

Monitoring the reduction of sodium content of selected food items using label information in South Africa

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Abstract

Background

Hypertension is a growing concern, not only in South Africa, but worldwide. Sodium (salt) intake has been proven to have a major effect on the development of cardiovascular diseases and hypertension. It will therefore be beneficial to decrease the amount of sodium added to certain foodstuffs to relieve the burden of disease in the country and ultimately sustain a reduced consumption of sodium in the diet.

Aim

The aim of the study is to investigate if the food industries are making changes to the sodium content of foodstuffs over a 14-month period as listed in the Regulations (identified in R214:20 March 2013), before the first target date of June 2016.

Study design

This study is a descriptive, observational study.

Methods

Data collection took place at two well-known retailers over a 14-month period (March 2014 and May 2015). Photographs of foodstuffs were taken and data was statistically analysed regarding minimum to maximum ranges, mean and standard deviation of sodium per 100g as well as number and percentage of products below the target set for 2016 and 2019 respectively by the Department of Health (DoH).

Results

The sodium content of over 300 foodstuffs was collected. More than 60% (61.5%) of all the foods had already reached the 2016 target and an additional 23% had reached the 2019 target by May 2015. Breakfast cereals and porridges, uncured meat and soup powders showed good compliance of above 60% towards the new targets.

Conclusions

The DoH can be applauded for the great initiative undertaken to reduce sodium in the diet of all South Africans. The reduction of sodium in foodstuffs is currently slowly being implemented. However, the reduction will not go without challenges. Monitoring systems to ensure the sustained reduction of sodium content are important and should be implemented annually.

Key terms: Salt, Sodium, Hypertension, Foodstuffs, Regulation

Summary

Hypertension is one of the leading causes of mortality in the world (Day *et al.*, 2014). In South Africa, 8.2 million people above the age of 15 years have been diagnosed with hypertension (Day *et al.*, 2014). Even though hypertension is a deadly disease, prehypertension leads to even more mortality cases because treatment is not yet given during this phase and therefore leading to stroke and heart attacks (He & MacGregor, 2010). Hypertension can be defined as systolic blood pressure above 140mmHg and/or diastolic above 90mmHg. Prehypertension on the other hand is in the range of 120-139mmHg / 80-89 mmHg (Fukuhara *et al.*, 2012).

The treatment of hypertension and prehypertension primarily includes dietary adaption. The dietary approach to stop hypertension (DASH) diet is one of the best researched dietary adaptations and proven treatments that have a positive effect on the reduction of hypertension and prehypertension. The consumption of fruit, vegetables, low fat dairy and legumes are high in this diet in contrast to full cream dairy, saturated fats, trans fatty acids and sugars that is used sparingly. It is mainly based on the Mediterranean diet with large amount of nuts, seeds and legumes (Monsivais *et al.*, 2015).

The terms sodium and salt are often used synonymously. However, throughout this dissertation the term sodium will be used unless unsuitable, in which case salt will be used. Salt consists of 40% sodium and 60% chloride, thus 1g sodium equals 2.5g salt (He & MacGregor, 2010).

Increased intake of sodium in the diet has been proven to have a major effect on the development of cardiovascular diseases (CVD) and hypertension (WHO, 2007). Voluntary regulations regarding the reduction of sodium were established around the world with much success (Apple & Anderson, 2010, Smith-Spangler *et al.*, 2010, He *et al.*, 2010, He & MacGregor, 2010; He & MacGregor, 2009). South Africa has implemented new legislation that will be effective as from June 2016 and June 2019 respectively to reduce the total amount of sodium in certain foodstuffs. Ultimately this will likely reduce the burden of disease in the country and have a beneficial effect on the economic status of South Africa by reducing the population-level systolic blood pressure and mortality due to CVD and stroke (Bertram *et al.*, 2012).

However, monitoring systems should be put in place to guarantee the sustained sodium reduction in foodstuffs. This research was therefore conducted in an effort to compile a monitoring system for sodium reduction to ensure that food manufacturing companies comply with the requirements of the new legislation. The results of the study provide valuable

information to the National Department of Health (DoH); Directorate: Non-communicable as well as the Directorate: Food Control.

Results suggest that food manufacturing companies are slowly reducing sodium in an effort to reach the targets set out by the DoH. The sodium content of over 300 foodstuffs was collected. By May 2015 61.5% of all the foods have already reached the 2016 sodium target and an additional 23% have reached the 2019 target by May 2015. The soup, uncured process meats and the porridges and cereals groups are within the target range, with only a few exceptions. Bread and cured meat are still in the process of reducing sodium content with only a limited number of foodstuffs currently within the target range.

In conclusion, the DoH and food manufacturing companies can be applauded for the effort made to improve the cardiovascular health of all South Africans and to reduce the burden of nutrition-related disease in the country. Sodium reduction monitoring systems should be put in place and repeated on an annual basis. Overall, the food manufacturing companies are starting to reduce sodium content and they will most probably reach the June 2016 target.

Acknowledgement

I would like to express my sincere thanks towards Prof Edelweiss Wentzel-Viljoen as my supervisor and Ms Bianca Swanepoel as my co-supervisor for their assistance during this research project. It was a privilege and an honour to have been involved with you in this regard.

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Conversion

The conversion of different units of salt and sodium is as follows:

1 g of sodium = 2.5 g of salt

1 g of salt = 0.4 g of sodium

Salt consists of 40% sodium and 60% chloride, thus 1g sodium equals 2.5g salt

Definitions

- Hypertension is defined as systolic blood pressure higher than 140mmHg and/or diastolic blood pressure higher than 90mmHg (Fukuhara *et al.*, 2012).
- Prehypertension is between 120-139 / 80-89mmHg (Fukuhara *et al.*, 2012).
- Foodstuffs can be defined as any substance that is used as food or to make food.
- Salt can be defined as a white crystalline substance which gives seawater its characteristic taste and is used for seasoning or preserving food.
- Discretionally sodium intake can be defined by the individuals' personal option to add or use sodium or sodium rich foods in the diet.
- Food processing can be defined as any deliberate change in a food that occurs before it is available for consumption.
- Food labelling can be defined as the practice of providing nutritional information on labels on food packaging.
- The traditional African diet can be defined as a combination of locally available fruits, cereal grains and vegetables, as well as milk and meat products, the diet does not contain processed food or food that is imported.
- Westernized diet can be defined as a diet high in saturated fats, red meats, simple carbohydrates and junk food. The diet lacks fresh fruits and vegetables, whole grains, seafood and poultry.
- Miso soup is a traditional Japanese soup consisting of a stock called "dashi" into which softened miso paste is mixed. Many ingredients are added depending on regional and seasonal recipes, and personal preference.
- Textured vegetable protein can be defined as a type of protein obtained from soya beans and made to resemble minced meat.
- Monosodium glutamate can be defined as a sodium salt of the amino acid glutamic acid that enhances the flavour of certain foods.
- Mixed ancestry can be defined as involving, or acting on behalf of various races
- Cereals can be defined as a breakfast food made from roasted grain, typically eaten with milk.

List of abbreviations

BMI	body mass index
BP	blood pressure
CASH	Consensus Action on Salt and Health
CVD	cardiovascular disease
DALYs	Disability adjusted life years
DASH	Dietary Approaches to Stop Hypertension
DoH	Department of Health
ENaC	epithelium sodium channel
Na	sodium
WASH	World Action on Salt and Health
AWASH	the Australian Division of World Action on Salt and Health
WHO	World Health Organization

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CHAPTER 1: INTRODUCTION

1.1 Background

The terms sodium and salt are often used synonymously. However, throughout this dissertation the term sodium will be used unless unsuitable, in which case salt will be used. Salt consists of 40% sodium and 60% chloride, thus 1g sodium equals 2.5g salt (He & MacGregor, 2010).

According to the Global Burden of Disease Study 1990 – 2010 (Feigin *et al.*, 2014) hypertension is one of the main contributing factors to the global burden of diseases globally as it is accountable for 9.4 million deaths worldwide. Poulter *et al.* (2015) predicted that hypertension will increase worldwide, resulting in a further 560 million people being affected by 2025.

The prevalence of hypertension is increasing in Africa due to urbanization; which includes a transition from the more traditional diet to a more westernized diet (He *et al.*, 2014). He *et al.* (2014) concluded that people of low socio-economic circumstances have an increased prevalence of hypertension due to the intake of increased sodium in food.

South Africa is also presenting with a high prevalence of hypertension according to the Global Burden of Disease Study (Feigin *et al.*, 2014) and the study by Lloyd-Sherlock *et al.* (2014). In 2010 more than 40% of adults aged 25 years and older presented with hypertension, of which only 36.4% of reported cases were controlled (Day *et al.*, 2014). In general South Africa has a prevalence of 8.2 million people aged 15 years and older presenting with hypertension (Day *et al.*, 2014). Only 2.7 million of these reported cases are on treatment (Day *et al.*, 2014). Amongst the black population in South Africa the prevalence of hypertension is currently at 78% according to Lloyd–Sherlock and colleagues (2014). Feigin *et al.* (2014) reported that in low and middle income sectors of South Africa, the incidence of CVDs and intake of sodium rich food are increasing.

High sodium diets are linked to hypertension, causing an increased risk for other cardiovascular diseases (CVD). Therefore, limiting sodium intake in the diet will have a beneficial effect on the overall health of the population and reduce the burden of disease in this country (WHO, 2007).

The World Health Organization (WHO, 2012) recommends a daily intake of less than 5g salt (2000mg sodium). Data on the average intake of salt in South Africa is limited and outdated.

Wentzel-Viljoen and co-workers (2013) summarized the studies that estimated the average intake of salt in South Africa and reported it as between 6 and 11g/day, which is clearly more than the WHO's recommended daily intake.

It has been suggested that reducing sodium intake is one of the most cost-effective ways to address the management of hypertension (Bertram *et al.*, 2012). Sodium reduction strategies have been introduced internationally to reduce sodium intake through foods. These initiatives could have a positive effect on the health of the population and on medical expenses incurred for chronic diseases (He & MacGregor, 2009). Presently only three countries have conducted successful sodium reduction strategies, namely Finland, Ireland and the United Kingdom (He & MacGregor, 2009). These strategies consisted mainly of reducing the total sodium content in food generally consumed by the specific population of that country. These strategies subsequently reduced the overall burden of diseases associated with an increased sodium intake.

A study on the sources of dietary sodium intake in the South African population determined that discretionary sodium intake is between 33% and 46% in three different ethnic groups (black, white and mixed ancestry) (Charlton *et al.*, 2005). The rest of the sodium comes from processed foods and it is therefore important to address the sodium content of processed foods as part of the total strategy to reduce the sodium intake of the population. The foods identified as contributing the most to the total sodium intake, excluding discretionary sodium intake (Wentzel-Viljoen *et al.*, 2013) and other high sodium content foods are listed in a regulation. The regulation was published under the Foodstuffs, Cosmetics and Disinfectant Act (54/1972) as Regulation R214: Regulations relating to the reduction of sodium in certain foodstuffs and related matters and published on 20 March 2013 (R214:20 March 2013). From now on it will be referred to as Regulation R214. Sodium targets were set for 13 different categories of foodstuffs.

Two dates were set for the food industry to reach these targets, these being 30 June 2016 and 30 June 2019. Strategies to monitor the sodium content of these categories of foodstuffs are required to ensure that the regulations are implemented correctly and timely.

1.2 Rationale for the study

Regulation R214 was published in 2013 with the first implementation date in 2016. The food industry needed sufficient time to make changes to the formulation and preparation of foodstuffs to reduce the sodium content of their products. In order to reduce the sodium content of for

example bread, a number of issues have to be addressed. The sodium does not only contribute to the taste of the bread, but is also needed as part of the structure of the bread during the leavening process. This leads then to a change in the process and equipment used for the baking of bread on large scale (Anchor yeast South Africa, 2015). In addition, time must be allowed for the public to get used to a lower sodium content of the foodstuffs.

Therefore, the focus of the current study is to investigate if the food industry is already reducing the sodium content of foodstuffs (according to label information) before the first implementation date of June 2016, as stipulated in the Regulation R214.

1.3 Aim and objectives

The aim of the study was to investigate (over a 14-month period) if food companies are reducing the sodium content of foodstuffs and reflecting it on the food label as stipulated in the Regulation R214, before the first target date of June 2016.

The objectives were:

- 1) to obtain the sodium content information of the different identified foodstuffs from the labels at two (March 2014, and May 2015) intervals over 14 months;
- 2) to compare the sodium content of the identified foodstuffs with the target values given in the Regulation R214;
- 3) to identify the foodstuffs that do not show a decrease towards the targets as stipulated in the Regulation R214.

1.4 Hypothesis

Null (H_0)

Sodium content of identified foodstuffs will not decrease in the one year period as identified on their nutrition labels prior to the first implementation date of June 2016.

Alternative (H_A)

Sodium content of identified foodstuffs will decrease in the one year period as identified on their nutrition labels prior to the first implementation date of June 2016.

1.5 Significance of this study

The Regulation has set targets for the sodium content of 13 different categories of foodstuffs, namely bread, cereal, instant noodles, dry gravy powder, dry soup powder, stock, uncured meat, cured meat, raw sausages, dry sauces, fats and spreads, savoury snacks and potato crisps and snacks. The food companies responsible for the manufacturing of these foodstuffs must comply with the Regulations by June 2016 and June 2019 respectively.

Globally, sodium reduction strategies for foodstuffs have been implemented with much success (Anderson *et al.*, 2010, Brown *et al.*, 2009, Cobiac, 2010; Smith-Spangler, 2010). However, South Africa is the first country in the world to legislate the sodium content of 13 food categories as part of the total strategy to reduce the sodium intake of the population. In the UK, Ireland etc. the sodium reduction of foods is voluntary.

It will be of the utmost importance to implement and apply strict reduction monitoring systems to ensure a gradual and sustainable reduction of sodium in food. Currently and to our knowledge there is no monitoring system that is being utilized in the South African food production industry. Therefore, this research was conducted in an effort to develop a monitoring system for sodium reduction to ensure that food manufacturing companies comply with the requirements of the new legislation. The results of the study will provide valuable information to the National Department of Health; Directorate: Non-communicable disease as well as the Directorate: Food Control (responsible for the implementation of the Regulation R214).

1.6 Structure of the mini-dissertation

The content of each chapter is briefly described below.

Chapter 1

The chapter provides a general introduction to the research problem. It also presents the objectives and hypotheses, and describes the significance of the study.

Chapter 2

The chapter provides a detailed description of literature available regarding sodium reduction strategies, strategies undertaken globally as well as in South Africa, and monitoring systems

currently available to monitor sodium reduction in food as set out in the guideline by the DoH in 2013.

Chapter 3

Manuscript (Monitoring reduction of sodium content of selected food items using label information in South Africa) providing evidence regarding the sodium content of certain foodstuffs over a 14-month period as indicated on the labels of these foodstuffs. The article will be submitted for publication in the South African Journal of Clinical Nutrition after the examination process.

Chapter 4

This chapter gives a summary of the main findings of this mini-dissertation and recommendations for future studies. It also addresses the limitations of the study.

Chapter 5

Chapter 5 contains the references used in Chapters 1, 2 and 4, using the referencing method as prescribed by the North-West University. The references used in the article are included as part of the manuscript.

CHAPTER 2: LITERATURE REVIEW

The addition of sodium to food became a reality around 5000 years ago. Before this time an estimate of only 0.1g of sodium was consumed in the diet (He *et al.*, 2010). In the early years salt was used to preserve the food during the winter months (He *et al.*, 2010).

2.1 Background

2.1.1 Hypertension as a global and South African problem

The WHO has set a global target to reduce the incidence of chronic (non-communicable) diseases by 2% each year (WHO, 2006). Chronic diseases account for 80% of deaths worldwide (Asaria *et al.*, 2007).

CVD is one of the main causes of mortality in the world, accounting for 75.6% of deaths, followed by respiratory disease at 15.4% and 8.7% deaths related to cancer (Asaria *et al.*, 2007; He, 2010). CVD includes hypertension, coronary heart disease, heart failure and stroke (WHO, 2006). Hypertension can be defined as systolic blood pressure higher than 140mmHg and/or diastolic blood pressure higher than 90mmHg. Prehypertension is identified as a blood pressure that is between 120-139 / 80-89mmHg (Fukuhara *et al.*, 2012) and it affects about 600 million individuals globally (He, 2010).

Hypertension has been described by the Global Burden of disease study (Feigin *et al.*, 2014) as one of the major contributing factors to the burden of disease globally, leading to 9.4 million deaths annually (Poulter *et al.*, 2015). However, as concluded in a study by Lloyd-Sherlock *et al.* (2014), the biggest concern is prehypertension due to the fact that treatment is not supplied during this phase (He and MacGregor, 2009). This concern was raised again in the Global Burden of Disease study (Feigin *et al.*, 2014). The prevalence of hypertension is predicted to rise in all regions of the world. This will ultimately result in an estimated 560 million people that may be effected (Poulter *et al.*, 2015) by 2025.

The mechanism through which dietary sodium intake affects blood pressure is clearly described by Meneton *et al.* (2005) (**Figure 2.1**). The main system in the body responsible for the regulation of blood pressure is the kidney-fluid system. Once the arterial pressure rises in the body it affects the kidneys, causing water and sodium excretion through the urine

which decreases extracellular volumes and blood volumes, relieving stress on the heart and decreasing arterial pressure.

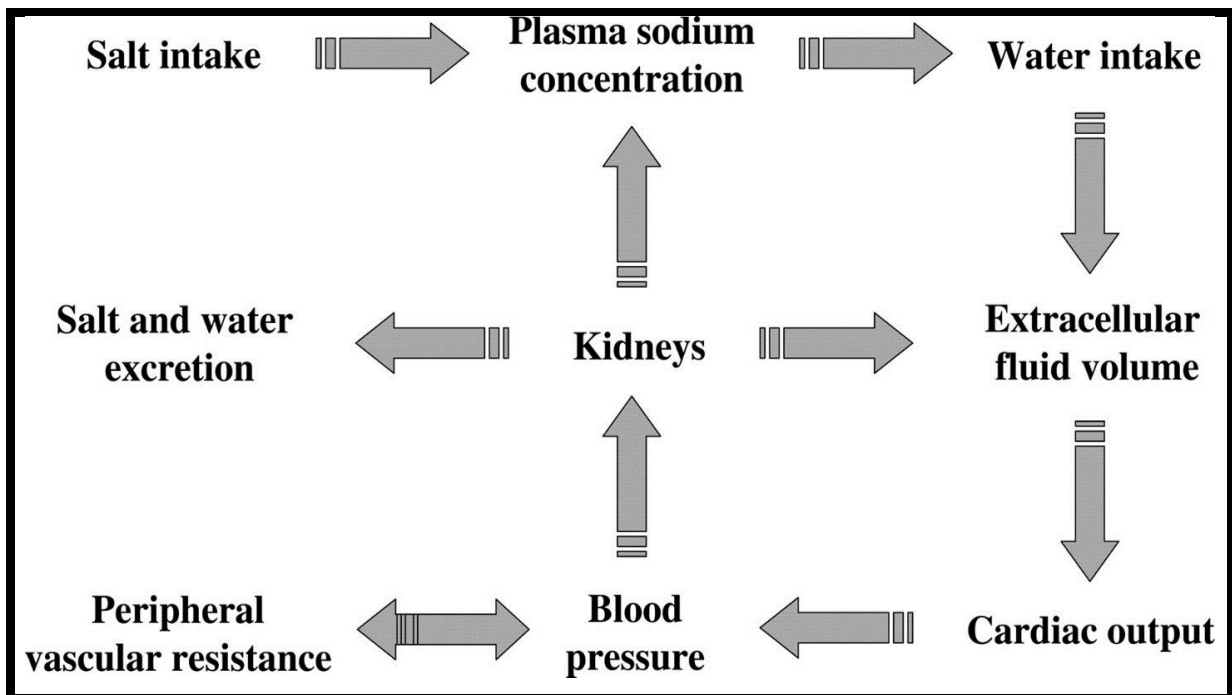


Figure 2.1: Links between dietary sodium intake and blood pressure (Adapted from Meneton *et al.*, 2005)

In Africa, urbanization is a major cause of hypertension in low and middle income countries (Lloyd-Sherlock *et al.*, 2014). This is partly due to the nutrition transition from a traditional African diet to a more western lifestyle (Hendriks *et al.*, 2012). South Africa has the highest reported prevalence of hypertension at 78% in the black population aged 50 years and older (Lloyd-Sherlock *et al.*, 2014). Only 4.1 to 14.1% of the 78% manage to control their blood pressure (Lloyd-Sherlock *et al.*, 2014). The same study concluded that a higher socio-economic status results in more awareness of hypertension and thus better control of blood pressure.

A study done by Hendriks *et al.*, (2012) concluded that there is an increased prevalence of higher systolic blood pressure in rural African countries even though systolic blood pressure has been decreasing since 1980 in higher income countries. Individuals in low socio-economic circumstances tend to consume an increased amount of sodium due to consumption of processed foods in Western countries only. Consequently, the prevalence of hypertension, stroke, obesity and CVD will increase (He *et al.*, 2014). The SAGE study, which is a study on global ageing and adult health, was done as a longitudinal study and comprised of two population groups, namely adults older than 50 years and adults of

between 18 to 49 years. The study was undertaken in six countries, one of which was South Africa (Hendriks *et al.*, 2012). Findings indicated that socio-economic status does not affect control and awareness. This is, however, in contrast with Lloyd-Sherlock *et al.* 2014 who found that a higher economic status, good control and awareness correlate.

The 500 researchers across 50 countries participating in the Global Burden of Disease Study (Feigin *et al.*, 2014) reported that wealth is also the main risk factor for chronic lifestyle diseases in Sub-Saharan Africa.

The Global Burden of Disease Study reported on the burden of stroke in terms of incidence, prevalence, mortality and disability-adjusted life years (DALYs). Findings of this study showed that stroke and ischemic heart disease are the leading causes of death between 1990 and 2010 in South Africa (Feigin *et al.*, 2014). The study also concluded that even though stroke mortality rates have decreased, the total number of people affected by stroke is increasing, especially in low and middle income countries (Feigin *et al.*, 2014). They also reported that in South Africa the main risk factors that accounted for the highest disease burden were alcohol, high body mass index (BMI) and high blood pressure.

2.1.2 Link between hypertension and sodium intake

An increase of 6g/day salt over a period of 30 years may result in a total increase of 9mmHg in systolic blood pressure (He & MacGregor, 2009).

Global evidence shows that an increase in dietary sodium intake causes a rise in blood pressure (Aburto *et al.*, 2013; He & MacGregor, 2009; He *et al.*, 2010). It is also clear that a reduction in sodium intake will decrease the risk of CVD and stroke by reducing blood pressure in both hypertensive and normotensive adults and children (**Figure 2.2 and Figure 2.3**) (Aburto *et al.*, 2013; He & MacGregor, 2009; He *et al.*, 2010).

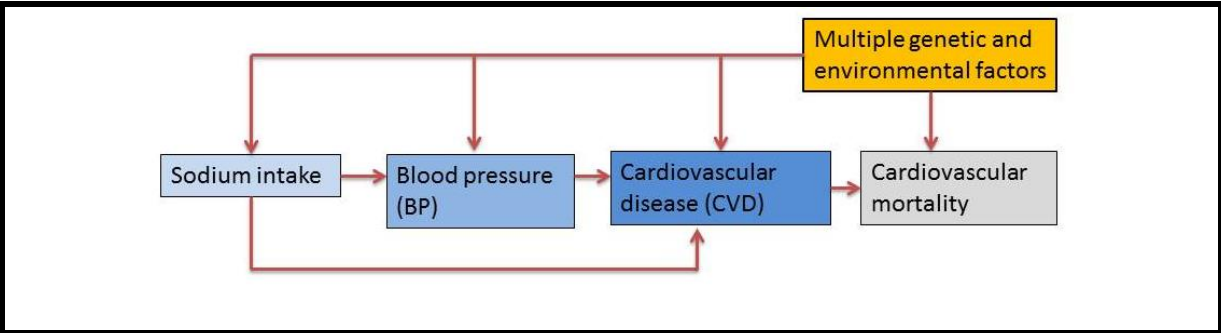


Figure 2.2: Conceptual framework for analysing the link between dietary sodium intake and morbidity and mortality (Adapted by WHO, 2007)

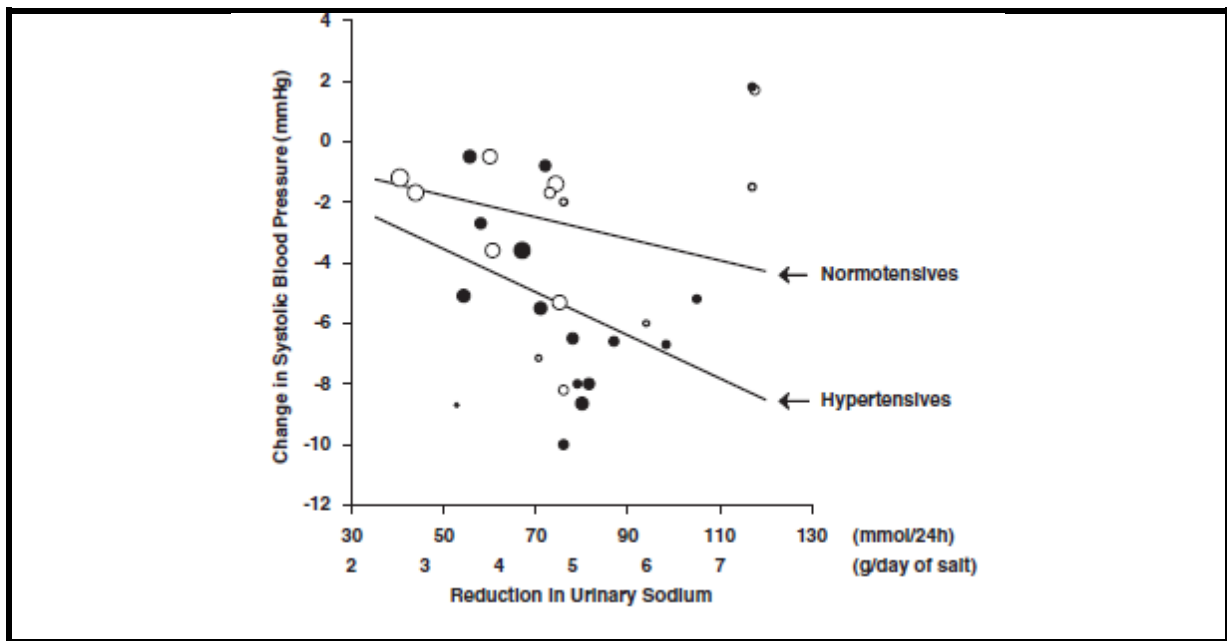


Figure 2.3: Relationship between the reduction in 24-hour urinary sodium and the change in blood pressure in a meta-analysis of modest salt reduction trials. Open circles represent normotension and solid circles hypertension (Adapted from He & MacGregor, 2009)

Evidence also shows that not only does increased sodium intake affect the cardiovascular system, but it can also cause fibrosis of the kidneys, heart and arteries and contribute to the development of stomach cancer (Apple & Anderson, 2010). The prevalence of poor dietary choices and an inactive lifestyle further increases the risk of developing CVD. Even though sodium reduction is only one of several prevention methods for CVD, calorie and potassium intake from the diet should also be regulated. A poor dietary intake of high fat and sodium foods also results in increased risk of hypertension that will lead to CVD as the evidence has shown (WHO 2007, He & MacGregor, 2010).

2.1.3 Measurement of sodium intake

Sodium concentrations in the body are adjusted constantly to maintain normal physiological levels. This adjustment is made possible by the excretion of sodium mainly through the urine. Therefore, the excretion of sodium in the urine over 24 hours is seen as the gold standard to estimate sodium intake in a population (Quilez & Salas-Salvado, 2012).

2.2 Recommended sodium/salt intake

The consumption of salt is on the increase (**Figure 2.4**), with an average intake of 9 - 12g/day in North-America and Europe according to He *et al.*, (2010). WHO recommends

reducing total salt intake to less than 5g salt (2000mg sodium) per day (WHO, 2012) to relieve the burden of disease related to a high sodium intake. A further reduction to 3g/day salt consumption will, however, be ideal (He & MacGregor, 2009).

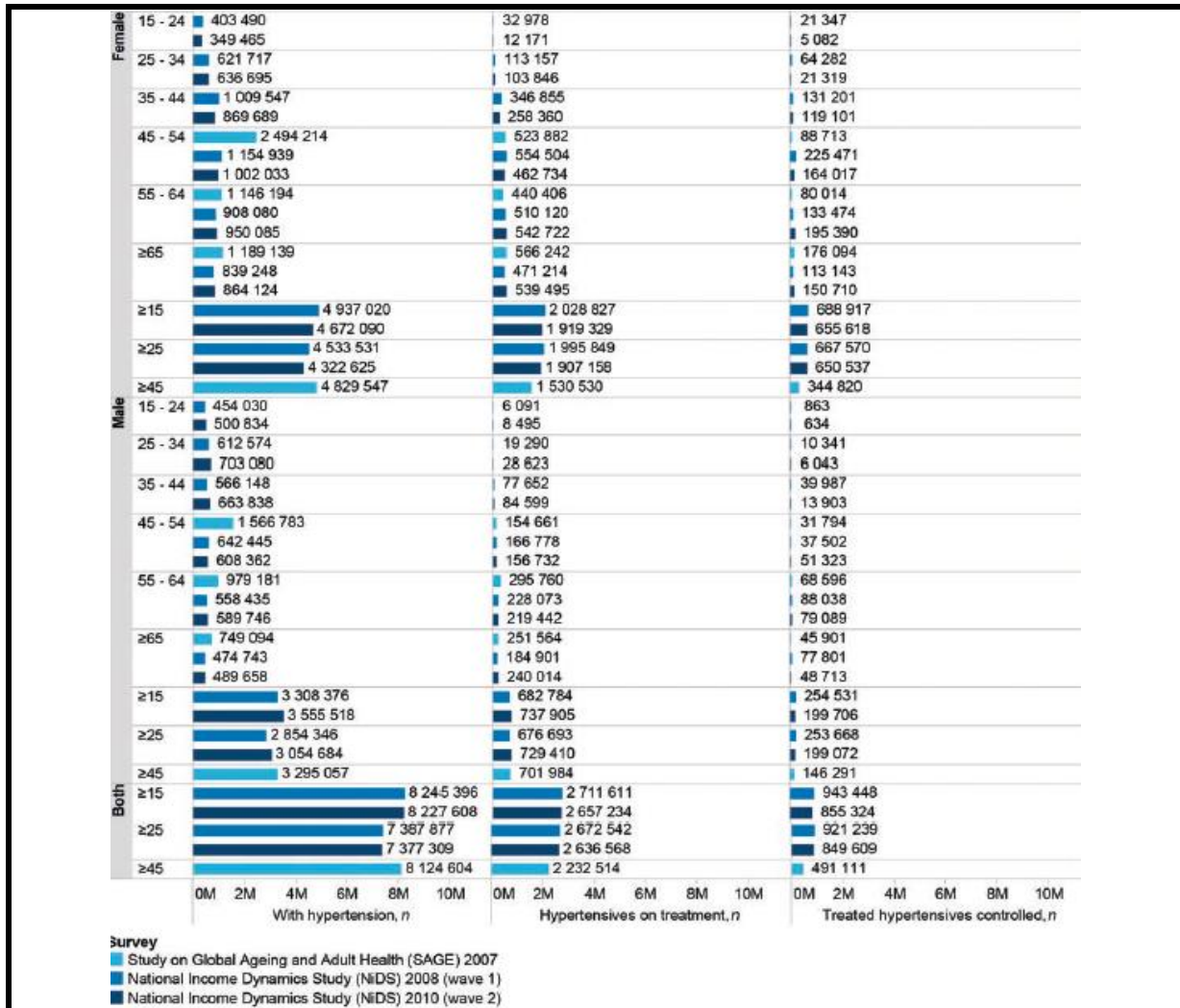


Figure 2.4: Estimated numbers with hypertension on treatment and controlled on treatment based on three surveys by gender and age group, 2007 – 2010 in South Africa. (M = million)(Adapted from Day *et al.*, 2014)

According to Asaria *et al.* (2007), the potential adverse effect of the interventions to reduce the burden of chronic diseases is the increased prevalence of iodine deficiency due to the fact that salt is a vehicle for iodine fortification, therefore over reducing salt intake may cause iodine deficiency (Charlton *et al.*, 2012). However, salt should be fortified with sufficient iodine per 5g consumption to prevent deficiency of this mineral. Therefore, the recommended 5g per day intake of salt, which is equivalent to 2000mg sodium per day, will meet the required iodine levels. In South Africa an intake of 5g salt per day will not have a negative effect on the iodine status of the population (Charlton *et al.*, 2012 & WHO, 2007).

2.3 Current salt intake globally and in South Africa

In a study done by Brown *et al.* (2009), the authors studied salt intake around the world and concluded that dietary salt intake (discretionary salt use and salt intake from processed foods) is in excess of the normal physiological ranges. European and Northern American countries had the highest salt intake with more than 75% coming from processed food. Countries in Europe that exceed the recommended daily salt intake are Italy (12g/day), Portugal (12g/day) and Turkey (16.6g/day). Amongst the adult population in the United Kingdom, the main contributors to sodium intake (88.6%) are table spreads, dairy, spices, bread, cereals, grains, red meats, poultry, eggs and vegetables. In the United States of America, the main contributors of salt intake (90.8%) are cereals, baked goods, sauces, cured meats, salt from restaurants or take away food, red meat, dairy, vegetables and textured vegetable protein, poultry, eggs, pickles, olives, salad dressing, margarine, soy sauces, gravies. In Japan the main sources of salt include miso soup, soya sauce, salted vegetables and fruits, restaurants and take away food, other soups, fish, cured meat and eggs. In China the main source of salt intake come from salt in its raw form and soy sauce added to food at the table, as well as bread, cereals, grains, sauces, cured meats, noodles, Monosodium glutamate (MSG), mustard, turnip greens, cabbage (Brown *et al.*, 2009; Anderson *et al.*, 2010).

A study conducted in South Africa by Chalton *et al.* (2012) which included three ethnic groups found that the daily table salt added to food resulted in 46% (4.08g salt), 33% (4.15g salt) and 42% (4.76g salt) in black, mixed-ancestry and white populations respectively. The same article concluded that especially the black community reported that salt is usually used for the taste of the food as this is the most economical product that can be used to flavour food within poorer communities. Knowledge regarding the effects of high sodium intake in the diet was poorest in the black (10%) community followed by the mixed ancestry (23%) and lastly the white (26%) community (Charlton *et al.*, 2005). Wentzel-Viljoen and co-authors (2013) reported an average intake of salt of 6 - 11g/day for South Africa with the main contributors of sodium intake being bread (5% - 35%), hard or block margarine (13%), soup and gravy powders (17%) and atchar (5%).

2.4 Management of hypertension

Essentially, the management of hypertension should start with a change in dietary behaviour. The Dietary Approaches to Stop Hypertension (DASH) (**Figure 2.5**) diet was

developed to prevent the increased occurrence of hypertension. The DASH diet consists of high amounts of fruit and vegetables, legumes and low fat dairy. Full cream dairy, fat and sugar are limited in this diet. Research suggests that the DASH diet is the most important treatment of CVD as this diet has been proven to decrease hypertension and prehypertension without sodium reductions or medication treatment (Apple *et al.*, 2010; Monsivais *et al.*, 2015). However, a limitation of this diet includes its financial impact. Foods included in the diet are expensive and people from poor socio-economic communities will not be able to afford and sustain this dietary approach (Monsivais *et al.*, 2015). Even though dietary intervention should be the first step in the treatment of hypertension, drug therapy has become an everyday approach in the management of hypertension. Medication includes beta-blockers, calcium channel blockers, angiotensin-converting enzyme (ACE) inhibitors, renin inhibitors, thiazide diuretics and angiotensin II receptor blockers. However, primary care in the form of diet transformation should be introduced as first line treatment (Monsivais *et al.*, 2015).

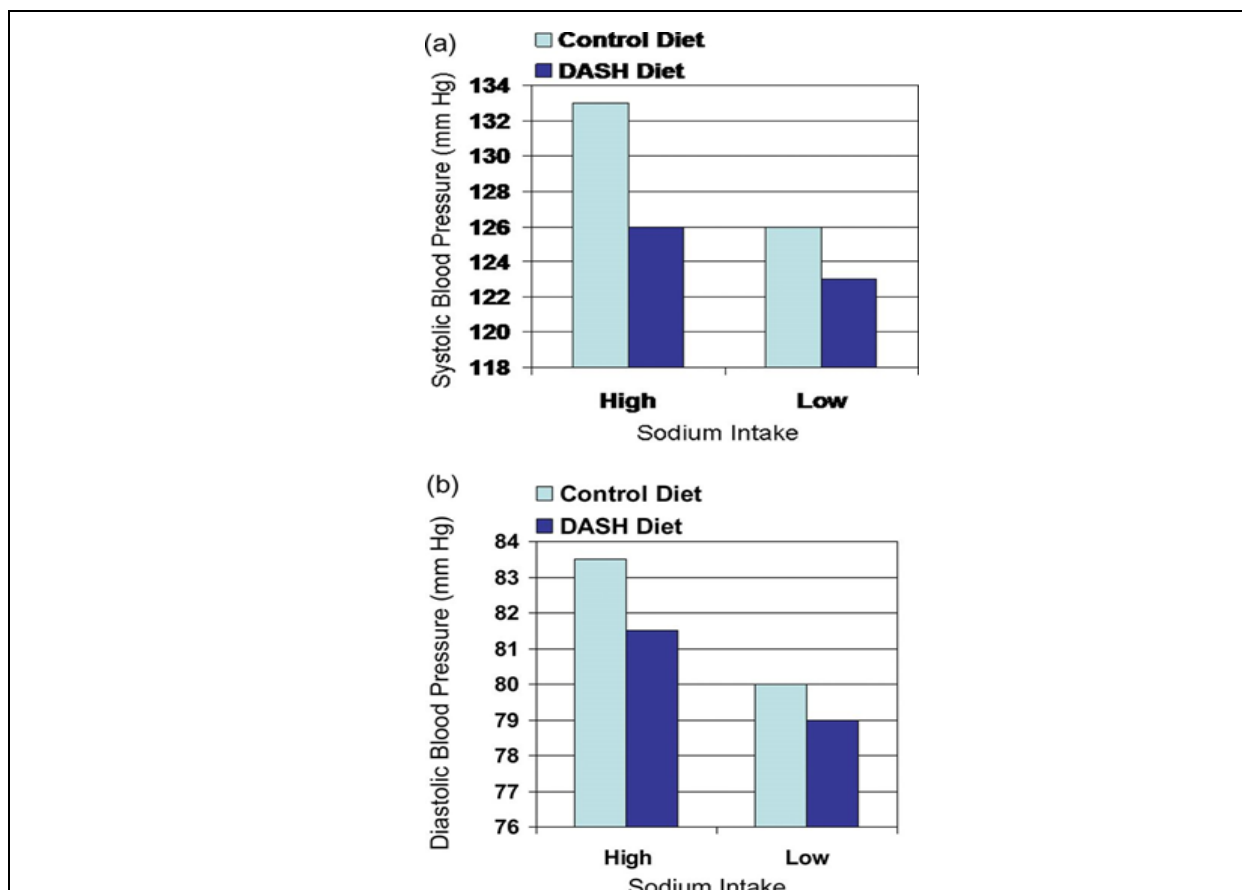


Figure 2.5 Changes in mean SBP (a) and DBP (b) in the DASH-Sodium trial (Adapted from Mohan & Campbell, 2009)

2.5 Advantages and cost-effectiveness of sodium reduction

As mentioned, the recommended intake of salt is <5 g/day (<2000 mg/day sodium), and a reduction of sodium to this level is very beneficial and may decrease the mortality rate as seen in **Figure 2.6** and **Figure 2.7** and have a cost saving effect (WHO, 2007; He & MacGregor, 2010). A reduction of only 2 mmHg in diastolic blood pressure may result in a reduction of 17% of hypertension prevalence, 6% reduction in the risk of stroke and 15% reduction in risk of coronary heart disease (He & MacGregor, 2010). It has been reported that a 4.6g reduction in salt intake will decrease blood pressure by 5 mmHg /2.7 mmHg (Systolic/diastolic) in hypertensive patients and 2 mmHg /1 mmHg (Systolic/diastolic) in normotensive individuals (He & MacGregor, 2010).

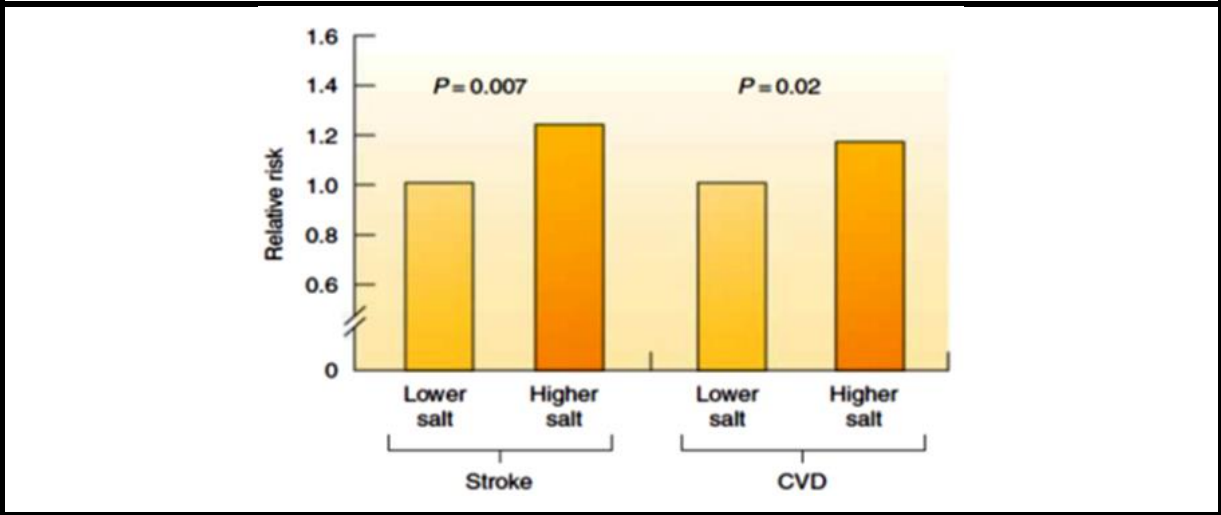


Figure 2.6: Relative risk for stroke and total cardiovascular disease associated with a 5g/day increase in salt intake (Adapted from He & MacGregor, 2010)

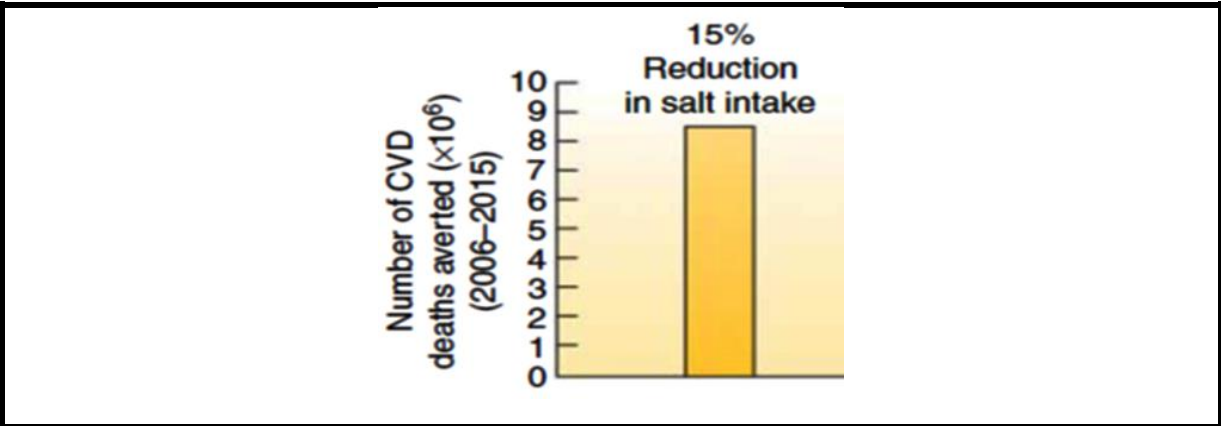


Figure 2.7: Number of cardiovascular disease deaths averted associated with implementation of salt reduction in 23 low and middle income countries. (Adapted from He & MacGregor, 2010)

Bertram *et al.* (2012) calculated the cost-effectiveness of a lower sodium intake based on the prevalence and incidence of CVD and strokes in South Africa. The authors concluded that if there is a decrease in sodium content in certain foods resulting in a lower sodium intake by the population, it will relieve the burden of chronic diseases in South Africa and prevent 7400 deaths annually due to cardiovascular-related diseases. It was reported that the amount needed to treat each individual stroke patient adds up to R76 000. The prevention of the incidence of strokes and CVD will have a R300 million annual cost saving for South Africa (Bertram *et al.*, 2012). Bread contributes the most to the sodium intake of consumers in South Africa (Wentzel-Viljoen *et al.*, 2013). Therefore, if there is a reduction of sodium content in bread alone, there could be an overall monetary cost decrease of 80% in the health system (Bertram *et al.*, 2012).

Considering the abundant evidence for the positive effects of reduced sodium intake on CVD, hypertension and stroke, it is clear that a reduction of sodium in the South African diet would improve the overall health of the South African population and will have economic advantages for the health system.

2.6 Sodium in processed foods

2.6.1 The role of sodium in foodstuffs

According to a study done by He and MacGregor (2009) food companies add sodium to processed foods to improve the taste of cheap, inedible foods at no extra cost and to preserve the food. It is also used to increase the weight of meats (for example brined chicken) in conjunction with other water binding chemicals by 20% at little extra cost for the food company. Constant consumption of high sodium foods causes the salt taste receptors to become suppressed, causing higher sodium demand (He & MacGregor, 2009). Major food companies argue that if sodium is reduced in a product, sales will decrease (He and MacGregor, 2009). Salt has water-binding effects, increasing the thirst of the consumer, which in effect causes soft drink sales to rise. Most of the snack companies have a direct connection with soft drink sales, so if salt is reduced in foodstuffs the sales of soft drink will decrease as well. However, in the United Kingdom sodium was reduced successfully in selected foodstuffs and sales did not decrease (He & MacGregor, 2009) (**Figure 2.8**).

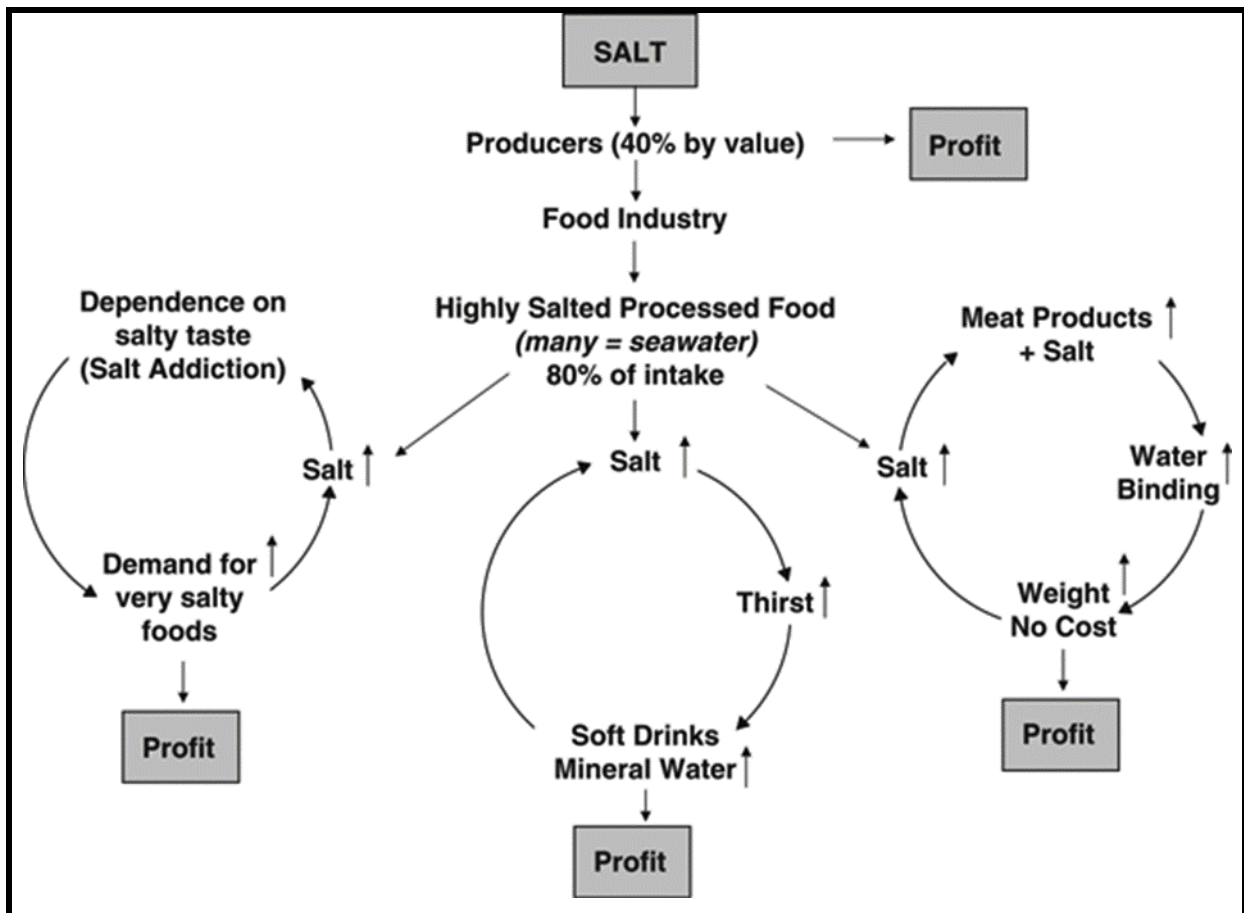


Figure 2.8: Commercial importance of salt in processed food (adapted from He & MacGregor, 2009)

2.6.2 Palatable effect of a reduction in sodium

DeSimobe *et al.* (2013) advised that the sodium content in foodstuffs should be decreased gradually to preserve the palatable effect. This ensures that consumers are exposed to the change in sodium content slowly so that it does not have a drastic unwanted effect such as a decrease in sales. In South Africa a study was done on the palatable effect of low sodium containing stock cubes. The study was conducted on 432 participants who received one of four test meals of chicken stew made of four different sodium content stock cubes. Participants reported no taste difference between the normal amount of sodium and the reduced amount of sodium. However, in the case where the reduction of sodium was at the lowest level, salt was added almost to the fully compensated level. Most consumers reported that they feel that they are consuming the correct amount of salt through their diet (52%). Only 15% indicated that the salt is too high in foodstuffs, while unfortunately a further 33% indicated salt is too little in the foodstuffs (De Kock *et al.*, 2015). This indicates that a reduction in sodium in foodstuff is not the only intervention needed. Consumer awareness and education should be addressed for the population to understand the effects of sodium.

Fortunately, consumer education is one of the goals set out by the Heart and Stroke Foundation of SA.

In a study done by Bolhuis *et al.* (2011) on the reduced salt content of bread and the palatable effect of this, it was concluded that a reduction in salt up to 52% did not have an effect on the consumption of bread or the choice of filling added to the bread by the consumers. This reduction of the salt content in bread led to an overall reduction of 21% salt intake and a total of 0.23g sodium for breakfast.

In order to reduce sodium content, it is important to understand the purpose of the added salt to the foodstuff. Salt not only has a palatable effect, but also a preservative effect, which might cause challenges if reduced in certain foodstuffs. Currently, there is a gap in the literature regarding the mechanism of salt taste perception. Even though it has been proven that the epithelium sodium channel (ENaC) is involved in the recognition of salt taste in cells, it is not the sole explanation (Oka *et al.*, 2013). Adding salt to foodstuffs enhances certain preferable flavours such as sweetness and suppresses bitter flavours. Given this flavour-enhancing effect of salt it is, therefore, important to preserve the flavour in the foodstuff even though salt content is reduced. In addition to this, the safety of the foods must also be ensured given that salt is used as a preservative in some cases.

A recently published article concluded that changes in perceived palatability and a pattern of adding extra salt to foodstuffs became evident whenever a claim is made on the package that the foodstuff in question is low in salt (DeSimobe *et al.*, 2013). Consumers perceive the claim as an indication that there is a lack of salt and tend to automatically add salt to the product. Not adding a low salt claim to the packaging may possibly mean that the consumers' taste perception is not affected and that they will not add table salt to the product (Dotsch-Klerk *et al.*, 2015 & Liem *et al.*, 2012).

2.7 Population-wide sodium reduction strategies

2.7.1 International sodium reduction strategies

Studies done by Cobiac (2010) and Smith-Spangler (2010) reported that many countries have successfully decreased salt intake through public awareness, reduction of sodium content in certain foods and labelling on processed and prepared foods.

Worldwide systems have been developed to focus on reducing the intake of sodium by the public through the reduction of the amount of sodium in certain foodstuffs. At the forefront of this initiative is the United Kingdom, followed by Finland, Japan and the United States of America (Appel & Anderson 2010, Smith-Spangler *et al.*, 2010, He *et al.*, 2010, He & Macgregor, 2010; He & Macgregor, 2009). The World Action on Salt and Health (WASH) was established in 2005 (He, 2010). Their aim is to encourage worldwide sodium reduction. WASH has members in countries across the world who is encouraged to set targets for the food industry. Since the establishment of WASH, Canadian and Australian divisions have also been established (He & MacGregor, 2010).

The United Kingdom established a group named CASH (Consensus Action on Salt and Health) (He & MacGregor, 2009). Their main aim is to reduce sodium intake and prevent lifestyle diseases due to excessive sodium intake. Since the group's existence, salt intake has been reduced from 9.5g/day to a total of 8.1g/day, which translates into an overall 15% decrease based on 24-hour urinary sodium excretion data that was collected in 2001. The initiatives' goal overall was to decrease sodium content in processed food by 40% as well as the salt added to food at the table. Bread is in most countries the food of choice or staple food and it is therefore important to focus on limiting sodium content in bread. Findings from a study conducted by Dunford *et al.* (2011) revealed that voluntary reduction strategies were undertaken in Australia and New Zealand regarding the amount of sodium in bread products. Breads from Australia meeting the national targets increased from 29% (2007) to 50% (2010). New Zealand had an increase of 49% (2007) to 90% (2010), indicating that New Zealand reached targets much quicker even though the same food manufacturing company was monitored in both Australia and New Zealand. There is still room for improvement in both these countries and government legislation approaches may be needed. The initiative managed to decrease the sodium content in bread by 20% in the United Kingdom (Hashem *et al.*, 2015). Finland also followed this example and was one of the first countries to establish a sodium reduction strategy. Through this strategy the country managed to reduce salt intake from 12g/day to 9g/day (40% reduction on salt intake), blood pressure decreased by 10mmHg and there was a total drop of 70% in heart diseases and strokes reported (Mohan & Campbell, 2009). Evidence is clear that only a 2g per day reduction in salt intake can have a 20% reduction in the risk of CVD (He *et al.*, 2010).

It is, however, crucial to note that all the initiatives mentioned were undertaken on a voluntary basis and not due to regulations set out by the countries.

2.7.2 Elements of the sodium reduction strategy of South Africa

The Department of Health, Directorate: Food Control published Regulations relating to the reduction of sodium in certain foodstuffs and related matters (R214:20, March 2013). The targets for different foodstuffs are due to be met by 2016 and 2019. See **Table 2.1** for a description of the targets. The aim of the National Department of Health, Directorate: Non-communicable diseases is to decrease mean population salt intake to less than 5g (2000mg sodium) per day by 2020 and then to decrease the prevalence of high blood pressure by 20% before 2020 as part of the national strategic framework (Department of Health, 2013).

In South Africa a group, Salt Watch, was established in March 2014 and consists of different stakeholders such as professional bodies, non-governmental organisations, the Department of Health, media and the food industry. This group will undertake the salt reduction education and awareness campaign and is also a member of the previously mentioned WASH group. The Heart and Stroke foundation of South Africa was nominated as the implementing body of a public awareness campaign on hypertension and is supported by the National Department of Health.

Table 2.1: Sodium reduction targets of certain foodstuffs (Regulation R214)

Foodstuffs category	Maximum total Na (mg) per 100g foodstuff	Target dates
Bread	400 mg	30 June 2016
	380 mg	30 June 2019
All breakfast cereals and porridges, whether ready-to-eat, instant or cooked, hot or cold	500 mg	30 June 2016
	400 mg	30 June 2019
All fat spreads and butter spreads	550 mg	30 June 2016
	450 mg	30 June 2019
Ready-to-eat savoury snacks, excluding salt-and-vinegar-flavoured snacks	800 mg	30 June 2016
	700 mg	30 June 2019
Flavoured potato crisps, excluding salt-and-vinegar-flavoured potato crisps	650 mg	30 June 2016
	550 mg	30 June 2019
Flavoured, ready-to-eat, savoury snacks and potato crisps, salt-and-vinegar only	1000 mg	30 June 2016
	850 mg	30 June 2019
Processed meats – uncured	850 mg	30 June 2016
	650 mg	30 June 2019
Processed meat – cured	950 mg	30 June 2016
	850 mg	30 June 2019
Raw processed meat sausages (all types) and similar products	800 mg	30 June 2016
	600 mg	30 June 2019
Dry soup powders (not instant type)	5500 mg	30 June 2016
	3500 mg	30 June 2019
Dry gravy powders and dry instant savoury sauces	3500 mg	30 June 2016
	1500 mg	30 June 2019
Dry savoury powders with dry instant noodles to be	1500 mg	30 June 2016

Foodstuffs category	Maximum total Na (mg) per 100g foodstuff	Target dates
mixed with a liquid	800 mg	30 June 2019
Stock cubes, stock powders, stock granules, stock emulsions, stock pastes or stock jellies	18000 mg	30 June 2016
	13000 mg	30 June 2019

mg – milligram; Na - sodium

The legislation regarding the reduction of sodium content in foodstuffs as indicated in **Table 2.1** was signed in March 2013 and will come into effect in June 2016, which will contribute to lowering sodium content in those foods that are most frequently consumed by South Africans (Bertram *et al.*, 2012; Wentzel-Viljoen *et al.*, 2013).

2.8 Importance of consumer education

Food labelling is an important part of providing consumers with adequate information to make informed decisions about the healthiness of foods they are purchasing. However, education on how to understand these labels is important to facilitate this. An important point is that when the words “salt” and “sodium” appear within the top lines of the food label it is an indicator that the product is high in salt, even though no value is available. High sodium foods are those foods that have more than 600mg sodium per 100g, opposed to low sodium foods which have a sodium level of less than 120mg per 100g or per 100ml (Wentzel-Viljoen *et al.*, 2013).

Consumer awareness campaigns should be included in the sodium reduction strategies to extend the population’s knowledge regarding the diseases related to excessive sodium intake. Consumers have to understand the effect of sodium on their health and quality of life for them to make the relevant lifestyle changes (Dotsch-Klerk *et al.*, 2015; Hashem *et al.*, 2015). As mentioned, the Heart and Stroke Foundation of South Africa initiated a Salt Watch group in 2013. The group identified some actions to be taken as part of the bigger strategy to reduce the sodium intake of the population. They will also undertake a public awareness programme and education on, for example, food preparation to improve the knowledge of South Africans on sodium and hypertension.

A few factors should be put in place for a population-wide sodium reduction strategy to be implemented successfully. These factors include setting up action groups, determining the current sodium intake of the population, getting government support and food industry engagement (Dotsch-Klerk *et al.*, 2015; Hashem *et al.*, 2015).

2.9 Importance of a monitoring strategy/system with regard to sodium reduction

In order to establish whether the initiatives to reduce sodium in certain foodstuffs are successful, a monitoring system should be put in place. There is limited information regarding monitoring systems for sodium reduction in foodstuffs around the world. The Australian division of World Action on Salt and Health (AWASH) monitors the salt reduction in foodstuffs in Australia (Webster *et al.*, 2009). In South Africa, to our knowledge, there is currently no sodium reduction monitoring system available. The monitoring system to be implemented will have to consist of these main objectives. Firstly, the system will need to compare the sodium content of the identified foodstuffs with the regulations. In order to compare the sodium content of foodstuffs accurately, the food product should be measured for the sodium content due to the fact that not all products on the market have detailed nutrition labels. Next is to identify the foodstuffs that do not show a decrease towards the targets as identified in the Regulations. Lastly, there should be an investigation of which food companies are lowering the sodium content of foodstuffs. To ensure that the regulation is also successful at a national level, salt intake levels should also be monitored closely by means of 24-hour urinary sodium excretion.

A monitoring system is of the utmost importance as this will enable the Department of Health to investigate and monitor food manufacturers with regard to how they comply with the new sodium reduction legislation.

2.10 Summary of literature

In view of current available data, it is evident that the reduction in sodium intake has a direct beneficial effect on the risk of CVD, stroke and hypertension. Multiple initiatives have been undertaken across the world to relieve the burden of diseases associated with increased sodium intake. The ideal will be to reach the goal set by the WHO and the Department of Health in South Africa to decrease salt intake to less than 5g (2000mg sodium) per day. Fortunately, South Africa has started a sodium reduction initiative to increase the overall health of the population in an effort to decrease medical costs related to CVD. One of the goals of this initiative is to reduce the sodium content of certain foodstuffs by 2016 and 2019 respectively. In an effort to ensure full compliance with this initiative, it is important to implement monitoring systems regarding sodium reduction as there is currently no system in

place. This will contribute to the goal to reduce the salt intake of the population to less than 5g/d and consequently reduce the prevalence of hypertension in the country.

CHAPTER 3: ARTICLE

The article has been written in compliance with the author guidelines for the South African Journal of Clinical Nutrition. The article will be submitted for publication after the examination of the mini-dissertation. Any suggestions made by the examiners will be included before submission.

Monitoring the reduction of sodium content in selected food items using label information in South Africa

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Abstract

Objective: To investigate if food companies are making changes to the sodium content of foodstuffs over a 14-month period as stipulated in the Regulation R214 before the first target date of June 2016 as reflected on food labels.

Design: Descriptive, observational study.

Outcome measures: Data collection took place at two well-known retailers over a 14-month period. Photographs of foodstuffs were taken, the information captured and data was statistically analysed by looking at the range, mean, standard deviation of sodium per 100g, as well as the number and percentage of products below the 2016 and 2019 targets according to Regulation R214.

Results: The sodium content of over 300 foodstuffs was collected. By May 2015 61.5% of the foods had already reached the 2016 sodium target and an additional 23% had reached the 2019 target. Not one of the breads included complied with the June 2016 target. Breakfast cereals and porridges, uncured meat and soup powders showed good compliance of above 60% towards the new targets.

Conclusion: The Department of Health (DoH) and food companies can be applauded for their great initiative to reduce sodium intake of all South Africans. Currently the reduction of the sodium in foodstuffs is slowly being implemented. However, the reduction will not go without challenges. Monitoring systems to ensure compliance with the reduced sodium content of foodstuffs is important and should be applied annually.

INTRODUCTION

Hypertension is one of the main contributing factors to the global burden of disease and it accounts for 9.4 million annual deaths worldwide¹. In 2010 more than 40% of adults aged 25 years and older presented with hypertension, of which only 36.4% of reported cases were controlled².

Global evidence shows that an increase in dietary sodium intake results in a rise in blood pressure and consequently increases the risk of developing other CVD's^{3,4,5,6,7}. It is evident that 30% of deaths are related to CVD globally and that hypertension is accountable for 49% of the coronary heart diseases and 62% of stroke cases worldwide². It is also clear that a reduction of sodium intake will decrease the risk of CVD and stroke by reducing blood pressure in both hypertensive and normotensive adults and children⁸. Even the smallest reduction in blood pressure of normotensive and hypertensive individuals is beneficial⁸. A reduction of only 2 mmHg in diastolic blood pressure may result in a reduction of 17% of hypertension prevalence, 6% reduction in the risk of stroke and 15% reduction in risk of coronary heart disease³.

In South Africa intake of salt exceeds the amount recommended by the WHO of less than 5g salt (2000mg sodium) per day⁶. Currently the sodium intake in South Africa ranges from 6 to 11g/day⁹. In addition, a reduction in sodium intake that results in a decrease in blood pressure will be cost-effective and could lead to an estimated health cost saving of R300 million annually⁹.

According to a study done by He and MacGregor (2009)¹⁰, food industries add sodium to processed foods to improve the taste of inexpensive, flavourless foods at little extra cost. It is also used to increase the weight of meats in conjunction with other water-binding chemicals by 20% at little extra cost. Constant consumption of high sodium foods cause the salt taste receptors to become suppressed, causing higher sodium demand^{10,11}. However, a study done by De Kock *et al.* (2015)¹² reported that consumers did not report any palatable changes after being given a meal made with target-reduced sodium stock cubes. Another study found that a reduced salt content (up to 52%) in bread and the palatable effect did not influence on the consumption of bread or the choice of filling added to the bread by the consumers¹³. Lucas *et al.* (2011)¹⁴ reported that when salt reduction in foodstuffs was done as part of a meal there is a smaller effect than when salt reduction took place in a single food component. The effect of salt reduction may in some cases have an effect on the appeal of products and may lead to a decrease in sales.

The National Department of Health, Directorate: Non-communicable diseases aim to reduce the salt intake of South Africans to less than 5 grams per day by 2017¹⁵. As part of this national strategy the Regulations (R214)¹⁵ were published to reduce the sodium content of 13 food categories that is known to contribute to salt intake. The categories are: bread, cereal, instant noodles, dry gravy powder, dry soup powder, stock, uncured meat, cured meat, raw sausages, dry sauces, fats and spreads, savoury snacks, potato crisps and snacks. The specific targets set for each item are required to be met by June 2016 and June 2019 to give the food industry ample time to reformulate and if necessary change manufacturing processes. In addition, a gradual decrease in the sodium content of foodstuffs is necessary for the palate of the population to adapt to the lower sodium foods¹⁶.

In order to establish whether the initiatives to reduce sodium in certain foodstuffs are successful, a monitoring system must be implemented. In South Africa, to our knowledge, there is currently no sodium reduction monitoring system available.

The aim of this study was to investigate if the food industry is already reducing the sodium content of foodstuffs before the first implementation date of June 2016, as stipulated in the Regulations¹⁶ based on the nutrition label information.

METHODOLOGY

This study is a descriptive, observational study.

Identification of foodstuffs

Most available food items from different food manufacturers were identified in each of the food categories according to R214. Only products displaying a nutrition information panel which included the sodium content were included.

Data collection

Data were collected in two of the biggest supermarkets in the Gauteng province of South Africa. After approval was granted from the supermarket manager, photographs were taken of the available items. The photographs included front of the package, the nutrition panel and the ingredients of each food item.

This information was captured in an Excel spreadsheet, reflecting the following: food product, picture of food product, date of data collection, brand of product, manufacturer, and sodium content in mg per 100g. Data collection was done in March 2014 and May 2015. The same supermarkets were visited for the second round of data collection.

Statistical analysis

Data were analysed using Microsoft Excel 2010. The range, mean sodium content (mg/100g), standard deviation and percentage of products below the targets were calculated for each food item. Data were normally distributed according to the Shapiro Wilk test ($p=0.322$).

RESULTS

The sodium content of 338 foodstuffs was collected on two occasions over 14 months. Table 1 shows the sodium content per 100g of food. Nearly two-thirds (61.5%) of all the foods reached the 2016 target by March 2014 and an additional quarter (23%) reached the 2019 target by May 2015.

Table 1: Sodium (mg) content per 100g food

Food category	Range		Mean \pm SD		Sodium reduction target June 2016	Sodium reduction target June 2019
	Data collection March 2014	Data collection May 2015	Data collection March 2014	Data collection May 2015		
Bread (n=6)	451-618	464-618	528 \pm 171	517 \pm 70	400	380
All breakfast cereals and porridges, whether ready-to-eat, instant or cook up, hot or cold (n=14)	57-705	65-510	348 \pm 207	335 \pm 138	500	400
All fat spreads and butter spreads (n=33)	0-883	11-826	558 \pm 237	570 \pm 212	550	450
Ready-to-eat savoury snacks, excluding salt-and-vinegar-flavoured snacks (n=7)	300-1090	426-1090	764 \pm 273	720 \pm 265	800	700
Flavoured potato crisps, excluding salt-and-vinegar-flavoured potato crisps (n=20)	455-1670	455-1670	808.4 \pm 272.4	819. \pm 275	650	550
Flavoured, ready-to-eat, savoury snacks and potato crisps-salt-and-vinegar only (n=8)	615-2220	615-1730	1330 \pm 626	1149 \pm 469	1000	850
Processed meats - uncured (n=5)	74-773	74-773	473 \pm 271	3689 \pm 305	850	650
Processed meat – cured (n=130)	349-2500	349-2500	1034 \pm 232	1007 \pm 270	950	850
Raw processed meat sausages (all types) and similar products (n=7)	596-1022	627-1022	810 \pm 131	827 \pm 117	800	600
Dry soup powders (not instant type) (n=14)	374-7557.4	323-5879	2604 \pm 2396	3228 \pm 2106	5500	3500
Dry gravy powders and dry instant savoury sauces (n= 44)	280-11170	232-5467	2935 \pm 2539	2144 \pm 1654	3500	1500
Dry savoury powders with dry instant noodles to be mixed with a liquid (n=36)	40-1658	40-1658	833 \pm 463	880 \pm 456	1500	800
Stock cubes, stock powders, stock granules, stock emulsions, stock pastes or stock jellies (n=14)	2301-26332	2760-26332	14749 \pm 9799	15292 \pm 9102	18000	13000

mg = milligrams; n = number of foodstuffs in the category

Not one of the bread items met either of the two targets (Figure 2). More than 60% of the food items in the breakfast cereals and porridges food group, 90% of the food items in the uncured meat group and 67% in the soup powders group reached the targets for both 2016 and 2019. Fewer products from the potato crisps and cured meat categories reached the target, with only 19% and 20%, respectively (Table 3).

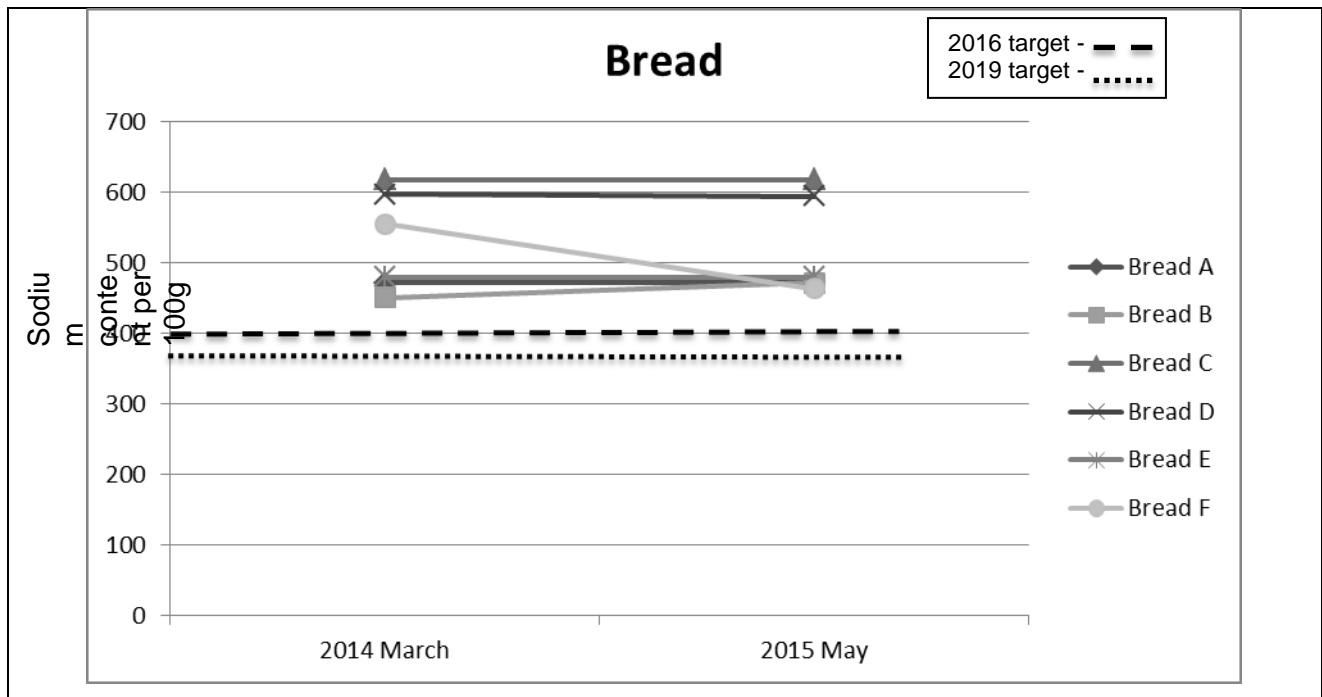


Figure 2: Change in sodium content of bread over time.

Table 3: Food items below the sodium reduction target for 2016 and 2019 respectively				
Food item	Data collection March 2014		Data collection May 2015	
	2016 Sodium reduction target reached n (%)	2019 Sodium reduction target reached n (%)	2016 Sodium reduction target reached n (%)	2019 Sodium reduction target reached n (%)
Bread (n=6)	0(0)	0(0)	0(0)	0(0)
All breakfast cereals and porridges, whether ready-to-eat, instant or cook-up, hot or cold (n = 14)	12(85)	10(71)	10(71)	8(57)
All fat spreads and butter spreads (n=33)	15(45)	14(42)	13(39)	13(39)
Ready-to-eat savoury snacks, excluding salt-and-vinegar-flavoured snacks (n=7)	3(43)	3(43)	4(57)	4(57)
Flavoured potato crisps, excluding salt-and-vinegar-flavoured potato crisps (n=20)	6(30)	2(10)	5(25)	2(10)
Flavoured, ready-to-eat, savoury snacks and potato crisps-salt-and-vinegar only (n=8)	3(38)	3(38)	2(25)	2(25)
Processed meats - uncured (n=5)	5(100)	4(80)	5(100)	4(80)
Processed meat – cured (n=130)	42(32)	20(15)	31(23)	21(16)
Raw processed meat sausages (all types) and similar products (n=7)	3(42)	1(14)	2(28)	0(0)
Dry soup powders (not instant type) (n=14)	14(100)	10(71)	12(85)	6(42)
Dry gravy powders and dry instant savoury sauces (n=44)	27(61)	15(34)	29(66)	15(34)
Dry savoury powders with dry instant noodles to be mixed with a liquid (n=36)	34(94)	14(39)	28(78)	9(25)
Stock cubes, stock powders, stock granules, stock emulsions, stock pastes or stock jellies (n=14)	8(57)	6(42)	7(50)	6(42)

n=number of products in category

Table 4 shows products that have increased in sodium content over the two consecutive data collection periods. Within this time a number of products were removed from the shelves or companies closed down resulting in limiting foodstuffs. The maximum (6181mg) and minimum (1mg) increases in sodium content were both in the Stock food category.

Table 4: Food items that presented with an increase in sodium content over the data collection period (sodium in mg/100g food)				
Food item	Sodium content March 2014	Sodium content May 2015	2016 target	2019 target
Bread				
Bread B	451	472	400	380
All breakfast cereals and porridges, whether ready-to-eat, instant or cook-up, hot or cold				
Cereal A	180	190	500	400
Cereal B	306	332	500	400
All fat spreads and butter spreads				
Spread FF	750	780	550	450
Ready-to-eat savoury snacks, excluding salt-and-vinegar-flavoured snacks				
Snacks E	300	480	800	700
Processed meat – cured				
Cured meat W	876	998	950	850
Cured meat B1	930	1080	950	850
Cured meat R1	996	1120	950	850
Cured meat J2	1213	1215	950	850
Cured meat X2	888	1041	950	850
Cured meat P1	1080	1100	950	850
Cured meat N3	1060	1166	950	850
Cured meat J4	842	882	950	850
Cured meat K5	866.51	1003	950	850
Raw processed meat sausages (all types) and similar products				
Sausage D	690	808	800	600
Sausage I	596	627	800	600
Dry soup powders (not instant type)				
Soup M	4656	4874	5500	3500
Soup O	1101	4665	5500	3500
Dry gravy powders and dry instant savoury sauces				
Sauce A	2716	2821	3500	1500
Sauce B	2371	2625	3500	1500
Sauce P	2240	2785	3500	1500
Gravy W	2945	3208	3500	1500
Gravy H1	458	468	3500	1500
Dry savoury powders with dry instant noodles to be mixed with a liquid				
Noodle B	1178	1314	1500	800
Noodle G	1312	1314	1500	800
Noodle K	875.2	939	1500	800
Noodle J	535	536	1500	800
Noodle T	644	1306	1500	800
Stock cubes, stock powders, stock granules, stock emulsions, stock pastes or stock jellies				
Stock H	2301	8200	18000	13000
Stock J	2419	8600	18000	13000

Red – Products not reaching 2016 or 2019 targets

Orange – Product reaching either 2016 or 2019 target

Green – Reaching both 2016 and 2019 target

Breakfast cereals and porridges (Figure 3), uncured meat (Figure 4) and soup powders (Figure 5) showed good compliance with more than 60% reaching the new targets for 2016 and 2019.

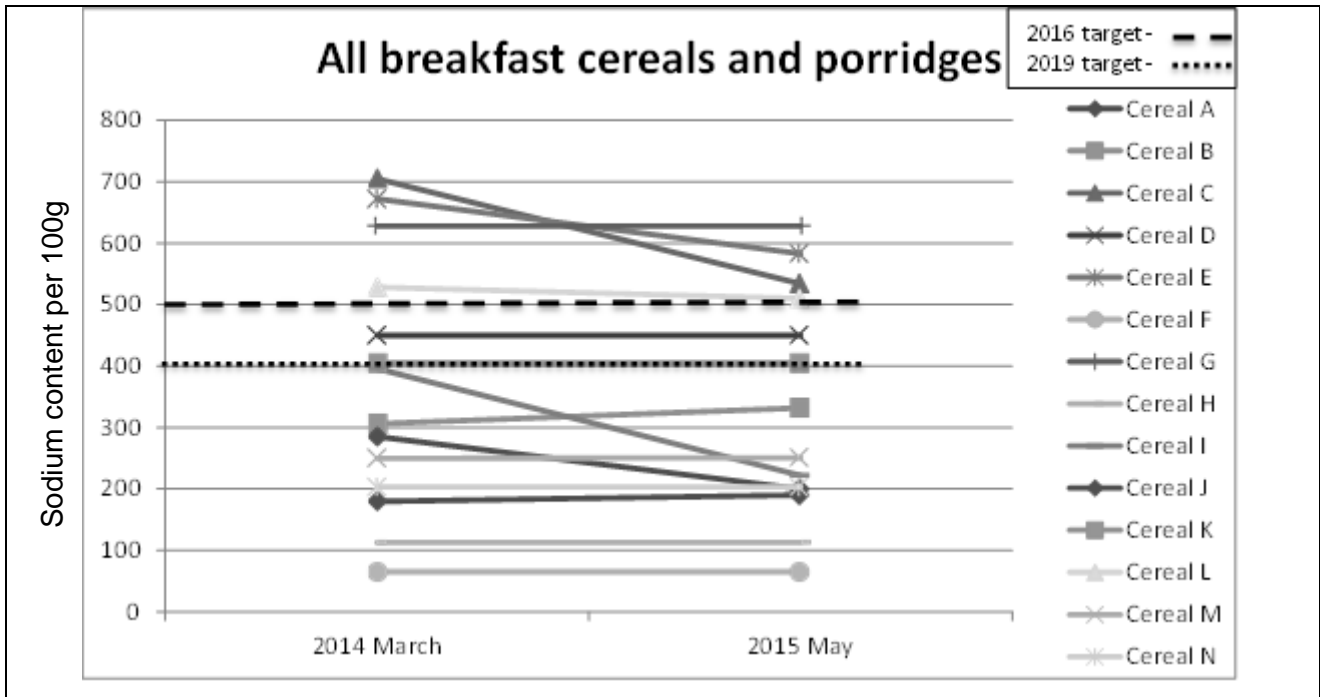


Figure 3: Change in sodium content of breakfast cereals over time

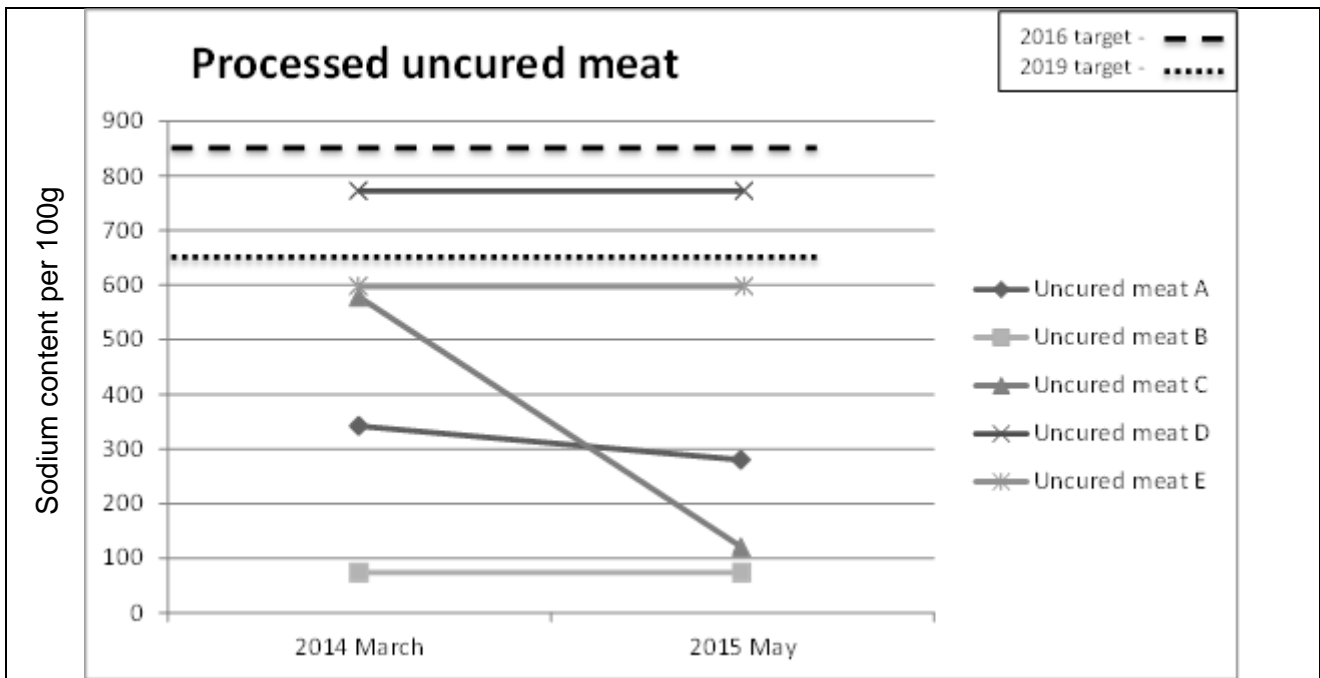


Figure 4: Change in sodium content of uncured meat over time

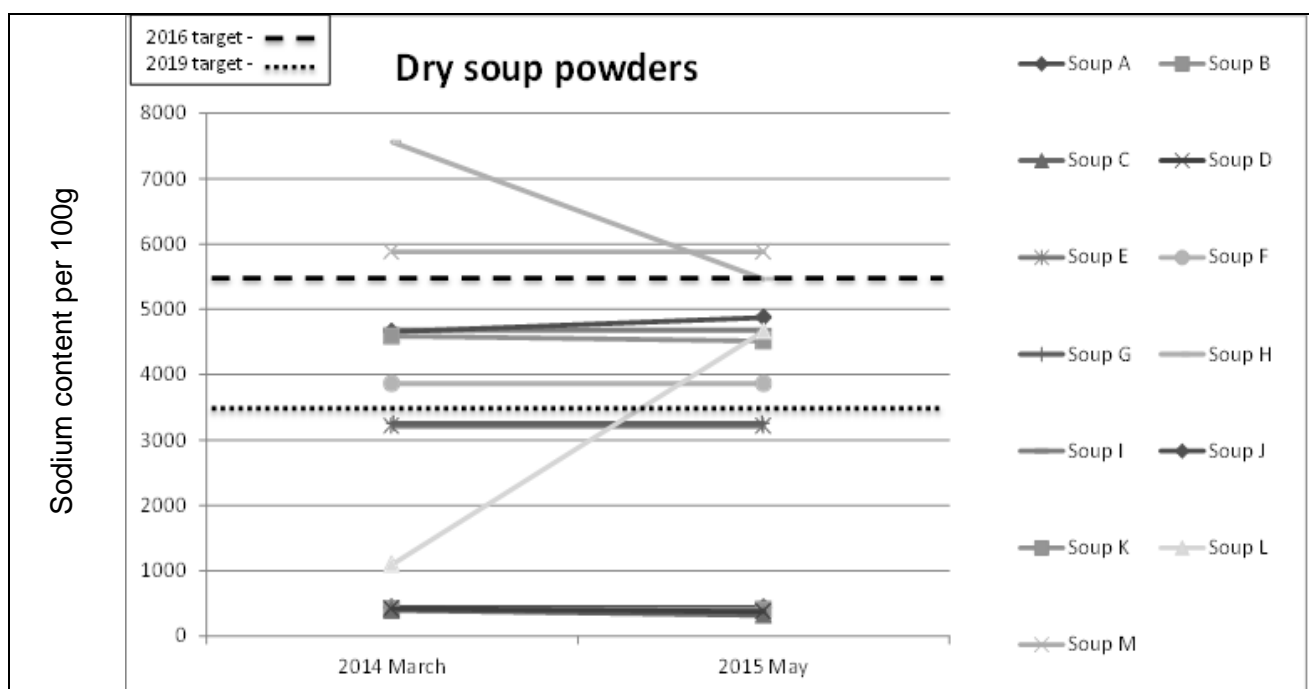


Figure 5: Change in sodium content of soup powders over time.

Results indicated that all food items, with a few exceptions, in the cereals and porridges food group, processed uncured meats and dry soup powders group were mostly under the target set by the DoH (Table 5).

Table 5 Products within the cereal and porridges, savoury snacks and uncured meat categories not reaching targets (Sodium in mg/100g food)			
Food stuff	Sodium content May 2015	2016 Target	2019 Target
All cereal and porridges			
Cereal C	534*	500	400
Cereal E	583	500	400
Cereal D	450 ^{\$}	500	400
Cereal G	628	500	400
Cereal M	510	500	400
Savoury flavoured snacks			
Snacks B	932	800	700
Snacks G	1040	800	700
Snacks H	1090	800	70
Processed uncured meat			
Uncured meat D	772.6	850	650

*Red colour – Product reaching 2016 or 2019 target

^{\$}Orange colour – Product reaching 2016 target

DISCUSSION

The study focussed on the change in the sodium content of certain foodstuffs over a 14-month period in light of Regulation R214 that will come into effect in June 2016.

The data gathered for this research suggested that only cereal products, uncured meat and soup powders are complying with the new legislation. Foodstuffs nearing the targets set for especially 2016 include spreads, raw sausages, cured meats, gravy powders and sauces, noodles and stock. These products are frequently consumed by the South African population and it is good to see that these products contributing to high sodium intake in the population¹⁷ are decreasing in sodium content and reaching targets.

Not one of the bread products monitored met the 2016 target. This is a concern as bread is one of the main contributors to sodium intake in South Africa^{17,18}, contributing up to 1.6g per day to the total salt intake⁹. Only one of the six breads included showed a decrease in sodium content. Australia and New Zealand follow a voluntary reduction strategy and a study was done to study the change in sodium content in bread products¹⁹. Breads from Australia meeting the national targets increased from 29% (2007) to 50% (2010). New Zealand had an increase of 49% (2007) to 90% (2010)¹⁹. Since bread is one of the staple foods of the South African population²⁰ it is very important to meet the sodium target levels to be able to reduce the sodium intake of the population, improve public health and lead to cost savings⁹.

Soup products are mostly complying with the regulations, perhaps due to the other flavour enhancers that can be added to soup, for example peppers or chillies for a burning sensation. This assists that consumers do not taste the full impact of the lowered sodium. However, this claim still needs to be proven through more research^{5,21}. A recent study by De Kock *et al.* (2015) on the palatability effect of reducing sodium to the target levels as set by the DoH for 2016 and 2019 respectively, did report an overall positive response from consumers. Consumers were given test meals (of chicken stew prepared stock cube powder and rice) with the 2013 sodium content and meals with reduced target sodium content. The meals were equally liked, whether it was prepared with 2013 sodium content stock or with the new reduced regulations sodium content.

Reducing sodium in foodstuffs is more complex than one would think. Salt is added to food to improve the taste and flavour of the food, but it also acts as a preservation method²². In the production of bread, salt is also added for dough handling (it reduces the stickiness of the dough), dough fermentation and mould growth. It has been reported that if the salt content in bread is reduced it will have a financial impact as the shelf life of bread will decrease due to mould growth, handling of the dough and fermentation will be less effective^{1,23}. However, Bertram *et al.*, (2012) reported that the cost of making bread in 2012 was 92.3c per loaf and the additional cost would be about 8.91c per loaf⁹. An update on the cost implications should be done in lieu of the current drought and increase in food prices and the possibility that wheat will have to be imported.

One alternative that can be added to food as a sodium replacement is potassium chloride (KCl), but unfortunately this product has a bitter aftertaste and it is more expensive than sodium. Adenosine-5'-monophosphate, DHB (2,4-dihydroxybenzoic acid), lactose, sodium gluconate, and mixtures for use in combination with potassium chloride⁵ - these products mask the bitter taste of food and allow for the reduction of sodium⁵. It might be easier for food companies to produce new products and flavours than to change current foodstuffs with an associated 'known' taste. The product might have a change in colour, appearance and taste. Consumers are used to the look and taste of products, so changing can have an effect on sales and consumption of product²⁴.

In our study data collection took place over a period of 14 months and collection was only limited to the few products chosen and not all products available in South Africa were included in each of the food categories. However, a more extensive monitoring system is needed to cover all the possible products within every food category to have a better understanding of the sodium content of foodstuffs and compliance with the new legislation. Consumer education is of utmost importance to improve the knowledge of all South Africans regarding the effect of sodium on health. Since we need a change in salt behaviour, education should also include 'do not add salt to food at the table'. This is an important focus point as not all the salt that is being consumed originates from processed, ready prepared foods. The public awareness campaign of the Heart and Stroke Foundation of SA will be a valuable contribution to the reduction of the sodium intake of the South African population to less than 5g salt (2000mg sodium) per day by 2020.

A few limitations were identified in the study. In addition to not all products having been included, some of the products did not provide the sodium content of the product. Companies take long to change nutritional labels as this is an expensive process. The sodium content of the foodstuffs were not analysed to verify if the information on the label is correct.

CONCLUSION

The national Department of Health targets appear to have resulted in sodium reduction in some foods. This reduction will have a beneficial effect on both the health of the population and the economy of the country. Currently, a reduction of the sodium in foodstuffs is slowly being implemented, but it will not go without challenges. It is encouraging to see that the food industry is already working on reformulations and changing the sodium content of their products to be able to comply with the Regulations when it comes into effect in 2016.

A monitoring system should be developed for South Africa to ensure the sustained reduction in the sodium content of the targeted foodstuffs. A suggestion for this monitoring system is that volunteers are requested to take photographs of products in main retailers using an appropriated software application. The data could then be collected and evaluated in a master dataset.

The monitoring system that should be developed and implemented will have to address if each food product in each of the 13 categories comply with the targets as stipulated in the regulation or not. Food companies should be identified and appropriate actions should be taken against those companies with products not complying. Lastly, the system should verify the sodium content of foodstuffs as indicated on the label. Once the public is educated and understand the importance of reducing their salt intake the addition of a low salt logo could be considered for those products meeting specified criteria to assist the consumers in making a good choice to purchase.

In addition to monitoring the sodium content of these targeted foodstuffs, the Department of Health should address other sources of non-discretionary sodium, for example the fast food sector and large scale food production. Targeting the sodium content of foods is only part of the total strategy. Education of the population to ensure behaviour change regarding sodium intake is essential. Furthermore, the monitoring and evaluation of the impact of the total strategy in the long run is also necessary by assessing sodium intake by means of 24-hour urinary sodium excretion and measuring blood pressure of the population.

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CHAPTER 4: CONCLUSIONS AND RECOMMENDATIONS

The strategy of the DoH to reduce sodium content in foodstuffs was developed to reduce the prevalence of hypertension and CVD in South Africa resulting in an overall decrease in the burden of disease.

Sodium is used in most food production processes and it is a common additive in most foods consumed by South Africans on a daily basis. The reasons sodium is added to a product include fermentation, dough handling, taste, flavour, mould growth, safety and preservation (Henney *et al.*, 2010). However, the negative effects caused by sodium consumption outweigh the positive effects of adding sodium to foodstuffs.

CVD is one of the many diseases associated with an excess intake of sodium. Research has shown that sodium has a direct effect on blood pressure and subsequently causes hypertension (WHO, 2007; WHO, 2012; He & MacGregor, 2010; He & MacGregor, 2009; He *et al.*, 2010).

The DoH implemented new legislation regarding the reduction of sodium content in certain foodstuffs to try and address the burden of disease of CVD. The first reduction target that should be met is in June 2016 and the second in June 2019 with even lower sodium content targets. Currently only a few food groups are reaching the first target, namely dry soup powders, uncured meats and cereal and porridges. Bread is a worrisome food group, as this is one of the staple foods in South Africa and none of the bread products researched was reaching targets.

This study had certain limitations like for example the fact that only two supermarkets were targeted in Gauteng and not all products available in South Africa were included. Not all products had sufficient nutritional information available on packaging and in many cases the sodium content was lacking. The foodstuffs were not analysed for correct sodium content, therefore labelling might be incorrect regarding sodium content in the food product.

A comprehensive monitoring system should be developed to evaluate if the regulations are followed. Sodium analyses on a subset of the foodstuffs should be done to ensure that the sodium content displayed on the label is correct. Monitoring should take place on an annual basis in major supermarkets in South Africa, as well as most products available on the market in South Africa. The DoH should address all other sectors responsible for non-discretionary salt intake for example the fast food sector. In order to monitor the effect of a sustained reduction in the sodium content of foodstuffs, 24-hour urinary sodium excretion samples should be obtained, as well as the blood pressure of a representative sample of the population.

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