





Food purchasing behaviour of shoppers from different South African socio-economic communities: results from grocery receipts, intercept surveys and in-supermarkets audits

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Abstract

Objective: To identify factors associated with food purchasing decisions and expenditure of South African supermarket shoppers across income levels.

Design: Intercept surveys were conducted, grocery receipts collated and expenditure coded into categories, with each category calculated as percentage of the total expenditure. In-supermarket food quality audit and shelf space measurements of foods such as fruits and vegetables (F&V) (healthy foods), snacks and sugar-sweetened beverages (SSB) (unhealthy foods) were also assessed. Shoppers and supermarkets were classified by high-, middle- and low-income socio-economic areas (SEA) of residential area and location, respectively. Shoppers were also classified as “out-shoppers” (persons shopping outside their residential SEA) and “in-shoppers” (persons shopping in their residential SEA). Data were analysed using descriptive analysis and ANOVA.

Setting: Supermarkets located in different SEA in urban Cape Town.

Participants: Three hundred ninety-five shoppers from eleven purposively selected supermarkets.

Results: Shelf space ratio of total healthy foods *v.* unhealthy foods in all the supermarkets was low, with supermarkets located in high SEA having the lowest ratio but better quality of fresh F&V. The share expenditure on SSB and snacks was higher than F&V in all SEA. Food secure shoppers spent more on food, but food items purchased frequently did not differ from the food insecure shoppers. Socio-economic status and food security were associated with greater expenditure on food items in supermarkets but not with overall healthier food purchases.

Conclusion: Urban supermarket shoppers in South Africa spent substantially more on unhealthy food items, which were also allocated greater shelf space, compared with healthier foods.

Keywords

Retail food environment
Shopping behaviours
Food expenditure
Shelf space allocation
Food security

South Africa, like many other low- and middle-income countries (LMIC), is undergoing a nutrition transition which is characterised by dietary intakes that are low in fruits

and vegetables (F&V) high in salt, fats, added sugars and highly processed food^(1,2). This transition has also been linked to urbanisation, obesity and diet-related non-communicable diseases (NCD) such as diabetes, cancer and heart diseases^(1–3). Furthermore, while more than

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45 % of the population in South Africa are either overweight or obese, and 39 % of deaths in South Africa are linked to these NCD^(4,5), over half of all households experience or are at risk of hunger⁽⁶⁾. Additionally, there is substantial evidence concerning the obesity-food insecurity paradox in LMIC and “at risk” populations, where food insecurity is typically associated with poor dietary quality and diversity⁽⁷⁾.

The expansion of the retail food environment in LMIC, especially “big box” stores and supermarkets, coincides with this nutrition transition^(8,9). The retail food environment has been highlighted as significant in the determining and shaping of dietary behaviours⁽¹⁰⁾. In South Africa, supermarkets have become a primary source for food shopping, accounting for more than 50 % of food sales^(11,12). Consequently, the purchase pattern from supermarkets should represent to a large extent the dietary pattern of shoppers in South Africa. In 2014, a South African study postulated that supermarkets promote unhealthy food purchase⁽¹³⁾. Battersby and Crush also reported that supermarkets in low-socio-economic areas (SEA) in South Africa have fewer varieties of food, and lower quality foods, than those in higher income areas⁽¹³⁾. In addition, a recent study from Kenya reported that supermarkets are a significant factor contributing to the increase in diet-related NCD⁽¹⁴⁾. Conversely, a study from Tunisia reported a positive association between supermarket purchases and diet quality⁽¹⁵⁾.

There is also evidence that shelf space allocation of food products in supermarkets plays a role in shaping food purchase patterns of consumers^(14,16). Frequently, it is the “unhealthy” foods that are strategically placed and allocated more shelf space than healthier counterparts⁽¹⁶⁾. There is indication that these retail marketing strategies have health implications, with a study linking the cumulative shelf space allocated to unhealthy foods such as energy-dense snacks with increased BMI⁽¹⁷⁾.

These studies indicate that dietary intake behaviour may be shaped by factors such as socio-economic drivers, urbanisation, retail food environment, food access and quality which may vary in different regions^(17,18). However, there is limited information from LMIC. Furthermore, studies conducted in South Africa have shown that some people shop outside their residential areas (out-shoppers), and that they have unique characteristics compared with people that shop within their residential area (in-shoppers). For example, out-shoppers are more likely to be employed, have better means of transportation and to perceive the quality of products in their residential area to be poor^(19–22). These findings are similar to studies in developed countries^(23,24). However, there is also limited information on the food expenditure of this unique group of shoppers.

Most studies in developing countries that have assessed the association between food purchasing and expenditure, and dietary behaviour, have relied on self-report, which may be prone to inaccuracy, bias and contradictory outcomes⁽²⁵⁾. However, the use of supermarket audits and

grocery receipts to collect data on food quality, access to food, purchase patterns and expenditure in supermarkets are methods used for characterising dietary patterns that have been successfully explored in developed countries^(26,27).

In a previous article⁽²²⁾, we shared the results of the self-reported purchasing behaviours and perceptions of the food environment of South African high-, middle- and low-income shoppers based on intercept surveys. The current study combines information from intercept surveys against new data from grocery receipts collected from the supermarket shoppers, as well as food price and quality audits of supermarkets located in different SEA. The objective of this study was to identify factors associated with food purchasing decisions and expenditure of supermarket shoppers residing in low, middle and high SEA and their access to healthy and quality food items in Cape Town, South Africa.

Materials and methods

This cross-sectional study is part of a larger study, STOP SA (Slow, Stop or Stem the Tide of Obesity in the People of South Africa), aimed at addressing the challenges of obesity in conjunction with food insecurity. Data for this study were collected between March and May 2017. Full details of the methods are provided in an earlier work⁽²²⁾.

Socio-economic profile of Cape Town

We categorised the residential areas of shoppers into different SEA according to average household income based on the Cape Town socio-economic profile, Statistic South Africa (STATSA) 2019 and ZAR3500//≈US\$153 monthly minimum wage^(28,29). In the current study, the low SEA that were selected were Langa and Khayelitsha. Both areas are townships located in the Cape Flats, which is one of the poorest parts of Cape Town. Langa has an average monthly household income of ZAR2144/≈US\$153⁽³⁰⁾ and Khayelitsha an average monthly household income of ZAR1600/≈US\$114⁽³¹⁾. The middle SEA selected were Athlone and Mowbray both having an average monthly household income of ZAR5217/≈US\$373⁽³²⁾. The high SEA included Parklands, one of the fastest growing new residential areas and Claremont, an old residential area. Both high SEA have an average monthly income of ZAR12 000/≈US\$857⁽³³⁾.

Supermarket sample

Supermarkets in this study are major recognised retail store chains in South Africa that offer a broad selection of foods and household products^(22,34). Major supermarkets in the purposively selected study areas were approached to obtain permission to conduct the study within their premises. We approached the managers of five different supermarkets located in high SEA, but only got permission



from two managers, as they did not wish their customers to be disturbed. There was only one refusal from a manager of a selected supermarket located in the middle SEA and none from the managers of the selected supermarkets located in the low SEA. Consent was obtained from eleven supermarket managers (four supermarkets in the low SEA, five in the middle SEA and two in the high SEA) representing approximately 20 % of the total supermarkets in the study areas.

Intercept surveys and grocery receipt data collection

Intercept surveys were conducted with eligible shoppers, who were ≥ 18 years old and who purchased ten or more different food items, as confirmed by their grocery receipts. The intercept surveys were conducted on the premises of the supermarkets after the shoppers completed their shopping and having obtained informed consent. Trained fieldworkers administered the structured questionnaire, which had been piloted in two supermarkets using similar methods described in the current study, in either one or a combination of the three major languages in Cape Town: English, Xhosa and Afrikaans, depending on the preference of the shoppers, and lasted between 20 and 25 min. These were conducted from 10:00 to 17:00 h on weekdays and 10:00 to 14:00 h on Saturdays in the beginning, middle and end of the month to capture various categories of shoppers and types of shopping trips. After the interviews, the grocery receipts of the shoppers were photographed, identically coded as the shoppers' questionnaires and archived for further analysis. Participants were given a shopping voucher (ZAR50/ \approx US\$4), as compensation for their time after completing the intercept surveys.

Questions in the intercept survey relevant to this current article included as follows.

Shopping characteristics

Questions covered shopping behaviours and patterns including shopping frequency, persons for whom they shop, persons responsible for shopping, major shopping destination/s and availability of F&V and snacks in the supermarkets.

Out-shoppers and in-shoppers

In the present study, we also looked at a sub-population based on the SEA in which they shopped compared with the socio-economic status of the area in which they resided. This sub-population was classified into two groups: out-shoppers and in-shoppers. Out-shoppers refers to persons shopping outside their residential SEA and in-shoppers refers to persons living and shopping in the same SEA.

Demographic characteristics

Characteristics included gender, age in years, residential location and three indicators of an individual's socio-economic position, specifically educational attainment, employment status and socio-economic status of residential area.

Food security assessment

Three key food security questions were adapted from the US Household Food-Security/Hunger Survey Module: 3-Stage Design⁽³⁵⁾.

Food purchase and expenditure measures

Two experienced registered dietitians coded the grocery receipts of the shoppers. Purchases were allocated into different food categories (Table 1). Food items such as soup packets, chewing gum, baby food and food items that did not have an adequate identifiable name/description and ready-to-eat meals comprising of various food categories on the grocery receipts were identified as uncategorised items. Each food category purchased by shoppers was coded in a binary manner, 1=food category that was purchased, 0=food category that was not purchased. Expenditure on each food category was calculated as percentage (share expenditure) of the total grocery expenditure (food and non-food items) for each participant.

Audits of food quality and shelf space measurements

The lowest food prices and quality audit of targeted food items in each supermarket were assessed by trained fieldworkers in pairs, as well as the shelf space allocation for specific food categories defined in Table 1.

Audit of food price and quality

Quality audits were conducted at all the supermarkets during the same season and during the week to maximise comparability. In addition, the food price audits commenced within the same period the intercept surveys were being conducted and were completed within a fortnight after the last intercept survey was conducted. The lowest prices of the food items were compared between the supermarkets located in the different SEA, similar to the study by Ghosh-Dastidar *et al.*⁽³⁶⁾. As the lowest food prices of food items in different SEA supermarkets were comparable (after applying the Bonferroni correction because of the small sample size and multiple comparisons), the data are not presented here, but are available in online supplementary material, Supplemental Table 1.

Quality of foods was classified into categories. F&V were classified as "Excellent" if they were fresh, firm, clean and had good colour, "Satisfactory" if relatively fresh looking with minor defects and "Poor" if bruised, old looking, overripe, showing signs of shrivelling or excessive softening. Dairy products were classified as "Excellent" if they were within sell by/best before date with no odour and "Poor" if they had noticeable odour and were after the best before/sell by date. Bread and fresh baked products were classified as "Excellent" if they were soft, fresh and within the sell by/best before date, "Satisfactory" if they were reasonably soft and before the sell by/best before

Table 1 Food categories and definitions

Food category	Definition
Fruits	Any fruit-based item: fresh, canned, frozen, dried, whole, cutup or pureed
Vegetables	Any fresh, frozen or tinned vegetable product, including butternut/potatoes/beetroot/peas/maize
Bread	All types of breads
Grains and potato	All whole and refined grains such as maize, wheat (flour), rice, oats, cornmeal, barley or another cereal grain, pasta, oatmeal, breakfast cereals, porridges and tortillas, wraps, potato, two-minute noodles, instant couscous
Snacks	High-energy baked goods, ready-to-make/ingredients, frozen treats, milk-based desserts, sweets, candy and sweet toppings with a sweet or salty taste. These include chocolates, chips, biscuits, donuts, cookies and others, nuts, peanuts, energy bars, crackers, muffins, sugar (all types), honey, syrup, ice cream, trail mixes, droewors ice cream, sugared dried fruit
Sugar-sweetened beverages	All cool drinks or soft drink beverages with sugar, high fructose maize syrup, or fruit-juice concentrate added, or natural with high calorie: soft drinks/sodas, flavoured juice drinks, non-alcoholic wine, flavoured water with sugar, sports drinks, sweetened tea. Coffee drinks, energy drinks and fruit juice blends, cordials, chocolate milk/sweetened milk, including fruit nectar and all fruit juices
Meat	All meat types: red meat (beef, lamb, goat), poultry (chicken and turkey) and pork, whether fresh, frozen, smoked or dried – including boerewors or sausage, tripe, organ meats)
Dairy products	All type of food produced from milk such as yogurt, cheese and butter whether low or high in fats, fresh, frozen, canned or processed and dairy alternatives, for example, soya milk – if fortified
Processed protein	Cold cuts, viennas, tinned meats, meat pies, chicken nuggets, samosas, breaded fish fingers, bacon, etc.
Fish	All fish types and other seafood such as shrimps or shellfish, whether fresh, canned, frozen or dried
Eggs	All types of eggs : farm fresh, free range, etc.
Oils, spreads and dressings	All types of margarine (brick and tub), cooking oils, creams, mayonnaise, salad dressings, etc.
Spices and condiments	Salt and pepper, spices, tomato sauce, mustard, curry paste, etc.
Dry legumes	Dried beans, split peas, lentils, chickpeas broad beans, soya beans, kidney beans, canned kidney beans, haricot, lentils, chickpeas, lima beans and others
Tea and coffee	All tea and coffee types
Alcohol	Any fermented liquor, such as wine, beer or distilled spirits
Water	Bottled spring and distilled water
Non-food items	Purchased items that are not edible for human consumption
Uncategorised item	Items that are not in the categorised items, for example, artificially sweetened cordial, specialised dietary foods, almond milk, packet of soups, salt, baby food, etc.

date and “Poor” if they are hard, not fresh and past sell by/best before date. Protein foods (meat, eggs, beans and fish) were classified as “Excellent” if they had good colour, no odour, no freezer burn, no visible blood and were within best before date and poor if noticeable odour, inconsistent colour, some evidence of freezer burn, some visible blood and past the sell by date. If a food item was not available in the supermarket, it was classified as unavailable. For this study, the quality of fresh F&V found in the South African food basket⁽³⁷⁾ was assessed and used for analyses because of their high perishability and nutritional value. The variables were coded as excellent = 1; satisfactory = 2; poor = 3 and not available = 4 for analysis.

Shelf space measurement

Using measuring wheels that were either rolled along the shelves or the floor, pairs of trained fieldworkers measured the supermarket size and shelf space allocation. Shelf spaces were measured for food types that were specified in Table 1. The shelf space (in linear metres) of each food category in the aisle was measured. Measurements did not include height, depth or number of shelves. Measurement of freestanding bins (that were not round) was performed by measuring the accessible sides from which customers could select products. For round freestanding food bins,

the diameter was measured, and circumference calculated using $2\pi r$. When a food type to be measured was located in several places in the supermarket, all the measurements were summed to produce a total shelf length. These methods of measurement are consistent with previous studies^(10,38). In the current study, the ratio of the shelf space measurement of “total healthy foods” (fresh and frozen F&V *v.* “total unhealthy” (sugar-sweetened beverage (SSB) and snacks) was assessed using the same indicators that were validated in previous studies^(10,39).

Data analysis

Data were analysed using IBM SPSS for Windows, version 25 (IBM Corporation). Means and SD were calculated for the continuous variables and χ^2 tests were computed for categorical variables and presented as *n* (%). Distributions for continuous variables were tested using Shapiro–Wilk tests for normality, which showed that most variables were not normally distributed within our sample. However, the statistical analyses used have been shown to be robust even when the requirements of normally distributed data are not met⁽⁴⁰⁾. ANCOVA was used to compare the mean differences among the food categories varying by residential SEA. Covariates included were



age, shopping pattern, food security and mode of travel to shop. Gender and the number of persons in the household that will be fed with the purchases being made on the day of the intercept survey were not significant covariates. As employment and education are closely interrelated as indicators of socio-economic status with residential SEA, they were not included as covariates. Pairwise comparisons were made with the least significant difference ($P < 0.05$).

One-way ANOVA was used to compare the unadjusted mean differences of the food categories (share expenditure) varying by food security status and out-shopping/in-shopping. Results are available in online supplementary material, Supplemental Table 2. Descriptive statistics (median, ratio and range) were used to assess the healthiness of in-store food environments using aforementioned indicators.

Results

Demographic and shopping characteristics

Of the total of 635 shoppers approached in all three SEA settings, 425 agreed to be interviewed. The main reasons given for refusal were lack of time and lack of interest. More than 60 % of non-respondents were from high-SEA supermarkets. Of the 425 respondents who agreed to be interviewed, only 395 respondents were included in the final analysis, due to either inadequate or unintelligible information on grocery receipts. The participants' demographics and shopping patterns ($n = 395$) are presented in Table 2. Most of the participants (82.4 %) were women and more than half ($n = 245$, 62.1 %) were between the ages of 30 and 55 years. There were significant differences in age distribution, education level and employment between the three SEA groups. More than 50 % of the participants from

Table 2 Demographic and shopping characteristics by shopper's socio-economic area (SEA)

Variables	SEA								P-values
	High SEA		Middle SEA		Low SEA		Overall total		
	n	%	n	%	n	%	n	%	
Demographics	71	18.0	120	30.4	204	51.6	395	100	
Age									
18–30 years old		18.3		14.3		22.7		19.3	0.003
30–55 years old		54.9		59.7		66.0		62.1	
>55 years old		26.8		26.1		11.3		18.6	
Gender									
Male		26.8		16.9		14.9		17.6	0.08
Female		73.2		83.1		85.1		82.4	
Education									
Primary		5.8		39.3		51.8		39.7	<0.001
High school		43.5		39.3		37.7		39.2	
Tertiary		50.7		21.4		10.3		21.1	
Employment status									
Employed		66.7		43.2		49.5		50.6	0.003
Unemployed		21.7		38.1		41.4		36.9	
Retired		11.6		18.6		9.1		12.5	
Food security status									
Food secure (yes)		47.4		43.3		31.5		37.7	0.68
Shopping characteristics									
No of persons in household									
Mean	4.0		4.6		3.7				0.55
SD	1.9		4.1		2.4				
Shopping pattern									
Daily		32.4		31.7		24.5		28.1	0.002
Weekly		60.6		41.7		46.1		47.3	
Monthly		7.0		26.7		29.4		24.6	
Shopping for									
Self		28.2		21.7		25.5		24.8	0.57
Household		71.8		78.3		74.5		75.2	
Shopping area									
High SEA		100		9.2		3.9		22.8	<0.001
Middle SEA		0		86.7		19.1		36.2	
Low SEA		0		4.2		77.0		41.0	
Main transportation mode to shop									
Walk		11.3		43.3		68.1		50.4	<0.001
Public transport		15.5		21.7		25.0		22.3	
Private car		73.2		35.0		6.9		27.3	
Main shopping store (yes)		85.9		78.3		88.7		85.1	0.04
Varieties of snacks available (yes)		84.5		91.7		90.5		89.7	0.54
Varieties of fruits and vegetable available (yes)		78.3		80.7		89.1		84.6	0.85

P-values determined through χ^2 and ANOVA.

the low-residential SEA had only a primary school education compared with more than 50 % of participants from the high-residential SEA who had a tertiary education. There was a high prevalence of unemployment of the participants from low-residential SEA compared with shoppers from high-residential SEA (41.4 % *v.* 21.7 %). The food security status of the shoppers residing in the different SEA was comparable, with more than 50 % of each SEA category food insecure.

For 85.1 % of shoppers, the supermarket in which they were interviewed was the one in which they mainly shopped. Many of the respondents regardless of their residential SEA were weekly shoppers (47.3 %, $P=0.002$) compared with daily (28.1 %) or monthly (24.6 %). Most of the shoppers residing in high SEA (73.2 %) drove their private cars to shop. Conversely, many shoppers residing in low SEA (68.1 %) walked to their shopping destination and one-quarter use the public transportation. There were no differences between the supermarkets in the different SEA for varieties of snacks or fruits available. More than 75 % of shoppers interviewed were shopping primarily for their household rather than for only themselves. The number of persons per shopper's household being shopped for from all the residential SEA was comparable. Most of the respondents shopped within their neighbourhoods ($P<0.001$) and none of residents from the high-residential SEA were "out-shoppers" in contrast to 13.4 % from the middle-SEA and 24.0 % from the low-SEA groups (Table 2). Consequently, from this point for comparison purposes, in-shoppers and out-shoppers include only shoppers residing in low and middle SEA ($n\ 324$).

Purchases and expenditure of shoppers from different socio-economic areas

Figure 1 shows the proportion of 395 shoppers from different residential SEA that purchased specific food categories. Significantly, more high-SEA resident shoppers purchased fruits, vegetables, eggs, dairy and bread compared with the

other shoppers. Approximately two-thirds of shoppers from high-residential SEA purchased vegetables compared with less than half of the shoppers from low- and middle-residential SEA. More shoppers from middle-residential SEA (80 %) purchased snacks compared with low- (57.8 %) and high-SEA resident (74.6 %) shoppers. Less than a third of the shoppers from all the residential SEA purchased dry legumes; however, the percentage of shoppers from low-residential SEA that purchased legumes was significantly higher ($P=0.02$). The percentages of shoppers who bought meat, fish, cooking oil, grains and potatoes and SSB were not significantly different between all residential SEA groups. The frequency of the purchase of fish by all the shoppers was notably low relative to purchases of other protein-rich foods such as meat, eggs and dairy.

Table 3 depicts the average grocery and food expenditure (ZAR) and percentage expenditure on the different categories by shoppers from different residential SEA. Shoppers from high-residential SEA had the highest grocery and food expenditure ($P<0.001$) in the supermarkets and spent a higher proportion of their expenditure on fruits ($P<0.001$), vegetables ($P<0.03$) and alcohol ($P<0.05$) when compared with shoppers from the middle- and low-residential SEA. High-SEA resident shoppers spent a higher proportion of their expenditure on vegetables compared with those from middle SEA but have a comparable expenditure with low-SEA resident shoppers. Shoppers from low-residential SEA spent more on grains and potatoes ($P<0.001$) and dry legumes ($P<0.05$) when compared with shoppers from middle- and high-residential SEA. Middle-residential SEA shoppers spent more on snacks ($P<0.05$).

The proportion of total ZAR spent by low-SEA resident shoppers on snacks, grains and potatoes, and SSB was higher than was spent on F&V. Furthermore, the share expenditure by low- and middle-residential SEA shoppers

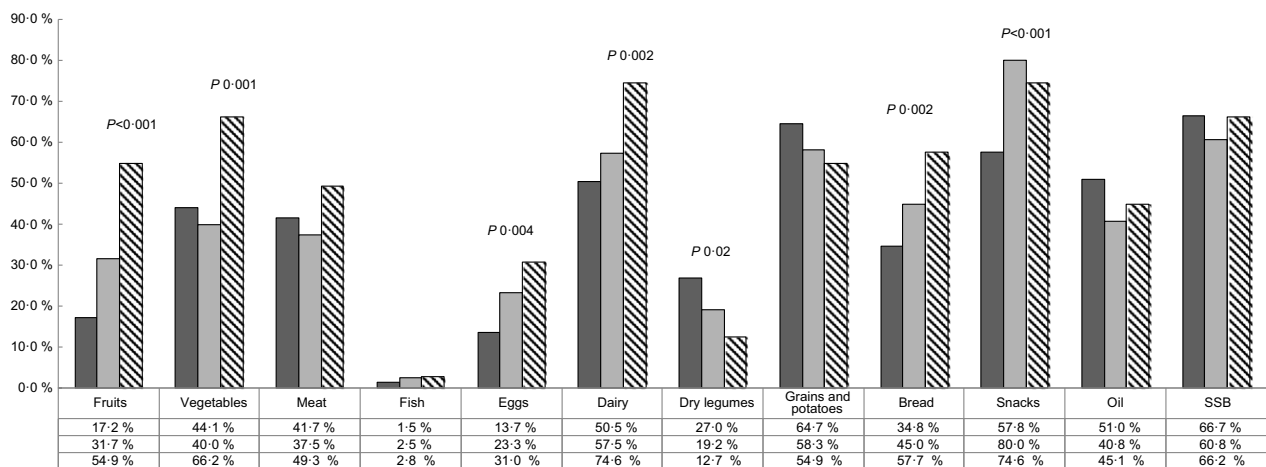


Fig. 1 Percentages of shoppers from low-, middle- and high-SEA neighbourhoods that purchased food from various categories, respectively

Table 3 Adjusted means for percentage expenditure on food categories of shoppers residing in different socio-economic area (SEA)

Variables	Low SEAs n 204	Middle SEAs n 120	High SEA n 71
Average grocery expenditure (ZAR)	410.3 ± 28.3	412.7 ± 35.6	681.8 ± 48.6 ^a
Average food expenditure (ZAR)	348.2 ± 26.0	328.9 ± 32.7	511.9 ± 44.8 ^a
Food categories			
Fruits	1.5 ± 0.4	2.2 ± 0.5	4.6 ± 0.6 ^a
Vegetables	3.0 ± 0.4 ^{ab}	2.5 ± 0.5 ^b	4.4 ± 0.6 ^a
Meat	7.4 ± 0.7	6.1 ± 0.9	6.6 ± 1.3
Fish	1.3 ± 0.3 ^{ab}	1.8 ± 0.4 ^b	0.6 ± 0.5 ^a
Egg	1.2 ± 0.3	1.7 ± 0.4	1.8 ± 0.5
Processed protein	2.0 ± 0.4	2.7 ± 0.5	3.0 ± 0.7
Dairy	5.7 ± 0.6	5.3 ± 0.7	6.2 ± 1.0
Bread	2.0 ± 0.3	2.3 ± 0.3	2.1 ± 0.5
Grains and potatoes	8.8 ± 0.6 ^a	5.7 ± 0.7	4.2 ± 1.0
Dry legumes	2.1 ± 0.3	1.0 ± 0.4	0.7 ± 0.5
Snacks	6.6 ± 0.9	13.4 ± 1.1 ^a	7.9 ± 1.6
SSB	5.2 ± 0.5	5.1 ± 0.6	5.6 ± 0.8
Oil, creams and spread	4.6 ± 0.4	3.5 ± 0.5	3.4 ± 0.7
Water	0.4 ± 0.3	0.2 ± 0.3	0.2 ± 0.5
Alcohol	0.6 ± 0.4	0.2 ± 0.5	2.2 ± 0.7 ^a
Spice and condiments	2.8 ± 0.4	2.4 ± 0.5	3.3 ± 0.7
Tea and coffee	1.1 ± 0.4	0.9 ± 0.5	1.1 ± 0.6
Non-food item	11.6 ± 1.3	14.9 ± 1.6	15.0 ± 2.2
Uncategorised items	3.6 ± 0.5	2.9 ± 0.6	2.0 ± 0.8

SSB, sugar-sweetened beverages.

 Values of adjusted means in the same row with different superscript (a, b) are significantly different ($P < 0.05$).

Adjusted for age, shopping pattern, food security status and transport mode to shop.

Mean and SE determined through ANOVA.

on SSB was about twice what was spent on fruits, and their share expenditure on snacks was more than two-folds what was spent on either fruits or vegetables. High-SEA resident shoppers spent more than three-folds the share expenditure on fruits than low-SEA resident shoppers. Proportional expenditure of shoppers on meat, eggs, processed protein, bread, SSB, oil and cream, spices, tea and coffee and non-food items was comparable across all residential SEA groups.

Expenditure of shoppers categorised by food security status and out-shopping/in-shopping

Expenditures of shoppers ($n 395$) based on their food security status and whether they were in-shoppers or out-shoppers ($n 324$) are shown in online supplementary material, Supplemental Table 2. The grocery and food expenditures of food secure shoppers were both significantly higher than for food insecure shoppers ($P < 0.05$). Despite this, there was no difference between these groups for the percentages spent on the different food categories, except for alcohol, which was higher in the food secure shoppers. Grocery and food expenditure of the shoppers when categorised by out-shopping status was comparable except for fruits and SSB which were lower for in-shoppers compared with out-shoppers.

Quality of fruits and vegetables in supermarkets located in different socio-economic areas

The quality of most of the F&V in the high-SEA supermarkets was of the better quality compared with those found in

the middle- and low-SEA supermarkets that mostly varied between good and poor grades (see online supplementary material, Supplemental Fig. 1).

Shelf space of selected food items in supermarkets located in different socio-economic area

Table 4 shows the average cumulative linear shelf length for food groups categorised as total healthy (fresh and frozen F&V), total unhealthy (SSB and snacks), fresh F&V, SSB and all snacks, as well as the ratios between the shelf length allocated for the different types of foods. Supermarkets located in high SEA had a lower ratio of shelf length of total healthy foods to total unhealthy foods compared with the other groups. However, on separating the shelf space into subgroups (fresh F&V, SSB and all snacks), more shelf space in high- and middle-SEA supermarkets was allocated to fresh F&V when compared with SSB in supermarkets located in low SEA. Less shelf space was allocated to fresh F&V compared with snacks in all the SEA supermarkets. However, when the supermarkets were combined ($n 11$), the ratio of shelf space for total healthy foods *v.* unhealthy foods and for fresh F&V *v.* all snacks was lower. The allocated shelf space for fresh F&V and SSB in the combined supermarkets was comparable.

Discussion

In this study, we combined intercept surveys, analysis of grocery receipts and in-supermarkets audits to add to our

Table 4 Shelf length of healthy and unhealthy foods in high, middle and low socio-economic area (SEA) supermarkets in Cape Town

	High-SEA supermarkets (n2)		Middle-SEA supermarkets (n5)		Low-SEA supermarkets (n4)		Combined supermarkets (n-11)	
	Median	Min-Max	Median	Min-Max	Median	Min-Max	Median	Min-Max
Cumulative linear shelf length								
Total healthy foods shelf length (m)	64.3	63.7–64.9	44.5	9.50–60.7	24.2	20.4–67.5	44.5	(9.5–67.5)
Total unhealthy foods shelf length (m)	214.7	114.7–314.6	61.9	40.2–136.9	55.5	46.5–133.2	62.3	(40.2–314.6)
Ratio	0.30		0.72		0.44		0.71	
Fresh fruits and vegetables shelf length (m)	51.5	47.0–56.0	33.0	5.6–44.4	20.9	18.3–53.1	33.0	(5.6–56.0)
SSB shelf length (m)	34.8	33.7–35.9	21.9	18.5–48.9	31.8	18.4–69.8	34.0	18.4–69.8
Ratio	1.48		1.51		0.66		1.0	
Fresh fruits and vegetables shelf length (m)	51.5	47.0–56.0	33.0	5.6–44.4	20.9	18.3–53.1	33.0	5.6–56.0
All snacks	179.9	81.0–278.0	43.4	21.6–92.1	27.4	20.9–63.4	43.4	20.9–278.7
Ratio	0.29		0.8		0.8		0.8	

Min, minimum; Max, maximum; SSB, sugar-sweetened beverages.

current understanding of food purchasing behaviour in retail supermarkets from high-, middle- and low-socio-economic communities in urban South Africa. We have shown that the shelf space ratio of healthy foods to unhealthy foods in all the supermarkets was low, with supermarkets located in high SEA having the lowest ratio. Consequently, snacks and SSB (unhealthy foods) were ranked as the second most frequently purchased food items by shoppers from the three residential SEA. Fresh F&V were of lower quality and less frequently purchased in supermarkets located in middle and low SEA than in high-SEA supermarkets. As a result, out-shoppers tended to spend more on fruits than in-shoppers as they able to purchase better quality in supermarkets located in higher SEA. This is supported by findings in our earlier study that out-shoppers are better employed and perceived the quality of the F&V in their neighbourhoods to be of low quality⁽³¹⁾. Furthermore, our current study also shows that out-shoppers are more likely to be employed, mostly use public transport to shop and outshop mostly due to quality and closeness proximity to their place of work (data not shown). Although food secure shoppers spent more overall, the type of food items purchased frequently did not differ from the food insecure shoppers. The high percentage of shoppers from high SEA who were categorised as food insecure is surprising. This could be attributed to the high percentage of women in the study (>80 %) as it has been reported that women in households regardless of their socio-economic status tend to perceive themselves as being food insecure rather than men⁽⁴¹⁾. Hence, there might be a gender bias in the reporting which needs to be further explored.

Findings in this study such as the higher purchase of F&V by high-SEA resident shoppers compared with other residential SEA shoppers, the frequent purchase of unhealthy foods by all shoppers and the low quality of F&V in supermarkets located in low income areas, consequently resulting in outshopping by lower SEA resident shoppers, are supported by our earlier work on self-reported purchasing behaviours of shoppers in our study area⁽³¹⁾.

Our earlier work adds more in-depth, context and reliability to these comparable outcomes. The current study further brings novel results of food purchasing behaviours of supermarket shoppers from different residential SEA and characteristics of supermarkets located in different income areas.

Our finding that shoppers from high-residential SEA had spent more on food than shoppers residing in low and middle SEA is not surprising as persons of higher socio-economic status are more likely to have disposable income. This is confirmed by various studies conducted in South Africa and other LMIC^(42,43). In addition, poverty and high food prices reduce consumer purchasing power and provide more limited food choices for persons from low and middle SEA, especially for healthy foods⁽⁴⁴⁾. Although it has been documented that F&V are also commonly purchased from street vendors located in low and middle SEA⁽⁴⁵⁾, in our study, the low purchase and expenditure of low and middle resident shoppers on F&V compared with shoppers from high SEA are similar to other studies from South Africa, which have assessed the consumption and/or purchase of F&V irrespective of any specific retail food environment. For instance, in a study conducted in a low income area in Cape Town, more than half of the participants indicated that F&V were often missing in their diet and were not among their top six food items commonly purchased⁽⁴⁶⁾. Another study in South Africa documented that vegetables and fruits were not among the top ten food items commonly consumed⁽³⁾. We have also shown that the share expenditure on fruits by shoppers from the high-residential SEA was more than three times higher than that of the low SEA (4.6 % *v.* 1.5 %), although expenditure in vegetables is comparable. Previous studies in South Africa have also reported an almost four times higher purchase in volume and absolute spend of fruits by persons of higher socio-economic status compared with the poor households, while the percentage expenditure on vegetable is more comparable between the SEA groups. This may be because fruits are often perceived as a luxury while vegetables are included as one of the common



secondary ingredients in low-income South African meals^(37,47). The results of our current study might also be attributable to the superior quality of the F&V in supermarkets located in high SEA and the higher prices of F&V compared with staples, snacks and SSBs as shown in other studies on food prices in South Africa^(22,47,48).

It is unclear whether the poorer quality of F&V in supermarkets located in lower SEA is as a result of poor demand, or there is poor demand as a result of poor quality of the F&V. Previous study conducted in low income communities in the USA shown that lower consumption of F&V can be attributed to the poor quality of F&V in the environment⁽⁴⁹⁾. Whereas Thorndike *et al.* demonstrated a positive association between combination of improvement in the quality and visibility of F&V in food stores and purchase⁽⁵⁰⁾.

Although shoppers from high-residential SEA spent more on food, shoppers from low-residential SEA possibly spent a higher share of their income on food. An earlier study showed that low income households from developing countries spend between 50 % and 80 % of their income on food, middle income households spend 35–65 % of their income on food and high income households spend about 15 %⁽⁵¹⁾. With most of the shoppers in our study being weekly shoppers, we estimated that the average monthly expenditure on food for low-SEA resident shoppers was ZAR1258/≈US\$90 (ZAR314.4 × 4) which is approximately 59–79 % of the documented average monthly household income of persons residing in Khayelitsha and Langa. The monthly estimate of food expenditure (ZAR1323/US \$95) was about 25 % of their average monthly income while shoppers from high-residential SEA presumably spend about 19 % (ZAR2243/≈US\$170) of their income on food monthly (see “Materials and methods”).

Even though the proportion of shoppers from low-residential SEA who bought grains and potatoes was comparable with other shoppers, the share expenditure varied with shoppers from low-residential SEA spending more than middle- and high-SEA resident shoppers. In fact, the highest expenditure on food item by low-SEA resident shoppers was in this food category. Although potatoes and grains are not necessarily unhealthy, our findings suggest that low-SEA resident shoppers might consume mostly a diet of staples due to their high energy density and affordability^(48,52) and therefore have low dietary diversity⁽⁵³⁾. A possibility of low dietary diversity in shoppers from low-residential SEA is evidenced by the significantly lower number of persons from low-residential SEA that purchased fruits, vegetables, egg and dairy. In addition, grains and potatoes are easier to store as they are not highly perishable which is an important factor to consider when there is limited funds and storage facility which is common in low income households⁽⁴⁷⁾.

Although shoppers from high-residential SEA were mostly employed and had a higher educational attainment, which has been associated with higher nutritional knowledge and healthy lifestyle^(54,55), they purchased and spent

more on snacks than F&V. Likewise, the share expenditure on fruits, vegetables and SSB was also comparable in the high-SEA resident shoppers. The consumption of SSB and snacks in South Africa has been on a sharp increase in recent times, while there has been a slow progress in the consumption of F&V as between 2009 and 2014, the percentage change in consumption of F&V was 3.1 % and 0.52 %, respectively, in sharp contrast to 7.8 % and 15 % increase in consumption rate of SSB and snacks, respectively⁽⁵⁶⁾. Moreover, data from our food audits in the supermarkets indicated that all the supermarkets have more shelf space allocated for unhealthy food groups (SSB and snacks). Studies in Kenya showed a positive association between purchasing food in supermarkets and increasing BMI⁽⁸⁾, and that supermarket promotes unhealthy purchases⁽¹⁴⁾. Studies have also indicated that unhealthy foods in supermarkets are often more advertised and heavily promoted compared with healthy foods^(57,58). Hence, not surprisingly, snacks and SSB (unhealthy foods) were frequently purchased by all shoppers.

The lower grocery and food expenditure by food insecure respondents in our findings are similar to a study conducted in an informal settlement in Johannesburg, South Africa⁽⁵⁹⁾ and also in other LMIC^(60,61). However, despite this, in our study, the share expenditure on food categories was comparable between the food secure and insecure groups. Both food secure and food insecure shoppers spent the most on snacks, meat and grains and potatoes (in descending order). This suggests that even though food secure persons may spend more on food and probably buy more in terms of quantity than food insecure person, the quality of food procured in terms of “nutrients” and “health” may not differ.

Undoubtedly, a major contributing factor to the prevalence of obesity and diet-related NCD in South Africa is unhealthy food purchase behaviour which is encouraged by more shelf space allocated to unhealthy foods than healthy foods in supermarkets. This is supported by studies in high income countries that have shown the association of purchase and food items strategic placement and shelf space allocations^(10,17,38). Socio-economic status and food security status are associated with greater expenditure on food items in supermarkets but not associated with overall healthier food purchase. Based on the results of the current study as well as systematic reviews, supermarkets are not making sufficient efforts to promote positive food choices^(62,63).

Study limitations

This study is novel in South Africa as it uses a combination of intercept surveys, data from supermarket grocery receipts and in-supermarket food price and food quality audits to better understand the food purchasing behaviours of the urban South African population. It also assesses the



associations between food access and purchase behaviours. However, the study only focused on shoppers in a limited number of supermarkets and did not consider other local food purchasing outlets such as spazas, shebeens and street vendors. The study was also conducted in one city which limits the generalisation to other regions in South Africa. In addition, grocery receipts collected and coded were for only a single shopping trip which may not be reflective of the participants' comprehensive grocery purchases, and we were unable to ascertain if the grocery receipt collected depicts the shopper's typical shopping day. The coding food item process was broad and may not have captured all the different subgroup of food items. For example, lean meat, red meat, chicken feet, tripe and liver were all classified under the meat category, and food items such as ready-to-eat meals were not uncategorised. Also, although, "processed protein" was a food category (Table 1), we did not collect further details on whether or not foods within this category were highly processed or pre-prepared. There was also no consideration of the food items which may have been on sales promotions, and this may have influenced the food items purchase and amount spent during the shopping trip. In addition, the price and quality audits of the food items were conducted once, whereas prices and quality may have changed over the survey period. Due to the short form of the food security questionnaire used in this study, we were unable to further explore different levels of food insecurity. Lastly, we were unable to ascertain the quantities of food items purchased and the BMI and health status of the shoppers were not measured.

Conclusion

The South Africa population food expenditure is substantially more on unhealthy food. This unhealthy purchasing behaviour may be promoted by supermarkets as the main retail food environment in South Africa, by creating more accessibility to snacks and SSB compared with high quality F&V which is evidenced in the larger shelf spaces allocated to unhealthy foods. It is imperative to improve the quality of F&V in supermarkets located in the middle and low SEA. Consequently, further studies are needed to identify suitable interventions to encourage healthier food changes and choices especially in supermarkets in South Africa and to better understand other retail food environments in relation to dietary behaviours. Health and nutrition strategies such as promoting healthy food awareness, improved shelf space allocation and visibility of healthy foods, and access to quality and affordable healthy foods may have to be combined for effective outcomes. Further research should include a better understanding of underlying factors which may contribute to food purchase behaviour and expenditure in order to inform effective interventions.

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Supplementary material

For supplementary material accompanying this paper visit <https://doi.org/10.1017/S1368980020001275>

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