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Memorandum comparing FBDG and Nutri-Score algorithm

26 June 2020

1   Motivation

Several European governments, including Belgium's, have chosen to introduce Nutri-Score. They have agreed to take joint responsibility for the governance of Nutri-Score from now on and, among other things, to jointly discuss potential further adjustments to the algorithm within a scientific committee that they set up for this purpose.

In connection with this consultation on possible adjustments to the Nutri-Score algorithm, Fevia has made a scientific comparison between this algorithm and the dietary recommendations recently adopted by the Supreme Health Council. These dietary recommendations – the Food Based Dietary Guidelines – encapsulate the nutritional priorities for the Belgian consumer to achieve the greatest health gains.

The findings of this memorandum may be a source of inspiration for the competent Belgian authorities in the context of the aforementioned consultation with the other countries opting to introduce Nutri-Score.

2   FBDG priorities

The Food Based Dietary Guidelines (FBDG – most recent dietary recommendations for Belgium) were summarised by the authors of the guidelines in a few key messages that should be given the most attention in order to preserve and promote the health of Belgians in view of the link with disease burden:

- **Eat a minimum of 125 grams of whole grain products per day; replace refined products with whole grains as often as possible.**

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Examples of whole grain products include bread, rice, pasta, quinoa, couscous, bulgur, breakfast cereals, and popcorn. According to the most recent food consumption survey (FCS[1]), the average habitual consumption of bread, rusks, and breakfast cereals in Belgium is 141 g/d. Bread is the main item consumed (104 g/d). Half of the population (49%) eat brown bread and/or wholemeal bread daily (44 g/d). The proportion of whole grains is very low (8 g/d).

Consumption of the rice, pasta, quinoa, couscous, and bulghur product group is 62 g/d. More than 90% of the population eat white rice and pasta but less than half choose brown rice or wholegrain pasta.

Belgians therefore opt for sufficient quantities of cereal products. However, the proportion of whole grains is low to very low.

- **Eat 250 grams of fruit per day. Choose fresh fruit as much as possible.**

Belgians eat an average of 110 grams of fruit per day. Consumption of vegetables should therefore be more than doubled.

- **Eat 300 grams of vegetables (fresh or prepared) per day. Vary your choices according to seasonal availability.**

Belgians eat an average of 145 grams of vegetables per day. Consumption of vegetables should therefore be more than doubled.

- **Eat legumes at least once a week.**

In the FCS 2014, the consumption of legumes was not studied separately because consumption in Belgium was too low. In 2014, the consumption of legumes and vegetarian meat substitutes amounted to 4 g/d.

Weekly consumption of legumes is yet to become widespread in Belgium.

- **Eat 15 to 25 grams of nuts or seeds per day, without salty or sweet shells.**

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[1] https://fcs.wiv-isp.be/SitePages/Results.aspx?WikiPageMode=Edit&InitialTabId=Ribbon.EditingTools.CPEditTab&VisibilityContext=WSSWikiPage

According to the FCS, the average habitual consumption of nuts and seeds in Belgium is 3 grams per day. Daily consumption of a handful of nuts or seeds is yet to become widespread in Belgium.

- **Limit your salt intake.**

The Superior Health Council in Belgium recommends the consumption of no more than 5 g of salt per day[2]. Current consumption in Belgium averages 9.5 g of salt per day. The current average consumption in Belgium therefore needs to be reduced further.

3 Nutri-Score algorithm

The Nutri-Score algorithm is based on assigning points to nutrients and to the energy value of a food product. Two reference tables are used:

Tabel 1: Punten toegekend aan elk van de elementen van de zogenaamde "negatieve" component N

Punten	Energie (kJ/100g)	Verzadigde vetzuren (g/100g)	Suikers (g/100g)	Natrium (1) (mg/100g)
0	≤ 335	≤ 1	≤ 4,5	≤ 90
1	> 335	> 1	> 4,5	> 90
2	> 670	> 2	> 9	> 180
3	> 1005	> 3	> 13,5	> 270
4	> 1340	> 4	> 18	> 360
5	> 1675	> 5	> 22,5	> 450
6	> 2010	> 6	> 27	> 540
7	> 2345	> 7	> 31	> 630
8	> 2680	> 8	> 36	> 720
9	> 3015	> 9	> 40	> 810
10	> 3350	> 10	> 45	> 900

(1) Het natriumgehalte stemt overeen met het zoutgehalte dat vermeld staat op de verplichte vermelding gedeeld door 2,5.

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https://www.health.belgium.be/sites/default/files/uploads/fields/fpshealth_theme_file/9285_voedingsaanbev_16122016_a5.pdf

Tabel 2. - Punten toegekend aan elk van de nutriënten van de zogenaamde "positieve" component P

Punten	Fruit en groenten, peulvruchten en noten (g/100g)	Vezels (g/100g) AOAC-methode	Eiwitten (g/100g)
0	≤ 40	≤ 0,9	≤ 1,6
1	> 40	> 0,9	> 1,6
2	> 60	> 1,9	> 3,2
3	-	> 2,8	> 4,8
4	-	> 3,7	> 6,4
5	>80	> 4,7	> 8,0

Nutri-Score = Total points N − Total points P = normal calculation

Criteria:

- If N points < 11 → normal calculation
- If N points >=11 but fruit and vegetables = 5 →normal calculation
- If N points >= 11 but fruit and vegetables <5 → P points for protein are not to be taken into account

There are also a number of different calculations, namely for cheese, added fats, and drinks. As these products do not feature among the top priorities of the FBDG, the calculation of these special cases will not be discussed further. For the sake of completeness, the relevant guidelines for the calculation of these non-standard scores are included in the appendix.

The group of fruit and vegetables, legumes, and nuts was recently expanded to include rapeseed, nut, and olive oil. The calculation for this product group is as follows:

% f, v, l, n, & o in a product =

$$\frac{(\text{Gewicht f, g, p, n \& o}) + (2 \text{ x het gewicht van gedroogd f, gedroogde g, p})}{(\text{gewicht f, g, p, n \& o}) + (2 \text{ x gewicht gedroogd f, gedroogde g, p}) + (\text{gewicht bestanddelen zonder f, g, p, n \& o})}$$

$$\times 100$$

f, v, l, n, & o: fruit, vegetables, legumes, nuts, and rapeseed, nut, and olive oil, including juices and purées;
Dried f, dried v, l: includes vegetable concentrate.

3.1 N and P parameters and their link to current intake and recommendations

In the documents of the FPS Public Health, energy and the N parameters are described as elements for which it is recommended to limit consumption and P parameters as elements for which it is recommended to promote consumption. For energy, saturated fat, sugars, salt, fruit and vegetables, legumes and nuts, rapeseed, nut, and olive oil, and fibre, there is a link between discouraging or promoting these elements and the actual intake among the Belgian population (see FCS and Voedingsaanbevelingen voor België 2016[3]). There is no such link in the case of protein.

Energy
The average energy intake in Belgium is 2149 kcal/day. The recommendation according to the FIC Regulation is 2000 kcal/day. This means that, on average, energy intake in Belgium is too high. Energy-dense foods can compensate for their negative score in case P elements are present or other N elements are absent. Energy-dense diets containing mainly saturated fats and sugars see their N score deteriorate further as saturated fats and sugars add extra N points without compensating with P points.

Only 17% of Belgians consume at least 50% of their energy through carbohydrates. Belgians should therefore obtain more energy from carbohydrates. In order for Belgians to better meet the guidelines, the consumption of potatoes, fibre-rich fruit, vegetables, and whole grains should be promoted in particular, while energy from fats and protein should be limited further.

Saturated fats
In 2014, the average intake of saturated fatty acids in Belgium was 31 g per day. The recommendation (maximum 10% of daily energy intake) is 24 g. In 2014, 90.4% of the Belgian population (3–64 years) did not follow the recommendation.

Sugars (monosaccharides and disaccharides)
The Superior Health Council did not formulate a specific recommendation for sugars. For added sugars, the recommendation is a maximum of 10% of the daily energy intake. Initially, the FCS could not calculate the intake of added sugars, as only sugars are mentioned on the label. Sciensano recently recalculated the results of the FCS 2014 and estimated the amount of added sugars present in food. These results are yet to be published. The FCS indicates that the average Belgian's consumption of sugars is 109 g/day. The FIC Regulation recommends 90 g per day. The intake of sugars in Belgium is therefore too high.

Salt, fruit and vegetables, legumes and nuts, rapeseed, nut, and olive oil
For salt, fruit and vegetables, and legumes and nuts, the link between recommendations and intake was highlighted in point 2. (see above). When this group of oils was expanded, oils with a specific fatty acid profile were chosen. These can be linked to the results of the FCS regarding intake of unsaturated fatty acids. In 62% of the Belgian population, the consumption of PUFAs was within the recommendations (5–10 en%) but the intake of n-3 PUFAs was far below the recommendations. The selected oils can remedy this deficiency while respecting the omega-3/omega-6 balance.

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[3]

https://www.health.belgium.be/sites/default/files/uploads/fields/fpshealth_theme_file/9285_voedingsaanbev_16122016_a5.pdf

Fibre

Belgians consume an average of 18 grams of dietary fibre per day. Only 16% comply with the guideline of 25 g per day. A study comparing[4] 27 European regions found a dietary fibre intake of 14 to 33 g/day in people aged 35 to 64. This means that fibre intake in Belgium is rather on the low side compared with other EU countries.

Protein

According to the FCS, an insufficient protein intake is not a problem for the Belgian population: only 0.1% of men and 0.5% of women do not meet the guideline of 15% of their
energy intake.

3.2 Assignment of colours

The table below is used to assign the colours. A different table (attached) is used for drinks.

Klasse	Scoregrenzen	Kleur
A	Min tot -1	Donkergroen
B	0 tot 2	Lichtgroen
C	3 tot 10	Lichtoranje
D	11 tot 18	Middenoranje
E	19 tot Max	Donkeroranje

The colour scale is described by the FPS Public Health as follows: from A for the foods that should be focused on, to E for the foods that should be limited.

Below, we will examine the extent to which the Nutri-Score system will effectively differentiate the products/nutrients from the top 5 of the FBDG within their respective product groups. By making this distinction, the Nutri-Score could effectively promote the consumption of the products recommended by the FBDG.

4 Synergy

At least 125 grams of whole grain products per day

The food consumption survey showed that Belgians eat enough cereal products (203 g/d > 125 g/d) but not enough of the whole grain variety. Within this product group, Belgians mainly consume bread, pasta, and rice. When the Nutri-Score algorithm is applied to the whole grain and the refined grain variant, the following scores are obtained[5]:

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[4] Cust AE, Skilton MR, van Bakel MME, Halkjaer J, Olsen A, Agnoli C, et al. Total dietary carbohydrate, sugar, starch and fibre intakes in the European Prospective Investigation into Cancer and Nutrition. European journal of clinical nutrition 2009;63:S37-S60.

[5] Several products have been verified on the Delhaize and Colruyt online stores

Product	Nutri-Score whole grain variant	Nutri-Score refined grain variant
Bread	A	B
Pasta	A	A
Rice	A/B	A/B

The Nutri-Score algorithm fails to make a clear distinction.

Eat 250 grams of fruit per day, preferably fresh fruit
The algorithm requires at least 40% fruit before P points can be awarded. Only if vegetables, nuts etc. are also present can smaller quantities of fruit be counted. The 40% threshold provides no incentive to add small amounts of fruit to food products, with P points only being awarded to products containing a lot of fruit. This aspect results in a positive synergy between the FBDG's priority of eating more fruit and the Nutri-Score algorithm.
Fruit on its own (fresh, frozen, canned...) and puréed fruit easily exceed the 40% limit. If sugars or syrups are added, the Nutri-Score decreases. However, what is striking in the case of e.g. apple purée or tinned peaches is that the algorithm cannot distinguish between the forms with and without added sugar.

Product	Nutri-Score	Sugar content / 100 g
Apple purée	A	16–18g
Apple purée without sugar	A	8 g
Peaches in syrup	A	13 g
Peaches with sweetener	A	5.8 g

In theory, the algorithm can result in a Nutri-Score of A for e.g. apple purée with a sugar content of up to 20 g/100 g. This creates a negative synergy between the Nutri-Score algorithm and the recommendations of the Superior Health Council regarding sugars.

Eat 300 grams of vegetables (fresh or prepared) per day. Vary your choices according to seasonal availability
Fresh vegetables, frozen vegetables, tinned vegetables etc. all have a Nutri-Score of A. The added salt content is quite low. Only within the vegetable spreads (which contain a combination of fats and salt) is there a variation in Nutri-Scores. Vegetables are given a positive score, which also results in a positive synergy with the FBDG's objective.

The percentage of vegetables in prepared meals is not always taken into account by the algorithm. This is partly because the threshold of 40% is quite high for prepared meals. The guide to school meals published by the Flemish Government (Gids van de Vlaamse overheid voor schoolmaaltijden)[6] gives the following weight distribution: 200 g vegetables, 200 g potatoes (cooked), 130 g meat (not fried), and 15 g cooking fat. Assuming that vegetables do not change significantly in weight as a result of cooking (grilling is another matter) and meat decreases in weight from 130 g to 100 g after frying, the

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[6] https://www.gezondleven.be/files/voeding/schoolmaaltijdengids_2018.pdf

following distribution is obtained on the basis of weight: 39% vegetables, 39% potatoes, 19% meat, and 3% fat. Even in the "ideal scenario", the quantity of vegetables does not reach the 40% threshold.

If macaroni ham and cheese (no vegetables) is compared with chicory gratin (25% vegetables) with mashed potatoes, both score a B.

Energy/Nutrients per 100 g	Macaroni	Chicory gratin
Energy	568 kJ	427 kJ
Kilocalories	135 kcal	102 kcal
Fats	5.4 g	4.8 g
Saturated fats	2.4 g	1.6 g
Carbohydrates	15 g	9.2 g
Sugars	2 g	2 g
Fibre	0.5 g	1.4 g
Protein	6.4 g	4.7 g
Salt	0.65 g	0.56 g

It is the protein in the macaroni that provides enough P points to make the score B (N points do not exceed 11 so P points from protein may be taken into account). The vegetables do not help the chicory gratin as the percentage is lower than 40%.

Extra comment on proteins: according to the dietary recommendations, the intake of proteins should not exceed 15% of the energy requirement. A prepared meal of approximately 500 kcal should therefore theoretically (in the case of a complete meal) contain a maximum of 18.8 g protein. If we assume a portion of 450 g, this amounts to 4.2 g of protein / 100 g. The question is why, in the Nutri-Score algorithm, protein values higher than 4.2 g give extra P points.

Eat legumes at least once a week
Legumes are recommended in order to increase the variety of protein sources (pork, chicken, beef, fish etc.). Legumes on their own (fresh, frozen, canned...) will almost always score an A. Because they are added to the vegetables, fruits etc., they help achieve the threshold of 40% in prepared meals and, thanks to the proteins, the score can be improved even more. There is a positive synergy due to this favourable score. Fresh meat (pork, chicken (without skin), beef, and fish) also always scores an A. The algorithm does not distinguish between them. When prepared (with extra fat and salt), the score for both legumes and meat preparations decreases. Legumes will always score higher than meat preparations because legumes receive extra P points (legumes are in the category of vegetables, fruit etc.). One example is hummus, with a nutrient score of A:

Energy/Nutrients per 100 g	Hummus
Energy	1315 kJ
Kilocalories	317 kcal
Fats	24 g
Saturated fats	2.7 g
Carbohydrates	14 g

Sugars	1.3 g
Fibre	4.7 g
Protein	8.9 g
Salt	0.82 g

However, the relatively high fat content is striking. With 100 g of hummus you can easily reach 34% of the R.I. for fat.

Eat 15 to 25 grams of nuts or seeds per day, without salty or sweet shells
Nuts that are not sweetened or salted usually receive an A or B score. Salted nuts sometimes achieve a Nutri-Score of B but never A. Nuts with salty or sweet shells never achieve a score of A or B. The algorithm makes a sufficient distinction. For nuts, there is a positive synergy. One disadvantage of including nuts in the group of vegetables, fruits etc. is that nuts in a small quantity, e.g. added to a cereal bar, cannot improve the score because of the 40% threshold. This is despite the fact that the recommendation mentions 15 to 25 grams per day, which in itself is a small amount.
Seeds are not included in the Nutri-Score calculation. The Q&A of the FPS Public Health states "The following are not counted"... "Chia, poppy, sunflower, flax seeds and pine nuts that belong to Eurocode 7.30 not covered by the FSA document.[7]"

Limit your salt intake
Salt is somewhat of an oddity in the FBDG, as it is a nutrient and not a food or meal component. In order to determine how salt is taken into account in the algorithm, we will examine how much salt can be added to A or B products before they move up to the next class. The assumption is that adding salt does not change the relative amounts of the other components. In addition, the extent to which salt has to be reduced in order to move from C to B will also be examined. This will show the extent to which reformulation of food products in terms of salt is stimulated by the algorithm.

Situation 1 – product with Nutri-Score A:

Effective score of product with Nutri-Score A	Number of grams of salt that can be added per 100 g of product to achieve a B score (effective score 0)
−5	1.35
−4	1.125
−3	0.9
−2	0.675

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[7]

https://www.researchgate.net/publication/267194254_Application_of_the_Nutrient_profiling_model_Definiti on_of_'fruit_vegetables_and_nuts'_and_guidance_on_quantifying_the_fruit_vegetable_and_nut_content_of_ a_processed_product

Note: Not a peer-reviewed article, cited 5 times since 2005

−1	0.45

In other words, products with a Nutri-Score A can contain quite a lot of salt without affecting their score. Particularly in the case of vegetables (vegetable purée), cereal products, or prepared meals, this can be seen as a negative synergy with the FBDG objective.

Situation 2 – product with Nutri-Score C:

Effective score of product with Nutri-Score C	Number of grams of salt to be reduced per 100 g of product to achieve a B score (effective score 2)
3	0.225
4	0.45
5	0.675
6	0.9
7	1.125
8	1.35
9	1.575
10	1.8

Products with an effective Nutri-Score C of 7 or more can have their salt content reduced by > 1 g / 100 g and still remain within category C. The algorithm does not support reformulation, unless it is done in large increments. Products in the A, B, and C classes may have a wide range of salt concentrations within their class. The FBDG recommend limiting salt consumption, but the Nutri-Score algorithm fails to distinguish between products with a reduced salt content.

5   Conclusion

In the above exercise, it was consistently assumed that food products should be compared within their respective product group. The question was whether the Nutri-Score algorithm effectively favours products within a certain product group in such a way that they contribute to achieving the objectives of the food based dietary guidelines.

For whole grain products and salt, little positive synergy was found between the current algorithm and the objectives of the FBDG. For fruit and vegetables, positive synergy was observed, but there are questions about the product groups fruit purée/canned fruit and the sugar content on one hand, and the portion of vegetables and the protein content of prepared meals on the other. Positive synergy was observed for nuts but the question is whether the threshold of 40% is too high. No positive synergy was observed for seeds.

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Appendices

Conversion factors

1 gram of fat provides 9 kcal
1 gram of carbohydrate provides 4 kcal
1 gram of protein provides 4 kcal
1 gram of alcohol provides 7 kcal
1 gram of fibre provides 2 kcal

1 kJ is equal to 0.24 kcal

Reference intakes as defined in the FIC Regulation

DEEL B — REFERENTIE-INNAMES VOOR ENERGIE EN BEPAALDE
ANDERE NUTRIËNTEN DAN VITAMINEN EN MINERALEN
(VOLWASSENEN)

Energie of nutriënt	Referentie-inname
Energie	8 400 kJ (2 000 kcal)
Totale vetten	70 g
Verzadigde vetzuren	20 g
Koolhydraten	260 g
Suikers	90 g
Eiwitten	50 g
Zout	6 g

Calculation of Nutri-Score for special cases

Cheese: always calculate with protein, even if N points >= 11 but vegetables and fruit < 5 → normal calculation

Fats added:

Tabel 3. - Rooster voor toekenning van punten voor de component verzadigde vetzuren/vetgehalte in het specifieke geval van toegevoegde vetten

Punten	Ratio Verzadigde vetzuren/vetten
0	<10
1	<16
2	<22
3	<28
4	<34
5	<40
6	<46
7	<52
8	<58
9	<64
10	≥64

Awarding points for drinks:

Tabel 4. - Rooster voor toekenning van punten voor dranken

Punten	Energie (kJ/100ml)	Suikers (g/100ml)	Fruit en groenten (%)
0	≤0	≤0	≤40
1	≤30	≤1,5	
2	≤60	≤3	>40
3	≤90	≤4,5	
4	≤120	≤6	>60
5	≤150	≤7,5	
6	≤180	≤9	
7	≤210	≤10,5	
8	≤240	≤12	
9	≤270	≤13,5	
10	>270	> 13,5	>80

The specific grid for drinks replaces the columns for energy density, sugars, and fruit and vegetables with the columns used for other foods. The other columns (saturated fatty acids, salt, protein, fibre) remain similar and should be taken into account.

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Milk, yoghurt drinks, flavoured milk drinks, or chocolate drinks containing more than 80% milk, drinks reconstituted with a liquid other than water, soups and gazpacho, and vegetable drinks <u>are not considered</u> drinks for the purpose of calculating the Nutri-Score.

In het geval van dranken wordt rekening gehouden met de volgende drempels:

Klasse	Scoregrenzen	Kleur
A	Mineraal water	Donkergroen
B	Min tot 1	Lichtgroen
C	2 tot 5	Lichtoranje
D	6 tot 9	Middenoranje
E	10 tot Max	Donkeroranje

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