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RESEARCH

The nutritional quality of South African ready-to-eat breakfast cereals

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Background: Internationally, ready-to-eat breakfast cereals (RTEBC) make an important contribution to the nutritional intake of children. Significant differences have been found between the nutritional quality of children and non-children's RTEBC. South Africa has strict legislation regarding the use of nutrition claims to promote products.
Objectives: To determine i) differences in nutritional quality between children's and non-children's RTEBC; and, ii) compliance of nutrition claims with current legislation.
Outcome measures: An analysis of the nutrient content per 100 g and per recommended serving size; an audit of nutrient content claims.
Design: This study examined the packages of 134 RTEBC that were categorised into children's cereal and six types of non-children's cereal.
Results: Children's cereals formed 21% (n = 28) of the sample and were significantly more likely to have sugar as the first or second ingredient listed. Per 100 g, children's cereals contained significantly more carbohydrates, sugar and sodium than non-children's cereal collectively. Per 100 g and per serving, non-children's cereal was significantly higher in protein, fat and dietary fibre compared to children's cereal. Seventy-eight percent of all RTEBC (n = 104) had a nutrient content claim and 2% (n = 3) had a comparative claim. The most common claim was regarding dietary fibre (69 claims) followed by vitamins and minerals (65 claims). Ten nutrient claims were not compliant with legislation.
Conclusion: Significant differences in nutritional quality exist between South African children's and non-children's RTEBC. Food manufacturers need to be more vigilant regarding nutrient claims and adhere to the labelling legislation.

Keywords: nutrition information on labels, ready-to-eat breakfast cereals

Introduction

Internationally, ready-to-eat breakfast cereals (RTEBC) have been found to have a substantial influence on the dietary intake of children, adolescents and young adults.[1] RTEBC are considered a convenient option due to their ease of preparation[2] and their popularity has resulted in several international studies examining their nutritional quality.[1,3–7]

The positive benefits associated with RTEBC include their high micronutrient contents and the nutrient benefits obtained from the milk that they are commonly consumed with.[2,8,9] However, many RTEBC are highly processed[10] and children's cereals in particular contain high levels of energy, sugar and sodium.[3–5]

While the nutritional quality of RTEBC is important, the nutrition claims used to market these products have an important influence on the consumer's purchasing decision.[11] Nutrition claims may mislead consumers by creating the impression that the nutritional quality of the RTEBC is superior to a product without a claim; and, the consumer may be misled to interpret the product as having greater health benefits than it does.[7]

In South Africa, food manufacturers must adhere to the labelling legislation of the Regulations Relating to the Labelling and Advertising of Foodstuffs (R146/2010) as part of the Foodstuffs, Cosmetics and Disinfectants Act, 1972 (Act 54 of 1972).[12] According to the legislation, a food manufacturer may use two types of nutrition claims on their product: a nutrient content claim or a comparative claim. A nutrient content claim 'describes the level of a nutrient or energy contained in a foodstuff' and allows the food manufacturer to market their product as 'free or virtually free of, 'low in', 'source of', 'high in' or 'very high in' a particular nutrient. A comparative claim 'compares the nutrient level(s) and/or energy of two or more similar foodstuffs', and may allow the manufacturer to market their product using the terms 'reduced', 'less than', 'fewer', 'light' and 'lite'.

When a nutrition claim is made, mandatory nutrition information should appear on the product per serving size or per 100 g and, as an option, include the percentage Nutrient Reference Value (NRV) (for individuals older than four years) per single serving for protein, vitamin and mineral contents. This information must be obtained through an analysis of the foodstuff at a reputable laboratory. Both forms of nutrition claims must meet a minimum nutrient requirement as set by the legislation.[12]

A South African review of food consumption shifts revealed that RTEBC consumption had increased by 42.9% between 1999 and 2012.[13] Yet there is a paucity of information surrounding the nutritional quality of South African RTEBC. The purpose of this study was to: i) compare the nutrition information of RTEBC packaged and marketed towards children, against non-children's cereals; and, ii) validate all nutrition claims on the RTEBC to determine compliance with the current labelling legislation.

Methods

Sample selection

A list of RTEBC was obtained from manufacturer's websites and through a survey of all RTEBC sold at three major South African supermarket chains. All RTEBC available at the time of data collection were purchased from a variety of each of the three

chains in Pietermaritzburg. Only one of each product commonly sold at all three chains was purchased. Products that could be consumed immediately with the addition of milk or cold water were included in the sample. Products that required cooking or the addition of boiling water such as oats, maize meal and other porridges were excluded.

Data collection

Assessment of nutrition information

Data collection took place in March 2016. The information on the front, back and side panels of each package was recorded. This included the product category, the recommended serving size, the nutrition information per serving size and per 100 g, the NRV percentage per serving, the order of ingredients listed on the packaging and the presence of a nutrition claim. The nutrition information that was analysed included: energy; protein; carbohydrate; sugar; starch; total fat; saturated, trans, monounsaturated and polyunsaturated fat; cholesterol; dietary fibre; total sodium; salt; vitamins; minerals; and, in some cases, amino acids.

Products were classified into seven categories: i) children's cereal; ii) bubbles, flakes, puffs and rings (from here on referred to as 'bubbles'); iii) bran cereals; iv) oat cereals; v) protein cereals; vi) biscuits and bites; and, vii) muesli. Although some of the mueslis contained either oats or bran, the oats and bran cereals were categorised on the basis that they exclusively contained either oats or bran. RTEBC were classified as protein cereals if they were marketed as either a protein cereal or as a RTEBC containing amino acids. If the package included a free toy or activity inside or on the package; a television or movie theme promotion; a licensed cartoon character or any other cartoon drawing; or, photo of a child on the package, it was considered a children's cereal.

Assessment of nutrition claims

Nutrition claims were further categorised into nutrient content claims, comparative claims and a combination of the two. These claims were then verified by comparing them with the legislation and non-compliance was considered as a product that did not meet the minimum legislation requirements.

Data analysis

Data were analysed using IBM SPSS, Version 23 and Microsoft Excel 2010. Data were entered on two separate occasions and compared to ensure that there were no inconsistencies. Descriptive statistics and chi-square tests including Fisher's exact test were used for analysis. Significance was measured as $p < 0.05$.

Ethical clearance

Exemption from ethical clearance was obtained from the University of KwaZulu-Natal Human and Social Sciences Ethics Committee (Ref: HSS/0174/016).

Results

Comparison of nutrition information

In total 134 RTEBC were purchased. Children's cereals formed 21% (n = 28) of the sample, with the remainder consisting of 'bubbles' (17%, n = 23), bran cereals (8%, n = 11), oat cereals (5%, n = 6), protein cereal (12%, n = 16), biscuits and bites (3%, n = 4), and muesli (34%, n = 46).

Nutrition information panel

A Welch statistic was used to compare the mean serving sizes and it was found that the serving sizes for protein cereals and muesli were significantly larger than the other RTEBC serving sizes. The nutrition information per recommended serving size is presented in Table 1 and per 100 g in Table 2. Only the nutrients that contained significant differences are presented and, apart from those emboldened and marked with an asterisk (*), the nutrient amounts are significantly higher in each non-children's cereal category compared to the children's RTEBC.

Children's and non-children's RTBEC were compared per recommended serving size and per 100 g (Table 3). Again only nutrient categories with significant differences are presented and where non-children's cereals have significantly lower levels compared to children's cereals, an asterisk has been used and the number emboldened. For those RTEBC that contained NRV percentages per serving, non-children's cereal had a significantly higher NRV percentage contribution for protein, folic acid, vitamin A and iron.

Ingredient list contents

A Fisher's exact test revealed that children's cereal, protein cereal and biscuits and bites were significantly more likely to have added vitamins and minerals, while muesli was significantly more likely to not have any added vitamins and minerals (Fisher's = 120.306, $p < 0.0005$).

Sugar was most likely to be listed as the first ingredient in children's cereals; second ingredient in children's cereals and 'bubbles'; third in oats and protein cereals; fourth in protein cereals; fifth in biscuits and bites; and most likely not to be listed as an ingredient in muesli. The minimum amount of sugar listed per serving of children's cereal was 2 g (half a teaspoon) while the maximum listed was 20 g (five teaspoons) per serving.

Verification of nutrition claims

Seventy-eight percent (n = 104) of the RTEBC had a nutrient content claim, 2% (n = 3) had a comparative claim, 1% (n = 1) had both a nutrient content and comparative claim, while 19% (n = 26) had no claim. Figure 1 presents the percentage of claims across the various categories.

When nutrient content claims were compared (Table 4), the most common claim was for dietary fibre (69 claims), followed by vitamins and minerals (65 claims). The least common nutrient content claim was for amino acids (n = 1).

When analysing the claims according to the categories of cereals, the following was found: compared to other cereals, protein cereals claimed to be 'high in energy' and 'high in protein' significantly more often. 'Bubbles' claimed to be 'low in fat' significantly more often than other cereals. 'Free of trans fat' was significantly more likely to be claimed in oats cereals. Compared to other cereals, protein cereals claimed to be either a 'source of' or 'high in omega 3' significantly more often. Brans, oats, biscuits and bites and muesli claimed to be 'high in fibre' significantly more often, while children's cereals claimed to be a 'source of fibre' significantly more often the other cereals. 'Bubbles' claimed to be either a 'source of' or 'high in' vitamins and minerals significantly more often, while biscuits and bites and children's cereals claimed to be a 'source of' vitamins and minerals significantly more often.

Table 1: Nutrition information provided per recommended serving size[#]

	Children's cereal (*n* = 28)	Non-children's combined (*n* = 106)	'Bubbles' (*n* = 23)	Bran cereals (*n* = 11)	Oat cereals (*n* = 6)	Protein cereals (*n* = 16)	Biscuits and bites (*n* = 4)	Muesli (*n* = 46)
Recommended serving size (g)	Min: 30 Max: 40 Mean: 33.0 SD ±: 4.6	Min: 25 Max: 60 Mean: 42.5 SD ±: 9.3	Min: 30 Max: 40 Mean: 35 SD ±: 5.0	Min: 30 Max: 40 Mean: 37.3 SD ±: 4.7	Min: 30 Max: 50 Mean: 46.7 SD ±: 8.2	Min: 40 Max: 50 Mean: 49.4 SD ±: 2.5	Min: 38 Max: 50 Mean: 41.9 SD ±: 5.5	Min: 25 Max: 60 Mean: 44.7 SD ±: 10.6
Energy (kJ)	516.7	659.4			798.2	745.1		730.9
Protein (g)	2.4	4.6	2.8	4.7	4.3	8.2	4.5	4.2
Carbohydrate (g)	24.9	26.2		**21.0***				27.5
Total fat (g)	1.2	3.4			5.3	3.4		5.1
Saturated fat (g)	0.3	1.1			2.5	0.8		1.8
Monounsaturated fat (g)	0.5	1.1			2.1	0.9		1.9
Polyunsaturated fat (g)	0.4	0.9			1.0	1.7		1.3
Dietary fibre (g)	1.4	3.6		6.9		4.7	4.6	3.3
Sugar (g)	12.2	7.6						
Sodium (mg)	112.9	108.1		166.8				**53.1***
Cholesterol (mg)	0.17	0.1						
Vitamin B1(mg)	0.3	0.4	0.4			0.4		
Vitamin B2 (mg)	0.4	0.4				0.5		
Vitamin B6 (mg)	0.5	0.7	0.9					
Vitamin B12 (µg)	0.9	1.3	2.2					
Pantothenic Acid (mg)	1.5	1.9	2.1					
Biotin (µg)	9.3	12.9						25.0
Folic Acid (µg)	66.8	138.6	191.9		133.3			
Vitamin A (µg RE)	183.5	290.9	271.8			332.9		
Vitamin C (mg)	26.5	34.8	54.2					
Vitamin D (µg)	1.3	6.6				5.7		
Vitamin E (mg)	3.1	5.1				5.8		
Calcium (mg)	171.8	246.7				272.9		
Iron (mg)	3.3	4.7				6.4		
Zinc (mg)	1.9	3.1				3.9		

[#]Only the nutrients that contained significant differences are presented.
*These amounts were significantly lower compared to children's cereals.

When comparing the nutrient contents per 100 g of those RTEBC that made claims, it was found that products that made claims related to energy had significantly higher protein contents; protein claims had significantly higher protein contents; total fat claims had significantly lower energy and total fat contents; dietary fibre claims had significantly higher protein, fat and fibre contents; and, vitamins and mineral claims had significantly lower energy and total fat contents.

Ten (7.5%) RTEBC were found to be non-compliant with the legislation. Seven of these did not meet the minimum nutrient content criteria. These claims related to vitamins, minerals, dietary fibre and omega-3. Four of these products marketed themselves as being 'free of' trans fats; however, no nutrition information regarding trans fats was present on the label to verify these claims. Significantly more of the oats claims were not in line with the legislation compared to other cereals (Fisher's 18.499, $p < 0.0005$).

Three out of the four comparative claims were not compliant in terms of listing the foodstuff that they were comparing themselves to. The compliant product that promoted itself as 'light' and claimed to be 50% less fat, contained greater amounts of sodium and sugar per serving (185.0 mg sodium and 12.9 g sugar) compared to the non-light version (123.0 mg sodium and 7.0 g sugar). The product that marketed itself as 'lite' with 'no added salt or sugar' had slightly more total fat (0.7 g) per serving than its non-lite product (0.6 g).

Table 2: Nutrition information provided per 100 g[#]

	Children's cereal (*n* = 28)	Non-children's combined (*n* = 106)	'Bubbles' (*n* = 23)	Bran cereals (*n* = 11)	Oat cereals (*n* = 6)	Protein cereals (*n* = 16)	Biscuits and bites (*n* = 4)	Muesli (*n* = 46)
Energy (kJ)	1564.0	1543.3	**1465.9***	**1318.4***	1717.2		**1380.5***	1639.3
Protein (g)	7.3	10.5		12.6	9.1	16.5	10.8	9.4
Carbohydrate (g)	75.9	61.9	**71.7***	**56.2***	**59.8***	**53.9***	**62.4***	**61.6***
Total fat (g)	3.9	7.6			11.7	6.9		11.4
Saturated fat (g)	1.1	2.6			5.2			4.1
Monounsaturated fat (g)	1.6	2.7			4.4			4.5
Polyunsaturated fat (g)	1.1	2.2			2.2	3.3		2.9
Dietary fibre (g)	4.3	8.4		18.8	8.1	9.5	10.9	7.3
Sugar (g)	28.2	17.7	**18.4***	**15.7***	**17.2***	**19.6***	**3.3***	**18.5***
Sodium (mg)	338.6	219.8			**51.2***			**126.3***
Salt (mg)	1.1	0.4						**0.4***
Cholesterol (mg)	0.49	0.26						
Vitamin B1 (mg)	0.9	0.9	1.2	**0.7***	**0.6***			
Folic Acid (µg)	204.8	354.6	594.0			281.3		
Vitamin A (µg RE)	556.3	700.0	804.1					1000.0
Vitamin C (mg)	73.5	83.7	180.7					
Iron (mg)	10.2	10.3		**6.9***		12.9		
Zinc (mg)	5.2	6.8				7.9		
Selenium (µg)	29.0	43.3				38.9		

[#]Only the nutrients that contained significant differences are presented.
*These amounts were significantly lower compared to children's cereals.

Table 3: Comparison between children's (*n = 28*) *and non-children's (n = 106) RTEBC*

	Per recommended serving size		Per 100 g	
	Children's cereal	Non-children's combined	Children's cereal	Non-children's combined
Energy (kJ)	516.7	659.4		
Protein (g)	2.4	4.6	7.3	10.5
Carbohydrate (g)			75.9	**61.9***
Total fat (g)	1.2	3.4	3.9	7.6
Dietary fibre (g)	1.4	3.6	4.3	8.4
Saturated fat (g)	0.3	1.1	1.1	2.6
Monunsaturated fat (g)	0.5	1.1	1.6	2.7
Polyunsaturated fat (g)	0.4	0.9	1.1	2.2
Trans fat (g)	0.00	0.02		
Sugar (g)			28.2	**17.7***
Sodium (mg)			338.6	**219.8***
Folic Acid (µg)	66.8	138.6	204.8	354.6
Pantothenic acid	1.5	1.9		
Vitamin A (µg RE)	183.5	290.9	556.3	700.0
Iron (mg)	3.3	4.7		

*These amounts were significantly lower compared to children's cereals.

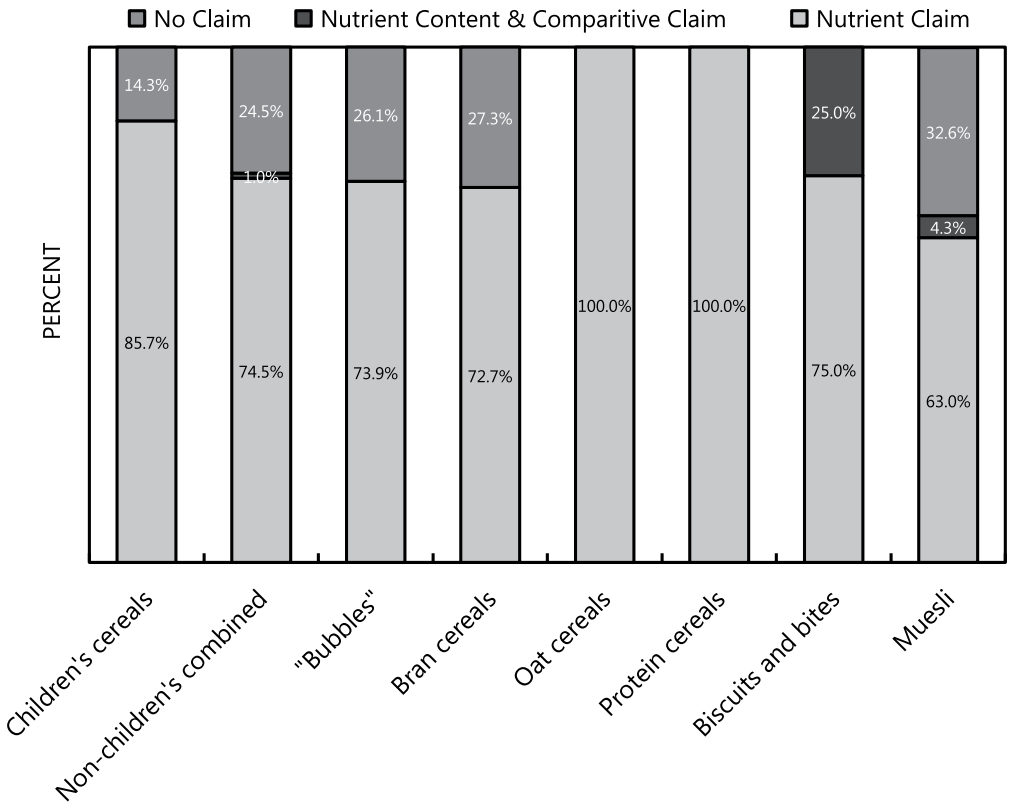

Figure 1: Percentage of RTBEC carrying a nutrition claim.

Discussion

The purpose of this study was to i) compare the nutrition information of children's cereals against non-children's cereals; and, ii) validate all nutrition claims on the RTEBC to determine compliance with the current labelling legislation.

Comparison of nutrition information

Serving sizes

Per serving size, the mean weight of the non-children's cereals was much larger than the children's cereals. This was in line with other findings.[3,5,6] While the manufacturer may determine the serving size themselves, the current legislation states that 'appropriate, scientific and evidence-based documentation' is required to validate the choice of serving size.[12] Unfortunately there is limited research regarding whether RTEBC consumers adhere to the recommended serving size suggested on the label. The legislation also states that the recommended serving size 'shall be an appropriate serving size for a single serving which would not encourage consumers to consume "supersize" servings which might result in an undesirable increase of their total energy intake that could contribute to unhealthy weight gain'.[12] This recommended serving suggestion applies to a wide age range of consumers and does not take into account the food and beverages accompanying the RTEBC or the consumer's complete food intake for the day.

Rolls *et al.* tested various flake sizes of the same RTEBC to determine the portion of cereal that consumers would serve themselves.[14] They found that as the flake size was reduced from 100% to 60%, consumers served themselves a greater portion of the smaller flake size and significantly underestimated the energy content of the serving with the smallest flakes.[14] In this study, the recommended serving sizes for protein and muesli were significantly larger than the other serving sizes. Interestingly, the texture of these two RTEBC is in complete contrast. However, muesli and protein cereals featured in the top three categories for highest energy content per recommended serving size and per 100 g. Unfortunately, RTEBC do not come with a scoop to allow the consumer to decant the recommended serving size. Therefore, it is important that consumers are educated regarding how the portion size of RTEBC that they serve themselves will contribute to the amount of energy that they will consume at breakfast.

Comparison of children vs non-children's cereal

Per 100 g, children's cereal had significantly higher amounts of carbohydrate, sugar and sodium compared to non-children's cereals. Higher contents were also found by Schwartz *et al.*[5] and Devi *et al.*,[3] while Louie *et al.*[4] observed higher amounts of carbohydrate and sugar. As the recommended serving size of children's cereals in this study was lower, these significant differences were however not observed per serving size.

The nutritional quality of non-children's cereal differed according to each category. When combined, non-children's cereal had significantly higher amounts of protein; total, saturated, monounsaturated and polyunsaturated fat; dietary fibre; folic acid; and, vitamin A per 100 g and recommended serving size. Non-children's cereal was significantly higher in pantothenic acid and iron per serving size; and, protein, total fat and dietary fibre per 100 g. Per recommended serving size and per 100 g, non-children's cereals offered more micronutrients than children's cereal. Therefore, non-children's cereal may offer a better nutritional quality breakfast for children.

Many international authors used nutrient profiling schemes and/or some form of guideline that their country employed to classify

Table 4: Types of claims across the various categories of RTEBC

	Children's cereals (*n* = 28)		'Bubbles' (*n* = 23)		Bran cereals (*n* = 11)		Oat cereals (*n* = 6)		Protein cereals (*n* = 16)		Biscuits and bites (*n* = 4)		Muesli (*n* = 46)		Total (*n* = 134)	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Energy																
High in	2	7.1	6	26.1	1	9.1	0	0	15	93.8	0	0	14	30.4	38	28.4
No claim	26	92.9	17	73.9	10	90.9	6	100	1	6.3	4	100	32	69.6	96	71.6
Protein																
Source of	0	0	0	0	0	0	0	0	3	18.8	0	0	0	0	3	2.2
High in	0	0	0	0	0	0	0	0	12	75.0	0	0	1	2.2	13	9.7
No claim	28	100	23	100	11	100	6	100	1	6.3	4	100	45	97.8	118	88.1
Amino acids																
Source of	0	0	0	0	0	0	0	0	1	6.3	0	0	0	0	1	0.7
No claim	28	100	23	100	11	100	6	100	15	93.8	4	100	46	100	133	99.3
Total fat																
Low in	2	7.1	11	47.8	2	18.2	0	0	0	0	1	25.0	2	4.3	18	13.4
No claim	26	92.9	12	52.2	9	81.8	6	100	16	100	3	75.0	44	95.7	116	86.6
Saturated fat																
Low in	1	3.6	0	0	0	0	0	0	0	0	0	0	4	8.7	5	3.7
No claim	27	96.4	23	100	11	100	6	100	16	100	4	100	42	91.3	129	96.3
Trans fat																
Free of	0	0	1	4.3	0	0	4	66.7	1	6.3	0	0	0	0	6	4.5
Low in	0	0	0	0	0	0	0	0	0	0	0	0	1	2.2	1	0.7
No claim	28	100	22	95.7	11	100	2	33.3	15	93.8	4	100	45	97.8	127	94.8
Omega-3																
Source of	0	0	0	0	0	0	0	0	1	6.3	0	0	1	2.2	2	1.5
High in	0	0	0	0	0	0	0	0	6	37.5	0	0	0	0	6	4.5
No claim	28	100	23	100	11	100	6	100	9	56.3	4	100	45	97.8	126	94.0
Cholesterol																
Free of	1	3.6	1	4.3	0	0	0	0	2	12.5	0	0	0	0	4	3.0
No claim	27	96.4	22	95.7	11	100	6	100	14	87.5	4	100	46	100	130	97.0
Sodium																
Low in	0	0	3	13.0	0	0	0	0	0	0	0	0	6	13.0	9	6.7
No claim	28	100	20	87.0	11	100	6	100	16	100	4	100	40	87.0	125	93.3
Dietary Fibre																
Source of	7	25.0	4	17.4	0	0	1	16.7	0	0	0	0	6	13.0	18	13.4
High in	5	17.9	1	4.3	7	63.6	5	83.3	7	43.8	4	100	22	47.8	51	38.1
No claim	16	57.1	18	78.3	4	36.4	0	0	9	56.3	0	0	18	39.1	65	48.5
Vitamins and Minerals																
Source of	17	60.7	1	4.3	3	27.3	0	0	0	0	3	75.0	0	0	24	17.9
High in	4	14.3	0	0	0	0	0	0	15	93.8	0	0	0	0	19	14.2
Source of and high in	3	10.7	11	47.8	2	18.2	0	0	0	0	0	0	0	0	16	11.9
No claim	4	14.3	11	47.8	6	54.5	6	100	1	6.3	1	25.0	46	100	75	56.0

these products into 'healthy' or 'less healthy' RTEBC.[3–6] A nutrient profile model has been developed for use in South Africa and is based on the UK Food Standards Agency and Food Standards Australia and New Zealand. This model has a calculator that allows the nutrition information of certain nutrients to be entered to generate a profile score. If the score meets specific criteria the product may make a health claim whereas if the score does not meet the criteria, the product may not make a health claim.[15]

This nutrient profile model is not part of the current R146 labelling legislation, however the new proposed R429 labelling legislation that is currently under consideration may make nutrient profiling mandatory.[16] The nutrition information from each RTEBC in this study was entered into the calculator to determine how many products might be eligible to make a health claim when the new legislation is promulgated (Table 5). Based on this calculator, less than half of all the RTEBC would be eligible to make a nutrition claim (*n* = 65, 48.5%). This has important implications for South African RTEBC manufacturers who are attracting consumers through the nutrition claims on their packaging. This is particularly so for manufacturers of children's cereal where more than 70% of the cereals were considered not eligible by the proposed nutrient profiling calculator.

Ingredient list contents

The labelling legislation states that ingredients 'shall be listed on any label in descending order of mass as present in the end product under the heading "ingredients"'.[13] Sugar featured as the first and second most often in the ingredients list of children's cereals. This was substantiated by the significantly higher amounts of sugar in children's cereals per 100 g compared to non-children's cereals. Sugar does not contain any micronutrients

Table 5: Eligibility of RTEBC to make a nutrition claim using the proposed nutrient profiling calculator

	Total	Eligible		Not Eligible	
		n	%	*n*	%
Children's cereal	28	8	28.6	20	71.4
Non-children's combined	106	57	53.8	49	46.2
'Bubbles'	23	11	47.8	12	52.2
Bran cereals	11	9	81.8	2	18.2
Oat cereals	6	2	33.3	4	66.7
Protein cereals	16	12	75.0	4	25.0
Biscuits and bites	4	4	100	0	0
Muesli	46	19	41.3	27	58.7
Total	134	65	48.5	69	51.5

and, when consumed frequently, it may be associated with tooth decay and obesity.[17] Furthermore, the frequent consumption of products high in sugar can increase the risk of type 2 diabetes and possibly cardiovascular disease.[18] Two thousand two hundred 24-hour dietary recalls from the 2005 National Food Consumption Survey (NFCS) were analysed to determine mean added sugar intake and the contribution of added sugar to total energy (% EAS) amongst children aged 1 to 8.9 years.[19] Children from rural areas consumed 20.9 g of added sugar and 7.5% EAS, and children from urban areas consumed 32.4 g of added sugar and 10.3% EAS. When combined, the mean % EAS was 9.1%. The World Health Organisation recommends that sugars should comprise less than 10% of the total energy intake per day.[20] Therefore, urban children were consuming slightly more sugar than what is recommended.

The 2005 NFCS data revealed that 77% of children consumed white or brown sugar at breakfast.[19] Interestingly, the 1999 NFCS revealed that breakfast cereals were one of the most commonly consumed sources of added sugar;[18] however, they were no longer in the top ten sources by 2005.

Harris *et al.* conducted a study comparing the consumption of added table sugar to high sugar children's cereals versus low sugar children's cereals.[21] Both groups of children were offered the option of adding milk, sugar and fruit to their cereal. The results indicated that children consumed larger portion sizes of the high sugar cereals, while the children consuming the low sugar cereal added significantly more sugar to their cereal. This added sugar, however, did not exceed the amount of sugar that the children were consuming from the high sugar cereals. Low sugar cereal consumers were significantly more likely to add the fresh fruit that was offered to them for their breakfast.[21]

Regular consumption of RTEBC containing added sugar may result in a preference for sweetened versions of RTEBC, which may condition children to prefer sweetened versions of all foodstuffs.[21] Although it is not well understood, research indicates that the preference for sweetness decreases as children transition from adolescence into adulthood.[22] Some parents are concerned that their child will not consume an adequate portion of RTEBC if a highly sweetened RTEBC is not provided. Harris *et al.* suggest that children may learn to accept a low sugar version of a RTEBC if they are offered fresh fruit and/or a small amount of table sugar to add to their RTEBC.[21]

Products marketed to children may influence their taste perceptions. In Roberto *et al*'s study, children perceived products with 'licensed' characters to taste better than products with 'plain packaging'.[23] Kraak & Story used focus groups with children and found that children's food preferences and appetites were influenced by the use of cartoon characters on the packages.[24] Freichs *et al.* found that the visual appeal of a product influenced a child's intake even when they knew the product was not healthy.[25] The influence that marketing has on children's preferences presents a great challenge and this should be included in the new legislation as the current legislation does not address this.

The combination of marketing strategies to lure children to prefer their products, combined with the potential of high sugar consumption particularly from children's RTEBC, creating an overall preference for sweetened foods, poses a challenge to health professionals who are trying to promote a healthy lifestyle for children. A healthy breakfast habit particularly, should be encouraged and maintained to ensure that a child has a good start to their day.

Assessment of nutrition claims

Around half of the products made a claim regarding fibre and/or vitamins and minerals. The RTEBC with dietary fibre claims had significantly higher protein and fat contents while the RTEBC with vitamins and mineral claims had significantly lower energy and fat contents. Schwartz *et al.* found that 'whole-grain' claims tended to have higher fat contents.[5] Interestingly, all oat cereals had claims regarding fibre and, per serving, they had the highest fat contents. There is no nutritionally significant standard to which one can compare an RTEBC to. These products are also consumed by a variety of consumers who have different nutritional requirements. Some may require a RTEBC with a higher fibre or protein content, while others may require a lower energy or lower fat RTEBC as part of a kilojoule restricted diet. Importantly, RTEBC are not consumed in isolation and the components accompanying the RTEBC including milk, yoghurt, fruit and perhaps table sugar should also be considered when assessing the nutritional quality of the breakfast meal as a whole.

Research into the reported use of health claims by South African consumers suggests that they are interested in and trust the information on them.[26] This was particularly more so when a consumer had a health condition that required paying attention to nutrition information on products.[27] However, very little South African research has been conducted investigating whether interest in health claims actually results in 'healthier' purchases. Interestingly, Cavaliere found that the Italian consumer most likely to use the nutrition information prioritised their health and took part in exercise.[28]

In this study, ten RTEBC were non-compliant with the labelling legislation. Seven did not meet the minimum criteria for a nutrient content claim and three did not meet the comparative content criteria. While this is a small percentage of the total sample, food manufacturers should be more vigilant in complying with the legislation and not mislead the consumer.

Conclusion

Significant differences in nutritional quality exist between South African children's and non-children's RTEBC. This study found that compared to children's cereal, non-children's cereals offered better quality in terms of overall nutrients.

Food manufacturers need to be more vigilant regarding nutrient claims and adhere to the labelling legislation. When implemented, the new labelling legislation will have an important influence on whether RTEBC manufacturers will be able to use nutrition claims on their products as a marketing tool. The mandatory implementation of a nutrient profiling model in South Africa will have important ramifications for RTEBC manufacturers. This will also help the consumer make the 'healthiest' choice and avoid misleading them into purchasing products based on 'clever' marketing.

Recommendations

Food labels are only effective if consumers are willing to make use of them.[28] An emphasis should be placed on educating consumers regarding what they should look for on the food labels of RTEBC to make the best quality choice possible. This should be implemented by the Department of Health together with registered nutrition professionals using the media as a platform to disseminate information. Further research should be conducted into what influences a parent's RTEBC purchasing decision for their children and determine how willing South African children are to eat lower sugar versions of RTEBC that do not provide marketing incentives on their packages. The recommended serving sizes are supplied by the manufacturer, however further research should be conducted to determine the actual portion sizes of the various RTEBC that are consumed.

This study only examined what was presented on the label and did not calculate the percentage contribution that each macronutrient made to the recommended serving size or 100 g portion. Further research could verify that when converted from grams to kilojoules, the combined percentage contribution of the macronutrients accurately totaled 100%. It would also be useful to evaluate the percentage contribution that each macronutrient made, keeping in mind that if the percentage contribution of one particular macronutrient is higher, the other two macronutrients would be lower. This may be an interesting component when evaluating the nutritional quality of RTEBC.

Further research should compare the nutritional quality of RTEBC against other commonly consumed breakfast items in South Africa, taking into account the diversity in socio-economic backgrounds in the population.

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