sugar and zero amount of salt, they did not reach level of significance. Indicating all categories of junk food studied have no significant difference regarding amount of salt.

Discussion

Societies worry about the high consumption of junk food (Manisera, van der Kooij, & Dusseldorp, 2010). Manisera et al. (2010) showed that on average, just over one-third (35 %) of total daily energy was from 'discretionary foods' (junk food) and among 14-18-year old (41%) the proportion of energy from discretionary foods was highest. In addition, junk food ads on TV has the power to promote unsafe eating habits within the whole population. A study by Boylan, Hardy, Drayton, Grunseit and Mihrshahi (2017), also showed that high junk food users were about 45 % and 35 % of younger and older kids who have a TV in their bedroom, respectively. This association can partially explain why kids with a TV in their bedroom are also at higher risk of developing obesity. Parents also reward the actions of children with sweet snacks, despite evidence pointing to detrimental long-term health effects linked with overeating and elevated consumption of fatty foods. In addition, if sweets are offered to children for consuming their fruit or vegetables as an incentive food, children can learn to put less importance on fruit and vegetables (Gibson et al., 2012). A study by Hardy et al. (2013) showed that the consumption of individual junk foods may hide the true extent of their intake.

To measure the total consumption of junk food, they thus created the Junk Food Intake Measure (JFIM) for children and adolescents. The findings of the study showed that the intake of junk food by school-age children, calculated by the JFIM

in aggregate, was ower in 2015 compared to 2010. This promising downward trend may be partly attributed to state-wide efforts to improve wellness, and the increasing unfavorable media attention it has been getting in recent years.

A research by Maldives National University students (Adam, 2016), showed that about 28 percent of participants consume fast food on a regular basis, while 40 percent of participants consumed some form of fast food on a weekly basis and 32 participants occasionally consume fast food from 100 participants. Frequent fast-food eating is of concern as these foods are usually high in kilojoules, calories, saturated fat, sugar and salt. Daily fast-food consumption is associated with higher calorie intake and lower standard of nutrition, characterized by a higher nutrition in fat, carbohydrates and sugar (Powell & Nguyen, 2013).

Salt is an inorganic compound that is formed from sodium and chloride ions (NCCFN (National Coordinating Committee on Food and Nutrition), 2010). Excess salt intake is particularly harmful for older people and for subjects who have chronic diseases; obesity, hypertension and renal diseases. Salt use for food preservation has declined in the globe. Yet it is a risk factor, due to poor dietary habits excessive salt intake is common. Currently salt intake is above 9-10g per day although maximum limit is 5 g per day as per WHO guidelines. Legislative measures need to be in place to limit salt level in processed food products such as use of salt as a preservative. Worldwide large-scale campaign is a good way that involve all the concerned people such as pharmacists, physicians and public health partners (Uzan & Delaveau, 2009).

To prevent premature deaths and disability salt reduction in diets is important. Thus, reformulation of processed food is required to prevent chronic diseases worldwide. Many countries have targets to reduce salt level of processed foods. For example, Brazil, Canada, Chile, Mexico, Ecuador, Argentina, Paraguay and US have targets to reduce salt level in their processed food products. These countries vary in their approaches on salt reduction as well as have different types of targets such as upper limits, sale weighted averages and percentage reductions. Policies need to developed on strategies to improve overall nutritional values of processed foods. For example, food companies could supply food composition data and be transparent and open as well as countries could harmonize targets, warning labels and nutrition labels (Campbell et al., 2014).

Salt in processed foods is used as stabilizers and colour enhancers besides as preservatives. A Malaysian study was conducted to compare salt content in processed food products available in the supermarkets and found that most processed food products were high in salt content. The study found that the highest salt content was found in gravy and sauce (3.97g/100g). Cheese contained 2.14g/100g, butter and margarine contained 1.13g/100g, breakfast cereal contained 0.94g/100g and sweet snacks contained 0.30g/100g (Haron et al., 2020). An Australian study revealed that the salt intake of its population is above the recommended level and the intake was from diverse sources. The authors concluded that a multi-faceted salt reduction strategy is required such as to focus on retail sector and food reformulation (Bolton et al., 2020).

In Ireland 80% of people consume cereals for breakfast. In 2003 cornflakes-type cereals were found to contain highest salt level (2g). Afterwards the salt level of cereals was lowered. The study recommended to continuously monitor salt

levels of processed food products to ensure the salt levels are kept at low level (O'Donovan et al., 2020).

In Croatia average salt consumption was between 13-16 g (World Health Organization, 2013). Croats annually consume 80 kg of bread per capita. A 2% salt is added into bakery products and daily intake of salt via these products was about 25-30%. A cross sectional study was conducted in Zagreb, Croatia to investigate the salt content in bakery bread; dark wheat bread, white wheat bread and other types of bread from various bakeries. Salt level was found variated between bakeries where average salt content was 2.3g/100g. The average salt content was higher than the Croatian National Regulation on Cereals and Cereal Products (1.4%). The recommendation of the study was that to teach bakers in reducing salt content and to continuously monitor and implement legal provisions (Aždajic, et al., 2019).

Sodium chloride (NaCl) play key role in physiological processes and thus is important but excessive sodium intake result in health disorders including heart, cardiovascular diseases and high blood pressure. It is encouraged to add low salt during food production. The study revealed that 50% of sodium chloride can be replaced with micronized NaCl without changing sensory and physicochemical properties in feta cheese. Micronized salt has larger surface area and thus elevate salinity which lead smaller amount of it sufficient to add into food products compared to classical NaCl (Lisak Jakopovic et al., 2020). For example, in ternary odour-sour-salty solutions saltiness can be enhanced due to sourness. In cream-based food systems use of odour-induced saltiness perception enhancement (OISE) combined with heterogeneous stimuli distribution may compensate more than 35% salt level reduction without effecting sensory properties. Consumption of processed food and elevation of high blood pressure were documented. It is necessary to limit salt intake per day to 5g to prevent cardiovascular disease. A study was conducted to evaluate the salt level of Portuguese processed food products available in their markets. The food was categorized, and higher salt intake were from bakery, fast-food, pastry, ready-to-eat meals, snacks, nuts, cereals, seeds, soups, patties and sauces. The salt level of these products were quantified using Charpentier-Volhard method. One portion of salty snack was found to contribute 31% of daily recommended intake. Food industry is tirelessly working on to reduce salt content of processed food products such as lowering salt level in bread. Thus, constant monitoring of progresses in salt reduction and reformulation is crucial to maintain low salt content in processed food (Albuquerque, Oliveira, Silva, & Costa, 2016). Taxing of processed food products that are high in salt may help reduce its consumption as it would influence what people eat. Taxing all foods that contain salt content has more impact (Dodd et al., 2020).

In a survey conducted in Argentina, the highest amount of salt among the 30 items was Amexicana flour tortillas (2.6g salts per 100g)., lowest amount of salt was cotton candy which has zero amount of salt. All the analyzed processed food products are within the WHO limit (<5g/100g) (Calliope & Samman, 2020).

A survey was conducted among six fast food chains functioning in six countries (Australia, Canada, France, New Zealand, United Kingdom and United State) which showed that there were significant differences among countries in the amount of salt in same type of food products. In UK the mean salt level per 100 g for Savory breakfast items were low (1.4g), in Australia it was (1.3g) in New Zealand it was 1.1g and in US it was 1.8g. Chicken products in the UK were much

lower in salt (1.1 g salt per 100 g) than in the US (1.8g) (Dunford et al., 2012). In this research they collected 2124 fast food items in seven product categories from six companies in six countries. There was significant variation in food categories in the mean salt content; chicken products had highest salt level (1.6g per 100g) and salads had the lowest salt level (2.5g per 100g) (Dunford, et al., 2012). in the mean salt content; chicken products had highest salt level (1.6g per 100g) and salads had the lowest salt level (2.5g per 100g) (Dunford, et al., 2012). More than 1.4 billion adults globally have high blood pressure that result 10.7 million deaths each year. Thus, it is crucial to eat diet that has low salt content which simultaneously reduce sodium intake, to reduce blood pressure (He et al., 2020). As high salt content in the diet are the top risk for death and ill health in worldwide, WHO has set a goal, to reduce the consumption of sat by 30% by the year 2025, by setting salt decreasing strategies (Dodd et al., 2020). It is important to bring the needed changes to reduce the salt intake to meet the goal in reducing the high blood pressure. All WHO countries are expecting to reduce by 30% by the year 2025, 25% of the premature death can be prevented by reducing salt consumption. Reducing the salt intake, helps to reduce the hypertensive cases. Hypertension ultimately leads to Cardio vascular disease. Reduction of salt intake helps to improve the human health. Moreover, the reduction of dietary salt intakes now become a global health urgency (Elias et al., 2020).

This study could be used as a baseline study to understand the salt level range in the processed food products available at Dh. Kudahuvadhoo shops, Maldives. Based on the finding of this study further study could be conducted on the consumption rate of processed food by the population of this island or other parts of the Maldives and further connect those findings with non-communicable diseases.

Conclusion

In conclusion, processed food products need to be minimally or moderately consumed, and the diet need to be monitored daily to reduce the adverse effects of junk food intake. Although the findings of this study identified the processed food products' level of salt was within the WHO recommendation level, daily meals and intake of junk foods together may exceed the WHO limit.

Recommendation

Government policies and interventions should establish conditions that allow communities to consume sufficient amounts of safe and nutritious foods, including low salt levels, that constitute a balanced diet. It is a societal and individual responsibility to improve dietary habits. It needs an approach that is population-based, multisectoral and culturally appropriate.

To reduce the intake of junk food, steps such as making the population conscious of the risk factors of fast food should be introduced. It should also raise awareness about nutritious meals and there should be a reasonable price for these healthy meals.

In addition, the community should be aware of the preparation of healthy food in food establishments, which are a major sources of the production of junk food. Also, to enable the population to eat at home, the population should be conscious

of the benefits of nutritious foods. Other realistic local actions for minimizing the consumption of salt include:

- Integrating salt elimination into the food handlers' preparation curriculum;
- Introduction of bottle or shelf labeling indicating that certain products are rich in sodium
- Providing individuals attending health centers with tailored nutritional recommendations
- Advocating for persons to reduce their use of goods rich in salt
- Educating children and supplying children with a safe atmosphere such that they continue to follow low-salt diets early.

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