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“HEALTHIER” AND “LESS HEALTHY” CLASSIFICATIONS ACCORDING TO THREE
NUTRIENT PROFILING SYSTEMS RELATIVE TO NUTRITION AND HEALTH
CLAIMS ON FOOD LABELS

Short title: **Comparison of nutrient profiling systems**

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A comprehensive sample of breakfast cereals (a total of 221 breakfast cereals available in the market) were compared according to their nutritional composition, being analysed using three nutrient profiling systems to categorise foods as “healthier” or “less healthy”. Differences were further investigated focusing on the use of nutrition and health claims on the labelling. The aim was to determine how much the use of such a claim corresponds to the categorisation into “healthier” or “less healthy” group.

The sample contained 161 (72.9%) items with claims and 60 (27.1%) items, without claims. The nutrient profiles of the foods were determined by the UK Ofcom model, the FSANZ model and the modified Traffic Light model. All the models use similar but

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nevertheless different ways of determining the final score of “healthier” or “less healthy”. The percentage of foods classified as “healthier” was well below 72.9% (from 24.8% to 52.2%), indicating that profiling with each model involves stricter criteria for the classifying of foods compared to the permission to carry a nutrition and/or health claim. The difference is the most pronounced for the modified Traffic Light system, while the UK Ofcom and FSANZ systems give results closer to the use of claims.

Keywords: nutrient profiling, UK Ofcom model, FSANZ model, Traffic Light model, breakfast cereals, nutrition and health claims

It is well recognised that diet can contribute to long-term health and well-being beyond simply providing basic nutrition. However, in the developed world a significant part of the population nowadays has a wide access to a variety of foods and their daily routine requires low physical activity. Due to these changes, balancing one’s energy intake and expenditure has become difficult, resulting in increased prevalence of chronic, non-communicable diseases. It is clear that diet, physical inactivity and lifestyle all play a role in the growing incidence of these diseases and the efficiency of our efforts to reduce them will depend on striking a balance between these three factors. To help consumers make healthy dietary choices, various nutrient profile models were developed that classify foods into “healthier” and “less healthy” (TETENS et al., 2007; EUFIC, 2008; VERHAGEN & VAN DEN BERG, 2008). Nutrient profiling is defined as the “science of classifying or ranking foods according to their nutritional composition for reasons related to preventing of disease and promoting health” (WHO, 2011). Although nutrient profile models cannot cover all aspects of nutrition and health, they can also be useful for educating consumers, improving knowledge about nutrition and suitable for regulating the labelling of pre-packed foods. By considering a suitable

nutrient profiling system consumers can make a better distinction between “healthier” and “less healthy” food (AZAÏS-BRAESCO et al., 2006).

A nutrient profiling system can be used for various purposes: regulating food labelling, product labelling with logos or symbols, identifying food products eligible to carry nutrition or health claims, informing and educating consumers, helping consumers in their healthy food choices and regulating the advertising of foods for children (TETENS et al., 2007; SCARBOROUGH et al., 2007a,b; VERHAGEN & VAN DEN BERG, 2008). The introduction of nutrient profiles was also provided in the European regulation on nutrition and health claims made on foods, although this part of the legislation has yet to be implemented (CAPPUCCIO & PRAVST, 2011).

Numerous nutrient profiling models have been developed, all enabling the classification of foods according to their nutritional composition (GARSETTI et al., 2007; VERHAGEN & VAN DEN BERG, 2008). The nutrient profiling systems vary with regard to their: (1) categorisation of foods; (2) reference values; (3) use of thresholds and/or scoring; and (4) selection of nutrients and other food constituents which are considered in the evaluation of the balance between “positive” and “negative” nutrients (GARSETTI et al., 2007; TRICHTERBORN & HARZER, 2007). While energy density and the content of fat, saturated fatty acids, sugars and sodium/salt are usually seen as negative factors, several models also consider positive components such as the content of protein, fibre, fruits, vegetables and nuts (RAYNER et al., 2009; FSANZ, 2011). Several of such nutrient profile models are currently used in practice, for example: in the United Kingdom, the UK Ofcom (Office of Communications) nutrient profile model is used to regulate the advertising of food to children (RAYNER et al., 2009). The model was developed by the Food Standards Agency (FSA) following calls by consumer and public health organisations to ban advertising of “unhealthy” food to children. The FSA has also developed the Traffic Light model for evaluating the

nutritional value of pre-prepared foods and to help consumers make healthier food choices and as well as to reduce their daily intake of fat, saturated fatty acids, sugars and salt (FSA, 2007). In Australia and New Zealand, the FSANZ (Food Standards Australia New Zealand) nutrient profile model has been developed as a tool to regulate the use of health claims on foods (FSANZ, 2011).

Labels on pre-packed food should provide consumers with all information about the product needed to allow an informed choice. The labelling of pre-packaged food is defined by law (EC, 2011) and divided into statutory and voluntary labelling. Up until the end 2016, the labelling of a nutrition declaration for pre-packed foods will not be statutory in the EU, except when nutrition or health claims are used.

Breakfast cereals are generally considered a healthy dietary choice. However, high energy density and especially high sugar content can be questionable in many products on the market. The aim of the study is twofold: a) to gain an insight into the composition of breakfast cereals generally sold in the market; and b) to correlate the results of nutrient profiling of these products according to three commonly used nutrient profiling systems (UK Ofcom model, FSANZ model and Traffic Light model). In addition, the results were compared with the classification specified for nutrition or health claims on food labels (EC, 2006; PRAVST, 2012).

1. Materials and methods

1.1. Collecting the samples and data included in the study

The sample included 221 breakfast cereals that were available in selected grocery stores at the time of sampling. Sampling was carried out in grocery stores of the three most important retailers with a share of sales exceeding 60% of the market in Slovenia (mega-market, supermarket and a discounter). The packaging of all available breakfast cereals was

photographed; data extracted from the photographs were used to compose a database containing the product composition and other labelling information (i.e. use of claims), enabling the nutrient profile models to be employed.

The 221 specimens were divided into two groups: the first included products labelled with nutrition and/or health claims, while the second one included products with no such claims. Three different nutrient profiling systems (UK Ofcom, FSANZ and Traffic Light) were applied to the full sample of foods (Group A (all)) and within the subgroups of Group B (claims) and Group C (no claims). Finally, the results of the nutrient profiling models were correlated with the presence or absence of nutrition and/or health claims.

1.2. Details of the models used

1.2.1. The UK Ofcom nutrient profile model. The UK Ofcom nutrient profile model is a points-based model. Points for nutrients are allocated on the basis of the nutritional content in 100 g of a food or drink. Final points are based on summarising the number of points for “negative” (energy, saturated fatty acids, sugars and sodium) and “positive” components (protein, fibre and fruits, vegetables and nuts). “Positive” points are subtracted from “negative” points; if a food scores 4 points or more, it is classified as “less healthy” while for drinks such a threshold is at 1 point (RAYNER et al., 2009).

1.2.2. The FSANZ nutrient profile model. The FSANZ nutrient profile model is another points-based model (FSANZ, 2011), which is a modified version of the UK Ofcom model and is used in Australia and New Zealand to regulate the use of health claims on foods. Similarly, points are allocated based on the nutritional composition per 100 g of food product. The final assessment is obtained by summarising the “negative” points (points for energy, saturated fatty acids, total sugars and sodium) from which the positive points for protein, fibre and

points for fruit, vegetables and nuts are subtracted. Foods are classified into three categories: (1) beverages; (2) all other foods; and (3) oils, oil spreads and cheese high in calcium. Each category has different cut-off points for determining whether a food is eligible to carry a health claim. The use of health claims is allowed on foods which are given less than 1 point for category 1, less than 4 points for category 2 and less than 28 points for category 3. Consequently, also in this study those were considered as “healthier” (FSANZ, 2011).

1.2.3. The Modified Traffic Light model. The modified Traffic Light model only includes “negative” nutrients. The evaluation is presented in colour, which indicates the level of fat, saturated fatty acids, sugars and salt per 100 g of food product (FSA, 2007). A red colour indicates a “high” level of each nutrient; an amber colour indicates a “medium” level and a green colour indicates a “low” level of the nutrient in question. Although in practice this model was not developed as a scoring system, it has been used as such. The modified Traffic Light model assigns points for every colour: 1 point for every green colour, 2 points for every amber colour and 3 points for every red colour, giving a total possible of 12 points. Products scoring less than 7 points are considered “healthier” and products scoring 7 points or more are considered “less healthy” (SACKS et al., 2009; 2011).

1.3. Statistical analysis

Statistical analyses were conducted using statistical programming language R which is a free software environment for statistical computing and graphics (R CORE TEAM, 2013). The data on nutrient composition are presented as mean \pm standard deviation, as well as by the minimum and maximum. A comparison of the mean values between Group B (claims) and Group C (no claims) was evaluated with a t-test, and different variances were taken into account if necessary (Welch *t*-test). Distributions of the Ofcom points and FSANZ points

were obtained using a standard smoothing technique for density estimation, while for the modified Traffic Light model the distributions are presented as histograms. Smoothing technique would not be relevant in this case because there are only 8 values in the range from 4 to 11, while the ranges are much larger for Ofcom and FSANZ models. For each model, the density for group B (claims) and group C (no claims) was compared graphically. The outcomes of the “healthier” and “less healthy” classifications obtained by the three models were compared with the outcome of the nutrient/health classification on food labels. For each classification, a 2 x 2 contingency table was obtained. To compare two classifications, McNemar’s test of symmetry was used. Under the null hypothesis, two classifications are identical and the 2 x 2 matrix is diagonal; McNemar’s chi-square statistics tests the symmetry of this matrix (AGRESTI, 1990).

2. Results and discussion

Table 1 gives values for nine nutritional components relevant to the allocation of points when profiling food. As expected, the mean values for all negative nutritional components (1 to 6) are lower in Group B (claims) than in Group C (no claims), and they are higher for all positive ingredients (7 to 9). However, large standard deviations were observed in all three groups, reflecting large variability in each of the three groups due to the significant differences between the foods described as breakfast cereals. The P-values obtained by comparing the means for group B (claims) and group C (no claims) reveal statistically significant differences in the means for energy value ($P=0.0000$), fat content ($P=0.0439$), content of sugars ($P=0.0000$), proteins ($P=0.0002$) and fibre ($P=0.0000$); a marginally significant difference was obtained for the contents of saturated fatty acids ($P=0.073$), while no statistically significant differences were found for contents of sodium, salt and in the percentage of fruit, vegetables

and nuts. Groups with P-value lower than 0.05 were considered statistically significantly different.

In Table 1 min and max values for each variable are presented (as given on the label of the cereal. (The corresponding mean and SD are presented with one additional digit.)

Table 1 compares group B and group C for each variable separately. This is not a multiple comparison. Consequently, the P-value is a good parameter for a meaningful comparison. Nevertheless, comparing nine nutritional components simultaneously requires multicomparison correction; corrected significance level according to Bonferroni is $0.05/9=0.0056$, meaning that one gets significant different values for energy, sugars, proteins and fibre.

App. position for Table 1

Fig. 1 shows the comparison of densities for B group (claims) and C group (no claims) for the Ofcom and FSANZ profiling models. Generally, the results are similar. In both cases, the B group (claims) densities have two similarly expressed peaks, showing that approximately half of these items are in the “healthier” and half in the “less healthy” section. The C group (no claims) densities have one dominant peak in the “less healthy” section. Fig. 2 presents the histograms of Traffic Light points for the B (claims) group and C (no claims) group. In this case, the shapes of the histograms are surprisingly similar.

Figure 1

Figure 2

Table 2 presents these results in a different way. The percentage of items in “healthier” and “less healthy” category for each group (A (all), B (claims) and C (no claims)) and for

each profiling system is given. As expected, the group with claims (B) includes the highest fraction of “healthier” products and that with no claims (C) the lowest.

App. position for Table 2

According to the use of nutrition and/or health claims, which were found on 72.9% of the specimens in Group A (all) we had expected the “healthier” score for far more specimens than turned out to be the case. If we compare the 72.9% of specimens in group A (all) with the percentage which were scored “healthier” by the three models: 45.2% for the FSANZ model, 34.8% by the UK Ofcom model and 20.8% by the modified Traffic Light model, we cannot but observe that the fact of carrying a nutrition and/or health claim corresponds very poorly to the “healthier” and “less healthy” scores given by any of the three models included in this study. Even the FSANZ model which has been developed to function as a tool for regulating the use of health claims of foods (FSANZ, 2011) fails to match this demand.

Table 3 presents the 2×2 tables obtained by comparing the nutrient/health label classification with the UK Ofcom model, FSANZ model and Traffic Light model classifications, respectively. The three tables reflect poor symmetry. McNemar’s chi-square statistic is highly significant in all three cases, while its value is extremely high in the Traffic Light case. These results suggest that a certain product in the B (claims) group is more likely to be given the score “less healthy” with the Traffic Light model than with the UK Ofcom model and FSANZ model classifications.

App. position for Table 3

3. Conclusions

The use of nutrition and/or health claims on breakfast cereals is relatively poorly related to their nutrient profile as determined by the UK Ofcom, FSANZ or modified Traffic Light nutrient profile models. The share of specimens with claims (72.9%) is far greater than the percentage of specimens considered as “healthier”. For example, group A (all) contains 72.9% specimens with claims and only 34.8% (UK Ofcom model), whereas 45.2% (FSANZ model) and 20.8% (Traffic Light model) of specimens scored “healthier” (details for other groups are given in Table 2). The difference is the most pronounced for the modified Traffic Light system, while the UK Ofcom and FSANZ systems come much closer to the use of claims. A certain product is most likely to pass as “healthier” if estimated by the FSANZ model and is most likely to be given the score of “less healthy” if treated by the modified Traffic Light model. The EU legislation on nutrient profiling is a constant concern but a rather slow moving topics at least since 2009. So is the use of nutrition, health and related claims on the food labelling. The work is always behind the schedule and the discrepancies described in this paper may well be one of the reasons.

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Table 1. Means, standard deviations (SD), minimum and maximum for each nutritional component and each group under investigation; mean comparison of group B (claims) (n=161) and group C (no claims) (n=60) for each nutritional component

Nutritional component		Group A (all) n=221	Group B (claims) n=161	Group C (no claims) n=60	Mean comparison between B (claims) and C (no claims) P-value for <i>t</i> - test
1	Energy (kJ/100 g)				
	Mean±SD	1631.1±172.6	1601.8±170.0	1709.5±155.2	P=0.0000***
	Min–max	968–2079	968–2009	1410–2079	
2	Fat (g/100 g)				
	Mean±SD	7.38±5.68	6.85±5.16	8.81±6.74	P=0.0439*
	Min–max	0.4–26.0	0.7–23.96	0.4–26.0	
3	Saturated fatty acids (g/100 g)				
	Mean±SD	2.76±2.89	2.55±2.82	3.32±3.03	P=0.0783
	Min–max	0.0–17.6	0.0–17.6	0.2–11.0	
4	Sugars (g/100 g)				
	Mean±SD	18.75±11.6	16.88±11.16	23.78±11.39	P=0.0000***
	Min–max	0.0–45.0	0.0–45.0	0.7–45.0	
5	Sodium (mg/100 mg)				
	Mean±SD	227.32±302.67	208.85±232.47	276.89±437.74	P=0.2559
	Min–max	0.4–3100.0	0.4–1500.0	4.0–3100.0	
6	Salt (g/100 g)				
	Mean±SD	0.58±0.76	0.53±0.58	0.69±1.09	P=0.2677
	Min–max	0.0–7.8	0.0–3.8	0.0–7.8	
7	Proteins (g/100 g)				
	Mean±SD	9.65±3.30	10.04±3.60	8.59±1.99	P=0.0002***
	Min–max	4.5–36.9	5.0–36.9	4.5–13.5	
8	Fibre (g/100 g)				
	Mean±SD	7.97±6.04	8.81±6.77	5.7±2.27	P=0.0000***
	Min–max	0.2–45.0	0.9–45.0	0.2–10.8	
9	% fruits, vegetable, nuts				
	Mean±SD	4.64±14.88	4.89±14.92	3.94±14.88	P=0.6705
	Min–max	0.0–63.8	0.0–63.8	0.0–63.8	

Table 2. Percentage of items in "healthier" and "less healthy" breakfast cereals as determined for group A (all) (n=221), group B (claims) (n=161) and group C (no claims) (n=60) by the UK Ofcom, FSANZ and Traffic Light models

Groups	UK Ofcom [†]		FSANZ ^{†††}		Traffic Light ^{††}	
	HEALTHIER (< 4 points)	LESS HEALTHY (≥ 4 points)	HEALTHIER (< 4 points)	LESS HEALTHY (≥ 4 points)	HEALTHIER < 7 points	LESS HEALTHY ≥ 7 points
A (all) (n=221) 100 %	34.8%	65.2%	45.2%	54.8%	20.8%	79.2%
B (claims) (n=161) 72.9 % of A (all)	42.2%	57.8%	52.2%	47.8%	24.8%	75.2%
C (no claims) (n=60) 27.1 % of A (all)	15.0%	85.0%	26.7%	73.3%	15.0%	85.0%

Table 3. Number of items according to nutrition and health claims and according to “healthier” and “less healthy” status by the UK Ofcom model, FSANZ model and Traffic Light model

Food labels	UK Ofcom [†]		FSANZ ^{†††}		Traffic Light ^{††}		Total
	HEALTHIER (< 4 points)	LESS HEALTHY (≥ 4 points)	HEALTHIER (< 4 points)	LESS HEALTHY (≥ 4 points)	HEALTHIER < 7 points	LESS HEALTHY ≥ 7 points	
Claims	68	93	84	77	37	124	161 (72.9%)
No claims	9	51	16	44	9	51	60 (27.1%)
McNemar χ^2 -statistics	$\chi^2=14.28$		$\chi^2=11.50$		$\chi^2=97.71$		
P-value	P=0.0002***		P=0.0007***		P=0.0000***		

[†] RAYNER et al., 2009; ^{††}FSANZ, 2011; ^{†††}SACKS et al., 2009

Figure captions

Fig. 1. Comparison of density vs. points scored by the UK Ofcom model for group B (claims) and group C (no claims) (left) and by the FSANZ model for the same two groups (right).

— : B (claims); ---- : C (no claims)

Fig. 2. Histograms showing the percentage of items vs. points scored for group B (claims) by the modified Traffic Light model (left) and for group C (no claims) by the same model

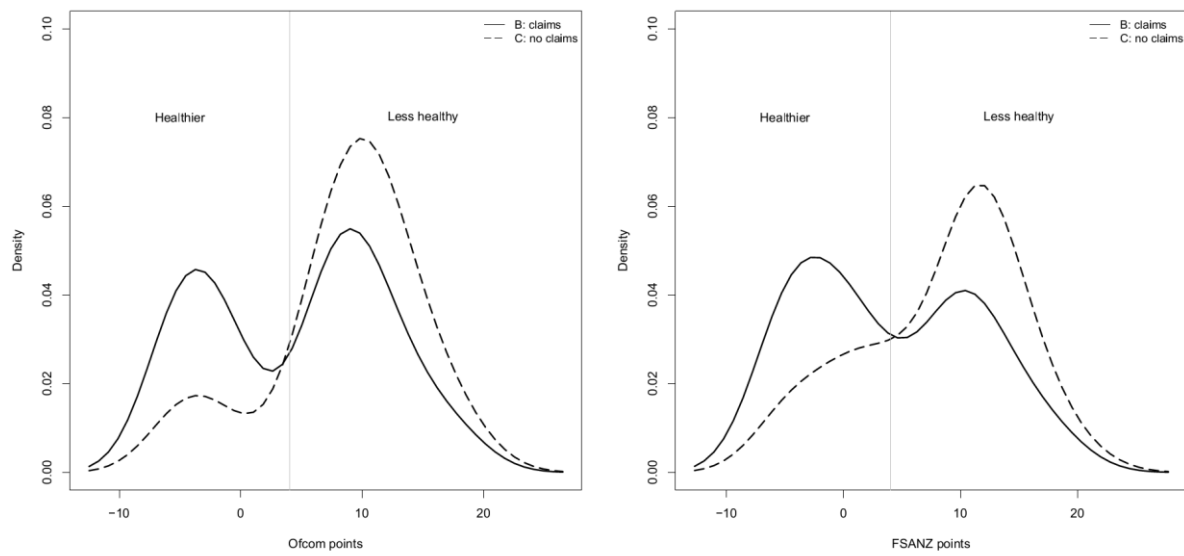


Fig.1.

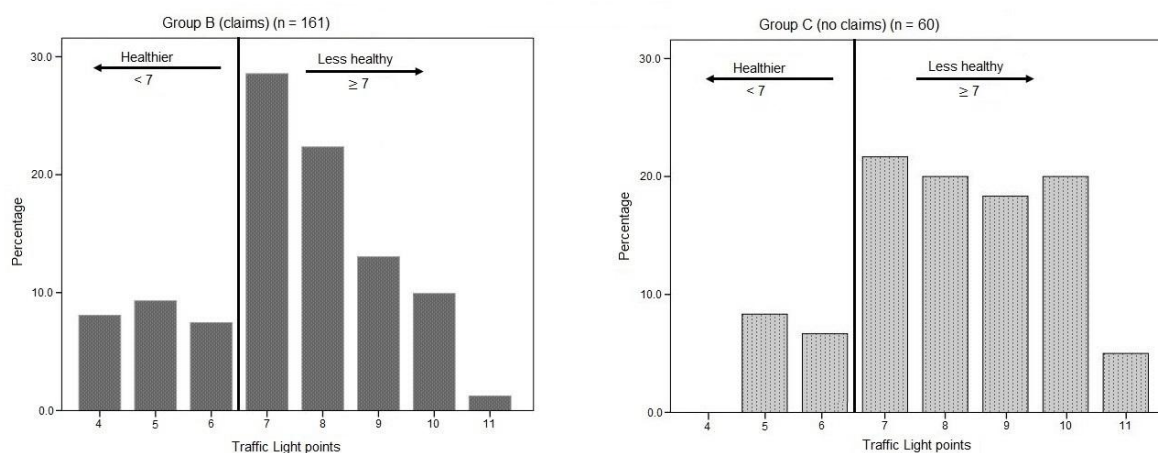


Fig.2.