

1 **Projected effects on salt purchases following implementation of a national salt reduction policy**
2 **in South Africa**

3 **Abstract**

4 **Objective:**

5 To assess the contribution of different food groups to total salt purchases and to evaluate the estimated
6 reduction in salt purchases if mandatory maximum salt limits in South African legislation were being
7 complied with.

8 **Design:**

9 This study conducted a cross-sectional analysis of purchasing data from Discovery Vitality members.
10 Data was linked to the South African FoodSwitch database to determine the salt content of each food
11 product purchased. Food category and total annual salt purchases were determined by summing salt
12 content (kg) per each unit purchased across a whole year. Reductions in annual salt purchases were
13 estimated by applying legislated maximum limits to product salt content.

14 **Setting:**

15 South Africa

16 **Participants:**

17 The study utilised purchasing data from 344,161 households, members of Discovery Vitality,
18 collected for a whole year between January and December 2018.

19 **Results:**

20 Vitality members purchased R12.8 billion worth of food products in 2018, representing 9,562
21 products from which 264,583 kg of salt were purchased. The main contributors to salt purchases were
22 bread and bakery products (23.3%); meat and meat products (19%); dairy (12.2%); sauces, dressings,
23 spreads and dips (11.8%); convenience foods (8.7%); processed fruit and vegetables (7.8%); cereal
24 and grain products (4.2%); and snack foods (3.8%). The projected total quantity of salt that would be
25 purchased after implementation of the salt legislation was 250,346 kg, a reduction of 5.4% from 2018
26 levels. Bread and bakery products were projected to have the greatest reduction, followed by meat
27 and meat products, sauces, dressings, spreads and dips and snack foods.

28 **Conclusions:**

29 A projected reduction in salt purchases of 5.4% from 2018 levels suggests that meeting the mandatory
30 maximum salt limits in South Africa will make a meaningful contribution to reducing salt purchases.

31 **Keywords:** Salt, Packaged foods, Processed foods, South Africa

32

33 **Introduction**

34 Excess dietary salt intake causes high blood pressure and is associated with increased risks of
35 stroke and coronary heart disease ⁽¹⁾. The World Health Organization (WHO) recommends a
36 maximum intake of 5 g salt per day ⁽²⁾. However, dietary salt consumption above the recommended
37 level is the norm for most populations around the world ^(3,4). In South Africa, the median salt intake
38 is 7.2 g per day ⁽⁵⁾, with the major dietary contributors being processed foods, such as bread, sausages,
39 salami, pies, packaged powdered soup, canned soup, French fries, and potato crisps ⁽⁶⁾. Furthermore,
40 according to the 2012 South African National Health and Nutrition Examination Survey
41 (SANHANES-1), 31.8% of the population had hypertension (blood pressure above 140/90 mmHg
42 and/or taking hypertension medication) ⁽⁷⁾, indicating a need for reductions in population salt
43 consumption.

44 In 2013, South Africa became the first country to implement legislation that sets mandatory
45 limits for the maximum sodium content in a wide range of processed foods, as part of strategies to
46 reduce salt intake among its population ^(8,9). The legislation contained a stepped approach, with
47 manufacturers given until 30 June 2016 to meet one set of category-based targets, and another three
48 years, until 30 June 2019, to meet more stringent requirements. Thirteen food categories which are
49 high in salt and are regularly consumed by South Africans were targeted: bread, breakfast cereals and
50 porridges, fat and butter spreads, savoury snacks, salt and vinegar flavoured savoury snacks,
51 flavoured potato crisps, processed meat (cured and uncured), meat sausages, dry soup powders, dry
52 gravy powders, dry instant savoury sauces and powders and stock cubes, powders and pastes ⁽¹⁰⁾. A
53 previous study showed that two-thirds of targeted food items already met the 2016 maximum sodium
54 limits during early stages of policy implementation ⁽¹⁰⁾. However, these analyses did not consider the
55 relative contribution of foods items to food purchasing.

56 Linking of supermarket purchasing data with nutrient composition information is increasingly
57 used to identify major dietary contributors to energy and nutrients, and changes in purchasing patterns
58 over time ^(11,2,13). The aim of the current analysis was to assess the contribution of different packaged
59 food groups to total salt purchases in South Africa, using a large supermarket sales dataset linked to
60 product-specific nutrient information between January and December 2018. Then, to evaluate the
61 potential impact of the salt reformulation legislation, we modelled the estimated reduction in salt
62 purchases if all products purchased adhered to the 2019 maximum sodium limits specified by South
63 African legislation.

64 **Materials and methods**

65 *Study population*

66 This study utilised purchasing data from members of the Vitality programme, run by
67 Discovery, a private health insurer. Data were collected between 1st January 2018 and 31st December
68 2018. The Vitality programme incentivises its members to eat healthily, engage in regular exercise,
69 and have regular health checks ⁽¹⁴⁾. The programme rewards its members for purchasing healthy
70 products from Pick n Pay and Woolworths, by providing up to 25% cashback. These two food retail
71 partners of Vitality represent about 17% of the retail food market share in South Africa, with more
72 than 1000 stores countrywide ^(15,16).

73 *Supermarket purchasing data*

74 Vitality members are provided with one card per household that they scan at Pick n Pay and
75 Woolworths. In addition, the card is linked with the retailer's loyalty card at Woolworths. Purchasing
76 data, at the household level, were provided by Discovery. Households were excluded from analyses
77 if their annual purchases were less than 8000 South African Rand (R) (equivalent to US \$439 at
78 30/04/2020) or above R150,000 (equivalent to US \$8,229 at 30/04/2020); where 50% or more of
79 annual purchases were from only one food category, and if they had less than 7 months of purchasing
80 data. These cut-offs were applied by Discovery based on elements such as assessing the histogram of
81 amounts spent whereby an absolute top end could be a relatively wealthy individual spending ~R3000
82 per month, buying all of their food at the partner supermarket, thus spending R150k for the year,
83 while at the bottom end someone less well-off spending ~R700 per month, maybe also shopping
84 elsewhere. Barcodes of products were provided by Discovery and available for linkage to product
85 level nutrition information.

86 *Product nutrition information*

87 Nutrition information for packaged products was obtained from the South African
88 FoodSwitch database. The products did not include processed meats sold at deli and unpackaged fruit
89 and vegetables. This database included data collected between 2015 and 2018 through in-store
90 surveys and crowdsourcing of information reported on food labels ^(17,18). In-store surveys were
91 conducted in Johannesburg, in collaboration with Discovery, in their retail partner stores with a large
92 market share of the South African economy: Shoprite Checkers (20% market share), Pick n Pay (13%),
93 Spar (9.5%), and Woolworths (3.7%) ⁽¹⁶⁾. Researchers used The George Institute's Data Collector
94 smartphone application to capture packaged product information including barcodes, product name,
95 ingredients list and nutritional information ⁽¹⁹⁾. Protocols for data entry and quality checks have been
96 described previously ⁽¹⁷⁾.

97 *Linking purchasing data to nutrition composition information*

98 Vitality purchasing data were linked to the FoodSwitch data using the product barcode as the
99 identifying variable. We excluded products with zero or negative sodium quantities, no pack size
100 information and food categories for which the NIP is not usually displayed, such as alcohol, baking
101 aids and black/ herbal teas, as well as foods intended for infants and babies. However, products with
102 missing sodium values, and which were eligible for inclusion, were retained and sodium values were
103 imputed as described below.

104 *Food categorization*

105 Food and beverage products were categorized into food groups and food categories in
106 accordance with the Global Food Monitoring Group categorization system, a standardized system
107 that classifies foods and beverages into groups (e.g., bread and bakery products), categories (e.g.,
108 bread), and subcategories (e.g., flat bread) to enable comparative assessment of nutrient composition
109 of processed foods worldwide ⁽²⁰⁾.

110 *Statistical analyses*

111 Sodium content, which was available in mg per 100g, was converted to salt in kg by using the
112 formula: sodium (mg)*2.5/100,000. We imputed missing sodium values for 1,576 products out of
113 9,562 products using the median sodium value for similar products that were in the same food
114 category at the finest level of categorisation. The amount of salt purchased was determined by using
115 the salt content, pack size and number of units purchased, and summed across food groups.

116 To assess the impact of the legislated maximum salt limits on salt purchased, we assumed that
117 products in the FoodSwitch database that exceeded the maximum limits (Table 1) would be
118 reformulated to meet the legislated targets for 2019. For products that were below or equal to the
119 target, we assumed sodium levels remained the same. Projected total, and percentage contributions,
120 to salt purchase after assumed complete implementation of legislation in June 2019 were thus
121 determined. Statistical analysis was performed using Stata version 15.1.

122 **Results**

123 A total of 9,562 products with complete purchase and nutrient information were available for
124 analysis. The products represented R12.8 billion worth of purchases made by 344,161 households.
125 The majority of purchases were from households comprising four or more members. Most purchases
126 were made in Gauteng Province (R7.1 billion) followed by Western Cape Province (R3.2 billion),
127 reflecting the large population sizes within these provinces (Table 2). Of the 9,562 food and beverage
128 products, 956 (10%) were in food categories covered by the legislation.

129 *Contribution of food group and food categories to total salt purchased*

130 A total of 264,583 kg of salt, excluding plain salt, was purchased annually. The highest food
131 group contributors to total annual salt purchases were bread and bakery products (23.3%); meat and
132 meat products (19%); dairy (12.2%); and sauces, dressings, spreads and dips (11.8%), and
133 convenience foods (8.7%) (Table 3). The highest food category contributors were bread (18.6%),
134 processed meat (18.6%), sauces (7.3%), processed vegetables (7.1%), cheese (6.6%), crisps and
135 snacks (3.8%), and ready meals (3.7%). The total quantity of salt purchases projected under
136 conditions where the salt legislation was fully complied with was 250,346 kg, a reduction of 14,238
137 kg (5.4%). Bread was projected to be responsible for the greatest reduction comprising 15.1% of the
138 total reduction, followed by soup (11.4%), crisps and snacks (10.6%) and breakfast cereals (6.6%)
139 (Figure 1).

140 **Discussion**

141 Findings from this study indicate that household purchases of sodium would reduce by 5.4%
142 from 2018 levels after completely successful implementation of the mandatory salt legislation. Given
143 that the South African maximum salt legislation only targets reformulation for processed foods, other
144 policy interventions may be needed to achieve the WHO 30% salt reduction target by 2025 ⁽²¹⁾.

145 South Africa has been recognised as a world leader in introducing legislation as part of
146 population salt reduction strategies ⁽²²⁾. Frameworks for analysing and optimising the performance of
147 public health regulation ⁽²³⁾ identify the value of mandatory over voluntary approaches to achieve
148 industry adherence, but also highlight that public health impact will depend on the scope of products
149 included, and the strength of the nutrient thresholds set. Salt reduction has been achieved in the UK
150 through voluntary salt reduction in processed foods, negotiated with the food industry. An estimated
151 7% reduction in salt content of processed foods was achieved between 2006 and 2011 after voluntary
152 salt reduction targets were introduced for various food categories ⁽²⁴⁾. However, it is important to note
153 that in the UK case, the industry salt reduction occurred hand in hand with a social marketing
154 campaign to change consumer behaviour which led to a 10% reduction in salt intakes ⁽²⁵⁾. This implies
155 that the average salt levels in foods purchased was lowered and consumers were encouraged to make
156 healthier food choices through the social marketing campaign.

157 While the mandatory nature of South Africa's regulation is important, the effectiveness of
158 regulation is also impacted by other factors. For example, the scope of legislation (i.e. the products
159 covered) must be sufficiently broad to achieve the desired effects. In the current study, the major food
160 category contributors of salt purchases include bread, processed meat, cheese, sauces and canned
161 vegetables. Even though cheese and canned vegetables contribute significant amounts to sodium

162 purchases, they are not currently covered by South African legislation. There is a need to cover these
163 and other product categories in order to generate greater reductions. Feasibility of salt reduction in
164 cheese has been demonstrated in different studies ^(26,27), with minimal effects on consumer
165 acceptability. Canned vegetables contain high salt content and have been proposed as a target for salt
166 reduction in Canada ⁽²⁸⁾. Consequently, including canned vegetables and cheese in the salt legislation
167 in South Africa would further enhance reduction in population salt intake.

168 Dietary sources of salt differ substantially between countries ⁽²⁹⁾. For instance, in Brazil,
169 China, Costa Rica, Guatemala, India, Japan, Mozambique, and Romania, most of the salt consumed
170 is from discretionary sources. On the other hand, bread and bakery products and meat are top
171 contributors of dietary salt in European countries, USA, Australia and New Zealand, while sauces
172 and dressings contribute majority of the salt in Japan. This highlights the importance to conduct
173 country specific analyses using contemporary purchasing data. In New Zealand, bread, processed
174 meat, savoury sauces and cheese were identified as categories with high contribution to salt purchases
175 in a study comprising of 16,800 packaged processed food and beverages ⁽¹³⁾. On the other hand, bread,
176 milk, cheese, bacon and sauces accounted for more than one-thirds of the salt purchases in a study of
177 44,372 food products in the United Kingdom ⁽¹²⁾. It should be noted that our study only looked at
178 projected reductions. For these to be achieved in practice, legislation must also be monitored and
179 enforced, with meaningful sanctions for products that exceed legislated maximums.

180 In South Africa, in addition to processed foods, salt added during cooking or at the table
181 accounts for a large proportion of salt intake in the population ⁽³⁰⁾. In our study, table salt purchases
182 contributed 120,543kg of salt which was about half the total purchased in processed foods. To reduce
183 discretionary salt consumption among the South African population, various behaviour change
184 programs through mass media campaigns have been formulated with studies showing that participants
185 were taking steps to control discretionary salt intake ⁽³¹⁾. Substitution of regular salt for a reduced
186 sodium alternative would be another option since this has been shown that it has potential to reduce
187 deaths from cardiovascular disease ⁽³²⁾.

188 In addition to legislation, other efforts are required from governments and public health bodies
189 to reduce salt consumption. These might include; ensuring compliance with salt legislation in practice
190 in order to meet these projected benefits; strengthening and expanding salt legislation to have stronger
191 targets and cover more products; ensuring it is part of a comprehensive strategy as recommended by
192 WHO to achieve population salt reduction in the SHAKE package. These include; surveillance
193 through measuring and monitoring salt use; harnessing industry to promote the reformulation of foods
194 and meals to contain less salt; adopting standards for effective labelling and marketing of food;

195 empowering individuals to eat less salt through education and communication; and supporting food
196 environment that promotes healthy eating ⁽³³⁾.

197 Ultimately, the impact of salt legislation is best measured through assessment of the reduction
198 in the burden of cardiovascular diseases (CVD) and other associated health care costs. In a previous
199 modelling study to assess the effect of sodium reduction in South Africa, it was estimated that a
200 reduction of 0.85 g of sodium intake per person per day would result in prevention of 7,400 CVD
201 deaths and 4,300 non-fatal strokes annually resulting to cost savings of up to R300 million ⁽³⁴⁾. A
202 longitudinal study using Discovery Vitality members' purchasing data linked to their health outcomes
203 would provide valuable information on the effect of salt reduction on health.

204 Major strengths of this study include the use of a large dataset of processed food and beverage
205 product purchases linked to nutrition information data. Availability of per capita salt in foods
206 purchases, rather than household purchases, would have enabled a better estimate of salt purchases
207 for population subsets. Because this study utilised data from members of a health insurance company
208 who receive incentives for purchasing healthier products, recorded purchasing behaviour may not be
209 representative of the entire South African population. The inclusion of two retailers representing a
210 minority of food retail market share and a possible preference for Pick n Pay and Woolworths by
211 those in upper socioeconomic sectors of the population may also affect the representativeness of
212 purchases included in this study. The 5.4% reduction may be an underestimate of what remains to be
213 achieved nationally because the Vitality members are likely already buying healthier products, and
214 the gains from shifting to products achieving the regulated targets might therefore be smaller. This
215 study included only packaged foods and not unpackaged foods such as deli meats, thereby omitting
216 some contributors to salt intake such as processed meats available at deli counters. As our study has
217 shown, processed meats are a key contributor to salt intake, meaning that our projected reductions
218 are a potential underestimation of the effect of the legislated maximum salt limits. Comparison with
219 baseline levels of salt purchases before the introduction in 2013 of the legislated maximum salt limits
220 would better enable a comparison of the overall effects of this legislation to international efforts in
221 this area. Lastly, the unavailability of longitudinal tracking data for this study means that we cannot
222 quantify any reformulation that may have taken place prior to this analysis.

223 In conclusion, this study has highlighted the food groups and food categories that are major
224 contributors of salt purchases in South African diets. We have demonstrated that if South African salt
225 legislation were fully complied with, a further 5.4% reduction in salt purchases would be achieved
226 from processed foods. This excludes salt contributed by unprocessed foods and discretionary salt.
227 While these data cannot be directly compared to consumption data, the South African maximum salt

228 legislation only targets reformulation for processed foods, suggesting that other policy interventions
229 may also be needed to achieve the WHO 30% salt reduction target.

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331 **Figure legends**

332 Figure 1. Percentage reduction in salt projected after reformulation in June 2019 in different food
 333 categories

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335 **Table 1. Maximum sodium levels allowed in specified food categories by 30 June 2019**

Food Category	Maximum Total Sodium per 100g by June 2019
Bread	380
Breakfast cereals and porridges	400
Dry gravy powders and instant sauces	1500
Dry savoury powders with instant noodles	800
Dry soup powders	3500
Fat and butter spreads	450
Potato crisps excluding salt and vinegar flavoured	550
Processed meat, cured	650
Processed meat, uncured	1150
Processed raw meat sausages	600
Salt and vinegar flavoured savoury snacks and potato crisps	850
Savoury snacks excluding salt and vinegar flavoured	700
Stock cubes, powders, pastes, emulsions, granules or jellies	13000

336

337 **Table 2. Demographics and annual salt purchases of Discovery Vitality members**

	Number (%)	Purchases (SA Rand)
<i>Household size</i>		
Single person	109,997 (32.0)	2,515,843,998
Two people	86,834 (25.2)	3,010,635,246
Three people	53,909 (15.7)	2,174,212,998
Four or more people	93,421 (27.1)	5,071,788,273
Overall	344,161 (100)	12,772,480,515
<i>Household province</i>		
Eastern Cape	11,094 (3.2)	301,025,167
Gauteng	179,101 (52.0)	7,098,516,505
KwaZulu-Natal	41,621 (12.1)	1,233,213,962
Limpopo	3,705 (1.1)	100,833,046
Mpumalanga	4,775 (1.4)	159,591,471
North West	5,426 (1.6)	166,384,648
Northern Cape	1,266 (0.4)	34,099,503
Western Cape	81,394 (23.7)	3,283,368,380
Free State	5,666 (1.7)	152,819,102
Unknown	10,113 (2.9)	242,628,731
Total	344,161 (100)	12,772,480,515

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340 Table 3. Quantity of salt purchased in different food categories in 2018 and as projected after legislated reformulation

Food group and category	Number of products	Total quantity of salt (kg)	% of total (excluding plain salt)	Total quantity of salt projected after reformulation (kg)	% of total (excluding plain salt)
Salt	68	120,543			
Bread and bakery products	697	61,598	23.3	54,161	21.6
Bread*	156	49,207	18.6	41,770	16.7
Biscuits	410	9,945	3.8	9,945	4.0
Cakes, muffins and pastries	131	2,446	0.9	2,446	1.0
Meat and meat products	566	50,224	19.0	47,888	19.1
Processed meat*	504	49,300	18.6	46,964	18.8
Meat alternatives	62	924	0.3	924	0.4
Dairy	1,108	32,335	12.2	32,335	12.9
Cheese	308	17,368	6.6	17,368	6.9
Milk	276	8,552	3.2	8,552	3.4
Yoghurt and yoghurt drinks	307	3,639	1.4	3,639	1.5
Ice cream and edible ices	101	1,275	0.5	1,275	0.5
Desserts	80	1,251	0.5	1,251	0.5
Cream	36	250	0.1	250	0.1
Sauces, dressings, spreads and dips	968	31,260	11.8	30,073	12.0
Sauces*	609	19,237	7.3	18,050	7.2
Mayonnaise and salad dressings	206	6,610	2.5	6,610	2.6
Spreads and dips	153	5,413	2.0	5,413	2.2
Convenience foods	457	22,972	8.7	22,029	8.8
Ready meals	143	9,869	3.7	9,869	3.9
Soup*	180	8,248	3.1	7,305	2.9
Pre-prepared salads and sandwiches	59	2,530	1.0	2,530	1.0

Pizza	45	1,900	0.7	1,900	0.8
Meal kits	29	385	0.1	385	0.2
Other frozen foods not otherwise specified	1	40	0.0	40	0.0
Fruit and vegetables	1,697	20,764	7.8	20,764	8.3
Processed vegetables	960	18,798	7.1	18,798	7.5
Processed fruit	453	1,381	0.5	1,381	0.6
Nuts and seeds	178	521	0.2	521	0.2
Jam and marmalades	106	64	0.0	64	0.0
Cereal and grain products	816	11,240	4.2	10,828	4.3
Breakfast cereals*	280	6,287	2.4	5,874	2.3
Noodles	60	1,961	0.7	1,960	0.8
Other cereal and grain products	173	1,723	0.7	1,723	0.7
Pasta	166	594	0.2	594	0.2
Rice	69	332	0.1	332	0.1
Cereal and nut-based bars	45	209	0.1	209	0.1
Couscous	23	135	0.1	135	0.1
Snack foods	232	10,138	3.8	9,069	3.6
Crisps and snacks*	232	10,138	3.8	9,069	3.6
Fish and fish products	243	8,388	3.2	8,388	3.4
Processed fish	243	8,388	3.2	8,388	3.4
Edible oils and oil emulsions	266	7,443	2.8	6,591	2.6
Edible oils*	119	7,414	2.8	6,562	2.6
Cooking oils	130	27	0.0	27	0.0
Cooking oil spray	9	2	0.0	2	0.0
Coconut oil	8	0	0.0	0	0.0
Non-alcoholic beverages	1,426	5,573	2.1	5,573	2.2
Waters	170	1,447	0.5	1,447	0.6
Soft drinks	367	1,233	0.5	1,233	0.5
Coffee and tea	96	1,111	0.4	1,111	0.4

Fruit and vegetable juices	534	819	0.3	819	0.3
Cordials	152	716	0.3	716	0.3
Electrolyte drinks	22	150	0.1	150	0.1
Energy drinks	53	82	0.0	82	0.0
Beverage mixes	15	13	0.0	13	0.0
Fermented drinks (e.g. Mageu)	17	1	0.0	1	0.0
Confectionery	545	1,107	0.4	1,107	0.4
Chocolate and sweets	507	1,085	0.4	1,085	0.4
Jelly	38	21	0.0	21	0.0
Sugars, honey and related products	274	697	0.3	697	0.3
Sugar	62	339	0.1	339	0.1
Syrup	31	185	0.1	185	0.1
Condensed caramel	2	77	0.0	77	0.0
Sweeteners	71	47	0.0	47	0.0
Dessert toppings	61	34	0.0	34	0.0
Honey	36	12	0.0	12	0.0
Dessert additions	11	3	0.0	3	0.0
Eggs	31	568	0.2	568	0.2
Special foods	236	277	0.1	277	0.1
Protein and diet bars	11	135	0.1	135	0.1
Baby foods	189	119	0.0	119	0.0
Sports/protein powders	24	13	0.0	13	0.0
Diet soup mixes (meal replacements)	1	6	0.0	6	0.0
Diet drink mixes (meal replacements)	7	4	0.0	4	0.0
Other fitness or diet products	4	0	0.0	0	0.0
Total (excluding plain salt)	9,562	264,583	100.0	250,346	100.0

341 *Food categories with reformulation targets