Nutri-Score - Critical Notes

Results of an investigation

First publication: 14.2.19 - Last status: 20.3.22

Table of contents

List of Figures

List of tables

Foreword

A study on the informative value of Nutri-Score for the evaluation of meals and dishes in community catering as well as individual foods was published for the first time on 2/14/19. It has been revised several times through December 2020, with continued refinements. The August 2020 version was a comprehensive revision of the first version, in particular describing the Nutri-Score assessment method in more detail. Furthermore, there were some assessment modifications in GTS, especially regarding the redefinition of the Q-values, which were also taken into account with this first major update.

The purpose of this revision was to clarify how complicated and difficult to understand and perform the evaluation process is with the Nutri-Score method. After all, this aspect is by no means irrelevant for the application of a method. In practice, the results of assessments should be supportive, plausible, fast and transparent. The assessment itself should be easy to perform, ideally by the practitioners themselves. Only then is there any chance at all that an instrument will be used across the board and accepted by practitioners.

The results of the food and dish assessments were presented in detail and again compared with the nutritional calculations and with the results of GTS. The described limitations in the assessment for specific Food-groups by Nutri-Score did not have to be considered, since the specific foods are included as ingredients in the recipes and thus were not to be assessed individually, e.g. fats and oils. The scores of the test items referred to the final results of nutritional calculations for 100 g.

For the latest revision of December 2020 of the evaluative comparison, the decisive factor was that the calculations could now be carried out with the current BLS, version 3.02. This gave the statements, which were after all decisive, a higher degree of accuracy. This gave the statements, which are largely based on the nutritional value calculations, even more certainty than with the previously used BLS 2.3. In addition, some changes were made to the formulations in this latest revision and additional formulations were used for comparison. With these recipe changes, the contrasts in the qualities of the menus should become even clearer, so that the ratings should be analogous.

The nutritional calculations will show better than in the earlier study that the menus are nutritionally far apart, which should be expressed very clearly with Nutri-Score and with GTS.

Incidentally, the author does not use gender appropriate language. Details of the rejection can be found in Bayer[1] and Eisenberg[2], with which the author fully agrees.

1 Bayer J: Sprachen wandeln sich immer – aber nie in Richtung Unfug. Neue Zürcher Zeitung v. 14.4.2019. https://www.nzz.ch/feuilleton/die-geschlechtergerechte-sprache-macht-linguistische-denkfehler-ld.1472991

2 Eisenberg P: Das missbrauchte Geschlecht. Süddeutsche Zeitung v. 2.3.2017. https://www.sueddeutsche.de/kultur/essay-das-missbrauchte-geschlecht-1.3402438

1. Introduction

In order to be able to evaluate foods or dishes, information other than nutritional values is often used, since these are not very informative for the consumer or guest of a restaurant. Examples for other instruments are the "Ernährungskreis" of the DGE[3], the "3D-Lebensmittelpyramide" of the DGE[4], the "Ernährungspyramide" of the BZfE[5], the "Gastronomic Traffic Light System" (GTS)[6] or the relatively new "Nutri-Score" from France, which is the focus of interest here. Nutritional value calculations have always been used as a reference, for which details of the labeling were defined in a national regulation more than 50 years ago (Nährwert-Kennzeichnungs-VO).

Nutritional information still plays an important role in many regulations today, including the 2011 LMIV, where the earlier specifications were modified and expanded[7]. Also in the quality standards of the DGE[8,9] specifications are made for the design of meal plans with the help of nutritional information. Nutritional value calculations are thus of great importance for quality assurance, although they are associated with considerable problems, at least in the Community catering[10],[11]. However, valuable information can be obtained with them if suitable programs are used carefully.

The ratings of meals and dishes using GTS have been compared with the results of nutritional calculations in extensive studies using 4-week meal plans. It was found that the assessments with GTS are very plausible because they are in good agreement with the recommendations for food selection and quantities and with the results of nutritional calculations[12]. The informative value is even better and more differentiated than with the nutritional value calculations, because with this instrument only the nutritional values are determined and then an actual-target comparison with reference values is made. These results are not self-explanatory. The deviations of the actual values from the target values do not say much. Therefore, the results have to be interpreted, which often turns out to be difficult8. In any case, a nutritional value calculation cannot provide a summarizing and easily understandable result. However, in the hands of a professional, the results are an important aid for the evaluation of meal plans.

In October 2017, France introduced a voluntary nutrition labeling system for foods called Nutri-Score[13]. The system is described and exemplified in a concise summary by Danone[14]. A de-

3 DGE: DGE-Ernährungskreis. www.dge.de/ernaehrungspraxis/vollwertige-ernaehrung/ernaehrungskreis
4 Cremer M, Rademacher C: Die Dreidimensionale Lebensmittelpyramide. Fachinformation. Herausgeber: aid und DGE. Moeker Merkur Druck GmbH, Köln, 1. Aufl. 2005, 18 S.
5 BZfE=Bundeszentrum für Ernährung. Kompetenz- und Kommunikationszentrum für Ernährungsfragen in Deutschland. https://www.bzfe.de/inhalt/ernaehrungspyramide-615.html
6 Peinelt V: Gastronomic Traffic Light System. Longversion. https://ewd-gastro.jimdo.com/gas/beschreibung/longversion/
7 Verordnung (EU) Nr. 1169/2011 DES EUROPÄISCHEN PARLAMENTS UND DES RATES vom 25.10.2011: Informationen der Verbraucher über Lebensmittel. Amtsblatt der Europäischen Union, L 304/18-63 vom 22.11.2011. www.bmel.de/SharedDocs/Downloads/Ernaehrung/Kennzeichnung/VO_EU_1169_2011_Lebensmittelinformation_nurAmtsblatt.html?nn=406624
8 DGE (Hrsg): z.B. DGE-Qualitätsstandard für die Betriebsverpflegung. Job&Fit. DGE Bonn, 02/2015, 48 S.
9 Die Qualitätsstandards der DGE wurden im November 2020 aktualisiert. Zu diesen wird später Stellung bezogen. Zwischen den "alten" Standards und den neuen bestehen keine elementaren Unterschiede.
10 Peinelt V: Nährwertberechnung als QS-Instrument in der Gemeinschaftsgastronomie? Ernährung im fokus (10), 370-375 (2010). https://ewd-gastro.jimdo.com/gas/probleme-nw-berechnung/
11 Peinelt V: Stellungnahme - Nährwertberechnung. Langfassung. https://ewd-gastro.jimdo.com/gas/probleme-mit-nwb/
12 Peinelt V: Bewertung von 4-Wochen-Modellspeiseplänen. https://ewd-gastro.jimdo.com/gas/validierungen/4-wo-plan-modell/
13 Danone: Einführung von Nutri-Score in Deutschland. www.ernaehrungs-umschau.de/branche-aktuell/10-07-2018-einfuehrung-von-nutri-score-in-deutschland/
14 Der Nutri-Score. Aufbau des Systems und erste Erfahrungen zur Wirksamkeit. www.foodwatch.org/fileadmin/Themen/Ampelkennzeichnung/Bilder/Danone_Der_Nutri_Score.pdf

tailed description can be found in a French source[15]. Here the nutritional quality is marked with letters from "A" to "E". The reactions in the professional world, among consumer associations and in the food industry were consistently positive. The responsible ministry (BMEL) initially found it very difficult to give a final assessment. It commissioned a study to produce brief assessments of a total of eleven international assessment models. This study was presented in April by the Max-Rubner-Institute (MRI), whereby Nutri-Score was also discussed over only six pages, with a tendency to a positive conclusion[16].

In the meantime, more and more companies in Germany are willing to label their food according to this system. These include Danone as well as iglo, a supplier of frozen products. However, in the meantime there has been an injunction against iglo because of labeling with the Nutri-Score[17], which illustrates the uncertainties of using this method in Germany. The world's largest food manufacturer, Nestlè, also introduced Nutri-Score labeling for its products[18], but only in those countries that have adopted corresponding legal regulations. This requirement was not met in Germany until recently. It was only on 30.9.19 that the responsible ministry announced that Nutri-Score would also be introduced in Germany[19].

The increasing social interest in this assessment tool and the good evaluation and acceptance were the reason for a comparative examination of the informative value of this assessment system. In particular, recent considerations in France to introduce Nutri-Score in the Community catering have contributed to re-examine the suitability of this method for the nutritional evaluation of food and beverages. For this purpose, various realistic test objects were compared with the results of the evaluation of GTS as well as of nutritional value calculations. It was only about meals, dishes as well as menus.

2. Description of Nutri-Score

2.1 Aim of the Nutri-Score

Nutri-Score is based on the nutritional profile model of the British Food Standards Agency[20] (FSA score) and is a system for the assessment and labeling of foods. Official documents on the Nutri-Score distinguish between a "nutritional score" and "Nutri-Score". The difference is that the nutritional score expresses "nutritional quality", i.e. nutritional value, over a range of -15 to +40, while the Nutri-Score is a graphical scale for the nutritional score, i.e. an illustration, with foods divided into five classes. These five classes are represented with a letter scale from "A" to "E" and a color gradient from green to red.

15 Santepublicfrance: Nutri-Score Frequently Asked Questions. 1. Update vom 20.6.2019, 28 S. www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=6&ved=2ahUKEwiRw5q7pJXgAhVMQhoKHQqhBCoQFjAFegQICBAC&url=https%3A%2F%2Fwww.santepubliquefrance.fr%2FMedia%2FFiles%2FNUTRISCORE%2FQuestions_reponses_EN&usg=AOvVaw0K6NME8oCNIvTNgtJiOsjg

16 Max Rubner-Institut (MRI), Bundesforschungsinstitut für Ernährung und Lebensmittel: Beschreibung und Bewertung ausgewählter „front-of-pack"-Nährwertkennzeichnungs-Modelle. April 2019. www.bmel.de/SharedDocs/Downloads/Ernaehrung/Kennzeichnung/MRI-Bericht-Naehrwertkennzeichnungs-Modelle.html, S. 56-61

17 Kwasniewski N: Iglo darf Nährwertkennzeichnung nicht nutzen. Spiegel Online vom 16.4.19. www.spiegel.de/wirtschaft/service/nutri-score-bei-iglo-gericht-stoppt-naehrwertkennzeichnung-a-1263159.html

18 FAZ: Nestlé führt Lebensmittelampel ein. vom 26.6.19. www.faz.net/aktuell/wirtschaft/unternehmen/nestle-fuehrt-lebensmittelampel-nutri-score-ein-16254592.html

19 flg/nck/dpa: Klöckner gibt Widerstand gegen Nutri-Score auf. Spiegel online, 30.9.19, 17:32h. www.spiegel.de/wirtschaft/service/nutri-score-julia-kloeckner-will-neues-naehrwert-logo-a-1289345.html

20 Ministerium für Gesundheit und Soziales (DHSC): Das Nährstoffprofilierungsmodell. www.gov.uk/government/publications/the-nutrient-profiling-model, publiziert 4.1.2011

Its purpose is to provide guidance when purchasing products from Food Retail and to raise awareness among customers about healthy eating. This scale is intended to express the degree to which the foods promote health. It is not about "good" and "bad" food, as it is stated in the explanation of the official text on FAQs[21]. These terms are inappropriate anyway, as the frame of reference for these categories would need to be defined.
The orientation should be understandable without any special previous education. Since the letters are represented in the colors "green" via "yellow" to "red", the labeling is self-explanatory, because it refers to the well-known traffic light system. Traffic light systems are used for all kinds of product categories, e.g. for the energy consumption of household appliances or for the CO2 emissions of cars. Here, "green" stands for favorable, and "red" for unfavorable. The label therefore provides information directly and quickly, and large letters have been found to be particularly informative in studies[22]. The five letters are used because there are two intermediate levels in addition to the three main colors.

2.2 Determination of the Nutri-Score

2.2.1 Basic information

In exact accordance with the FSA score from Great Britain, the evaluation of foods with Nutri-Score is carried out via negative points (N) in the case of an unfavorable influence on health and positive points (P) in the case of a favorable influence. The score is usually determined on the basis of seven criteria (calorific value, saturated fatty acids, sugar, sodium, protein, fiber, and the proportions of the Food group "fruits, vegetables and nuts"), the degree of fulfillment of which is converted into points. The negative and positive points determined in this way are then added together to give the so-called Nutritional Score. Ranges were defined for these numbers, which are then assigned to the five letters, the Nutri-Score. The lower the score, the better it is. It is best for negative scores. For the evaluation of some product groups (cheese, oils/fats, beverages), other criteria were used, and a modified scoring method must be applied. This will be discussed later.

The criteria mentioned are not only based on the British FSA score, but also on the European Food Information Regulation (LMIV)[23], and in particular on Article 30, which specifies which nutrients must be declared on packaged foods (Para. 1) or may additionally be declared (Para. 2). A mandatory nutrition declaration exists for calorific value, fat, saturated fatty acids, carbohydrates, sugar, protein and salt (Big Seven). Only the declaration of dietary fiber and sodium, which must be known for the Nutri-Score, is not mandatory.

The dietary fiber content may be declared as a supplement and can usually be found on the labels of packaged foods. For sodium, the amount can be determined via the table salt content (=40%). In addition, the proportions of the three Food-groups must be known in order to determine the Nutri-Score. All nutrient contents and amounts of the foods used are of course

21 NUTRI-SCORE FREQUENTLY ASKED QUESTIONS. Scientific & Technical. Updatet 20/06/2019. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=2ahUKEwiohaqh0aPjAhUSLFAKHVqUAWEQFjAAegQIABAC&url=https%3A%2F%2Fwww.santepublique-france.fr%2FMedia%2FFiles%2FNUTRISCORE%2FQuestions_reponses_EN&usg=AOvVaw0K6NME8oCNIvTNgtJiOsjg. Appendix 2, S. 23

22 Julia C, Hercberg S: Nutri-Score: Evidence of the effectiveness of the French front-of-pack nutrition label. www.ernaehrungs-umschau.de/fileadmin/Ernaehrungs-Umschau/pdfs/pdf_2017/12_17/EU12_2017_WuF_Nutriscore_englisch.pdf

23 Verordnung (EU) Nr. 1169/2011 DES EUROPÄISCHEN PARLAMENTS UND DES RATES vom 25.10.2011 (LMIV): Informationen der Verbraucher über Lebensmittel. Amtsblatt der Europäischen Union, L 304/18-63 vom 22.11.2011. www.bmel.de/SharedDocs/Downloads/Ernaehrung/Kennzeichnung/VO_EU_1169_2011_Lebensmittelinformation_nurAmtsblatt.html?nn=406624

known to the manufacturers, so that in principle nothing stands in the way of determining the Nutri-Score.

The situation is different for the users, i.e. the processors of the products, such as the specialists in commercial kitchens. They do not have the recipes and therefore do not have sufficient data to determine the Nutri-Score, unless they are provided by the producer. For the unfavorable nutritional elements (N), the system determines plus points (0-10), depending on the nutritional content per 100 g. For the favorable elements (P), minus points (0 to -5) are assigned. The following table summarizes the seven criteria.

Ungünstige (negative) Nährwertelemente (N)	Punkte pro 100g	Günstige (positive) Nährwertelemente (P)	Punkte pro 100g
+ Energie	0 - 10	- Obst, Gemüse, Nüsse	-5 - 0
+ Gesättigte Fettsäuren	0 - 10	- Ballaststoffe	-5 - 0
+ Gesamtzucker	0 - 10	- Protein (Eiweiß)	-5 - 0
+ Natrium	0 - 10	*je negativer, desto besser*	
Summe:	max. 40	Summe:	max. -15

Tab. 2.1: Point ranges of the seven nutritional elements of Nutri-Score

2.2.2 Details of the rating

Let us now turn to some details of the assessment. Each point of a nutritional element corresponds to certain ranges of numbers. The Dietary Reference Values (DRV) from Great Britain (2004) serve as the basis. One point corresponds to 3.75% of the DRV of the respective nutrient, with differentiation for different product groups. The reason for this "crooked" number is not given. Why is it not 3 or 4%? Thus, when reaching the max. score of 10, 37.5% of the reference value would be achieved. This crooked end point is also not justified. Despite these unfounded determinations as well as the evaluation of favorable and unfavorable ingredients is considered "scientifically sound" by the MRI[24]. It remains to be seen whether these conditions are sufficient to achieve plausible results.

In total, a maximum of 40 plus and 15 minus points can be achieved due to the system. The points for all nutritional elements are added and the total value is assigned to one of five letters (A-E) corresponding to certain ranges of numbers (Tab. 2.2).

24 Max Rubner-Institut (MRI), Bundesforschungsinstitut für Ernährung und Lebensmittel: Beschreibung und Bewertung ausgewählter „front-of-pack“-Nährwertkennzeichnungs-Modelle. April 2019. www.bmel.de/SharedDocs/Downloads/Ernaehrung/Kennzeichnung/MRI-Bericht-Naehrwertkennzeichnungs-Modelle.html, S. 58

Punktzahl	Bewertung
-15 bis -1	A
0 bis ≤ 3	B
3 bis ≤ 10	C
11 bis ≤ 18	D
≥19	E

Tab. 2.2: Scoring ranges for Nutri-Score determined scores

The lower the nutritional score, the more favorable the nutri-score, i.e. the meaningful result of this number acrobatics. The best result is symbolized by an "A" (<0 points), the worst by an "E" (≥19 points). The size of the number ranges is not the same; in fact, they show considerable differences. The very small range of only 3 points for the letter "B" is striking. Therefore, a jump over three letters (from yellow [C] to dark green [A] and vice versa) can be achieved with a small point improvement.

However, the scoring concept described is not a uniformly applicable algorithm. The evaluation for solid foods and for beverages is carried out with different calculation modes. The solid foods are differentiated again, namely for fats and oils as well as for cheese and for other foods ("general")[25]. Thus, there are four different product groups for evaluation.

This division shows similarities with the "3D food pyramid of the DGE "[26], where four different Food-groups are also defined on the pyramid pages (beverages, oils/fats, plant and animal foods). Furthermore, there are also different evaluation approaches between these models: a summarizing evaluation over all pyramid sides is strictly rejected by the DGE, which is why a final, all food comprehensive evaluation (e.g. of a menu) is not possible, as this is also done with the Nutri-Score. Dishes or dishes that are composed of different ingredients of different Food-groups are rated with Nutri-Score with one letter. After all, with Nutri-Score you know how the food or dish is to be classified. When using the 3D food pyramid, on the other hand, you have almost no help when you want to rate a dish that is composed of foods from different sides of the pyramid.

Even though there may be good reasons for deviating determinations for the Nutri-Score, it is already evident after this short characterization that the rules for the evaluation are complicated and difficult to understand. Therefore, the publication of algorithms that can be applied to all Food-groups would be desirable, with the aim of achieving more transparency and reproducibility. However, anyone who thought that the maximum degree of complexity had been reached with the above-mentioned evaluation approaches will be proven wrong by further specifications. By the explanations in the appendix 2 of the mentioned source to the "Score Calculation Methods: General" the procedure with special cases is represented, which is reproduced

25 NUTRI-SCORE FREQUENTLY ASKED QUESTIONS. Scientific & Technical. Updatet 20/06/2019. www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=2ahUKEwiohaqh0aPjAhUSLFAKHVqUAWEQFjAAegQIABAC&url=https%3A%2F%2Fwww.santepubliquefrance.fr%2FMedia%2FFiles%2FNUTRISCORE%2FQuestions_reponses_EN&usg=AOvVaw0K6NME8oCNIvTNgtJiOsjg, Appendix 2, S. 21ff

26 Jungvogel A, Michel M: Die Dreidimensionale Lebensmittelpyramide. Fachinformation. Herausgeber: aid und DGE. DCM Druck Meckenheim GmbH, Köln, 6. Aufl. 2016, 22 S.

in the following in the original, in order to avoid shortenings or distortions of the translation (N=unfavorable, P=favorable influence of the components):

- *"If the total for the N-component is less than 11 points, then the nutritional score is equal to the total N-component points minus the total for the P-component.*
- *If the total for the N-component is greater than or equal to 11 points and*
  - *If the total for "fruits and vegetables" is equal to 5, then the nutritional score is equal to the total N-component points minus the total for the P-component.*
  - *If the total for "fruits and vegetables" is less than 5, then the nutritional score ist equal to the total N-component points minus the sum of the points for "fibres" and "fruits and vegetabels". In this case, the protein content is therefore not taken into account in the calculation of the nutritional score."*

This is shown again graphically to reduce some of the confusion about how to correctly determine the Nutri-Score:

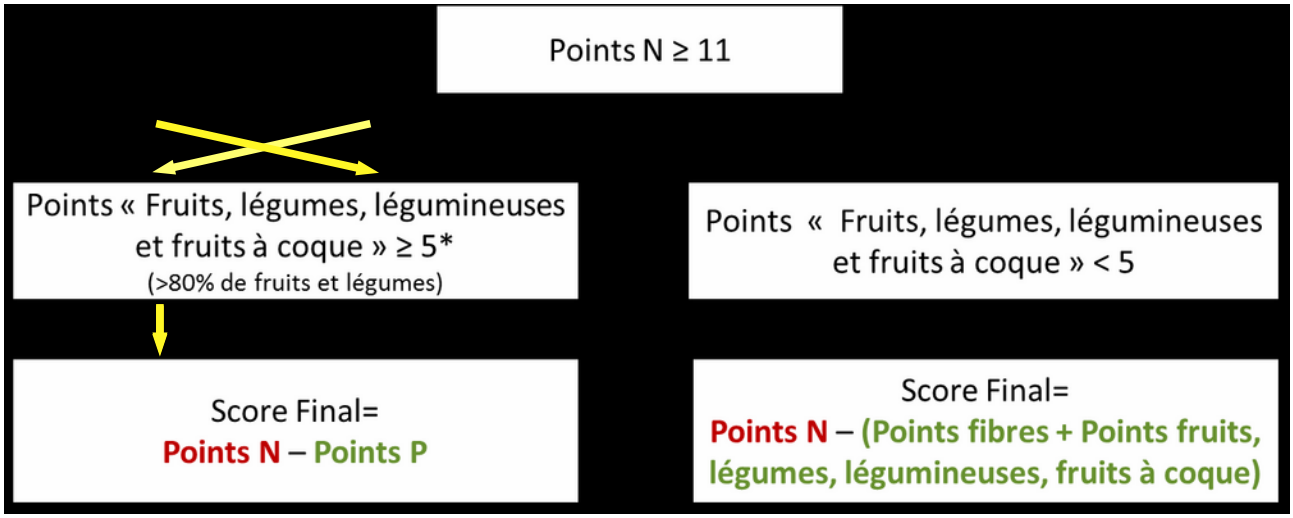

Fig. 2.1: Determination of the final scores

This description shows that the rule for determining the "general" scores alone is almost incomprehensible, at least it is likely to cause considerable problems in its implementation. This determination of the scores and the evaluation are linked to further strict conditions, which were explained in the already mentioned technical-scientific publication[27]. Anyone wishing to use Nutri-Score, it states, must register on a French website. After that, information about the product segment must be provided. The Nutri-Score label may only be used at all by "producers and distributors of products," i.e., manufacturers and distributors of packaged foods operating in France or Europe.

The use of Nutri-Score is therefore not possible for everyone, even if they have the necessary nutrient details, understand the complicated determination procedure and have a suitable evaluation tool at their disposal. This excludes many food providers, thus also the providers in

27 NUTRI-SCORE FREQUENTLY ASKED QUESTIONS. Scientific & Technical. Updatet 20/06/2019. www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=2ahUKEwiohaqh0aPjAhUSLFAKHVqUAWEQFjAAegQIABAC&url=https%3A%2F%2Fwww.santepubliquefrance.fr%2FMedia%2FFiles%2FNUTRISCORE%2FQuestions_reponses_EN&usg=AOvVaw0K6NME8oCNIvTNgtJiOsjg, Appendix 2, S. 10ff

the Community catering. They obviously do not belong to the circle of Nutri-Score users. Therefore, considerations to introduce this tool in the Community catering seem absurd. Nevertheless, there are companies that produce meals and dishes, stabilize and package them, and then sell them as high-convenience products to canteens and cafeterias. For these companies, a favorable evaluation of their dishes with Nutri-Score could be a sales argument.

2.2.3 Tabular specifications for the evaluation

The identification of N-points that have a negative impact on health is defined in tabular form as follows[28]:

Punkte	Energie (kcal)	Zucker (g)	GFS[29] (g)	Natrium (mg)
0	≤ 80	≤ 4.5	≤ 1	≤ 90
1	> 80	> 4.5	> 1	> 90
2	> 160	> 9	> 2	> 180
3	> 240	> 13.5	> 3	> 270
4	> 320	> 18	> 4	> 360
5	> 400	> 22.5	> 5	> 450
6	> 480	> 27	> 6	> 540
7	> 560	> 31	> 7	> 630
8	> 640	> 36	> 8	> 720
9	> 720	> 40	> 9	> 810
10	> 800	> 45	> 10	> 900

Tab. 2.3: Limits for N-scores (nutritional score) from Nutri-Score

Limits for N-scores (nutritional score) from Nutri-Score:

Punkte	Früchte, Gemüse, Nüsse (%)	Ballaststoffe (g)	Protein (g)
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

Tab. 2.4: Limits for P-scores (nutritional score) from Nutri-Score

So far, we have been talking about the "normal" calculation of the Nutritional Score. However, there are also so-called adaptations, i.e. adjustments. These are used for cheese, fats and beverages. Reasons for the exceptions or different treatment in the calculation can be seen in the

28 Ebda, S. 26ff
29 GFS = gesättigte Fettsäuren

fact that no five categories can be formed which are necessary to assign the letters A-E. In the following, only the first two groups will be discussed, since an investigation for beverages is not provided.

On cheese:
It is noted that there is a strong correlation between protein and calcium content. Since calcium is not part of the mandatory declaration, protein is used as a substitute and as a counterpart to the negative factors of salt, energy and saturated fatty acids (SFA). Therefore, the protein content is evaluated in the case. Cheeses are divided into only three Nutri-Score classes instead of five. Reasons for this were not given, nor which classes they are. The calculation is based on the formula:

Cheese Nutritional Score = total N points - total P points

On fats/oils:
Although fats and oils would end up in the worst category (E) according to the original FSA score due to their high energy content, such an assessment is not made with the Nutri-Score approach because the Nutritional Guidelines are not sufficiently taken into account. These also take into account the type of fatty acids, paying particular attention to GFS, which should be as low a proportion as possible. Therefore, the assessment of fats or oils is based on the proportion of IFTs in the total fat. Previously, only the content of GFS was used. A table has also been developed for this evaluation approach:

Punkte	Anteil der gesättigten Fettsäuren (%)	Punkte	Anteil der gesättigten Fettsäuren (%)
0	<10	**6**	<46
1	<16	**7**	<52
2	<22	**8**	<58
3	<28	**9**	<64
4	<34	**10**	≥64
5	<40		

Tab. 2.5: Limits for N-points (nutritional score) of Nutri-Score for fats

There is no other assessment criterion, e.g. the ratio of the various fatty acid groups or the vitamin E content. However, the nutritional recommendations for the intake of fatty acids go beyond the JRC content, which is why limiting the assessment to the JRC must be described as too one-sided.

The assessment with Nutri-Score is mainly about individual and packaged foods, which have to be labeled according to LMIV. As is well known, ready-to-eat meals can also be purchased in supermarkets (mostly frozen or canned), to which the rating system is also applied. The evaluation of dishes with Nutri-Score should therefore lead to useful results that provide orientation for the customer. This additional evaluation of dishes and meals is a major reason why the informative value of Nutri-Score is examined here.

An Excel spreadsheet is provided by a French governmental organization to generate Nutritional scores and Nutri scores including traffic light colors[30].

2.3 Critical comments on the determination of the Nutri-Score

The specifications for determining the Nutri-Score are associated with ambiguities and questionable points, which are briefly described below - without any claim to completeness.

1) The specifications for the number ranges are unclear, since nothing is said about how values in the borderline ranges, e.g. between 0 and -1, are assigned. For example, does the value of - 0.5 already belong to category "A" or still to "B"? Because of this lack of specifications, the procedure for this examination is defined in such a way that numerical values below a limit value are assigned to the category below. Thus, a Nutritional Score of < 0 is assigned to category "A". Similarly, cutoff scores between 2 and 3 (< 3="B"), 10 and 11 (< 11="C"), and 18 and 19 (< 19="D") are treated in the same manner.

2) The scores, Nutritional Scores, are determined for six nutrients and three food groups (Table 2.1). Although the selection and scoring of nutrients are related to the accepted UK FSA score, they are still inconclusive. For an evaluation of the quality of the fats and oils used, not only the proportion of saturated fatty acids should be negative, but also the unsaturated fatty acids would have to be taken into account. As is well known, it is recommended that the three fatty acid groups be in a certain ratio to each other[31]. In addition, information on the n3 fatty acids would be desirable, since they are usually ingested in Germany in too small quantities and there is an unfavorable quantitative relationship to the n6 fatty acids. The n3 fatty acids are not listed in paragraph 2 of Art. 30 of the LMIV, where the labeling is regulated. Therefore, they must not be labeled at all. The same applies, for example, to the trans fatty acids, whose content would also be interesting. The ratio of the three fatty acid groups to each other can only be determined via nutrition labeling. The prohibition of the labeling of n3 fatty acids thus prevents valuable information and is therefore to be seen as a weakness of the evaluation of Nutri-Score, which can only evaluate on the basis of the labeling elements according to the LMIV. The fatty acid groups may be declared in any case and would thus be available. Nevertheless, an evaluation of the other fatty acids is waived.

3) It is astonishing that the high-fat and high-energy "nuts" are lumped together with the low-caloric group "fruits and vegetables incl. legumes" and insofar treated in the same way. The achievable points of a food or dish (and thus the Nutri-Score) depends on the proportion of these Food-groups. This means that, for example, a 50% share of vegetables will score the same as nuts. However, a balance is created in the evaluation via the energy content and the proportion of GFS, so that a high proportion of nuts would nevertheless have a negative effect. Nevertheless, the question must be asked why only these three Food-groups are included in the evaluation. What about whole grains, fish or dairy products, to name only the most important Food-groups? These are very valuable foods whose consumption is recommended in

30 Nationale französische Gesundheitsagentur Santé publique France. Nutri-Score. https://www.santepubliquefrance.fr/en/nutri-score
31 GFS:EUF:MUF=<33:>33:<33

all dietary guidelines around the world. For the evaluation of the Nutri-Score they play at best indirectly - via nutrient content - a role.

In any case, these Food-groups have a positive impact on health and thus deserve a bonus. Thus, calcium content could be taken into account by a bonus scheme for the proportion of dairy products, and not only for cheese. Moreover, the statement that protein content is strictly linked to calcium content, even for cheese, is quite uncertain. For example, sour milk cheese (Harz cheese) has one of the highest protein contents of all and yet does not contain more calcium than milk. Including all dairy products in the assessment would therefore be a better criterion than restricting it to cheese by the indirect route of protein content. The calcium content of other protein-rich foods is sometimes very low. Consider, for example, meat or fish, which contain only marginal amounts of calcium. Furthermore, it must be asked whether the focus on calcium in dairy products is sufficient for an evaluation, because these Food-groups are also characterized by other valuable components.

4) There is also the question of whether, instead of a bonus for some foods, a malus should be given for others. One could think, for example, of meat, which, due to the increased cancer risk associated with red meat, has disadvantages that cannot be measured in terms of nutrients. The quality differences in cereal products do not only refer to the fiber content, which is used exclusively as a differentiation criterion with Nutri-Score. It is questionable whether this criterion adequately captures the differences in value, which remains to be seen through this research.

5) Certain foods are excluded from the calculation. This is true, for example, for different starches. Legumes belong to the bonus group (vegetables, fruits, etc.). However, legume flours are not included. Yet there are numerous recipes using these flours. For example, if a dish is prepared with chickpeas, they receive a bonus. However, if the flour of chickpeas is used, for example, to make falaffles, no bonus points may be credited. In this case, the difference lies only in a slightly higher loss of micronutrients due to the process of flour production. The exclusion of flours in the bonus scheme is therefore not understandable.

6) The upper point limits for positive and negative nutritional elements appear arbitrary. For example, the favorable elements are rated at 0-5 points, while the unfavorable ones are rated at twice the range, i.e., 0-10 points. From what does it follow that, for example, a sodium content of approx. 0.5 g is equivalent to >80 % vegetables, i.e. it is evaluated with the same number of points of 5, sometimes as addition, sometimes as subtraction? If even 1 g of sodium is ingested (=2.5 g of salt), even 10 points would be deducted.

That this value is by no means unrealistic is shown by a look at the nutritional value tables, where salted herring in particular can contain up to 12 g/100 g salt[32]. Most types of sausage contain between 2 and 6 g of salt per 100 g, thus usually exceeding the above-mentioned maximum value. If we then consider that a higher consumption of fruits and vegetables has been highly recommended internationally for a long time[33], because these foods are very valuable

32 Heseker, Heseker: Die Nährwerttabelle der DGE. 4. Aufl. 2016/2017, Umschau-Verlag, S. 94
33 DGE: 5 am Tag. www.dge.de/ernaehrungspraxis/vollwertige-ernaehrung/5-am-tag/

for numerous reasons and many people eat too little of them, a high consumption of these foods should have a greater impact than the consumption of salt or even GFS.

On the other hand, it is difficult to compare and evaluate different food or nutrient groups. Therefore, the DGE has strictly rejected such a cross-pyramid comparison in the concept of the 3D food pyramid[34]. It can be argued, however, whether this attitude is purposeful for the overall evaluation of meals, dishes or even meal plans, because in the end they usually consist of differently composed foods. How then does one want to evaluate such objects? Without a summary of the different qualities, it is hardly possible to derive useful statements. In Nutri-Score, such a cross-group evaluation is carried out in any case, since meals and dishes are also assigned a letter.

7) Since the products that are labeled with Nutri-Score are packaged foods that are offered in food retail, it is necessary for certain products to still be cooked. This finishing can change the nutritional value of the products, so that this can result in a different rating for the Nutri-Score. This can be seen, for example, with French fries, which are usually purchased as frozen goods. This product contains only little fat and can therefore be evaluated favorably. However, if they are deep-fried, the fat content can increase rapidly, depending on the method of preparation.

The official answers in the Nutri-Score FAQ manual on this are to point out that the Nutri-Score can change by 1-2 values. This is a very inaccurate statement, which cannot be made otherwise simply because of the different conditions during the final preparation. In order to avoid these inaccuracies, the data would have to refer to precisely specified preparation methods, so that the Nutri-Score data could be classified as safe if these conditions were met. However, they are not.

8) As shown, various arbitrary definitions have been made in Nutri-Score, the meaningfulness of which can only be judged if the assessment results are compared with one or more other instruments that serve as a reference. Whether and to what extent an assessment concept with all its specifications is justified can therefore only be recognized by a validation, which is possible with the help of the nutritional value calculation in connection with international food recommendations of professional societies.

Therefore, if there is uncertainty as to whether a system plausibly represents reality, these two instruments can help to provide clarity. The statements of the scoring system and the reference system should be largely consistent. This seems to have been done in the case of Nutri-Score, because it is repeatedly referred to (see chapter 1). The author is not aware of such nutritional calculation and plausibility checks, at least not for the area of Community catering, i.e. for food and beverages.

Therefore, one has to ask why the algorithms or exact assessment methods are not made easily accessible and explained so that the interested person can quickly find and apply them? This does not mean a few example calculations for certain products for which special rules apply, such as dried fruits. Perhaps the algorithms can be found in French sources, but they could

34 Jungvogel A, Michel M: Die Dreidimensionale Lebensmittelpyramide. Fachinformation. Herausgeber: aid und DGE. DCM Druck Meckenheim GmbH, Köln, 6. Aufl. 2016, 22 S.

not be discovered through an Internet search. The question is therefore, with which instrument should the Nutri-Score be determined and by whom? It should be possible for every food producer to calculate the Nutri-Score for his products himself. Then poor results could be identified and improved. The more complicated the determination of a key figure is, the more important it would be to provide and explain clear and comprehensible rules. An Excel file to help determine the Nutri-Score has been made available on a website of the French national health agency Santé publique France. Furthermore, guidance from the BMEL will help interested users to evaluate their products[35].

2.4 Preliminary conclusion

The description of how the Nutri-Score is determined has shown that the evaluation processes are anything but plausible, i.e. comprehensible. On the contrary, they exhibit a high degree of complexity in several respects. Questions have been raised that could not be clarified, or only unsatisfactorily, even by studying the extensive FAQ manual. Rather, it raised even more questions. Despite the meticulous specifications, it has not always become clear how to proceed in order to determine the Nutri score.

The critical comments on the Nutri-Score approach are intended to illustrate that doubts about the plausibility of the results are justified. This applies to the definitions of the criteria and the achievable point ranges. Whether such determinations are meaningful for an evaluation can only be seen when the results are subjected to a validity test. The conditions may be scientifically sound. This alone does not guarantee plausible results. Rather, what is important is whether all essential aspects have been taken into account in the evaluation.

Only if the results obtained are in line with proven assessment tools and recommendations, i.e. with nutritional value calculation and international guidelines for food selection, such as the DGE, can an assessment model pass the acid test. This is to be found out by the following investigation.

3. Procedure for the evaluation of the Nutri-Score

3.1 Determination of the test objects and backgrounds

3.1.1 Menu optimization

We start with a menu consisting of a fish dish, a starch side dish, a salad and a dessert, which is optimized step by step.

Initially, a very unfavorable composition of the menu is assumed, whereby in particular the fat content and thus also the energy content is very high and therefore a correspondingly low nutrient density is assumed. This is determined with nutrient value calculations. The initial menu is calculated and evaluated once with coconut fat (rich in saturated fatty acids) and secondly with rapeseed oil (rich in unsaturated fatty acids) with otherwise unchanged components and quantities. From this initial menu, the individual meals are optimized over four

35 Rexroth A: Der neue Nutri-Score zur erweiterten Nährwertkennzeichnung. Ernährung im Fokus 04 2020, 256-261

stages, so that it is in a very good composition at the end. It is to be expected that the assessment tools will reflect this if they are able to deliver valid results.

So, based on nutritional recommendations, menus are created that are evaluated with the usual evaluation tool, the nutritional value calculation. On the basis of these calculations it should be shown that the conception for the stepwise optimization is correct, in that value-giving parameters improve ever further. In addition to the pure summation of the nutritional values of the individual ingredients of a recipe for a larger number of nutrients, actual-target comparisons are also carried out. This involves determining the extent to which reference values are achieved with the nutrient contents of the menus. As a reference, an average age group of the D-A-CH reference values is chosen, whose reference values are used once for the lunch and once for 1000 kJ (MJ). The reference values are available separately for both sexes. The mean values for both sexes are calculated as reference values and these are then used for comparison with the actual values. These results represent the reference values for the comparisons with the other two evaluation methods.

In the second step, the menus are evaluated with GTS. Finally, an assessment is made using the Nutri-Score system. The results of the different methods are compared with each other in terms of plausibility. Given the changes of the menu from one extreme to the other, it is expected that all evaluation levels are represented. The worst menu should receive the worst rating of all possible rating levels of the respective system and vice versa.

3.1.2 Various menu sets

Since the first phase of the study only deals with one specific menu, the second phase will examine how differently composed menus are evaluated. Thus, a greater variety of foods will be worked with, so that the evaluation of the systems is on a broader basis.

Pairs of dishes are formed that essentially have the same composition, but contain ingredients of different value, e.g. pizzas or pasta dishes with and without whole grains, with and without meat, or with few and many vegetables. The diversity is also noticeable in the preparation methods, with different amounts of fat being used. If there are major differences in the evaluation of these menus or dishes, a third menu is developed that represents an average of the two extremes.

Again, all evaluation methods are used in this investigation, as described in point 3.1.1.

3.2 Assessment tools

The instruments described below are used to determine the results and their evaluations.

- Nutritional value calculation program EwB-gastro©

- Federal food code 3.02

- Gastronomic traffic light system (GTS)

- Determination of the Nutri-Score

- Reference values for nutrient intake

- International recommendations for a complete diet (Nutritional Guidelines)

3.2.1 Nutrient calculation program and BLS

The nutritional value calculations were performed on the basis of the Federal Food Code (BLS 3.02) maintained by the Federal Ministry of Food and Agriculture (BMEL). This is the latest version[36]. The special gastronomic software EwB-gastro[37] was used to process the nutritional values. With this software it is possible to display the calculation results with any combination of nutrients and dimensions, to compare them with the official reference values, to take into account any proportions for men and women, to define specific target groups and to base the comparison on them. It is also necessary to establish different comparative references for the dishes (weight of the dish or its energy content=nutrient density) and to combine them with any percentages of the daily reference values.

In the printouts of the results of the nutritional value calculations, the target values below the total line refer to the reference values for lunch in canteens, i.e. to an age range of 19-65 years. The reference value for a lunch in company canteens is given by the DGE in the corresponding quality standards[38] with a percentage of 33% of the daily reference values, which was also used for the calculations.

A total of 18 nutrients are taken into account in the calculated menus, which exceeds the specifications in the DGE quality standards[39]. With the help of suitable software, the results of nutritional value calculations can be displayed according to the type and quantity of ingredients and the actual quantities can be compared with target quantities. However, this is not yet associated with an assessment. The problem of evaluations with nutritional value calculations was discussed in detail in a special publication[40]. Guests or kitchen specialists do not yet receive any action orientation with it. However, with the help of nutritional knowledge, which is laid down in nutritional recommendations of the professional societies, statements about the quality of the meals and dishes can be derived. This is done in the context of this study.

3.2.2 Gastronomic traffic light system (GTS)

This instrument evaluates individual meals, dishes and menus up to meal plans. The evaluation procedure has been described in great detail[41]. It has already been used in the Community catering since 2010 with growing success and distribution. Pilot operations were two large student unions as well as two headquarters of the insurance industry[42,43]. In the meantime, it is used in well-known companies of different industries and their branches[44], in total currently in more than 50 kitchens nationwide.

With GTS, dishes and meals are labeled with traffic light symbols. This provides guests and kitchen staff with valuable information for selecting meals or optimizing recipes. In addition to these application-related effects, it has been demonstrated in extensive studies using practical

36 BMEL: Bundeslebensmittelschlüssel, Version 3.02. https://www.blsdb.de/
37 Peinelt V: EwB-gastro. Ernährungswissenschaftliche Berechnungen für die Gastronomie. Entwicklung, Einsatz und Verfeinerung der Software in der GG seit 1985.
38 DGE (Hrsg): DGE-Qualitätsstandard für die Betriebsverpflegung. Job&Fit. DGE Bonn, 02/2015, 48 S.
39 DGE (Hrsg): DGE-Qualitätsstandard für die Betriebsverpflegung. Job&Fit. DGE Bonn, 02/2015, 48 S., s. Kap. 7
40 Peinelt V: Probleme mit Nährwertberechnungen. Langfassung. https://ewd-gastro.jimdo.com/gas/probleme-mit-nwb/
41 Peinelt V: Gastronomic Traffic Light System. Longversion. https://ewd-gastro.jimdo.com/gas/beschreibung/longversion/
42 Pflug G: GAS im SW-Berlin. Erfahrungsbericht. https://ewd-gastro.jimdo.com/gas/beschreibung/erfahrungsbericht/
43 Pflug et al.: Kap. 58: Gastronomisches Ampelsystem II, Erfahrungsberichte. Band 2, S. 1597-1632, in: Peinelt V, Wetterau J: Handbuch der Gemeinschaftsgastronomie. Anforderungen, Umsetzungsprobleme, Lösungkonzepte. Rhombos-Verlag, 2. Aufl., 2016, 1642 S.
44 GESOCA: Referenzen. gesoca.de/ueber-uns/referenzen/

approaches[45] that the ratings correspond very well with the results of nutritional value calculations. In contrast to nutritional value calculations, with GTS the dishes are presented with a numerical value and with a traffic light color, which makes it possible to make clear and differentiated statements about quality that are helpful for guests and kitchen staff alike.

GTS is therefore the reference against which other assessment instruments, such as Nutri-Score, must be measured in the field of Community catering. If other instruments validly indicate food quality, they would have to come to similar results as GTS, whose results - as mentioned - have a very good correlation with nutritional calculations. The evaluation for the test objects always refers to 100 g. If recipes are available, the portion quantities are converted to 100 g.

3.2.3 Evaluation method for Nutri-Score

To determine the Nutritional score (total score) as well as the Nutri score (letter), an Excel table was created containing the negative (N) and positive (P) elements. Here, the standard score is used as a basis. The N and P scores are determined as specified in the relevant specifications[46] and presented in Tables 2.3 and 2.4 in Chap. 2. Pure fats/oils as well as cheese and beverages are not evaluated separately, so that the special specifications for these do not have to be observed.

For each menu or dish, the corresponding data are provided for the entire recipe and, derived from this, per 100 g. From the data determined in this way, the Nutritional Score and the Nutri Score are calculated using a specially developed algorithm. These determinations are made using the Excel program. The evaluation basis of 100 g thus corresponds to GTS. The algorithm used here was compared with the results of the Excel file of the French national health agency Santé publique France as well as with products from the trade that were given a Nutri-Score. The results were identical.

3.2.4 Reference values for nutrient intake

The significance of Nutri-Score and GTS is compared with each other. This is done on the basis of nutritional value calculations. The nutritional values of the test objects (menus) are not only calculated, but also compared with reference values ("target values"). The D-A-CH reference values in the current version[47] are used for this purpose. In addition to the energy content, 16 nutrients are used for comparison. The comparison is made once in relation to a standard lunch and then in relation to the nutrient density (MJ=1000 kJ).

The significance of the nutrient density is greater, since it is ultimately important that the recommended nutrient amounts are also consumed with the energy intake. A guest will often not eat the standard amount, for which there are many reasons. It would be important that the foods he eats have adequate nutrient density. Lunch in particular can be designed in a particularly favorable way, so that a surplus of valuable nutrients can be realized. This would allow

45 Peinelt V: Bewertung von 4-Wochen-Modellspeisplänen. GAS im Vergleich zu Nährwertberechnungen. https://ewd-gastro.jimdo.com/gas/validierungen/4-wo-plan-modell/

46 NUTRI-SCORE FREQUENTLY ASKED QUESTIONS. Scientific & Technical. Updatet 20/06/2019. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=2ahUKEwiohaqh0aPjAhUSLFAKHVqUAWEQFjAAegQIABAC&url=https%3A%2F%2Fwww.santepublique-france.fr%2FMedia%2FFiles%2FNUTRISCORE%2FQuestions_reponses_EN&usg=AOvVaw0K6NME8oCNIvTNgtJiOsjg.

47 D-A-CH-Referenzwerte Referenzwerte für die Nährstoffzufuhr: https://www.dge.de/wissenschaft/referenzwerte. Fassung vom Nov. 2020

the consumption of less favorable foods on one occasion and still achieve a balanced diet. Therefore, when evaluating the menus, attention is paid to the degrees of fulfillment in nutrient density.

3.2.5 Nutritional Recommendations/Nutritional Guidelines

For the evaluation of plausibility, it is necessary to refer to recognized dietary recommendations, which will be briefly discussed in conclusion. Which foods are recommended, which should be eaten in larger or smaller quantities, or if possible not eaten at all, has been known for a long time and can be found in national and international nutrition recommendations or guidelines.

In this study, reference is made primarily to the statements of the DGE. These are primarily the "10 rules of the DGE"[48] and the "3D food pyramid of the DGE"[49]. Another important source are the American guidelines for 2015-2020[50]. These and many other publications worldwide agree in the essential statements, as a review has shown[51]. It is important to meet the energy requirements and to take in all essential nutrients. This is most likely to be achieved if foods are chosen from a wide range, with preference given to those with high nutrient density, especially vegetables and fruits, and whole grain-based cereal products. In the case of animal products, care should be taken to ensure a low fat content. In the case of oils and fats, the proportion of fatty acids is important, and the intake of saturated fatty acids should be minimized as far as possible.

With regard to the distribution of macronutrients, i.e. the energetic proportion of protein, fat and carbohydrates (nutritional value ratio), there are also very similar guidelines internationally, which provide for a clear limitation of protein and fat, while the largest proportion should be covered by high-quality carbohydrates. This distribution has been discussed again and again for some time, with an increase in the proportions of protein and fat being demanded, to the detriment of carbohydrates[52]. However, such an approach is rejected by all scientific societies worldwide.

The previous distribution recommendation is well founded[53,54] and has been repeatedly reviewed and confirmed. Certainly, the requirement of strict adherence to this distribution is not necessary. More important is the quality of the main nutrients. As an orientation, the recommended nutrient ratio still seems reasonable.

48 DGE: Vollwertig essen und trinken nach den 10 Regeln der DGE. www.dge.de/ernaehrungspraxis/vollwertige-ernaehrung/10-regeln-der-dge/
49 DGE: Die Dreidimensionale DGE-Lebensmittelpyramide. Presseinformation vom 27.9.2016. www.dge.de/fileadmin/public/doc/pm/2016/DGE-Pressemeldung-intern-07-2016-Fachinformation-LM-Pyramide.pdf
50 U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015 – 2020 Dietary Guidelines for Americans. 8th Edition. December 2015. Available at https://health.gov/dietaryguidelines/2015/guidelines/.
51 Peinelt V: Wissenschaftliche Basis von GAS. https://ewd-gastro.jimdo.com/gas/wissenschaftliche-basis/
52 Empfehlungen der DGE in der Kritik. aerzteblatt.de. 23.1.2017. www.aerzteblatt.de/nachrichten/72608/Empfehlungen-der-Deutschen-Gesellschaft-fuer-Ernaehrung-in-der-Kritik
53 Peinelt V: Low-Carb-Konzept vs. GAS. Stellungnahme und Hintergründe zu den NWR. https://ewd-gastro.jimdo.com/gas/low-carb/
54 DGE: Leitlinien zum Anteil von Fett und Kohlenhydraten. Hintergründe zu den Nährwertrelationen. https://ewd-gastro.jimdo.com/gas/low-carb/

4. Results menu optimization

4.1 Introduction

The first assessment approach is a menu with the usual components, namely a protein, vegetable and carbohydrate component. This composition, which is classic in Western industrial societies, is often supplemented by a salad or dessert. The portion amounts for the individual dishes and for the overall menu have been set reasonably realistically. However, the issue here is not how realistic this combination is, but how they are evaluated by the various instruments. The determination was based on the ascending principle, starting from an extremely unfavorable initial condition, which was then improved in stages. In total, four optimization levels were developed and evaluated.

The unfavorable composition of the initial menus is primarily due to the high fat content. Fish is breaded and fried in copious amounts of fat, resulting in maximum fat intake. The same is true for French fries, which has a maximum fat content due to deep frying. When deep-frying or frying breaded foods, a fat intake of 16% is used as a basis, a value that is frequently observed in practice. This percentage may be lower for certain foods. However, this is not important for this study, since the fat content of all instruments is to be evaluated at the same level. A value of 16% should be regarded as an extreme value, which is quite realistic for frying breaded foods or deep-frying. Standard values have also been set for other cooking methods containing fat, with a distinction being made between medium-fat and low-fat. Such standardization is useful to see how well the various evaluation methods are able to assess the quality of the menus.

In addition to the high fat content in the initial menu, coconut fat with an extremely high saturated fat content is used (85%). This was determined to have an impact on the Nutri-Score score, as Nutri-Score is negatively impacted by the saturated fat content. For comparison, the same menu was scored using a high quality vegetable oil instead of coconut fat. In the initial menu, the salad dressing used is also very rich in fat, as is the dessert. All of this serves to create an extremely unfavorable dish, which would have to be very clearly expressed in any valid evaluative instrument.

All of this may well be the case in reality, with many dishes containing no or very few vegetables, the consumption of which was still assumed here (salad). The inclusion of low-fat fish (pollock) is also a favorable assumption, since the fat content is higher in many meat dishes. The treatment of fish in fried and breaded form increases the fat content. It is the most common method of preparation, also for many meat dishes. The portion size for fish used as a basis corresponds to the usual consumption (150 g). The other portion sizes are also based on the usual, although this would not have been necessary for this study. On the other hand, if the portion weights were completely unrealistic, the validity of the evaluation would suffer. It could be said that such menus do not occur in practice, so that something would be evaluated that does not exist in this way. Therefore, the portion quantities are reasonably adapted to reality, whereby the initial menu certainly represents an extreme.

The presentation of the nutritional calculations first gives the ingredients of the menus and their quantities and then the nutritional values, the target or reference value of the lunch and the deviations. This is done once in absolute terms for a lunch and in terms of 1000 kJ (MJ). The deviations are thus presented in a double way and also treated accordingly during the dis-

cussion. This information is important in order to be able to make statements about the nutrient density.

4.2 Results of the nutritional calculation

Tab. 4.1: Grundmenü 0a (Kokosfett)

Zutaten	1 Portion(en)	Menge in g
1.	Seelachs, fettfrei gegart	150
2.	Kokosfett	24
3.	Pommes Frites, fettfrei gegart	200
4.	Kokosfett	30
5.	Blattgemüse, roh	70
6.	Salatsoße, fettreich	35
7.	Mousse au chocolat	150
Portionsmenge		659

	Ener kcal	Prot g	Fett g	GF g	Kh g	MoSa g	Disa g	Ball g	Mg mg	Ca mg	Fe mg	Zk mg	Na mg	VAÄ myg	VEÄ myg	VB1 myg	VB2 myg	FolÄ myg	VC mg
Rez	1555	50	118	72,1	75	1,6	35,7	9,4	237	211	13,8	3,3	422	88319922	382	1094	191	68	
Soll	677	34	23	7,5	85			9,9	107	330	4,1	3,6	495	256	4290	363	380	99	34
I/S-%	230	149	522	958	89			95	221	64	333	90	85	345	464	105	288	193	200
MJ	239	8	18	11,1	11	0,2	5,5	1,4	36	32	2,1	0,5	65	135	3057	59	168	29	10
Soll	239	12	8	2,7	30			3,5	38	118	1,5	1,3	178	91	1524	129	134	36	12
I/S-%	100	65	227	416	38			40	96	27	139	40	36	149	201	46	125	83	86

25-51 Jahre,50%-M/50%-F,P:F:K=13:68:19 (20:30:50),GF:EUF:MUF=64:21:15 (<33:>33:<33)

Tab. 4.2: Grundmenü 0b (Pflanzenöl)

Zutaten	1 Portion(en)	Menge in g
1.	Seelachs, fettfrei gegart	150
2.	Rapsöl	24
3.	Pommes Frites, fettfrei gegart	200
4.	Rapsöl	30
5.	Blattgemüse, roh	70
6.	Salatsoße, fettreich	35
7.	Mousse au chocolat	150
Portionsmenge		659

	Ener kcal	Prot g	Fett g	GF g	Kh g	MoSa g	Disa g	Ball g	Mg mg	Ca mg	Fe mg	Zk mg	Na mg	VAÄ myg	VEÄ myg	VB1 myg	VB2 myg	FolÄ myg	VC mg
Rez	1555	50	118	31,4	75	1,6	35,7	9,4	237	211	13,8	3,3	422	89052522	382	1094	191	68	
Soll	677	34	23	7,5	85			9,9	107	330	4,1	3,6	495	256	4290	363	380	99	34
I/S-%	230	148	522	418	89			95	221	64	334	91	85	348	1224	105	288	193	200
MJ	239	8	18	4,8	12	0,2	5,5	1,4	36	32	2,1	0,5	65	137	8067	59	168	29	10
Soll	239	12	8	2,7	30			3,5	38	118	1,5	1,3	178	91	1524	129	134	36	12
I/S-%	100	64	227	182	39			41	96	27	139	40	36	151	529	46	125	83	87

25-51 Jahre,50%-M/50%-F,P:F:K=13:68:19 (20:30:50),GF:EUF:MUF=28:31:41 (<33:>33:<33)

Explanation of the 1st optimization

The optimization now starting is based on the initial menu with vegetable oils, as these oils are normally used. In the first optimization step, the very high-fat preparation of the fish was replaced by a medium-fat one. In addition, the high-fat salad dressing was replaced with a low-fat one. The portion weight for the dessert was also reduced.

Tab. 4.3: Menü 1. Optimierung

Zutaten	1 Portion(en)	Menge in g
1.	Seelachs, mittelfett	150
2.	Rapsöl	13
3.	Pommes Frites, fettreich	200
4.	Rapsöl	30
5.	Blattgemüse, roh	100
6.	Salatsoße, fettarm	50
7.	Mousse au chocolat	100
Portionsmenge		643

	Ener kcal	Prot g	Fett g	GF g	Kh g	MoSa g	Disa g	Ball g	Mg mg	Ca mg	Fe mg	Zk mg	Na mg	VAÄ myg	VEÄ myg	VB1 myg	VB2 myg	FolÄ myg	VC mg
Rez	1183	49	81	24,7	65	1,7	25,7	8,2	219	238	11,5	3,0	341	104833179		431	1125	219	86
Soll	677	34	23	7,5	85			9,9	107	330	4,1	3,6	495	256	4290	363	380	99	34
I/S-%	175	144	359	328	77			83	204	72	278	83	69	410	773	119	297	221	254
MJ	238	10	16	5,0	13	0,3	5,2	1,7	44	48	2,3	0,6	69	211	6684	87	227	44	17
Soll	239	12	8	2,7	30			3,5	38	118	1,5	1,3	178	91	1524	129	134	36	12
I/S-%	100	82	204	187	44			46	116	40	153	48	39	233	439	67	169	124	144

25-51 Jahre,50%-M/50%-F,P:F:K=16:62:22 (20:30:50),GF:EUF:MUF=32:31:37 (<33:>33:<33)

Explanation of the 2nd optimization

In the next optimization step, the amount of fat used in the preparation of French fries was reduced. In this optimization, the fries were prepared in a combi steamer instead of a deep fryer, which means that only a small amount of fat remains in the fries. Further, the serving weight of leafy greens was slightly increased, which should improve nutrient density. The lower-fat dessert also has a beneficial effect in this regard.

Tab. 4.4: Menü 2. Optimierung

Zutaten	1 Portion(en)	Menge in g
1.	Seelachs, fettarm	150
2.	Rapsöl	13
3.	Pommes Frites, fettarm	200
4.	Rapsöl	10
5.	Blattgemüse, roh	120
6.	Salatsoße, fettarm	50
7.	Bayerische Creme	100
Portionsmenge		643

	Ener kcal	Prot g	Fett g	GF g	Kh g	MoSa g	Disa g	Ball g	Mg mg	Ca mg	Fe mg	Zk mg	Na mg	VAÄ myg	VEÄ myg	VB1 myg	VB2 myg	FolÄ myg	VC mg
Rez	919	47	52	16,8	63	1,7	24,0	5,3	167	283	6,4	2,5	309	121520460		444	1170	225	97
Soll	677	34	23	7,5	85			9,9	107	330	4,1	3,6	495	256	4290	363	380	99	34
I/S-%	136	140	231	224	74			53	156	86	155	68	62	475	477	122	308	227	285
MJ	240	12	14	4,4	16	0,4	6,2	1,4	44	74	1,7	0,6	80	317	5330	116	305	59	25
Soll	239	12	8	2,7	30			3,5	38	118	1,5	1,3	178	91	1524	129	134	36	12
I/S-%	100	103	170	165	55			39	114	62	109	51	45	349	350	90	228	165	209

25-51 Jahre,50%-M/50%-F,P:F:K=21:51:27 (20:30:50),GF:EUF:MUF=34:31:35 (<33:>33:<33)

Explanation of the 3rd optimization

In the 3rd optimization, the French fries are replaced by boiled potatoes and the amount of fat in the preparation of the fish is further reduced (grilling with little fat), which again leads to a

significant reduction in the amount of fat. Replacing Bavarian cream with a chocolate flummery further reduces the amount of fat, the amount of which was slightly increased to keep the total amount about the same.

Tab. 4.5: Menü 3. Optimierung

Zutaten	1 Portion(en)	Menge in g
1.	Seelachs, fettarm gegart	150
2.	Rapsöl	6
3.	Kartoffeln, gedämpft	200
4.	Blattgemüse, roh	120
5.	Salatmarinade, Sauerrahm 20%	50
6.	Schokoladenflammeri	125
Portionsmenge		651

	Ener kcal	Prot g	Fett g	GF g	Kh g	MoSa g	Disa g	Ball g	Mg mg	Ca mg	Fe mg	Zk mg	Na mg	VAÄ myg	VEÄ myg	VB1 myg	VB2 myg	FolÄ myg	VC mg
Rez	651	41	25	9,7	63	1,7	23,4	6,7	202	299	7,3	2,5	508	1120	9127	456	1094	221	118
Soll	677	34	23	7,5	85			9,9	107	330	4,1	3,6	495	256	4290	363	380	99	34
I/S-%	96	122	110	129	74			67	188	91	177	68	103	438	213	126	288	224	348
MJ	240	15	9	3,6	23	0,6	8,6	2,5	74	110	2,7	0,9	187	412	3362	168	403	82	43
Soll	239	12	8	2,7	30			3,5	38	118	1,5	1,3	178	91	1524	129	134	36	12
I/S-%	100	127	115	134	77			69	195	93	177	72	105	455	221	130	301	230	360

25-51 Jahre,50%-M/50%-F,P:F:K=25:34:38 (20:30:50),GF:EUF:MUF=41:31:28 (<33:>33:<33)

Explanation of the 4th optimization

In the final optimization stage, the preparation of the fish was first changed to fat-free cooking such as steaming. Furthermore, the portion size for the salad was increased a little more and the fat content of the salad dressing was reduced. Finally, the chocolate pudding was replaced by a fruit salad.

Tab. 4.6: Menü 4. Optimierung

Zutaten	1 Portion(en)	Menge in g
1.	Seelachs, fettarm gegart	150
2.	Kartoffeln, gedämpft	200
3.	Blattgemüse, roh	150
4.	Salatmarinade m. Joghurt	50
5.	Obstmischung, roh	100
Portionsmenge		650

	Ener kcal	Prot g	Fett g	GF g	Kh g	MoSa g	Disa g	Ball g	Mg mg	Ca mg	Fe mg	Zk mg	Na mg	VAÄ myg	VEÄ myg	VB1 myg	VB2 myg	FolÄ myg	VC mg
Rez	507	44	8	2,4	61	8,6	15,5	8,4	208	267	6,8	2,1	468	1235	5467	488	1151	267	151
Soll	677	34	23	7,5	85			9,9	107	330	4,1	3,6	495	256	4290	363	380	99	34
I/S-%	75	131	34	32	72			85	194	81	163	56	95	483	127	134	303	269	445
MJ	240	21	4	1,1	29	4,1	7,3	4,0	98	126	3,2	1,0	222	585	2588	231	545	126	71
Soll	239	12	8	2,7	30			3,5	38	118	1,5	1,3	178	91	1524	129	134	36	12
I/S-%	100	175	46	43	96			112	258	107	211	77	125	645	170	179	407	355	593

25-51 Jahre,50%-M/50%-F,P:F:K=35:14:48 (20:30:50),GF:EUF:MUF=32:29:38 (<33:>33:<33)

4.3 Results of menu optimization with GTS

The changes from step to step are shown with a red fill color. The column with the GTS results per 100 g is marked in double way, once as traffic light color and secondly as GTS numerical values. The limits of the traffic light color for GTS are:

GTS-Points	Traffic light color
<1,75	red
1,75 - <3	yellow
≥ 3	green

Tab. 4.7: Valuation margins for GTS

With GTS it is possible to evaluate the preparation of the food as a lump sum by entering certain numbers for the cooking method, which lead to deductions of the quality values. In this case, both the quality and the quantity of fat used are calculated as a lump sum. The quantity depends on the cooking method. A certain quality value is assigned to the fat, which was determined via an algorithm based on various factors. The types of fat and quantities used were shown in the following tables for all menus.

Ausgangsmenü (Kokosfett) Fischmenü	Qualität (#0-4)	Garen (#0-4)	Fett (in %)	Zucker (in %)	Heißhalten (in h)	GAS-Wert	P-Menge (1=100)	Wert pro Speise
Seelachs, paniert, gegart	4	1	3,0	0,0		3,61	1,50	5,42
Kokosfett	0,4	1	100,0	0,0		-9,69	0,24	-2,33
Pommes frites, roh	3	1	0,0	0,9		2,87	2,00	5,73
Kokosfett	0,4	1	100,0	0,0		-9,69	0,30	-2,91
Blattsalat	5	0	0,0	0,5		4,98	0,70	3,48
Dressing, fettreich	2	0	65,0	1,9		-4,60	0,35	-1,61
Mousse au Chocolat	3	0	25,0	23,0		-0,65	1,50	-0,98
1.555 kcal					**GAS**	**1,03**	**6,59**	**6,81**

Tab. 4.8: GTS rating for the output menu (coconut fat)

Ausgangsmenü (Rapsöl) Fischmenü	Qualität (#0-4)	Garen (#0-4)	Fett (in %)	Zucker (in %)	Heißhalten (in h)	GAS-Wert	P-Menge (1=100)	Wert pro Speise
Fisch, paniert, fettreich	4	1	3,0	0,0		3,61	1,50	5,42
Rapsöl	4	1	100,0	0,0		-6,09	0,24	-1,46
Pommes frites, fettreich	3	1	0,0	0,9		2,87	2,00	5,73
Rapsöl	4	1	100,0	0,0		-6,09	0,30	-1,83
Salat	5	0	0,0	0,5		4,98	0,70	3,48
Dressing, fettreich	2	0	65,0	1,9		-4,60	0,35	-1,61
Mousse au Chocolat	3	0	25,0	23,0		-0,65	1,50	-0,98
1.555 kcal					**GAS**	**1,33**	**6,59**	**8,76**

Tab. 4.9: GTS evaluation for the output menu (vegetable oil)

1. Optimierung Fischmenü	Qualität (#0-4)	Garen (#0-4)	Fett (in %)	Zucker (in %)	Heißhalten (in h)	GAS-Wert	P-Menge (1=100)	Wert pro Speise
Fisch, fettarm	4	1	3,0	0,0		**3,61**	1,50	5,42
Rapsöl	4	0	100,0	0,0		**-6,00**	0,13	-0,78
Pommes frites, fettreich	3	1	0,0	0,9		**2,87**	2,00	5,73
Rapsöl	4	0	100,0	0,0		**-6,00**	0,30	-1,80
Salat	5	0	0,0	0,5		**4,98**	1,00	4,98
Dressing, fettarm	3	0	18,0	4,4		**0,98**	0,50	0,49
Mousse au Chocolat	3	0	25,0	23,0		**-0,65**	1,00	-0,65

Tab. 4.10: GTS evaluation for the 1st optimization of the menu

2. Optimierung Fischmenü	Qualität (#0-4)	Garen (#0-4)	Fett (in %)	Zucker (in %)	Heißhalten (in h)	GAS-Wert	P-Menge (1=100)	Wert pro Speise
Fisch, fettarm	4	1	3,0	0,0		**3,61**	1,50	5,42
Rapsöl	4	0	100,0	0,0		**-6,00**	0,13	-0,78
Pommes frites, fettarm	3	1	0,0	0,9		**2,87**	2,00	5,73
Rapsöl	4	0	100,0	0,0		**-6,00**	0,10	-0,60
Salat	5	0	0,0	0,5		**4,98**	1,20	5,97
Dressing, fettarm	3	0	18,0	4,4		**0,98**	0,50	0,49
Bayerisch Creme (fettreich)	3	1	16,0	21,1		**0,26**	1,00	0,26
919 kcal					**GAS**	**2,56**	**6,43**	**16,48**

Tab. 4.11: GTS rating for the 2nd optimization of the menu

3. Optimierung Fischmenü	Qualität (#0-4)	Garen (#0-4)	Fett (in %)	Zucker (in %)	Heißhalten (in h)	GAS-Wert	P-Menge (1=100)	Wert pro Speise
Fisch, sehr fettarm	4	1	3,0	0,0		**3,61**	1,50	5,42
Rapsöl	4	0	100,0	0,0		**-6,00**	0,06	-0,36
Kartoffeln, gedämpft	3	1	0,0	0,9		**2,87**	2,00	5,73
Blattsalat	5	0	0,0	0,5		**4,98**	1,20	5,97
Dressing, fettarm	3	0	18,0	4,4		**0,98**	0,50	0,49
Schokoladenflammeri	3	1	5,0	15,7		**1,63**	1,00	1,63
676 kcal					**Summe:**	**3,01**	**6,26**	**18,87**

Tab. 4.12: GTS evaluation for the 3rd optimization of the menu

4. Optimierung Fischmenü	Qualität (#0-4)	Garen (#0-4)	Fett (in %)	Zucker (in %)	Heißhalten (in h)	GAS-Wert	P-Menge (1=100)	Wert pro Speise
Fisch, fettarm	4	1	3,0	0,0		**3,61**	1,50	5,42
Kartoffeln, gedämpft	3	1	0,0	0,9		**2,87**	2,00	5,73
Blattsalat	5	0	0,0	0,5		**4,98**	1,50	7,46
Salatmarinade, sehr fettarm	3	0	6,0	7,4		**2,03**	0,50	1,02
Obstsalat	5	0	0,0	18,0		**4,10**	1,00	4,10
547 kcal					**Summe:**	**3,65**	**6,50**	**23,72**

Tab. 4.13: GTS evaluation for the 4rd optimization of the menu

4.4 Results with Nutri-Score

The calculated nutritional values were entered into the matrix for determining the N and P points, from which the Nutritional Score can be calculated, which in turn is the basis for assigning the letter of the Nutri-Score. The first lines in each case show the values of the entire recipe. One line below, the nutritional values for 100 g were shown. The determination of the Nutri-Score has to be done for 100 g. As Tab. 4.14 shows, Nutri-Score rates five of the six menus green. From the 2nd optimization onwards, Nutri-Score no longer shows any differences with regard to the letter assigned. Only the score still shows small differences. The last three menus are all rated "A".

Menü-Optimierung	Energie kcal	Zucker g	GFS g	Na mg	Protein g	Ballast g	Obst, Gem, Hülfrü, Nü %	Punkte pro 100g	P-Men g	Nutri-Score
Fisch, pan, gebr, Kokosöl	1555	37,3	72,1	422	50,0	9,4	10,6			
Fisch, pan, gebr, Kokosöl/100g	236	6	11	64	8	1,4	10,6	8,0	659	C
Fisch, pan, gebr, Rapsöl	1555	37,3	31,4	422	50,0	9,4	10,6			
Fisch, pan, gebr, Rapsöl/100g	236	6	5	64	8	1,4	10,6	2,0	659	B
Fisch, 1. Optimierung	1183	27,4	24,7	341	49,0	8,2	15,6			
Fisch, 1. Optimierung/100g	184	4	4	53	8	1,3	15,6	0,0	643	B
Fisch, 2. Optimierung	919	25,7	16,8	309	47,0	5,3	18,7			
Fisch, 2. Optimierung/100g	143	4	3	48	7	0,8	18,7	-1,0	643	A
Fisch, 3. Optimierung	651	25,1	9,7	508	41,0	6,7	19,2			
Fisch, 3. Optimierung/100g	104	4	2	81	7	1,1	19,2	-3,0	626	A
Fisch, 4. Optimierung	507	24,1	2,4	468	44,0	8,4	38,4			
Fisch, 4. Optimierung/100g	78	4	0	72	7	1,3	38,4	-5,0	650	A

Tab. 4.14: Nutri-Score for the optimization of a menu - Na content according to BLS 3.02

With the BLS, it is not always possible to find the prepared and salted food required for the test, e.g. French fries. The prepared foods found did not always have the desired fat and salt content. Thus, it can be assumed that the salt content and thus the sodium content was underestimated in the calculations. This has an impact on the evaluation with Nutri-Score, since the sodium content negatively influences the evaluation. The Nutri-Score therefore turns out to be too favorable.

For this reason, two supplements were calculated. In the first supplement, the salt content was set uniformly at 800 mg. This corresponds to 2 g NaCl, i.e. one third of the guideline value for one day, which corresponds to the recommendation for lunch. For comparison, twice the salt content was still used as a basis, i.e. 1,600 mg Na or 4 g NaCl. It can be assumed that the latter salt content is too high for lunch. The reason is to be seen in the fact that the bread meals with sausage, cheese and fish products such as herring salad are much more salted. Sausage and cheese are in the range of 2-4 g/100 g, fish often even higher, so that the salt intake from these bread toppings is higher than from a lunch. The two tables below show the results.

Menü-Optimierung	Energie kcal	Zucker g	GFS g	Na mg	Protein g	Ballast g	Obst, Gem, Hülfrü, Nü %	Punkte pro 100g	P-Men g	Nutri-Score
Fisch, pan, gebr, Kokosöl	1555	37,3	72,1	800	50,0	9,4	10,6			
Fisch, pan, gebr, Kokosöl/100g	236	6	11	121	8	1,4	10,6	9,0	659	C
Fisch, pan, gebr, Rapsöl	1555	37,3	31,4	800	50,0	9,4	10,6			
Fisch, pan, gebr, Rapsöl/100g	236	6	5	121	8	1,4	10,6	3,0	659	C
Fisch, 1. Optimierung	1183	27,4	24,7	800	49,0	8,2	15,6			
Fisch, 1. Optimierung/100g	184	4	4	124	8	1,3	15,6	1,0	643	B
Fisch, 2. Optimierung	919	25,7	16,8	800	47,0	5,3	18,7			
Fisch, 2. Optimierung/100g	143	4	3	124	7	0,8	18,7	0,0	643	B
Fisch, 3. Optimierung	651	25,1	9,7	800	41,0	6,7	19,2			
Fisch, 3. Optimierung/100g	104	4	2	128	7	1,1	19,2	-2,0	626	A
Fisch, 4. Optimierung	507	24,1	2,4	800	44,0	8,4	38,4			
Fisch, 4. Optimierung/100g	78	4	0	123	7	1,3	38,4	-4,0	650	A

Tab. 4.15: Nutri-Score for menus with standardized sodium content (800 mg Na)

Menü-Optimierung	Energie kcal	Zucker g	GFS g	Na mg	Protein g	Ballast g	Obst, Gem, Hülfrü, Nü %	Punkte pro 100g	P-Men g	Nutri-Score
Fisch, pan, gebr, Kokosöl	1555	37,3	72,1	1600	50,0	9,4	10,6			
Fisch, pan, gebr, Kokosöl/100g	236	6	11	243	8	1,4	10,6	10,0	659	C
Fisch, pan, gebr, Rapsöl	1555	37,3	31,4	1600	50,0	9,4	10,6			
Fisch, pan, gebr, Rapsöl/100g	236	6	5	243	8	1,4	10,6	4,0	659	C
Fisch, 1. Optimierung	1183	27,4	24,7	1600	49,0	8,2	15,6			
Fisch, 1. Optimierung/100g	184	4	4	249	8	1,3	15,6	2,0	643	B
Fisch, 2. Optimierung	919	25,7	16,8	1600	47,0	5,3	18,7			
Fisch, 2. Optimierung/100g	143	4	3	249	7	0,8	18,7	1,0	643	B
Fisch, 3. Optimierung	651	25,1	9,7	1600	41,0	6,7	19,2			
Fisch, 3. Optimierung/100g	104	4	2	256	7	1,1	19,2	-1,0	626	A
Fisch, 4. Optimierung	507	24,1	2,4	1600	44,0	8,4	38,4			
Fisch, 4. Optimierung/100g	78	4	0	246	7	1,3	38,4	-3,0	650	A

Tab. 4.16: Nutri-Score for menus with standardized sodium content (1.600 mg Na)

As can be seen, the differences in the Nutritional Score for the salt variants are only slight. The Nutritional Score goes up by one point in each case. This is due to the limits drawn by the developers of Nutri-Score. A point increase and thus deterioration is seen from 180 mg Na and then only again from 270 mg Na. As can be seen from Tab. 4.16, the upper value is not reached by any menu of the 2nd salt variant.

Since the value of 4 g NaCl/meal must be considered too high in practice, and the value of 2 g NaCl/meal should rather be regarded as a lower limit, a realistic value for menus should lie between these two limits. However, since the two salt variants do not differ in the letters assigned, it does not matter which variant is preferred. On the other hand, the salt variants differ only slightly from the first variant, which slightly underestimates the salt content. For the following discussion, the 1st salt variant with 2 g NaCl/lunch is assumed.

For comparison, the six menus were also evaluated using the Excel spreadsheet of the French National Health Agency[55]. that the results obtained with the Excel tool used here are the same as those obtained with the original table, which is why no further checks are carried out for other calculations.

5. Discussion menu optimization

5.1 Discussion output menu

5.1.1 Results of the output menus with the nutritional value calculation

The extreme amounts of fat in almost all dishes of the two initial menus are very clearly reflected in the results of the nutritional value calculations. The energy content is more than twice as high as the recommendation for a lunch according to the DGE quality standards. The deviation is particularly serious in the fat content, which is five times as high as recommended. The protein content is also significantly higher than the target value, although this can hardly be avoided in a menu with a protein-rich component such as fish or meat. Over a longer period of time, this could still be balanced out. The value for the nutritional value ratio for protein at 13en% (energy percent) is so favorable because the energy content is so high that the excessive protein content is within the relative recommendation. This shows that the NWR alone is not yet meaningful enough.

55 Santé publique France: Nutri-Score. http://www.santepubliquefrance.fr/determinants-de-sante/nutrition-et-activite-physique/articles/nutri-score

Very low is the proportion of carbohydrates, which should make up the largest proportion in a dish. The nutritional ratio thus deviates strongly from the recommendations, especially in favor of fat. Due to the extreme approach of using only coconut fat, which has a very high proportion of saturated fatty acids, the fatty acid spectrum is very unfavorably shifted, namely in favor of this fatty acid group. If vegetable oils are used instead of coconut oil, the fatty acid pattern is much better.

The micronutrient content of Menu 0a can reasonably meet the requirements related to a lunch. Despite the very high energy content, there are moderate to slight deficiencies in some minerals (64% for calcium). The target values for the vitamins considered here are met. Since this menu contains more than twice the recommended energy, reference to the recommended energy is more appropriate. Halving the nutrient contents shows that the number of deficient nutrients then increases significantly. Therefore, considerations based on nutrient density are important. As the rows below in Table 4.1 show, there are sometimes significant deficiencies (<50%) for more than half of the micronutrients. For calcium, the coverage even drops to 27%. Furthermore, the dietary fiber content is 60% below the guideline value.

The variant of the initial menu with vegetable oil can only be rated better with regard to the fatty acid spectrum and the vitamin E content. All other points of criticism of menu 0a also apply to this variant.

***Conclusion-1a**: As expected, the nutritional calculation for the initial menu shows a very poor result. It is far too high in fat and energy. In terms of nutrient density, more than half of the micronutrients do not reach the target values.*

5.1.2 Results of the output menus with GTS

With GTS, it is already very easy to see in terms of color that the red rating predominates. Overall, the initial menu achieves a deep red rating with a GTS value of 1 (coconut fat) to 1.3 (vegetable oil). Since a high fat content of the dishes is associated with high deductions in the GTS system, a rating better than red can also hardly be achieved. GTS differentiates whether rapeseed oil or coconut fat is used. Coconut fat, which is rated worse, reduces the overall rating to a GTS value of 1, while with rapeseed oil the negative rating is slowed down somewhat, so that the GTS value increases by a third of a point, but is still clearly in the red range.

The red rating for both menus is plausible because the energy and fat content is very high. For the quality of a menu, the criterion of energy density plays a more important role than the absolute values. If the energy density is high, the nutrient density for the micronutrients is correspondingly low and often does not reach the target values, as has also been shown here. The ingredients fish and salad have been rated green, but this cannot compensate for the negative effects of the high-fat other ingredients.

***Conclusion-1b**: GTS evaluates a very high-fat menu with few vegetables very negatively, i.e. red. This is plausible. The fat quality can be differentiated with GTS.*

5.1.3 Results of the output menus with Nutri-Score

The initial menu with a high content of coconut fat and a low fruit and vegetable content is rated "C" (yellow) by Nutri-Score, i.e. a medium rating. Based on 100 g, it makes a difference of 6

points whether a lot or little saturated fatty acids are contained. The initial menu with rapeseed oil receives a point value of 3.0 and is thus classified in category "C", which is exactly on the borderline between "green" and "yellow", i.e. significantly better than the menu with coconut fat. While this is plausible on the one hand, a dish with an energy content of 1,555 kcal and a correspondingly high fat content should not be rated green because of the negative effects of a high-calorie and very high-fat dish. This is even more true because the proportion of valuable foods such as fruits, vegetables and legumes is very low (10%).

The high amount of coconut fat resulted in 72 g of saturated fat in the first menu, by far the highest value of all the menus studied. A higher content can only be achieved in pure fats and oils. This most unfavorable of all menus, whose energy content corresponds to about three quarters of the daily energy value, cannot achieve a poor rating with Nutri-Score, which should have been expressed with the letter "E", or at least with "D". This is astonishing and completely implausible. It should be mentioned in addition that the initial menu with vegetable oil is also rated "C" for the salt variants.

Since menu 0a was designed extremely unfavorably and can hardly be worsened, it can be assumed that the average rating level "C" achieved for it is to be regarded as the lower limit for a menu rating with Nutri-Score. Ratings of menus thus lie between "A" and "C" and thus comprise only three levels. This is a spread that is also found in the usual traffic light rating. However, this three-light rating lacks the red traffic light color. Only green, light green and yellow are displayed. However, this is not understood to be a traffic light. Red apparently does not appear at all for courts. With Nutri-Score nevertheless straight a larger differentiation is to be made possible (A to E), which cannot be used however for menus obviously.

The fact that the rapeseed oil variant of this extreme menu, in which only the saturated fatty acid content is lower, receives a green rating (B) must basically be described as misleading. Such a menu must not be recommended, but this is expressed with a "B".

Conclusion-1c: Nutri-Score still rates even menus with a very high energy and fat content and few vegetables as green (B). This is misleading. The range seems to be only from green to yellow for menus. However, this is not a traffic light rating because red is missing.

5.2 Discussion 1. optimization

5.2.1 Results of the 1st optimization with the nutritional value calculation

With the changes of the 1st optimization, the energy and fat content has decreased significantly. The data can be found in Tab. 4.3. However, at almost 1,200 kcal, the energy content of this menu is still well above the target value. Despite the reduction, the fat content is still three times higher than recommended. On the other hand, the nutritional value ratio has improved somewhat, far from the recommendation. The fatty acid spectrum shows a good ratio.

The content of micronutrients in the menu is increased compared to the initial menu, so that only a few nutrients still show deficiencies. Less favorable again are the nutrient densities per 1000 kJ. The lowest value is 40% of the reference values (Ca). In contrast to the initial menu, the majority of the reference values are now met. The dietary fiber content is still significantly below the reference value at only 46%.

***Conclusion-2a**: The quality of this menu is still far from adequate, especially because the macronutrients and the energy content are still far too high. However, clear improvements can be seen compared to the initial menu.*

5.2.2 Results of the 1st optimization with GTS

The fat-reducing measures and the increase in the quantity of lettuce are reflected in a jump in quality of over half a point. The GTS score of 2.08 is now stable in the yellow range.

This rating expresses that there is still a lot of potential for improvement. A lot still needs to be done to reach the green limit of GTS=3.0. The more favorable contents of the micronutrients make the yellow rating by GTS appear justified.

***Conclusion-2b**: The better nutritional quality between the initial menu and the 1st optimization is well expressed with the yellow traffic light color of GTS.*

5.2.3 Results of the 1st optimization with Nutri-Score

The evaluation of the 1st optimization has resulted in only a small difference in the score per 100 g in Nutri-Score compared to the initial menu with rapeseed oil. This menu is now given a score of "+1", i.e. slightly better than the initial menu with rapeseed oil. The 1st optimization now receives a green "B" as the overall rating. The difference to the very high-fat initial menu is only expressed with 2 points, which can easily lead to a change of the letter due to the very narrow corridor between B and C (3 points), as happened here.

We do have a difference in nutri score here, but only a small difference in numbers, which does not do justice to the significant difference in energy and fat content. The green score for the 1st Optimization menu seems inappropriate given an energy content of nearly 1,200 kcal, as it still has significant weaknesses.

***Conclusion-2c**: Nutritional score shows only minor changes with Nutri-Score. The 1st optimization is rated "B" (green). At best, a medium rating would be appropriate here, i.e. yellow.*

5.3 Discussion 2. optimization

5.3.1 Results of the 2nd optimization with the nutritional value calculation

The optimization measures mean that the energy content of this menu has come closer to the target value, but at over 900 kcal is still well above the guideline value. The fat content is also more than twice as high, which is reflected in the nutritional value ratio. With the exception of calcium, zinc and dietary fiber, the contents per recipe are within the target range. The nutrient density could also be further increased, but the fulfillment levels related to 1000 kJ are significantly lower than the recipe-related ones. The mineral contents either only just meet or do not yet meet the requirements, while the vitamin contents are consistently above the target values. So even despite further optimization, this menu still reveals significant deficiencies in macro- and micronutrients.

<u>Conclusion-3a</u>: The menu of the 2nd optimization shows further improvements, which can be clearly seen with the nutritional value calculation. Nevertheless, weak points are still present.

5.3.2 Results of the 2nd optimization with GTS

Since GTS evaluates a reduction of fat favorably, it is not surprising that the evaluation of the 2nd optimization could be further improved compared to the 1st optimization. This can be clearly seen in the higher GTS value of now 2.56 compared to 2.08, i.e. a jump of half a point. This menu has thus reached the upper yellow range. This result is plausible, because compared to the 1st optimization, some positive changes have been made, but there are still weak points. Anyone who eats this menu has already made a good choice. But it could be a little better.

<u>Conclusion-3b</u>: The evaluation by GTS shows that the 2nd optimization has been further improved, but this is not yet satisfactory.

5.3.3 Results of the 2nd optimization with Nutri-Score

The Nutri score has improved a little in the 2nd optimization because of the significant reduction in fat content, from +1 to 0. With this minimal change in numbers, this menu has achieved a rating of "B", on the borderline of "A". This overall rating seems appropriate because there are still some weaknesses. Just think of the high energy content or the three times the amount of fat compared to the target value. The saturated fat content of over 16 g is also still relatively high.

Furthermore, it should be considered that this menu does not even contain 20% of valuable foods (fruits, vegetables, legumes). In a well-constituted menu, the proportion of these foods should be at least one-third. Especially at lunch, these foods can be integrated in higher proportions. Salads, cooked vegetables or desserts containing fruits are good and versatile to offer in a menu, so that a share of 50% in the total menu is also achievable. In this way, a lunch would greatly contribute to the "5 a day" rule[56], i.e. five servings of these foods per day. The low proportion of valuable foods in this menu should therefore not be rewarded with the best rating, which almost happened. With GTS, on the other hand, the rating with yellow is much more restrained, which does more justice to the actual weak points that still exist. Therefore, the rating with GTS is more plausible.

<u>Conclusion-3c</u>: After the 2nd optimization, Nutri-Score already awards grade "B", which only just misses the top grade "A". The rating seems a bit too good for various reasons.

5.4 Discussion 3. optimization

5.4.1 Results of the 3rd optimization with the nutritional value calculation

The changes made are noticeable in a further improvement in the nutritional content. This means that the guideline value for the energy content of a lunch is now well observed. The fat

56 DGE: Vollwertige Ernährung. https://www.dge.de/ernaehrungspraxis/vollwertige-ernaehrung/5-am-tag/

content in relation to the energy content is now 34%, which is still somewhat too high, but better than all previous menus. The fatty acid spectrum is still satisfactory.

The mineral content of the menu still has a few weaknesses, and the fiber content should also be increased somewhat. This already good impression is confirmed by the similar figures for nutrient density. The values for the vitamins are consistently in the green range. So this menu still has only a few weaknesses. However, not all parameters are optimally fulfilled yet.

Conclusion-4a: The nutrient contents show further progress in the quality of the menu. Improvement is now hardly possible.

5.4.2 Results of the 3rd optimization with GTS

The improvements can also be seen very well in the GTS rating. The GTS value jumped by almost half a point to a GTS value of 3.01. The menu is now in the green range, even if only just. GTS thus expresses that it is a very good menu, but that there must still be a few weak points due to the threshold value to the green range. This is also covered by the interpretation of the nutritional value calculations.

It is therefore a recommendable dish, although the amount of vegetables in the salad with a medium portion size cannot yet be described as optimal. The only criticism is really the dessert, which prevented an even better rating due to its high sugar content and medium quality.

The criticism of this already very good menu seems perhaps exaggerated. Therefore, a basic remark is allowed here: It is clear that a single menu does not have to meet the requirements in every respect. Only a few menus are capable of this at all. A weak point of a menu can be compensated for by other menus and vice versa with good menu planning. Requirements should be met over a period of time, such as four weeks.

The extent to which a meal plan meets the quantity recommendations for different food groups can be analyzed using a special tool[57] from GTS, which was not included in this study. If there are imbalances or "deficits" in individual food groups, e.g. defined in the quality standards of the DGE, this can be detected well with this tool, so that a readjustment is possible. In this case, the tool would inform that the amount of vegetables should still be increased. In this respect, GTS can be used to provide even more precise assessments and indications for improvements than is already possible with the traffic light labeling. However, this will not be discussed in more detail here.

Conclusion-4b: With GTS the repeated improvements are expressed appropriately. The 3rd optimization of the menu is now rated green, although small weak points are still visible due to the GTS value on the border to yellow.

5.4.3 Results of the 3rd optimization with Nutri-Score

With the 3rd optimization, Nutri-Score remains the same with the rating "A". The Nutritional Score rating increases from 0 to -2, since negative values are better for Nutri-Score. The improvements of the 3rd optimization are therefore recognizable here. The individual positions differ only marginally. Decisive for the top score is the lower energy content as well as less saturated fatty acids of this menu.

57 Peinelt V: Beschreibung von GAS. Langfassung. https://ewd-gastro.jimdo.com/gas/beschreibung/longversion, s. Kap. 9.2

<u>Conclusion-4c</u>: As expected, the 3rd optimization is rated "A", with the score changing from 0 of the 2nd optimization to -2. This is also plausible in view of the significant improvements, e.g. in energy content.

5.5 Discussion 4. optimization

5.5.1 Results of the 4th optimization with the nutritional value calculation

As expected, due to further fat reductions, the energy content has further decreased so that the menu is now below the guideline value for a lunch. However, an inadequate fat supply is unlikely throughout the day. The diet of industrialized societies is characterized by too much fat, not too little. Fat is supplied through other meals anyway, especially bread meals. Moreover, not all lunches are designed to be low in fat. In this respect, a concern about an undersupply of essential fatty acids seems unfounded.

As expected, the nutritional value ratio of this optimization is very low for fat, but can still be described as good overall. Due to a large amount of protein in the main dish, the protein content is relatively high, but this is not problematic over a longer period of time. The fatty acid spectrum is similarly favorable.

The nutrient density continues to increase with this optimization. With the exception of Vit. E, which is due to the higher fat content of the previous optimization, all micronutrient contents are higher than before. Thus, this 4th optimization was able to further improve the already quite good values of the 3rd optimization.

<u>Conclusion-5a</u>: The nutritional value calculation shows a superiority of the 4th optimization. This is clear for all criteria.

5.5.2 Results of the 4th optimization with GTS

GTS also indicates a further improvement of the 4th optimization over the 3rd optimization. The overall score increases from a GTS score of 3.01 to 3.65, an increase of over half a point. The essential evaluation approach of GTS is to evaluate high nutrient densities favorably, which is inevitably the case with low fat and sugar in combination with high-quality foods.

These are precisely the characteristics that the 4th optimization menu exhibits to an even greater degree than the other optimizations. Therefore, the rating with a score of over 3.6 is understandable and justified. Responsible for the better rating is the fat-free cooking method for the fish, fruit as a dessert as well as the higher portion size for the salad and the lower fat content of the marinade. It went thus still another piece upward.

Here it must be considered that GTS does not only evaluate the nutrient content. As explained in the detailed description of GTS, seven criteria are used to make an overall assessment[58]. The content of fruits and vegetables is of particular importance and this is also another reason why the menu of the 4th optimization scores even better. GTS goes thus beyond the borders of the pure nutrient value computation, an approach, which is represented by the way also with the 3D food pyramid of the DGE[59].

58 Peinelt V: Beschreibung von GAS - Langfassung. https://ewd-gastro.jimdo.com/gas/beschreibung/longversion, s. Kap. 3
59 Cremer M, Rademacher C: Die Dreidimensionale Lebensmittelpyramide. Fachinformation. Herausgeber: aid und DGE. Moeker Merkur Druck GmbH, Köln, 1. Aufl. 2005, 18 S.

If over a longer period of time certain food groups are contained in a meal plan in too low or too high amounts, this would be detected via the already mentioned analysis tool of GTS. This is also true for fat amounts, for example. A fat amount as low as assumed in this menu is unlikely, although possible in individual cases. In a normal, versatile meal plan with different preparation methods, such an ingredient analysis is not necessary in order to derive corrective measures.

***Conclusion-5b**: This menu deserves a very good rating for a variety of reasons, not just nutritional. Therefore, GTS rightly rates the menu highest.*

5.5.3 Results of the 4th optimization with Nutri-Score

As can be seen, there was again a small improvement in Nutri-Score, further consolidating the "A" rating, with Nutritional-Score dropping from -2 to -4, which in this case represents an improvement. However, the highest proportion of fruits and vegetables of all menus did not contribute to this (38% versus 10-20%), as a score increase only occurs above 40%. Given the high nutritional value of these foods, it is incomprehensible that they receive such a low positive score.

In any case, the better rating of Nutri-Score for the menu of the 4th optimization compared to the 3rd can be described as plausible. Here, Nutri-Score agrees with GTS.

***Conclusion-5c**: Like the 3rd optimization, the 4th optimization achieves the rating "A". The Nutrional score improves slightly. This rating is plausible.*

6. Graphical representation of the results

6.1 Nutritional calculations

The macronutrient contents of all menus are shown graphically below.

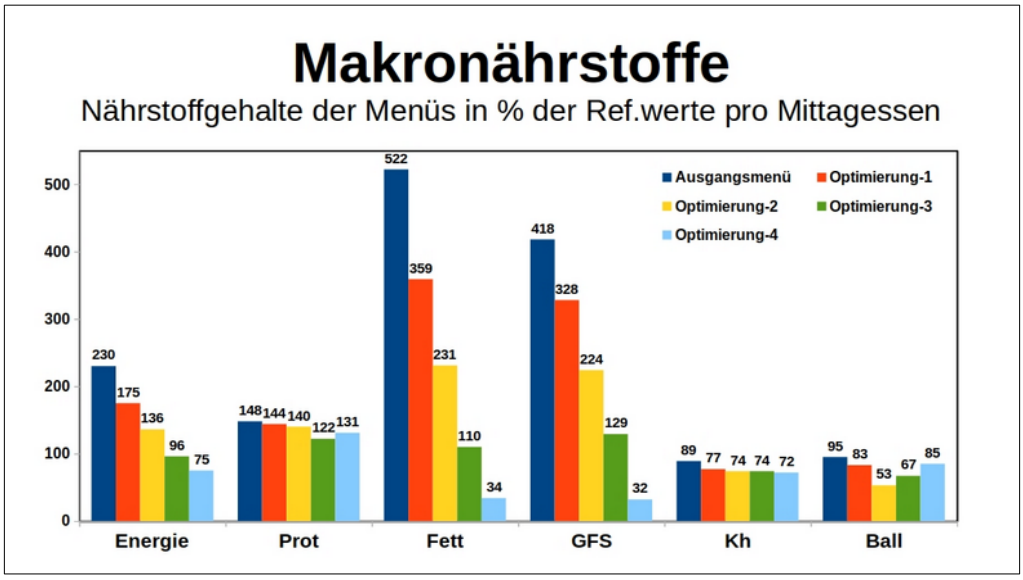

Fig. 6.1: Macronutrient content

With the exception of carbohydrates and dietary fiber, a clear development of the levels can be seen, which is particularly evident in the case of fat and saturated fatty acids. In order to better identify the energetic relationship of the macronutrients, the nutritional ratios of the initial menu with vegetable oil and the optimization levels are shown below.

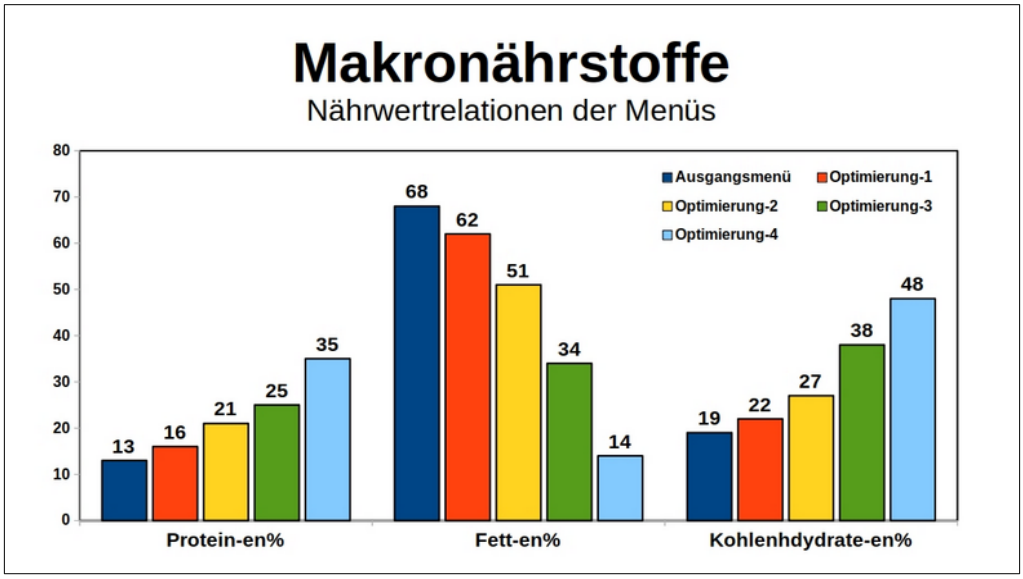

Fig. 6.2: Nutritional ratios (en%=proportion related to energy)

The next figure shows the development of the contents of the micronutrients. With the exception of Vit. E, the contents increase steadily up to the 4th optimization.

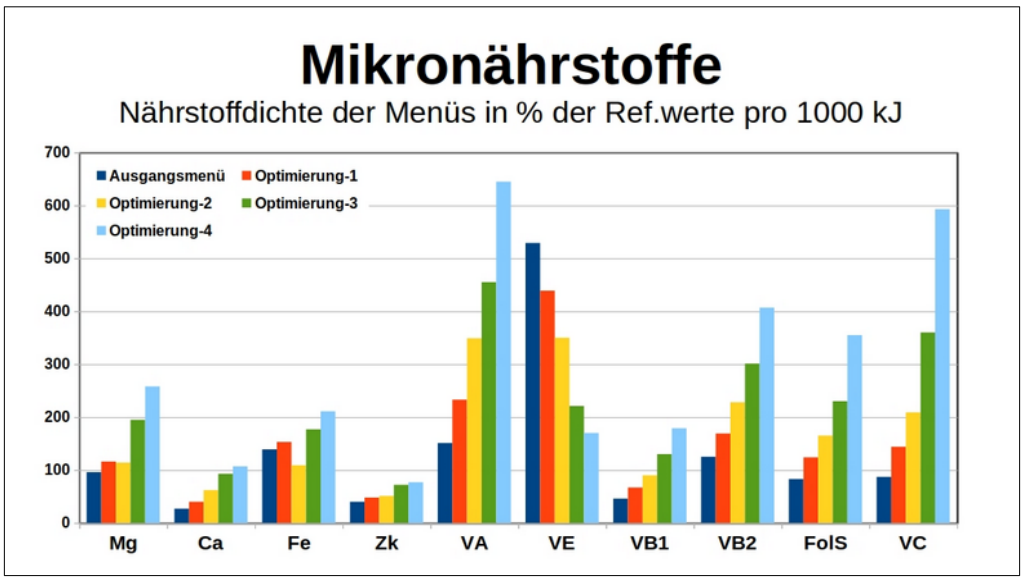

Fig. 6.3: Micronutrient content

6.2 GTS ratings of the menus

The GTS ratings show a completely uniform upward trend from the initial menus to the 4th optimization level. The traffic light colors are associated with integral evaluations that take into account several evaluation parameters. The ratings thus go beyond the results of the nutritional value calculations. Other aspects, such as preventive medical properties, are not included in these figures.

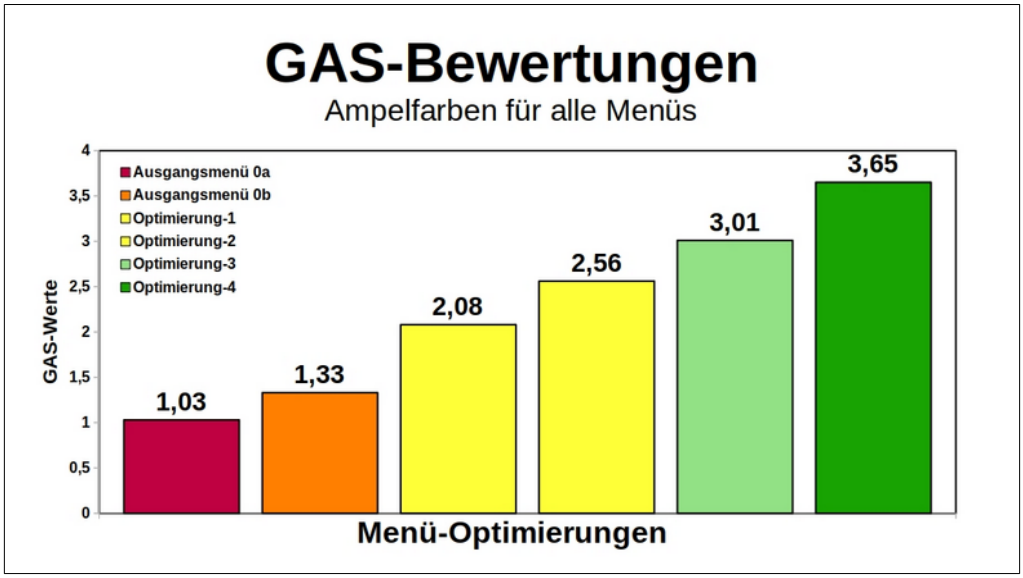

Fig. 6.4: Results of the calculations with GTS

An assessment can be derived if all nutrient parameters are within an optimal range. If this is not the case, which is the rule, there must be considerations as to how the deviations from the reference values are to be evaluated, e.g. whether a deficit of vitamin C weighs more heavily than too much saturated fatty acids. There are no guidelines for this. Therefore, nutritional value calculations cannot make overall assessments, but only provide the data from which the assessments are then to be derived with corresponding reference values. These can be nutritional guidelines that go beyond the fulfillment of reference values.

6.3 Nutri-Score ratings of the menus

A rating that only differentiates between green and yellow is not sufficiently differentiated and cannot be called a traffic light rating either. If two-thirds of the menus are then rated green, even though some have considerable weaknesses in that they are far too high in fat and energy, the rating system appears very questionable. It will be further examined in the second part of this study how plausible these ratings are.

The next figure shows the Nutritional Score values obtained for all the menus studied. The bar color is used to illustrate the letter.

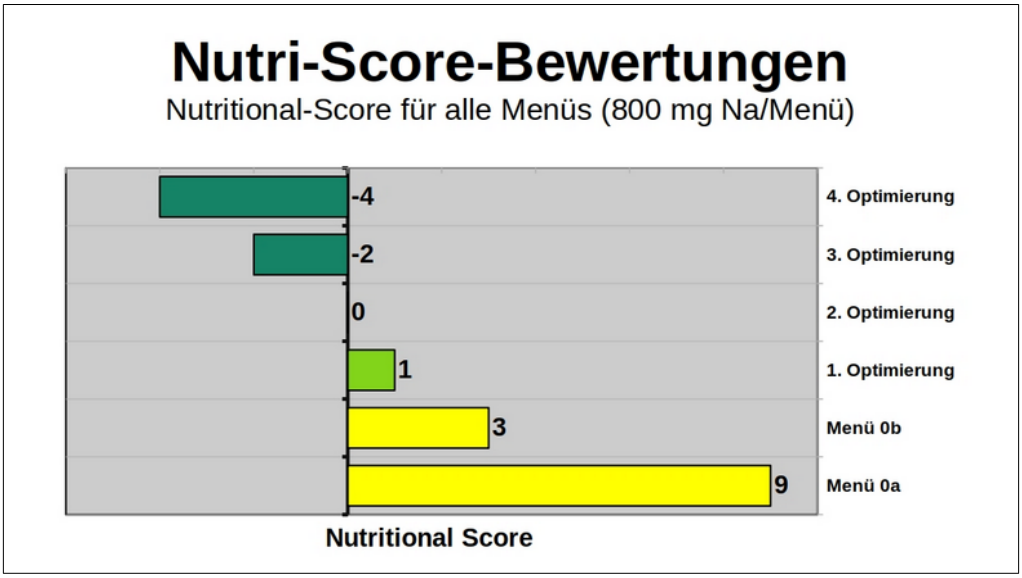

Fig. 6.5: Results of calculations with Nutri-Score

7. Conclusion menu optimization

The evaluations of six menus, starting from two extremely high energy and fat variants to one low energy and fat menu with only high quality ingredients has produced different results depending on the evaluation tool.

- The nutritional value calculation correctly reflected the ever-improving compositions in the nutritional values. This is particularly evident due to the reduced energy and fat values and the associated increasing nutrient densities. The results of the nutritional calculations are largely in line with the assessment made on the basis of international recommendations for the use of foods. However, the overall message of the nutrient value calculations may not always be clear. This is a fundamental problem of this tool. In some cases, the statements are ambivalent, since both favorable and unfavorable nutrient contents were determined. These would have to be summarized, which cannot be done by a nutritional value calculation. It can only indicate the individual values and, at best, compare these with the reference values using appropriate software. An overall evaluation must therefore be carried out by experts. A guideline (e.g. from the DGE) on how deviations are to be evaluated does not exist or is not known. Irrespective of these problems, a tendency can be recognized in the nutritional value calculations, which is becoming increasingly favorable in this study. This is well illustrated by the graphs.
- In principle, the evaluations with GTS go in the same direction. That is, the ratings of the menus get better and better from the initial variants to the last menu, which can be seen based on the traffic light color as well as the GTS numerical values. While the initial menus were rated red, green ratings could be given for the last two menu variants. The spread for the individual menus ranges from 1 to 3.6 and thus includes all traffic light colors. The spread as well as the individual ratings are also plausible due to the stated characteristics of the respective menus. Thus, the results of the nutritional value calculations and GTS largely coincide, with the statements of GTS condensing all aspects of the evaluation into a

well-founded overall value as a number. In conjunction with the traffic light color, GTS therefore makes it easier to see how the menus should be rated. On the other hand, nutrient-specific references are missing. Since a meal plan rated green with GTS has no weak points with usual variety and diversity, and even a yellow meal plan already largely meets the requirements[60], this detailed information is not relevant unless the focus is to be placed on very specific nutrients that may have dietary significance. It should also be borne in mind that the evaluation of GTS goes beyond nutritional values and includes diverse criteria. This also explains certain differences in the assessment, which cannot be captured by a purely numerical approach.

- The situation is different for the evaluation with Nutri-Score. It turned out that the theoretically two levels greater spread of the scale ("A" to "E") cannot be used for the evaluation of dishes. Even the worst menu with an exorbitantly high fat and energy content and a very high proportion of saturated fatty acids, which are rated particularly negatively by Nutri-Score, was classified in the middle category "C" (yellow). Here an evaluation with one of the lower categories ("D" or "E") would have been expected nevertheless actually. Since there is still a clear gap between cat. "C" and "D" (3 points: from 8 to 11), it is also difficult to imagine how a dish can be designed to at least reach cat. "D", let alone "E". Thus, the Nutri-Score rating scale is reduced to only three levels, but with the serious difference that the lowest rating is not red, but yellow.

  It should therefore be noted that Nutri-Score does not adequately rate the poor menus, and these are at least the two initial menus and the 1st optimization. Furthermore, it is noticeable that the other end of the scale is also rated too favorably. Thus, already from the 2nd optimization of the menus an "A" is assigned. As the nutritional value calculation and also the evaluation by GTS have shown, this menu still has some clear weaknesses that do not justify such a good rating. Related to the scale of GTS, the cat. "A" would correspond to a rating of at least "3" at Nutri-Score. However, such a rating is only awarded by GTS for the last two optimizations. In this respect, the evaluation of Nutri-Score in this case is correct in tendency, but not sensitive enough in detail and thus not plausible.

  The additional consideration of different salt contents (2 and 4 g per menu) showed that only insignificant changes occur as a result. The Nutritional Scores have deteriorated by one point. As a result, the 2nd initial menu has also been rated "C", but still with a significant difference between the two versions of these menus. The 2nd optimization has also been changed, as the shift from -1 to 0 has resulted in a "B" score. Both changes were caused by minor limit violations. This is due to the very tight A and B rating limits set by Nutri-Score. The range of these two scores is only 3 points, so minor changes can very easily result in a completely different category.

  The last determination based on 4 g of salt did not cause any more changes in the letters. The Nutritional Scores worsened again by one point each. But this deterioration had no more influence on the final score. So at 4 g of salt we have the distribution of 2x yellow, light green and green respectively.
- The application with Nutri-Score is linked to the condition of nutritional calculations, which in the Community catering should often prevent the determination of the values. It has

60 Peinelt V: Bewertung von 4-Wochen-Modellspeiseplänen. https://ewd-gastro.jimdo.com/gas/validierungen/4-wo-plan-modell/

been pointed out several times that there are many problems with nutritional calculations that make it difficult to apply the Nutri-Score system in this field[61]. In particular, it is difficult to determine the Na content. A transfer from the BLS is usually too inaccurate because the amount of salt added can hardly be determined by the preparation[62,63] or the product is not included in the database, e.g., granulated broths whose salt contents vary greatly. This further limits the applicability of the Nutri-Score.

8. Results of selected menus

8.1 Introduction

So far, only one specific menu has been considered, which has been continuously optimized with regard to the individual components, whereby all quality levels have been run through. This has already provided important insights into the informative value of Nutri-Score in comparison with GTS on the basis of nutritional value calculations.

In this chapter, the aim is to evaluate other menus of different composition in order to better recognize the plausibility of the evaluation of Nutri-Score in comparison to GTS. The menus are presented in two different variants, favorable and unfavorable. If the differences are large, an additional menu of medium quality is scored.

The test consists again in presenting the menus with all the results of the nutritional calculations, of GTS and of Nutri-Score. The target values of the nutritional values again refer to 33% of the daily target values (lunch) and to 1000 kJ, which are then compared with the actual values in each case. Further specifications for the target values regarding the age group and the distribution of men and women correspond to those for the menu optimizations. 8.2 Results of the nutritional calculations

8.2 Results of the nutritional calculations

Tab. 8.1: Pizza with salami and salad (1)

Zutaten	1 Portion(en)	Menge in g
1.	Pizzateig gebacken	270
2.	Gouda	30
3.	Salami	150
4.	Blattgemüse, roh	70
5.	Salatsoße, fettreich	35
6.	Mousse au chocolat	150
Portionsmenge		705

	Ener kcal	Prot g	Fett g	GF g	Kh g	MoSa g	Disa g	Ball g	Mg mg	Ca mg	Fe mg	Zk mg	Na mg	VAÄ myg	VEÄ myg	VB1 myg	VB2 myg	FolÄ myg	VC mg
Rez	2193	63	148	54,5	154	3,2	37,3	11,3	240	529	15,8	8,8	3194	104310053	1015	726	169	37	
Soll	677	34	23	7,5	85			9,9	107	330	4,1	3,6	495	256	4290	363	380	99	34
I/S-%	324	187	656	724	182			114	223	160	383	242	645	408	234	280	191	171	108

61 Peinelt V: Probleme der Nährwertberechnungen. Langfassung. https://ewd-gastro.jimdo.com/gas/probleme-mit-Nährwertberechnung/
62 Peinelt V: Gastronomic Traffic Light System. Longversion. https://ewd-gastro.jimdo.com/gas/beschreibung/longversion, s. Kap. 5.5
63 Peinelt V: Nutritional Footprint. Stellungnahme. https://ewd-gastro.jimdo.com/gas/nutr-foodprint-gas, s. Kap. 1.2.2

MJ	239	4	22	7,7	7	0,2	3,7	0,4	18	31	0,9	0,6	243	109	4658	127	74	19	8
Soll	239	12	8	2,7	30			3,5	38	118	1,5	1,3	178	91	1524	129	134	36	12
I/S-%	100	36	270	291	25			12	47	26	56	44	137	120	306	99	56	53	71

25-51 Jahre,50%-M/50%-F,P:F:K=7:81:12 (20:30:50),GF:EUF:MUF=38:38:24 (<33:>33:<33)

Tab. 8.2: Whole wheat pizza with vegetables (2)

Zutaten	1 Portion(en)	Menge in g
1.	Vollkornpizza mit Gemüse (Standardrezept	270
2.	Gouda	30
3.	Gemüsemischung, gegart	150
4.	Blattgemüse, roh	70
5.	Salatsoße, fettarm	35
6.	Joghurt mit Früchten	150
Portionsmenge		705

	Ener kcal	Prot g	Fett g	GF g	Kh g	MoSa g	Disa g	Ball g	Mg mg	Ca mg	Fe mg	Zk mg	Na mg	VAÄ myg	VEÄ myg	VB1 myg	VB2 myg	FolÄ myg	VC mg
Rez	790	38	36	19,2	77	13,3	25,2	16,1	212	867	7,3	6,8	1509	1636	8876	719	1008	254	139
Soll	677	34	23	7,5	85			9,9	107	330	4,1	3,6	495	256	4290	363	380	99	34
I/S-%	117	111	160	255	90			163	197	263	176	188	305	640	207	198	266	256	412
MJ	239	11	11	5,8	23	4,0	7,6	4,9	64	262	2,2	2,1	456	495	2684	217	305	77	42
Soll	239	12	8	2,7	30			3,5	38	118	1,5	1,3	178	91	1524	129	134	36	12
I/S-%	100	95	137	218	77			137	168	222	145	163	257	546	176	169	228	216	350

25-51 Jahre,50%-M/50%-F,P:F:K=19:41:39 (20:30:50),GF:EUF:MUF=56:34:10 (<33:>33:<33)

Tab. 8.3: Boiled potatoes with cottage cheese (1)

Zutaten	1 Portion(en)	Menge in g
1.	Quark mind. 60% Fett i. Tr	200
2.	Kartoffeln, gegart	300
3.	Blattgemüse, roh	70
4.	Salatsoße, fettreich	35
5.	Bayerische Creme (6)	150
Portionsmenge		755

	Ener kcal	Prot g	Fett g	GF g	Kh g	MoSa g	Disa g	Ball g	Mg mg	Ca mg	Fe mg	Zk mg	Na mg	VAÄ myg	VEÄ myg	VB1 myg	VB2 myg	FolÄ myg	VC mg
Rez	1231	29	86	39,6	83	1,6	38,7	5,0	143	445	6,3	3,4	362	137	417629	370	846	196	83
Soll	677	34	23	7,5	85			9,9	107	330	4,1	3,6	495	256	4290	363	380	99	34
I/S-%	182	86	382	527	99			50	134	135	153	94	73	537	411	102	223	198	244
MJ	239	6	17	7,7	16	0,3	7,5	1,0	28	87	1,2	0,7	70	267	3424	72	164	38	16
Soll	239	12	8	2,7	30			3,5	38	118	1,5	1,3	178	91	1524	129	134	36	12
I/S-%	100	47	210	289	54			27	73	73	81	52	40	294	225	56	123	107	134

25-51 Jahre,50%-M/50%-F,P:F:K=9:63:27 (20:30:50),GF:EUF:MUF=49:32:19 (<33:>33:<33)

Tab. 8.4: Boiled potatoes with cottage cheese (2)

Zutaten	1 Portion(en)	Menge in g
1.	Quark, Magerstufe	200
2.	Kartoffeln, gegart	300
3.	Blattgemüse, roh	70
4.	Salatsoße, fettarm	35
5.	Obstsalat (Standardrezeptur)	150
Portionsmenge		755

	Ener kcal	Prot g	Fett g	GF g	Kh g	MoSa g	Disa g	Ball g	Mg mg	Ca mg	Fe mg	Zk mg	Na mg	VAÄ myg	VEÄ myg	VB1 myg	VB2 myg	FolÄ myg	VC mg
Rez	544	36	7	3,4	77	12,1	20,1	8,1	159	340	6,2	3,1	219	604	2899	423	853	181	112
Soll	677	34	23	7,5	85			9,9	107	330	4,1	3,6	495	256	4290	363	380	99	34
I/S-%	80	108	32	45	92			82	148	103	150	86	44	236	68	116	225	183	332
MJ	239	16	3	1,5	34	5,3	8,8	3,6	70	150	2,7	1,4	96	266	1276	186	375	80	49
Soll	239	12	8	2,7	30			3,5	38	118	1,5	1,3	178	91	1524	129	134	36	12
I/S-%	100	134	40	56	114			100	183	126	180	110	54	293	84	145	280	225	412

25-51 Jahre,50%-M/50%-F,P:F:K=27:12:57 (20:30:50),GF:EUF:MUF=50:29:21 (<33:>33:<33)

Tab. 8.5: Boiled potatoes with cottage cheese (3)

Zutaten	1 Portion(en)	Menge in g
1.	Quark mind. 30% Fett i. Tr.	200
2.	Kartoffeln, gegart	300
3.	Blattgemüse, roh	70
4.	Salatsoße, fettreich	35
5.	Schokoladenpudding vollfett	150
Portionsmenge		755

	Ener kcal	Prot g	Fett g	GF g	Kh g	MoSa g	Disa g	Ball g	Mg mg	Ca mg	Fe mg	Zk mg	Na mg	VAÄ myg	VEÄ myg	VB1 myg	VB2 myg	FolÄ myg	VC mg
Rez	846	32	43	14,8	81	1,6	25,0	5,0	151	513	5,6	3,3	400	79315832		370	951	189	83
Soll	677	34	23	7,5	85			9,9	107	330	4,1	3,6	495	256	4290	363	380	99	34
I/S-%	125	96	189	197	96			51	141	156	136	91	81	310	369	102	251	191	246
MJ	238	9	12	4,2	23	0,4	7,0	1,4	42	144	1,6	0,9	113	223	4452	104	268	53	23
Soll	239	12	8	2,7	30			3,5	38	118	1,5	1,3	178	91	1524	129	134	36	12
I/S-%	99	76	150	157	76			40	111	122	104	74	63	246	292	81	200	149	195

25-51 Jahre,50%-M/50%-F,P:F:K=15:45:38 (20:30:50),GF:EUF:MUF=37:30:34 (<33:>33:<33)

Tab. 8.6: Spaghetti with minced meat (1)

Zutaten	1 Portion(en)	Menge in g
1.	Teigwaren, Weißmehl, gegart	230
2.	Schwein Hackfleisch, gegart	75
3.	Rind Hackfleisch, gegart	75
4.	Tomate rot gekocht	100
5.	Zwiebeln gegart	50
6.	Pflanzliche Öle Linolsäure 30% - 60%	20
7.	Gouda	50
8.	Bayerische Creme (6)	150
Portionsmenge		750

	Ener kcal	Prot g	Fett g	GF g	Kh g	MoSa g	Disa g	Ball g	Mg mg	Ca mg	Fe mg	Zk mg	Na mg	VAÄ myg	VEÄ myg	VB1 myg	VB2 myg	FolÄ myg	VC mg
Rez	1508	69	94	40,8	97	4,2	32,7	6,6	128	660	6,0	12,1	735	59315953		735	765	83	20
Soll	677	34	23	7,5	85			9,9	107	330	4,1	3,6	495	256	4290	363	380	99	34
I/S-%	223	205	416	542	115			67	119	200	145	334	148	232	372	202	202	83	59
MJ	239	11	15	6,5	15	0,7	5,2	1,0	20	105	0,9	1,9	116	94	2526	116	121	13	3
Soll	239	12	8	2,7	30			3,5	38	118	1,5	1,3	178	91	1524	129	134	36	12
I/S-%	100	92	186	243	52			29	53	88	63	152	66	104	166	90	90	37	27

25-51 Jahre,50%-M/50%-F,P:F:K=18:56:26 (20:30:50),GF:EUF:MUF=46:37:17 (<33:>33:<33)

Tab. 8.7: Wholemeal spaghetti with vegetables (2)

Zutaten	1 Portion(en)	Menge in g
1.	Vollkornteigwaren, gegart	230
2.	Tomate rot, gedämpft	150
3.	Zwiebeln, gekocht	50
4.	Paprikaschoten, gekocht	50
5.	Pflanzliche Öle	20
6.	Linsen reif, gekocht	50
7.	Gouda	50
8.	Obstsalat (Standardrezeptur)	150
Portionsmenge		750

	Ener kcal	Prot g	Fett g	GF g	Kh g	MoSa g	Disa g	Ball g	Mg mg	Ca mg	Fe mg	Zk mg	Na mg	VAÄ myg	VEÄ myg	VB1 mg	VB2 mg	FolÄ myg	VC mg
Rez	885	32	39	13,6	99	16,9	13,2	21,0	188	578	5,3	6,3	555	35316508	795	330	120	96	
Soll	677	34	23	7,5	85			9,9	107	330	4,1	3,6	495	256	4290	363	380	99	34
I/S-%	131	95	173	180	117			213	175	175	127	174	112	138	385	219	87	121	284
MJ	239	9	11	3,7	27	4,6	3,6	5,7	51	156	1,4	1,7	150	95	4465	215	89	32	26
Soll	239	12	8	2,7	30			3,5	38	118	1,5	1,3	178	91	1524	129	134	36	12
I/S-%	100	72	132	138	90			160	133	132	93	136	85	105	293	167	67	91	216

25-51 Jahre,50%-M/50%-F,P:F:K=14:40:45 (20:30:50),GF:EUF:MUF=37:26:36 (<33:>33:<33)

Tab. 8.8: Spaghetti with minced meat (3)

Zutaten	1 Portion(en)	Menge in g
1.	Teigwaren, Weißmehl, gegart	230
2.	Rind Hackfleisch, gegart	70
3.	Tomate rot gekocht	100
4.	Zwiebeln gegart	50
5.	Pflanzliche Öle	15
6.	Gouda	40
7.	Vanillepudding	125
Portionsmenge		630

	Ener kcal	Prot g	Fett g	GF g	Kh g	MoSa g	Disa g	Ball g	Mg mg	Ca mg	Fe mg	Zk mg	Na mg	VAÄ myg	VEÄ mg	VB1 mg	VB2 mg	FolÄ myg	VC mg
Rez	939	44	45	18,7	89	4,4	14,9	6,8	101	567	4,0	8,3	580	284	11	0,20	0,53	57	20
Soll	677	34	23	7,5	85	8,3	8,3	9,9	107	330	4,1	3,6	495	256	4	0,36	0,38	99	34
I/S-%	139	130	200	248	105	54	180	69	94	172	96	230	117	111	264	56	139	57	60
MJ	239	11	11	4,8	23	1,1	3,8	1,7	26	144	1,0	2,1	147	72	3	0,05	0,13	14	5
Soll	239	12	8	2,7	30	3,0	3,0	3,5	38	118	1,5	1,3	178	91	2	0,13	0,13	36	12
I/S-%	100	94	144	179	75	38	128	49	67	122	66	168	83	80	189	38	100	41	43

25-51 Jahre,50%-M/50%,P:F:K=19:43:38 (20:30:50),GF:EUF:MUF=44:33:23 (<33:>33:<33)

Tab. 8.9: Steak with fries (1)

Zutaten	1 Portion(en)	Menge in g
1.	Schwein Steak (ma), gegrillt	250
2.	Pflanzliche Öle	10
3.	Pommes Frites, fettfrei gegart	200
4.	Pflanzliche Öle	30
5.	Blattgemüse, roh	70
6.	Salatsoße, fettreich	35
7.	Bayerische Creme	150
Portionsmenge		745

	Ener kcal	Prot g	Fett g	GF g	Kh g	MoSa g	Disa g	Ball g	Mg mg	Ca mg	Fe mg	Zk mg	Na mg	VAÄ myg	VEÄ myg	VB1 myg	VB2 myg	FolÄ myg	VC mg
									-										
Rez	1453	72	98	25,3	72	1,4	33,0	4,4	156	268	9,5	6,1	432	91642107		1699	872	156	68
Soll	677	34	23	7,5	85			9,9	107	330	4,1	3,6	495	256	4290	363	380	99	34
I/S-%	215	213	433	337	85			45	146	81	231	168	87	358	982	468	230	158	202
MJ	238	12	16	4,2	12	0,2	5,4	0,7	26	44	1,6	1,0	71	150	6910	279	143	26	11
Soll	239	12	8	2,7	30			3,5	38	118	1,5	1,3	178	91	1524	129	134	36	12
I/S-%	100	99	201	156	39			21	67	37	103	79	40	166	453	217	107	72	93

25-51 Jahre,50%-M/50%-F,P:F:K=20:61:20 (20:30:50),GF:EUF:MUF=28:41:32 (<33:>33:<33)

Tab. 8.10: Steak with fries (2)

Zutaten	1 Portion(en)	Menge in g
1.	Schwein Steak (ma) gegrillt	250
2.	Pflanzliche Öle Linolsäure 30% - 60%	10
3.	Pommes Frites, fettfrei gegart	200
4.	Blattgemüse, roh	100
5.	Salatmarinade, fettarm	50
6.	Obstsalat (Standardrezeptur)	150
Portionsmenge		760

	Ener kcal	Prot g	Fett g	GF g	Kh g	MoSa g	Disa g	Ball g	Mg mg	Ca mg	Fe mg	Zk mg	Na mg	VAÄ myg	VEÄ myg	VB1 myg	VB2 myg	FolÄ myg	VC mg
Rez	783	69	25	6,4	67	12,4	15,3	8,3	182	251	9,9	5,8	509	85910100		1748	836	198	113
Soll	677	34	23	7,5	85			9,9	107	330	4,1	3,6	495	256	4290	363	380	99	34
I/S-%	116	203	109	85	79			84	170	76	240	159	103	336	235	482	220	200	335
MJ	240	21	8	2,0	21	3,8	4,7	2,5	56	77	3,0	1,8	156	263	3091	535	256	60	35
Soll	239	12	8	2,7	30			3,5	38	118	1,5	1,3	178	91	1524	129	134	36	12
I/S-%	100	176	95	74	69			72	146	65	199	140	88	290	203	415	191	170	289

25-51 Jahre,50%-M/50%-F,P:F:K=35:28:34 (20:30:50),GF:EUF:MUF=28:38:34 (<33:>33:<33)

Tab. 8.11: Lentil stew (1)

Zutaten	1 Portion(en)	Menge in g
1.	Linsen reif, gegart	80
2.	Kartoffeln, gegart	40
3.	Karotten, gegart	40
4.	Bockwurst, erwärmt	200
5.	Wasser	250
6.	Saure Sahne 10 % Fett	50
7.	Brötchen (allgemein)	70
Portionsmenge		730

	Ener kcal	Prot g	Fett g	GF g	Kh g	MoSa g	Disa g	Ball g	Mg mg	Ca mg	Fe mg	Zk mg	Na mg	VAÄ myg	VEÄ myg	VB1 myg	VB2 myg	FolÄ myg	VC mg
Rez	993	45	61	24,7	65	1,3	6,9	7,9	117	161	4,9	5,2	1927	723	1789	1102	504	66	47
Soll	677	34	23	7,5	85			9,9	107	330	4,1	3,6	495	256	4290	363	380	99	34
I/S-%	147	133	272	328	77			80	109	49	119	145	389	283	42	304	133	66	140
MJ	239	11	15	5,9	16	0,3	1,7	1,9	28	39	1,2	1,3	464	174	431	265	121	16	11
Soll	239	12	8	2,7	30			3,5	38	118	1,5	1,3	178	91	1524	129	134	36	12
I/S-%	100	90	185	223	53			54	74	33	78	100	261	192	28	206	91	45	95

25-51 Jahre,50%-M/50%-F,P:F:K=18:56:26 (20:30:50),GF:EUF:MUF=43:45:12 (<33:>33:<33)

Tab. 8.12: Lentil stew (2)

Zutaten	1 Portion(en)	Menge in g
1.	Linsen reif, gegart	150
2.	Kartoffeln, gegart	100
3.	Karotten, gegart	100
4.	Wasser	250
5.	Saure Sahne 10 % Fett	30
6.	Vollkornbrötchen	90
Portionsmenge		720

	Ener kcal	Prot g	Fett g	GF g	Kh g	MoSa g	Disa g	Ball g	Mg mg	Ca mg	Fe mg	Zk mg	Na mg	VAÄ myg	VEÄ myg	VB1 myg	VB2 myg	FolÄ myg	VC mg
Rez	540	25	8	3,6	90	2,5	8,2	16,8	187	137	7,8	4,9	547	1613	2189	605	288	79	18
Soll	677	34	23	7,5	85			9,9	107	330	4,1	3,6	495	256	4290	363	380	99	34
I/S-%	80	74	35	48	106			169	175	41	190	136	111	631	51	167	76	80	53
MJ	240	11	3	1,6	40	1,1	3,6	7,4	83	61	3,5	2,2	243	716	971	268	128	35	8
Soll	239	12	8	2,7	30			3,5	38	118	1,5	1,3	178	91	1524	129	134	36	12
I/S-%	100	93	44	60	133			209	218	51	229	173	137	790	64	208	95	99	66

25-51 Jahre,50%-M/50%-F,P:F:K=19:13:66 (20:30:50),GF:EUF:MUF=54:27:19 (<33:>33:<33)

Tab. 8.13: Curry sausage with fries (1)

Zutaten	1 Portion(en)	Menge in g
1.	Curry-Bratwurst	200
2.	Pommes Frites, roh	200
3.	Pflanzliche Öle	30
4.	Mayonnaise	80
5.	Blattgemüse, roh	70
6.	Salatsoße, fettreich	35
7.	Bayerische Creme (6)	150
Portionsmenge		765

	Ener kcal	Prot g	Fett g	GF g	Kh g	MoSa g	Disa g	Ball g	Mg mg	Ca mg	Fe mg	Zk mg	Na mg	VAÄ myg	VEÄ myg	VB1 myg	VB2 myg	FolÄ myg	VC mg
Rez	2134	39	193	69,1	66	1,7	32,9	4,0	161	275	7,6	5,0	2173	97241	654	1140	666	168	76
Soll	677	34	23	7,5	85			9,9	107	330	4,1	3,6	495	256	4290	363	380	99	34
I/S-%	315	114	854	919	78			40	150	83	185	139	439	380	971	314	175	170	224
MJ	239	4	22	7,7	7	0,2	3,7	0,4	18	31	0,9	0,6	243	109	4658	127	74	19	8
Soll	239	12	8	2,7	30			3,5	38	118	1,5	1,3	178	91	1524	129	134	36	12
I/S-%	100	36	270	291	25			12	47	26	56	44	137	120	306	99	56	53	71

25-51 Jahre,50%-M/50%-F,P:F:K=7:81:12 (20:30:50),GF:EUF:MUF=38:38:24 (<33:>33:<33)

Tab. 8.14: Curry sausage with fries (2)

Zutaten	1 Portion(en)	Menge in g
1.	Curry-Bratwurst	200
2.	Pommes Frites, roh	200
3.	Pflanzliche Öle	30
4.	Mayonnaise	80
5.	Blattgemüse, roh	70
6.	Salatsoße, fettreich	35
7.	Bayerische Creme (6)	150
Portionsmenge		765

	Ener kcal	Prot g	Fett g	GF g	Kh g	MoSa g	Disa g	Ball g	Mg mg	Ca mg	Fe mg	Zk mg	Na mg	VAÄ myg	VEÄ myg	VB1 myg	VB2 myg	FolÄ myg	VC mg
Rez	2134	39	193	69,1	66	1,7	32,9	4,0	161	275	7,6	5,0	2173	97241654		1140	666	168	76
Soll	677	34	23	7,5	85			9,9	107	330	4,1	3,6	495	256	4290	363	380	99	34
I/S-%	315	114	854	919	78			40	150	83	185	139	439	380	971	314	175	170	224
MJ	239	4	22	7,7	7	0,2	3,7	0,4	18	31	0,9	0,6	243	109	4658	127	74	19	8
Soll	239	12	8	2,7	30			3,5	38	118	1,5	1,3	178	91	1524	129	134	36	12
I/S-%	100	36	270	291	25			12	47	26	56	44	137	120	306	99	56	53	71

25-51 Jahre,50%-M/50%-F,P:F:K=7:81:12 (20:30:50),GF:EUF:MUF=38:38:24 (<33:>33:<33)

8.3 Results with GTS

Pizza mit Salami (1)	Qualität (#0-4)	Garen (#0-4)	Fett (in %)	Zucker (in %)	Heißhalten (in h)	GAS-Wert	P-Menge (1=100)	Wert pro Speise
Pizzateig, normal	2	1	12,0	1,0		**0,66**	2,70	1,78
Käse	2,5	1	31,0	0,0		**-0,69**	0,30	-0,21
Salami	1,5	1	33,0	1,8		**-1,98**	1,50	-2,97
Blattsalat	5	0	0,0	0,0		**5,00**	0,70	3,50
Salatsoße, fettreich	2	0	57,0	0,8		**-3,74**	0,35	-1,31
Mousse au Chokolade	3	0	25,0	23,0		**-0,65**	1,50	-0,98
2.193kcal					**Summe:**	**-0,03**	**7,05**	**-0,18**

Tab. 8.15: GTS rating for pepperoni pizza

Vollkornpizza mit Gemüse (2)	Qualität (#0-4)	Garen (#0-4)	Fett (in %)	Zucker (in %)	Heißhalten (in h)	GAS-Wert	P-Menge (1=100)	Wert pro Speise
Pizzateig, Vollkorn	4	1	6,0	3,3		**3,15**	2,70	8,49
Käse	2,5	1	31,0	0,0		**-0,69**	0,30	-0,21
Gemüsebelag	5	1	0,0	3,0		**4,76**	1,50	7,14
Blattsalat	5	0	0,0	0,5		**4,98**	0,70	3,48
Jogh-Dressing, fettarm	3	0	18,0	4,4		**0,98**	0,35	0,34
Joghurt m. Früchten	3,2	0	3,0	15,4		**2,13**	1,50	3,20
790 kcal					**Summe:**	**3,18**	**7,05**	**22,45**

Tab. 8.16: GTS rating for whole grain pizza

Pellkartoffeln & Quark (1)	Qualität (#0-4)	Garen (#0-4)	Fett (in %)	Zucker (in %)	Heißhalten (in h)	GAS-Wert	P-Menge (1=100)	Wert pro Speise
Kräuterquark, fettreich	3	0	20,0	2,8		**0,86**	2,00	1,72
Pellkartoffeln	3	1	0,0	0,7		**2,88**	3,00	8,63
Blattsalat	5	0	0,0	0,5		**4,98**	0,70	3,48
Dressing, fettreich	3	0	65,0	1,9		**-3,60**	0,35	-1,26
Bayerisch Creme (fettreich)	3	1	16,0	21,1		**0,26**	1,50	0,38
1.231 kcal					**Summe:**	**1,72**	**7,55**	**12,95**

Tab. 8.17: GTS rating for jacket potatoes with cottage cheese (1)

Pellkartoffeln & Quark (2)	Qualität (#0-4)	Garen (#0-4)	Fett (in %)	Zucker (in %)	Heißhalten (in h)	GAS-Wert	P-Menge (1=100)	Wert pro Speise
Kräuterquark, fettarm	3	0	0,0	3,2		**2,84**	2,00	5,68
Pellkartoffeln	3	1	0,0	0,7		**2,88**	3,00	8,63
Blattsalat	5	0	0,0	0,5		**4,98**	0,70	3,48
Jogh-Dressing, fettarm	3	0	18,0	4,4		**0,98**	0,35	0,34
Obstsalat	5	0	0,0	14,6		**4,27**	1,50	6,41
544 kcal					**Summe:**	**3,25**	**7,55**	**24,54**

Tab. 8.18: GTS rating for jacket potatoes with cottage cheese (2)

Pellkartoffeln & Quark (3)	Qualität (#0-4)	Garen (#0-4)	Fett (in %)	Zucker (in %)	Heißhalten (in h)	GAS-Wert	P-Menge (1=100)	Wert pro Speise
Kräuterquark, mittelfett	3	0	7,0	3,4		**2,13**	2,00	4,26
Pellkartoffeln	3	1	0,0	0,7		**2,88**	3,00	8,63
Blattsalat	5	0	0,0	0,5		**4,98**	0,70	3,48
Dressing, fettreich	3	0	65,0	1,9		**-3,60**	0,35	-1,26
Schokopudding	3	1	3,0	11,1		**2,06**	1,50	3,08
846 kcal					**Summe:**	**2,41**	**7,55**	**18,19**

Tab. 8.19: GTS rating for jacket potatoes with cottage cheese (3)

Spaghetti mit Hackfleisch (1)	Qualität (#0-4)	Garen (#0-4)	Fett (in %)	Zucker (in %)	Heißhalten (in h)	GAS-Wert	P-Menge (1=100)	Wert pro Speise
Spaghetti, Weißmehl	2	1	0,0	0,2		**1,90**	2,30	4,37
Hackfleisch, halb/halb	2	3	26,0	0,0		**-1,41**	1,50	-2,12
Tomaten	5	1	0,0	2,8		**4,77**	1,00	4,77
Zwiebeln	5	1	0,0	4,2		**4,70**	0,50	2,35
Pflanzl. Öle	3	1	100,0	0,0		**-7,09**	0,20	
Käse	2,5	1	31,0	0,0		**-0,69**	0,50	-0,35
Bayerisch Creme	3	1	16,0	21,1		**0,26**	1,50	0,38
1.508 kcal					**Summe:**	**1,26**	**7,50**	**9,41**

Tab. 8.20: GTS rating for spaghetti with minced meat (1)

Vollkorn-Spaghetti mit Gemüse (2)	Qualität (#0-4)	Garen (#0-4)	Fett (in %)	Zucker (in %)	Heißhalten (in h)	GAS-Wert	P-Menge (1=100)	Wert pro Speise
Spaghetti, Vollkorn	4	1	1,0	0,4		**3,79**	2,30	8,72
Gemüse, gegart	5	1	0,0	3,0		**4,76**	2,50	11,90
Rapsöl	4	1	100,0	0,0		**-6,09**	0,20	-1,22
Linsen, gekocht	4	1	0,0	0,5		**3,89**	0,50	1,94
Käse, Parmesan	2,5	0	31,0	0,0		**-0,60**	0,50	-0,30
Obstsalat	5	0	0,0	14,6		**4,27**	1,50	6,41
885 kcal					**Summe:**	**3,66**	**7,50**	**27,45**

Tab. 8.21: GTS rating for whole grain spaghetti with vegetables (2)

Notes: For pasta, a dry quantity of 90 g was assumed, which was converted to wet, i.e. ready-to-eat pasta, in order to compare at the consumption level. Conversion tables[64] were used for this purpose. However, the differences in water absorption between white flour and whole wheat pasta were neglected. Conversions were also necessary for legumes (see lentil stew).

64 Zacharias R, Dürr H: Lebensmittelverarbeitung im Haushalt. Verlag Ulmer, Stuttgart, 1984, 4. neubearb. und erweiterte Aufl.

Spaghetti mit Hackfleisch (3)	Qualität (#0-4)	Garen (#0-4)	Fett (in %)	Zucker (in %)	Heißhalten (in h)	GAS-Wert	P-Menge (1=100)	Wert pro Speise
Spaghetti, Weißmehl	2	1	0,0	0,2		**1,90**	2,30	4,37
Hackfleisch, Rind	2	1	17,0	0,1		**0,21**	0,70	0,14
Tomaten	5	1	0,0	2,8		**4,77**	1,00	4,77
Zwiebeln	5	1	0,0	4,2		**4,70**	0,50	2,35
Pflanzl. Öle	3	1	100,0	0,0		**-7,09**	0,15	-1,06
Käse	2,5	1	31,0	0,0		**-0,69**	0,50	-0,35
Vanillepudding	3	1	3,0	11,2		**2,05**	1,25	2,56
939 kcal					**Summe:**	**2,00**	**6,40**	**12,79**

Tab. 8.22: GTS rating for spaghetti with minced meat, moderate (3)

Steak mit Pommes (1)	Qualität (#0-4)	Garen (#0-4)	Fett (in %)	Zucker (in %)	Heißhalten (in h)	GAS-Wert	P-Menge (1=100)	Wert pro Speise
Schweinesteak, gegrillt	2	1	4,0	0,0		**1,51**	2,50	3,78
Pflanzl. Öle	3	1	100,0	0,0		**-7,09**	0,10	-0,71
Pommes frites	3	1	0,0	0,9		**2,87**	2,00	5,73
Pflanzl. Öle	3	1	100,0	0,0		**-7,09**	0,30	-2,13
Blattsalat	5	0	0,0	0,5		**4,98**	0,70	3,48
Dressing, fettreich	3	0	65,0	1,9		**-3,60**	0,35	-1,26
Bayerisch Creme	3	1	16,0	21,1		**0,26**	1,50	0,38
1.453 kcal					**Summe:**	**1,25**	**7,45**	**9,28**

Tab. 8.23: GTS rating for steak with fries (1)

Steak mit Pommes (2)	Qualität (#0-4)	Garen (#0-4)	Fett (in %)	Zucker (in %)	Heißhalten (in h)	GAS-Wert	P-Menge (1=100)	Wert pro Speise
Schweinesteak, gegrillt	2	1	4,0	0,0		**1,51**	2,50	3,78
Rapsöl	4	1	100,0	0,0		**-6,09**	0,10	-0,61
Pommes frites	3	1	0,0	0,9		**2,87**	2,00	5,73
Blattsalat	5	0	0,0	0,5		**4,98**	1,00	4,98
Jogh-Dressing, fettarm	3	0	6,0	7,4		**2,03**	0,50	1,02
Obstsalat	5	0	0,0	14,6		**4,27**	1,50	6,41
783 kcal					**Summe:**	**2,80**	**7,60**	**21,29**

Tab. 8.24: GTS rating for steak with fries (2)

Linseneintopf mit Wurst (1)	Qualität (#0-4)	Garen (#0-4)	Fett (in %)	Zucker (in %)	Heißhalten (in h)	GAS-Wert	P-Menge (1=100)	Wert pro Speise
Linsen, gegart	4	1	1,0	1,0		**3,76**	0,80	3,01
Kartoffeln, gegart	3	1	0,0	0,7		**2,88**	0,40	1,15
Karotten, gegart	5	1	0,0	6,7		**4,58**	0,40	1,83
Brühe	3	0	0,0	0,0		**3,00**	2,50	7,50
Bockwurst, gegart	1,5	1	25,0	0,3		**-1,11**	2,00	-2,21
Saure Sahne	3	1	18,0	3,5		**0,94**	0,50	0,47
Brötchen, Weißmehl	2	0	2,0	3,2		**1,64**	0,70	1,15
993 kcal					**Summe:**	**1,77**	**7,30**	**12,89**

Tab. 8.25: GTS rating for lentil stew (1)

Linseneintopf ohne Wurst (2)	Qualität (#0-4)	Garen (#0-4)	Fett (in %)	Zucker (in %)	Heißhalten (in h)	GAS-Wert	P-Menge (1=100)	Wert pro Speise
Linsen, gegart	4	1	1,0	1,0		**3,76**	1,50	5,64
Kartoffeln, gegart	3	1	0,0	0,7		**2,88**	1,00	2,88
Karotten, gegart	5	1	0,0	6,7		**4,58**	1,00	4,58
Brühe	3	0	0,0	0,0		**3,00**	2,50	7,50
Saure Sahne	3	0	18,0	3,5		**1,03**	0,30	0,31
Brötchen, Vollkorn	4	0	2,0	1,0		**3,75**	0,90	3,38
540 kcal					**Summe:**	**3,37**	**7,20**	**24,27**

Tab. 8.26: GTS rating for lentil stew (2)

Currywurst mit Pommes (1)	Qualität (#0-4)	Garen (#0-4)	Fett (in %)	Zucker (in %)	Heißhalten (in h)	GAS-Wert	P-Menge (1=100)	Wert pro Speise
Currywurst, gegrillt	1,5	1	25,0	0,3		-1,11	2,00	-2,21
Pommes frites	3	1	0,0	0,7		2,88	2,00	5,75
Pflanzl. Öle	3	1	100,0	0,0		-7,09	0,30	-2,13
Majo, normal	2	0	83,0	0,0		-6,30	0,80	-5,04
Blattsalat	5	0	0,0	0,5		4,98	0,70	3,48
Dressing, fettreich	3	0	65,0	1,9		-3,60	0,35	-1,26
Bayerisch Creme	3	1	16,0	21,1		0,26	1,50	0,38
2.134 kcal					**Summe:**	**-0,13**	**7,65**	**-1,02**

Tab. 8.27: GTS rating for Currywurst with fries (1)

Currywurst mit Pommes (2)	Qualität (#0-4)	Garen (#0-4)	Fett (in %)	Zucker (in %)	Heißhalten (in h)	GAS-Wert	P-Menge (1=100)	Wert pro Speise
Currywurst, gegrillt	1,5	1	25,0	0,3		-1,11	2,00	-2,21
Pommes frites	3	1	0,0	0,9		2,87	2,00	5,73
Pflanzl. Öle	3	1	100,0	0,0		-7,09	0,10	-0,71
Majo, light	2	0	45,0	1,7		-2,59	0,40	-1,03
Blattsalat	5	0	0,0	0,5		4,98	1,00	4,98
Jogh-Dressing, fettarm	3	0	6,0	7,4		2,03	0,50	1,02
Obstsalat	5	0	0,0	14,6		4,27	1,50	6,41
1.154 kcal					**Summe:**	**1,89**	**7,50**	**14,17**

Tab. 8.28: GTS rating for Currywurst with fries (2)

8.4 Results with Nutri-Score

The results are given for the recipe and per 100 g. The data are given with salt correction, to 800 mg Na/recipe if the value for sodium is lower. The values broken down to 100 g are the basis for determining the Nutritional Score as well as the Nutri-Score.

Einzel-Menüs	Energie kcal	Zucker g	GFS g	Na mg	Protein g	Ballast g	Obst, Gem, Hülfrü, Nü %	Punkte pro 100g	P-Men g	Nutri-Score
Salami-Pizza (1)	2193	40,5	54,5	3194	63,0	11,3	10,0			
Salami-Pizza (1)/100g	311	5,8	7,7	453	9,0	1,6	10,0	10,0	705	C
Vollkornpizza mit Gemüse (2)	790	38,5	19,2	1509	38,0	16,1	34,0			
Vollkornpizza mit Gemüse (2)/100g	112	5,5	2,7	214	5,4	2,3	34,0	1,0	705	B
Pellkartoffeln & Quark (1)	1231	40,3	39,6	800	29,0	5,0	9,0			
Pellkartoffeln & Quark (1)/100g	163	5,3	5,2	106	3,8	0,7	9,0	7,0	755	C
Pellkartoffeln & Quark (2)	544	32,2	3,4	800	36,0	8,1	29,0			
Pellkartoffeln & Quark (2)/100g	72	4,3	0,5	106	4,8	1,1	29,0	-2,0	755	A
Pellkartoffeln & Quark (3)	846	26,6	14,8	800	32,0	5,0	9,0			
Pellkartoffeln & Quark (3)/100g	112	3,5	2,0	106	4,2	0,7	9,0	1,0	755	B
Spaghetti mit Hackfleisch (1)	1508	36,9	40,8	800	69,0	6,6	20,0			
Spaghetti mit Hackfleisch (1)/100g	201	4,9	5,4	107	9,2	0,9	20,0	4,0	750	C
Vollkornspaghetti mit Gemüse (2)	885	30,1	13,6	800	32,0	21,0	60,0			
Vollkornspaghetti mit Gemüse (2)/100g	118	4,0	1,8	107	4,3	2,8	60,0	-4,0	750	A
Spaghetti mit Hackfleisch (3)	939	19,3	18,7	800	44,0	6,8	22,0			
Spaghetti mit Hackfleisch (3)/100g	148	3,0	2,9	126	6,9	1,1	22,0	-1,0	635	A
Steaks mit Pommes (1)	1453	34,4	25,3	800	72,0	4,4	9,0			
Steaks mit Pommes (1)/100g	195	4,6	3,4	107	9,7	0,6	9,0	2,0	745	B
Steaks mit Pommes (2)	783	27,7	6,4	800	69,0	8,3	33,0			
Steaks mit Pommes (2)/100g	103	3,6	0,8	105	9,1	1,1	33,0	-4,0	760	A
Linseneintopf (1)	993	8,2	24,7	1927	45,0	7,9	16,0			
Linseneintopf (1)/100g	136	1,1	3,4	264	6,2	1,1	16,0	2,0	730	B
Linseneintopf (2)	540	10,7	3,6	800	25,0	16,8	49,0			
Linseneintopf (2)/100g	75	1,5	0,5	111	3,5	2,3	49,0	-4,0	720	A
Currywurst mit Pommes (1)	2134	34,6	69,1	2173	39,0	4,0	9,1			
Currywurst mit Pommes (1)/100g	279	4,5	9,0	284	5,1	0,5	9,1	13,0	765	D
Currywurst mit Pommes (2)	1154	28,4	25,0	1959	37,2	8,4	33,0			
Currywurst mit Pommes (2)/100g	154	3,8	3,3	261	5,0	1,1	33,0	2,0	750	B

Tab. 8.29: Nutri-Score evaluation for paired individual menus - with salt correction

For the following discussion, the salt-corrected version is again used as the basis, since only small differences can be seen in the point values, the Nutritional-Score, and the salt-corrected version is the more realistic one.

9. Discussion of selected menus

9.1 Overview of the results

The results of the evaluations of selected menus with GTS and with Nutri-Score are compared in a table below.

Nr	M e n ü s	GTS rot/gelb/grün	Nutri-Score A-E	kcal
1	Pizza mit Salami (1)	-0,03	C (10)	2193
2	Vollkornpizza mit Gemüse (2)	3,18	B (1)	790
3	Pellkartoffeln mit Quark (1)	1,72	C (7)	1231
4	Pellkartoffeln mit Quark (2)	3,25	A (-2)	544
5	Pellkartoffeln mit Quark (3)	2,41	B (1)	846
6	Spaghetti mit Hackfleisch (1)	1,26	C (4)	1508
7	Vollkornspaghetti mit Gemüse (2)	3,66	A (-4)	885
8	Spaghetti mit Hackfleisch (3)	2,19	A (-1)	953
9	Steak mit Pommes (1)	1,25	B (2)	1453
10	Steak mit Pommes (2)	2,80	A (-4)	783
11	Linseneintopf mit Wurst (1)	1,77	B (2)	993
12	Linseneintopf ohne Wurst (2)	3,37	A (-4)	540
13	Currywurst mit Pommes (1)	-0,13	D (13)	2134
14	Currywurst mit Pommes (2)	1,77	B (2)	1154

Tab. 9.1: Comparison of ratings of selected menus

The results of the examined dishes with GTS are broadly spread and range from deep red (-0.13) to deep green (+3.66), i.e. across all traffic light colors. In contrast, Nutri-Score's ratings essentially go across only three of five categories, from "A"-"C," with a single exception for a curry sausage variety, which receives a close "D." Green ratings dominate the ratings (5x "A" and 4x "B" >> 9 out of 14=64%). Otherwise, 4x "C" and 1x "D" are awarded.

The very high-fat and high-energy dishes should all have been given "E". After all, there are seven of these, i.e. the majority. However, such a rating is far away for all menus. The distance to the worst rating "E" is still large (6 points) from the D menu (curry sausage with fries 1). Pre-

sumably it is not even possible with Nutri-Score to design a dish in such a way that it achieves the worst rating, in contrast to GTS, which still rates six of the 15 dishes as red. The subsequent discussion will show which ratings are more plausible. In the menus previously examined, the higher plausibility was clearly with GTS.

In the following, the individual menus will be discussed in more detail, especially when the ratings with GTS and Nutri-Score show clear differences. As mentioned above, Nutri-Score relates the results to 100 g, taking into account the salt correction (≥ 2 g NaCl/meal).

9.2 Pizza with salami

This uses mostly high-fat foods, which are not limited to the ingredients of the pizza. The dressing and dessert are also high in fat.

This becomes clear in the nutritional value calculation. The energy content of this menu is very high. At almost 2,200 kcal, it reaches the guideline value for daily energy for adults. A look at the micronutrients including dietary fiber in relation to 1,000 kJ shows that there is a shortfall in 9 out of 11 of the nutrients examined. The main ingredient of the pizza consists of normal flour (type 405), which helps to explain the poor values. In particular, the dietary fiber content of only 12% is far below the target value. In addition to the high fat content, the high sugar content of over 40 g is critical, which is due to the very sweet dessert. The nutritional value ratio is strongly shifted towards fat, the fatty acid spectrum is acceptable, but the absolute amounts are of course too high. Such a menu would have to be rated poorly by a valid and plausible scoring instrument. In any case, the nutritional value calculation clearly shows the deficits.

GTS rates clearly with red, whereby the GTS value with -0.03 is far below the limit value to yellow. With the exception of the leaf lettuce, all ingredients are also red. This is very reasonable and therefore plausible.

Nutri-Score, surprisingly, only assigns a medium rating of "C", or yellow, for such a menu. The Nutritional Score of 10, however, is just before the border to "D". An "E" would actually be appropriate here. As with the menu optimization, the much too favorable rating of Nutri-Score is confirmed. This rating must be seen as a misleading one.

Conclusion-1: While the results of the nutritional value calculation and of GTS ("red") are comprehensible, Nutri-Score rates unreasonably favorable with "yellow".

9.3 Wholemeal pizza with vegetables and salad

The whole grain pizza has been optimized compared to the first pizza in almost every ingredient. For example, the dough is made from whole wheat flour and a vegetable topping is chosen instead of salami. The other ingredients are also more favorably classified.

This results in an energy reduction from 2,200 kcal to just under 800 kcal in the nutritional value calculation. As a result, this pizza is on par with the energy recommendation for an adult lunch. As the nutrient densities show, all micronutrients are significantly above the target values (i.d. about twice as high). The nutrient ratio and the fatty acid spectrum, although not optimal, can still be described as good.

This positive assessment of the nutritional value calculation is reflected in the evaluation of GTS. The whole wheat pizza menu has a GTS score of 3.18 points, much better than the peppe-roni pizza, which puts it clearly in the green zone. Despite the relatively high amounts of fat in the pizza dough (29 g) as well as in the cheese with 30% fat, this very well composed dish also rightly skipped the green rating threshold. A better result could be achieved if the pizza dough recipe were optimized with regard to the amount of fat. In any case, the green rating is plausi-ble.

Nutri-Score only awards a "B" for this very good pizza, which is somewhat disappointing. Ho-wever, the numerical value of +1.0 is in the borderline range of "A" and "B". The rating is still plausible overall, but should be a bit more favorable.

Conclusion-2: Nutri-Score rates the whole grain pizza as green (B), but somewhat too poorly due to the very good composition of this dish. With GTS, a clear green traffic light color is awarded.

9.4 Jacket potatoes & cottage cheese (1)

The first version of boiled potatoes has three high-fat ingredients. On the other hand, only the leafy vegetables and the boiled potatoes can be judged favorably.

The nutritional value calculation turns out to be correspondingly unfavorable. The energy and fat content is well over 1000 kcal and almost 90 g of fat, respectively. This is two to three times higher than desirable. The sugar content of almost 40 g is also unfavorable. Nutrient density for micronutrients shows shortfalls in more than half. The nutrient ratio is strongly shifted in favor of fat, and saturated fatty acids dominate the fatty acid spectrum. The nutritional value calculation thus gives an unfavorable report card.

With GTS, this menu is therefore also rated as red. The value of 1.72 is just before the yellow li-mit line. This almost yellow GTS value is due to the leaf salad as well as the boiled potatoes. So there is some room for optimization here. The GTS result largely coincides with the result of the nutritional value calculation.

This unfavorable evaluation is also reflected in a medium C score in Nutri-Score. At 7 points, the score is well away from a green and a D rating. Thus, Nutri-Score once again rates more fa-vorably than GTS, which is not justified given some serious weaknesses (energy, fat).

Conclusion-3: For this menu, Nutri-Score rates too favorably with a "yellow." GTS, with a red traffic light color, rather represents the value of this high-fat menu.

9.5 Jacket potatoes & cottage cheese (2)

The second variant is again characterized by optimizing measures, which can be seen in the lean quark, the low-fat salad dressing and the fruit salad.

The nutritional calculation shows corresponding values, with a low energy and fat content. The sugar content is also more favorable. The nutrient ratio has a very low fat content, while the fatty acid spectrum is somewhat shifted towards saturated fatty acids, but this is due to the very low fat content, so that an imbalance can be created with even small amounts of a fat-

ty acid. The nutrient density is much better than in the 1st variant, so that now there are no shortages. Overall, therefore, a very good dish.

This statement is confirmed by GTS because a green rating of 3.25 is achieved. Almost all ingredients are now in the green range or close to it. Only the dressing is still red, but with a much better score than the 1st variant.

With Nutri-Score, the best rating is now also achieved, namely an "A". However, the value of -2 is on the borderline of "B". Here, therefore, there is a congruence of the evaluation of all three instruments.

Conclusion-4: Both instruments rate this dish with the best score, i.e. a clear green.

9.6 Spaghetti with minced meat (1)

Several unfavorable ingredients are prominent in this dish. The spaghetti is made of white flour, high-fat ground meat is used, the amount of vegetables is small and the cheese is high in fat. The dessert also contains a lot of sugar and fat. Therefore, the rating should be poor.

This assumption is supported by the nutritional value calculation, because the energy content of over 1500 kcal is much too high for a lunch. This is mainly due to the high fat content, which exceeds the reference value almost by a factor of 4. Therefore, the nutritional value ratio is strongly fat-heavy. Furthermore, the low-grade white flour in the pasta provides too few micronutrients. The fiber content is also too low and does not even reach one third in energy terms. The poor nutrient density is shown by the fact that most micronutrients are deficient. The nutritional calculation thus speaks a clear verdict against this dish.

GTS also comes to a poor assessment. The GTS value of 1.26 is clearly in the red range and thus corresponds to the rating of the nutritional value calculation. Only the vegetables are rated green, but this hardly carries any weight and thus cannot compensate for the other unfavorable ingredients.

The Nutri-Score evaluation results in 4 points and thus a "C", just on the border of "B". This is too favorable given the weaknesses of this dish. Yellow, i.e. a good medium rating, should not be awarded for such a menu. Previous experience has shown that Nutri-Score cannot give dishes a rating lower than "C". In this respect, it fits again. However, such information for the guest would be misleading.

Conclusion-5: The rating at Nutri-Score is too favorable with "C" (yellow) and misrepresents the poor composition of the dish. The nutritional calculation and GTS, on the other hand, rate this menu poorly (red), which also corresponds to the quality.

9.7 Wholemeal spaghetti with vegetables (2)

Analogous to the pizza, a whole-grain version was also created for the spaghetti dish. Here, in addition to the use of whole-grain pasta, minced meat is completely omitted and instead a lot of vegetables are used. The fruit salad also contains a relatively high amount of sugar, but as fresh fruit it is clearly more nutritious than a pudding. Overall, a nutritionally very well put together menu.

As the nutritional calculation shows, this dish has an energy content over 600 kcal lower than the first spaghetti dish. It also contains several very high-quality foods in larger quantities, especially vegetables. Therefore, the nutrient density is high, although some minor shortfalls remain. The fiber content reaches about twice the target value. The fatty acid spectrum is fairly balanced and the nutrient ratio is also good, although somewhat fat-heavy. Overall, a very good result - with minor drawbacks.

In this respect, **GTS**'s overall green rating of 3.66 is plausible, the best value of all the menus. All ingredients except the small amounts of oil are rated green. It is hardly possible to increase the value of this menu. As mentioned in the nutritional value calculation, there are some small weaknesses in this overall very good menu. Nevertheless, GTS rates this menu with the highest value. Is that a contradiction? This is because GTS does not only consider the nutritional values, but also various other criteria[65], e.g. preventive medical ones. With the Q-values, GTS expresses the overall evaluation of individual Food-groups, with vegetables achieving the highest Q-value. For this reason GTS evaluates this menu better than it would be the case on the basis of the pure nutritional value consideration. GTS goes beyond this isolated nutritional aspect of nutritional quality. This is also the approach taken by the DGE in its 3D food pyramid.

Nutri-Score also assigns the highest rating of "A" with a score of -4, which is clearly in this best rating range, i.e. far from the borderline to "B". The favorable value is only to a small extent due to the relatively high proportion of valuable foods such as vegetables, since only from 40% is another point to be achieved at all. Here, 60% was reached and thus another point.

Conclusion-6: Both instruments rate this menu similarly, namely very well, which is expressed with an "A" or a high green GTS value.

9.8 Spaghetti with minced meat - moderate version (3)

Because of the agreement and the difference in the evaluation of the two spaghetti dishes, a medium spaghetti menu is still evaluated, whereby some extreme approaches of the 1st variant were taken back.

The nutritional value calculation shows that with an energy content of 953 kcal, this menu is still to be rated as unfavorable, although a lot better than the 1st variant. High fat contents including saturated fatty acids, a low fiber content and a significantly worse nutrient density than the 2nd variant show that this menu has some serious weak points. For example, the sugar content as well as the amount of saturated fatty acids is significantly higher than the 2nd variant. Furthermore, the fiber content and the proportion of valuable foods of this 3rd variant only reach one third of the second one in each case, which should lead to devaluations.

With GTS this difference shows up very convincingly, because a value of 2.19 was determined. This is in the lower yellow range, so only a moderate result. The weak points of this menu are thus plausibly shown.

However, Nutri-Score also assigns an "A", just like the 2nd variant. This is too favorable, since an "A" suggests to the guest that this is a highly valuable, recommendable dish. However, this cannot be said at all due to the characteristics of this menu. An average rating of "C" or at best "B" would be appropriate. In this respect, the Nutri-Score rating is misleading.

65 Peinelt V: Description of GTS. Longversion. https://ewd-gastro.jimdo.com/gas/beschreibung/longversion-94-s, s. Kap. 3

<u>Conclusion-7</u>: Nutri-Score and GTS rate differently for the medium spaghetti option. Nutri-Score gives a very good green rating ("A"), which does not do justice to the weaknesses of this menu. GTS, on the other hand, gives a weak-yellow plausible rating.

9.9 Steak with fries (1)

This is a large piece of lean meat (250 g) and a medium salad with a sauce with moderate fat and sugar content. The starch side dish of French fries was assumed to be high in fat with a normal serving size of 200 g. Dessert also contributes its fair share to the fat and sugar content. These ingredients alone suggest that the dish cannot be rated good, mediocre at best.

The nutritional calculation shows that the energy content of about 1,450 kcal is more than double the reference value for a lunch. The fat and protein contents show an analogous overlap. The KH content is correspondingly low. With large meat or fish portions, the nutritional ratios are basically shifted toward protein. The amount of fat is also usually too high, which is particularly true here. As expected, the nutrient density is unfavorable, with more than half of the micronutrients, including dietary fiber, failing to reach the target values. The value for dietary fiber is only a meager 21%. The fatty acid spectrum, on the other hand, is okay. Overall, this is a poor to average rating.

GTS rates this dish as red, far from yellow (1.25). This is because GTS assigns quality deductions to red meat. So again, an extended criterion is used here. The two main components of this dish, meat and fries, add up to 60% of the total, which is to be rated unfavorably. Even the green salad cannot compensate for this "mortgage" due to the low portion weight. An overall red verdict is therefore understandable and thus justified.

Nutri-Score has determined a "B" rating for this unfavorable variant of the steak menu, with a score of 2. Given the undoubted weaknesses of this dish, a green rating does not seem plausible. The disadvantages of meat are viewed differently by Nutri-Score than by GTS. If only because of the increased cancer risk of red meat, as well as other unfavorable ingredients in meat, only moderate consumption is recommended by all professional organizations worldwide. But with the Nutri-Score toolbox, such criteria cannot be taken into account. Primarily, the high protein content is evaluated, regardless of the source. The unfavorable ingredients of meat hardly enter into this evaluation. The over-rating for this dish joins other mis-rating by Nutri-Score.

<u>Conclusion-7</u>: Nutri-Score rates this high energy, high fat, high meat, low vegetable dish as green ("B") too favorable. The red GTS score, on the other hand, is more plausible and takes much better account of the dish's drawbacks.

9.10 Steak with fries (2)

The optimized version of this menu has been optimized several times. The fries are now cooked without fat and the salad marinade is low-fat, as is the dessert. Accordingly, the rating for this variant should be more favorable.

A look at the nutritional values shows that they should be rated much better. At just under 800 kcal, the energy content is half that of the first steak meal. The fat content is well in line with the recommendation for a lunch. Of course, the protein content is much too high for a large

piece of meat (around 100%), which is reflected accordingly in the nutritional value ratio. The fatty acid spectrum, on the other hand, is good. The nutrient density has also improved, with only one micronutrient (Ca) and the dietary fiber contents being too low. The levels of iron and B vitamins are particularly high. Overall, then, a good menu.

This is also reflected in a good yellow rating in GTS. The value of 2.8 is just short of a green rating (from 3.0). Essential to the failure to reach the green range is the devaluation of meat for the reasons already mentioned. The Q-value for meat, i.e. the initial value that is decisive for the subsequent GTS value, was set at 2.0, so that after the GTS-specific deductions only a red GTS value of 1.5 can be determined. The high portion weight of meat is the main reason for an overall GTS value below 3, and thus below green. If fish or vegetarian ingredients were used instead of meat, the menu could be moved into the green range. For the various reasons detailed in the long version of the GTS description, there should not be an equal rating of fish and meat. Therefore, GTS rates this menu only a high yellow.

In contrast, Nutri-Score comes in at an "A", with a Nutritional Score of -4. The high protein content contributed by the meat is mainly responsible for this. The large portion of meat alone results in 5 Nutritional Score points. The relatively high proportion of valuable foods such as vegetables of 33%, on the other hand, has no influence whatsoever. Only from a portion of 40% can an additional point be scored here. In view of the high value of fruit and vegetables incl. legumes and nuts, which is estimated worldwide by professional societies, this complete lack of points is not understandable with a proportion of vegetables of after all one third. On the other hand, a reduction in sodium of only 200 mg is already rewarded with a point advantage. This is probably an incorrect weighting of Nutri-Score.

Conclusion-8: Nutri-Score already rates the dish with medium energy and fat content and a high meat and low vegetable content as green ("A"). This is too favorable, as meat has some principal disadvantages. The traffic light color yellow would therefore be more plausible, which is also assessed as such by GTS.

9.11 Lentil stew with sausage (1)

With legumes, potatoes and vegetables, this dish contains many valuable foods. However, the value is reduced in variant 1 by a high-fat sausage (25% fat) and an inferior white flour roll. In this respect, the rating would have to cut back and be in a medium range.

The nutritional value calculation indicates an excessively high energy content (approx. 1000 kcal), which is far above the reference value for a lunch. The fat content is about three times higher than recommended. The distribution of the main nutrients is therefore too fat-heavy, while the fatty acid spectrum has too many saturated fatty acids. As expected, the nutrient density leaves much to be desired, as about one-third of the micronutrients studied do not meet the reference values per 1000 kJ. The dietary fiber content of about 50% is also clearly too low. Overall, the result is a medium to unfavorable rating.

A low yellow, almost red value (1.77) is given by GTS. While the vegetable ingredients, with the exception of the white flour roll, are in the green range, the animal ingredients are rated red. The bockwurst is even in the negative range due to its high fat content and poor Q value. For this dish, the bockwurst would have to be replaced by a vegetable alternative with less fat

and the good vegetable ingredients would have to be increased in portion weight to get to a much better rating. GTS's yellow, almost red, rating is therefore plausible.

The situation is different again for Nutri-Score, where a "B" was again awarded. In view of the described weak points, this rating is clearly too good. The evaluation of water, which makes up a large proportion of a stew, is unclear. Water is apparently not taken into account by Nutri-Score in the rating. However, it makes a difference whether the components of the stew are consumed with or without water. If the water is taken into account, there is a dilution of the nutritional values of all the ingredients, for better or worse. In the case of GTS, the liquid is also evaluated, taking a neutral position.

Conclusion-9: With Nutri-Score, the unfavorable quality of the lentil stew is not represented. Therefore, the green ("B") rating is again considered misleading. GTS, on the other hand, rates appropriately with a "yellow" close to "red".

9.12 Lentil stew without sausage (2)

The second lentil stew is composed of much better ingredients. Only a little fat is used and, in addition to lots of vegetables (350 g), a whole-grain roll is served.

The nutritional values are thus characterized by a low fat and sugar content. Fat and protein are below the reference value for lunch, while carbohydrates are above. This is an extreme nutritional value ratio that is not achieved by any other menu. Of course, too little fat in the nutritional value ratio is not a cause for concern, since too little fat is hardly to be expected even with a very thoughtful food selection. More important are other criteria, such as nutrient density, which are correspondingly high with such a low energy content. However, since there is no dairy product in the recipe and the very fat content is very low, deficiencies in calcium and vit. E could not be avoided. Other nutrients also did not have good coverage of the target values, but significantly more than in the first variant of the lentil stew. Therefore, this menu would have to be rated better.

GTS rates this menu as green, and the GTS value of almost 3.4 can be considered quite high. There are other menus that may have higher nutrient densities, but are rated lower by GTS. This can be explained by the fact that GTS uses criteria other than nutritional content for a rating, with high Q scores being given to vegetables and legumes in particular. These receive small deductions, so that the good initial values are largely retained. The high value cannot be adequately represented by the nutritional value calculation alone. The fact that the nutritional value calculation is not sufficient for a holistic evaluation of meals has also been recognized by the DGE, which is why it has developed the 3D food pyramid. With this, additional criteria are also used for the evaluation. For this reason, the good rating of the second stew by GTS is quite plausible.

Nutri-Score rates this stew as "A", with a good Nutritional Score of -4, which is helped by the high proportion of vegetables and legumes. From 40%, an additional point can be awarded for this, which, as already mentioned, is basically too little. Decisive for the good value are the favorable values with the criteria, which lead to negative points, like the energy, the saturated fatty acids as well as sugar (sodium was standardized here). So there is a good agreement with GTS here.

***Conclusion-10**: Nutri-Score plausibly shows the improvement of this stew. The "A" score corresponds to the nutritional values and is consistent with the high GTS value.*

9.13 Curry sausage with fries (1)

The epitome of an "unhealthy meal" is expressed with this dish. All the individual dishes are chosen to be unfavorable. The usual palette for this classic dish has been expanded somewhat and also set unfavorably. This menu again has a rather fictitious character, which can nevertheless be subjected to an evaluation. Here, no instrument should result in a medium rating, let alone a good one.

First of all, the nutritional value calculation again. The energy and fat content is exorbitantly high at approx. 2,134 kcal and over 193 g fat, respectively, and can only be matched by the salami pizza among the examples evaluated so far. Thus, the energy target value of an adult for one day is reached. Such a dish should be rated very poorly for these two characteristics alone.

The nutrient density is low. The requirements for most nutrient contents are around half (except for fat-soluble vitamins). The fiber content is also very low (12%). While the nutrient ratio is extremely skewed towards fat, the fatty acid spectrum can even be described as acceptable, which is due to the high proportion of vegetable oils. Overall, therefore, a downright devastating rating.

GTS determines a negative value for this, namely -0.13, which is deep red. This is the worst GTS value of all the menus examined, which is entirely plausible based on the nutritional value calculation and the foods used. All ingredients are rated red, with the exception of the salad, of course, but its dressing also contains an extreme amount of fat, so the salad as a whole also has a negative impact on the overall score.

With Nutri-Score, the dish is still rated "D" despite its extremely poor nutritional qualities. After all, one would like to say, because this rating has not been achieved by any menu so far. However, the Nutritional Score of 13 is not far from "D". The borderline to "C" runs at 11, so it wouldn't have taken much for this curry sausage variant to still be rated "C." A slight reduction in the amount of mayo would have been sufficient. The distance to "E", the most plausible rating for this menu, is still very large at 6 points. So, once again, the question arises as to how a dish actually has to be composed in order for it to receive an "E" from Nutri-Score? This again shows that Nutri-Score is unsuitable as an evaluation tool for poorly composed dishes and menus.

***Conclusion-11**: GTS rates this dish a deep red, which is plausible and very much in line with what the nutritional calculations say. Nutri-Score, on the other hand, gives it only a "D," close to "C." So that's a poor medium rating. This letter seems to be the utmost that Nutri-Score can award for poor dishes.*

9.14 Curry sausage with fries (2)

Once again, the first variant is optimized. Admittedly, this is not easy with currywurst, because apart from mayo/ketchup and French fries, nothing is actually consumed in addition to the sausage. This optimization is also more of a fictitious menu, with the aim of sounding out how the instruments can handle improvements.

The improvements relate to fries, which are cooked low-fat this time, mayonnaise, which is adopted in smaller portion sizes and as a light version (half the fat content), a low-fat marinade and, last but not least, a fruit salad instead of a high-fat dessert. These numerous improvements should have a significant impact.

It is not possible to create a favorable menu from a very unfavorable one, even with highly unrealistic changes. At least nutritionally, the improvements are readily apparent, as the energy and fat contents are roughly halved. Therefore, the nutritional ratio is not as bad as before, although still fat-heavy. The fatty acid spectrum is in a good range because high-quality vegetable oil was used. As expected, the nutrient density is significantly improved, with only one micronutrient still showing a slight deficiency. All others are excellent, at 150 to 300% of target. The amount of dietary fiber should also still be increased. Overall, then, a medium-quality menu.

This is also expressed in the evaluation with GTS. The GTS value of 1.89 is in the lower yellow range, not far from the red limit. Compared to the first version, these improvements mean a jump of over 2 full points, which is a lot! The high fat content of the curry sausage and mayo, even though it contains significantly less fat here, have a corresponding impact. This cannot be better than yellow.

Improvements are still possible if a lower-fat sausage is used, whereby then the characteristic of this sausage is likely to be changed, which is already the case by the imputed dishes (leaf salad, fruit salad) anyway. There are certain dishes that can hardly be optimized, especially if the characteristic ingredients are to remain constant. This second version of the curry bratwurst is therefore an -unrealistic- optimum of the possibilities for improvement, which cannot go beyond a bad yellow.

Nutri-Score rates this menu a "B", or green, with a Nutritional Score of +2 (11 points lower than the 1st variant). It's hard to believe that this high-fat dish, riddled with other weaknesses, is rated green by Nutri-Score, while GTS almost makes it a red. These are already very significant differences in the rating. Even if the first variant is significantly worse than the second, a dish with these characteristics cannot get the stamp "recommended", which is the case with a green rating.

<u>Conclusion-12</u>: GTS gives this dish a poor yellow rating, which is very much in line with what the nutritional calculation says. Nutri-Score, on the other hand, gives it a green rating ("B"), which is too favorable.

10. Plausibility of the evaluations

The results of the ratings of the menus have been summarized in the table below. The colors of the cells reflect the traffic light color. Furthermore, details of the evaluation were reported: once the GTS value and the Nutritional Score as well as the letters.

Nr	M e n ü s	GTS	Nutri-Score	kcal/Port.	Fett/Port.
1	Pizza mit Salami (1)	-0,03	C/10	2193	148g
2	Veget. Vollkornpizza mit Gemüse (2)	3,18	B/1	790	36g

Nr	M e n ü s	GTS	Nutri-Score	kcal/Port.	Fett/Port.
3	Pellkartoffeln und Quark (1)	1,72	C/7	1231	86g
4	Pellkartoffeln und Quark (2)	3,25	A/-2	544	7g
5	Pellkartoffeln und Quark (3)	2,41	B/1	846	43g
6	Spaghetti mit Hackfleisch (1)	1,26	C/4	1508	94g
7	Vollkorn-Spaghetti mit Gemüse (2)	3,66	A/-4	885	39g
8	Spaghetti mit Hackfleisch (3)	2,09	A/-1	1104	57g
9	Steak mit Pommes (1)	1,25	B/2	1453	98g
10	Steak mit Pommes (2)	2,80	A/-4	783	25g
11	Linseneintopf mit Wurst (1)	1,77	B/2	993	61g
12	Linseneintopf ohne Wurst (2)	3,37	A/-4	540	8g
13	Currywurst mit Pommes (1)	-0,13	D/13	2134	193g
14	Currywurst mit Pommes (2)	1,89	B/2	1154	91g

Tab. 10.1: Plausibility of the ratings of selected menus

As Table 10.1 shows, there are only three matches for Nutri-Score with GTS, namely three deep green menus. This corresponds to only 21% of the selected menus. For all other dishes, there were, in some cases, significant rating differences. This can be seen well in the example of salami pizza, which was rated deep red in GTS and yellow in Nutri-Score. Also, the very good composition in the whole grain pizza, which deserved a very high rating, was only given a weak green rating in Nutri-Score. The first steak and lentil stew variants also show significant rating differences. The high-fat steak menu can only achieve a red on GTS, but a green B on Nutri-Score. During the discussions, it then turned out that the ratings of GTS were always more plausible. The higher plausibility of the GTS ratings could be substantiated with dietary recommendations as well as with the nutritional value calculations.

In some cases, it is even necessary to speak of false evaluations in the case of Nutri-Score and misleading in the case of traffic light labels, if these results were communicated to the guests of a restaurant.

11. Conclusion of selected menus

In order to be able to compare the significance of Nutri-Score and GTS even better, 14 differently composed menus were developed as test objects, whereby favorably and unfavorably composed recipes were compared. The scores were the same for only three dishes, and these were green menus. Thus, for eleven menus, there were more or less significant discrepancies in the ratings. After weighing the plausibility of the ratings, taking into account nutritional value calculations and international nutritional recommendations, it could be determined for

each deviation that better comprehensible ratings could be achieved with GTS. In contrast, not once was this true for Nutri-Score.

There was a tendency for dishes with Nutri-Score to be rated too favorably. It was noticeable that even very energy- and fat-rich dishes with numerous deficits were basically never rated worse than "C", i.e. yellow. Only one dish with curry sausage (1st variant), which is unlikely to be offered and eaten in this extreme composition, was rated "D". However, the rating even for this dish is still close to "C". Thus, it is clear that "C" is the lower limit for Nutri score menus. Nutri-Score's traffic light rating for the Community catering area, i.e., for meals, dishes, and menus, has become a "green-yellow rating." Nutri-Score thus cannot warn of any unfavorable menu because a red rating, i.e., an "E," is completely out of the range of this rating spectrum.

Nutri-Score was supposed to provide a more differentiated evaluation, because it works with five letters, whereby two intermediate colors were introduced in addition to the three common traffic light colors. The opposite turned out after this investigation: it is evaluated only with two colors. In addition, the dishes rated "A" are not always convincing. This is true for the second steak menu, or for the third spaghetti menu. On the whole, however, these results can be left standing. GTS comes to similar results for these menus, but more differentiated and plausible in the tendencies. The green "B" dishes are often overrated by Nutri-Score. Overall, the significance of the ratings of the menus examined with Nutri-Score can be described as unsatisfactory.

Since a larger number of different menus were reviewed, it is to be feared that many, if not most, Nutri-Score ratings of dishes, meals, and menus show major deviations from plausible results with nutritional calculations or recommendations for food use. In some cases, Nutri-Score results must even be described as misleading if they were advertised as traffic light colors on a menu.

Therefore, the conclusion must be: The use of Nutri-Score for the evaluation of meals and dishes must be discouraged on the basis of these additional menu ratings.

12. Final discussions

12.1 Nutri-Score

12.1.1 Problems with nutritional calculations

The evaluation of meals and dishes with Nutri-Score requires that exact nutritional values for six parameters are known. For this purpose, the nutritional values for the dishes must either be available via labeling in accordance with the Food Information Regulation[66] or be determinable with a suitable nutritional value calculation program. In the Community catering, and this is the area in which the present study is concerned, nutritional value calculations are very time-consuming if they are not determined automatically via the merchandise management system. However, this also involves a number of problems that can hardly be solved. Nutritional value calculations are fundamentally prone to error in the Community catering, which has

66 Verordnung (EU) Nr. 1169/2011 DES EUROPÄISCHEN PARLAMENTS UND DES RATES vom 25.10.2011 (LebensmittelIV): Informationen der Verbraucher über Lebensmittel. Amtsblatt der Europäischen Union, L 304/18-63 vom 22.11.2011. www.bmel.de/SharedDocs/Downloads/Ernaehrung/Kennzeichnung/VO_EU_1169_2011_Lebensmittelinformation_nurAmtsblatt.html?nn=406624

been described in detail elsewhere[67]. Apart from missing data, it is often difficult to determine the nutritional values of ready-to-eat foods, such as pasta or pulses, if the quantity data in the recipes refer to the dry goods. This is necessary because the nutritional information for the ready-to-eat product must be used in order to compare it with the reference values. Therefore, it must be known how much water is absorbed by the dry goods, which is often not known and is also difficult to determine using software.

Another problem is, for example, the exact determination of the Na content. The transfer from recognized databases such as the BLS can easily cause errors. For example, cooked potatoes contain only 2 mg Na. This is obviously the Na content after the cooking process without any salting. Seasoning or salting, which is common when cooking with potatoes ("boiled potatoes"), is taken into account by the BLS elsewhere for cooked foods. Thus, care must be taken to access the recipes (groups X and Y) for the salt content. Such selection problems also apply to other nutrients, e.g., fat. As a result, the number of available foods is severely limited, so that certain ingredients cannot be found and calculated.

A realistic value for the Na content in food can be found in the BLS for potato dishes. Here the Na amount is between 100 and 200 mg/100 g. However, this information is not very useful for your own recipes, as it does not correspond to the recipes in the BLS. It would therefore be necessary to weigh out the salt quantity exactly and determine the Na quantity from this. This may lead to reasonably accurate results for added amounts that remain completely in the food. However, problems also arise here, e.g., in that often granulated broth and not pure salt is used, with the salt contents varying greatly. Thus, attention must be paid to which product is used and what the salt content is. Such products can differ by a factor of 3 in terms of salt content. It is also difficult to estimate how much salt is transferred from the water to the product (transfer factor). Such differentiation cannot be found in the BLS.

Therefore, the selection of foods may result in incorrect values. In this study, the problem of estimating the salt content has been solved by defining a minimum amount of salt, so that the amount of Na has been considered reasonably realistically. In reality, however, the actual values should already be used as a basis, which is difficult for the reasons mentioned and easily leads to distortions. After all, 200 mg of Na already leads to a point deduction or surcharge in the Nutri-Score. Compared to a single point for 40% of high quality foods such as vegetables, fruits, legumes and nuts, this is an astonishing weighting of the value of Nutri-Score's attributes of dishes. In any case, this shows that the amount of Na has a significant impact on Nutri-Score scores.

Nutri-Score also requires information on dietary fiber. According to the Food Information Regulation, these do not belong to the ingredients that must be declared. According to Art. 30, Para. 2, they may be declared in addition. Therefore, even on packaged foods, to which the regulation refers, information for dietary fiber is not always found. If this information is missing, point values for dietary fiber cannot be determined. Branded products are generally not included in the BLS. To obtain this data, special computer programs must be used. However, not all of them will be found there, so that there are gaps, i.e. this information is missing when determining the Nutri-Score.

67 Peinelt V: Probleme der Nährwertberechnungen. Langfassung. https://ewd-gastro.jimdo.com/gas/probleme-mit-Nährwertberechnung/

High-convenience products are often offered for the Community catering, the labeling of which refers to the state of supply at the time of purchase. These products are usually still finished in the kitchen, i.e. somehow made ready for consumption, e.g. by deep-frying or hot-air steaming. If the products are still deep-fried, it is obvious that the rating on the packaging can no longer be identical to that of the final product. Then it can happen that an A product from the packaging becomes a C product on the plate. But this transformation is difficult to determine. Basically, the user, who still regenerates the products, would have to carry out an exact measurement, determining at least by way of example what quantities of fat are absorbed by the products. But this is far from the end of the determination, because it also depends on which fat is used, because this has an impact on the saturated fat content. It is therefore very difficult to correctly label purchased high-convenience products that are only slightly finished so that all final process steps are taken into account.

If, on the other hand, no high-convenience products are used that have comparatively few processing steps, with greater production depth being used, the problems of evaluation are not likely to be less, rather the opposite. This is also true if a good nutritional calculation program is available. Some of the problems have already been mentioned above.

Missing information leads to distortions in the determination of the Nutri-Score. The problematic nutrients, on the other hand, are more likely to be known in foods of the Food Retail, so that manufacturers can calculate them or even have them determined by chemical analysis. The latter is very time-consuming and expensive, but only has to be done once as long as the recipe remains constant. In the Community catering, this way is of course not feasible because of the large number of dishes.

12.1.2 Problems with the determination of the Nutri-Score

Apart from the problems with nutrient calculations, the inputs for the determination of the Nutri-Score itself are very complex. An input scheme as well as an evaluation procedure must be developed, with which the nutrients can be converted into the Nutritional Score and finally into the Nutri-Score and thus the color and the letter. The evaluation program itself may be defectively designed or incorrectly applied. In Chap. 2, the complexity of Nutri-Score evaluation was outlined in broad terms, with many exceptions and special rules.

It is true that an Excel spreadsheet is provided by a French governmental organization, which can be used to generate the Nutritional-Scores and the Nutri-Scores including the traffic light colors. What remains is the error-prone transfer of the nutritional values into the Excel sheet, especially with the large number of inputs. Therefore, software would be desirable to replace the manual entries to a large extent. In this way, a higher degree of certainty in the evaluation can be achieved. Whether such software exists is not known to the author.

While the determination of the Nutri-Score for products of the LM industry should still succeed reasonably well, since the necessary information is usually available, numerous difficulties are associated with it for the Community catering. These include the fact that the nutritional values are often missing because not all foods are purchased in packaged form, so they do not have to be declared. The assessments are then difficult to make.

Incidentally, it should be noted again that even if the above requirements are met, an assessment is not yet readily possible, as use of Nutri-Score must first be applied for from the French National Health Agency. Although the application itself is free of charge and there are no license fees, the registration is dependent on the owner of the trademark rights[68]. The question is, of course, on what grounds this owner can refuse such applications. There is uncertainty here for interested food suppliers, who may be excluded from using the logo for possibly non-transparent reasons.

12.1.3 Benefits of Nutri-Score for kitchen professionals

All this shows that the application of the evaluation tool Nutri-Score in the Community catering is associated with considerable effort, but also with uncertainties. The kitchen professionals can hardly use Nutri-Score in practice, which would first require them to have the appropriate software or to create an evaluation tool themselves. Both of these are a major obstacle, as the computer skills of kitchen professionals are often insufficient to create such a tool themselves. This might be possible in larger companies where there is an IT department that could then do something like this. However, IT staff already have enough to do with their daily work, so programming such a tool would be a low priority. It also involves the risk of the error sources described above.

Since an IT employee has no expertise in food, the background of this assessment would first have to be explained to him in detail. Since even a cook is not likely to be sufficiently familiar with the Nutri-Score system, this would probably be a task for oecotrophologists, provided that they are active in the Community catering department at all. This is usually only the case in large companies.

It is questionable whether the Excel application of the French agency mentioned above is sufficient for the concerns in large kitchens. If the final result of the nutritional value calculation is to be entered in the Excel line provided, then this presupposes that this final result has first been created. Therefore, this preliminary work would have to be done first with a suitable nutritional value calculation program and with a serious database. The operation of such programs is usually also linked to the availability of specialists in this field. These are usually not the cooks. So again an oecotrophologist or a dietician is needed, with the capacity problems already mentioned. Even if all the above-mentioned conditions were met, and thus correct results were obtainable, it would be very cumbersome to draw consequences from these results - and this would matter at least as much. This should be explained briefly:

> *If a dish is rated poorly, optimization is only possible via several steps. First of all, a nutritional value calculation with promising changes would have to be carried out again. Then all the figures in the evaluation matrix would have to be corrected. Only then would it be possible to see what the change has brought about. This would have to be repeated for each change. Even if, after a few runs, a recipe had then ultimately been corrected to such an extent that a good result had been achieved, at least a "B", it would not be possible to know, on the basis of the investigation presented here, whether this result also correctly reflected the quality of the dish.*

68 Rexroth A: Der neue Nutri-Score zur erweiterten Nährwertkennzeichnung. Ernährung im Fokus 04 2020, S. 261

As has been shown with the menus studied in Chapters 8-11, even poor menus have only a medium, or yellow, rating. The ratings of Nutri-Score deviate from the results of nutritional value calculations or the results of GTS by about 80%. When such a massive effort has already been made, as described above, a kitchen professional cannot even be sure that the results obtained are correct. This then quickly leads to frustration. For these reasons, the Nutri-Score instrument is unlikely to be widely used in Community catering practice.

12.1.4 Sensitivity and differentiation ability of Nutri-Score

Several examples, in particular curried sausage with French fries and mayo, have shown that the sensitivity of Nutri-Score for the evaluation of dishes and meals is far too low. Very clear quality differences in the foods used often have little effect on the Nutri-Score of the dishes. More often than not, completely different qualities of dishes are only one letter apart, e.g., white flour salami pizza and whole grain vegetable pizza. These dishes are at the two ends of the rating spectrum in terms of nutritional quality, respectively, which in this case should be expressed by an "A" and an "E." However, the spaghetti menus are rated "C" and "B" respectively.

Under realistic conditions, bad dishes never get beyond a "C". The spread of five letters in Nutri-Score can therefore not be used at all for dishes. In the end, only three letters are used, as in a normal traffic light, with the difference that the worst rating is yellow and not red. On the other hand, the many good to very good ratings for menus have proven to be too favorable and only confirm Nutri-Score's poor discriminating ability. If these food and dish ratings were to make it onto menus, they would mislead diners into thinking that "green" is a good choice, which is often not justified.

After all, there were three matches with GTS and with the nutritional calculations that involved the best green rating, or "A." Thus, Nutri-Score responds inconsistently: at one time it seems to lack any ability to differentiate, and at other times the rating is accurate. These different rating results leave the user confused and unsettled. A critical guest will soon realize that something can't be right. If he then does not get a plausible explanation, and that is unlikely to be obtained, then he will lose confidence in the validity of this instrument. And when that happens, Nutri-Score will be completely worthless.

The guest must rely on the displayed results, must be able to trust them in order to orient his selection behavior on them, because he believes it benefits his health. With Nutri-Score, the trust of the guests is very likely to be shaken á la longue. Then the steering of the guest in the direction of a healthier diet can no longer function. Once that has happened, traffic light systems for evaluating meals in the context of workplace health promotion will lack credibility. It will then also be difficult for any other tool based on a traffic light rating to gain trust. So the failure of Nutri-Score will also have a negative impact on other nudging systems, because it will then not be possible to influence the guest to a healthy eating behavior, e.g. with GTS. Other systems therefore have a harder time if Nutri-Score does not deliver what it promises, namely a valid and plausible evaluation of meals and dishes.

12.1.5 Reasons for Nutri-Score misjudgments

The question naturally arises as to what the reason could be that Nutri-Score assigns a "C" as the worst rating for meals and dishes. To answer this question, one should consider Nutri-Score's approach to food retailing. Particularly unhealthy foods, especially products high in fat and sugar, should be labeled accordingly. Consumers should know that they are harming their health with certain products that they consume frequently.

This applies in particular to individual products, such as nut nougat creams. These resulted in a Nutritional Score of 23, a value that is 4 points beyond the limit of "E." So, this product arrived in the worst category "E". Such a rating is also very plausible, since nut nougat creams have high contents of energy, sugar, fat, as well as saturated fatty acids, additionally failing to meet the positive criteria. Thus, there are only negative characteristics. Specifically, this product has 57% sugar and 31% fat, so it consists of almost 90% sugar and fat. It stands to reason that such a product must score very poorly. To that extent, this Nutri-Score rating is fine here.

Compared to an unhealthy menu, as represented for example by the menu of the curry sausage of variant 1 of this study, a nut nougat cream must receive a worse label. There is no menu that consists of 90% fat and sugar. And from this you can see roughly how a menu would have to be composed to actually achieve an "E". If an "E" had already been awarded for the menu "Currywurst mit Pommes frites und Majo 1", which would be appropriate for nutritional reasons, nut nougat creams & co could not be rated any lower. If one bases the yardstick of an extremely bad composition as with nut nougat creams, in fact for very "unhealthy" menus at most a "C" can be assigned. The relation of extreme products on the entire food market to meals and dishes in the catering trade would thus be maintained.

Even if the ratings of unhealthy menus and very unhealthy individual products from food retailing show comprehensible relations, a "yellow" for decidedly unhealthy menus can nevertheless not be accepted. The benchmark for the evaluation of meals and dishes must not be a sweet or a very high-fat and high-sugar spread, but other meals and dishes. The evaluated foods must therefore be "comparable"! Therefore, the conclusion can only be that Nutri-Score is not suitable for the evaluation of meals, dishes or menus, because the totality of the evaluated foods is not comparable. This further leads to the question of how the comparable foods are then evaluated in the absence of a universal benchmark. Perhaps a suitability of Nutri-Score for the evaluation of meals and dishes is achievable by modifying the evaluation approach.

12.1.6 Change of Nutri-Score evaluation logic

Since Nutri-Score often produces incorrect results for meals and dishes, and very unhealthy dishes in particular are rated far too favorably, it would be worth considering whether a change in the scoring method could solve the problem of incorrect scoring.

First and foremost, there would have to be a shift in the color or letter boundaries. A poor rating for menus would have to end at "E" (red) and not already at "C" (yellow). This would mean that the boundaries for the numerical values, i.e. the nutritional scores, would have to be shifted accordingly.

The worst results for the menus studied were in the borderline area "C", i.e. at a nutritional score of 10. The borderline to "E" would have to be so low that the worst rating would be possible from a nutritional score of around 3. In relation to the menus examined, at least the two initial menus of the menu optimization would end up in this category. The 1st optimization would certainly not have earned more than a "D". In terms of the paired menus, at least four menus would be assigned to the "E" category with this boundary shift. A few other menus would receive the second worst rating category, "D". This would be somewhat plausible.

However, shifting the scoring boundaries would mean that the calculation mode or scoring would have to be changed. This would further mean that the extremely unfavorably composed products from the Food Retail would be rated even worse than they already are. But this would not be expressible with the current model of Nutri-Score, since they now already have an "E". The letters and colors for such products as nut nougat creams would have to be extended, at least with an "F", probably even with a "G" and "H". If the manufacturers of such poorly rated products were to make an effort to work their way up from the "rating cellar" with better recipes, an additional improvement of the points by 1-3 levels would make this much more difficult. Even an improvement into the yellow range would then be largely impossible. Manufacturers of such products would then presumably forego any improvement efforts.

Basically, an extension of the rating spectrum by 1-3 letters would not help either, because then the letters "D" and "E" would be in the middle range and thus again only a yellow rating would be given for menus with these letters. Very bad menus would have to be rated red and thus receive the rating "G" or "H" in the case of an extension, so that the problem of the distance to unhealthy individual products of the Food Retail remains. Nut nougat creams & Co would always have to be rated lower than bad menus.

What purpose should Nutri-Score serve? This has a twofold orientation: a) a quality information shall be given to the customer to facilitate a health-oriented choice. And b) it sends a message to the manufacturer so that he can optimize his product in terms of health. However, if this were futile, he would refrain from doing so, which is likely to be the case for labeling anyway, since it is known to be voluntary. Therefore, you will hardly find any products on the shelves of food retailers that are rated worse than "B" (green).

Thus, Nutri-Score labeling is in a dilemma. The rating procedure, which provides correct values for very poor Food Retail products, cannot be applied to meals and dishes, as these would then be rated too favorably. Changing the scoring mode with plausible scores for meals and dishes will result in even worse scores for the unhealthy Food Retail products, so they will never get to a "yellow branch," let alone a green one. Health improvements in the recipes of these products, which are certainly desirable, would be stopped because of the hopelessness.

The solution can only be to apply different evaluation procedures for meals and dishes on the one hand and for individual foodstuffs of the Food Retail on the other hand. However, there would then no longer be a uniform procedure!!! Somehow both procedures would have to be made recognizable. When indicating the logo for Nutri-Score, one would have to add which procedure it is, e.g. "Nutri-Score-gastro" and "Nutri-Score-market". This would make it clear that gastronomic or market objects are evaluated with this. To distinguish the logo, all products would have to be marked accordingly. Of course, additional logos could also be used for this purpose, in order to remain in the figurative language.

But this would also be unsatisfactory. The original aim of such a logo was to enable the customer or guest to see at a glance how the product is to be evaluated from a health point of view. He would now have two logos that give him this information. Now one could object that such a separate evaluation does not represent a problem insofar as the products are to be found in different life worlds. Once a customer buys his products in a supermarket and then during working hours he goes to the canteen and eats his meal.

However, it is not quite as simple as that, because there are also many products in food retailing that are to be understood as meals, e.g. pizzas or stews and much more. So we would then have the case that in a living environment, in the supermarket, the products offered there are labeled with different logos. That would be irritating for many. And even in a company restaurant, no "purity" can be maintained. In the cafeteria or even in the company restaurant, more than just food and dishes are offered nowadays. There are of course also merchandise of the most different kind to buy, thus products of the Food Retail . Therefore, a guest in a company restaurant would also be irritated to find different labeling elements of the same system, i.e. Nutri-Score. However, it is essential to avoid irritating customers or guests, because this undermines confidence in the correctness of the statements. And that would be the death of any evaluation tool.

Incidentally, it might be difficult to draw a clear dividing line between the two product categories. When is a product assigned as "gastro," when as "market"? Is a cereal bar to be understood as a substitute for a meal and thus to be evaluated according to this method, or does it belong to the category of Food Retail , which would then require the application of the other evaluation method.

These considerations show only one thing: with Nutri-Score, a uniform evaluation of all foods is not possible in a meaningful way, and changes in the evaluation methodology are problematic in application.

12.1.7 Questionability of the Nutri-Score evaluation method

Section 2.3 already pointed out various ambiguities in the determination of nutritional scores and the assignment of letters and traffic light colors. Among other things, it was asked how the definition of threshold values, the evaluation corridors and the level as well as the determination of malus and bonus points can be justified. It was conspicuous again and again in the course of the investigation that in some cases small changes in the nutrient content due to certain criteria made it possible to shift the evaluation from one letter to the next. The width of the letter corridors varied from 3 to 8 points.

It may be that such "crooked" determinations could be verified as reasonable by appropriate investigations. However, these investigations are not known to the author. They did not emerge from the relevant documents. A substitute for these unknown or missing investigations could have been the verification of the meaningfulness of Nutri-Score for meals and dishes in this elaboration. However, as it turned out, the verification of the assessment method by the established parameters was not possible. Also, in the discussions about the results of the different test objects depending on the assessment method, it became clear again and again that the assessments of Nutri-Score are often not plausible and frequently contradict the results of

the nutritional value calculations. Therefore, the method would have to be changed, at least for meals and dishes. In its current version, its application is too uncertain.

12.1.8 Conclusion for Nutri-Score

The clear conclusion from this research as well as the discussions is that Nutri-Score should not be used in the field of Community catering. The scores have often proven to be implausible and are therefore subject to too much uncertainty. In food retailing, the nutritional values are known for processed, packaged and appropriately declared products, which gives the ratings a higher degree of certainty. Here, certain foods, for example those with an extremely high fat and sugar content, can then sometimes be given an "E" rating. On the other hand, the plausible labeling of meals and dishes, which are after all also offered in food retail, must be doubted. It is therefore incomprehensible why the Nutri-Score is supposed to provide correct ratings for at least 95% of foods[69].

Extreme compositions as with some very sweet and high-fat products in Food Retail are not possible with meals and dishes even with high fat contents, which is why the ratings here can only be a maximum of yellow. However, this is far too favorable, as has been shown many times. Therefore, the whole rating system for meals and dishes would have to be changed in order to be able to use Nutri-Score for the rating in the Community catering in a meaningful way. However, this would be an oath of revelation for Nutri-Score, because it would mean admitting that not all foods including dishes can be plausibly evaluated using a single evaluation approach. If there were different evaluation procedures (algorithms), this would hardly be communicable and would lead to considerable irritation among customers and guests.

12.2 GTS

The scores of the menus with GTS were highly consistent with the results of the nutritional calculations as well as the general recommendations the LM consumption. All problems and weaknesses encountered when using Nutri-Score were avoided when using GTS. Assessment with GTS also does not require a nutritional calculation, eliminating most of the problems described with Nutri-Score. The data needed for scoring are easily obtained or are already available. The scoring problems of high-convenience products can also be solved with GTS[70]. The user-friendliness for kitchen professionals is excellent and has been proven many times in the meantime. After a short training, this group of people is able to understand the evaluation principle and to make improvements to the recipes.

These changes are immediately represented by traffic light colors and numbers, so that it is possible to see in real time whether and to what extent the changes have led to a better evaluation. So there is very little effort involved in getting the results. Thus, a kitchen professional can "play" with the system by making trial changes in several places to quickly see where the effects are strongest or where the costs are lowest. In view of the few numbers that have to be entered, incorrect entries are hardly possible or are intercepted by the system through appropriate input controls.

69 Rexroth A: Der neue Nutri-Score zur erweiterten Nährwertkennzeichnung. Ernährung im Fokus 04 2020, s. S. 261
70 Peinelt V: Gastronomic Traffic Light System. Longversion. https://ewd-gastro.jimdo.com/gas/beschreibung/longversion/, s. Kap. 4.3

This fast display not only immediately brings the results to the screen without the need for cumbersome re-evaluations, but also motivates the kitchen staff to keep optimizing their recipes due to the simple and fast modifications. Many have developed the ambition to optimize away all "red" recipes, but this is not at all necessary. In a normal meal plan, gradual changes are often enough to improve many recipes by one color level, leaving a residue of red recipes. Also, the appeal of the system has led to chefs applying to companies where GTS is used[71]. Kitchen professionals are largely independent of other professionals, as there are no complicated programs to operate in order to receive optimization advice for recipe changes. Thus, they do not need to wait for free capacities of other professionals. In the meantime, software has been developed[72] for the evaluation of GTS, which is linked to the merchandise management system. This makes the handling of GTS even easier.

Last but not least, it should be pointed out that GTS allows for better differentiation. For example, differences in the rating between white flour and whole grain products are clearly shown. A high proportion of vegetables is also more noticeable in the rating than with Nutri-Score.

13. Summary

The Nutri-Score instrument was tested in this study for its suitability in assessing dishes and menus to see to what extent it can be used in Community catering. The results were compared with nutritional calculations and with GTS assessments. The review was conducted in two steps.

First, a very poor initial menu was optimized over four steps. These progressively better intermediate results should show up clearly with the evaluation method of the respective instrument. In a second examination, seven pairs of specific menus were compared, differing in poor and favorable composition. The aim here was to check whether there was sufficient differentiation capability of the instrument. This requires a good sensitivity with which the qualities of the menus can be clearly recognized. Sensitivity depends largely on the defined criteria. The bad and the good variants should be at opposite ends of the evaluation spectrum for each of these menu pairs.

13.1 Results of the menu optimizations

While the results of the nutritional value calculations and GTS largely agree for the menu optimizations, the Nutri-Score results deviate more strongly from them. It is striking that even very poor menus, which have extremely high energy and fat contents as well as a very high proportion of saturated fatty acids, are still rated with the medium level "C" of five levels (A-E). This means that menus with Nutri-Score cannot be rated poorly.

On the other hand, menus with Nutri-Score can relatively easily achieve good to very good ratings, e.g. the first optimization of the menu series, which still has significant weak points (approx. 1,200 kcal/27 g sugar/25 g ges. Fettsre.), achieves level "B" (green). The 2nd optimization also achieves a "B", but already on the borderline to "A" and all subsequent menus are also

71 Feist, Christian, Geschäftsführer von GESOCA, persönliche Mitteilungen, 2021
72 Feist, Christian: Mündliche Mitteilungen, März 2022

rated "A", which is mostly also too favorable. The improvements of two further optimization levels are only recognizable by very small changes in the numerical values, which means that they are classified as almost equal. However, the differences are not small, which was explained in chapter 5. It was precisely the greater spread of the rating over five levels (A-E) that was intended to achieve greater differentiation. The opposite is the case.

In contrast, GTS evaluates the menus in a much more differentiated manner. A green rating is only awarded from the 3rd optimization onwards. The first optimization level achieves a yellow rating and the initial menu is deep red. All ratings are plausible. These statements are helpful for the guests, while the informational value of the Nutri-Score meal rating for the guests must be classified as doubtful. Based on the research presented here, if a dish was rated "C" by Nutri-Score, it must be assumed that this dish has a high fat and energy content. In that case, a warning should actually be issued, but this is not done by Nutri-Score with a "C". A guest should only choose very high-fat dishes as an exception. However, he is lulled into a sense of security by Nutri-Score's medium, yellow rating and is thus virtually misled.

13.2 Results of selected menus

In order to be able to assess the significance of Nutri-Score for the evaluation of meals and dishes even better, seven differently composed menu pairs were evaluated with GTS and with Nutri-Score in a second investigation step. This again showed that green ratings with Nutri-Score were very frequent (10 out of 14 menus). There was no change in the maximum range for dish ratings of only three levels (A-C) for these study items.

The predominantly good to very good ratings of many dishes by Nutri-Score is not very plausible, as has been explained in detail. An example is the curry menu Variant 2, which scored a green "B" despite unfavorable nutritional values. Also, the differentiation capability of Nutri-Score is considered unsatisfactory. For example, many menu pairs differ in Nutri-Score scores by only one letter, although the nutrient contents say something quite different. This applies, for example, to the two pizzas, the whole-grain spaghetti and spaghetti variant 3, or the two lentil stews. For several dishes, the nutritional values are extremely poor, so that at least a "D", but more correctly an "E" should have been awarded, e.g. for the salami pizza or the curry sausage variant 1. Instead, Nutri-Score only awards a "C", which as a medium rating would not cause any "deterrence" in a guest.

It is not surprising, then, that there were few matches in this survey compared to GTS. GTS comprehensibly assigned traffic light colors and GTS scores to all menus across a wide range of ratings. Only 20% of the surveyed dishes were rated the same by Nutri-Score and GTS. Plausibility checks showed that GTS's ratings were well understood, while this was not the case for any of Nutri-Score's discrepant ratings.

13.3 Application benefits

Doubts about the application benefit of Nutri-Score are also justified with regard to the optimization measures of the recipes for kitchen specialists, since e.g. the increase of vegetable quantities or the replacement of white flour products by whole grain products are surprisingly little effective with Nutri-Score. This is understandable, since, for example, a bonus point is

only awarded if the proportion is 40% (!). The difference with white flour and whole grain flour shows up actually only in the fiber content. Here as maximum a value of 2,8 g/100 g ballast materials was specified. Higher contents fall with Nutri score under the table, although these can occur absolutely. Incidentally, the measures are always linked to the need for nutritional calculations, as half a dozen nutrients need to be known for scoring. This is hardly feasible for practitioners in kitchens and clearly shows that Nutri-Score is only intended for packaged foods primarily in grocery stores. In addition, there are problems associated with nutritional calculations in Community catering that make it very difficult to accurately determine the required nutritional values, e.g., for sodium. The numerous problems have been pointed out in detail[73]. Thus, Nutri-Score is unlikely to be of much use to kitchen professionals.

The problems of nutrient value calculations do not matter if the recipes and nutrient contents are precisely known. This is the case in the food industry or in the food trade. Here, the data are sometimes even available as analytical values. The extreme effort of chemical analyses can, if at all, only be provided there. In the Community catering the demand for chem. Nutritional value analyses would be downright absurd.

In the Community catering, however, the nutrients are often not known. This is due on the one hand to the problems of calculating nutritional values and on the other hand to the fact that more and more so-called high-convenience products are being used. These are no longer produced in-house in the production plant, but are purchased from specialist companies and then only finished. The recipes of these products are generally not known, only the nutrient quantities according to the mandatory declaration. This makes it difficult or impossible to calculate nutritional values and thus also to determine Nutri-Score.

13.4 Discussions

In some basic considerations on Nutri-Score, numerous questions and ambiguities were raised. This concerns the problem of calculating the nutritional value in order to determine the required nutritional content for the rating. There are various difficulties here, especially for users in the Community catering. The evaluation program for calculating Nutri-Score is also a problem because it is not readily available. How then can the values for Nutri-Score be determined? Basically, only with an Excel spreadsheet.

The usefulness of Nutri-Score for kitchen professionals was also discussed, and no useful application could be seen. This concerns not only the difficulties of the determination, but also the handling for the optimization of recipes, the actual sense for this target group. Also for the guests of a restaurant the labels with the logo of Nutri-Score are of questionable use, because the ratings are often misleading. If the guests become aware of the contradictions and questionable nature of the ratings, a massive loss of trust towards Nutri-Score's ratings is to be expected. This eventually leads to the uselessness of this label for guests.

The astonishing misratings on some menus were reason to look for the reasons. They are primarily due to the effort to evaluate all foods with one and the same instrument or with only one evaluation method. However, since some products in food retailing are extremely composed, i.e. contain a lot of fat and sugar, there can only be a medium rating, i.e. yellow, for menus,

73 Peinelt V: Probleme mit Nährwertberechnungen. Wo sind die Probleme? https://ewd-gastro.jimdo.com/gas/probleme-mit-Nährwertberechnung/

no matter how poorly composed they are. As understandable as this may be, it does not change the criticism that Nutri-Score does not rate appropriately for very poor menus. Therefore, it was discussed whether Nutri-Score should work with different methods and shift the thresholds here. However, this would involve some additional problems, which were discussed in more detail.

In the quintessence of all investigations, the associated discussions and considerations, it can be stated that the use of Nutri-Score in the evaluation of meals and dishes must be discouraged.

14. Overall conclusion

The studies have shown that

- ratings of meals and dishes with Nutri-Score are in principle too favorable, since practically no dishes are rated worse than "C
- green ratings are given too easily
- the ratings are not differentiated enough
- ratings for extremely fatty and sugary foods can reach an "E", but this scale is not applicable for meals and dishes
- different rating scales for individual foods as well as meals and dishes would cause irritation
- many Nutri-Score ratings must be considered misleading, as even high-fat dishes with moderate nutrient density are still rated green
- the ratings mostly deviate significantly from the ratings with GTS. Only with GTS were plausible traffic light colors assigned for all dishes and meals

Therefore, it is strongly advised not to rate meals and dishes with Nutri-Score.