



Gastronomic traffic light system (GTS)

Long version

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Summary

In order for guests of a restaurant to make a health-conscious choice, they must be informed about the health value of the dishes and meals. Usually, this is done by indicating the nutritional values. But this information is not very comprehensible for guests.

On the other hand, everyone is familiar with the traffic light system, which is why the evaluation of dishes with traffic light colors is understood by everyone. With the "Gastronomic Traffic-Light System" (GTS) presented here, all food offerings can be evaluated in terms of health value, not only complete menus, but also individual dishes or meals. This system is therefore also suitable - in contrast to nutritional value labeling - for information on the qualified selection of individual dishes within the framework of component selection or free-flow offers. After a brief introduction, kitchen professionals are able to optimize their recipes with GTS in terms of health. It is not necessary to replace all red dishes with yellow or green ones, which is hardly possible. The only important thing is that the overall offering has a good, i.e. predominantly green-yellow color distribution.

The evaluations with GTS essentially correspond to the results of Nutritional value calculation and support the adherence to recommendations of international professional organizations for the consumption of Food. Extensive research has been conducted to substantiate this. GTS has an expanded assessment base so that more criteria are included for the results than just nutritional values. For example, preventive medicine findings are taken into account, which is similar to the assessment approach of the DGE's 3D-Food-pyramid.

To ensure that GTS is used safely, a licensed company performs quality assurance. This includes various measures, from staff training and recipe optimization/control to unannounced audits. The results of these audits are prepared in detailed reports to identify existing weaknesses as well as progress. Overall, the GTS evaluation and labeling tool is a very good alternative to the previous NCA.

The GTS concept has proven itself over many years and is now used in over 60 large kitchens of well-known companies. It is usually a component of workplace health promotion and is now also recognized by some health insurance companies, which is associated with financial support for its introduction in the companies.

1. Introduction

The long version for the detailed explanations of GTS has already been presented in the "Manual of Community Catering"¹. This system has been constantly optimized and adapted since its introduction, which is why it makes sense to develop a digital version that can be updated as needed and easily published.

The guest of a restaurant wants information about the composition of the offered meals and dishes. Some of this information is required by regulation, such as additives, which must also be labeled. Others are voluntary, as is the case with nutritional information. If the nutritional values are labeled, exact specifications must be observed. This was newly regulated in the European Regulation 1169/2011² and its specific requirements have been mandatory since the end of 2016.

Of particular interest is information about the nutritional value of dishes. Here, the results of an NCA are usually used. Even today, this labeling is still frequently encountered and is considered, for example, by the DGE as the only serious instrument for the evaluation of dishes. NCAs are required in many quality standards in Germany and abroad, e.g. also for the premium certification of the DGE for all areas of Community Catering, e.g. for company catering³.

However, despite good tools for calculating nutritional values with digital databases as well as proven programs, health information about meals and dishes in the form of NW labeling in Community Catering is still not very meaningful, if it is possible at all. Labeling is not possible when products with a higher degree of convenience are used, the so-called "high-convenience products". These are being used more and more frequently, especially in the Community Catering, due to a massive shortage of skilled workers and guest requests for a diverse range of products. Therefore, these convenience products are necessary in practice. They are "finished" in conjunction with commercial kitchen-specific equipment to create high-quality meals. The recipes of these high-convenience products, however, are not known to the users in detail. For this reason alone, a Nutritional value calculation is no longer possible. The producer's NW information for the individual dishes is limited to only seven nutrients ("Big Seven") (according to VO 1169/2011). Thus, NW information for the guest is, first of all, strongly reduced and always refers only to the respective dish. However, since a guest chooses several dishes, he would have to add up the NW information himself, if this individual information is provided at all. Of course, nobody does that. But that is not enough.

In addition, the NW labeling of the packaged goods usually does not correspond to the exact nutritional values, since the products are often prepared with fat. However, these fat quantities are not taken into account in the NW information on the packaging, so that NW labeling of the end products, i.e. on the menu, for example, is not permitted at all - unless the exact fat intake quantities of the prepared dishes are known and taken into account. However, this is usually not the case. For this, the kitchen staff would have to carry out exact measurements to determine the fat quantities, which nobody does either.

1 Peinelt V: Kap. 57: Gastronomisches Ampelsystem I, Band 2, S. 1522-1596, in: Peinelt V, Wetterau J: Handbuch der Gemeinschaftsgastronomie. Anforderungen | Umsetzungsprobleme | Lösungskonzepte. Rhombos-Verlag, 2. Auflage, 2016, 1642 S.

2 Verordnung (EU) Nr. 1169/2011 DES EUROPÄISCHEN PARLAMENTS UND DES RATES vom 25.10.2011 (LIV): 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

3 Deutsche Gesellschaft für Ernährung (DGE) (Hrsg.): Qualitätsstandards für die Betriebsgastronomie. 5. Auflage 2020, DGE e.V., Bonn



For example, for "ready-to-eat French fries" in BLS 2.3⁴, only a value for fat of 5% was given. This value only applies if the fries are not cooked in oil, but in a combi steamer. But even in the current BLS (version 3.02⁵), contradictory and even misleading information can be found, once with and once without fat absorption. The fat values vary between 3.8% and 20%. At first glance, this is difficult to recognize and it takes a lot of experience with Nutritional value calculation to avoid a wrong selection from the database. However, the normal case is the deep fryer, so the fat content of French fries would have to be assumed to be around 15%⁶. There are other problems that can occur with the NCA, which were presented in a detailed statement, to which reference is made⁷. From these few references it should have become clear that NCA data are often only possible with difficulty or not at all and, in the case of lack of experience, are burdened with considerable uncertainties even with the corresponding software.

In addition to the uncertainty of the NW labeling, it must be pointed out that the NW information is usually not very helpful for the guest's selection. Most guests can't do much with the numbers given. What does it mean, for example, that a dish contains "25 g protein, 50 g fat and 40 g carbohydrates"? Even oecotrophologists would have to compare the values more closely with the requirements for the target group before they could be classified. The numbers only have a certain orientation value in comparison to other dishes. In most cases, they would have to be explained so that they are understandable for the guest. This is an effort that can hardly be made given the hectic pace of everyday life in a large kitchen and the chronic shortage of staff.

In order to avoid these evaluation difficulties, the "Gastronomic Traffic Light System" was developed, which evaluates dishes according to a simple system and can thus provide faster and easier orientation. The favorable influence of traffic light colors on guests' decisions was confirmed in a study⁸. Since the system has already been used in numerous establishments in different sectors⁹, experience is already available in the kitchen and among guests.

2. Development of traffic light ratings

2.1 Visualization of nutrient recommendations

There are now many models with which Foods are visually evaluated. These are mainly "circles" and "pyramids", with which the nutrient content or certain metabolic effects of the Foods are in focus. Also recommendations for the respective Foods quantities are to be given thereby partly. The statements for the consumption of Foods are therefore different and often not comparable with each other. Other systems evaluate Foods in a more general sense.

4 Hartmann B, Bell S, Vásquez-Caicedo AL et al.: Der Bundeslebensmittelschlüssel. Aktuelle Entwicklungen, Potenzial und Perspektiven. Ernährungs Umschau 2006, 53(4): 124–129

5 BMEL: Bundeslebensmittelschlüssel, Version 3.02. <https://www.blsdb.de/>

6 Stiftung Warentest: Der Pommes-King. test, Heft 3/2007, S. 20-25 sowie Angaben des Bundeslebensmittelschlüssels (BLS)

7 Peinelt V: Probleme mit Nährwertberechnungen. <https://ewd-gastro.jimdo.com/gas/probleme-mit-nwb/>

8 Enax L, Hu Y, Trautner P, Weber B: Nutrition Labels Influence Value Computation of Food Products in the Ventromedial Prefrontal Cortex. Obesity Biology and integrated Physiology. Obesity, Volume 00, Number 00, Month 2015, 1-7. www.obesityjournal.org

9 Aktuelle Zahl Anfang 2020: über 60 Kantinen, über 50.000 Essen pro Tag zzgl. ca. 30.000 Essen im SW Berlin. Quelle: Gesoca, Seukendorf



Important objectives are instructions for action for the prevention of diet-related diseases, whereby exercise is also addressed¹⁰. For years, attempts have been made to find alternatives to the common symbols or graphic arrangements. Here, for example, indices are identified, which can be nutrient- or Food-based or combined, combined with the hope to improve clarity, practicability and informative value¹¹. Individual countries in the EU have also created their own evaluation systems, which, however, have mostly only attained significance in the national context and are supported there in part by broad social strata¹².

Before the specifics of GTS are discussed in more detail, some well-known traffic light assessment models will be briefly presented and commented on below.

2.2 Known traffic light models

2.2.1 Nutri-Score

A summary evaluation of such graphically supported, international information systems for Foods was prepared by the Max Rubner Institute (MRI) in 2019¹³. This work was intended to serve as a decision support for the German Federal Ministry of Food and Agriculture (BMEL). A recommendation was made in favor of Nutri-Score, which was later decided upon by the BMEL. This means that labeling may be done with a five-level traffic light symbol (A=green, E=red). For high-sugar and high-fat products in food retailing, these ratings may make sense. A detailed opinion was prepared on the informative value in the area of Community Catering, i.e. meals and dishes¹⁴. It was shown that Nutri-Score is less suitable for the evaluation of meals and dishes, i.e. gastronomic offers. Some scores even had to be described as misleading. Details can be found in the study.

2.2.2 The British traffic light

Because of the high level of awareness and the support of consumer organizations in Germany, the "British traffic light" 1 should be briefly discussed. Here, four nutrients are rated with traffic light colors: Fat, saturated fatty acids, sugar and salt. A traffic light color is assigned for each nutrient. Thus it can happen that all traffic light colors are to be seen with a Food. This is likely to be confusing at first. The customer must then pay attention to which nutrients are important to him, so that he focuses his attention only on these. If the traffic light colors for relevant nutrients are completely different, i.e. green and red, the decision is difficult. Basically, the Foods would have to be rejected as not very suitable.

Apart from the difficulties of conflicting assessments of individual criteria, the informative value of the British traffic light is limited because no information is available on other nutrients, e.g. on dietary fiber or vitamins. Preventive medicine aspects are also not included. For a comprehensive evaluation of Food, more than four nutrients should be used. Therefore, a decision

10 Boeing H: Lebensmittelbasierte Präventionskonzepte. Ernährung Umschau 56 (2009) S. 468–473

11 Diethelm K: Indices zur Bewertung der Ernährungsqualität - eine aktuelle Übersicht. Ernährung Umschau 56 (2009) S. 395-403

12 aid: Ampelkennzeichnung - Pro und Contra. 2008. www.aid.de/downloads/ampelkennzeichnung.pdf, Zugriff: 9.5.14

13 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

14 Peinelt V: Nutri-Score - Ergebnisse einer Untersuchung. <https://ewd-gastro.jimdo.com/gas/nutri-score-vs-gas/>



for or against Foods or meals and dishes with the "British traffic light"¹⁵ is problematic, which is even more true for meal plans.

In the Community Catering, there is still a lot of home cooking. For meal preparation, it is difficult to determine the salt content and set the traffic light value. Normally, the amount of salt is not weighed out exactly. Furthermore, unknown amounts of salt get into the food when it is seasoned. Thus, for sufficient certainty, an Foods chemical analysis would have to be made, which would be downright absurd in the work process of a large kitchen with the many dishes. These comments show that the British traffic light is too one-sided in its informative value and encounters considerable difficulties in practical implementation in the Community Catering.

2.2.3 Three-dimensional Food pyramid of the DGE

For the evaluation of Food, the DGE has also created a traffic light-based instrument, the "3D-Food pyramid of the DGE"^{16,17}, hereafter abbreviated as 3D-LP. It is a three-dimensional Foods pyramid, using the four sides and additionally the base area. This is primarily used to evaluate Food group in an expanded, holistic sense. Because the 3D-LP forms an orientation for GTS, this concept will also be discussed.

For the evaluation with the 3D-LP different criteria are used: energy density, NSD, epidemiological findings (preventive medicine) as well as the content of undesirable accompanying substances. On the four pages, the groups "Vegetable Food", "Animal Food", "Oils and Fats" and "Beverages" are shown in a qualitative classification, marked with traffic light colors at the edge. At the top are the unfavorable ("red") Foods to be evaluated, at the base the favorable ("green"). On the base area, a quantity recommendation for the most important Food group is additionally given in the form of the nutrition circle of the DGE¹⁸. Both elements thus give quantitative and qualitative indications, which is the special approach of this concept.

There are numerous criticisms of the 3D-LP, which have been presented in an extensive article¹⁹. The main criticism is that the 3D-LP cannot be used to evaluate dishes or meals because the ingredients come from different sides of the pyramid. However, a cross-page evaluation is prohibited by the DGE. Therefore, only simple statements can be made, such as whole grain bread is better to evaluate than white bread. This means that the instrument of the 3D-LP can only be used to a very limited extent.

2.3 Consequences for GTS

The examples of well-known traffic light systems show that they are not suitable for evaluating dishes and meals in a differentiated enough or even plausible manner. They can therefore not be used as an instrument for labeling for guests and as an aid for the development of who-

15 Food Standard Agency (FSA): food - using trafficlights - to make healthier choices. 2007. www.food.gov.uk/multimedia/pdfs/publication/food-trafficlight1107.pdf, Zugriff: 9.5.14

16 Food Standard Agency (FSA): food - using trafficlights - to make healthier choices. 2007. www.food.gov.uk/multimedia/pdfs/publication/food-trafficlight1107.pdf, Zugriff: 9.5.14

17 Cremer M, Rademacher C: Die Dreidimensionale Lebensmittel-Pyramide. Fachinformation. Herausgeber: aid und DGE. Moeker Merkur Druck GmbH, Köln, 1. Aufl. 2005, 18 S.

18 DGE: DGE-Ernährungskreis. www.dge.de/ernaehrungspraxis/vollwertige-ernaehrung/ernaehrungskreis

19 Peinelt V, Wetterau J: Stellungnahme zur 3D-Lebensmittel-Pyramide der DGE. <https://ewd-gastro.jimdo.com/gas/3d-lm-pyramide-der-dge/>

lesome dishes for kitchen professionals. Therefore, another instrument must be found for this purpose.

In addition to fulfilling the above-mentioned functions, it is also important that the evaluation approach for GTS is scientifically based. The assignment of traffic light colors for meals and dishes as well as the dividing lines between the colors should be well justified or prove to be justified in a scientific examination. Therefore, as a consequence of what has been said so far, a testing instrument should be found to prove the seriousness of GTS. And this instrument is also applied.

The objective and the evaluation approach of GTS are presented first. It is important that all objects in practice, i.e. all formulations, can be evaluated. This is also true for the frequently used high-convenience products, which are purchased as complete meals, and therefore the recipes are not known. Therefore, it is explained how these products can be integrated into the system of GTS. If this were not possible, a consistent assessment could not be made.

3. GTS valuation method

3.1 Objective of GTS

3.1.1 Basic

With GTS, the intention is to support compliance with internationally recognized nutritional recommendations (including quality standards of the DGE²⁰, D_A_CH reference values²¹, reference values of the efsa²²) for meal planning in the Community Catering by means of traffic light symbols. The guest should be encouraged ("nudging") to prefer the nutritionally favorable offers, while kitchen professionals receive guidance in the development of such offers.

3.1.2 Orientation to the reference values

Whether the traffic light labeling with GTS actually promotes compliance with the reference values must be verified (validated). The result of this verification should not only confirm the consistency of the assessment at the nutrient level, but also for the recommended Foods as well as their quantities (Fig. 1).

20 DGE (Hrsg.), z.B. DGE-Qualitätsstandard für die Betriebsverpflegung. 5. Aufl., Bonn 12/2020

21 DGE: Referenzwerte für die Nährstoffzufuhr. 6/2015. www.dge.de/presse/pm/aktualisierte-referenzwerte-in-neuem-design/

22 EFSA: Dietary Reference Values for nutrients. Summary report. European Food Safety Authority (EFSA). 12/2017. www.efsa.europa.eu/de/press/news/171211

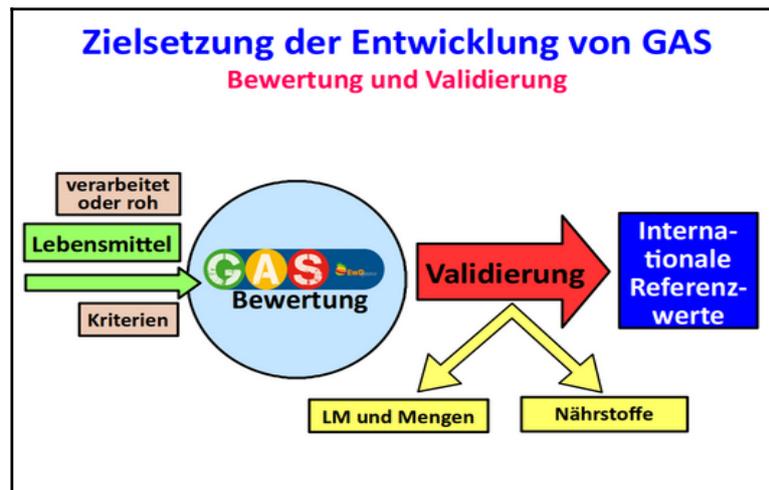


Fig. 3.1: GTS evaluation and validation

In Annex XIII of the Regulation 1169/2011 (Lebensmittel-Informations-VO) the official reference amounts are given, once for the micronutrients (Part A) and for the main nutrients (Part B). For the nutritional value relation the main nutrients are of importance. There one finds the following data, which are mentioned in comparison to the Efsa as well as the D_A_CH reference values:

Nutrients	VO 1169/2011 ²³	Efsa 12/2017 ²⁷	D_A_CH 6/2015 ²⁴
Energy ^{a)}	2000 kcal	2000 kcal	~2200 kcal
Fat ^{b)}	32en%	20-35en%	30en%
Protein ^{b)}	>10en%	>10en%	10-20en%
Carbohydrates ^{b)}	52en%	45-60en%	40-50en%

^{a)}Refers to adults of both genders i.D. ^{b)} Data in energy percent=energetic portion of the nutrient (en%)

Tab. 3.1: International comparison of macronutrients

In most countries of the EU, the consumption of animal products, especially meat, is widespread. Therefore, in practice, the nutrient ratio for protein is well above 10% of the energy intake. In any case, it can be clearly seen that the reference values for the nutritional value ratio in the EU are largely identical.

This is also true for the statements of the USA²⁵. In the Guidelines, great emphasis is placed on translating the nutrient recommendations into specific Foods recommendations. In the case of the nutrient ratio, a preference is expressed for KH, which should clearly make up the largest proportion. This lies with 45-65en% in the same order of magnitude as with the DGE or the efsa, likewise with the fat with 20-35en%. In the USA, particular importance is attached to saturated fatty acids, which should be kept as low as possible (milk 0% fat!).

23 VO (EU) 1169/2011. https://www.bmel.de/SharedDocs/Downloads/Ernaehrung/Kennzeichnung/VO_EU_1169_2011_Lebensmittelinformation_nurAmtsblatt.pdf?__blob=publicationFile. www.bmel.de/SharedDocs/Downloads/Ernaehrung/Kennzeichnung/VO_EU_1169_2011_Lebensmittelinformation_nurAmtsblatt.html?nn=406624

24 DGE: Aktualisierte Referenzwert für die Nährstoffzufuhr in neuem Design. 17.2.2015. www.dge.de/presse/pm/aktualisierte-referenzwerte-in-neuem-design/

25 Empfehlungen der USA: www.health.gov/dietaryguidelines/2015/resources/2015-2020_Dietary_Guidelines.pdf, S. 97



If we look at Japan²⁶, similar values apply. The same applies to the WHO data²⁷. The WHO explicitly points out that 30en% for fat should not be exceeded, so it is even more restrictive with NRW than the industrialized countries. Therefore, this is a global consensus, with only the ranges for the level of recommended nutrient content varying slightly. Thus, there is no reason to align the recommendations for nutrient ratios with the ideas of low carb diets²⁸.

What is true for the macronutrients is also true for the micronutrients: the differences in the international reference values are only slight. A detailed comparative presentation has been published²⁹, to which reference is made.

3.1.3 Assistance for guests and kitchen staff

In addition to conforming to nutritional recommendations, GTS should make the evaluation of meals quickly recognizable and easy to understand for the guest. This makes it easier for the guest to make a health-oriented choice of meals. For this purpose, not only dishes of a certain line have to be selected. Rather, the guest should have the option of selecting his or her own meals from the entire range on offer. Therefore all meals must be evaluated with the traffic light system. GTS should not only evaluate the entire offer, but also be applicable with different offer forms and/or serving systems, like e.g. complete meals, plate meals with component choice or "free flow" serving. The evaluation system must adapt to the circumstances. The now common type of output with a high degree of freedom will not be able to go back to the 60s and 70s, when there were only complete menus. These can be easily calculated. However, it is not even necessary to offer complete meals so that the guest can eat a full meal, because with GTS it is now possible to evaluate each individual component. If the guest makes sure that the individual components are predominantly green, he can eat a complete meal.

He is not forced to choose only "green" dishes to get the best nutrition. With a good supply design, there is also room for popular but unfavorably rated dishes, such as the infamous "curry sausage with fries and mayo." It is up to the guest whether he or she eats "red" food only once in a while or more often. There is therefore no paternalism through this labeling. If he eats nutrition-consciously, he will choose red dishes only rarely and otherwise mainly look for his luck with the green ones. This presupposes that the supplier is able to make an attractive offer of green and yellow dishes, with an appropriate selection. And thus we come to the kitchen professionals.

For kitchen professionals, the rating system should serve as a guide for recipe optimization. The system should show which ingredients are rated less favorably (yellow) or even unfavorably (red). Then the professionals would know where to start. GTS should offer various levers or adjusting screws to improve the overall result. Changes should be possible, for example, via other portion quantities as well as other Food qualities. Other cooking methods can also have a significant influence on the final evaluation of the dishes, which should be taken into account by the system. The kitchen staff would then only decide which of the options is most suitable. They are also the most likely to be qualified to do so.

26 Peinelt V: Kann Deutschland von der Schulverpflegung in Japan lernen? 2. Aufl., Rhombos-Verlag, 2018, 420 S, <https://ewd-gastro.jimdo.com/schulverpflegung/internationaler-vergleich>, hier: Kap. 5.1.

27 WHO: Empfehlungen der WHO: www.who.int/elena/healthy_diet_fact_sheet_394.pdf, hier: S. 3, Zugriff: 27.6.16

28 Low-Carb: Hoher Anteil an Fett und Protein, niedriger Anteil an Kohlenhydraten, s. auch <https://ewd-gastro.jimdo.com/gas/low-carb/>

29 Peinelt V: Wissenschaftliche Basis von GAS. <https://ewd-gastro.jimdo.com/gas/wissenschaftliche-basis/>

Because individual ingredients are rated, kitchen professionals have full transparency and therefore oversight for the ratings. Substituting lower-quality ingredients for higher-quality ones may fail because the cost is too high, so reducing the portion size might be easier and more cost-effective. Also, other cooking methods are not always possible because they are tied to the capacity of the available equipment and the appropriate usage schedules. Therefore, the decision as to which measure is most effective or even possible is best made by kitchen professionals who have several alternatives available with GTS. It is important to note that the traffic light assessment can improve these measures.

Just as it should be required that diners be free to decide what food they choose, it should also be required that kitchen professionals be free to decide what actions they take to improve the quality of the food. In other words, they have an important say in the process, which experience has shown greatly increases their willingness to be actively involved in the optimization process. The system should not only be liberal, but also easy to apply, since the traffic light color achieved makes it easy to see how the recipe should be rated. If the result is still not sufficient, further adjusting screws would have to be changed.

The advantages of GTS for these two groups are presented again below.

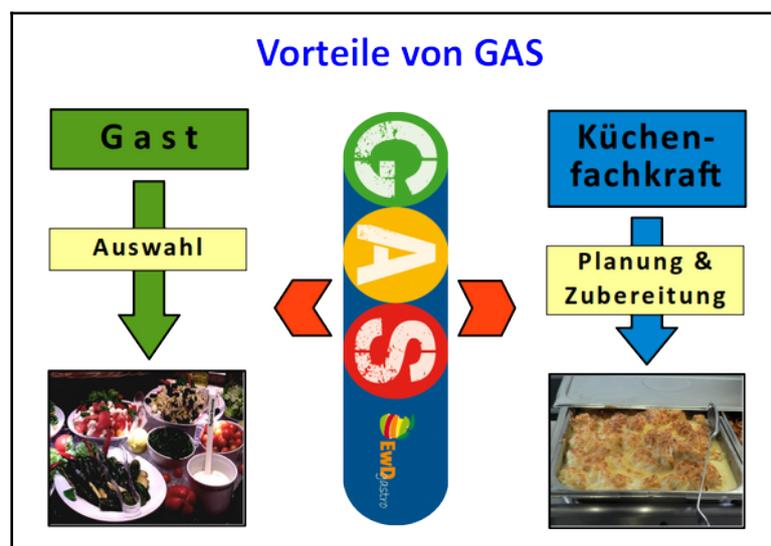


Fig. 3.2: How do guests and kitchen staff benefit from GTS?

3.2 Evaluation criteria

With GTS a method was developed, with which a summarizing evaluation of meals and courts in nourish-physiological regard is possible. The guest is given an orientation for the choice of food with only one symbol, a traffic light color. The traffic light color is catchy for everyone: Green is favorable, red unfavorable, yellow lies in between. Because it is so easy to understand, traffic light labeling is now used in many areas.

An evaluation must refer to certain criteria, which can be used to decide how the food is to be classified from a health point of view. In the following, therefore, the criteria of the assessment are first discussed in order to define the assessment basis and background of GTS. Subsequently, it is explained how these criteria are used to convert into "Q-values" and then into

"GTS-values". With the help of these values, assignments of the dishes to traffic light colors are possible in the first place.

3.2.1 Criterion: Desirable nutrients

The concept of GTS is committed to the official recommendations of nutrition science as published by the D_A_CH reference values³⁰ as well as the quality standards of the DGE for the field of Community Catering derived from them. The reference values of the EU as well as many other international recommendations of individual countries up to the WHO show great similarities with the D_A_CH reference values³¹.

With regard to macronutrients, all these reference values for the energetic fat portion of the diet have for decades unchanged specified the low value of about 30% and for carbohydrates the high portion of at least 50%. Protein should make up 10-20% of the energy. The recommendations for fat refer not only to the energy content, but also to qualitative aspects, namely the fatty acid spectrum. The same applies to the intake of carbohydrates, for which a high proportion of whole grains and a low proportion of white flour and sugar are recommended. The recommendations for fats and carbohydrates enter into the assessment of GTS in that Foods with low levels of fat, fats and oils with good fatty acid spectra, and whole grain products receive a principally higher Q-value than Foods without these characteristics.

In addition to macronutrients, micronutrients also play a role in the assessment. Good nutritional quality of food is associated with high Nutrient density and low energy density. However, even Foods with a high energy content can be evaluated favorably if they contain high levels of micronutrients or other essential nutrients per 100 g or if they have favorable nutrient profiles. Examples would be certain oils and nuts.

The question is how NSDs are compared so that tiered assessments can be made. For this purpose, a comparative value was determined, with NSDs of the major Food group for 14 nutrients based on the latest BLS 3.02. The actual-target ratios for these nutrients, based on 1000 kJ, were calculated and summed. The D_A_CH reference values for the age group 25-51 years for men were used as the target values. These are the primary comparison values.

The actual target sum values were additionally formed for 100 g and compared with the daily reference values. For this purpose, the sum values were multiplied by 10 to provide better comparability with the results for NSD, since the daily target values are about ten times higher than the target values per 1000 kJ. Thus, supplemental (secondary) comparison values were available. The investigations showed that very high sum values in Nutrient density are present for the Food group vegetables/mushrooms, fruits, legumes and offal. For offal, liver stands out with extremely high values.

With the exception of liver, vegetable Foods are at the top of the NSD. As expected, nuts can only achieve low Nutrient density due to their high fat content (approx. 50%). On the other hand, the nutrient content per 100 g is among the highest of the Food group compared. In the case of fish, a differentiation must be made according to the fat content (fat fish or lean fish), which also applies to mopros, meat and sausage. The total values for 1000 kJ are higher for

30 DGE et al. (Hrsg.): D_A_CH-Referenzwerte für die Nährstoffzufuhr, 1. Aufl., 5. korrigierter Nachdruck, Neuer Umschau Buchverlag, Neustadt/Weinstraße, 2013, 292 S.

31 Peinelt V: Wissenschaftliche Basis von GAS. <https://ewd-gastro.jimdo.com/gas/wissenschaftliche-basis/>

fish than for meat, Mopros and whole grain products. Sausages bring up the rear, excluding those products that contain a higher proportion of liver. The sum values for the micronutrients were summarized in Table 3.2.

Food-Groups	Σ -Values/1000 kJ Reference value: 1000 kJ	Σ -Werte/100 g x 10 Reference value: day
Liver (beef, pork, veal)	440-890	250-430
Vegetables, mushrooms	37-375	7- 36
Fruit	10-83	5-15
Legumes	25-51	15- 55
Fish, fat/lean	20-50	7-27
Eggs (whole egg)	27	16
Potatoes	25	8
Whole grain products	15-20	15- 30
Muscle meat fat/lean	15-30	11-17
Dairy products fat/lean	9-25	5-21
Nuts	8-22	14- 43
Sausages fat/lean	6-20	8-17

Tab. 3.2: Comparison of summed actual-target ratios for micronutrients per 1000 kJ/100 g

Conclusion: Plant Food have the highest Nutrient density (per 1000 kJ). The exception is liver. Nuts have very good nutritional values per 100 g. Vegetables and fruits should therefore be highly valued.

3.2.2 Criterion: Undesirable nutrients

These substances are not toxins such as heavy metals or pesticides, but nutrients naturally present in food that can have negative effects on health. While reference values for intake exist for desirable nutrients, there are warnings for limiting intake of undesirable nutrients.

For example, an increased intake of purines can trigger gout, so individuals at risk should avoid eating purine-rich Foods or limit them by, for example, eating only a maximum of one small portion of meat per day.

For saturated fatty acids, it is recommended to consume only a maximum of one third of all fatty acids. The general recommendation to hold back on the intake of saturated fatty acids can be found worldwide. An excessive intake of these fatty acids carries the risk of cardiovascular diseases. In this context, mention should also be made of trans fatty acids, which can occur naturally, e.g. in the cow's rumen stomach. These fatty acids then enter the milk and can provide relevant amounts in butter. They can also be formed during certain Food technological processes (margarine production). In any case, they have toxic effects and their intake should be kept as low as possible. Since no labeling may be done, Foods with a high content of trans

fatty acids cannot be identified. However, some Foods are known to perform poorly in this regard, e.g., butter. Due to the poor data situation, they should not be included as a criterion.

Cholesterol is not viewed as critically today as it was in the past. Nevertheless, the DGE guidelines for fats still recommend limiting not only the amount of fat but also the amount of cholesterol. Reference should be made to the last DGE guideline for fat³². In the context of coronary disease prevention, significant relationships with increased risk of myocardial infarction are pointed out, which have been found in some studies, including follow-up evaluations of very long duration studies. Here, the intake of cholesterol was about 400 mg per day, only slightly more than is contained in a hen's egg. Other studies did not find this correlation. So the situation is unclear. In such cases, the worst case should rather be assumed, which is why a limitation of this substance seems reasonable. In any case, a high cholesterol intake cannot be considered completely harmless based on this guideline.

Some Food contain flatulent substances, so-called oligosaccharides. They are primarily found in legumes. As a result, the digestibility of this Food group is usually reduced, which may also be the reason why consumption has remained at a low level for a long time.

Last but not least, sodium is also considered, which is a component of salt (share=40%). Too much salt consumption can increase the likelihood of suffering a stroke and other cardiovascular diseases. It is true that there are people who are not sensitive to cooking salt. However, there will certainly be a larger number among Community Catering guests who react positively to salt, i.e., suffer cardiovascular disease more easily. Therefore, salt consumption should be kept as low as possible. After all, those who do not react to salt would not be harmed by a low salt intake.

As Table 3.3 shows, the plant Foods almost without exception have favorable values for the undesirable nutrients. Only legumes have a somewhat higher purine content, similar to meat, and should not be consumed more frequently than once a day if uric acid levels are elevated. Because of the very low consumption of legumes in Germany, a daily consumption of these Food is far above the norm, so that a restriction is not necessary in practice. A daily consumption would even be recommendable for gout patients, if this would reduce the consumption of meat and sausage.

The high proportion of saturated fatty acids in animal products is striking. In meat, it is almost 50%. Only fish have an acceptable proportion of 30% among animal Food. There is also the fact that this Food group has a high proportion of n-3 fatty acids (omega-3). Cholesterol is known to be found only in animal Food. It is known to be high in eggs, but also in liver. The salt content of animal products can also be very high, especially in sausages and cheese, but also in certain fish products if they are salted (e.g. maties, anchovies). Normal fish cuts, on the other hand, contain only little salt, analogous to untreated meat.

The following table shows the contents and the double-weighted sums of the Food group with respect to undesirable nutrients (favorable=3, medium=2, unfavorable=1).

32 DGE: Evidenzbasierte Leitlinie Fett. Fettzufuhr und Prävention ausgewählter ernährungsmitbedingter Krankheiten. Kap. 9: Fettzufuhr und Prävention der koronaren Herzkrankheit. Sonstiges: Einfluss von Cholesterin. 2. Ausg. 2015, S. 150. www.dge.de/wissenschaft/leitlinien/leitlinie-fett/

Food-Groups	Purins	SFA/ Total Fat	Choleste- rol	Flatulent Substances	NaCl	Total
Weighting factors	1	2	1	1	2	max=15
Vegetables, mushrooms	3	3	3	3	3	15
Fruit	3	3	3	3	3	15
Nuts	3	3	3	3	3	15
Potatoes	3	3	3	3	3	15
Whole grain products	3	3	3	2	3	14
Eggs	3	3	1	3	2	13
Legumes	2	3	3	1	3	12
Fish	2	3	2	3	2	12
Herring, salted	2	3	2	3	1	11
Muscle meat	2	1	2	3	2	10
Dairy products	3	1	2	3	1	10
Liver	1	2	1	3	2	9
Sausages	2	1	2	3	1	9

Tab. 3.3: Content of undesirable ingredients

Conclusion: Due to the high proportion of undesirable nutrients, animal products should also be devalued in comparison to plant Food in this criterion.

3.2.3 Criterion: Secondary plant substances

These are plant substances (secondary metabolites) that occur in many different plant Food. Up to 10,000 of them are found in the human diet, of which about 1.5 g are ingested per day. Based on their chemical structure and functional properties, they are classified into different groups, such as polyphenols, carotenoids, sulfides, saponins or lectins.

They do not belong to the essential nutrients, but have a favorable influence on many metabolic processes. The importance of these substance groups can now be well described and their health effects are widely known. They may protect against various types of cancer, have a positive effect on blood pressure, and have anti-inflammatory and antibacterial effects, to name but a few. At present, it is not possible to derive a specific recommendation for the consumption of any of these substances. There is much to suggest that their efficacy exists only in combination³³.

The criterion is therefore simple. If the Food used belong to the Food group with a high content of sec. plant substances (vegetables incl. legumes, fruits, nuts and whole grain products), then they are classified higher. All animal Food are thus left empty-handed in this respect. It is not possible to make an exact numerical assignment based on the content of individual se-

33 DGE: Sekundäre Pflanzenstoffe und ihre Wirkung auf die Gesundheit. www.dge.de/wissenschaft/weitere-publikationen/fachinformationen/sekundaere-pflanzenstoffe-und-ihre-wirkung/



condary plant compounds as to how much higher the classification is. The positive effects of this substance group are too unspecific for this. In addition, the data for the Food are missing or difficult to obtain. This criterion can only be an orientation or the stabilization of the achieved score.

Conclusion: Vegetables, fruits, nuts and whole grain products are also rated favorably because they are rich in phytochemicals.

3.2.4 Criterion: Preventive medicine

For the preventive medicine aspects, similar criteria are used in the Food assessment as in the 3D-LP of the DGE. Decisive for the evaluation are epidemiological findings, especially the effects on four disease groups, namely diabetes mellitus type 2, coronary diseases, stroke and cancer. Numerous studies are available for the involvement of specific Food group in these diseases, which were published in the 2016 Nutrition Report in the form of meta-analyses. These were assessed for their levels of evidence and used to evaluate Food-groups. Beyond the results of these studies, salt content (significant for coronary disease and stroke), was also included in the evaluation if a threshold was exceeded.

The results of the above studies in the 2016 Nutrition Report are summarized below in tabular form. The positive numbers indicate a beneficial effect of the Food group on the respective disease and vice versa. The levels of evidence are given as 0-3. Here, "0" means no discernible influence and "3" means a very high probability of influence³⁴. The number "- 3" would therefore indicate a very high probability that there is no influence. The individual levels of evidence were summed.

As can be seen, almost all plant Food group have a favorable influence on the four diseases considered. Whole grain products are at the top with a summed score of "9" out of a maximum of 12 points, closely followed by vegetables and fruits. Of the animal Food, only fish can achieve positive values.

Very unfavorable values are achieved by red meat and meat products, both of which are strongly located in the negative. Meat products top the list of negative attributes. Only white meat, i.e. poultry, scores neutrally³⁵.

34 Definition der Evidenzgrade (nach den Kriterien der WHO): 3=überzeugend, 2=wahrscheinlich, 1=möglich, 0=unzureichend

35 DGE (Hrsg): 13. Ernährungsbericht 2016, im Auftrag des BMEL. Kap. 5: Härtegrade für die Evidenz einer kausalen Beziehung zwischen dem Verzehr von Lebensmittel-Gruppen und ausgewählten Krankheiten anhand von Meta-Analysen. Bonn (2016) - Legende: grün=hohes, gelb=mittleres, rot=schlechtes präventivmedizinisches Potenzial

Food-Groups	Cancer	Diabetes mell. Type 2	Coronary diseases	Blowattack	Total (max. 12)
Whole grains products	2	3	2	2	9
Vegetables	2	1	2	2	7
Fruit	2	1	2	2	7
Nuts	1	1	2	1	5
Fish	0	0	2	2	4
Dairy products	0	2	1	1	4
Legumes	1	0	1	0	2
Potatoes	0	0	0	0	0
Meat, white	0	0	0	0	0
Eggs	0	-2	0	0	-2
Meat, red	-2	-1	0	-2	-5
Meat products	-2	-2	-2	-2	-8

Tab. 3.4: Preventive medical properties of Food according to the 2016 nutrition report

Conclusion: From a preventive medicine point of view, vegetable Food are again to be rated higher than animal Food. Because of the differences between fish and meat and red and white meat, different scores are assigned.

3.2.5 Criterion: "5 a day"

In 1990, the WHO already recommended a minimum intake of 400 g of fruit and vegetables per day. The reason given was the higher risk of cancer with low consumption of these Food. International studies at the turn of the millennium came to the conclusion that 7-14% of the energy intake should come from fruits and vegetables, distributed over 5-10 servings. This corresponded to 400-800 g of fruits and vegetables per person per day. The DGE took up these recommendations and advocated 10% of energy intake from fruits and vegetables, although the higher value of 14% was considered more favorable. Because of the implementation difficulties of this recommendation, the moderate value was chosen³⁶.

Thus, this concept^{37, 38} is about increasing the consumption of fruits and vegetables. To this end, the DGE, the German Cancer Society, ministries, foundations, health insurance companies and representatives of the fruit and vegetable industry founded the non-profit association "5

36 DGE: Obst und Gemüse. Die Menge macht's. www.dge.de/wissenschaft/weitere-publikationen/fachinformationen/obst-und-gemuese-die-menge-machts/

37 "5 am Tag" - eine Erfolgsgeschichte. Ernährung im Fokus - Online Spezial. www.bzfe.de/inhalt/5-am-tag-eine-erfolgsgeschichte-4656.html

38 "5 am Tag": Pressemitteilung zum 20jährigen Bestehen des Vereins. www.5amtag.de/service/presseinformationen/pressemitteilung/article/categories/5-am-tag-20-jahre-erfolgreiches-engagement-fuer-ausgewogene-ernaehrung-mit-gemuese-und-obst/



am Tag e.V." in 2000. The patronage is held by the Ministry of Nutrition and the Ministry of Health. It is thus an alliance of science, politics, health care and business.

From the outset, the aim has been to communicate to consumers that five portions of vegetables and fruit per day should be consumed because of their high health value. The recommendation is based on preventive medical effects that are scientifically undisputed. Several hundred scientific studies prove that people with a high consumption of these Food group have a lower incidence of typical civilization diseases such as heart attacks and strokes. Blood pressure can also be lowered. Furthermore, positive effects on dementia and various types of cancer have been observed. In addition, weight can be positively regulated due to a stronger feeling of satiety and low energy density. As a result, obesity-associated diseases are less frequent. The most important studies on this are readily available³⁹.

As of today, too few vegetables and fruits are consumed in Germany. It was found that i.D. only 3.2 servings of these Food are consumed³⁸. That is less than two thirds of the recommendation! There has never been a comparable campaign for animal products. Therefore, it seems justified to highlight and especially evaluate these two Food-groups, even if there is some overlap with other criteria.

***Conclusion:** The most successful campaign in Germany on healthy nutrition recommends a high consumption of fruits and vegetables and, in moderate form, nuts. This recommendation is missed. Good traffic light ratings could favorably influence consumption.*

3.2.6 Criterion: Fatty acid spectrum and vitamin E

The evaluation of fats and oils must be evaluated according to different criteria than with a broad spectrum of nutrients. Oils consist of different proportions of certain fatty acids and they contain different amounts of Vit. E. It is recommended to divide the three fatty acid groups in which the saturated fatty acids and the polyunsaturated fatty acids each account for a maximum of up to one third, while the monounsaturated fatty acids account for at least one third⁴⁰. This distribution, together with the Vit. E content, represents the essential basis for the evaluation of high-fat Food.

The polyunsaturated fatty acids must be differentiated once again. There are two essential fatty acids, the n6-linoleic acid and the n3-linolenic acid. According to the DGE reference values, the two fatty acids should be ingested in a certain ratio, namely max. 5:1. However, dietary habits show that relatively too little of n3 fatty acids is ingested (approx. 10:1). Thus, there is a disproportion in these fatty acids. Therefore, Food with a high proportion of n3 fatty acids should be evaluated particularly favorably to promote measures to increase their proportion in fat intake.

Oils contain different amounts of Vit. E. If the proportion of polyunsaturated fatty acids is high, the Vit. E content should also be high. However, this is not always the case. For example, there are oils with a high content of PUFAs but only a low content of Vit. E, e.g. soybean oil, walnut oil or linseed oil. Since this is an essential substance found in particular in this Food-group, fats and oils should also be evaluated according to their Vit. E content.

39 "5 am Tag": Aus der Wissenschaft. Studien und Forschungsergebnisse. www.5amtag.de/wissen/aus-der-wissenschaft/

40 DGE: Fettzufuhr spielt Rolle für die Prävention von Krankheiten. Presseinformation 04/2015 v. 24.3.15. www.dge.de/presse/pm/dge-empfehltauf-fettmenge-und-qualitaet-achten/



In connection with the fatty acid spectrum, reference should be made to fatty fish, seeds and nuts, where a high proportion of omega-3 fatty acids can often be found. These are the so-called n3-LC-PUFA⁴¹, which are formed by conversion of the original n3-linolenic acid into so-called EPA and DHA, i.e. highly unsaturated omega-3 fatty acids. They are not found in plant Food. The conversion rate of the initial fatty acids (C18) into the LC-PUFA in the body is very small⁴² n3-LC-PUFA=omega-3-long-chain-polyunsaturated fatty acid. (about 5%) and is not sufficient for the biosynthesis of the final substrate (EPA and DHA), which is why an alimentary supply is necessary (>>semi-essential substance). They are particularly valuable, which justifies the high estimation of fish.

Conclusion: In the case of high-fat Food, especially oils and fats, the fatty acid spectrum is important and can vary greatly. Particular attention should be paid to the n-3 fatty acids, as they are not consumed enough. Vit. E should also play a role in the evaluation.

3.2.7 Criterion: Toxic substances

Food contain natural nutrients and foreign substances that have been added or have arisen during processing. Some substances of both categories can be toxic to the body above a certain concentration. For example, Vit. A, iodine and trans fatty acids belong to the first category. Certain Food can contain such high concentrations that they have a toxic effect on certain groups of people even at normal consumption, e.g. the liver in pregnant women or some types of algae with regard to iodine absorption.

The second category includes, for example, heavy metals such as lead, cadmium or mercury, which are released into the environment and then into foodstuffs through the combustion of fossil fuels or through industrial processes. It is also known that the world's oceans are littered with plastics, which are ingested by fish and other aquatic organisms in minute quantities (nanoparticles) and thus also reach humans. In addition to these unintentional inputs into natural cycles, there are many that are intentional, such as pesticides used for crop protection or antibiotics used in animal production. However, this should be done in such a way that they are no longer detectable at the time of consumption, but this is often not the case.

These and many other substances enter the animal or plant body in the short or long term and threaten the health of the consumer. "Pure" Foods have not existed for a long time. Therefore, upper limits have been established that make the consumption of Foods still acceptable within these limits.

Unfortunately, for Food-groups, a certain proportion exceeds these limits and must be objected to. If certain Food group are frequently affected or if the toxic substance has a greater relevance, this should have an impact on the assessment of these Food-groups. GTS is used to check whether certain Food group have an increased toxic risk, so that a devaluation of this group is made. Evidence for such an assessment can be found, for example, in the nutrition reports of the DGE^{43,44}.

41 n3-LC-PUFA=omega-3-long-chain-polyunsaturated fatty acid.

42 Wehrmüller K: Gesundheitlicher Nutzen von omega-3-Fettsäuren und die Bedeutung von Alp-Produkten für die Zufuhr. Ernährungs Umschau, 11/08, 655-661, s. S. 657

43 DGE (Hrsg): 11. Ernährungsbericht 2008. Kap. 4: Toxikologische Aspekte der Ernährung. Im Auftrag des BMEL. Druck Center Meckenheim

44 DGE (Hrsg): 12. Ernährungsbericht 2012. Kap. 4.3: Unerwünschte Stoffe in Lebensmittel. Im Auftrag des BMEL. Warlich Druck Meckenheim

Conclusion: Certain nutrients and foreign substances may be present in the diet in such high concentrations that they have a toxic effect. Such Food group should be devalued accordingly.

3.2.8 Criteria exclusion

3.2.8.1 Ecological and ethical criteria

Ecological or ethical characteristics of the food are not defined as criteria in GTS. They are therefore not evaluated and do not influence the traffic light color. Ecological properties refer to questions of CO₂ emissions, i.e. which "carbon footprint" the ingredients used or the meals produced have. There are numerous studies that investigate this question. In individual cases, the question of ecological quality is difficult to answer, since factors such as agriculture, processing, preparation as well as transport have a considerable influence on the assessment. These factors are difficult to determine, possibly with different results, which would make the assessment poorly comparable.

The environmental aspects of food undoubtedly play an important role in climate change, as the food sector accounts for approximately 20% of total CO₂ emissions. Therefore, attention should be paid to the ecological quality of food. GTS has a positive impact on the ecological characteristics of the food offer, which will be discussed later.

With ethical characteristics a code of conduct is meant, which would have to be supplemented basically still by the social as well as economic basic conditions, if the question of the lastingness of an enterprise or enterprise is to be answered. This includes the minimum wage and social benefits in the company, as well as family-friendly conditions and a good working atmosphere. Conduct toward cooperation partners such as suppliers and society as a whole should also meet high standards. An evaluation of all these areas would overtax the possibilities of GTS as an instrument related to nutritional quality. Here, certification instruments would have to be used, such as the "Excellent Community Catering"⁴⁵.

There is another aspect to this. Even if such assessments could be made with GTS, this would lead to blurring if everything is to be mapped with a traffic light value. For example, in the case of a mediocre rating, it would be unclear whether this was due to poor nutritional and good ecological as well as ethical properties, or vice versa. All properties could also be mediocre. Not much is gained by these ambiguities of the informative value of a label. It therefore makes much more sense to evaluate and label ecological or ethical aspects separately. This can be better illustrated, for example, with an eco-label or a seal for fair trade, etc.

But such an extension to completely different areas would also be of little help to kitchen professionals, because they would now have no assistance in optimizing their recipes. Everything would be mixed up. If the topic of ecology is to be included in an evaluation in such a way that the kitchen specialists would also have points of reference for changes in this area, then there would have to be various points, analogous to nutrition physiology, at which the kitchen could start modularly. In this way, an improvement in this area could be achieved step by step. Here it does not concern only the kind of the agriculture. A double evaluation of nutritional quality

45 Peinelt V: "Ausgezeichnete Gemeinschaftsgastronomie". <https://ewd-gastro.jimdo.com/zertifizierung/ausgezeichnete-gg/>

according to wholesomeness and ecology was attempted in the so-called Nutritional Footprint. The results are to be seen very critically⁴⁶.

3.2.8.2 Sensory criteria

Sensory aspects, such as the taste and appearance of food, are also not included in the evaluation. They would also falsify the nutritional statements and thus make them more uncertain. It would have to be considered downright misleading if, for example, a curry sausage with fries and mayo were rated yellow because the dish has poor nutritional properties but tastes good. Rather, a good sensory evaluation is a prerequisite for a successful offering.

Without this prerequisite, any tool for determining health attributes is worthless because the offering would not be accepted by guests. Guests will not eat food, no matter how healthily advertised, if it does not taste good to them. Sensory quality should be measured with the instrument of acceptance surveys. These surveys are even very important because they can be used to check whether the dishes marked green are attractive enough.

Conclusion: Properties other than nutritional should not be included in the evaluation for the traffic light colors. This only leads to dilution of the statements.

3.2.9 Summary of the criteria

The results of applying the criteria to the relevant Food group are summarized below. Here the results were subjected to a double weighting, once according to the relevance of the criteria and then according to the fulfillment of the criteria with the following meaning: high=3, medium=2, low=1, none=0. As the table shows, the content of desirable nutrients as well as the preventive medical properties are weighted most heavily. The content of toxic substances as well as the fatty acid spectrum was not presented in this summary for obvious reasons. The individual results were summed. This allows a better clarification of the health value of the Food group and helps to determine the Q-values (see chapter 3.3).

⁴⁶ Peinelt V: Nutritional Footprint. Ergebnisse einer Untersuchung. <https://ewd-gastro.jimdo.com/gas/nutritional-footprint/>

Food-Group/ Criterion	Desirable nutrients ⁴⁷	Undesirable te nutrients	Sec. Plant substances	Preventive- medicine	Konzept "5 am Tag"	Total
Weighting factors	4	1	1	3	1	max. 30
Vegetables	3	3	3	3	3	30
Fruit	3	3	3	3	3	30
Legumes	3	3	3	2	2	26
Whole grain products	2	3	3	3	0	23
Nuts	2	3	3	2	2	22
Fish	3	2	0	2	0	20
Potatoes	2	3	2	1	0	16
Dairy pro- ducts	2	1	0	2	0	15
Eggs	2	2	0	1	0	13
Liver	3	1	0	0	0	13
Meat	2	1	0	0	0	10
Sausages	1	1	0	0	0	5

Tab. 3.5: Summary of the evaluation of Food group with weighting

3.3 Considerations on the evaluation logic

3.3.1 Basic procedure

After the criteria of the evaluation have been introduced and before the procedure for the determination of the Q-values and GTS-values is presented, basic considerations for the evaluation with GTS are to be spread out first. Herewith the following determinations are better understandable.

In the first step of the evaluation, all Food group in their highest quality form are assigned a point value, which is derived from the criteria. This means, for example, that cereal products are taken as whole grain products. This point value is the so-called Q-value. As a rule, points are then deducted from this initial value. The point deductions are made in two stages, first the step from the primary Q-value to the secondary Q-value and then the determination of the GTS value. In the first stage, only flat deductions of 0.5-1 point are made, e.g. for processing into canned vegetables. In the second stage, devaluations are made depending on product-specific properties and kitchen treatment. Criteria have also been defined for this.

3.3.2 Orientation of the deduction rule

It is certainly indisputable that a Food or a dish loses value due to the criteria mentioned, so that a devaluation is justified compared to the optimal initial evaluation. In addition to the cri-

⁴⁷ Erwünschte Nährstoffe=Ermittelt als Summenwerte der NSD bezogen auf 1000 kJ



teria, the extent of the devaluation also had to be determined. This was to be based on plausibility considerations and be free of contradictions. Therefore, care was taken to ensure that, for example, the fat intake due to the cooking processes resulted in comparable deductions as the fat content of the Food itself.

The deductions were determined by extensive calculations with different recipe examples. The aim of these calculations was to evaluate meals, dishes and meal plans in such a way that they largely conform to the general recommendations of nutritional science. These are general recommendations as published internationally. For German-speaking countries, the "Ernährungskreis"⁴⁸ and the "10 Regeln"⁴⁹ of the DGE are used.

The DGE has also developed quality standards for Community Catering, which also serve as a guide. All national and international recommendations agree that the proportion of plant-based Food should dominate in the diet. Therefore, it should be possible to show for GTS that the specifications for the criteria lead to green rated meals meeting the DGE quality standards to a significantly higher degree than yellow or even red ones.

3.3.3 "Fat" as a deduction criterion

Here, the rating of fat content is to be questioned. GTS makes point deductions for fat, so that the lowest fat dishes are rated best. This could be seen critically, since some fatty acids are known to be essential. A certain amount of fat, especially if it contains these fatty acids, should therefore be rated positively. Is the assessment of GTS thus in need of correction?

As already explained, the nutrients "fat" and "sugar" fulfill an indicator function, with which it should be recognized how good the Nutrient density of the food is. Thus, it is not a matter of evaluating fat in a fundamentally negative way. Rather, fat must be viewed from two different perspectives. One perspective refers to the high energy content and the associated reduction in the Nutrient density of the food. The second perspective considers the proportion of fatty acid groups. These two aspects of fat will be taken up and discussed again under the term "ambivalence" in section 3.3.4. Such an evaluation, including the vit. E content, is also made by GTS. The different oils and fats are evaluated in such a way that the point deduction is lower for high-quality oils, e.g. rapeseed oil, and vice versa. Due to the multiple evaluation approach, very low-fat dishes do not automatically receive a favorable rating with GTS. Valuable ingredients still need to be included in the recipe.

However, the question raised here of the possibly incorrect, because too positive evaluation of very low-fat dishes does not play a role in practice. On the contrary, in Germany too much fat is usually added due to the Food selection and its preparation, which is essentially responsible for the strong spread of overweight. Overweight can be called in the meantime a people illness. After all, according to nutrition reports of the DGE, an increasing trend has been observed for years. Thus in the report of 2016 for men a BMI>25 in the extreme case of 75% was determined⁵⁰. The following EB of 2020⁵¹ also came to similar conclusions.

48 DGE: DGE-Ernährungskreis. www.dge.de/ernaehrungspraxis/vollwertige-ernaehrung/ernaehrungskreis

49 DGE: Gesund essen und trinken 10 Regeln. www.dge.de/ernaehrungspraxis/vollwertige-ernaehrung/10-regeln-der-dge/leichte-sprache.

50 DGE: 13. Ernährungsbericht von 2016. Abb. 1/32a: Verbreitung von Präadipositas und Adipositas, s. S. 75

51 DGE: 14. Ernährungsbericht von 2020. Abb. 1/39b: Verbreitung von Präadipositas und Adipositas, s. S. 95

Fat is responsible for the development of obesity for several reasons. For example, high-fat Foods send weaker metabolic satiety signals. The palatability of high-fat foods stimulates greater consumption. Furthermore, fat has the lowest "postprandial thermogenesis," or energy conversion to heat after digestion, at only 3%, making energy intake more effective. Furthermore, fat supplementation, as is common in many meals, does not trigger increased fat oxidation, but leads to fat storage. Last but not least, the volume of food and the resulting distension of the stomach is much less pronounced with fat^{52,53}. This gastric wall distension is an important regulator of satiety. For the above reasons, fat is a major contributor to obesity.

The development of obesity also depends on the nutritional ratio, the energetic relationship of the main nutrients to each other. It has long been recommended that the proportion of fat should be around 30%, which is the global consensus⁵⁴ (see also section 3.1.2). Fat consumption correlates with BMI. The higher the fat consumption, the higher the overweight, expressed by the BMI. This was also shown by the evaluation of 200,000 food diaries by the working group of Prof. Pudel. Conversely, people who consumed a lot of carbohydrates and little fat were more likely to have normal weight⁵⁵. This was confirmed in a Scottish study⁵⁶. Low-fat meals and high consumption of high-quality carbohydrates and vegetables not only lead to better NSD, but also have a beneficial effect on body weight. This effect is another reason for point deductions based on fat content.

The question remains: is this doing too much of a good thing by giving even very low fat contents a positive rating? The answer to this question presupposes that very low-fat meals are actually offered to a significant extent. If this is not the case, the answer is superfluous. For very low-fat meals in company restaurants, extreme recipes would have to be developed and accepted by the guests. Such recipes are possible and are occasionally offered, but certainly not on a large scale. This was shown by evaluations of meal plans, e.g. in Company catering^{57,58} and university catering⁵⁹. Very low-fat dishes do not correspond to the nutritional habits and taste sensations of guests, which a good caterer must take into account. Therefore, these dishes are exceptions.

Thus, there is no danger of the meal plan as a whole being too low in fat and then being rated too favorably with GTS. The method of deducting points for fat is therefore suitable for assessing the quality of the food appropriately.

3.3.4 Ambivalence of high fat foods

For oils and other very high-fat Food, a double assessment statement should be possible. After all, it happens that certain high-fat Food group are rated very highly due to their nutrient content (certain fatty acids), but on the other hand bring disadvantages with stronger consumpti-

52 Evidenzbasierte Adipositas-Leitlinie der DGE, aktualisierte Auflage von 02/2014. <https://www.dge.de/presse/pm/aktualisierte-leitlinie-zur-praevention-und-therapie-der-adipositas/>

53 DGE: Evidenzbasierte Leitlinie. 2. Version 2015. s. Kap. 4: Fettzufuhr und Prävention der Adipositas. <https://www.dge.de/wissenschaft/leitlinien/leitlinie-fett/>

54 Peinelt V: Low-Carb-Konzept vs GAS. <https://ewd-gastro.jimdo.com/gas/low-carb/>

55 Pudel V: Endlich frei von Diäten! Droemersch Verlagsgesellschaft 2003, S. 33f

56 Bolton-Smith C, Woodward M. Dietary composition and fat to sugar ratios in relation to obesity. *Int J Obes* 1994; 18: 820–8.

57 Giebel S, Feist C (GESOCA): Erfahrungen bei der Bewertung von Speiseplänen aus über 60 Kantinen seit mehr als fünf Jahren.

58 Peinelt V: Auditierung großer Betriebe des Deutschen Instituts für Gemeinschaftsgastronomie über ca. 10 Jahre

59 Peinelt V: Auditierung von ca. 50% aller Mensen über ca. 8 Jahre



on due to the high energy intake. For such Food, both properties should be communicated to avoid misunderstandings. If only the good nutrient content were evaluated, the high energy content would be ignored. Conversely, if only the energy content were focused on, it might be overlooked that this Food contains important nutrients.

This is exactly what is intended and feasible with GTS. With a high Q-value it is expressed that oils or nuts - related to the criteria - are valuable. However, this fact should not distract from the fact that all oils and most nuts make a high energetic contribution. Thus, in principle, they have the same unfavorable effect on obesity as other high-fat Foods and should be limited to small amounts. To express this, all oils and nuts are given a deduction because of fat content. Because the fat content is high, the deduction is also high, and the amount of GTS ultimately achieved depends on the Q-value.

The statements for oils and nuts are thus ambivalent:

- a high Q-value expresses that the product is of high quality
- a red GTS value, on the other hand, indicates that nevertheless not too much of it should be eaten.

This double evaluation by GTS corresponds in principle to the approach of the 3D-LP of the DGE, with which on the pyramid sides qualitative and on the base surface with the nourishing circle quantitative statements are made. However, the evaluations with GTS can be concretized, are more comprehensive and plausible, and can be applied to all gastronomic offerings (individual dishes to meal plan), which is not possible with the 3D-LP. More details can be found in a detailed statement⁶⁰.

3.3.5 Diversity assessment tool

Now, one could object that an instrument for an evaluation must always function properly, i.e. also under extreme conditions. These should even be able to be identified with a suitable tool. However, GTS can also provide a correct assessment for extreme conditions if a special tool from GTS is used for this purpose. So, if there is a suspicion that extreme conditions exist that may lead to incorrect results, this tool can be used to make an additional assessment based on the comparison of Food recommendations.

The results can then be used to see if all Food-groups, as well as their quantity, are within an acceptable range in a meal plan or offering over a definable period of time. How this instrument measures and with which results will be described in more detail later (see chapter 6). Thus, even extreme conditions would be assessable with GTS.

3.3.6 Optimization aids

GTS is intended to reduce the use of oils and fats, as well as high-fat Food, because a shift to a green rating is then more likely. Everyone responsible for the meal plan will try to bring their meals and dishes to at least a "yellow" rating. And this is easily possible even with oil, if the other ingredients are chosen favorably (high Q-values), if it is a high-quality oil with a low oil quantity. These measures can change the food offerings in the desirable direction. At the same

60 Peinelt V: Stellungnahme zur 3D-LM-Pyramide der DGE. Stand: 11-2021. <https://ewd-gastro.jimdo.com/gas/3d-lm-pyramide-der-dge/>

time, GTS encourages the use of high quality oils. Thus, the evaluation of oils is ambivalent, but not contradictory. It meets both requirements of providing a nutritional assessment while limiting quantity to avoid high-calorie meals and thus prevent obesity.

The correctness of the type and amount of deductions can be shown by the fact that GTS favors compliance with the recommendations in the quality standards. This can be seen by comparing the results of vaporization with Nutritional value calculation. Therefore, validations with this tool will be performed on different objects. Details of these comparisons can be found in Chap. 5 for menus and 4-week meal plans.

It should be noted that the settings and determinations of GTS for the traffic light value determinations are flexible. If it should turn out that certain determinations would have to be changed, e.g. the deduction by keeping hot, then a preset factor can be changed. The entire vaporization is thereby adjusted in this respect without any changes having to be made to the individual dishes and meals. This correction option applies to all fume hood types.

3.4 Determination of the Q-value

3.4.1 Definition of the Q-value

The Q-value is a starting value for the evaluation of Food or Food-groups, from which the GTS value and thus the traffic light color can be derived. It is determined by determining the quality of a Food with the aid of defined criteria (primary Q-value). Subsequently, a modification is made if necessary, taking into account the Food technological treatment, which reduces the primary Q-value (secondary Q-value). If a Food is not treated, the primary Q-value is the starting value for the determination of the GTS value, otherwise the secondary one.

The determination of the Q-value represents only a rough evaluation by assigning the Food group a score from 0-5. These can possibly be slightly modified due to technological processing. With this point evaluation as well as the possibly slight modification, it is not yet possible to sufficiently represent the sometimes serious quality differences of the Food, which arise due to further factors. For example, different fat and sugar contents are to be considered. This final determination for the traffic light color will be made in the next step when the GTS value is determined.

3.4.2 Determination of the primary Q-value

For the assignment of a primary Q-value, only a few, unprocessed Food group are initially assumed, comparable to the information in the nutrition circle of the DGE. These are "plant foods" (vegetables, fruits, nuts, potatoes, legumes, cereals) and "animal foods" (meat, fish, milk, eggs) and their products. In addition, there are "oils and fats", which can come from either group. The choice of beverage is not included in the evaluation and therefore has no influence on the determination of a traffic light value for a complete meal. This would lead to distortions. More on this later.

Fig. 3.3 shows the major Food group with their primary Q-values, as determined by their Nutrient density and preventive medicine properties in particular. The Q-values of Foods are given as a numerical value from 0-5. The higher this value, the better the quality. Since we are

initially dealing with unprocessed Food, the Q-values are usually high. Based on the criteria as outlined in Section 3.2, the highest point values are assigned to vegetables, fruits and nuts.

Other plant Food-groups, especially whole grains and legumes, also receive high point values due to their also very good nutritional properties. Of the animal Food, fish are at the top of the ranking, followed by meat including meat products and sausage, which are, however, assigned different Q-values due to different qualities. The Q-values for oils also differ greatly.

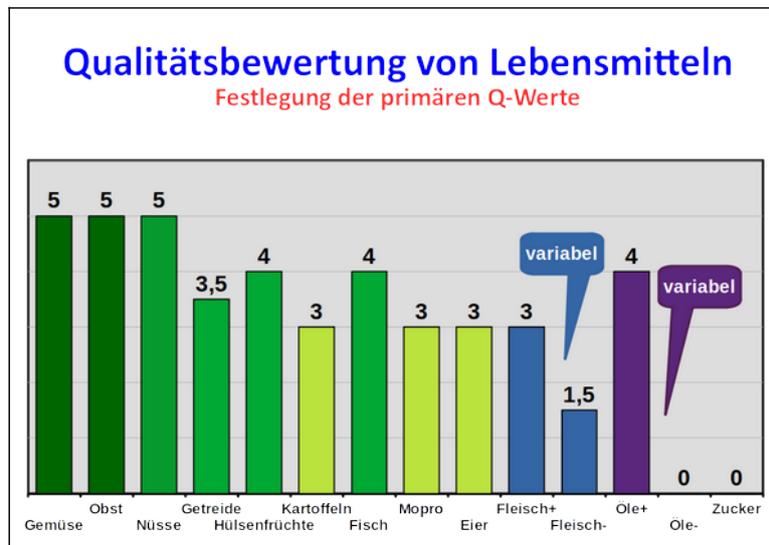


Fig. 3.3: Quality assignment (primary Q-values) for Food main groups

3.4.3 Determination of the secondary Q-value

The various Food may have been technologically processed in the Food industry or in the Food trade. Kitchen processing is not yet meant here. This will be considered in the next step. Food technological processing essentially involves the following processes.

Preservation	Grain processing
<ul style="list-style-type: none"> • Wet canning • Pasteurization • Drying (dehydration) • Deep freezing • Salting • Curing 	<ul style="list-style-type: none"> • Different type numbers • (high - medium - low) • Rice husking • Parboiled process

Tab. 3.6: Important Food technological processes

In some cases, the processes are also combined, e.g. wet canning with added salt. In these processes, vitamins and minerals or even dietary fiber are usually lost. This reduces the Q-values. The magnitude of the losses will be discussed later. They are not negligible differences.



The exception with regard to the loss of vitamins and minerals is salting, whereby the stronger salting is meant, which is associated with a preservative effect and serves Food safety. This measure has the disadvantage that the Food often has too high a salt content (NaCl). This, in turn, is more likely to have adverse health effects. With the salt content, therefore, the preventive medical quality decreases, which should therefore also lead to a deduction. In the case of curing, there is the additional issue of nitrate, which is added together with the salt. The nitrate transforms into nitrite and thus develops additional antibacterial effects. Nitrite is, however, problematic, as the risk of cancer increases with higher consumption of cured products (keyword: nitrosamine).

The primary concern here is not the nitrate, but the salt content, which is an important factor in cardiovascular diseases. Salt is assessed on a blanket basis based on the content of certain Foods rich in salt, especially fish products, meat and sausage products, and cheese. Thus, the number of Food group with elevated salt content is manageable and can be easily determined. If a certain threshold for salt content is exceeded, a flat-rate deduction of half a point is made. Salt amounts below this are disregarded because a certain amount of salt is necessary for taste reasons. The exact amounts of salt in the catering industry are often difficult to determine. The threshold value is set at 2 g salt/100 g. There are two reasons for this. Firstly, this is one third of the daily recommendation and thus corresponds to the upper limit for a main meal. On the other hand, this content is the lower limit of many more heavily salted Food, such as in the above-mentioned products.

3.4.4 Food technological processes

Undoubtedly, technology in the Food industry has advanced in recent decades. Therefore, nutrient losses have been reduced during processing operations. There are studies on this^{61,62}. On the other hand, nutritional data speak against equating dried Food as well as wet canned products with fresh or frozen products. The DGE also points out these quality differences in all its quality standards, e.g. for company catering⁶³. In order to quantify these losses somewhat, nutritional data were taken from the BLS (version 3.02) and compared.

3.4.4.1 Conservation

The nutrient data in the BLS show that drying and wet preservation are not only associated with higher losses for fruits and vegetables. This is shown by the values for sensitive vitamins, which serve as lead substances. The reference to 1000 kJ was chosen for the presentation because this makes it easier to compare the individual Food variants, irrespective of the different water content.

For the study of vitamin losses, 5-10 vegetable varieties were used. For them, the vitamin content of fresh and different preserved Food after cooking was determined. As Fig. 3.4 shows, the nutrient contents are far apart. The particularly sensitive vitamins C and folic acid are about 2-

61 Basendowski S et al: Effect of Harvesting, Processing and Preparation on the Nutrient Retention of (Phyto) Nutrients of Dried and Homemade Soups. *FRBM*, 65, Suppl 2: S111, 2013

62 Masrizal MA, Giraud DW, Driskell JA: Retention of vitamin C, iron, and B-Carotene in Vegetables prepared using different cooking methods. *Journal of Food Quality*, 20: S403-418, 1997

63 DGE (Deutsche Gesellschaft für Ernährung e.V.) (Hrsg.), DGE-Qualitätsstandard für die Betriebsverpflegung. 5. Aufl., Bonn 12/2020, hier: Convenience-Produkte

4 times higher in the cooked fresh product. Even for the less sensitive Vit. B1, they are still about twice as high. The comparison also shows that the canned product tends to perform somewhat worse than the dry product.

In the following tables, the losses of the most important vitamins are shown graphically. These are contained in higher concentrations in vegetables, which is why the differences are easy to see. Basically, losses occur in canned goods due to heating and leaching. Due to optimized cooking methods in canning technology, the load of canned goods may have become lower. However, as shown in Fig. 3.4, vitamin losses are still serious.

In the cooked product of canned goods, only about one-third are still present compared to fresh and cooked goods. This should not be surprising, because the microbiological hazards and enzymatic changes inside the can necessitate a sufficiently high heat load in excess of the necessary cooking process, especially since the canned product is stored for a long time at room temperature.

There is also the fact that over such a long period of time as is common with canned goods (up to several years), considerable leaching takes place⁶⁴, which is of nutritional interest. This leads to a devaluation of these Food compared to fresh or frozen goods. Therefore, the DGE also makes corresponding recommendations in its quality standards. It should also be noted that precisely because of the leaching effect, flavor substances are also lost, so that some salt or sugar is added to the wet canned products to compensate. However, the addition of these substances is in principle undesirable and thus additionally reinforces the devaluation. The nutrient contents after different vegetable treatments^{65,66} are shown in the next figure.

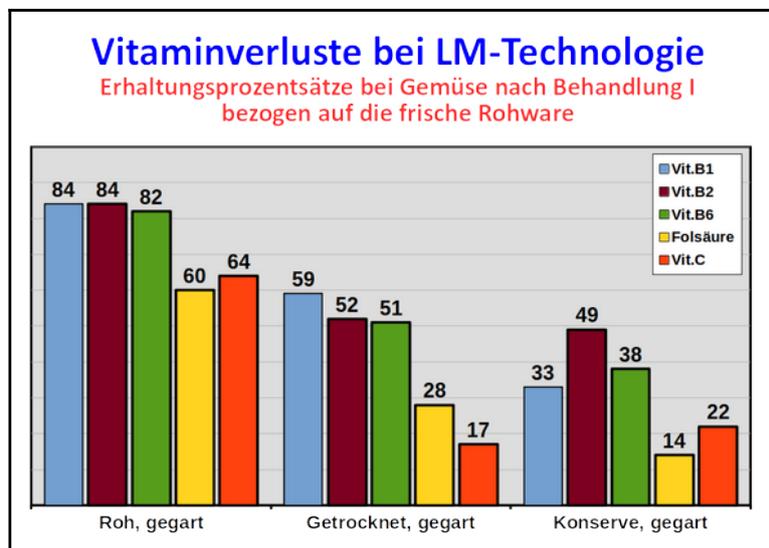


Fig. 3.4: Nutrient contents of cooked vegetables per 1000 kj

64 Loh S, Schlich E: Nährstoffveränderungen bei der Lebensmittelzubereitung im Haushalt. aid special, 3048/2004, S. 16

65 Max Rubner-Institut (MRI): Bundeslebensmittelschlüssel - Vitamine, Mineralstoffe, Fett und Kohlenhydrate - der Bundeslebensmittelschlüssel weiß alles über fast 15.000 Lebensmittel. www.mri.bund.de/de/service/datenbanken/bundeslebensmittelschlüssel.html, Zugriff: 5.5.2014

66 Hartmann B, Bell S, Vásquez-Caicedo AL et al.: Der Bundeslebensmittelschlüssel. Aktuelle Entwicklungen, Potenzial und Perspektiven. Ernährungs Umschau 2006, 53(4): 124-129



Studies by the "Initiative Food-Dose"⁶⁷ claimed that the nutrient losses of canned products are so low that they are comparable to fresh products. However, this is only true if the liquid contained in the food is also utilized. However, most vegetable dishes are prepared without this liquid. This is also the case in Community Catering. Therefore, the higher values cannot be used as a basis for comparison. The results and background of this study were analyzed and evaluated in more detail in a detailed statement⁶⁸.

Since the BLS is a reputable, government-supported database used in all NCA programs and is also used for scientific studies, these nutritional values are used as a basis for the classification of canned and dry goods. For this reason, it is justified that canned vegetables are devalued relative to fresh produce. The devaluation is applied at a flat rate of half a point to one point. Many valuable properties of vegetables are retained even after preservation, such as their low energy density or high content of secondary plant compounds. The high preventive medical potential is also hardly affected. In this respect, a high rating for the secondary Q-value is justified.

3.4.4.2 Grain processing

The Food group of cereal products is characterized by different nutrient contents due to different degrees of flour milling. For lunch, pasta and rice are the main foods used. Furthermore, bread is also served at lunch, e.g. for stews. Whole grains receive the highest rating. One point is deducted for a medium degree of milling, because not only is the vitamin and mineral content significantly reduced, but also the fiber content. It is precisely this that is associated with preventive medical properties. Another half point deduction is applied to the lowest grinding level.

The following table shows the nutrient losses (expressed in maintenance percentages) for three vitamins and the dietary fiber for various wheat flours in relation to whole wheat flour. Types 812 to 1200 can be counted among the medium milling grades, and those below that can be counted among the low milling grades. The nutrient losses of wheat flours stand only as examples of other cereal products whose losses are similar during processing^{69,70}.

67 Initiative Lebensmitteldose (Hrsg): Lebensmittel in Dosen. Nährwertuntersuchung im Vergleich zu Frischware. Institut für Lebensmittelqualität, Willich, Hochschule Niederrhein, Mönchengladbach, Fresenius SE, Bad Homburg. Kontaktadresse: Initiative Lebensmitteldose, zweiblick, Wilhelm-Hale-Str. 50, 80639 München, 2008 und 2015.

68 Peinelt V: Dosenware versus Frischware. <https://ewd-gastro.jimdo.com/gas/gas-stellungnahmen/Im-konserven/>

69 Max Rubner-Institut (MRI): Bundeslebensmittelschlüssel - Vitamine, Mineralstoffe, Fett und Kohlenhydrate - der Bundeslebensmittelschlüssel weiß alles über fast 15.000 Lebensmittel. www.mri.bund.de/de/service/datenbanken/bundeslebensmittelschlüssel.html, Zugriff: 5.5.2014

70 Hartmann B, Bell S, Vásquez-Caicedo AL et al.: Der Bundeslebensmittelschlüssel. Aktuelle Entwicklungen, Potenzial und Perspektiven. Ernährungs Umschau 2006, 53(4): 124–129

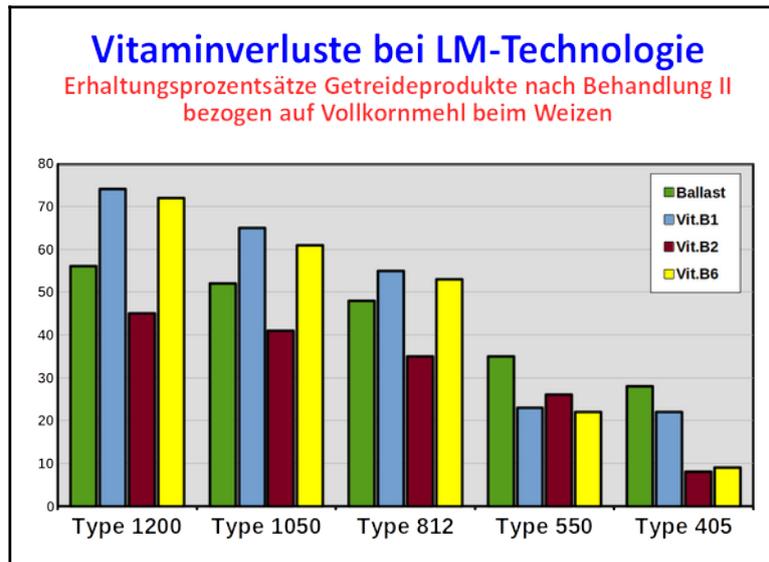


Fig. 3.5: Nutrient contents of flours of different milling grades in percent

3.4.5 Results of the determination of the Q-values

A two-stage process is used to determine the Q-values. First, the unprocessed Food are assigned 0-5 points according to their quality characteristics based on defined criteria (primary Q value). In the second step, Food technological processing is taken into account, resulting in flat-rate deductions of half a point to one point. In addition to nutrient losses due to processing, salt additions above a certain amount are also taken into account with a flat-rate deduction of half a point. These modifications result in the secondary Q-value.

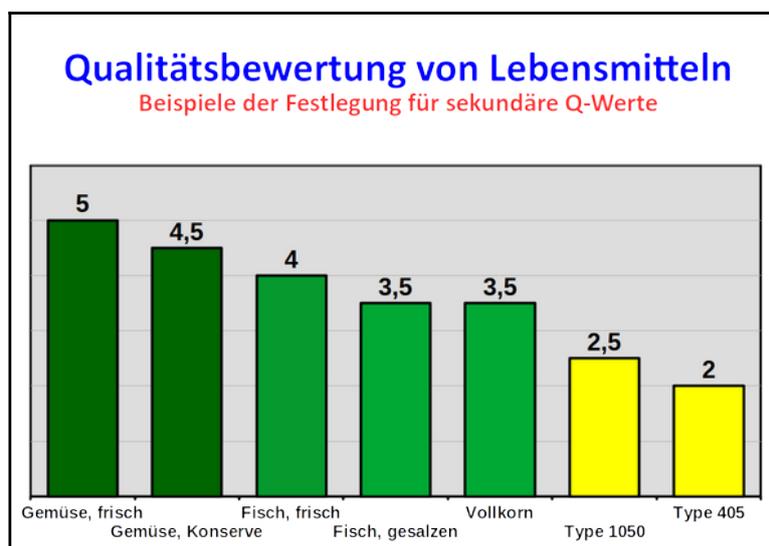


Fig. 3.6: Quality assessment (secondary Q-values) of Foods

3.5 Details of the Q-values

The procedure for determining the Q-values was presented in section 3.4. In this chapter, the individual categories for the Q-values will be explained. Which Food are assigned to these categories and with what reasons. The descriptions refer to the three traffic light colors associated with the categories. To understand the categories, it should be emphasized once again that these are the primary Q-values, which may still be reduced due to deductions. They are therefore always the optimal values. This is also the reason why the Food group described here are predominantly rated as "green". A part is assigned to the category "yellow" and only very few to the category "red". Due to devaluations, which are made both during the determination of the final Q-values and subsequently with the GTS values, these initial good to very good evaluations shift downwards, towards the red range.

3.5.1 Category "green" (Q-value ≥ 3.0)

The "green" category includes all Food group that have good to outstanding properties. They fulfill the criteria to a high degree. This category starts from the Q-value of 3.0 and ends at 5.0. The description of the individual Food group of the respective categories is in descending order.

3.5.1.1 Fruit and vegetables (Q-value=5)

A Q-value of 5 is the premium category of green. It includes primarily fruits and vegetables, fresh or frozen. They have the highest Nutrient density after liver and numerous preventive medical benefits. Thus, consumption of these Food is highly desirable (see also the "Five a Day" campaign⁷¹). Tab. 3.5 shows vegetables and fruits to be of very high quality in total. A green rating of a dish is well possible if vegetables or fruit are included. In the case of fruit, it should be noted that a deduction is made due to the sugar. This reduces the NSD. If the average sugar content is 10%, there is a downgrade of half a point.

If these Food are treated technologically, slight devaluations may occur. As explained in section 3.3.4, significant nutrient losses occur in this case, which justify a flat-rate devaluation of half a point. For example, canned vegetables are now only assessed with a Q-value of 4.5 points.

3.5.1.2 Nuts and seeds (Q-value=5)

As very valuable and are also nuts and seeds. They are rich in micronutrients, i.e. vitamins (vitamin B group and vitamin E) and minerals (including potassium, calcium, iron and magnesium). Also, their fiber content is usually high. However, they are also rich in fat, with an average content of 50%^{72,73} which reduces NSD. Therefore, due to the evaluation approach of GTS, high deductions become effective. However, the nutrient content shows very good values (Table 3.2). In addition, the quality of most nut fats can be classified as favorable due to good fatty

71 DGE (Hrsg.): "5 am Tag"-Kampagne: Wissenschaftliche Begründung. DGE-Info. Forschung, Klinik und Praxis 07/2001, 1.7.2001

72 Rösch R, Lobitz R: Nüsse: Gesund essen. Stand: 18.9.2015. www.bzfe.de/inhalt/nuesse-gesund-essen-5380.html

73 Dujardin U: Nüsse in der gesunden Ernährung. Ernährungs Umschau 9/07, 555-556. www.ernaehrungs-umschau.de/fileadmin/Ernaehrungs-Umschau/pdfs/pdf_2007/09_07/EU09_554_556.qxd.pdf

acid spectra. Taking the various criteria into account, nuts and seeds perform well to very well. Therefore, they belong to the top group of all Food group discussed here.

Therefore, nuts and seeds are also rated with the highest Q-value of "5". However, due to the high fat content, the GTS value is unfavorable. Incidentally, this is also a reason to set the Q-value so high to "cushion" the devaluation. Nevertheless, the GTS value is low, usually even red. This is not a contradiction. The evaluation is quite deliberately ambivalent: here a high Q-value, there high deductions when determining the GTS value.

This expresses two things: on the one hand, the high value of the Food-group, on the other hand, the high fat content with the danger of an over-caloric diet, which is why the consumption of nuts can only be recommended in moderation. And exactly that is also the statement of the nourishing science. This double assessment statement can prevent the erroneous opinion that an Food may be consumed in larger quantities because of the favorable Q-value (see also chapter 3.3).

3.5.1.3 Legumes (Q-value=4)

Legumes have very good properties that justify their assignment to the top of the ranking. These properties contrast with consumption, which has declined sharply over the last century. A significant increase would therefore be desirable. As already seen in Table 3.2, their Nutrient density is so good that this important criterion alone places them in the top group. However, due to their high content of macronutrients, the Nutrient density is reduced, so that they cannot quite reach the value of vegetables. However, the micronutrient content - based on 100 g - cannot be surpassed by any other Food, except liver.

But it is not only the nutrient content that is very remarkable in legumes. As Table 3.5 shows, all criteria are met to a high degree. Only in terms of preventive medicine and the "5 a day" concept do they score slightly lower than vegetables and fruit. A disadvantage is that legumes often cause flatulence due to their content of indigestible oligosaccharides. In addition to the lower NSD, this leads to a slight devaluation compared to vegetables and fruit.

3.5.1.4 Fish (Q-value=4)

Fish also plays a special role in the evaluation with GTS, for which there is no upper limit for the consumption recommendation as for meat because of the beneficial health effects. Rather, a lower limit has been established for fish consumption, which is at least once, and in other publications three times per week⁷⁴.

The benefits of fish consumption are manifold. In addition to the high-quality protein, the high proportion of omega-3 fatty acids (in particular the proportion of long-chained fatty acids such as EPA and DHA⁷⁵) in the total fat of fatty fish, the high content of vitamins A and D, and the generally very low fat content of sea fish are worthy of mention. These advantages have been well elaborated in a review article⁷⁶. The special nutritional value of this Food is also shown in Tab. 3.2, where fish achieve similar high values in the assessment of Nutrient density

74 Schuchardt JP: Gesundere Ernährung durch mehr Fisch - Was ist wissenschaftlich gesichert? Vortrag auf dem 4. Niedersächsischen Forum Gesundheitlicher Verbraucherschutz "Fisch - gesund und nachhaltig?" am 12.10.2011, Oldenburg

75 EPA=Eicosapentaensäure, DHA=Docosahexaensäure

76 Lobitz R: Fisch als Lebensmittel. Ernährung im Fokus, 02/2019, S. 114-122

as legumes. In Tab. 3.5, where the different criteria and the ratings of the Food group are summarized, it can be seen that fish could reach the highest value within the animal Food. In terms of preventive medicine, fish, together with mopro, is at the top of the animal Foods.

Because of the high content of EPA and DHA in fish oil, which can hardly be found in any other Food, the consumption of fatty fish is also explicitly recommended, among others also by the DGE⁷⁷. The intake of these highly unsaturated omega-3 fatty acids cannot be replaced by Food with a high content of medium-chain omega-3 fatty acids, such as walnuts and certain vegetable oils. This is because the transfer rate from medium to long chain omega-3 fatty acids in the body is only possible to a very small percentage. Corresponding statements that the aforementioned vegetable Foods are sufficient to cover the long-chain and highly unsaturated omega-3 fatty acids are therefore not true⁷⁸. This is what makes fish so valuable and why it is placed very high in the Q-value table.

Another reason is a calculation-related one. Since in principle Food receive a deduction according to their fat content, which can be considerable in the case of fatty fish, these valuable Food would be devalued significantly. This would not be appropriate. To avoid this, there are two possibilities:

- the fat content could be given a different weight, e.g. only half of it could be credited, or
- the corresponding Food group receives a higher Q-value.

A deviation from the deduction system is problematic, as this may be difficult to control from an EDP point of view. Therefore, an adjustment of the Q-value is more reasonable. As can be seen in Tab. 3.5, the total value of fish is somewhat lower than that of legumes or whole grain products. Thus, the fish could be scored as "3.5" like whole grain products.

Qualitätsbewertung - Fisch
Gründe für eine höhere Einstufung

1. Fettgehalt meist niedrig
2. Verzehr mit höherem Fettgehalt empfohlen
 - Omega-3-Fettsäuren!
3. Seefisch ist jodreich
4. Keine Krebsförderung
5. Bekömmlichkeit
 - wenig Bindegewebe
6. Keine reduzierte Verzehrsempfehlung



Fig. 3.7: Reasons for the higher valuation of fish (© Fotolia, euthymia)

77 DGE: Regelmäßig Fisch auf den Tisch. DGE aktuell 09/2016 vom 2.8.2016. www.dge.de/presse/pm/regelmaessig-fisch-auf-den-tisch/

78 Wehrmüller K: Gesundheitlicher Nutzen von omega-3-Fettsäuren und die Bedeutung von Alp-Produkten für die Zufuhr. ErnährungsUmschau 11/08, 655-661.

With the Q-value of "4", the deduction due to the fat content is cushioned. This is mainly due to the high value placed on long-chain, highly unsaturated omega-3 fatty acids, for which there is often an undersupply (see also section 3.3). Also significant are the levels of important trace elements, above all iodine, whose status in Germany is still characterized by slight deficiencies. In terms of preventive medicine, the positive effects on the cardiovascular system, maculopathy of the eye and risk reduction in Alzheimer's disease should also be mentioned. Some disadvantages of fish are also claimed, but these do not stand up to scrutiny⁷⁹.

No objections have been raised by nutritional science against a higher consumption of fish. The latest recommendations in the "10 rules of the DGE" to eat fish only once or twice a week is due to the ecological situation, as many edible fish are almost extinct⁸⁰.

The toxicological aspects such as the content of heavy metals as well as the increased finding of plastic parts has not yet found its way into the nutrition reports of the federal government or is (still) classified as irrelevant⁸¹. More recent publications see a need for further research in this area and consider final assessments to be premature⁸². According to statements of specialists, the burdens of aquacultures seem to be lower than often feared⁸³. However, for some time there have been very critical voices in the aquaculture of salmon⁸⁴, whose feed is mixed with ethoxyquin⁸⁵, which is classified as toxic to humans and, according to Efsa, may no longer be contained in salmon from summer 2020. In any case, the salmon are contaminated with this feed, as Öko-Test found in the 12/2018 issue⁸⁶. There are other problems associated with excessive salmon aquaculture, especially in Norway, which severely limits the quality - including the nutritional quality - of this popular fish. If this trend were to intensify or spread to other fish, fish as a whole would have to receive a deduction in the GTS assessment.

For GTS, ecological recommendations do not play a role, as otherwise nutritional statements would be diluted, whereas toxicological ones do. Because of the toxicological aspects for fish in general, which have not been relevant so far, as well as the good preventive medical and nutritional properties, fish is assigned to category "4".

3.5.1.5 Whole grain cereal products (Q-value=3.5)

Food of this category are characterized by the fact that they have only a "good" Nutrient density and are thus of somewhat lower quality than the previously mentioned Food-groups. In Tab. 3.2, where the results of the assessment of Nutrient density can be found, whole grain products achieve a middle place. Based on 100 g, the nutrient contents for micronutrients for whole grain products are slightly below vegetables and significantly below legumes and nuts.

On the other hand, if one looks at the summary of the results of all criteria in Tab. 3.5, whole grain products achieve a respectable ranking, which is due to good to very good individual re-

79 Oehlschläger J: Fisch: Ein natürlich funktionelles Lebensmittel. Ernährungs Umschau 57 (2010) S. 246-251

80 DGE: 10 Regeln der DGE, 9. Aufl., 2013. www.dge.de. Zugriff: 30.1.17

81 DGE (Hrsg.): 12. Ernährungsbericht. Warlich Druck, Meckenheim, 2012, 427 S., keinerlei Angabe im EB 2016

82 Rösch R: Belastungen der Ozeane - Belastungen des Menschen? Ernährung im Fokus, 02/2019, S. 121

83 Ueberschär B: "Die Aquakultur" im Zerrspiegel der Medien. Zwischenruf. Ernährung im Fokus, 02/2019, S. 123

84 ZDF: Hannes Jaenicke: Im Einsatz für den Lachs. Fernsehfilm vom 16.6.20, 22.15h

85 Fischermann T et al.: Der gefährlichste Fisch der Welt. Dossier. Die Zeit. 26.7.2018. <https://www.zeit.de/2018/31/lachs-raubfisch-nahrung-soja-norwegen-brasilien>

86 Ökotest: Lachs mit Ethoxyquin belastet. BAV Institut. Newsletter vom 14.12.18. www.bav-institut.de/de/news/Oekotest-Lachs-mit-Ethoxyquin-belastet

sults for all criteria. In particular, the results for preventive medicine are excellent, where the highest score was achieved. Due to the significantly lower Nutrient density of whole grain products compared to the top performers, there is a downgrade of the Q score to "3.5".

The gradation for grain products with a lower degree of milling is done in steps of 0.5-1 point (whole grain="3.5", medium degree of milling="2.5", white flour="2"). This rating scheme is applicable to all comparable products. In the case of rice, there is a small deviation, namely parboiled rice is given a "3" score due to a very good Nutrient density caused by the process, and normal, husked rice is then only given a "2". Again, this can be applied to other Food group if the parboiled process was used there.

A further modification of the Q-value would be made if, for example, pasta was made not only from cereal flour but also in part from legume flour. In this case, a mixed assessment should be made. If, for example, 50% chickpea flour (Q-value="4") and 50% normal flour type 405 (Q-value="2") were used, this would result in a total Q-value of "3".

3.5.1.6 Potatoes (Q-value=3.0)

Potatoes are very low in fat and can therefore achieve a good NSD. Table 3.2 assigns potatoes, together with eggs, a medium rank in the sum values of NSD. As the values per 100 g show, the nutrient content with this reference is only moderate, a finding potatoes share with several other Food-groups.

Table 3.5 summarizes the properties for all criteria. Here, too, potatoes can also end up only in the midfield. Of course, this applies only to cooked potatoes and not to products prepared with fat. Here, there would still be deductions, which will be explained in the next chapter. Because of their low energy density, the lowest of all starchy foods that normally function as side dishes, boiled or jacket potatoes contribute to a low energy content of the dishes. At the same time, due to the usual portion size of 150-200 g, they can help increase the feeling of satiety. Thus, they are suitable to counteract excessive energy intake.

In total, the potatoes are awarded the Q-value "3.0" and thus stand on the border between green and yellow, which seems justified based on the results in the application of the criteria.

3.5.1.7 Dairy products (Q-value=3.0)

For the evaluation of dairy products (Mopro), Tables 1 and 4 should again be consulted. As can be seen from Table 3.2 on the NSD, the total values for Mopro vary strongly depending on the fat content. The best value is 25 points and thus even surpasses whole grain products. Mopro are thus in the good midfield. Even some representatives of fruit, legumes and fish are below this best value for Mopro. Since the determination of Q-values is basically based on the optimal ratios, Mopro can perform well in comparison to other Food-groups.

When summarizing all criteria, we find Mopro in the middle to lower range of the evaluation of Food-groups. However, it must be emphasized that this group still scores two points for the preventive medicine criterion, as does the fish. Even if the evaluation of the criteria is basically about an overall assessment of all properties, it must be emphasized, especially in the case of mopro, that an important nutrient, calcium, is present in particularly high concentration in

some products. In order to meet the requirements of nutritional science for this nutrient, it would be difficult to do without this Food-group.

On the other hand, some mopro, especially milk, contains undesirable substances, e.g. lactose. These are not well digested by many people. Fatty acids also tend to be in unfavorable proportions. Last but not least, the salt content of some products, especially cheese, is high. Overall, therefore, a good to average Q-value of 3.0 seems appropriate. Due to the high fat content of some products, especially cheese, but also due to the high salt content, there are corresponding deductions, so that these Mopro are to be seen at best in the yellow range.

3.5.1.8 Eggs (Q-value=3.0)

As already mentioned, the content of desirable micronutrients per 1000 kJ is in the medium range. Eggs and potatoes are about equal in this respect (Table 3.2). Of the animal Food, eggs are the highest rated group for undesirable nutrients (Table 3.3), ahead of fish. Cholesterol, which used to be rated very negatively, is now seen in a much more relaxed light. Nevertheless, a high content of this nutrient, as is known to be present in eggs, is now not exactly to be viewed positively. There is still a residual risk associated with a high cholesterol content. Unlike mopro, there is no nutrient that is supplied to any particular degree. Eggs have a solid nutrient content across the board.

A look at the summary of all properties with respect to the selected criteria shows (Tab. 3.5) that eggs are rated significantly lower than fish and almost on a par with mopro, i.e. clearly ahead of meat and sausage. Desirable and undesirable nutrients are in the middle range and the preventive medical properties are moderate. Since the high cholesterol content is no longer evaluated negatively today and undesirable substances are hardly present, it seems justified to assign a Q-value of 3.0 for eggs - as for mopro - i.e. on the borderline between green and yellow.

3.5.2 Category "yellow" (Q-value 1.75 - <3.0)

The "yellow" category includes all Food with medium characteristics, including the low-fat varieties. These are essentially meat and meat products that are devalued compared to the previous Food-groups, which is explained below.

3.5.2.1 Meat and meat products (Q-value=2-3)

In the case of the Food group meat, a differentiation must be made, since the different products require different assessments. First of all, regarding muscle meat: although lean meat does not have a bad sum value in Nutrient density (Tab. 3.2), as little of it as possible should be consumed. The reason is the red meat. For this, an increased cancer risk has been proven with high evidence⁸⁷.

Furthermore, it has long been known that meat and meat products contain numerous ingredients with unfavorable health effects in relatively high concentrations, such as saturated fatty acids and purines. The high proportion of saturated fatty acids in total fat must be regarded as

87 DGE (Hrsg.): 12. Ernährungsbericht. Warlich Druck, Meckenheim, 2012, 427 S., hier: Rotes Fleisch und Fleischerzeugnisse S. 330

particularly unfavorable. A statement on this can be found in Table 3.3. Furthermore, problematic substances must also be evaluated that are formed during preparation or processing, such as benzpyrenes in grilled products, or that are added, such as nitrates or nitrites for preservation and taste reasons.

These substances have an additional potential to cause cancer, which was also very clearly expressed in a 2015 WHO statement⁸⁸. When looking at the preventive medical properties in Tab. 3.4, it is also clear that meat and meat products are to be evaluated very unfavorably. Finally, Tab. 3.5 also speaks an unmistakable language, since in the synopsis of all criteria this Food group occupies the worst ranks. For these reasons, fish and meat cannot be placed on the same level. Normal, red muscle meat is rather considered much lower with a Q-value of "2.0".

Another problem is antibiotics, which are more necessary due to the mass animal husbandry predominantly practiced in this country than in husbandry conditions with outdoor access for the animals, as is the case in organic farming. Based on investigations of the corresponding state offices, it is learned that antibiotic residues are frequently found, but they are below the limit values⁸⁹. The bigger problem here is the development of resistance. More and more pathogenic bacteria are becoming resistant to antibiotics due to their frequent use, often even to several antibiotics. This is then referred to as multi-resistance.

If the bacteria have a human medical significance, human health is at risk and current antibiotics may no longer be able to help with corresponding illnesses. A scenario that has unfortunately already become reality in the meantime, e.g. with Staph. aureus. For example, it was already determined in 2016 that 10% of hospital patients bring multi-resistant germs into the hospital⁹⁰. With the nature of our meat production, there is therefore an increasingly pressing health problem.



Qualitätsbewertung - Fleisch/Wurst
Gründe für eine geringere Einstufung

1. Fettgehalt mittel bis hoch
2. Hoher Salzgehalt in Wurst
 - Bluthochdruck
3. Fettsäure-Spektrum ungünstig (KHK)
4. Cholesteringehalt (KHK)
5. Puringehalt (Gicht)
6. Pökelfleisch, rotes Fleisch (Krebs)
7. Starke Limitierung durch DGE
 - v.a. Schulverpflegung



Fig. 3.8: Reasons for the devaluation of meat and meat products (© Fotolia, ExQusine)

88 WHO: Links between processed meat and colorectal cancer. WHO statement, 29 October 2015. www.who.int/mediacentre/news/statements/2015/processed-meat-cancer/en/

89 Bayerisches Landesamt für Gesundheit und Lebensmittelsicherheit. Überprüfung von Fleisch auf Antibiotikarückstände von 2018. www.lgl.bayern.de/lebensmittel/chemie/antibiotikarueckstaende/antibiotika/et_antibiotika_fleisch.htm#fazit

90 aerzteblatt: Medizin: Fast zehn Prozent der Klinikpatienten bringen multiresistente Keime mit. 15.8.2016. www.aerzteblatt.de/nachrichten/70030/Fast-zehn-Prozent-der-Klinikpatienten-bringen-multiresistente-Keime-mit

As already mentioned at the beginning, meat must be differentiated. Here we are talking about two products that should be viewed differently from normal muscle meat in the evaluation. This is, on the one hand, poultry meat. This is called "white meat" and is not associated with a higher cancer risk. For this reason, half a point is added for poultry meat. Poultry meat therefore receives a Q-value of "2.5".

Secondly, offal, in particular liver. As can be seen in Table 3.2, the total values for Nutrient density are extremely high, even higher than for vegetables. This also applies to the nutritional values per 100 g. However, Tab. 3.3 with the undesirable nutrient ratings shows that liver is in the lower range of ratings for this criterion. Liver is also likely to be rated more like meat and meat products for preventive medicine aspects. However, no specific data are available on this. If liver were to be classified quite differently here, this would certainly have been expressed. In the case of liver, there is also the fact that certain nutrients, especially vit. A, are present in such high concentrations that certain groups of people (pregnant women) are advised not to eat liver in the first three months.

Caution is also advised with regard to some toxic substances, especially heavy metals, in offal. As the German Federal Institute for Risk Assessment (BfR) already found in a pilot project in 2013, the livers and kidneys of common farm animals are significantly more contaminated with heavy metals than normal meat. Livers and kidneys from animals over two years old were even classified as unfit for human consumption⁹¹. Because of the outstanding nutritional properties of liver and the low risk of poisoning with moderate consumption of this Food, liver should receive a Q-value of "3.0", thus also lies on the borderline of green and yellow.

Meat consumption has been at a high level for decades. All consumer associations as well as the DGE never tire of castigating this high meat consumption and calling for lower consumption - so far with little success. The DGE's quality standard for school meals even explicitly calls for a maximum meat and sausage intake of twice a week, even for optional meals⁹². Without compliance with this requirement, certification cannot be achieved.

This makes it clear that politicians and scientists are unanimously calling for lower meat consumption, primarily for nutritional and preventive medical reasons. Climatological, i.e. ecological reasons have been added as counter-arguments to meat consumption, but are not considered in GTS as a matter of principle.

While liver is at the upper limit of the quality spectrum of meat, the opposite is usually true for sausages. Sausages form a separate Food group due to their production and ingredients. This is primarily due to the completely different production of sausages as well as various ingredients such as table salt, phosphates, nitrate, nitrite, preservatives, stabilizers, thickeners as well as other additives. In addition, low-quality ingredients such as skin or tendons are also added. The list of approved substances in sausage is long, which often reduces the quality of meat. There are deductions for fat and salt content anyway, regardless of the quality ratings on the Q-value, which will be discussed later.

A devaluation to the value of "1.5" was made simply because of the salt content in the sausage, which must be added in larger quantities for microbiological reasons. However, depending on the ingredients used, the rating can also be better, e.g. in the case of significant quantities of

91 BfR: Jahresbericht von 2013. Schwermetalle in Rindern und Schweinen.

92 BfR: Jahresbericht von 2013. Schwermetalle in Rindern und Schweinen.

vegetables. For these products, the principle of mixed evaluation must be applied (see section 3.7.3), so that the GTS rating can increase accordingly. In the case of ham, a devaluation of half a point is only necessary if salt or pickling salt has been used, which is not always the case.

In the evaluation of Food with regard to the triggering of cancer, meat and meat products score unfavorably⁹³.



Fig. 3.9: Cancer risk with different Food (© Fotolia, royaltystockphoto)

3.5.3 Category "red" (Q-value<1.75)

Only a few Food end up directly in the red category. Essentially, these are isolated substances such as gelling agents and binders or sugar and confectionery. Furthermore, unfavorable fats (high proportion of saturated fatty acids) are classified here, such as coconut or palm fat. The rating of fats can be viewed and evaluated in a separate table. Since binding and gelling agents cause a delay in gastrointestinal passage and are partly to be regarded as dietary fibers, the intake of which is desirable, they are rated "1". Sugars and products made from them (sweets), on the other hand, are rated "0" because no positive effect can be attributed to them.

Although only a few Food are directly assigned to the red category, a relatively large number of Food can nevertheless ultimately be rated in this way. This is due to the various deduction possibilities, especially the correction via the fat content of the Food. These deductions can even result in negative values. This is then dealt with when determining the GTS value.

93 DGE (Hrsg.): 12. Ernährungsbericht. Warlich Druck, Meckenheim, 2012, 427 S., hier: Kap. 5.1 Zusammenhang zw. Ernährung & Krebs, S. 319ff

3.5.4 Special category "Oils and fats"

For oils and fats, the evaluation criteria are the fatty acid spectrum, the vitamin E content and, in particular, the content of omega-3 fatty acids, which is evaluated separately. For the evaluation, an algorithm was developed with which any fat or oil can be evaluated according to the above criteria. It results that according to the recommendations of the DGE, certain oils, especially rapeseed oil, are rated green (4 points). The range is from 0 to 4. The risk of misunderstanding that a lot of "green" oils should be consumed is countered by a deduction rule for the fat content, which is dealt with in chapter 3.6 when determining the GTS value.

3.5.5 Final considerations on the Q-values

In chapters 3.3 to 3.5, it was explained according to which criteria Food group should be evaluated and how a Q-value is to be determined from this. These basic considerations were concluded with the assignment of Q-values for concrete Food-groups. The assignment of Q-values was also explained in detail. Q-values are flat-rate evaluations that are assigned for an entire Food-group. Even the modifications that may still have to be made, which result in slight devaluations, are flat-rate and do not yet provide precise information about the individual Food. If the individual Foods of a group are relatively homogeneous, i.e. differ only slightly with regard to relevant nutrients, such as fat in particular, the general ratings also apply to the individual Foods.

Certainly, there are some differences within a homogeneous Food-group, e.g. for certain vitamins and minerals, which should not be considered in the evaluation of GTS. With GTS it should be possible to evaluate simply and quickly and still correctly. This allows for certain inaccuracies. Therefore, differences such as those found in the use of different vegetables with an NCA will even out over a period of time. This inaccuracy is accepted by GTS, as it does not falsify the overall statement.

The situation is different, however, if the representatives of a Food group differ considerably in terms of fat or sugar content. It is not negligible if a sausage contains 40% fat or only 10%. It also plays a role whether the cooking processes have been carried out with a lot of or little fat, etc. Therefore, it is important that these specific characteristics of the Food and the processes are also taken into account in order to achieve a valid traffic light color for dishes and meals. And it is precisely these specific characteristics that are also taken into account with GTS.

With the system of criteria and the justifications for the assignment of Q-values based on them, the initial attempt was only to achieve a good plausibility for the ratings. However, this does not mean that there are no other criteria and justifications for the assignment of Q-values. The point was to create a comprehensible and solid basis on which the specific evaluation of Food can be derived. Ultimately, all this should lead to the development of ratings in the form of traffic light colors for Foods or ingredients of recipes that can withstand scrutiny by recognized instruments.

For this purpose, the solid basis of the initial assessment is important, otherwise the further assessment understandably cannot provide good final results. This first step towards the goal of assigning a traffic light color is done with the determination of Q-values. The next step is then taken by determining the GTS value.

3.6 Determination of the GTS value

3.6.1 Definition and principle procedure

In the last chapter it was explained how the Q-values for the evaluation of Food are formed. As described there, they are only the equivalents for a blanket evaluation on the basis of various quality criteria, which are modified somewhat if necessary. These modifications devalue the primary Q-values and result in the secondary Q-values. These are the starting points for the final evaluation with the aim of assigning a traffic light color to the Food. This traffic light color is represented by a GTS value. The GTS value is initially also only a numerical value derived from the Q-value. Since the numerical values are coupled with the traffic light colors, a GTS value can be directly assigned to a traffic light color.

The procedure for determining a GTS value is to specifically evaluate the further treatment of the Food in the kitchen as well as quality-relevant properties on the basis of the determined Q-value. This involves the following factors:

Kitchen processes	Evaluation of quality indicators
• Cooking method	• Fat content
• Hot holding time	• Sugar content

Tab. 3.7: Influences on the determination of the GTS value

During the cooking processes, the ingredient is heated and, if necessary, also leached if the cooking process is carried out with water. Thus, losses of vitamins and minerals occur. When heating is done with fat, fat is added to the cooked Food, which reduces NSD. Furthermore, it is a matter of keeping the prepared food hot, which can be of highly variable duration in the Community Catering. Nutrient losses also occur due to hot holding, which often lasts much longer than the actual cooking process.

Since Nutrient density is strongly influenced by the fat content of the food, the amount of fat in the ingredients in GTS plays an important role in the evaluation. Here, we are concerned with the fat content of the ingredient before cooking or preparation. Fat has the function of an indicator for NSD. A high fat content indicates that the Nutrient density is low and vice versa. The fact that fats and oils contain essential substances (fatty acids) is taken into account by a differentiated assessment of these ingredients, which will be discussed later.

Complementary to this, the sugar content is also important. Sugar also increases energy density and lowers Nutrient density because it contains virtually no micronutrients. Therefore, sugar also has an indicator function in the sense that the quality of the food decreases with increasing sugar content.

Bewertung von Speisen		
Ermittlung von Q-Werten und GAS-Werten		
Phasen	Stufe	Bewertungskriterien
Ermittlung der Q-Werte	I.	Primärer Q-Wert: Anwendung der Qualitätskriterien
	I.	Sekundärer Q-Wert: Anwendung der LM-Technologie, Salz
Ermittlung der GAS-Werte	II.	Küchentechnische Prozesse: Garverfahren, Heißhalten
	II.	Qualitätsindikatoren: Fettgehalt, Zuckergehalt

Fig. 3.10: Determination of Q-values and GTS values for Food

Unfavorable influences due to the kitchen treatment or the composition of the ingredients are taken into account when determining the GTS value. This is done by making further point deductions. These deductions are no longer across-the-board, but very concrete and specific to the ingredient in question. The GTS value thus leads to a differentiation in the evaluation of ingredients that was hardly possible before.

Food of a certain group are therefore not evaluated equally when determining the GTS values, but rather depending on the four factors mentioned. With this approach, identical recipes can be differentiated based on their hot holding times. It is clear that a dish that has been kept hot for only 30 min is to be evaluated nutritionally differently from a dish that has been kept hot for five hours, which occurs in practice. With the GTS value, such a differentiation is possible, so that different catering systems can be evaluated more fairly (key point: temperature-decoupled vs. temperature-coupled). Fig. 3.10 shows the steps for the procedure in determining the GTS value. In the following, the individual factors for determining the GTS value are presented and explained in more detail, i.e. the technical kitchen processes and the quality indicators.

3.6.2 Deduction: Cooking method

In the case of the cooking process, only a number is entered that characterizes a particular process. The deductions are then made automatically with the aid of a formula. There is an input possibility from 0 to 4. The meaning of the inputs is shown in Fig. 3.11, which will be explained briefly afterwards.

- If no cooking method is used, e.g. for salads or certain desserts, "0" is entered in the column. No deduction is made.
- When cooking without fat (e.g. boiling, steaming), the main concern is nutrient losses. These are given the lowest deduction. Fat-free cooking could still be differentiated, e.g. whether steaming or boiling is used, for which different points would then be awarded. Scoring is difficult because losses depend on whether the cooking water is reused or not. The evalua-

tion for GTS is intended to be as simple as possible, deliberately accepting minor inaccuracies. Therefore, no further differentiation is made.

Abzug: Garverfahren Durch Punkteingabe mit hinterlegten Formeln		
Pkt	Garverfahren	Beispiele
0	Kein Garen	Salat, Dessert
1	Fettfrei Garen/ Regeneration	Backen, Dämpfen/ C&C, C&F
2	Wenig Fett (<5%)	Grillen, Backen im HLD (Einpinseln, Sprühpistole)
3	Mittelfett (5-10%)	Braten ohne Panade
4	Fettreich (~15%)	Frittieren, Braten mit Pan.

Fig. 3.11: Deductions when cooking the food

- The regeneration of precooked food or dishes ("high-convenience products") is normally carried out in the Community Catering in a combi steamer. A two-stage process, with stabilization after cooking (e.g., in "cook and chill"), corresponds in total approximately to the nutrient losses of the uninterrupted cooking process. In practice, however, the total load on the product is greater because safety margins are used, which is why the input "1" should be used here. The cooking processes for the high-convenience products to be regenerated must be evaluated separately. If the recipe including the cooking process is known, this can be done in the usual way for GTS. Otherwise, an evaluation procedure must be used, as described in chapter 4.3. If the regeneration is not carried out in the combi steamer but, for example, in the deep fryer, the corresponding figure for this cooking process must be used.
- The point deduction for cooking with fat is based on the amount of fat absorbed by the food. The point deductions for these fat absorptions correspond approximately to the deductions for the fat content of the Food (see Chapter 3.6.4). A deduction of 0.1 points per gram of fat was specified for this. However, in the cooking process with fat (frying, deep-frying), there is the additional factor that the temperatures are higher than when cooking with water or steam. These are between 160°C and 180°C. There are indications that repeated heating of oils and fats, as is the case especially with deep-frying, results in the formation of trans fatty acids⁹⁴. But also independently of this, the deduction should be set higher in the case of high-fat cooking processes. In the case of a high fat intake ("4"), approx. 15% fat is assumed (e.g. French fries, pan. escalope). Reliable analytical values are available for this⁹⁵.

These deductions do not differentiate which fat is involved. A special table shows which oils are generally to be preferred. All oils are given a Q-value and are evaluated with traffic light colors ("oil traffic light"). It is not self-evident that the green oils are always the most suitable in

94 DGE: Fachinformationen. trans-Fettsäuren und ihr Einfluss auf die Gesundheit. hier: Entstehung. www.dge.de/wissenschaft/weitere-publikationen/fachinformationen/trans-fettsaeuren/

95 Stiftung Warentest: Der Pommes-King. test, Heft 3/2007, S. 20-25 sowie Angaben des Bundeslebensmittelschlüssels (BLS)

practice, because the choice of an oil also depends on the intended use. For example, highly unsaturated oil should not be used for deep-frying because it ages quickly. Conversely, a frying oil is not used as a salad oil. Both oils are ideally suited for their respective purposes.

However, it would be going too far if the different purposes were also specified in GTS and the preference of the oils were based on this. GTS evaluates according to nutritional criteria. For the fats or oils used, a good quality was assumed across the board, which is also common in practice ("rapeseed oil"). With GTS, however, it is also possible to enter a very specific oil and the corresponding quantity for the evaluation, e.g. sesame or peanut oil for frying. This evaluation procedure assumes that the amount of fat that penetrates or settles on the food being cooked is known. It is precisely because this quantity is usually unknown that the lump-sum deduction method for cooking was developed, after all, in order to have at least a plausible approximate value.

With a separate input procedure, it is possible that a lower quantity than assumed as a lump sum is used. This portion quantity is then entered. However, the reverse can also occur, that a larger amount of fat is taken up by the product. This depends on various factors, e.g. the type of product being cooked or the oil temperature. It is sufficient for a reliable evaluation to work with the flat-rate values.

3.6.3 Trigger: Keep hot

Losses of water-soluble vitamins in particular occur when food is kept hot. In the case of vitamin C, depending on the Food, losses can be significant after just one hour and are already over 50 percent after three hours^{96,97}. In addition, keeping food hot can significantly impair its sensory properties after just one hour. In practice, it is not uncommon for food to be kept hot for more than five hours⁹⁸. Therefore, the loss of quality due to hot holding should be visible in the point evaluation. The devaluation of 0.25 points per hour starts after one hour. This means, especially for the "Cook and Hold" system, that if the food is kept hot for five hours, it is devalued by one whole point, which means a color change. From a nutritional point of view, this seems appropriate.

96 Williams PG et al.: Ascorbic Acid and 5-Methyltetrahydrofolate Losses in Vegetables with Cook/Chill or Cook/Hot-Hold Foodservice Systems. *Journal of Food Science*. 60 (1995), Nr. 3, 541-546

97 Bognár A: Qualität warmer Speisen. *Angebotsformen in der Großküche. ernährung im fokus 6* (2006), Heft 01, 2-8

98 Peinelt V: Erfahrungen im Rahmen der Überprüfung der Schulverpflegung durch die AG-Schulverpflegung der Hochschule Niederrhein, Mönchengladbach, 2007-2015

Abzug: Heißhalten
Durch Zeiteingabe mit hinterlegter Formel

Abzug	Bezogen auf eine Speise
0	<1 Std heißhalten
-0,25	für jede weitere Std

Heißhaltezeit:

- Vom Garende bis zum Ende der Ausgabezeit
- Abzug erfolgt nach Eingabe automatisch über eine Formel



Häufig länger als 3 Stunden!

Fig. 3.12: Evaluation and definition of the hot holding time

A deduction is made separately for each dish, since some dishes are not kept hot, e.g. salads or desserts. A blanket deduction for all dishes of a meal would therefore also worsen cold dishes in terms of points. The entire hot holding time should be entered, i.e. from the end of cooking (possibly in a central kitchen) to the last guest of a production batch. If new production is then started, the heat retention time begins with this new cycle. This makes it possible to evaluate equivalent offers differently with regard to composition on the basis of the hot holding time.

3.6.4 Deduction: fat content of ingredients

Of particular interest for the evaluation of Nutrient density is the fat content of the ingredients. This does not mean the fat content added by the preparation of the food, but the original one. The Nutrient density is particularly unfavorably influenced by high-fat ingredients such as cream, butter, mayonnaise or bacon cubes. If the amount of fat is large, e.g., in hollandaise sauce, a dish is usually rated red. Conversely, careful selection of low-fat ingredients can significantly improve the rating. Instead of using regular mayonnaise, a low-fat substitute can often be used.

It should be reiterated here that the nutrient fat is not considered bad per se by GTS. Rather, fats and oils have various important functions for the body, including taste, but also essential (certain fatty acids), which is why some fats and oils are also rated green by GTS. Green Foods should generally be part of a diet. However, since Nutrient density is not more influenced by any nutrient than by fat content, fat is a very good indicator of NSD. Moreover, a high fat content in the diet alone is considered to have a detrimental effect on health⁹⁹.

Because of this indicator function, the lower the fat, the higher the score for GTS. In the extreme case, a fat-free diet would be rated most favorably according to this logic. However, this does not correspond to the nutritional recommendations. But this case is purely theoretical. Due to many common dishes that are cooked with fat as well as numerous fatty dressings and sauces or Food of animal origin that normally contain fat, a fat content of at least 15 en% in

99 DGE et al. (Hrsg.): D_A_CH-Referenzwerte für die Nährstoffzufuhr, 1. Aufl., 5. korrigierter Nachdruck, Neuer Umschau Buchverlag, Neustadt/Weinstraße, 2013, 292 S., hier: S. 49



the diet can only be undercut in extreme cases (e.g. with the Ornish diet¹⁰⁰). Even with a low-fat Food selection and preparation, as is possible in the Community Catering with modern equipment, it is normally hardly possible to undercut the D_A_CH reference values for fat of 25-30 en%. For further explanation see chapter 4.

The fat content is entered as a percentage of the respective ingredient, since the traffic light color is related to 100 g. The fat content is then converted into a deduction value. This number is converted into a deduction value for the respective ingredient. However, ingredients with a very high fat content, such as oils, can only be given a red rating in this way, with the final value depending on the quality classification. In this case, it would be particularly important to keep the portion quantity low. When specifying the portion quantity for oil, it must be taken into account that 100 ml of oil only have a weight of 85 g.

With this rating it becomes clear that on the one hand a Food can be classified as high quality (green quality rating for e.g. rapeseed oil), but on the other hand the intake of a larger quantity would be unfavorable. In this respect, GTS meets both requirements, i.e. to identify valuable and desirable Food while also observing the correct quantity, i.e. to evaluate qualitatively and quantitatively.

3.6.5 Deduction: sugar content of ingredients

The term "sugar" covers various easily absorbed types of sugar (mono- and disaccharides) as well as products with a high sugar content (e.g. honey or sugar syrup). Milk sugar is not included because it is only slowly absorbed. In addition to fat, sugar also reduces Nutrient density because sugar contains a lot of energy but hardly any micronutrients or other valuable ingredients. If the sugar used is not taken into account in a meal evaluation, this leads to relevant inaccuracies. With the deduction of GTS, this can be avoided.

Another argument for taking the sugar content into account when evaluating meals is findings from cancer research¹⁰¹. It is known that the metabolic pathway of cancer cells is different from that of normal cells. The peculiarity is that cancer cells do not take the effective path of oxygen combustion in the mitochondria, but ferment sugar, producing lactic acid, among other things. In current cancer research, the "waste product" lactic acid is considered to play an important role in the proliferation of cancer cells. The reasons for this are the strong release of so-called free radicals during mitochondrial oxygen utilization, i.e. the oxidative metabolism of sugar. Sugar and easily cleavable carbohydrates (white flour products, starch, etc.) can therefore increase the risk of cancer development. The authors explicitly point out that this influence is significant both preventively and therapeutically¹⁰².

Recent studies from Germany and the USA also indicate that it is not indifferent in which form the food energy is supplied to the body. Until now, the dogma was that it did not matter where the food energy came from, especially in the development of obesity. If the food contains sugar, insulin is released into the blood. Furthermore, blood sugar activates hormones (glucose-dependent insulinotropic peptide = GIP) which, among other things, increase insulin resistance

100 Ornish Diät. www.abnehmen.net/ornish-diaet/

101 Kleine-Gunk B: 15 Jahre länger leben. Die 7-Säulen-Anti-Aging-Strategie nach dem Hormesis-Prinzip. 190 S, 2017, Gräfe & Unzer, München, Kap. Krebs: Der Feind im Körper, s. S. 128ff

102 Ebda: S. 132 und Interview mit Dr. Coy (Deutsches Krebsforschungszentrum) auf S. 133



as well as liver fatty degeneration. These negative effects of high GIP concentrations were demonstrated in mouse experiments and confirmed in another study. It was found that high-sugar diets led to weight gain compared to the control diet, although the rats consumed less energy overall on this diet. Therefore, it is advised to generally avoid Food with high sugar content for diabetes prevention and weight problems¹⁰³.

The WHO has set an upper limit for sugar consumption of 10% of daily energy requirements (approximately 50g per day). This value was later reduced to a recommendation of only 5% as so-called free sugar¹⁰⁴. This strong limitation of sugar by the WHO, the most important health organization in the world, confirms the approach of GTS to consider sugar in the evaluation of food quality.

For a plausible evaluation, a deduction must also be made for sugar, analogous to fat. This deduction is based on the energy content and is therefore only half as high as for fat, i.e. 0.05 points. This deduction mechanism clearly shows the devaluation of a food containing sugar. Example: A pudding with added sugar results in a yellow rating, since a sugar content of 10% causes a deduction of 0.5 points, and the starch also leads to a further point deterioration, which makes the difference to sugar-free Food more plausible. If the sugar content is unknown, standard values from common recipes can be used as an approximation.

3.6.6 Deduction: salt content of the food

3.6.6.1 Problems of estimating the salinity

Salt also has an unfavorable influence on the value of food because salt is a risk factor for cardiovascular diseases (high blood pressure). The salt content should therefore be included in the evaluation of meals¹⁰⁵. In 2018, the German Federal Ministry of Food and Agriculture (BMEL) launched a "National Reduction and Innovation Strategy for Fat, Sugar and Salt in Ready-to-Eat Products"¹⁰⁶, which is being carried out together with the Food industry and research institutes. Similar efforts can be observed throughout Europe. One of the aims is to reduce salt in the recipes of salt-containing finished products in the food industry, the food trade and the food retail trade. Since GTS deducts a malus for the salt content of meals above a certain limit (see chapter 3.6.6.5), GTS also supports national efforts in the area of Community Catering. Incidentally, this area is also to be included in the above-mentioned strategy - but at a later stage. When determining the salt content, problems arise that are relevant for a point deduction.

Precise information on the salt content of recipes in the Community Catering is often lacking - unlike in finished products of the Food industry, where their declaration is mandatory. The salt content is also precisely specified in the Food trade. This specification is missing when preparing food in commercial kitchens for two reasons:

- There are ranges of variation in the sensory properties of the raw materials, which makes it necessary to add different amounts of salt or seasoning.

103 Ritzka M: Kalorien: Nicht nur die Menge macht's. Ernährung im Fokus, 09-10 2018, S. 303

104 World Health Organization (WHO): Healthy diet. Fact sheet No.394, www.who.int/publications/m/item/healthy-diet-factsheet394. 30.8.18

105 WHO: Salt reduction. Fact sheet No. 393, Sept. 2014. www.who.int/mediacentre/factsheets/fs393

106 Bundesministerium für Ernährung und Landwirtschaft (BMEL): Die Nationale Reduktions- und Innovationsstrategie für Fett, Zucker und Salz in Fertigprodukten. www.bmel.de/DE/Ernaehrung/_Texte/ReduktionsstrategieZuckerSalzFette.html;nn=310342

- Cooks in particular are accustomed to adding salt according to subjective perception, which leads to appreciable intra- and interpersonal variations.

On the other hand, recipes are generally available in the Community Catering, otherwise it would not be possible to work sensibly (e.g. cost calculation, allergen labeling, etc.). If the added salt is indicated at least approximately, the salt content of dishes could be determined well. It should be noted that granulated broths or seasoning salts are often used, the salt content of which can vary greatly. It is indicated on the packaging and can thus be determined for the recipe. Information for transfer processes of salt from the cooking water into the Food can be found via the BLS for cooked products. Of course, this requires appropriate know-how of the kitchen staff and suitable programs as well as databases. For example, the salt content of cooked Food, such as potatoes, does not reflect the salt content in the (seasoned) food. Information on the salt used in dishes can only be found under BLS No. "X" AND "Y".

3.6.6.2 Food salt content

Having said this, an attempt will now be made to calculate the salt content of food in order to justify a deduction mechanism. The salt content is made up of the addition of salt or seasonings containing salt during preparation and the original salt content of the ingredients. According to the BLS, a normal salting of food is 0.5 g salt/100 g for vegetable food ("X") and somewhat higher for animal food ("Y") (see tables 3.8 and 3.9). However, this also includes those foods that have a very high salt content. Excessive additions of salt during preparation can be disregarded because these are then "oversalted dishes" that are rejected by the guest. If there are significant exceedances of these average values, this is due to particularly high-salt Food. The various food groups according to BLS are shown below. The meaning of the terms in the header is shown in the legend¹⁰⁷.

SBSL	DISHES, VEGETABLE ORIGIN	Na-Av	NaCl-Av	Av/Ma	Filt/Ges	Na-Ma	NaCl-Ma	>50%Ma	>75%Ma	>90%Ma
	Without filter	[mg]	[mg]	[%]	[%]	[mg]	[mg]	[%]	[%]	[%]
X0	Wholemeal bread with spread / topping	455	1137	37	n/a	1214	3035	22	4	1
X1	Salads from cooked vegetables	204	510	38	n/a	534	1335	13	11	7
X2	Salads raw	283	707	7	n/a	4123	10308	1	1	1
X3	Sauces	233	582	9	n/a	2718	6795	1	1	1
X4	Soups	167	418	24	n/a	711	1778	4	1	1
X5	Vegetable side dishes	213	532	24	n/a	873	2183	3	1	1
X6	Potato dishes	177	442	15	n/a	1143	2858	3	1	1
X7	Pasta dishes	179	446	31	n/a	568	1420	18	8	3
X8	Rice dishes	236	589	22	n/a	1079	2698	18	4	4
X9	Cereal, flour and milk dishes	138	346	14	n/a	1022	2555	3	1	1

Tab. 3.8: Na and salt content of all food groups of vegetable origin

As the column ">50%Ma" shows, only a small part of the meals exceeds 50% of the maximum salt content of the respective subgroups. The most important subgroups of dishes of animal origin are shown below (Tab. 3.9). A reading example for this is shown in footnote¹⁰⁸.

107 **Legende der Überschrift:** Na-Av=durchschnittlicher Natriumgehalt, NaCl-Av=durchschnittlicher Salzgehalt, Av/Ma=Anteil des Durchschnitts bezogen auf das Maximum, Filt/Ges=Anteil der gefilterten LM bezogen auf alle LM der Gruppe, Na-Ma=maximaler Natriumgehalt, NaCl-Ma=maximaler Salzgehalt, >50%/>75%/>90%Ma=Anteil der LM über 50%/75%/90% des Maximums

108 **Lebeispiel für Y0=Schlachteplatten/Sülze:** Sie enthalten i.D. 403 mg Na und 1008 mg Salz, entspricht 36% des Maximalwertes dieser Gruppe, Anteil der Speisen=Gesamtzahl (kein Filter), Maximalwert=1113 mg Na oder 2783 mg Salz, 21% aller Speisen dieser Grup-Fortsetzung auf S. 51

SBLs	DISHES, ANIMAL ORIGIN	Na-Av	NaCl-Av	Av/Ma	Filt/Ges	Na-Ma	NaCl-Ma	>50%Ma	>75%Ma	>90%Ma
	Without Filter	[mg]	[mg]	[%]	[%]	[mg]	[mg]	[%]	[%]	[%]
Y0	Slaughterhouse dishes / Brawn	403	1008	36	n/a	1113	2783	21	8	3
Y1	Beef dishes	244	610	21	n/a	1145	2863	2	2	2
Y2	Veal dishes	257	644	36	n/a	722	1805	4	2	2
Y3	Pork dishes	355	888	12	n/a	3061	7653	2	2	1
Y4	Lamb and mutton dishes	242	606	51	n/a	475	1188	49	4	4
Y5	Game and poultry dishes with sauce	232	581	44	n/a	530	1325	24	5	2
Y6	Fish dishes	343	858	7	n/a	4679	11698	2	2	1
Y7	Egg-quark-cheese dishes	280	699	25	n/a	1100	2750	4	2	2
Y8	Sweet dishes - desserts	51	128	17	n/a	298	745	7	2	1
Y9	Quick dishes	383	957	36	n/a	1049	2623	34	12	5

Tab. 3.9: Na and salt content of all food groups of animal origin

The higher average values for the salt content of animal dishes are due to the high maximum values of certain subgroups. Pork and fish dishes are particularly noticeable here. These groups include a relatively large number of salted or cured dishes and products, with the salt content of these fish products being among the highest of all, as shown in Table 3.10 below.

SBLs	FISH, COOKED	Na-Av	NaCl-Av	Av/Ma	Filt/Ges	Na-Ma	NaCl-Ma	>50%Ma	>75%Ma	>90%Ma
	Filter: SALTED	[mg]	[mg]	[%]	[%]	[mg]	[mg]	[%]	[%]	[%]
T0	Fish	4219	10548	66	7	6438	16095	4	4	4
T1	Herring, tuna, mackerel	5237	13093	81	8	6451	16128	9	6	6
T2	Cod-like fish	5494	13736	79	6	6989	17473	6	6	6
T3	Flatfish	6149	15373	99	7	6226	15565	8	8	8
T4	Salmonids	3426	8565	85	7	4019	10048	10	9	4
T5	Carp-like fishes	6038	15094	99	7	6078	15195	8	8	8
T6	Perch-like fish	6102	15255	99	6	6163	15408	7	7	7
T7	Crustaceans	5643	14106	89	8	6362	15905	8	7	6
T8	Fish products	7223	18058	100	1	7223	18058	4	4	4

Tab. 3.10: Na and salt content of salted fish products

SBLs	SAUSAGE & MEAT PRODUCTS	Na-Av	NaCl-Av	Av/Ma	Filt/Ges	Na-Ma	NaCl-Ma	>50%Ma	>75%Ma	>90%Ma
	Without Filter	[mg]	[mg]	[%]	[%]	[mg]	[mg]	[%]	[%]	[%]
W0	Sausage	1091	2726	82	100	1328	3320	100	60	60
W1	Raw sausage	1191	2979	56	100	2130	5325	76	9	3
W2	Cooked sausage	882	2204	36	100	2481	6203	3	3	3
W3	Cooked sausage	781	1953	50	100	1557	3893	37	11	5
W4	Pork bacon and ham	1013	2533	35	100	2877	7193	39	16	5
W5	Kasseler	1848	4621	67	100	2753	6883	66	56	9
W6	Cured pork ribs	2445	6112	99	100	2472	6180	100	100	100
W8	Pork belly stuffed, butcher's tz	835	2088	29	100	2876	7190	13	3	3
W9	Meat sausage in puff pastry	788	1971	54	100	1448	3620	56	25	25

Tab. 3.11a: Na and salt content of sausage and meat products (without filter)

If the subgroups for sausage are filtered with regard to the term "cured", only three subgroups are found where this term applies, namely W4-W6 (Table 3.11b).

SBLS	SAUSAGE & MEAT PRODUCTS	Na-Av	NaCl-Av	Av/Ma	Filt/Ges	Na-Ma	NaCl-Ma	>50%Ma	>75%Ma	>90%Ma
	Filter: cured	[mg]	[mg]	[%]	[%]	[mg]	[mg]	[%]	[%]	[%]
W4	Pork bacon and ham	2473	6183	100	3	2473	6183	39	26	16
W5	Kasseler	1220	3050	100	3	1220	3050	100	94	88
W6	Cured pork ribs	2445	6112	99	100	2472	6180	100	100	100

Tab. 3.11b: Na and salt content of cured sausage and meat products

While almost all salted fish products have double-digit salt contents, salted meat products still reach more than 6 g salt/100 g. This already corresponds to the recommended daily value. Such high-salt foods are part of the traditional food palette all over the world, such as cured meat or salted fish. The high salt content has not only sensory but also microbiological reasons, as it is intended to ensure shelf life and microbial safety. Therefore, it is also difficult to reduce, especially since guests also want the typical salty taste in certain dishes (pickle aroma). Consumption of these dishes entails an increased risk because the high salt content can have an unfavorable effect on health.

Apart from salted sausages/meat products and fish products, dairy products also contain elevated levels of salt, basically only cheese, which has to be salted for reasons of shelf life. Milk and dairy products, on the other hand, contain only 5-10% of the salt content of cheese and can be neglected in the evaluation of salt content. Cheese generally contains 2 g salt/100 g, with a maximum of almost 6 g, but usually only up to 3.5 g (Table 3.12).

SBLS	DAIRY PRODUCTS	Na-Av	NaCl-Av	Av/Ma	Filt/Ges	Na-Ma	NaCl-Ma	>50%Ma	>75%Ma	>90%Ma
	Without Filter	[mg]	[mg]	[%]	[%]	[mg]	[mg]	[%]	[%]	[%]
M3	Hard cheese	689	1722	49	100	1400	3500	48	8	6
M4	Semi-hard cheese I	756	1890	54	100	1400	3500	41	24	5
M5	Semi-hard cheese II	926	2315	66	100	1400	3500	68	34	19
M6	Soft cheese	784	1960	60	100	1300	3250	91	25	6
M7	Cream cheese sour milk cheese etc	505	1263	35	100	1430	3575	36	28	4
M8	Processed cheese preparation	511	1278	22	100	2280	5700	20	2	2

Tab. 3.12: Na and salt content of dairy products and cheese (without filter)

3.6.6.3 Salt content of menus

Having discussed the salt content of various dishes and some particularly high-salt Food, we will now estimate how high the salt content of a menu can be. Tab. 3.13 shows the results of the salt calculation based on standardized meals¹⁰⁹ according to BLS. Quantities refer to ready-to-eat meals.

109 Peinelt V: Erfahrungswerte für Mengen verzehrfertiger Speisen in der GG von 20 Jahren Auditierung von Betriebsrestaurants.

Dishes	Portion size [g]		Na quantity/100 g [mg]		Salt quantity/Port [mg]	
	min	max	min	max	min	max
Main courses	100	150	100	300	250	1.125
Starch side dishes	100	175	50	500	125	2.188
Sauce	50	75	90	150	113	281
Vegetable garnish	100	175	100	300	250	1.313
Dessert	75	125	40	200	75	625
Mean value dishes I	85	140	76	290	163	1.106
Mean value dishes II	113		183		634	
Total dishes	425	700	380	1.450	813	5.531
Mean value sums	563		915		3.172	

Tab. 3.13: Na and salt content of a standard menu

As the calculation in Tab. 3.13 shows, the minimum content for salt is about 0.8 g salt per lunch, but on the other hand, it can reach almost seven times that value with more than 5.5 g. The average is 3 g. Based on 100 g of the lunch, the average salt content is ~560 mg. The ranges for the salt content of the meals are also widely spread i.D.. They range from ~160 to ~1,100 mg salt/serving. This does not even include the very high-salt meals (Tables 3.10-3.12), so that significantly higher maximum values are possible.

If lower to medium salt contents are used as a basis for the dishes with the largest portion quantities, the starch and vegetable side dishes, which is the normal case, the overall result looks significantly more favorable (Tab. 3.14).

Dishes	Portion size [g]		Na quantity/100 g [mg]		Salt quantity/Port [mg]	
	min	max	min	max	min	max
Main courses	100	150	100	300	250	1.125
Starch side dishes	100	175	50	200	125	875
Sauce	50	75	90	150	113	281
Vegetable garnish	100	175	100	200	250	875
Dessert	75	125	40	200	75	625
Mean value dishes I	85	140	76	210	163	756
Mean value dishes II	113		143		459	
Total dishes	425	700	380	1.050	813	3.781
Mean value sums	563		715		2.297	

Tab. 3.14: Na and salt content of a standard menu with reduced salt contents

The maximum value for the modified lunch of almost 3.8 g salt is still high, but now the mean value is only slightly above 2 g. The salt content per 100 g of the lunch is 408 mg.

Conclusion:

- Some Food group can be identified that have a particularly high salt content. These are salted fish and meat dishes, sausage and cheese.
- The salt content of lunches reaches an average of 2-3 g even without the very high-salt Food-groups.

3.6.6.4 Salinity evaluation

Now that the salt contents in the usual meals and menus have been determined, the task is to evaluate these quantities and define a limit value for a malus. The basis for this is the calculation for a lunch. The WHO recommends a daily salt intake of 5 g¹¹⁰, while the DGE recommends 6 g^{111,112}. However, salt consumption in Germany is usually 9 g per day, i.e. about 50% higher¹¹³! A lunch should contribute one third of all nutrients ("one third approach"). In the case of salt, this would ideally be up to 2 g.

If we look at the calculations of the standard menus of Tab. 3.13 and 3.14, only the lower-salt variant of Tab. 3.14 can approximately fulfill this requirement. This means that the value of ~400 mg/100 g determined for this menu should not be significantly exceeded. However, since portion sizes as well as the total weight of a lunch may vary more, the energy-based consideration for salt content is more accurate than the quantity-based consideration. The recommended energy intake for adults is approximately 2,200 kcal per day¹¹⁴. According to the one-third approach, a lunch should then contain approx. 750 kcal, which is to be regarded as the limit for the 2 g salt content. In other words, the limit for the salt content would be ~270 mg/100 kcal.

3.6.6.5 Lump sum deduction

There are two options for a deduction based on the salt content of the food: either a flat-rate deduction or a differentiated deduction. For the differentiated assessment, the salt content of a lunch would have to be determined, taking into account the salt of all processes and ingredients. However, as mentioned above, often neither the exact quantities during preparation nor the original contents of the ingredients themselves are available for this purpose. The salt contents of the ingredients could indeed be taken from the packaging or from the BLS. But packaged goods are not always processed, which is especially true for Community Catering. Therefore, the salt data would have to be researched in appropriate databases (which is not always the BLS) first. In any case, it is a very cumbersome process that is also prone to error and uncertainty.

In addition, it is practically impossible to achieve the target value due to the relatively high-salt dietary habits in Germany as well as in many other industrialized countries. If the amount of salt in meals were consistently reduced to the ideal value of <400 mg/100 g determined above, the meals would be perceived by most guests as "too weakly salted" and therefore rejected. Guests would then reach for the salt shaker and probably add more salt than would be the case with moderate salting by responsible kitchen staff. Or they would stay away from the Community Catering, which is also not desirable since the alternatives are usually worse. Thus, food ratings should not be so at odds with dietary habits that almost any food containing salt would receive a malus. The reduction of the salt level of the German nutrition is a

110 WHO: Wie viel Salz sollten Erwachsene pro Tag zu sich nehmen? <https://www.euro.who.int/de/health-topics/disease-prevention/nutrition/news/news/2011/10/reducing-salt-intake/frequently-asked-questions-about-salt-in-the-who-european-region>

111 DGE: DGE aktualisiert die Referenzwerte für Natrium, Chlorid und Kalium. Presseinformation vom 3.1.2017. <https://www.dge.de/presse/pm/dge-aktualisiert-die-referenzwerte-fuer-natrium-chlorid-und-kalium/>

112 DGE: Ausgewählte Fragen und Antworten zu Speisesalz. Punkt 5. <https://www.dge.de/wissenschaft/faqs/salz/#c2591>. DGE 2022

113 BMEL: Salzkonsum in Deutschland: Ergebnisse der DEGS-Studie. 10.5.21. <https://www.bmel.de/DE/themen/ernaehrung/gesunde-ernaehrung/degs-salzstudie.html>

114 DGE: Referenzwerte für die Energiezufuhr. <https://www.dge.de/wissenschaft/referenzwerte/energie/?L=0>

task for the whole society, which was given already over a decade ago by the WHO as a world-wide goal and for which efforts are already undertaken on the part of the state¹¹⁵.

Therefore, in the context of the evaluation with GTS, only a lump-sum deduction is to be made for certain, high-salt Food or meals. These are the Food group listed in Table 3.15. Other Food can be neglected. Other Food can be neglected because the salt content is not so high or only very little of it or rarely eaten (e.g. caviar: 5 g salt/100 g).

High salt foods	Na quantity / 100 g [mg]			Salt quantity / 100 g [mg]		
	min	Average	max	min	Average	max
Cheese	33	705	1.430	83	1.763	3.575
Sausage	31	1.040	2.877	78	2.600	7.193
Pork, cured	2.364	2.421	2.479	5.910	6.053	6.198
Beef/veal, cured	1.717	2.397	2.474	4.293	5.993	6.185
Fish, salted	53	5.230	6.989	133	13.075	17.473

Tab. 3.15: Na and salt content of salty foods

For the overall evaluation, half a point is deducted for high salt contents. This procedure can be implemented without much effort. A limit value of 2 g/100 g Food has already been set for the deduction. This value corresponds to the lowest salt content of the high-salt Food. This is that of cheese (Table 3.15), which at ~1,800 mg/100 g i.d. just reaches this value. All other high-salt Food group usually have significantly higher values. The aim of the point deduction is to draw the attention of the kitchen staff to the salt and thus to make the recipes lower in salt, which would also increase the GTS value of the dishes. If the particularly high-salt foods are largely avoided and the food is prepared in a salt-conscious manner, the ideal value of 2 g salt/lunch can be approximately achieved (see Table 3.14).

3.6.6.6 Procedure for the lump-sum deduction

The deduction condition of ≥ 2 g/100 g is fulfilled by the Food group sausage, cheese and salted meat and fish products. Thus, since only a few Food group are involved, they can be taken into account in a blanket approach without any problems. For this purpose, it is not necessary to know the exact values, because the high salt contents have been proven by the above studies. As a result of the salt deduction, Food of the mentioned groups obtain lower Q-values compared to the respective main groups. For example, the Q-value of 3 has been defined for the main group "dairy products". For cheese, the Q-value would be reduced to 2.5 due to the increased salt content. For sausage (beef, pork), the GTS value after deduction is only 1.5.

However, GTS is very flexible in its evaluation. If one of the high-salt Food has been produced with significantly less salt than usual and is significantly below the limit, the Q-value should be adjusted. For such Food, the deduction of half a point would not apply. However, Food with a particularly high salt content also receive only this moderate point deduction, which does not seem entirely appropriate. For example, a salted Matjeshering has a salt content of about 15 g/100 g, which is thus far above the limit. However, this inaccuracy can be accepted for reasons of ease of handling, especially since the consumption of such food is relatively infrequent.

115 Bundesministerium für Ernährung und Landwirtschaft (BMEL): Die Nationale Reduktions- und Innovationsstrategie für Fett, Zucker und Salz in Fertigprodukten. www.bmel.de/DE/Ernaehrung/_Texte/ReduktionsstrategieZuckerSalzFette.html;nn=310342, Stand: 20.11.19

Otherwise, further limit values would have to be defined, above which an additional deduction would then be made. For example, this could be ≥ 6 g salt/100 g Food and ≥ 10 g salt/100 g Food for the three high-salt Food-groups. Whether these expanded deductions should be made depends on practical feasibility. Currently, the deduction rule is only half a point for all high-salt Food.

High salt foods	Saltquantity pro 100 g	Point-Deduction	Status activated?
Cheese	≥ 2 g	0,5	yes
Sausage	≥ 2 g	0,5	
Pork, cured	≥ 6 g	1,0	no
Beef/veal, cured	≥ 6 g	1,0	
Fish, salted	≥ 10 g	1,5	no

Tab. 3.16: Flat-rate point deductions for high-salt meals (extended regulation)

Overall Summary-Salt: The blanket deduction method with one or a few limits is sufficient as a standard method for evaluating high-salt foods.

3.6.7 Treatment of drinks and alcohol

As already mentioned, beverages are not rated by GTS. If traffic light values for beverages and dishes were evaluated together, there could be bizarre results. For example, a "red" dish would be upgraded with a "green" drink, e.g. the dish "Currywurst mit Pommes frites & Majo" would be upgraded by a glass of water to a "yellow" overall dish. This would be easily possible because beverages can have about the same quantity as food. Such a rating would be "watered down" in the truest sense of the word. If beverages are to be rated already, this should be done separately by taking the rating on the corresponding pyramid page of the 3D-LP of the DGE.

Alcohol is also not rated with GTS, since it mostly plays a role as a beverage. It should not be used in Company catering food preparation even when only the taste remains. The reason is the risk of relapse for former alcoholics. Nevertheless, the use of alcoholic beverages in the Company catering cannot be completely ruled out, at least on special occasions. If these drinks are added during the preparation of food, some of the alcohol usually evaporates. The amount of alcohol involved depends on many factors. The most important are the alcohol content of the beverage, the preparation temperature and duration, the time at which the beverage is added, and the type of preparation (open/closed: possibility of evaporation of the alcohol).

GTS is used to define Q-values for alcoholic beverages when they are used as an ingredient in food, taking into account the alcohol content. Unlike fat and sugar, however, alcohol is not subtracted by the gram. Instead, flat rates are applied, with three categories of alcohol content defined:

(a) beer (~5% alc.) (b) wine (~12% alc.) and (c) spirits (~32% alc.)

Assuming an evaporation during preparation of 50% of the initial alcohol content, which was determined to be 4-85%¹¹⁶, this would leave 2.5%, 6%, and 16% alcohol, respectively, in 100 ml. Since less than 100 ml is usually added, the alcohol content that ultimately remains in the food is reduced accordingly. In the case of beer, with the assumptions made here, almost no alcohol should remain in the food.

For GTS, alcoholic beverages should be ranked lower than water as an ingredient of food according to their flat-rate alcohol content, which is plausible because of the negative aspect of alcohol. The beverage with the lowest alcohol content, which consists of at least 95% water, is classified one point lower than water, which receives the Q-value 3.0 (see section 3.7.4). This would be beer. Based on a Q-value of 2.0 for beer, the other two categories are each rated 0.5 points worse. Wine would then have a Q-value of 1.5 and spirits of 1.0. These Q-values are only offered so that dishes in the Company catering that are prepared with alcoholic beverages can still be evaluated.

3.6.8 Limit values for the traffic light colors of GTS

Based on the derivation for the evaluation of Foods and meals in the previous chapters, the result is a traffic light rating with the following limits:

<1,75=red / **1,75-<3,0=yellow** / **≥3,0=green**

These hard limits mean that Food evaluations in the limit range lead to a color change even with small changes. This usually happens in both directions, so that there is an overall compensation. In order to make the color changes in the limit range more difficult, i.e. to stabilize the evaluation, care is taken when checking the formulations to ensure that there is still a small buffer up to the limit.

It would also be possible to create a smooth color transition, so that the dishes and meals then have intermediate colors, e.g. green-yellow. However, this poses problems of classification, since the mixing areas would have to be clearly defined. At what point does pure color begin, and at what point does mixed color begin? Nutri-Score solves the boundary problem by introducing a uniform intermediate color, namely "light green" between yellow and green and "orange" between yellow and red. This provides more differentiation, but eliminates the typical traffic light rating. With five color symbols, one can no longer speak of a traffic light, which is usually limited to three symbols. However, it is precisely the symbolism of a traffic light that is a decisive statement that can be understood by everyone without further explanation. This clarity is dispensed with in the two modifications mentioned above. For this reason, only the three classic colors green, yellow and red are used for GTS.

It could now be objected that one limit value of GTS is a crooked number, namely in the transition from red to yellow with the value 1.75. Firstly, this is not a special feature of GTS, but can also be encountered in other evaluation systems. For example, the cut-off values in Nutri-Score are anything but smooth. There are also no equal value intervals, so that jumps across two limits are possible under certain circumstances even with small deviations. The decisive factor is not the numerical values of the limits, whether these are smooth or crooked, but how good,

116 Verbraucherzentrale Bayern: Wieviel Alkohol verdunstet beim Kochen? <https://www.verbraucherzentrale-bayern.de/wissen/haetten-sies-geusst/wieviel-alkohol-verdunstet-beim-kochen-47405>

i.e. plausible and scientifically comprehensible, the scores thus obtained are. In several plausibility tests of GTS it could be proven that the boundaries for the three traffic light colors led to very good results¹¹⁷, which, by the way, does not apply to Nutri-Score, at least not for meals and dishes¹¹⁸.

3.7 Features of the assessment

3.7.1 High-convenience products

Of the now widespread convenience products, the high-convenience products, which are being used more and more frequently in Community Catering, require special consideration. In the case of these products, there are usually no formulations available to the user. In order to be able to evaluate them nevertheless, at least the nutritional labeling according to the "Big Seven" must be known. This has been mandatory for packaged goods since the end of 2016 under EU Regulation 1169/2011.

According to the Food Labeling Regulation, the ingredients of packaged Food must be listed in descending order. The value-giving ingredients must even be indicated in percent (so-called quid regulation). Thus, it is also known whether vegetable or animal Food are contained, including their approximate proportions. This is usually sufficient for a quality classification. If there is great uncertainty, the proportions of lumpy or separable components can also be determined directly. Although this would involve greater effort, it would only be necessary once for a particular product. If this product is used frequently, the effort is worthwhile. The procedure is shown in abbreviated form in Fig. 3.13.

If a high-convenience product only needs to be regenerated later, it is sufficient to enter the fat content of the product. When the cooking method is later assigned, "fat-free heating" ("=1") is then entered. However, if the product is further processed in a different way, e.g. in the tilting frying pan, the corresponding entry is made for this process. The method of preparation for high-convenience products should be specified in writing and then strictly adhered to. If this depended on the availability of the equipment, different traffic light values could result.

"High-convenience products" save production capacities and provide know-how that may not exist in the respective company. These products then usually only need to be regenerated, as they are supplied as frozen or "cook and chill" products. For the evaluation, the relevant ingredients are first necessary. These can be obtained from the supplier's specifications. From these, the respective quantity proportions can usually already be derived. For the most important ingredients, quantity data are required by the so-called quid rule. The remaining ingredients must be specified in decreasing order. In this way, the proportions can be estimated relatively accurately. In estimation tests it could be shown that the differences in the final result with different quantity estimations are only small and the traffic light color does not change.

117 Peinelt V: Bewertung von 4-Wochen-Modellspeisenplänen. <https://ewd-gastro.jimdo.com/gas/validierungen/4-wo-plan-modell/>

118 Peinelt V: Nutri-Score - Ergebnisse einer Untersuchung. <https://ewd-gastro.jimdo.com/gas/nutri-score-vs-gas/>

Ampelfarbe von Convenience-Produkten

- **Problem: Mengen sind nicht bekannt**
- **Beispiel: "Maultaschen"**
 - Zutatenliste heranziehen
 - Zutaten auswiegen
 - Notfalls: abschätzen
 - Ähnliche Rezeptur verwenden
- **Über Big Four:**
 - 4 g Fett/100g (-0,4 Pkt)
- **Zutatenliste:**
 - Gemüse (2/3): 4 Pkt
 - Teigwaren (1/3): 2 Pkt
- ➔ **Ergebnis: (4x0,66)+(2x0,33)**
- ➔ **3,3-0,4=2,9 Pkt**



Fig. 3.13: Determining the traffic light color for a high-convenience product

The percentages are then entered in the corresponding column. Since only the relevant ingredients are considered, the sum of the proportions is less than 100%. Since the fat and sugar amounts of the ingredients are not known, no information may be entered in the corresponding columns. However, the total product must be declared in terms of nutritional value. This declaration also requires information on the fat and sugar content, which is needed for the evaluation with GTS. Since this information relates to the entire product, the information is entered under the ingredients in an additional line. In this case, the product contains 4% fat and 1.3% sugar (see Table 3.12).

Finally, two pieces of information are required. First, the Q-value of the convenience product is determined. This is obtained very simply by entering the qualities of the ingredients and the percentage quantity distribution. Via a cell reference to the determined total value, this value is automatically forwarded to the first position of the bottom line. In this case, the value is 2.61. The second value must still designate the cooking method of the convenience product with a number. For example, if the product is only regenerated in steam or hot air, it is specified as "1", and if it is deep-fried, it is specified as "4". Below is the GTS table with the rating in line CP-1. Above it are the ingredients of the dish and their proportions.

Convenience-Produkt (180g)	Q-Wert	Garen	Fett	Zucker	Heißhalten	GAS-Wert	Zutat in %	x GAS
Hähnchenroulade mediterran								
Hähnchenbrustfilet m. Haut, 70%	2,50					2,50	69	173
Wasser, Flüssigwürzung 8%	3,00					3,00	8	24
Modif. Stärken	1,00					1,00	7	7
Sauerrahm	3,00					3,00	6	18
Tomaten	5,00					5,00	5	25
Sahne	3,00					3,00	3	9
					Summe:	2,61	98	256
CP-1	2,61	1	4,0	1,3		2,05		

Tab. 3.17: GTS value and traffic light color of a meat-containing high-convenience product

Through the various inputs, the final GTS value can now be determined by automatically making the appropriate deductions for cooking method, fat content and sugar content. The result was the value of 2.05 and thus the traffic light color "yellow". This is a good value for a meat dish. When supplemented with a vegetable component and a good carbohydrate side dish, it is quite possible to develop a green dish from this.

A second example will demonstrate the procedure again. Here we are now dealing with a vegan product. The procedure is the same as for the first convenience product. Due to the very good Q-values of the individual ingredients, it was possible to achieve a high GTS value, which can be classified as green at 4.73. This is the Q-value of the overall product. However, the fat content of the product is significantly higher, as is the sugar content. It is regenerated with steam again. In this case, the side dishes don't have to be as good for the overall dish to be rated green. Thus, the overall value for the product CP-6 is still good at 3.39, i.e. green.

Convenience-Produkt (125g) Kürbis-Chiasamen-Burger	Q-Wert	Garen	Fett	Zucker	Heißhalten	GAS-Wert	Zutat in %	x GAS
Muskatkürbis 24%	5,00					 5,00	24	120
Kichererbsen	4,00					 4,00	22	88
Pastinaken	5,00					 5,00	20	100
Zwiebeln	5,00					 5,00	19	95
Spinat	5,00					 5,00	9	45
Chiasamen 4%	4,00					 4,00	4	16
					Summe:	 4,73	98	464
CP-2	4,73	1	11,0	3,1		 3,39		

Tab. 3.18: GTS value and traffic light color of a vegan high-convenience product

In summary, it was shown that GTS also makes it easy to evaluate high-convenience products, since the important information is provided via the declaration or is otherwise available. Incidentally, these assessments need to be done only once for a convenience product. Whenever these products are used, these results can be taken from a defined memory location. This means that the lowest line is entered in the respective ingredient line.

3.7.3 Mixed dishes

It is also often necessary to evaluate mixed dishes that consist of ingredients from different Food-groups. Examples are certain salads, soups, cakes or desserts. If recipes are available, the individual ingredients must be entered in the evaluation table. The determined traffic light values for the dishes can then also be saved separately, so that a new evaluation is not necessary each time. This further facilitates the use of GTS.

If, on the other hand, no recipes are available, the evaluation is more difficult. Depending on the quality of the individual ingredients and the quantity ratios, an appropriate score must be assigned. This is first done using the ingredient list, whereby the individual ingredient quantities can be estimated based on the sequence. If the number of ingredients is not too large and they are distinguishable, such an estimate should be possible with sufficient accuracy. This is true, for example, for a mixed salad. Only the different Food group are important for the evaluation, e.g. vegetables, cheese or poultry.

To achieve greater accuracy, the individual Food or ingredients can be weighed. However, if the ingredients are not loose, it is difficult to determine the quantity. For example, a cake may consist of a base, a curd filling and fruit. Since individual ingredients can have very different compositions (fat and sugar content!), it is important to obtain reasonably reliable information here. For example, the amount of cream or butter added to the individual ingredients should be indicated. If they are available, an evaluation can be made on the basis of the quality rating as well as the deductions.

If such details are missing, an evaluation can only be made on the basis of recipes from the literature or standard works for such dishes. A qualified kitchen specialist has the necessary detailed knowledge with which an approximate recipe can then be simulated. Otherwise, it would be necessary to consult the relevant reference books. Detailed information on the fat content for the base and the curd filling can also be obtained in this way. However, this vaporization is associated with uncertainties, since the recipe could also be different. This approach is also preferred by the DGE for NCAs of dishes when the exact recipes are missing¹¹⁹. In this respect, this procedure is to be classified as permissible.

As a rule, the kitchen team in the Community Catering has its own recipes for such dishes, so that vaporization does not pose a problem.

3.7.4 Water

For certain foods, the water must be included in the evaluation, especially for soups and stews, but also for sauces and desserts. For vaporization according to GTS, the quantity of the ready-to-eat Food is always important. The value is initially determined by the chunky ingredients, e.g. vegetables, potatoes, pulses or meat. The valuation of these ingredients corresponds to the Q-values of the quality table. However, water is the largest ingredient in certain dishes. It should have more of a neutral function in the evaluation.

Since water itself is a valuable component of food, it should not be rated poorly. The water content of Food is not rated by GTS. Water as an ingredient in food dilutes the nutrient content of the other ingredients. This can be positive or negative - depending on the nutrient. Pure vegetables should be rated higher than vegetables in a soup. Conversely, it seems justified that an ingredient that is rated red is "enhanced" by dilution with water. Therefore, for example, a sausage with a high fat content alone should be rated less favorably than in a soup or stew. The dilution effect therefore results in a more favorable rating here.

Based on these considerations, a reasonable value of "3" for water was determined in various test recipes. The value is on the borderline from green to yellow. A soup or stew must contain green ingredients such as vegetables and be low in fat to be classified green. Conversely, if larger amounts of fat are found in these dishes (e.g. as butter), the rating quickly slips into yellow or red, which often can no longer be prevented even by the favorably rated water content.

¹¹⁹ Peinelt V: Stellungnahme - Nährwertberechnung. <https://ewd-gastro.jimdo.com/schulverpflegung/stellungnahmen/nw-berechnungen/>



3.7.5 Extreme combinations

Combining certain green-valued foods, e.g., fruits and salads, unilaterally into a longer-term meal plan would erroneously result in a favorable nutritional rating of GTS. By consuming only fruits and vegetables, as valuable as these individual foods are, the recommended nutrient requirements would not be met. Protein, for example, would be lacking. The following must be objected to the accusation of incorrect assessment:

- A very one-sided diet, no matter in which direction, is rejected by most people after a relatively short time. This effect is called the "specific sensory satiety"¹²⁰. In this respect, it can be assumed that one-sided diets are not practiced over a longer period of time.
- But even if someone were to eat only vegetables and fruit at lunch, this would not necessarily be considered negative. As is well known, too few fruits and vegetables are eaten in Germany, as the nutrition reports of the German government¹²¹ repeatedly point out. This is why the "5 a day" campaign was launched. It would therefore be a welcome development if significantly more of these very valuable Food were to be consumed through lunch.
- Because of the specific sensory saturation, this one-sidedness will not be maintained at the other meals of the day. So even if one were to actually eat a very one-sided diet of fruits and vegetables at lunch over a longer period of time, this would still not be a cause for concern. Only then, if over longer time and over the whole day exclusively fruit and vegetable were eaten, would have to be spoken of a malnutrition, although GTS expresses for this a very favorable quality. However, fruits and vegetables are very low in energy, so that it would hardly be possible to satisfy hunger with them alone. For this, very large quantities would have to be eaten, which is illustrated by a simple calculation: Vegetables have an energy content of approx. 25 kcal/100 g. In order to cover the energy requirement of a day, approx. 10 kg of vegetables would have to be eaten. That would be about 15-20 times the amount of a lunch. These quantities are of course impossible to achieve. Therefore, this diet will soon come to an end.
- However, there are people who deliberately eat a very one-sided diet because of an extreme ideology. These have usually dealt intensively with questions of nutrition and know that a supplementation with certain energy-providing Food is necessary. However, even an extreme group like vegans do not eat only vegetables and fruits. Rather, all plant Foods are allowed in this diet, including, for example, grain products, legumes, or nuts. Such a diet could be well evaluated by GTS and be designed to be complete. Realistically, it must be said about persons with extreme eating habits that they are unlikely to be dissuaded from their way of eating - neither by GTS nor by DGE.
- There is nothing at all wrong with a short-term selection behavior with a strong preference for fruits and vegetables, e.g. over a week. For a long-term diet, a varied food composition is explicitly recommended. This corresponds to the nutritional tradition. The usual menus in Germany are characterized by the fact that they consist of a plate dish (meat/fish, starch and vegetable side dish) and, if necessary, a starter and dessert. With such a composition of the meal plan, GTS can provide very good results, which are in broad agreement with the

120 Lebensmittel-Lexikon: Wissen, was man isst! Spezifisch sensorische Sättigung. www.lebensmittelllexikon.de/s0003470.php#0 vom 10.8.15

121 DGE (Hrsg): Ernährungsberichte seit 1969. Erscheint alle vier Jahre. Zuletzt erschienen 2012. Gefördert durch das BMEL aufgrund eines Beschlusses des Deutschen Bundestages. Warlich Druck Meckenheim GmbH



results of Nutritional value calculation^{122, 123}. GTS recommends to consider the recommendations of the nutrition circle of the DGE. Here, not only the different Food group are given, but also an approximate quantitative composition. The correct use of GTS is therefore not limited to the vaporization of the food, but also includes general recommendations for the Food selection.

- For those who still want to know exactly whether such recommendations are being followed, there is a test tool available¹²⁴. This can be used to determine, over any period of time, what the composition and weight proportions of the various Food are. The individual Food-groups, which can be specified similarly as with the nourishing circle, were deposited with target values, so that also an actual-target comparison can be made. This tool can be used, for example, to determine whether a meal plan for a lunch corresponds to the Food recommendations over four weeks. Thus, in addition to the reference to scientific recommendations for the Food selection, an exact check with GTS is also offered, with which it is possible to determine to what extent these recommendations have been adhered to. How this tool works will be demonstrated by way of example.

Conclusion: For the selection, the traffic light color of GTS gives a good orientation for the guest and also has its justification when extreme dietary habits exist.

3.8 Traffic light colors of dishes, meals and meal plans

To determine the traffic light color of a dish, the type and quantity of individual ingredients are important, i.e. their proportions in the recipe. The ingredient quantities are taken into account via a factor. This results in a specific numerical value for each individual ingredient, which reflects the GTS value adjusted to the quantity. These numerical values are converted to 100 g for the dish, so that the traffic light color of the dish refers to this quantity, as with the individual ingredients. The same procedure is used for dishes, except that dishes are now used instead of ingredients. Due to the reference to 100 g, the basis for comparison is the same.

Dishes or dishes can be combined to a meal plan. For this, the results of the meals or dishes are taken over and combined as desired, e.g. to a 4-week meal plan. Here, the portion quantities of the meals can be modified if it turns out that the meal plan still has weaknesses. The GTS assessment is therefore very variable. It can refer to individual ingredients, a dish, dishes or the entire meal plan of any size.

In summary, GTS is a quality assignment and deduction system. A green traffic light color for a dish results from a high initial quality of the ingredients (Q-value) and from low deductions due to the fat and sugar content as well as their treatment (GTS value).

3.9 Advantages for the implementation in practice

The approach of GTS facilitates the practical implementation of the assessment. Often, only a few characteristic ingredients per dish are necessary for the "vaporization", so that the evalua-

122 DGE (Hrsg): Ernährungsberichte seit 1969. Erscheint alle vier Jahre. Zuletzt erschienen 2012. Gefördert durch das BMEL aufgrund eines Beschlusses des Deutschen Bundestages. Warlich Druck Meckenheim GmbH

123 Peinelt V: Bewertung von 4-Wochen-Modellspeiseplänen. s. Kap. 7. <https://ewd-gastro.jimdo.com/gas/validierungen/4-wo-plan-modell/>

124 Peinelt V: Vergleich Nutri-Score, Nährwertberechnung, GAS. <https://ewd-gastro.jimdo.com/gas/validierungen/nutri-score-nwb-gas/>



tion is possible in a very short time. Here, expertise is required so that, for example, the cooking methods are correctly assigned. This approach has the following advantages:

- Only a few Food group need to be evaluated. An extensive database is therefore not required.
- By taking into account various influences on quality, in principle all individual Food can be recorded.
- The application of the concept automatically leads to the preference of Food with high Nutrient density and low-fat cooking methods in menu optimizations with the aim of a good evaluation by GTS.
- Since especially animal Food contain fat and are often prepared high in fat, optimizing recipes to more green dishes automatically reduces their quantities or replaces them with low-fat products.
- Since low-processed and low-fat prepared vegetable Food are rated highest, optimized meal plans increasingly feature these dishes, especially vegetables. Without these Food, GTS makes it difficult to achieve a green rating for a dish. GTS is thus a driver for high vegetable content in dishes.

Therefore, both quantitative and qualitative aspects are considered and expressed with only one traffic light value. If dishes are rated green overall, it can be assumed that they consist of high-quality ingredients and also contain appreciable amounts of them. The rating is immediately recognizable after all data has been entered, and the changes are also immediately displayed in terms of their effect. This quick display allows kitchen staff to try out the optimization options and select the variant that has the strongest ampele effect, the lowest cost or requires little effort.

In addition to this evaluation system, it is helpful to have an orientation for the meal composition, such as that given by the DGE in various ways. These clearly express that plant Food should be dominant in the diet. With both the nutritional circle and the 3D-LP, there are quantity recommendations for the different Food-groups, which are highly favored by the assessment approach of GTS.

In the extreme case where a meal plan or the overall offering is lopsided in composition and thus there is concern that it can be classified as fully balanced, there is an opportunity to use GTS to check the extent to which all the major Food group have been used and whether their quantities fall within a desirable range. This can be used to show how balanced the meal plan is. But this case is not encountered in Community Catering practice, since guest requirements make it necessary to offer a wide range of dishes.

3.10 Validation of the GTS results

Extensive investigations were carried out to check whether the traffic light results of GTS are consistent with those of NCA and with the Food recommendations of international professional societies. The results of these investigations will not be discussed in detail here. They can

be found in a detailed article. Particular reference should be made to the study on 4-week model meal plans¹²⁵. The main conclusions are summarized in Fig. 3.14.

Schlussfolgerungen zur Aussagekraft von GAS

1. Übereinstimmung von GAS mit **NW-Vorgaben der DGE**
2. Übereinstimmung von GAS mit **LM-Empfehlungen der DGE**
3. Plausibilität:
 - Grün heißt mehr Obst/Gemüse
 - Grün heißt mehr Vollkorn
 - Grüne LM sind fett- und zuckerarm
 - Grüne Zubereitung mit wenig Fett
 - Grüne LM sind präv.-med. wirksam
 - Die NSD wird deutlich erhöht
 - Aber: keine detaillierten NW-Angaben

GAS hilft Ernährungsziele zu erreichen

Fig. 3.14: Summary statements on the informative value of GAS

4. Applications with GTS

In order to better understand the application of GTS, some examples are presented below. Basically, individual components or dishes (consisting of ingredients) or a plate dish as well as a menu (consisting of individual dishes) or entire meal plans of any length can be vaporized.

4.1 Dishes

In the following, individual dishes are vamped. These are individual Food of various ingredients and cooking methods.

125 Peinelt V: Bewertung von 4-Wochen-Modellspeiseplänen. s. Kap. 7. <https://ewd-gastro.jimdo.com/gas/validierungen/4-wo-plan-modell/>

Speisen ohne Rezeptur	Q-Wert	Gar-Verfahren	Fett (in %)	Zucker (in %)	Heißhalten (in Std.)	GAS-Wert pro 100g
Vollkornnudel, gekocht	3,5	1	0,0	0,0		 3,41
Vollkornnudel, gekocht & gebraten	3,5	3	0,0	0,0		 2,69
Nudel, mittl. Ausm.Grad, gekocht	2,5	1	0,0	0,0		 2,41
Nudel, niedr. Ausm.Grad, gekocht	2	1	0,0	0,0		 1,91
Nudel, niedr. Ausm.Grad, gek & gebr	2	3	0,0	0,0		 1,19
Steak, gegr m. wenig Fett	2	2	0,0	0,0		 1,64
Seefisch, gedünstet	4	1	0,0	0,0		 3,91
Seefisch, gegr. m. wenig Fett	4	2	0,0	0,0		 3,64
Seefisch, gebraten	4	3	0,0	0,0		 3,19
Seefisch, pan. & gebr	4	4	0,0	0,0		 2,56
Fettfisch, gegr. m. wenig Fett	4	2	15,0	0,0		 2,14
Fettfisch, gebr	4	3	15,0	0,0		 1,69
Gemüse, gedämpft	5	1	0,0	0,0		 4,91
Gemüse, pan. & frittiert	5	4	0,0	0,0		 3,56
Milch, vollfett	3	1	3,5	0,0		 2,56
Pudding (Milch vollfett)	3	1	3,5	10,0		 2,06

Tab. 4.1: Vaporization of individual Food with different treatment

In extreme cases, an Food can be shifted from green to red. This is largely dependent on the process and the fat content of the Food. Dishes can also be composed of different Food. Three of these dishes will be used as examples in the following.

Speisen mit Rezeptur	Q-Wert	Gar-Verfahren	Fett (in %)	Zucker (in %)	Heißhalten (in Std.)	GAS-Wert pro 100g	P-Menge (1=100)	Ergebnis pro Port
Schnitzel								
Schnitzfleisch, pan & gebr	2	4	10			 -0,44	1,50	-0,66
Eier	3	4	10			 0,56	0,15	0,08
Paniermehl	1	4				 -0,44	0,15	-0,07
					Summe:	 -0,36	1,80	-0,64
Frikadelle								
Hackfleisch, braten	2	3	20			 -0,81	1,50	-1,22
Brötchen, Weißmehl	2	3				 1,19	1,50	1,79
Eier	3	3	10			 1,19	0,15	0,18
Zwiebeln	5	3				 4,19	0,15	0,63
					Summe:	 0,42	3,30	1,38
Tortelloni								
Nudelteig, Vollkorn	3,5	1	2			 3,26	1,00	3,26
Spinat	5	1				 4,91	0,70	3,44
Mozzarella	3	1	20			 0,91	0,15	0,14
					Summe:	 3,69	1,85	6,83

Tab. 4.2: Vaporization of individual dishes with recipe (without deductions due to keeping hot)

Meat components with high-fat cooking methods usually end up in the red zone (sometimes even in the negative). Only if they are supplemented with green Food, e.g. with vegetables and whole grain products, the dish can still become green. Important here is also the portion size.

When dishes are combined, they are called dishes. Here, a distinction is made between a plate dish and a menu. For both categories, examples have been selected below to illustrate the declaration and optimization possibilities through GTS.

4.2 Plate dishes

Optimization options are presented using the example of a simple plate meal consisting of three dishes. For demonstration reasons, the specifications were deliberately set at an extreme, but not completely unrealistic, level. The optimization relates only to the fat content and the portion size. Deductions due to hot holding were omitted in all examples. Sugar deductions were also not necessary here.

Spargel & Salzkartoffeln 1	Q-Wert	Gar-Verfahren	Fett (in %)	Zucker (in %)	Heißhalten (in Std.)	GAS-Wert pro 100g	P-Menge (1=100)	Ergebnis pro Port
Variante a)								
Spargel, gek	5	1				 4,91	2,50	12,28
Salzkartoffeln, gek	3	1				 2,91	2,00	5,82
Sauce Hollandaise	2	1	60			 -4,09	1,80	-7,36
					Summe:	 1,70	6,30	10,73
Variante b)								
Spargel, gek	5	1				 4,91	2,50	12,28
Salzkartoffeln, gek	3	1				 2,91	2,00	5,82
Sauce Hollandaise	2	1	60			 -4,09	1,20	-4,91
					Summe:	 2,31	5,70	13,19
Variante c)								
Spargel, gek	5	1				 4,91	2,50	12,28
Salzkartoffeln, gek	3	1				 2,91	2,00	5,82
Sauce Hollandaise	2	1	60			 -4,09	0,60	-2,45
					Summe:	 3,07	5,10	15,64

Tab. 4.3: Evaluation of high fat asparagus dishes

Asparagus and boiled potatoes receive a green rating. Nevertheless, due to the high fat content of the sauce and the large portion size, variant a) receives a red traffic light rating. A moderate reduction in quantity can already achieve a yellow color (b). Only after a radically reduced amount of only 60 g can the rating of the dish be brought into the green (c). The sauce recipe is changed, resulting in a significantly lower fat content.

Spargel & Salzkartoffeln 2	Q-Wert	Gar-Verfahren	Fett (in %)	Zucker (in %)	Heißhalten (in Std.)	GAS-Wert pro 100g	P-Menge (1=100)	Ergebnis pro Port
Variante a)								
Spargel, gek	5	1				4,91	2,50	12,28
Salzkartoffeln, gek	3	1				2,91	2,00	5,82
Sauce Hollandaise (fettreduziert-1)	2	1	40			-2,09	1,80	-3,76
					Summe:	2,28	6,30	14,33
Variante a)								
Spargel, gek	5	1				4,91	2,50	12,28
Salzkartoffeln, gek	3	1				2,91	2,00	5,82
Sauce Hollandaise (fettreduziert-1)	2	1	40			-2,09	0,90	-1,88
					Summe:	3,00	5,40	16,21

Tab. 4.4: Rating medium fat asparagus dishes

With the lower-fat but still fat sauce, a yellow rating is possible even with 180 g of sauce. If the amount is reduced to an acceptable 90 g, even the green limit can be exceeded.

In the final step, the fat content is once again significantly reduced. These low-fat products are also available in stores.

Spargel & Salzkartoffeln 3	Q-Wert	Gar-Verfahren	Fett (in %)	Zucker (in %)	Heißhalten (in Std.)	GAS-Wert pro 100g	P-Menge (1=100)	Ergebnis pro Port
Variante a)								
Spargel, gek	5	1				4,91	2,50	12,28
Salzkartoffeln, gek	3	1				2,91	2,00	5,82
Sauce Hollandaise (fettreduziert-2)	2	1	20			-0,09	1,80	-0,16
					Summe:	2,85	6,30	17,93
Variante b)								
Spargel, gek	5	1				4,91	2,50	12,28
Salzkartoffeln, gek	3	1				2,91	2,00	5,82
Sauce Hollandaise (fettreduziert-2)	2	1	20			-0,09	1,20	-0,11
					Summe:	3,16	5,70	17,99

Tab. 4.5: Evaluation of low fat asparagus dishes

With the first low-fat variant, only a yellow rating is achieved with a large amount of sauce, but just ahead of green. With the completely sufficient portion size of 120 g of sauce, on the other hand, a green result is possible without any problems. Further adjusting screws would be the portion quantities of the other two dishes. If, for example, the asparagus portion size were increased from 250 to 500 g, the traffic light value would skyrocket to 3.7.

With this simple dish, consisting of three ingredients, it could be shown how significant changes in the traffic light color can be achieved based on only two variables, namely the fat content and the portion quantity of an ingredient.

In a more complex composition, it will then be demonstrated what other modification possibilities exist beyond the above-mentioned variables.

4.3 Calculation of a high-convenience product

Section 3.7.1 already dealt with the problem of determining traffic light values for high-convenience products. Here, the procedure for the evaporation of vegetarian Maultaschen will be described in concrete terms using an example.

The vegetarian Maultaschen are available refrigerated with a recipe and only need to be regenerated (with steam or hot air). On the packaging the preparation instructions as well as the ingredients including the nutritional values are indicated. This shows that the Maultaschen contain 4% fat. Vegetables are indicated as value-determining ingredients with 32%. Vegetables are processed with curd cheese and eggs to a filling. This is encased in dumplings. The filling and the pasta dough each account for about one-third.

With an input table, the evaluation can be presented in a simplified form (without hot holding and sugar deduction) (see Table 4.6). In this rough calculation, a green rating has been achieved. A more precise calculation would be possible if the individual ingredients were weighed, which would be possible at least for the pasta dough and the filling. The other filling ingredients could then be determined from the known vegetable content. The effort shown here would only be necessary once. This example shows that a "high-convenience product" can be evaluated with GTS if some information is available. Due to the labeling obligation, the information is also available.

Vegetarische Maultaschen	Q-Wert	Gar-Verfahren	Fett (in %)	Zucker (in %)	Heißhalten (in Std.)	GAS-Wert pro 100g	P-Menge (1=100)	Ergebnis pro Port
Gemüsemischung	5	1				 4,91	1,20	5,89
Eier/Quark-Füllung	3	1	4			 2,51	1,20	3,01
Nudelteig, Weißmehl	2	1				 1,91	1,20	2,29
					Summe:	 3,11	3,60	11,20

Tab. 4.6: Evaluation of a convenience product (Maultaschen)

4.4 Creation of a meal plan with GTS

GTS can also be used to create and evaluate weekly or monthly plans. Here, too, corresponding changes are then to be made in such a way that the traffic light colors of the plans are improved. This is to be demonstrated exemplarily with a 4-week meal plan of a 5-day week for lunch with menus. For other meal plans with different times of partial or full meals, the same procedure can be followed in principle.

Here, the menus with the meals and dishes are first vamped, as shown above. It is advisable to form separate groups for plate dishes, salads and desserts as well as other dishes such as stews and soups and to save them in tables. From these groups, the desired dishes and meals are compiled for the plan.

Necessary are only the traffic light values and the portion quantities of the dishes or meals. All deductions in the creation of the meal plan are omitted, as otherwise double deductions would occur. To avoid errors, this information can also not be entered in the corresponding mask for meal plans. The final value for the respective menu is then determined from the entries.

If the information for the menus is already available, it can also be entered directly. Here, too, only the reduced data for each lunch menu is required. Furthermore, it is possible to use the data via "cell reference", e.g. "=A4" with specification of the table name. Here the menu name, the traffic light value as well as the total quantity can be taken over from other cells. This has the advantage that when the individual menus are changed, the information in the menu plan is automatically changed as well.

This cell reference can also be made for individual dishes or menus by referring to the stored dishes. Thus, changes to the dishes can have an effect on the dishes or menus. However, this is not always desired. The cell reference is therefore not mandatory, but is merely an elegant way for the user to have to make changes only once. In the following, a meal plan for one week is shown in tabular form.

Menüs	Q-Wert	Gar-Verfahren	Fett (in %)	Zucker (in %)	Heißhalten (in Std.)	GAS-Wert pro 100g	P-Menge (1=100)	Ergebnis pro Port
Tellergericht 1						 2,20	4,50	9,90
Salat 1						 3,30	1,00	3,30
Dessert 1						 2,00	1,25	2,50
					Menü 1	 2,33	6,75	15,70
Tellergericht 2						 3,00	4,00	12,00
Salat 2						 4,00	1,50	6,00
Dessert 2						 2,00	1,00	2,00
					Menü 2	 3,08	6,50	20,00
Tellergericht 3						 1,00	3,50	3,50
Salat 3						 2,40	1,25	3,00
Dessert 3						 1,40	1,50	2,10
					Menü 3	 1,38	6,25	8,60
Tellergericht 4						 2,00	4,50	9,00
Salat 4						 1,50	1,00	1,50
Dessert 4						 1,00	1,00	1,00
					Menü 4	 1,40	6,50	11,50
Tellergericht 5						 2,00	4,75	9,50
Salat 5						 3,00	1,00	3,00
Dessert 5						 1,00	1,00	1,00
					Menü 5	 2,00	6,75	13,50
					Mittelwert	 2,04		

Tab. 4.7: Evaluation of a menu plan for 5 days

The 4-week meal plan has thus achieved an average rating of almost "2" (yellow). Now, in order to optimize it, changes can be made to the meals and dishes so that a green meal plan results. To do this, it would first be a good idea to change the portion quantities. For red dishes, they should tend to be reduced, and for green dishes, they should be increased. Certain meals or dishes might also have to be replaced altogether, e.g. the plate dish-3, which has the lowest traffic light value. For certain dishes, it may also be enough to change only the composition for a better traffic light value, e.g., Dessert-4 and Dessert-5. Of course, entire dishes can also be replaced, since they cannot always be changed in terms of recipe or quantity.

So there are many ways to optimize a meal plan. Every single change is immediately noticeable in the entire plan. Because of the colors, it is also possible to see immediately where optimization is most likely to be worthwhile, so that perhaps only a few adjustments are necessary to achieve a better color for the plan.

These tabular representations should make it clear that GTS allows traffic light statements for all forms of supply, from individual meals in the "free-flow" supply to monthly plans for full catering.

4.5 Logo for GTS

A logo was developed for GTS for practical use. This can be used to identify meal plans or notices for vamped meals and dishes. As is well known, a logo has a higher expressiveness than textual representations. In addition to the acronym "GTS", the licensor is also indicated.



Fig. 4.1: Logo for meals and dishes on meal plans

5. Safety in the use of GTS

GTS is simple to use and therefore quick to learn. Nevertheless, it is necessary that the correct application of GTS in the plants is first taught to the skilled workers and then controlled. This training and control is carried out by specialists who can prove their qualification for this and are licensed. So far, GESOCA¹²⁶ has been licensed for this purpose.

An important part of the control are audits, during which it is checked on site whether the statements made are also adhered to in practice. This increases the reliability of the statements about the traffic light value of the food. In concrete terms, this means checking the process from formulation and preparation to the labeling of the dishes at the serving point. Unannounced audits take place at least three times a year. Furthermore, the menu design and purchasing are also regularly checked.

Compliance with recipes can be checked using the GTS quality criteria. For this purpose, the dishes served are checked for compliance with the quality criteria as well as the labeling. Tolerances are defined for deviations from the GTS value. In addition to the GTS quality range, company-specific criteria for meal plan design have been defined. These relate to the frequency with which certain dishes are offered (x-% green, y-% yellow and z-% red), the purchasing quality (e.g. regional, seasonal) as well as parameters of a health-promoting price structure and labeling. The company-specific quality area is also part of the audits.

¹²⁶ Konzept von GESOCA. <https://ewd-gastro.jimdo.com/gas/gesoca/>

As part of the monthly reporting, regular mystery shopping and regular customer surveys supplement the provision of the health indicator. Furthermore, an overview of the health subsidies paid promotes the quality assurance process. Reporting and communication is always made to the company as the client of the control company and the caterer¹²⁷. Details about the introduction of the concept in a company as well as verification measures were presented in a detailed article in the trade press¹²⁸.

The following illustration shows how safe working can be ensured when using GTS in the companies. Close contact and exchange between the licenser and the control company is also an important element.



Fig. 5.1: Ensuring the correct application of GTS in operation

The following figure shows schematically what is to be achieved with GTS. It is a QA instrument to ensure a wholesome diet.

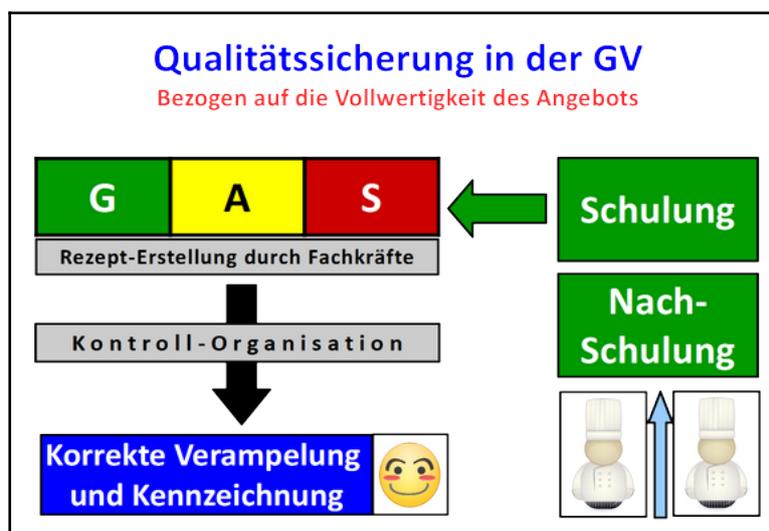


Fig. 5.2: Ensuring the completeness of the offer with the help of GTS

127 Giebel S: Qualitätssicherung von GAS in den Betrieben durch GESOCA. Auszug der Richtlinien von GESOCA. 2016

128 Giebel S, Peinelt V, Feist C: Nudging in der Betriebsgastronomie. Das gastronomische Ampelsystem. Ernährung im Fokus. 07-08 2017. <https://ewd-gastro.jimdo.com/gas/gas-fachpresse/>

The aim is to take into account the requirements of the DGE, i.e. to comply with the quality standards as far as possible. For this purpose, the correct implementation of the rules of GTS must be controlled.

The external control of companies working with GTS by a license partner is a prerequisite for the use of the GTS logo.

6. Benefits of GTS

The described evaluation mechanisms of GTS have been constantly refined over a longer period of time. Initially, for example, the sugar content has not yet been taken into account. In a long-term project at the Niederrhein University of Applied Sciences, which ran for more than a decade, tests were carried out on various issues, including practical and nutritional aspects.

This enabled weak points to be found and eliminated. The project was not only constantly developed internally through numerous semester and bachelor theses. Rather, it was used in companies, where the critical eye of practitioners checked its practicality over a period of years. Through this use, it was also possible to recognize the actual and not only supposed benefit for the guests.

6.1 Scientific research

GTS was the subject of several dozen bachelor and project theses^{129,130}. For example, health-conscious meal plan concepts could be confirmed by student unions ("Mensavital") or by a large catering company ("Vitality").

Within the scope of a diploma thesis, two groups of recipes were formed, whose effects on the performance of the employees were to be examined¹³¹. These were, on the one hand, high-energy and high-fat recipes and, on the other hand, low-energy and low-fat recipes, for which NCAs were performed. These two groups of recipes were subsequently vaporized with GTS, and the traffic light ratings for both the individual recipes and the respective group corresponded very well with the results of calculations - based on the main criteria.

In a double bachelor thesis it was examined whether it is possible to shift the eating behavior in a reference company clearly in the direction of "green"¹³². With the help of GTS, an evaluation of the offers was possible in the first place. As a result, it could be shown that a strongly changed eating behavior was achieved in a short time, in which the choice of green dishes dominated.

129 Peinelt V: GAS in Bachelor-Arbeiten. <https://ewd-gastro.jimdo.com/gas/abschlussarbeiten/>

130 Peinelt V, Wetterau J: Langfristprojekte zur Schulverpflegung und zum GAS. Hochschule Niederrhein, Fachbereich Oecotrophologie, 2005-2015

131 Giebel S: Untersuchung des Einflusses des Mittagessens auf die Leistungsfähigkeit von Mitarbeitern eines Versicherungsunternehmens. Diplomarbeit, Hochschule Niederrhein, Fachbereich Oecotrophologie, Betreuung durch: Prof. Dr. Peinelt, Mönchengladbach, 2010

132 Gey F, Dmitrieva K: Optimierung der ernährungsphysiologischen Qualität von Speisenangeboten in der Betriebsgastronomie mit Hilfe einer Subventionssteuerung in Kombination mit dem GAS, 2/2015

It is also important to ask whether the traffic light colors are comparable with the evaluations based on Nutritional value calculation. This study was conducted as part of a bachelor's thesis with a positive result¹³³.

As a last example, we would like to point out an investigation in a bachelor thesis, in which vegetarian recipes were compared with non-vegetarian ones¹³⁴. With GTS, quick, meaningful and plausible results could be achieved here.

GTS has proven to be a useful tool for scientific investigations of meals or dishes in all areas of application and testing to date and has always passed the validity test.

6.2 Food selection of the guests

All guests have the opportunity to optimize their eating behavior based on the traffic light labeling and thus do something for their health. Anyone who wants to do without this offer is not prevented from doing so. GTS therefore does not exert any coercion or patronize the customer in any way. There will continue to be red dishes in a well-composed offer, but not as often and with the same breadth of choice as before.

If, on the other hand, the guest is willing to accept health advice or recommendations for his or her food choices, he or she may implement them in whole or in part. Reasonably, he will incorporate these recommendations into his decision. While a NCA can only ever refer to a complete menu, which is hardly ever offered and would be unwillingly accepted by the guest, with GTS it is possible to give ratings for each individual component or dish.

Since it is furthermore improbable that the guest, if he would select already a complete menu, eats also exactly the computed quantity, the consumed quantity does not agree usually with the computations. There are therefore deviations in the "actual" with high probability from the "target". There are many reasons for these deviations, e.g. the guest has less appetite that day or does not like certain dishes and therefore leaves them on the plate. Unfortunately, this often applies to vegetables, so that precisely the most valuable part of a menu is only partially consumed. Thus, a guest lulls himself into a false sense of security if he chooses menus that are recommended on the basis of calculations, but does not consume the total amount at all. Therefore, other aids are needed.

In the case of a free selection, the guest can choose each individual component himself, usually also with regard to the quantity. Therefore, a higher consumption rate can be assumed for this type of offer, because the guest only selects the dishes that he or she likes or for which he or she has an appetite. The same applies to the quantity. This means that there will hardly be any leftovers. Due to the traffic light color he gets the hint, how the individual meals are to be evaluated and can optimize thus his decisions.

If a food was evaluated with "green", he does not need to impose restrictions on himself. He cannot make any mistakes here. If he takes a lot of this food, the intake of valuable nutrients can be increased, with relatively low energy intake. So the Nutrient density is high. A strict limitation of the quantity is superfluous here, since with a large portion quantity the saturation

133 Meister J: Über den Aussagewert von Nährwertberechnungen im Vergleich zu den Ampelwerten des Gastronomischen Ampelsystems für eine Vier-Wochen-Speiseplan in einem Betriebsrestaurant, 7/2015

134 Peter, M: Untersuchung und Bewertung von veget. Speiseangeboten in der Betriebsgastronomie mit Hilfe von GAS, 7/2013



via stomach stretching lasts clearly longer, so that he will be content e.g. to the afternoon only with a coffee and not select still another sweet pastry or sweets in addition, which he would have done with a smaller portion quantity possibly. He may also eat less in the evening. This compensates for the larger portion size from lunch. With a large portion of a green food, he can allow himself a "blunder" at the other meals.

If, on the other hand, he has a big appetite for a food marked "red", he does not have to practice asceticism and do without it. Thanks to the traffic light color, he knows that he should enjoy it with caution and will keep the portion size as small as possible and forgo a high-fat sauce or other dishes, e.g. a dessert. In this way, the guest does not have to avoid his favorite foods because he is given help for his eating behavior, so that the "damage" of the red foods remains low. If he then pays attention to eating rather "green" on the next days, this damage can easily be compensated. Thus GTS helps to unite appetite and health-conscious behavior.

With the information from GTS it is possible to control eating behavior over a longer period of time. Within one month i.D. all essential nutrients can be taken up in sufficient quantity. For this reason a monthly card in credit card format was developed, in which each guest can mark the traffic light colors of his daily chosen meals. In this way, they can see how often they have chosen green, yellow or red dishes in the course of a month. With the help of a rough numerical orientation, he knows to what extent he is within the scope of the recommendation.

GTS therefore does not want to prevent the customer from eating his favorite dish, e.g. the notorious "curry sausage with fries and mayo". The monthly menu gives him guidance on how "slips" can be recovered from. Of course, they must not occur too often. What this means can be easily seen by means of the monthly card. This gives every company the opportunity to create a company-specific self-monitoring instrument and to motivate employees to participate.

Even if the quantities of the individual meals are not available, a nutritional calculation is usually possible. This is because the portion quantities of the various dishes are largely the same. For example, meat/fish, mixed salad or desserts have a portion weight of approximately 100 g. Thus, in a rough approximation, the average of all traffic light colors could simply be chosen when selecting individual components. Example: If four dishes are chosen with the color distribution of 2x green, 1x yellow and 1x red, this would result in a yellow average with a slope towards green if equally weighted. Depending on the portion size of the components, interpolation could be done roughly. Interpolation errors will also balance out here over time.

The guest receives an easy orientation with exemplary compositions, whereby the respective components are indicated in the traffic light color. For the sake of simplicity, it is again assumed that the portion sizes are approximately the same. A realization of this approach was shown in the experience reports of the company AXA.

An app for smartphones would be even more helpful. With this, the provider can not only communicate the meal plan to his guests, but also the rating of the respective dishes with GTS. This shortens the decision-making process and thus the wait before serving. Such apps open up numerous other possibilities, which can only be hinted at here. The guest could save his or her individual meal compositions and possibly deviating portion quantities. These could then be evaluated individually, according to different time periods. The guest would see which traffic light color he or she has achieved on average over the course of a week, month, semester or year. This would thus go far beyond the determination via monthly card.

6.3 Recipe optimization

In the meantime, GTS is not only being used in several pilot projects, but also in companies, where it met with a very positive response from guests and kitchen staff right from the start. These are above-average-sized businesses of different target groups. GTS was subjected to close scrutiny by kitchen professionals before it was used in the establishments. Details of the experiences in these establishments can be found in a separate publication¹³⁵.

The main benefit of GTS is for the kitchen professionals as well as for the guests. The traffic light rating is designed to help kitchen professionals quickly identify and optimize the quality of their dishes or meals. The rating can be applied to individual dishes, plate dishes, multi-course menus and even entire meal plans. For the traffic light color of a food or a dish, its quantity, i.e. portion size, does not play a role. Vegetables weighing 50 g can be classified as green in the same way as those weighing 200 g. The same applies to a dish composed of different foods.

Thus, GTS can also be used to evaluate free-flow offerings and component choices, and the results can be easily communicated. NCAs cannot do this because the results are quantity dependent, assuming they are possible at all. If different dishes are combined, their traffic light colors can be used to derive the color for the dish. Because the traffic light colors are easy to understand, they serve as a quick orientation for the selection of dishes. The nutritional values for any combination of dishes, on the other hand, would be impossible to determine quickly, not to mention the problem of interpreting these results.

The aim of the vaporization is to identify which dishes still need to be optimized. However, it is not necessary to eliminate all red dishes, so that in the end only green and yellow ones remain. The concept of so-called "Healthy Choices" (only high-quality choices) may represent the ideal, but it can hardly be implemented in practice. What may still work in daycare centers will fail in schools, cafeterias and company restaurants.

Such an approach has been tried again and again without success, e.g. by eliminating French fries from the menu, resulting in drastic drops in meal participation. The employees of companies get the desired food elsewhere, e.g. at snack stands, which ultimately gains nothing, rather the opposite. Therefore, not all unfavorable meals or dishes should be eliminated. A reduction of such dishes is of course desirable and can be well controlled with GTS. Exactly this approach, not to discriminate individual Food or dishes, but to keep the total nutrition in mind, has always been the credo of nutrition science. GTS corresponds to these principles.

6.4 Expansion of "Workplace Health Promotion"

Amping up can improve the offer, and pilot projects have shown that this is also accepted by guests. This means that guests will increasingly turn to the higher-quality dishes if the recipes are optimized and the concept is well presented. If a guest at these establishments chooses a currywurst, to stick with this popular example, they will typically receive the same subsidy for their meal as someone else who chose a higher-quality meal with lots of vegetables (cross-

135 Pflug et al.: Erfahrungen mit GAS. <https://ewd-gastro.jimdo.com/gas/beschreibung-von-gas/>

subsidization aside). Below is an illustration of the benefits of GTS for the three areas shown (Fig. 6.1).

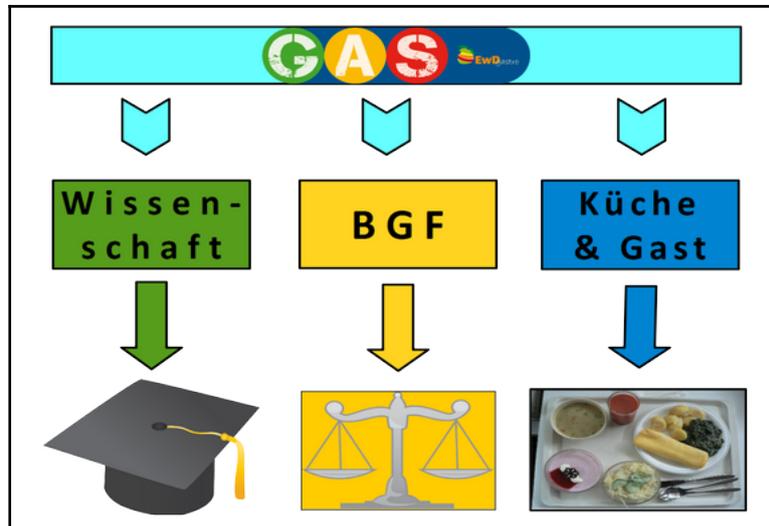


Fig. 6.1: Benefits of GTS

A service provider can best increase its profit with the so-called racers. These are dishes that are particularly popular with guests. However, these are often nutritionally unfavorable. With a few green "token" dishes, a service provider might meet the demand for "healthy" dishes, only to sell the high-profit, unfavorable dishes all the more. Greater efforts in the direction of "green" are rejected with the reference to the wishes of the guests, which must be satisfied primarily. "The guest just doesn't like 'healthy' food," is the common claim. The subsidy from the client has so far been the same for all meals, so it is not differentiated according to the quality of the meals. Nor has it been possible to make this differentiation so far.

And this is where the concept for workplace health promotion with the help of GTS comes in. The subsidy from the client is linked to the results of the vaporization of the dishes, i.e. it depends on the traffic light colors. The highest subsidy is paid for a green dish, and even a yellow dish still receives some subsidy, while a red dish no longer receives any subsidy at all. Establishments that pay their service provider according to this remuneration approach already exist¹³⁶.

A service provider can then still offer red dishes, but no longer receives a subsidy for them. Therefore, the cost of a "red" dish would have to be borne entirely by revenues, making such dishes more expensive than the others. However, if the full cost is not charged, e.g., due to price caps under operational agreements, the resulting shortfall would have to be compensated by the subsidized dishes. This would reduce the service provider's profit, which of course is not in its interest. So, in both cases, the supply of these meals is lowered and replaced by higher-quality ones, and that is precisely the point of the concept.

As already emphasized several times, a service provider will not be able to do without red dishes completely if he wants to keep his guests happy. But he must be careful to have enough

136 Siehe Referenzliste von Gesoca: <https://ewd-gastro.jimdo.com/gas/gesoca/>

green dishes to compensate for these red "slips." A high proportion of high-fat "racers," as is not infrequently the case, would soon lead to the service provider giving up his business if this new subsidy system were applied consistently. The decisive factor here is therefore that the entire recipe pool is optimized accordingly and presented attractively to the guest. A service provider who succeeds in doing this not only gains more know-how, but can also considerably enhance his image as a health-oriented service provider, because it is possible for him to prove his statement with the help of the evaluation of GTS.

The concept¹³⁷ was first introduced in a public service canteen. A financial framework was agreed with the service provider to at least cover its shortfall. However, the offer may not be designed at the discretion of the service provider, but is to be linked to the nutritional quality with the help of GTS. The client therefore gets more for his money. The benefit goes primarily to his employees and indirectly, through better health, performance and satisfaction of his employees, also to the client. The service provider should not be worse off if he does his job well. The concept got off to a very successful start in 2014¹³⁸, both with guests and with the kitchen staff in a test operation, who identify very well with this approach. This pilot project was scientifically accompanied and the results are available¹³⁹. The results showed that the offer improved considerably and the acceptance of the green dishes by the guests was high (see Fig. 7.2 and 7.3). Meanwhile, the concept has been running for more than two years in this establishment. As a result, it has been so well received that it is to be gradually introduced in all subsidiaries throughout Germany.

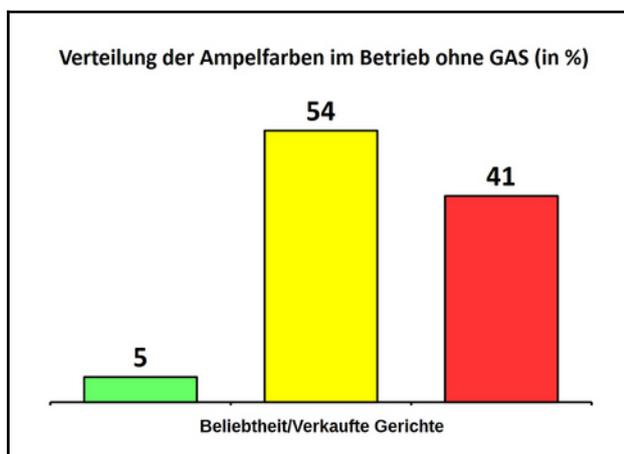


Fig. 6.2: Supply distribution without GTS

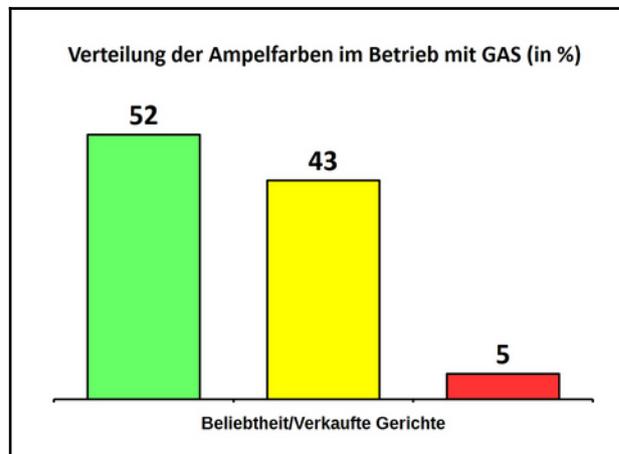


Fig. 6.3: Supply distribution with GTS

Since this is a measure of the BGF, it would be obvious to also use the budget for this, which is made available in many companies for various health offers. With this additional remuneration, the client could stimulate the service provider to offer even more green meals and thus

137 Feist C: Ver-führen. Gesundheitsorientierte Caterersteuerung mit GAS. Gastronomisches Konzept im Rahmen der Betrieblichen Gesundheitsförderung. München, März 2014. Anfragen unter: christian.feist@gesoca.de

138 Feist C: Cateringunternehmen Bilfinger in der Verwaltungs-Berufsgenossenschaft Hamburg (VBG). Mündliche Mitteilungen aufgrund der Erfahrung der ersten sechs Wochen nach Einführung des Konzepts, 9/2014

139 Gey F, Dmitrieva K: Vollwertig essen in der Betriebsgastronomie. Studie über die Auswirkung eine neuartigen Entlohnungsmodells auf die ernährungsphysiologische Speisenqualität. Überarbeitete Version der Bachelor-Arbeit am Fachbereich Oecotrophologie der Hochschule Niederrhein, Mönchengladbach, Juni 2015, 71 S. <https://ewd-gastro.jimdo.com/gas/studie-zum-essverhalten/>



also benefit financially. In the meantime, GTS is also used and supported as part of the prevention program of a large statutory health insurance company, the DAK. A film was even produced for this purpose¹⁴⁰.

7. Legal aspects

GTS evaluates Food and dishes by assigning them a traffic light color. This allows them to be compared at a glance. The respective traffic light color is used to make a statement about the value for nutrition, which is associated with a recommendation: "Greens" should be preferred if possible, "reds" should be chosen rather cautiously. The question is therefore whether the law is affected by these statements. The regulations on "nutrition and health claims" (Regulation 1924/2006¹⁴¹) and on "consumer information" (Regulation 1169/2011) can be consulted. In these regulations, specifications are made as to what must be taken into account in the declaration and presentation of nutrients and health claims in Food.

This also includes statements on the presentation in the form of graphic symbols. Particular reference should be made to Article 35 of Regulation 1169/2011. There it is about the representation of the calorific value as well as of nutrient quantities. However, such a specific statement is not made by GTS, not for any individual nutrient. Rather, it is about a holistic statement of the individual Food and dishes in the respective ready-to-eat form, e.g. after a cooking process. In this respect, the requirements of this Regulation should not affect GTS at all.

Further requirements are expressed in the Regulation 1924/2006, also referred to as the "Health Claims Regulation". In general, it is required that no false or misleading claims are used. Also, no doubts about the safety of other Foods should be raised. All this is complied with by GTS. The nutrient-related claims listed in the annex of this VO only concern individual nutrients, which are not presented or evaluated separately by GTS, since, as already mentioned, it is a matter of a holistic presentation.

However, in the presentation and labeling of the dishes or in the description of the traffic light colors, attention must be paid to the restrictions or specifications made in this annex. For example, the designation "low-energy" may only be used with caution because an upper limit has been set for the energy content for this designation. The same applies to "energy-reduced," "low-fat," or "energy-free." Since there is no NCA associated with GTS, it cannot be used to indicate specific nutritional values, which would be necessary to demonstrate compliance. Therefore, these claims should be omitted.

Also, caution should be exercised when it comes to the health effects of green foods. There is no doubt that they have some advantages over yellow or red foods. However, it is not permissible to make health claims such as "green Foods prevent colon cancer" or "prevent cardiovascular disease." On the question of which health claims are permissible, the Regulation has been silent in Article 13. It is not possible to go into further details here. A legally experienced person should therefore be consulted when describing traffic light colors or other statements

140 DAK Gesundheit: Arbeit und Ernährung. <https://www.dak.de/dak/mitarbeitergesundheit/kantinenprogramm-2121982.html>

141 Verordnung (EG) Nr. 1924/2006 des Europäischen Parlaments und des Rates über nährwert- und gesundheitsbezogene Angaben über Lebensmittel vom 20.12.2006. Amtsblatt der Europäischen Union, L404/9-25 vom 30.12.2006

that are certainly desirable in the presentation of food in the interests of the guest. In any case, health-related statements should be used cautiously.

GTS is based in its essential statements on the 3D-LP of the DGE, whereby the evaluation has been further developed and can now be made much more differentiated. The main criteria in the evaluation of GTS are the Nutrient density as well as preventive medical findings, just as in the DGE. The 3D-LP of the DGE is scientifically accepted.

Nevertheless, it is not excluded that Food surveillance sees problems when dishes are labeled with traffic light symbols because of the above mentioned regulations. This could be because GTS is not known or the given information has been misunderstood. Therefore, if there is any uncertainty, it is recommended to discuss the issue with the responsible agency (e.g., the veterinary office). A generally binding statement on this will probably not be obtained, as there is scope for discretion and individual veterinarians may have different views on the presentation of the evaluation of food using traffic light symbols.

It should be noted, however, that there are now many plants throughout Germany that work with GTS or a similar traffic light system without any complaints. GTS is used by several large companies in almost all German states, and has been for years. In total, we are talking about over 60 operations nationwide¹⁴². A survey conducted in February 2017 in all establishments, whether there were any complaints due to the Food control because of the labeling of the dishes with GTS, led to a negative result. That is, no complaint was made in any establishment. Such an absence of any complaints can be interpreted in reverse to an acceptance by the authorities, at least in these federal states.

If - contrary to expectations - the responsible body should take a negative stance, GTS can still be put to good use, as it provides valuable services for recipe development. If the kitchen staff have been trained accordingly, they can optimize a recipe with just a few changes. If this is done consistently for all recipes, the nutritional quality of the entire offering will be improved. This alone should be worth using GTS.



Fig. 7.1: Legal aspects of GTS

142 Aussage der Fa. Gesoca, Herr C. Feist, Anfang 2020



Conclusion

GTS provides an easy way to evaluate and label meals, dishes and menus according to health aspects. For service providers, GTS is therefore a valuable aid for optimizing their offerings. GTS is also helpful for guests, as it makes it easier for them to choose health-promoting dishes. Thus, GTS leads on the one hand to a higher quality of the offer and on the other hand also to a better state of health.

For the management of a company, it is only possible with GTS to link the subsidization of the meals to their health value. A remuneration model based on this motivates the employees of a catering company to achieve better quality. Therefore, GTS can also be used very well in the context of "workplace health promotion" and is increasingly recognized by the GKK as an effective instrument of prophylaxis.