Journal of Nutritional Dietetics & Probiotics

Chembio Publishers
Right Choice for Researchers

Research Article *Volume 1; Issue 2*

Is Salt Consumption in Local Foods a Public Health Concern Among Mauritian Adults?

Hanaa Amiirah Sohawon*

Department of Health Sciences, University of Mauritius, Mauritius

***Corresponding author:** Hanaa Amiirah Sohawon, Department of Health Sciences, Faculty of Science, University of Mauritius, Reduit, Mauritius, Email: s_hanaa11@hotmail.com

Received Date: August 08, 2018; **Published Date:** September 04, 2018

Abstract

Salt is the main source of sodium in the diet. A small amount of salt is important for good health; it helps to maintain the correct fluid and electrolyte balance in the body. However, most people consume much more sodium than they need for good health. Salt consumption has increased nowadays and most of the sodium we eat comes from packaged, processed, store-bought, ready-to-eat and restaurants. There is health risks associated with high salt intake, including high blood pressure in sensitive individuals. A cross-sectional study was carried out to evaluate the reported daily consumption of salt among Mauritian adults and to know their attitudes towards salt consumption and its recommended daily intake. Awareness of the local recommendations of salt to be consumed per day based upon the World Health Organisation (WHO) recommendations was also investigated. The study was carried out among 300 respondents chosen at random, in a wide variety of settings to ensure maximum representation of the Mauritian adult population. The respondents were aged between 30 and 60 years old and consisted of both males and females. A survey-based questionnaire was designed to carry out the investigation, and the results obtained were interpreted and analysed using the Statistical Packages for Social Sciences (SPSS 20.0). From the results obtained, it was found that 51.3% of the respondents were aware of the local daily salt intake recommendation, and reported putting 1 teaspoon (5grams) of salt, as per the recommendations, during their food preparation. 85.7% of the respondents also found this recommendation adequate. However, another 27.4% of respondents were neither aware of the fact that 1 teaspoon of salt is the daily recommended amount to be consumed nor did they consume the 5 grams of salt as recommended. Furthermore, the food frequency questionnaire included in the survey revealed to us that the consumption of highly salted processed foods such as fast foods/ready-to-eat foods and canned foods was quite high among the respondents. Therefore, the study demonstrates that nutrition education programmes need to be set up so as to raise awareness on the importance of salt in the diet. More particularly on its recommended daily intake for good health as well as on the risks associated with excessive intake of highly salted processed foods given that we have noted in our study that it is the consumption of processed salty foods which is the major culprit.

Keywords: Salt; High blood pressure; Highly salted processed foods

Abbreviations: WHO: World Health Organisation; AHA: American Heart Association; NaCl: Sodium Chloride; AI: Adequate Intake; UL: Upper Limit; G: grams; mmol:

Citation: Hanaa Amiirah Sohawon. Is Salt Consumption in Local Foods a Public Health Concern Among Mauritian Adults?. J Nutri Diet Probiotics 2018, 1(2): 180006.

Millimoles; BP: Blood Pressure; ICF: Intra-Cellular Fluid; ECF: Extra-Cellular Fluid; ECV: Extra Cellular Volume; Na+-K+-ATPase: Sodium-Potassium Adenosine Tri-Phosphatise; DASH: Dietary Approaches to Stop Hypertension; NO: Nitric Oxide; CVD: Cardio Vascular Disease; LVH: Left Ventricular Hypertrophy; CAD: Coronary Artery Disease; FAO: Food and Agriculture Organization; RNI: Reference Nutrient Intake; SACN: Scientific Advisory Committee on Nutrition; NHMRC: National Health and Medical Research Council; RCTs: Randomized Controlled Trials; RRs: Relative Risks; CI: Confidence Interval

Introduction

Salt is one of the oldest, most ubiquitous food seasonings. "The taste of salt (saltiness) is one of the basic human tastes and salting is an important method of food preservation" [1]. Salt is the main source of sodium in the diet. A small amount of salt is important for good health; it helps to maintain the correct fluid and electrolyte balance in the body. The total body fluid is distributed mainly between two compartments: the extracellular fluid and the intracellular fluid. The extracellular fluid is divided into the interstitial fluid and the blood plasma. There are 143mmol/L and 9mmol/L of sodium ions in the plasma and intracellular fluids (ICF) respectively. The concentration of chloride ions is 103mmol/L in the plasma and 9mmol/L in the ICF [2]. The kidneys regulate the fluid and electrolyte balance in the body. Disturbance in this balance leads to various health complications such as hypertension and chronic kidney disease [3]. Therefore, it is essential for us to maintain the right fluid and electrolyte balance. However, most people consume much more sodium than they need for good health. Salt consumption has increased nowadays and most of the sodium we eat comes from packaged, processed, store-bought, ready-to-eat and restaurants foods [4]. Various studies have shown that there are health risks associated with high salt intake, including high blood pressure in sensitive individuals. Therefore, health authorities around the world have recommended limitations of dietary sodium. In the WHO World Health Report 2002 (WHO, 2002) it is estimated that globally 62% of cerebrovascular disease and 49% of ischemic heart disease were attributable to elevated blood pressure (systolic > 115 mmHg). A technical report produced by WHO and the Food and Agriculture Organization of the United Nations (FAO) recommends the consumption of 5 g of sodium chloride or less (or 2 g sodium) per day as a population nutrient intake goal, while ensuring that the salt is iodized (WHO, 2010). This expert consultation stressed that dietary intake of sodium from all sources influences blood pressure levels in the population and should be limited so as to reduce the risk of coronary heart disease and stroke. In Mauritius, the prevalence of hypertension is 37.9%: 35.4% for women and 40.5% for men [5]. This is quite alarming and it tells us that if effective measures are not taken immediately to address the problem, the situation might deteriorate. In this connection, apart from traditional measures like health practitioner-patient counselling in hospitals/clinics, we need to devise aggressive prevention programmes to avoid the situation from getting worse. The aim of this project is to assess the knowledge and attitudes regarding salt consumption among Mauritian adults.

The main objectives are:

i. To investigate whether or not Mauritians are aware of the local recommendations of salt to be consumed per day based upon the World Health Organisation (WHO) recommendations.
ii. To know the attitudes of Mauritian adults towards salt consumption and its recommended daily intake.
iii. To evaluate the reported daily consumption of salt among Mauritian adults.

By assessing the knowledge and attitudes regarding salt consumption among Mauritian adults and by evaluating their reported salt consumption, we will be able to better target the population at risk of developing hypertension and heart diseases, and consequently propose corrective measures that need to be taken. The potential impact of the study will be to raise awareness among Mauritians on the recommended amount of salt to be consumed per day and lead to the implementation of national strategies/policies/programmes aiming at the reduction of dietary salt consumption. A cross-sectional study will be done which will be based on quantitative data. The quantitative data collected will then be statistically analysed. A questionnaire will be used in the survey as it is an inexpensive way to gather data from a potentially large number of respondents. Questions asked will be about socio-demographic factors, lifestyle factors, health/nutritional status, and consumption pattern of salt in foods. Respondents will be informed that any information gathered about them will be kept strictly confidential and anonymous. The survey will be carried out among both male and female respondents aged between 30 to 60 years old, and who are of different ethnicities since Mauritius is a multi-cultural country. 378 respondents will be taken at random, and the survey will be a face-to-face interview. Survey sites will be public places such as in hypermarkets, supermarkets, and bus stations all over the island. Data entry and analysis will then be carried out using special statistical software, the Statistical Packages for Social Sciences (SPSS 20.0).

Literature Review

Salt

Salt, also known as table salt or rock salt (halite), is a crystalline mineral that is composed primarily of sodium chloride (NaCl), a chemical compound belonging to the larger class of ionic salts. It is essential for animal life, but can be harmful to animals and plants in excess. Salt is one of the oldest, most ubiquitous food seasonings and salting is an important method of food preservation. The taste of salt (saltiness) is one of the basic human tastes. Salt for human consumption is produced in different forms: unrefined salt (such as sea salt), refined salt (table salt), and iodized salt. It is a crystalline solid, white, pale pink or light gray in colour, normally obtained from sea water or rock deposits. Edible rock salts may be slightly greyish in colour because of mineral content [1].

Types of salt

There are 3 main types of salt which are used as food seasoning: unrefined salt, refined salt (table salt) and iodized salt.

Unrefined salt: Different natural salts have different mineral ties depending on their source, giving each one a unique flavour. Fleur de sell, a natural sea salt from the surface of evaporating brine in salt pans, has a unique flavour varying with the region from which it is produced. Unrefined sea salt contains small amounts of magnesium and calcium halides and sulphates, traces of algal products, salt-resistant bacteria, and sediment particles. The calcium/magnesium salts make unrefined sea salt hygroscopic (it gradually absorbs moisture from air if stored uncovered) and confer a faintly bitter overtone [6]. Algal products contribute a mildly "fishy" or "sea-air" odour, the latter from organ bromine compounds. Sediments, the proportion of which varies with the source, give the salt a dull gray appearance. Since taste and aroma compounds are often detectable by humans in minute concentrations, sea salt may have a more complex flavour than pure sodium chloride when sprinkled on top of food. When salt is added during cooking however, these flavours would likely be overwhelmed by those of the food ingredients [7].

Refined salt (Table salt): Refined salt, the most widely used form, is mainly composed of sodium chloride. Food grade salt accounts for only a small part of salt production in industrialized countries (3 percent in Europe). Although worldwide, food uses account for 17.5 percent of salt production [8]. Salt can be obtained by evaporation of sea water, usually in shallow basins warmed by sunlight. Salt so obtained was formerly called bay salt, and is now often called sea salt or solar salt. Rock salt deposits are formed by the evaporation of ancient salt lakes, and may be mined conventionally or through the injection of water. Multiple stages of evaporation are then used to collect pure sodium chloride crystals, which are kiln-dried [9]. In many cuisines around the world, salt is used in cooking, and is often found in salt shakers on diners, eating tables for their personal use on food. Table salt is refined salt, which contains about 97 to 99 percent sodium chloride [10].

Iodized salt: Iodine is important to prevent the insufficient production of thyroid hormones (hypothyroidism), which can cause goitre, cretinism in children, and myxedema in adults. Iodine-containing compounds are added to table salt. Iodized salt is thus table salt mixed with a minute amount of potassium iodide, sodium iodide, or sodium iodated. A small amount of dextrose may also be added to stabilize the iodine. Iodized salt is used to help reduce the incidence of iodine deficiency in humans [11].

Salt consumption around the world

According to a report published by the WHO in 2007, it was found that daily intakes of salt varies considerably across population groups from 4g salt/day (1.56g/d, 68mmol/d sodium) among Alaskan Eskimos to 27 g salt/day (10.6g/d, 460mmol/d sodium) in Japan. American men had intakes averaging 10 g salt/day (3.91g/d, 170mmol/d sodium). Overall, 119 countries (about 88% of the globe) averaged more than 3,000 mg of dietary sodium per day. Only six nations had national averages that met WHO limits of 2,000 mg per day, and only Kenya met the American Heart Association's (AHA) 1,500 mg per day cut off. Central Asia ranks highest in salt consumption, averaging 5,500g sodium per day. Other high-income countries in the Asia Pacific region averaged 5,000g sodium per day, followed by East Asia at 4,800 g per day. Among world regions, east sub-Saharan Africa ranked lowest in salt consumption, with a daily mean sodium intake of 2,200g. In comparison, American adults averaged about 3,600 mg of dietary sodium a day. From 1990 to 2010, the global sodium intake increased by 124 mg per day, with an increase of more than 100 mg per day in 83 countries and a decrease of more than 100mg/day in 15 countries [12]. Recommended intakes of salt are usually expressed in terms of sodium intake. Salt (as sodium chloride) contains 40 percent of sodium by weight.

Country	Description	Salt intake (mg/day)	Authority
United Kingdom	The Reference Nutrient Intake (RNI) defined for a typical adult	RNI: 4000	Scientific Advisory Committee on Nutrition (SACN)
Canada	An Adequate Intake (AI) and Upper Limit (UL) recommended for persons aged 9 years or more.	AI: 3000–3750 UL: 5500–5750	Health Canada
Australia and New Zealand	An Adequate Intake (AI) and an Upper Level of intake (UL) defined for adults	AI: 1150–2300 UL: 5750	National Health and Medical Research Council (NHMRC)
United States	An Upper Limit (UL) defined for adults.	UL: 5750	Department of Agriculture and Department of Health and Human Services

Table 1: Recommended salt intake in different countries.

Source: Joint Technical Meeting Report convened by the World Health Organisation and the Government of Canada, 2010. Salt consumption has increased nowadays and various studies have shown that there is health risks associated with high salt intake, including high blood pressure in sensitive individuals. Therefore, some health authorities have recommended limitations of dietary sodium. In the WHO World Health Report 2006, it is estimated that globally 62% of cerebrovascular disease and 49% of ischemic heart disease were attributable to elevated blood pressure (systolic > 115 mmHg). Heart diseases are the leading cause of death for persons over 60 years of age and the second cause of death for persons aged 15–59 years. The WHO report also states that in all settings population-wide salt reduction strategies were the most cost-effective [13]. A technical report produced by WHO and the Food and Agriculture Organization of the United Nations (FAO) recommends the consumption of 5 g of sodium chloride or less (or 2g sodium) per day as a population nutrient intake goal, while ensuring that the salt is iodized (WHO, 2010). The American Heart Association (AHA) recommends limiting sodium in the diet to no more than 1,500mg a day.

Health aspects

The amount of salt is regulated in the human body by the kidneys and by perspiration. One component of salt, sodium (Na), is involved in muscle contraction including heartbeat, nerve impulses, and the digestion of body-building protein. Sodium is easily absorbed and is active in the absorption of other nutrients in the small intestine. Sodium is the major extracellular electrolyte responsible for regulating water balance, pH, and osmotic pressure. It is important in nerve conduction [2]. Because of sodium's importance to your body, several interacting mechanisms, including generation of hormones angiotensin and aldosterone, adjust the system in the event of consumption of insufficient amounts of salt which would threaten the body's nerves and muscles and interference with the sodium-potassium pump which adjusts intra- and extra-cellular pressures. If salt intake varies widely, these mechanisms activate to assure that the body remains healthy, maintaining a relatively constant blood pressure [3]. The other component of salt, chloride (Cl) is also essential to good health. It preserves acid-base balance in the body, aids potassium absorption and supplies the essence of digestive stomach acid [14].

In the adult human, water makes up approximately 60% of total body weight. This water is distributed between the intracellular fluid (ICF) and the extracellular fluid (ECF). The osmotic effect of sodium in the ECF allows it to draw fluid into both the intravascular and interstitial spaces. Because sodium can draw fluid into the intravascular space, excessive sodium intake can contribute to adverse health consequences such as hypertension. Salt is important to good nutritional status. Too little salt can cause disturbances in tissue-water and acid-base balance [15]. Many pathophysiologic factors have been implicated in the genesis of essential hypertension, namely increased sympathetic nervous system activity, perhaps related to heightened exposure or response to psychosocial stress; overproduction of sodium-retaining hormones and vasoconstrictors; long-term high sodium intake; inadequate dietary intake of potassium and calcium; increased or inappropriate rennin secretion with resultant increased production of angiotensin II and aldosterone; deficiencies of vasodilators, such as prostacyclin, nitric oxide (NO), and the natriuretic peptides; alterations in expression of the kallikrein– kin in system that affect vascular tone and renal salt handling; abnormalities of resistance vessels, including selective lesions in the renal microvasculature; diabetes mellitus; insulin resistance; obesity; increased activity of vascular growth factors; alterations in adrenergic receptors that influence heart rate, isotropic properties of the heart, and vascular tone; and altered cellular ion transport [16].

Sodium balance is precisely regulated by intake and output. The kidneys are responsible for adjusting sodium excretion to maintain balance at varying intakes. High salt intake increases extracellular volume (ECV), blood volume, and cardiac output resulting in elevation of blood pressure. High ECV induces release of a digitalis-like immunoreactive substance and other inhibitors of Na^+-K^+-ATPase. As a consequence, intracellular sodium and calcium concentrations increase in vascular smooth muscles predisposing them to contraction. Moreover, high ECV increases synthesis and decreases clearance of asymmetrical dimethyl-l-arginine leading to inhibition of nitric oxide (NO) synthase. High concentration of sodium and calcium in vascular smooth muscles, and decreased synthesis of NO lead to an increase in total peripheral resistance. Restoration of normal ECV and blood pressure are attained by increased glomerular filtration and decreased sodium reabsorption. In some individuals, the kidneys have difficulty in excreting sodium, so the equilibrium is achieved at the expense of elevated blood pressure [17]. Western industrialized societies are currently experiencing an epidemic expansion of hypertension, which extends alarmingly even to children and adolescents. Hypertension constitutes an independent risk factor for cardiovascular and renal diseases and represents an extremely common co-morbidity of diabetes and obesity.

Numerous randomized clinical trials and meta-analyses have provided robust scientific evidence that reduced dietary salt intake, increased dietary potassium intake, moderation of alcohol consumption, optimal weight maintenance, and the adoption of "heart-friendly" dietary patterns such as the Dietary Approaches to Stop Hypertension (DASH) diet or the Mediterranean diet can effectively lower blood pressure. Interestingly, the susceptibility of blood pressure to nutritional interventions is greatly variable among individuals, depending on age, race, genetic background, and co-morbidities [15]. Potassium and sodium act synergistically in the regulation of blood pressure (BP). Blood pressure is directly associated with the total body sodium and negatively correlated with the total body potassium. Epidemiologic, experimental, and clinical studies have shown that potassium is a significant regulator of blood pressure and further improves cardiovascular outcomes. Hypertensive cardiovascular damage, stroke, and stroke-related death are accelerated by salt intake but might be curbed by increasing dietary potassium intake. The antihypertensive effect of potassium supplementation appears to occur through several mechanisms that include regulation of vascular sensitivity to catecholamines, promotion of natriuresis, limiting plasma renin activity, and improving endothelial function. In the absence of chronic kidney disease, the combined evidence suggests that a diet rich in potassium content serves a vascular-protective function, particularly in the setting of salt-sensitive hypertension and pre-hypertension [18].

A reduction in salt intake lowers blood pressure (BP) and, thereby, reduces cardiovascular risk. Uncontrolled and prolonged elevation of BP can lead to a variety of changes in the myocardial structure, coronary vasculature, and conduction system of the heart. These changes in turn can lead to the development of left ventricular hypertrophy (LVH), coronary artery disease (CAD), various conduction system diseases, and systolic and diastolic dysfunction of the myocardium, complications that manifest clinically as angina or myocardial infarction, cardiac arrhythmias (especially atrial fibrillation), and congestive heart failure [19]. A recent meta-analysis was carried out by [20] and had as objectives to assess

i. The effect of a longer-term modest reduction in salt intake (i.e. of public health relevance) on BP and whether there was a dose-response relationship;
ii. The effect on BP by sex and ethnic group;
iii. The effect on plasma renin activity, aldosterone, noradrenaline, adrenaline, cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL) and triglycerides.

Thirty-four trials (3230 participants) were included. Meta-analysis showed that the mean change in urinary sodium (reduced salt versus usual salt) was -75 mmol/24-h (equivalent to a reduction of 4.4 g/d salt), the mean change in BP was -4.18 mmHg (95% CI: -5.18 to -3.18, I (2)=75%) for systolic and -2.06 mmHg (95% CI: -2.67 to -1.45, I (2)=68%) for diastolic BP. Meta-regression showed that age, ethnic group, BP status (hypertensive or normotensive) and the change in 24-h urinary sodium were all significantly associated with the fall in systolic BP, explaining 68% of the variance between studies. A 100 mmol reduction in 24 hour urinary sodium (6 g/day salt) was associated with a fall in systolic BP of 5.8 mmHg (95%CI: 2.5 to 9.2, P=0.001) after adjusting for age, ethnic group and BP status. For diastolic BP, age, ethnic group, BP status and the change in 24-h urinary sodium explained 41% of the variance between studies. Meta-analysis by subgroup showed that, in hypertensives, the mean effect was -5.39 mmHg (95% CI: -6.62 to -4.15, I (2) =61%) for systolic and -2.82 mmHg (95% CI: -3.54 to -2.11, I (2)=52%) for diastolic BP. In normotensives, the mean effect was -2.42 mmHg (95% CI: -3.56 to -1.29, I (2)=66%) for systolic and -1.00 mmHg (95% CI: -1.85 to -0.15, I (2)=66%) for diastolic BP.

Further subgroup analysis showed that the decrease in systolic BP was significant in whites and blacks, men and

women. Meta-analysis of hormone and lipid data showed that the mean effect was 0.26 ng/ml/hr (95% CI: 0.17 to 0.36, I (2)=70%) for plasma renin activity, 73.20 pmol/l (95% CI: 44.92 to 101.48, I (2)=62%) for aldosterone, 31.67 pg/ml (95% CI: 6.57 to 56.77, I (2)=5%) for noradrenaline, 6.70 pg/ml (95% CI: -0.25 to 13.64, I (2)=12%) for adrenaline, 0.05 mmol/l (95% CI: -0.02 to 0.11, I (2)=0%) for cholesterol, 0.05 mmol/l (95% CI: -0.01 to 0.12, I (2)=0%) for LDL, -0.02 mmol/l (95% CI: -0.06 to 0.01, I (2)=16%) for HDL, and 0.04 mmol/l (95% CI: -0.02 to 0.09, I (2)=0%) for triglycerides. The study demonstrated that a modest reduction in salt intake for 4 or more weeks causes significant and, from a population viewpoint, important falls in BP in both hypertensive and normotensive individuals, irrespective of sex and ethnic group. With salt reduction, there is a small physiological increase in plasma renin activity, aldosterone and noradrenaline. There is no significant change in lipid levels. These results provide further strong support for a reduction in population salt intake. This will likely lower population BP and, thereby, reduce cardiovascular disease. Additionally, the analysis demonstrates a significant association between the reduction in 24-h urinary sodium and the fall in systolic BP, indicating the greater the reduction in salt intake, the greater the fall in systolic BP. The current recommendations to reduce salt intake from 9-12 to 5-6g/d will have a major effect on BP, but are not ideal. A further reduction to 3g/d will have a greater effect and should become the long term target for population salt intake.

A vast epidemiological literature describes an apparent relationship between raised blood pressure and lifestyle choices and habits. Studies have shown that diet and a healthy lifestyle alone or in combination with medical treatment can lower BP and decrease the symptoms of heart failure, as well as reverse LVH. A heart-healthy diet is part of the secondary prophylaxis in patients with coronary artery disease and of the primary prophylaxis in patients at high risk for this disease. Specific dietary recommendations include a diet low in sodium, high in potassium (in patients with normal renal function), rich in fresh fruits and vegetables, low in cholesterol, and low in alcohol consumption [21]. Regular dynamic isotonic (aerobic) exercise, such as walking, running, swimming, or cycling, has been shown to decrease BP and improve cardiovascular well-being. It also has additional favourable cardiovascular effects, including improved endothelial function, peripheral vasodilatation, reduced resting heart rate, improved heart rate variability, and reduced plasma levels of catecholamines. Regular aerobic exercise sessions of at least 30 minutes for most days of the week can produce an average reduction in BP of 4-9mm Hg [22].

Randomized controlled trials have been carried out, enrolling patients who had raised average blood pressure defined as systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥85 mmHg, analysing either blood pressure or major cardiovascular endpoints on an intention-to-treat basis, of eight weeks or more follow-up. Statistically significant reductions in blood pressure were found, in the short term for improved diet and exercise, relaxation therapies, and sodium and alcohol reduction [23]. Although meta-analyses of randomized controlled trials (RCTs) of salt reduction report a reduction in the level of blood pressure (BP), the effect of reduced dietary salt on cardiovascular disease (CVD) events remains unclear. Seven studies were identified: three in normotensives, two in hypertensives, one in a mixed population of normo- and hypertensives and one in heart failure. Salt reduction was associated with reductions in urinary salt excretion of between 27 and 39 mmol/24 h and reductions in systolic BP between 1 and 4 mm Hg. Relative risks (RRs) for all-cause mortality in normotensives (longest follow-up-RR: 0.90, 95% confidence interval (CI): 0.58-1.40, 79 deaths) and hypertensive (longest follow-up RR 0.96, 0.83-1.11, 565 deaths) showed no strong evidence of any effect of salt reduction CVD morbidity in people with normal BP (longest follow-up: RR 0.71, 0.42-1.20, 200 events) and raised BP at baseline (end of trial: RR 0.84, 0.57-1.23, 93 events) also showed no strong evidence of benefit.

Salt restriction increased the risk of all-cause mortality in those with heart failure (end of trial RR 2.59, 1.04-6.44, and 21 deaths). Despite collating more event data than previous systematic reviews of RCTs (665 deaths in some 6,250 participants), there is still insufficient power to exclude clinically important effects of reduced dietary salt on mortality or CVD morbidity. Benefits from dietary salt restriction are consistent with the predicted small effects on clinical events attributable to the small BP reduction achieved [24]. Eating too much salt contributed to 2.3 million deaths from heart attacks, strokes and other heart-related diseases throughout the world in 2010, representing 15 percent of all deaths due to these causes, according to research presented at the American Heart Association's Epidemiology and Prevention/Nutrition, Physical Activity and Metabolism 2013 Scientific Sessions. The researchers analyzed 247 surveys of adult sodium intake, stratified by age, gender, region and country between 1990 and 2010 as part of the 2010 Global Burden of Diseases Study, an international collaborative study by 488 scientists from 303 institutions in 50 countries around the world. Next, they determined how the amount of sodium people were consuming was affecting their risk of cardiovascular disease, by performing a meta-analysis of 107 randomized,

prospective trials that measured how sodium affects blood pressure, and a meta-analysis of how these differences in blood pressure relate to the risk of developing cardiovascular disease compared with consuming no more than 1,000 mg per day of sodium, which the researchers defined as an optimal amount of sodium for adults.

Cardiovascular disease includes all diseases of the heart and blood vessels, including stroke. Nearly 1 million of these deaths, 40 percent of the total, were premature, occurring in people 69 years of age and younger. Sixty percent of the deaths occurred in men and 40 percent were in women. Heart attacks caused 42 percent of the deaths and strokes 41 percent. The remainder resulted from other types of cardiovascular disease. Eighty-four percent of these deaths attributed to eating too much sodium were in low and middle-income countries, rather than high-income countries. The U.S. ranked 19th out of the 30 largest countries, with 429 deaths per million adults attributed to eating too much sodium (representing 1 in 10 U.S. deaths due to these causes) [25].

Methodology

A cross-sectional study was done which was based on quantitative data. A cross-sectional study involves observation of all of a population, or a representative subset, at one specific point in time. Cross-sectional studies are descriptive studies and they may be used to describe some feature of the population, such as prevalence of an illness, or they may support inferences of cause and effect [26]. The quantitative data collected was then statistically analysed.

Questionnaire

A questionnaire was used in the survey as it is an inexpensive way to gather data from a potentially large number of respondents. Questions asked referred to 4 broad sections: socio-demographic factors, lifestyle factors, health/nutritional status, and consumption pattern of salt in foods. Respondents were informed that any information gathered about them will be kept strictly confidential and anonymous.

Pre-testing and administration of questionnaire

A pilot questionnaire was designed before the final questionnaire was set, to ensure that the questions set were clear, not ambiguous, and easy to understand and to respond to. Also, this was done to ascertain that the questionnaire's layout was clear and attractive. Face-to-face interview was preferred since it was better to ask the questions and to make the interviewee understand clearly the questions asked and to reply accordingly. The survey questionnaire was filled by the same interviewer to ensure consistency. Once a questionnaire was drafted, it was tried and tested on 20 respondents. This pre-testing is also referred to as piloting the questionnaire. In this study, the questionnaires were piloted among respondents of different age groups, gender, and ethnicity. Appropriate changes were then made before filling three hundred questionnaires.

Study type and sample size

The sample size, N, was calculated using the formula below:

$$N = \frac{t^2\, p\, (1-p)}{m^2}$$

where t is the 95% confidence interval (in this case, t=1.96), p is the proportion of the selected sample (in this case, p=total number of adults aged 30-60 years old in Mauritius/total Mauritian adult population, giving p=535 022/1, 237, 283= 0.4324), and m is the margin error at 5% significance level (in this case, m=0.05). By substituting these values in the above equation, the sample size was calculated and we obtained a sample size of 378. In this study, however, we could manage to get 300 respondents out of the 378, and the 300 respondents were randomly chosen. The survey was carried out among both male and female respondents aged between 30 to 60 years old, and who were of different ethnicities since Mauritius is a multi-cultural country.

Inclusion criteria

The survey was carried out among both male and female respondents aged between 30 to 60 years old.

Data collection

Survey sites were public places such as hypermarkets, supermarkets, and bus stations all over the island. These settings were chosen because at these places, a large number of people of different age, gender and ethnicity, could be taken. Before starting to fill in the questionnaire, the respondents were asked whether they wanted to participate or not. They were also informed that any information gathered about them will be kept strictly confidential and anonymous. Each questionnaire took around eight minutes to be filled. Questions were asked to assess the daily consumption of salt among Mauritian adults. Concerning the portion size for salt usage during

food preparation, a teaspoon (5grams) was taken as reference (Figure 1).

Figure 1: Teaspoon used to show portion size for salt usage during food preparation [27].

Data capture, Statistical analysis and Quality control

Various steps were taken to ensure the quality of data throughout the whole operational procedures. At the survey sites, the questionnaires were verified for completeness before the respondents were allowed to go. The questionnaires were re-edited for consistency and the data entry and analysis were then carried out using special statistical software, the Statistical Packages for Social Sciences (SPSS 20.0). The data entry was verified twice so as to eliminate errors which may affect the outcome of the results. After this task was performed, the results were represented graphically using pie charts, histograms and bar charts. The results obtained were then analysed and interpreted on SPSS using chi-squared tests.

Results

Data generated from questionnaire was analysed with the Statistical Package for the Social Sciences 20.0 (SPSS 20.0) and Microsoft Excel software 2007. The results are expressed using tables, bar charts, histograms and pie charts. Some of the results are also expressed in terms of percentages.

Results and analysis of survey questionnaire

Section A: Socio-demographic factors: The first section of the questionnaire consisted of the socio-demographic factors such as age, gender, ethnicity, and region where the respondent lives. The sample population consisted of 300 adults aged between 30 years and 60 years old, coming from both urban and rural areas of the island. People having different ethnic backgrounds were also included in the survey, and these include Indo-Mauritians, Afro-Mauritians, Sino-Mauritians, Euro-Mauritians and mixed population. The number of male and female respondents from the different age groups taken is listed in Table 2.

	Male		Female	
Age (Years)	Frequency	Percent (%)	Frequency	Percent (%)
30-40	88	59.5	93	61.2
41-50	38	25.7	39	25.6
51-60	22	14.8	20	13.2
Total	148	100.0	152	100.0

Table 2: Number (Frequency) and percentage of respondents interviewed during the survey. Among the 300 respondents, 200 (66.7%) were Indo-Mauritians, 56 (18.7%) were Afro-Mauritians, 12 (4%) were Sino-Mauritians, 8 (2.7%) were Euro-Mauritians and 24 (8%) were of mixed origins.

Section B: Socio-economic Factors: The second section of the questionnaire was based on socio-economic factors, including level of education of respondent, respondents' occupation, family income and number of people in the family. In the population surveyed, 5.3%, 33% and 61.7% of the respondents attained primary, secondary and tertiary level of education respectively. Workers surveyed were classified into three main categories, based on their level of activity: Sedentary, Moderate and Heavy workers. 44% of the respondents were sedentary workers, and 40% and 16% of them were moderate and heavy workers respectively. The family income of the respondents was also asked in this section. Based on the results obtained during the survey, it was noted that 17.3% of respondents who were sedentary workers had a family income of more than Rs 30 000, 12.3% of respondents who were moderate workers had a family income of Rs 20 001-30 000, and 6% of respondents who were heavy workers had a family income of Rs 10 001-20 000. There is a correlation between respondent's occupation and family income (p=0.000). Sedentary workers had a higher family income than moderate and heavy workers (Table 3).

Respondent's occupation	Family income				
	Less than Rs 5000	Rs 5000-10 000	Rs 1000-20 000	Rs 200-30 000	More than Rs 30 000
Sedentary worker (%)	0	5.3	10.7	10.7	17.3
Moderate worker (%)	0	11.7	5.3	12.3	10.7
Heavy worker (%)	2.7	1.3	6.0	2.7	3.3

Table 3: Number of respondents (expressed in terms of percentages) with a family income ranging from less than Rs 5000 to more than Rs 30 000 based on their occupation.

Section C: Lifestyle factors: The third section of the questionnaire was about lifestyle factors. Smoking habits, alcohol consumption and the practice of physical exercise are represented in Figure 2. More males were smokers and consumed more alcoholic drinks than females (36% versus 16% for smoking and 70% versus 32% for alcohol consumption). Another important factor which was considered in this part of the questionnaire was the practice of physical exercise among the respondents. It was noted that 75.7% and 74.3% of male and female respondents respectively practised a regular physical exercise, apart from work (Figure 2).

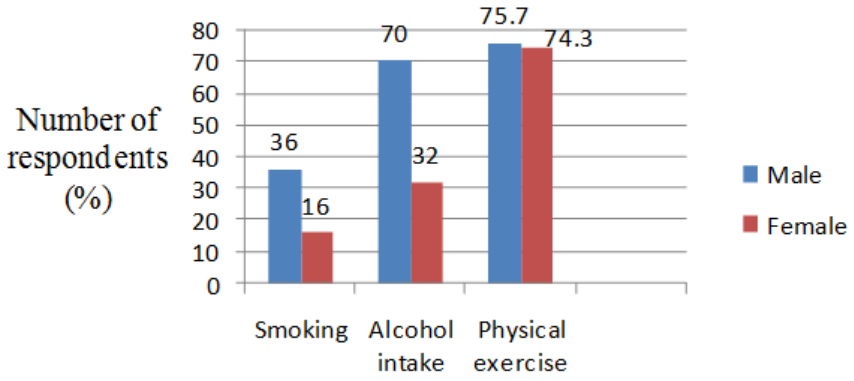

Figure 2: Male and female respondents who smoke and consume alcoholic drinks.

Section D: Health status: The next section of the questionnaire consisted of the health status of the respondents. Medical history of the respondents was enquired in this section. This was asked to determine the health status of the study population. Among the 300 respondents under study, 86.7% of them were considered to be healthy since they reported having no medical history of disease. 10.7% of the respondents claimed suffering from hypertension and 2.6% of the respondents reported suffering from both hypertension and heart disease (Figure 3).

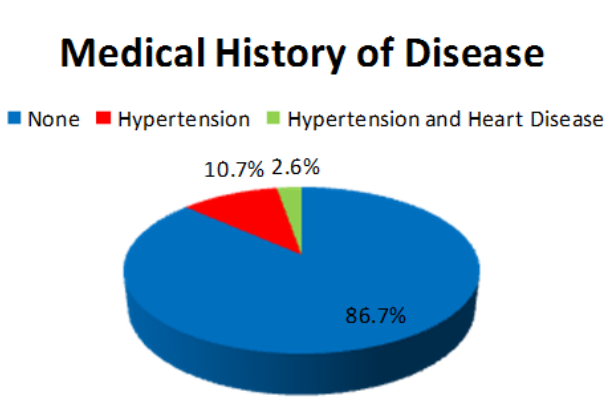

Figure 3: Medical history of the respondents.

Among the respondents who claimed suffering from hypertension, 87.5% were both taking medications for hypertension and followed a special diet (low salt diet) (Figure 4).

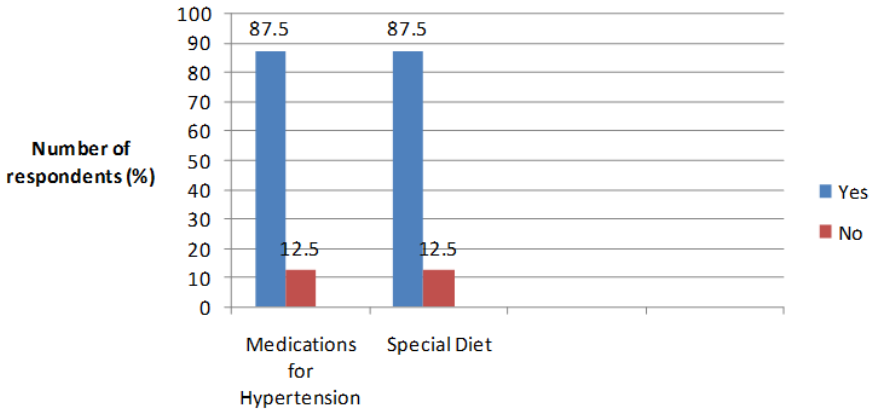

Figure 4: Number of respondents with hypertension (expressed in percentages) who were taking medications for hypertension and who were following a special diet (low salt diet).

Hypertension was more prevalent among respondents aged 30-40 years old, with 5.3% of the respondents suffering from it (Table 4). 1.3% of the respondents aged 41-50 years old claimed suffering from both hypertension and heart disease, and 4% of the respondents aged 51-60 years old had hypertension. The high prevalence noted among respondents aged 30-40 years old can be explained by the fact that more people in this age group were surveyed during the study (Table 2). This also reflects the population demographics of Mauritius. 44.6% of the Mauritian population are aged between 25 and 54 years old (Mauritius Demographics Profile 2013). A strong correlation was found between age of the respondents and medical history of disease (p=0.000), meaning that as age progresses, the risk of developing disease also increases. Hypertension was more prevalent among female respondents than among the males (8% versus 2.7%) (Figure 5). No association was found between gender and medical history of disease (p=0.116).

Age of Respondents (years)	Medical history of disease			Total (%)
	None	Hypertension	Hypertension and Heart disease	
30-40	55	5.3	0	60.3
41-50	23	1.3	1.3	25.7
51-60	8.7	4.0	1.3	14.0
				100

Table 4: Number of respondents (expressed in terms of percentages) in different age groups who had a medical history of disease.

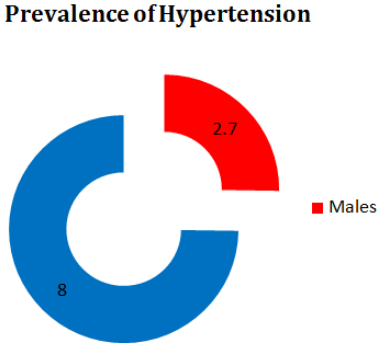

Figure 5: Number of male and female respondents (expressed in terms of percentages) who suffered from hypertension.

A correlation was found between respondent's occupation and medical history of disease (p=0.025). Sedentary workers were at higher risk of developing disease than moderate and heavy workers. 68.3% of the respondents practised physical exercise, apart from work, and had no medical history of disease (Table 5). A strong correlation was also found between the practice of physical exercise among the respondents and medical history of disease (p=0.001).

Practise physical Exercise apart from work	Medical history of disease			Total (%)
	None	Hypertension	Hypertension and Heart disease	
No	18.3	5.3	1.4	25
Yes	68.3	5.3	1.4	75
				100

Table 5: Number of respondents (expressed in terms of percentages) who practiced physical exercise apart from work and who had a medical history of disease.

Section E: Consumption pattern of salt: The fifth section of the questionnaire dealt with the consumption pattern of salt among the respondents. The aim of this project was to assess the knowledge and attitudes regarding salt consumption among Mauritian adults. The main objectives were:

i. To investigate whether or not Mauritians are aware of the local recommendations of salt to be consumed per day based upon the World Health Organisation (WHO) recommendations.
ii. To know the attitudes of Mauritian adults towards salt consumption and its recommended daily intake.
iii. To evaluate the reported daily consumption of salt among Mauritian adults.

To investigate whether or not the respondents were aware of the local recommendations of salt to be consumed per day based upon the World Health Organisation (WHO) recommendations, they were asked to choose between 0 tablespoon (tsp), 1 tsp, 2-3 tsp and more than 3 tsp. The following responses were obtained.

A technical report produced by WHO and the Food and Agriculture Organization of the United Nations (FAO) recommends the consumption of 5 g (1 tsp) of sodium chloride or less per day as a population nutrient intake goal (WHO, 2010). In the study, it was found that 67.3% of the respondents were aware of this daily salt intake recommendation whereas 27.3% of the respondents answered that 2-3 teaspoons of salt should be consumed per day (Figure 6). To know the attitudes of the respondents towards salt consumption and its recommended daily intake, they were asked whether they found that the recommended daily intake is too little. 85.7% of the respondents found that it was enough, while 14.3% found that it was too little (Figure 7).

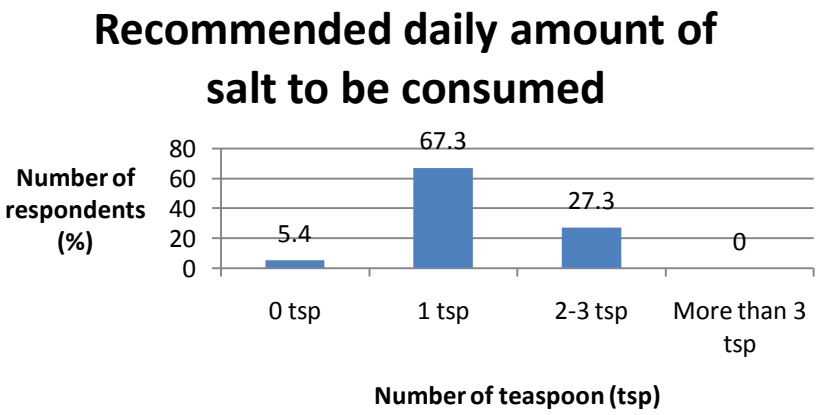

Figure 6: Number of respondents (expressed as percentages) who were aware of the local recommendations of salt to be consumed per day based upon the World Health Organisation (WHO) recommendations.

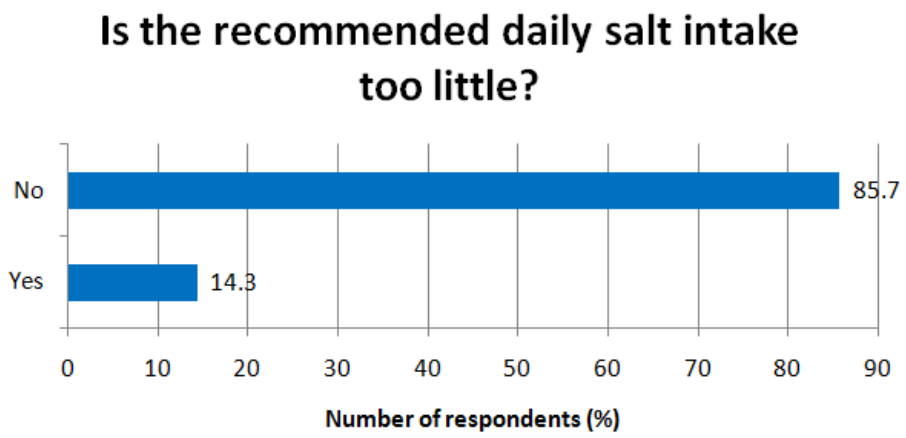

Figure 7: Number of respondents (expressed as percentages) who think that the recommended daily salt intake is too little.

To evaluate the reported daily consumption of salt among the respondents, they were asked how much table salt they consumed per day or put during their food preparation. They were asked to choose between 0 teaspoon (tsp), 1 tsp, 2-3 tsp and more than 3 tsp. 56.7% of the respondents reported putting 1 teaspoon (5 grams) of salt during their food preparation. 5.3% of the respondents did not put salt at all during their food preparation, whilst 35.3% and 2.7% of the respondents put 2-3 teaspoons and more that 3 teaspoons of salt respectively during their food preparation (Figure 8). A further analysis, which is scoring, was done to classify the respondents based upon their knowledge of the local recommendations of salt to be consumed per day based upon the World Health Organisation (WHO) recommendations, and their reported daily salt consumption. Respondents who were aware that 1 teaspoon (5grams) of salt is the daily recommended amount to be consumed, and if they actually consumed or put 1 teaspoon of salt per day during their food preparation, they were given a score of 3. Respondents who were aware that 1 teaspoon (5grams) of salt is the daily recommended amount to be consumed, but who did not consume the 5 grams of salt as recommended, were given a score of 2. Respondents who were not aware that 1 teaspoon (5grams) of salt is the daily recommended amount to be consumed, but who consumed the 5 grams of salt as recommended, were given a score of 1. Finally, respondents who were not aware that 1 teaspoon (5grams) of salt is the daily recommended amount to be consumed and did not consume the 5 grams of salt as recommended, were given a score of 0.

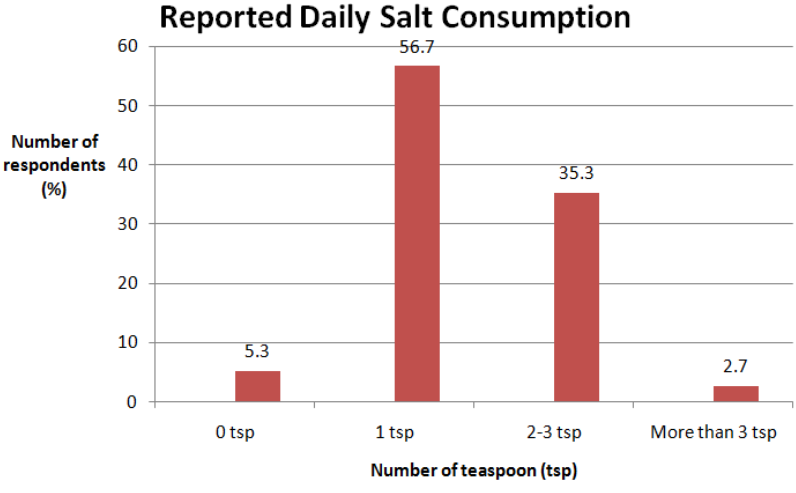

Figure 8: Reported daily salt consumption by the respondents.

Out of the 300 respondents surveyed, 154 (51.3%) of them obtained a score of 3 (Table 6), meaning that they were aware that 1 teaspoon (5grams) of salt is the daily recommended amount to be consumed, and they actually consumed or put 1 teaspoon of salt per day during their food preparation. 48 respondents were aware that 1 teaspoon (5grams) of salt is the daily recommended amount to be consumed, but did not consume the 5 grams of salt as recommended, and were therefore given a score of 2. 16 and 82 respondents obtained a score of 1 and 0 respectively, meaning that 16 respondents were not aware that 1 teaspoon (5grams) of salt is the daily recommended amount to be consumed, but consumed the 5grams of salt as recommended and 82 respondents were neither aware of the fact that 1 teaspoon (5grams) of salt is the daily recommended amount to be consumed nor consumed the 5 grams of salt as recommended. A food frequency questionnaire containing a list of foods most often consumed by Mauritian adults was also included in the survey questionnaire. The respondents were asked whether bread, butter, cheese, processed/canned foods and fast-foods/ready-to-eat foods contain salt, and their frequency of consumption of these food items. While asking about processed/canned foods and fast-foods/ready-to-eat foods, examples of such food items were given to the respondents for them to understand better what we mean by processed/canned foods and fast-foods/ready-to-eat foods. This has been done so as to obtain more accurate results. 97.3% of the respondents claimed that bread contains a high amount of salt. 93.3% of the respondents also claimed that butter, cheese and processed/canned foods are high salt-containing foods, and 96% of them know that fast-foods/ready-to-eat foods also contain high amounts of salt. 93.7% and 62.3% of the respondents consumed bread and butter respectively every day. 31.3% of the respondents ate cheese 2-3 times per week. Processed/canned foods were consumed 2-3 times per week by 38.7% of the respondents, and 39% of the respondents consumed fast-foods/ready-to-eat foods 1-2 times per month (Table 7).

Score	Number of respondents	Percentage (%)
3	154	51.3
2	48	16.0
1	16	5.3
0	82	27.4

Table 6: Scoring done to classify the respondents based upon their knowledge of the local recommendations of salt to be consumed per day based upon the WHO recommendations, and their reported daily salt consumption.

Food Items	Yes (%)	No (%)	Frequency of consumption (%)				
			Everyday	Once a week	2-3 times per week	1-2 times per month	Never
Bread	97.3	2.7	93.7	0.3	5.3	0	0.7
Butter	93.3	6.7	62.3	12.7	16.0	4.0	5.0
Cheese	93.3	6.7	29.3	20.7	31.3	13.4	5.3
Processed/Canned foods	93.3	6.7	2.7	20.0	38.7	35.3	3.3
Fast foods/Ready-to-eat foods	96.0	4.0	4.0	27.0	22.7	39.0	7.3

Table 7: Frequency of consumption of particular food items (expressed in terms of percentages of respondents).

The respondents were also asked what were the factors which affected their daily salt consumption, and they had to choose between 4 options. According to the responses obtained from the survey (Table 8), 66.3 % of the respondents did not agree that the price of one packet of salt was expensive, and therefore, it did not affect their ability to purchase and to consume salt. A strong correlation was found between daily salt consumption and price (p=0.003). 52% of the respondents were aware of the importance of salt in the diet and consumed salt because of this. A very strong association was found between awareness of the importance of salt in the diet and daily salt consumption among the respondents (p=0.000). 44.7% of the respondents claimed that medical reasons did play a role in affecting their daily salt consumption, and an association was also found to support this fact (p=0.026). Respondents were aware that excess salt intake may affect their health, and thus, they consumed moderate amount of it. 77.3% of the respondents disagreed to the statement “salt is not easily available on the market” and therefore claimed that this did not affect their salt consumption.

	Disagree	Neither disagree nor agree	Agree
Because of its price (1 packet of salt is expensive)	66.3	26.7	7.0
Aware of the importance of salt in the diet	24.0	24.0	52.0
For medical reasons	31.3	24.0	44.7
Availability on the market (not easily available)	77.3	16.0	6.7

Table 8: Factors affecting salt consumption among the respondents.

Summary of results

i. Regarding objective 1, 67.3% of the respondents were aware of the local recommendations of salt to be consumed per day based upon the World Health Organisation (WHO) recommendations.
ii. Regarding objective 2, 85.7% of the respondents claimed that the recommended daily salt intake is enough.
iii. Regarding objective 3, 56.7% of the respondents reported putting 1 teaspoon (5grams) of salt during their food preparation, as per the local recommendations. However, from the food frequency questionnaire, it was noted that the consumption of highly salted processed foods was quite high among the respondents.

Discussion

Salt consumption

The results of the study clearly show that more nutrition education needs to be done in order to raise awareness about the local recommendations of salt to be consumed per day based upon the World Health Organisation (WHO) recommendations, for appropriate consumption among Mauritians. A technical report produced by WHO and the Food and Agriculture Organization of the United Nations (FAO) recommends the consumption of 5 g (1 tsp) of sodium chloride or less per day as a population nutrient intake goal (WHO, 2010). From the data gathered, it was found that 67.3% of the respondents were aware of this daily salt intake recommendation whereas 27.3% of the respondents were not and answered that 2-3 teaspoons of salt should be consumed per day (Figure 6). 85.7% of the respondents found that this daily salt intake recommendation was enough, while 14.3% claimed that it was too little since they liked salty foods (Figure 7). As literature indicates, "The taste of salt is one of the basic human tastes and salt is one of the oldest, most ubiquitous food seasonings" [1]. Among the 300 respondents under study, 86.7% of them were considered to be healthy since they reported having no medical history of disease. 10.7% of the respondents claimed suffering from hypertension and 2.6% of the respondents reported suffering from both hypertension and heart disease (Figure 3).

Among the respondents who claimed suffering from hypertension, 87.5% were both taking medications for hypertension and followed a special low salt diet (Figure 4). An additional 5.3% of the respondents also claimed not putting salt at all during their food preparation. More than half of the respondents (56.7%) reported putting 1 teaspoon (5grams) of salt during their food preparation. 52% of the respondents were aware of the importance of salt in the diet and consumed salt because of this (Table 8). A very strong association was found between awareness of the importance of salt in the diet and daily salt consumption among the respondents (p=0.000). Salt is the main source of sodium in the diet. A small amount of salt is important for good health; it helps to maintain the correct fluid and electrolyte balance in the body [2]. 35.3% and 2.7% of the respondents put 2-3 teaspoons and more that 3 teaspoons of salt respectively during their food preparation (Figure 8). A very strong association was also found between high salt intake and the prevalence of hypertension among the respondents (p = 0.009).

Research indicates that high consumption of salt on a daily basis has detrimental effects on our health. High salt intake increases extracellular volume (ECV), blood volume, and cardiac output resulting in elevation of blood pressure [17]. Numerous randomized clinical trials and meta-analyses have provided robust scientific evidence that reduced dietary salt intake, increased dietary potassium intake, moderation of alcohol consumption and optimal weight maintenance can effectively lower blood pressure [15]. A reduction in salt intake lowers blood pressure (BP) and, thereby, reduces cardiovascular risk. Uncontrolled and prolonged elevation of BP can lead to a variety of changes in the myocardial structure, coronary vasculature, and conduction system of the heart. These changes in turn can lead to the development of left ventricular hypertrophy (LVH), coronary artery disease (CAD), various conduction system diseases, and systolic and diastolic dysfunction of the myocardium, complications that manifest clinically as angina or myocardial infarction, cardiac arrhythmias (especially

atrial fibrillation), and congestive heart failure [19]. Moreover, a recent meta-analysis carried out by [20] demonstrated that a modest reduction in salt intake for 4 or more weeks causes significant and, from a population viewpoint, important falls in BP in both hypertensive and normotensive individuals, irrespective of sex and ethnic group.

This latest study further confirms that serious preventive measures have to be taken to reduce hypertension and the health impact of high daily salt consumption. After doing the scoring analysis, it was found that 27.4% of the respondents obtained a score of 0 (Table 6), meaning that they were neither aware of the fact that 1 teaspoon (5grams) of salt is the daily recommended amount to be consumed nor did they consume the 5 grams of salt as recommended. This represents nearly a third of people surveyed who definitely need to be educated with respect to health and nutrition education. Although 97.3% of the respondents knew that bread contains a high amount of salt, 93.7% of them consumed it on a daily basis 93.3% of the respondents also claimed that butter, cheese and processed/canned foods are high salt-containing foods, but despite this, 62.3% of them continued to consume butter everyday. 31.3% of the respondents ate cheese 2-3 times per week. Processed/canned foods were consumed 2-3 times per week by 38.7% of the respondents, and 39% of the respondents consumed fast-foods/ready-to-eat foods 1-2 times per month (Table 7). This finding correlates with what has been stated in the literature. Salt consumption has increased nowadays and most of the sodium we eat comes from packaged, processed, store-bought, ready-to-eat and restaurants foods [4]. Salt contained in these highly salted processed foods is known as "hidden salt" since people are not aware of the amount of salt contained in them. Many foods that do not taste salty may still be high in sodium. Moreover, many local foods, such as bread and fast foods, do not have a proper food label to indicate the amount of salt or sodium that they contain.

Among the factors which affected the daily salt consumption of the respondents, it was noted that 66.3 % of the respondents did not agree that the price of one packet of salt was expensive, and therefore, it did not affect their ability to purchase and to consume salt (Table 8). A strong correlation was found between daily salt consumption and affordability (p=0.003). It is probable that if the price of one packet of salt increased, then the respondents would consume moderate amounts of it, and adhere to the local recommendations of salt to be consumed per day based upon the World Health Organisation (WHO) recommendations. 44.7% of the respondents claimed that medical reasons did play a role in affecting their daily salt consumption. These respondents were aware that excess salt intake may affect their health, and thus, they consumed moderate amounts of it. An association was also found between medical reasons and daily salt consumption (p=0.026). 77.3% of the respondents disagreed to the statement "salt is not easily available on the market" (Table 8) and therefore claimed that this did not affect their salt consumption.

According to a report published by the WHO in 2007, it was found that daily intakes of salt vary considerably across population groups. Many countries also have their own daily salt intake recommendations (Table 1). For Mauritius, regarding the local recommendations of salt to be consumed per day, no official document is available; either in a standalone format or within the general health policy. If it was officially published, then maybe more respondents would be aware of it, and this would have most probably had a positive impact on their daily salt consumption. Again this shows that nutrition education programmes need to be set up so as to raise awareness on the importance of salt in the diet, on its recommended daily intake for good health, and very importantly, on the risks associated with excessive intake of highly salted processed foods since we have seen earlier that it is the consumption of processed salty foods which is the major culprit. Lifestyle factors play a major role in the development of chronic diseases such as hypertension and cardiovascular diseases. In the study, it was found that 68.3% of the respondents practised a regular physical exercise apart from work, and had no medical history of disease (Table 5). A strong correlation was also found between the practice of physical exercise among the respondents and medical history of disease (p =0.001). This correlates with what has been stated in the literature.

A study conducted by [22] showed that regular dynamic isotonic (aerobic) exercise, such as walking, running, swimming, or cycling, decreases blood pressure (BP) and improves cardiovascular well-being. It also has additional favourable cardiovascular effects, including improved endothelial function, peripheral vasodilatation, reduced resting heart rate, improved heart rate variability, and reduced plasma levels of catecholamines. Regular aerobic exercise sessions of at least 30 minutes for most days of the week can produce an average reduction in BP of 4-9mm Hg. Furthermore, many randomized controlled trials have been carried out whereby statistically significant reductions in blood pressure were found, in the short term for improved diet and exercise, relaxation therapies, and sodium and alcohol reduction [23]. This shows that physical exercise should be further encouraged as it appears to be protective against hypertension and heart diseases. Hypertension was more prevalent among

respondents aged 30-40 years old, with 5.3% of the respondents suffering from it (Table 4). The high prevalence noted among respondents aged 30-40 years old can be explained by the fact that more people in this age group were surveyed during the study (Table 2). This also reflects the population demographics of Mauritius. 44.6% of the Mauritian population are aged between 25 and 54 years old [28]. A strong correlation was found between age of the respondents and medical history of disease (p=0.000), meaning that as age progresses, the risk of developing disease also increases. However, the high prevalence of hypertension noted among respondents aged 30-40 years old needs serious consideration as this indicates that the young Mauritian adult generation is vulnerable to the gradual development of chronic diseases such as cardiovascular diseases and hypertension. Western industrialized societies are also currently experiencing an epidemic expansion of hypertension, which extends alarmingly even to children and adolescents [15]. Hypertension constitutes an independent risk factor for cardiovascular and renal diseases and represents an extremely common co-morbidity of diabetes and obesity. Therefore, sensitisation campaigns and regular health monitoring needs to be continued so as to avoid progression to chronic diseases and to keep the prevalence of such diseases to a strict minimum level in Mauritius. It is also good to note that in our study, the respondents who claimed suffering from hypertension were both taking medications for hypertension and followed a low salt diet [29] (Figure 4).

Conclusion and Recommendations

Conclusion

During the study, it was found that more than half of the respondents were aware of the local recommendations of salt to be consumed per day and found that this recommendation was adequate. To note, the local recommendation is based upon the World Health Organisation (WHO) recommendations. However, nearly another third of respondents were neither aware of the fact that 1 teaspoon (5grams) of salt is the daily recommended amount to be consumed nor did they consume the 5 grams of salt as recommended. This level of unawareness is considered as quite high and as such, shows that nutrition education programmes need to be set up so as to raise awareness on the importance of salt in the diet. More particularly on its recommended daily intake for good health as well as on the risks associated with excessive intake of highly salted processed foods given that we have noted in our study that it is the consumption of processed salty foods which is the major culprit. Population-based strategies to reduce sodium intake must continue to be implemented and monitored, and further emphasized so as to reach the percentage of population, whom we have found are still ignorant. Only then can we expect better adherence to the daily salt intake recommendation in force.

Recommendations

Based on what was observed during the study, some recommendations to attain better compliance to the recommended daily salt intake among Mauritian adults are hereby suggested, and these are

At the individual level

i. More fresh fruits and vegetables must be used as processed foods usually contain more sodium.
ii. Food labels and nutrition facts should be checked for salt or sodium content. Any ingredient that has sodium, salt or soda as part of its name (monosodium glutamate, baking soda, and seasoned salt) should be avoided.
iii. Foods should be seasoned with herbs and spices rather than with salt.
iv. Salt shakers must be removed from the table, and food tasted before it is salted.
v. To reduce sodium intake, salt substitutes must be used, especially those that contain potassium.
vi. Canned foods, if used, must be rinsed in water to remove some of the salt before preparing or serving.

At the national level

i. Tools must be developed or those existing modified for use by the Government and health authorities concerned in monitoring and evaluation of national sodium reduction strategies and activities.
ii. Technical support must be provided to the Government and to the health authorities concerned in the development, implementation and maintenance of relevant monitoring and evaluation processes on sodium intake, and what influences sodium content of foods from farm-to-fork.
iii. Dialogue with the relevant multinational private sector entities must be continued to encourage sharing of up-to-date and accurate data on sodium content in foods, product re-formulation and product sales.
iv. The Government and health authorities concerned should make publicly available relevant databases which provide information on sodium content of foods.
v. Knowledge, attitudes and behaviour change of healthcare professionals and health care institutions must be monitored towards sodium and health.

Strengths of the study

i. The sample size taken for the study was quite large and was representative of the Mauritian adult population. This led to better accuracy of the results obtained.

ii. A pilot questionnaire was designed before the final questionnaire was set to ensure that the questions set were clear, not ambiguous, and easy to understand and to respond to all the survey questionnaires were filled by the same interviewer to ensure consistency and it was a face-to-face interview.

iii. Data entry and data analysis were carried out using very good statistical software, the Statistical Packages for Social Sciences (SPSS 20.0). The data entry was verified twice so as to eliminate errors which may affect the outcome of the results.

Limitations of the study

i. Only a food frequency questionnaire is not enough to evaluate salt consumption among the respondents. Measuring 24-h urine sodium excretion in representative sub-samples, stratified by sex and age provides absolute estimates of baseline salt intakes for comparison across different population groups and different regions. Additionally, urine spot analyses could have been considered as a valid method to monitor dietary salt intake over time.

ii. Not all local foods have a nutrition label indicating the amount of salt or sodium that they contain, so it was not possible to adequately assess the amount of salt contained in them.

Acknowledgements

I am greatly thankful to my project supervisor, Dr. Prity Pugo-Gunsam, and to my co-supervisor, Dr. Smita Goorah, for their precious advice, fruitful guidance and generous assistance all throughout this project. My thanks also go to all the respondents, my friends and other persons who have directly or indirectly helped me in carrying out this study, Last but not least. I would like to thank my parents, my brothers and sister who have always been supporting and motivating me while I was carrying out this study and during my studies.

References

1. Weller O, Dumitroaia G (2005) The earliest salt production in the world: an early Neolithic exploitation in Poiana Slatinei-Lunca, Romania. Antiquity publications, Cambridge University Press 79: 306.

2. Hall, JE (2011) Guyton and Hall Textbook of Medical Physiology. (12th edn), Saunders, Elsevier, Philadelphia, USA.

3. Geerling JC, Loewy AD (2007) Sodium depletion activates the aldosterone-sensitive neurons in the NTS independently of thirst. Am J Physiol Regul Integr Comp Physiol 292: 1338-1348.

4. Institute of Medicine of the National Academies (2004) Dietary Reference Intakes for Water, Potassium, Sodium Chloride, and Sulfate. The National Academies Press, Washington, DC.

5. Magliano D, Soderberg S, Alberti KGMM, Tuomilehto J, Gopee N, et al. (2009) The Trends in Diabetes and Cardiovascular Disease Risk in Mauritius. The Mauritius Non-Communicable Disease Survey 2009.

6. Soylak M, Peker DSK, Turkoglu O (2008) Heavy metal contents of refined and unrefined table salts from Turkey, Egypt and Greece. Environmental monitoring and assessment 143 (1-3): 267-272.

7. McGee H (2004) On Food and cooking. The Science and Lore of Kitchen. Scribner, pp. 1-884.

8. Wouter LOX (2011) European Salt Producers Association.

9. Kostick DS (2008) Salt. US Geological Survey Minerals Yearbook.

10. The International Codex Alimentarius Standard for Food Grade Salt, 2011 (PDF file).

11. Chakera AJ, Pearce SH, Vaidya B (2012) Treatment for primary hypothyroidism: current approaches and future possibilities. Drug Des Devel Ther 6: 1-11.

12. American Heart Association (AHA) (2013) Worldwide salt intake nearly double recommended limits.

13. WHO Forum (2006) Reducing salt intake in populations: report of a WHO forum and technical meeting, Paris, France, World Health Organisation. Geneva, Switzerland.

14. Berger LL (2007) Salt as an intake regulator. The Science: Salt and Trace Minerals.

15. Koliaki C, Katsilambros N (2013) Dietary sodium, potassium, and alcohol: key players in the pathophysiology, prevention, and treatment of human hypertension. Nutr Rev 71(6): 402-411.

16. Pimenta E, Calhoun D, Oparil S (2009) Etiology and pathogenesis of systemic hypertension. *In*: Crawford MH & DiMarco JP (Eds.), Cardiology. (3rd edn), Mosby International, London, pp. 1984.

17. Twardowski ZJ (2008) Sodium, hypertension, and an explanation of the "lag phenomenon" in hemodialysis patients. Hemodial Int 12(4): 412-425.

18. Kanbay M, Bayram Y, Solak Y, Sanders PW (2013) Dietary potassium: A key mediator of the cardiovascular response to dietary sodium chloride. J Am Soc Hypertens 7(5): 395-400.

19. Riaz K, Ali YS (2014) Hypertensive heart disease. Medscape.

20. He FJ, Li J, Macgregor GA (2013) Effect of longer-term modest salt reduction on blood pressure. Cochrane Database Syst Rev (4): CD004937.

21. Hajjar IM1, Grim CE, George V, Kotchen TA (2001) Impact of diet on blood pressure and age-related changes in blood pressure in the US population: analysis of NHANES III. Arch Intern Med 161(4): 589-593.

22. Kokkinos PF, Papademetriou V (2000) Exercise and hypertension. Coron Artery Dis 11(2): 99-102.

23. National Clinical Guideline Centre (UK) (2011) Hypertension: The Clinical Management of Primary Hypertension in Adults: Update of Clinical Guidelines 18 and 34. London: Royal College of Physicians (UK). National Institute for Health and Clinical Excellence: Guidance.

24. Taylor RS, Ashton KE, Moxham T, Hooper L, Ebrahim S (2011) Reduced dietary salt for the prevention of cardiovascular disease: a meta-analysis of randomized controlled trials (Cochrane review). Am J Hypertens 24(8): 843-853.

25. American Heart Association Meeting Report (2013) Eating too much salt led to nearly 2.3 million heart-related deaths worldwide in 2010. ScienceDaily.

26. Schmidt CO, Kohlmann T (2008) When to use the odds ratio or the relative risk? Int J Public Health 53(3): 165-167.

27. Sohawon HA (2013) Teaspoon used to show portion size for salt usage during food preparation.

28. CIA World Fact book (2018) Mauritius Demographics Profile. CIA World Fact book.

29. Elliott P, Brown I (2006) Salt intake around the world: Background document prepared for the Forum and Technical meeting on Reducing Salt Intake in Populations. World Health Organisation (WHO), Paris.