The susDISH analysis method

Sustainability in the catering industry

Taking account of both nutritional and environmental aspects in recipe planning

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Background

At least once a day, more than 15 million people in Germany ask themselves what they feel like eating in their canteen at work, school or university, in a care home, or in a similar external catering facility. But the choice available to customers is, of course, largely determined by the buyers and recipe planners who work for these organisations. If greater account were taken of health and environmental concerns in these daily decisions, dietary-related health costs could not only be reduced but also the entire process of food production could be more environmentally sustainable.

Nutrition as a key topic in sustainable development

The production and preparation of food, together with people's food choices, currently account for around 30 per cent of all environmental impacts in Germany. What's more, roughly one third of the entire health care expenditures are caused by unbalanced dietary habits. A shift to healthy, balanced meals, in accordance with the German Nutrition Society's (DGE) official standards for caterers, for example, has the potential to reduce the impact on the environment by 15 per cent. Measures to avoid food waste would reduce the impact on the environment by an additional 10 per cent (DGE 2013, Meier 2013, Meier & Christen 2015).

Potential for optimisation in the catering industry

Because they purchase and process large amounts of food, canteens and other high-volume catering establishments have been identified as having a key role to play in improving people's health and reducing environmental impacts. There is potential for optimisation not only in the processes of buying food and the compositions of recipes but also in the food preparation phase (kitchen and building engineering). Measures aimed at improvement will only be successful in the long term if they are communicated comprehensively and consistently, and if employees – and where appropriate customers – are sufficiently involved in the communication process.

Table 1: Reference values for a balanced lunchtime meal provided by a work canteen (19–64 years of age, PAL 1.6)

	Reference values	Tolerance range
Energy (kcal)	817	± 10%
Protein (g) max.	≤ 41	± 5%
Essential protein (g) min.	≥ 4,1	± 5%
Fat (g) max.	≤ 28	± 5%
Carbohydrates (g) min.	≥ 101	± 5%
Sodium (g) max.	≤ 0.79	± 5%
Fibre (g) min.	≥ 10	± 5%
Vitamin B1 (mg) min.	≥ 0,4	± 5%
Folic acid (µg) min.	≥ 100	± 5%
Vitamin B12 (µg) min.	≥ 1.0	± 5%
Vitamin C (mg) min.	≥ 33	± 5%
Vitamin E (mg) min.	≥ 5	± 5%
Calcium (mg) min.	≥ 333	± 5%
Magnesium (mg) min.	≥ 117	± 5%
Iron (mg) min.	≥ 5	± 5%
Cholesterol (mg) max.	≤ 99	± 5%

The purpose of this document is to describe the susDISH* method, which is designed for use in recipe planning and which takes both health and environmental aspects into consideration. The method was developed at Halle University as part of a project financed by the German Environmental Foundation (DBU), and so far it has been used in case of around 1,000 recipes provided by lunchtime caterers. Specific examples are presented in the second part of the article.

How the susDISH method works

1. Nutritional analysis

The susDISH software analyses recipes on the basis of two sets of criteria – one measuring how healthy they are and the other gauging their environmental impacts. The nutritional quality of the food is evaluated using the twelve reference values set out by the German Nutrition Society for public catering services (DGE 2013). To add further qualitative weight to this assessment, susDISH considers four extra criteria that are relevant from a nutritional perspective (essential protein/amino acids, salt, cholesterol and vitamin B_{12}). This means that the nutritional content of each recipe is evaluated using a total of 16 health-related criteria. Table 1 provides an overview of reference values for a nutritionally balanced lunchtime meal provided by a public caterer or canteen (PAL=1.6). Underlying this is what's called the ‚one third approach', which works on the basis that one third of the recommended daily intake of nutrients should be consumed at lunchtime.

The software, as well as evaluating each nutrient individually, also aggregates the 16 values so that dishes can be compared with each other and also compared in terms of their impact on the environment. It does this by determining the degree to which the actual value measured for the criterion corresponds to its reference value. If the actual value corresponds 100 per cent to the reference value, it is given a quotient of 1; if it only matches 50 per cent, the quotient is 0.5, and if it doesn't match at all (0 per cent), the quotient is 0, etc. Each recipe can therefore achieve a maximum of 16 health points. The analysis algorithm, except in the case of energy intake, adopts a tolerance range of 5 per cent to take account of variability in how recipes and menus are prepared. This means that for quotients of between 0.95 and 1.05, one full health point is awarded. Because physiological variability is relatively high, energy intake is subject to a tolerance range of 10 per cent.

*The abbreviation susDISH stands for 'sustainable dish'.

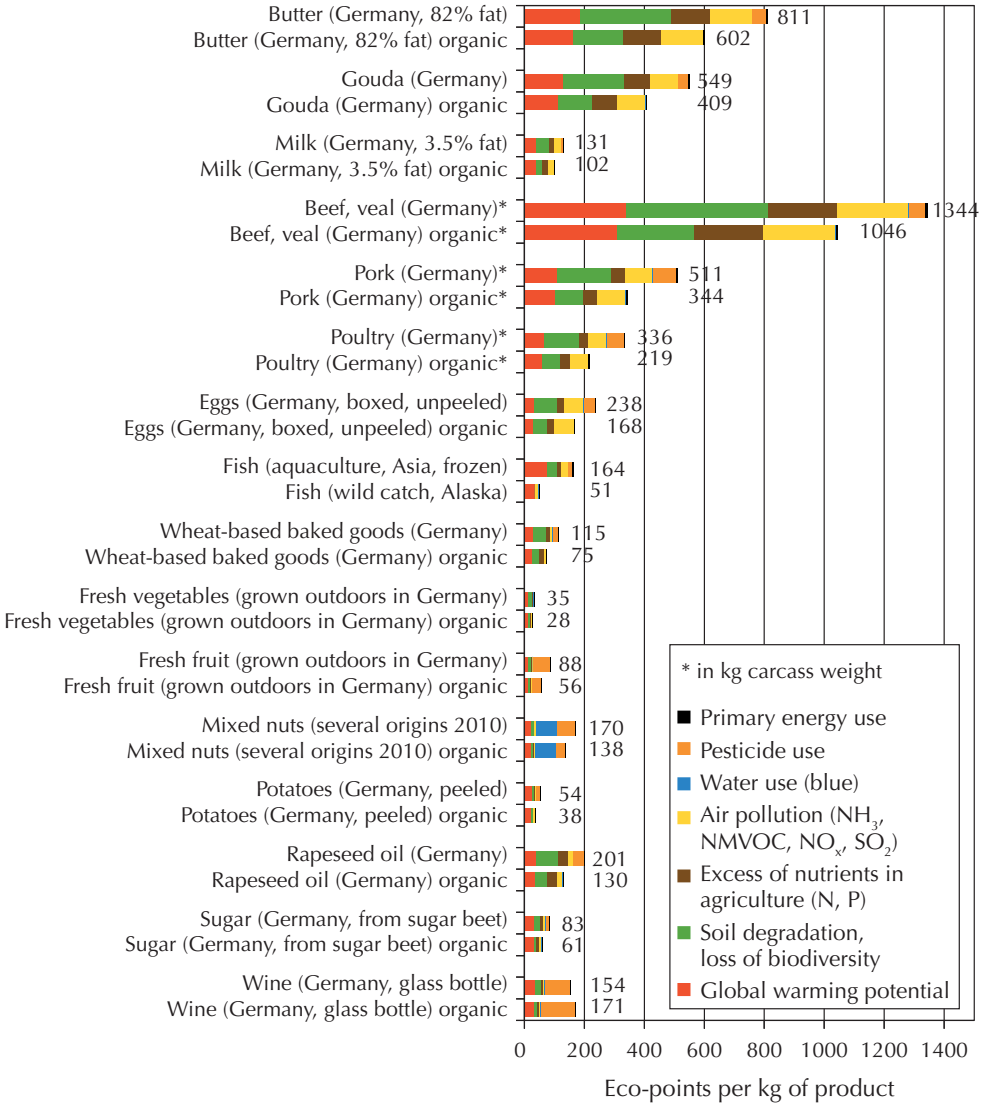
2. Environmental analysis

The quality of the food from an ecological standpoint is assessed applying the method of the ecological scarcity and using corresponding eco-points. This method – which was developed in Switzerland and where it is extensively used – offers an advantage over other means of measuring environmental impacts in that the weighting of the different environmental effects (emissions, water consumption, loss of biodiversity, etc.) is not specified arbitrarily but on the basis of national targets. Another advantage is that organic produce can be analysed separately to conventional produce. For a large number of indicators, specific environmental impacts can be taken into account (soil degradation/loss of biodiversity, use of pesticides, greenhouse gas emissions, etc.).

From an ecological perspective, it is also important to mention that susDISH analyses material flows over the complete life cycle – from field to fork – of all products. The impacts the products have on the environment are therefore measured from ‚cradle to grave', covering all relevant stages in the process value chain, i.e. from the production of fertilizers and pesticides in the agricultural pre-chain, agriculture, food processing industry, packaging, transport up to the preparation in the catering facilities (incl. cooling, cooking, cleaning, etc.).

In addition to the ecological scarcity method, susDISH also analyses the products and recipes on the basis of their carbon footprint. Although this category only allows conclusions regarding greenhouse gas emissions, which are just one part of a product's environmental footprint, it is a more widely established indicator. It can therefore be used to verify susDISH's results and can be used for comparison with the results of other analyses.

Fig. 1: Eco-points for a selection of products (EP / kg product)



A detailed description of the susDISH method is available on the project website (Meier 2014).

Results at product level

Figures 1 and 2 give a breakdown of the eco-points and levels of greenhouse gas emissions assigned to a sample selection of products that are commonly used in high-volume catering facilities. The eco-points in figure 1 are segmented to reflect the different types of environmental effects, whereas the segments for greenhouse gas emissions in figure 2 correspond to the stages in the process value chain. This allows identifying which parts of the value chain produce the most greenhouse gases for each individual product.

These values can vary from canteen to canteen depending on the catering situation (kitchen type, cooking technology, energy consumption, etc.).

Results at recipe level

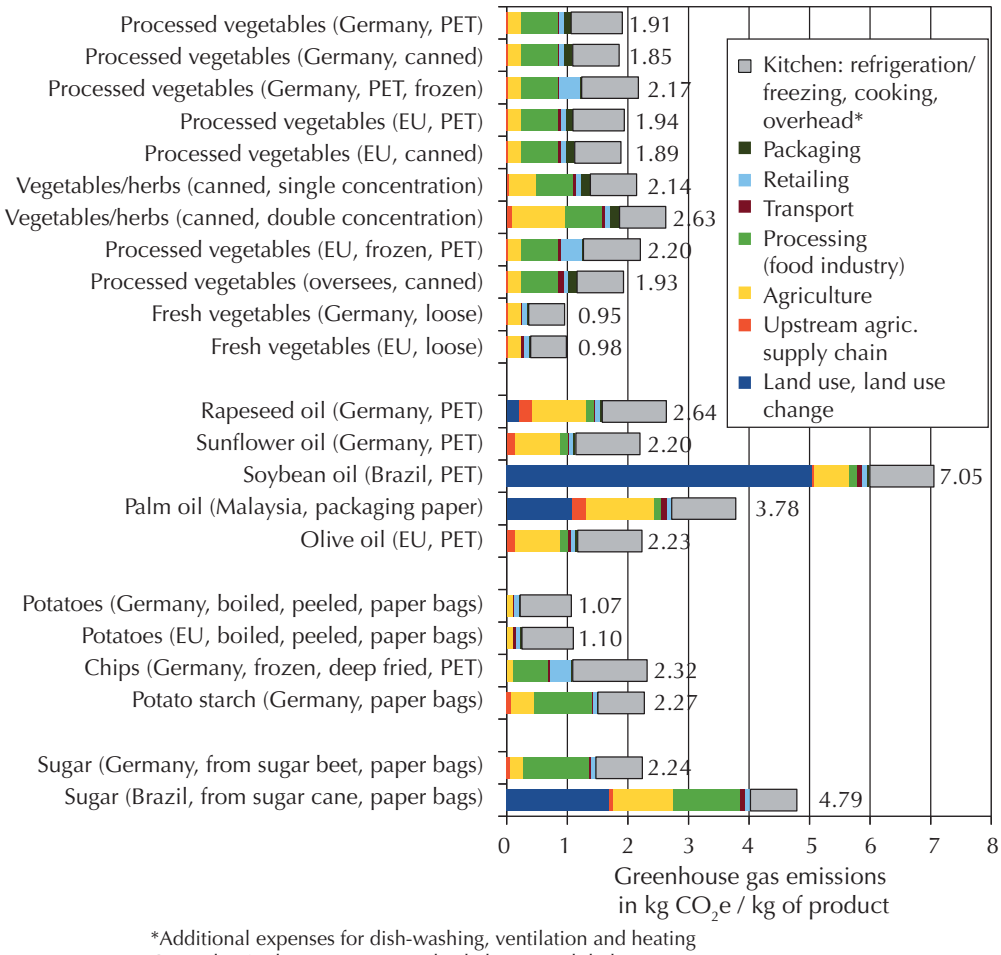
If the recipe-specific results from the nutritional and environmental analysis are combined, a uniform picture of single dishes, aggregated menu lines and/or the entire catering schedule can be drawn regarding healthiness and environmentally friendliness. The examples provided in figures 3 and 4 show the results generated by a high-volume catering facility. Each point on the chart represents a meal that was offered during a four-week period (weeks 47 to 50, 2013). The

environmental impact in figure 3 was measured using the ecological scarcity method; figure 4 adopts the carbon footprint method. Regardless of this difference in methodology, the two figures paint almost an identical picture.

Beef, veal and venison dishes have the greatest impact on the environment – largely because ruminants have a less efficient feed conversion ratio than other types of livestock. This results, although and because ruminants are able to digest roughages, in the above-average excretion of harmful substances, like methane, ammonia and nitrous oxide. There is, however, a large variation in the number of points assigned to dishes made using ruminant meat. This means that ultimately it is the composition of the recipe that determines its impact on the environment. It must also be pointed out that the nutritional quality of the ruminant dishes made by this particular kitchen is above average. But as the comparison of different canteens show that is not necessarily always the case. Table 2 provides a comparative overview of the different menu lines.

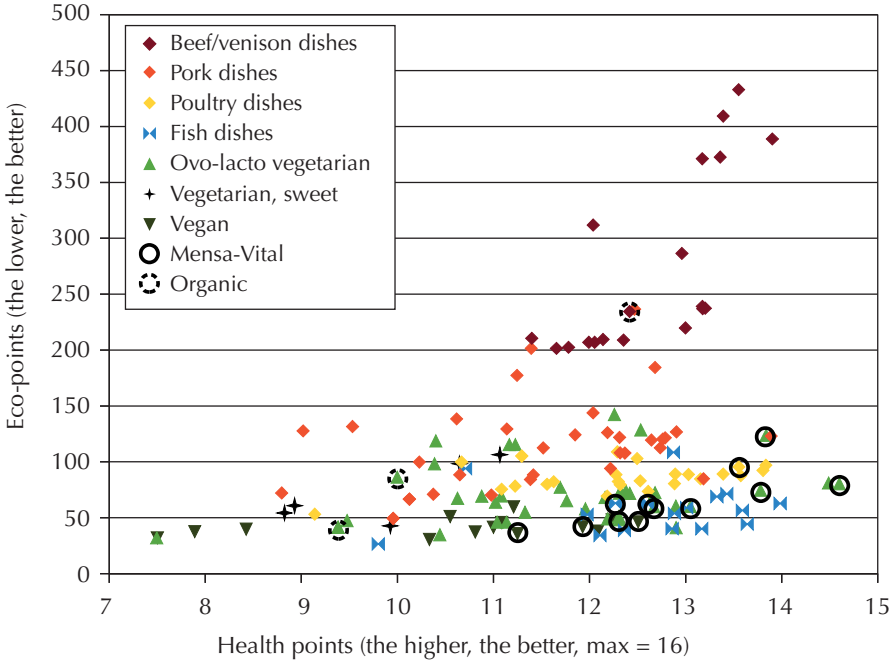
The healthiest and most environmentally friendly dishes are those that are based on fish and poultry or that use only ovo-lacto vegetarian or vegan ingredients. However, the nutritional quality within these menu lines does vary greatly. The results have been compared with those of the menu line *Mensa-Vital,* which has been used in the refectories of most German universities since 2013. Mensa-Vital dishes have been developed to be nutritionally balanced in accordance with the German Nutrition Society's criteria (DGE 2013). Using the susDISH method, it has been shown that Mensa-Vital recipes are not only healthier, they are also more environmentally friendly.

Fig. 2: Greenhouse gas emissions for a selection of products (in kg CO_2e/kg of product)



*Additional expenses for dish-washing, ventilation and heating
Canned = tinplate can, PET = Polyethylene terephthalate

Fig. 3: Scattergraph showing the health and eco-points of various recipes (155) within a four-week catering period



Health evaluation – identifying and optimising critical nutrient supplies

The entire output of a catering establishment must be analysed in order to identify critical supplies in the provision of particular nutrients. susDISH does this on the level of individual recipes, specific menu lines and in an aggregated form regarding the complete canteen offering. Figures 5 to 7 give a detailed nutritional breakdown of the kitchen's entire offering (155 recipes), of the Mensa-Vital menu line (14 recipes) and of the vegan offering (14 recipes) specifically.

In the nutritional analysis of the entire menu in the four-week period under review (fig. 5), the individual criteria, with just a few exceptions, closely match the reference values specified by the German Nutrition Society (DGE 2013).

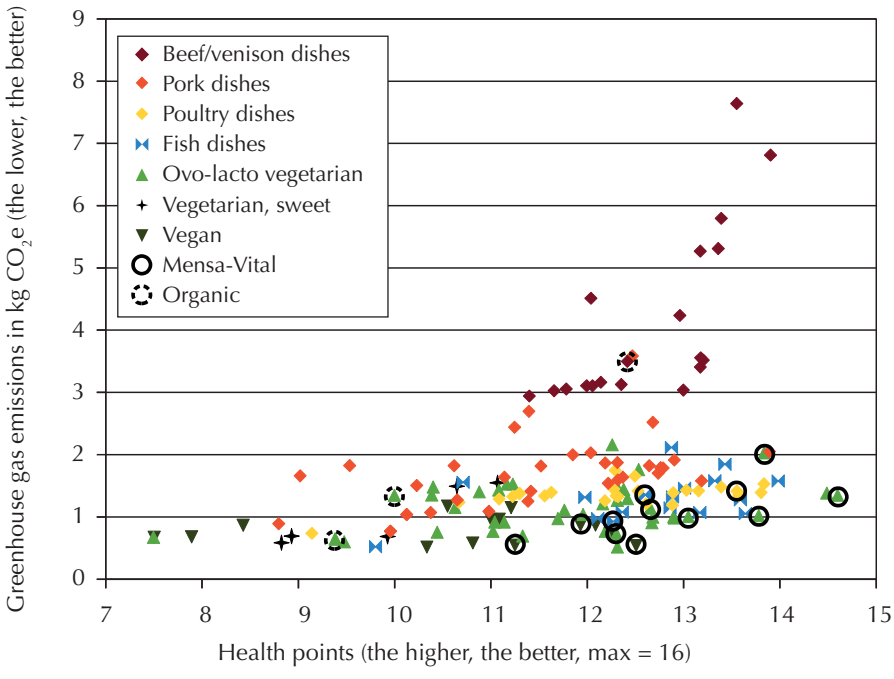
However, the reference values for calcium, fibre and carbohydrates were not achieved, even though in this analysis the meal was extended by a standardised dessert (made up of 50g of mixed lettuce and 50g of yogurt-fromage frais), bringing it up to an average lunchtime count of 815 kcal. The level of sodium (salt) clearly exceeded the recommended value, and there was a high level of fat, though this was still within the acceptable range. The separate analysis of the Mensa-Vital menu line shows that its values, in particular those for macronutrients, very closely matched the German Nutrition Society's reference values (DGE 2013). Nevertheless, critical levels were observed for sodium (salt) and vitamin B_{12}. Even factoring in the standardised dessert (50g of mixed lettuce, 50g of yogurt-fromage frais) the calcium level was moderately critical.

The separate analysis of the vegan recipes showed critical levels for vitamin B_{12}, calcium and sodium (salt). Moderately critical levels were observed for carbohydrates and fat content. Although the protein content fell within the lower end of the tolerance range, no deficit was established in the level of essential protein (essential amino acids).

In cases of critical levels of nutrient content, the susDISH method is used to make specific suggestions for improvement at recipe level (see inset ‚Examples of analysis and optimisation').

The objective is to improve the nutritional quality of menu items identified as critical, and to reduce their environmental impact, whilst retaining their essential culinary character. If the specific suggestions for improvement are

Fig. 4: Scattergraph showing the greenhouse gas emissions and health points of various recipes (155) during a four-week catering period



Tab. 2: Summary of the nutritional quality and environmental impact of the catering offering

	n	Health points	Eco-points	Greenhouse gas emissions (in kg CO_2e)
		The higher, the better, max = 16	The lower, the better	The lower, the better
		Per lunch		
Entire offering (four-week period)	155	11.8	104	1.6
Beef/veal/venison dishes	19	12.7	273	4.1
Pork dishes	34	11.5	114	1.7
Poultry dishes	25	12.3	87	1.4
Fish dishes	18	12.6	58	1.3
Ovo-lacto vegetarian	40	11.7	71	1.1
Vegetarian, sweet	5	9.9	73	1.0
Vegan	14	10.6	42	0.8
Mensa-Vital	14	13.1	65	1.0
Organic	4	10.3	101	1.5

n = number of recipes analysed

Fig. 5: Nutritional quality of the entire four-week catering period (155 recipes)

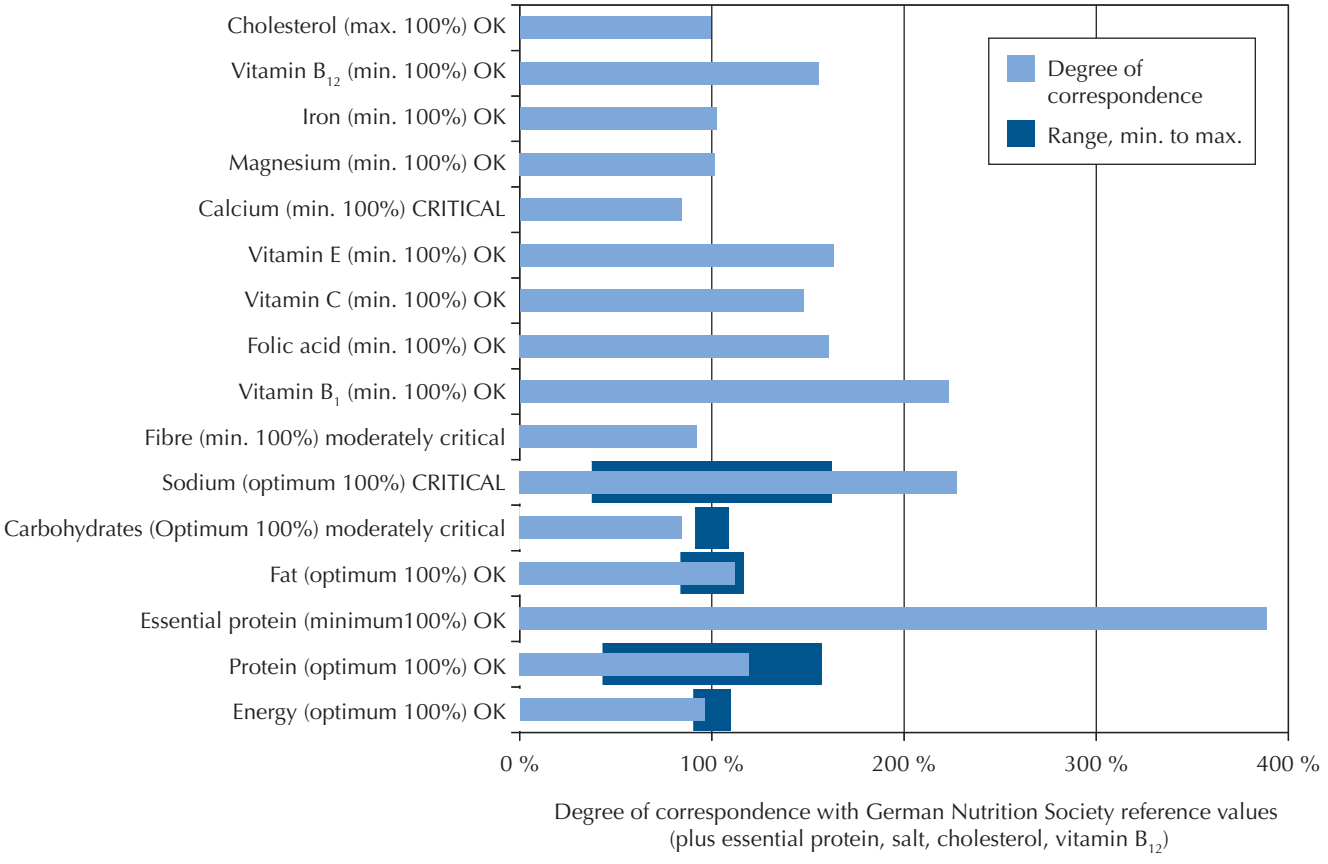


Fig. 6: Nutritional quality of the Mensa-Vital menu line (14 recipes)

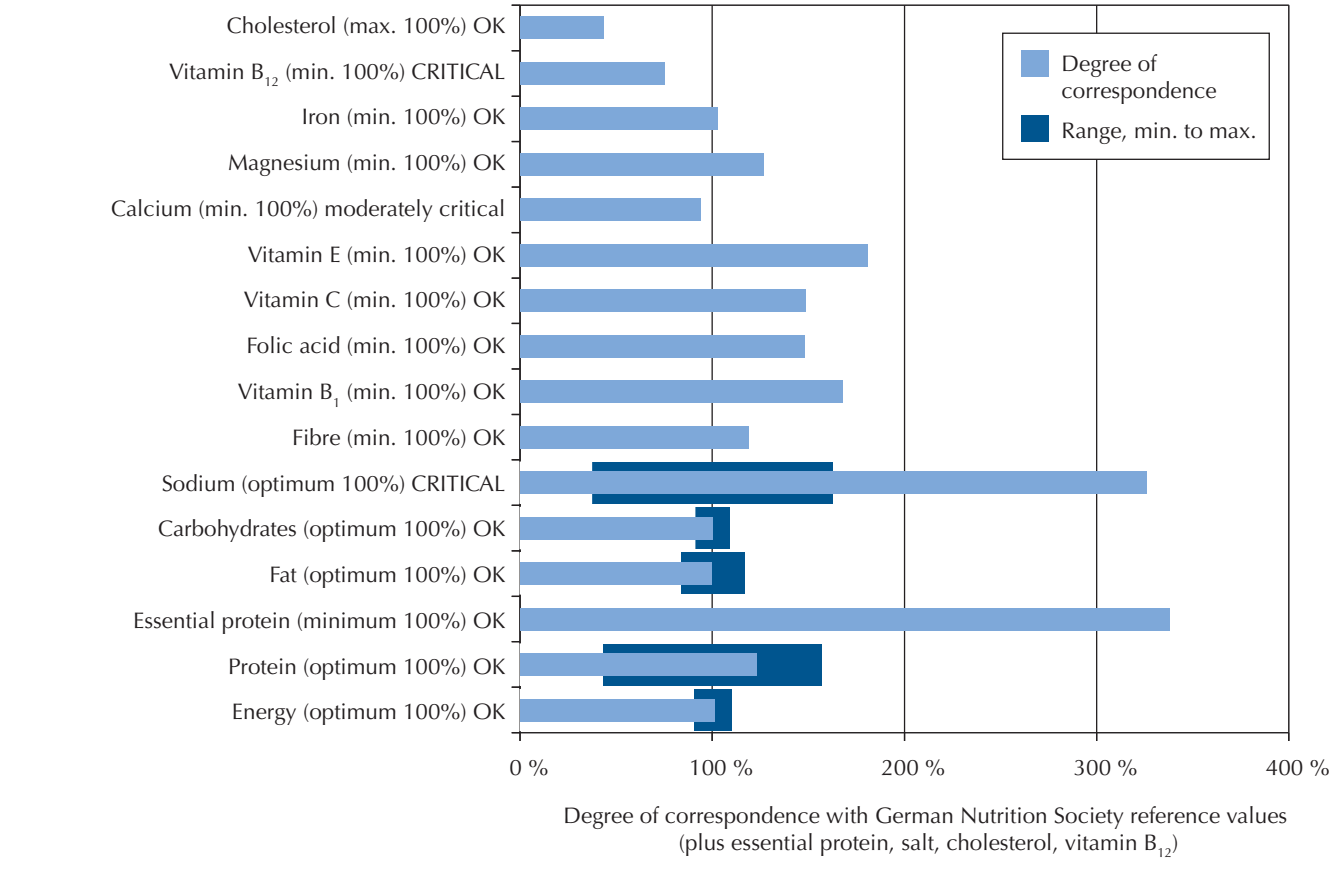
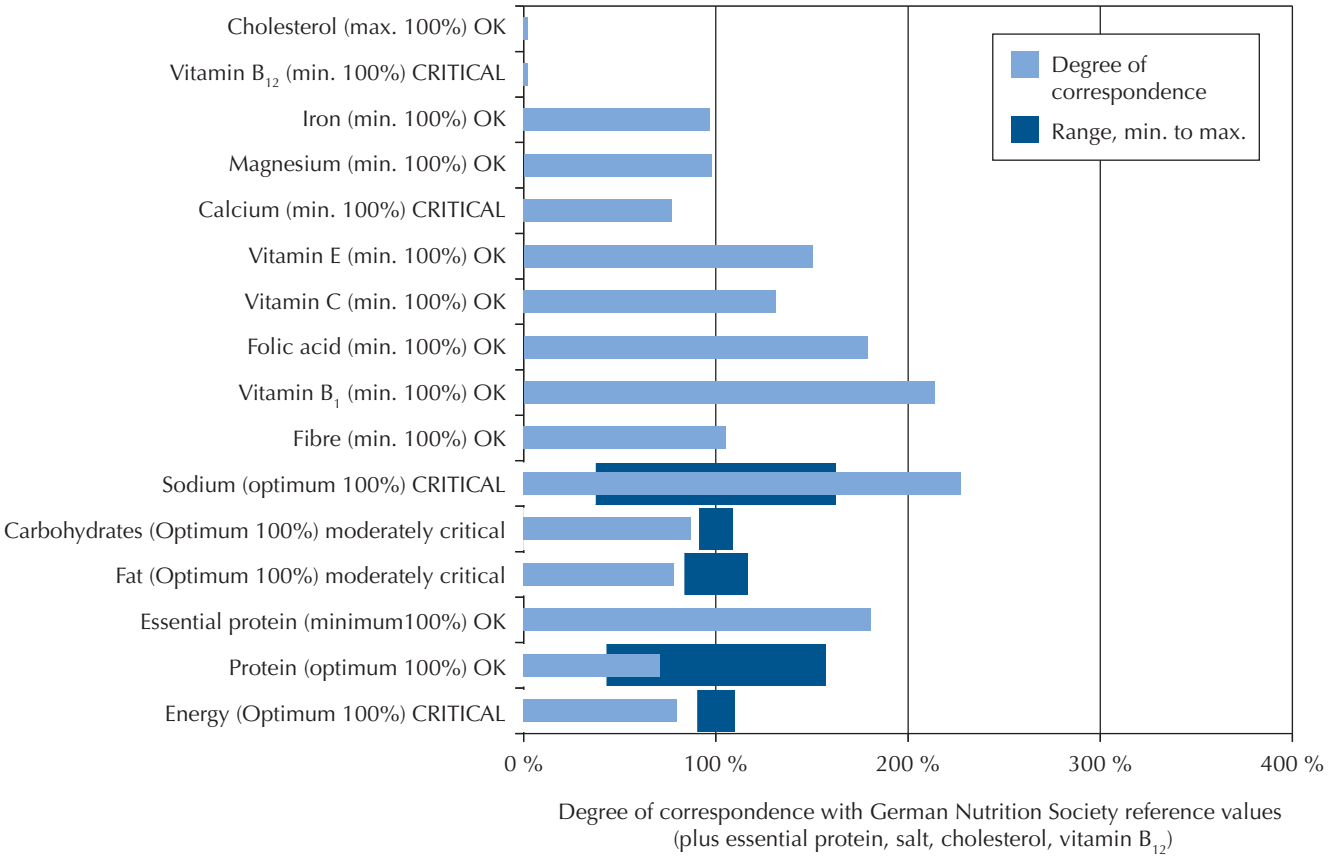


Fig. 7: Nutritional quality of the vegan offering (14 recipes)



put into practice, they can be fine-tuned once the customer response has been gauged and then re-analysed using the same dietary and environmental criteria in order to quantify the gains that have actually been achieved.

Successful communication of sustainability aspects

The results provided by susDISH can be integrated into the communication strategy of the respective establishment, depending on what type of kitchen it operates or its corporate philosophy. A differentiation must be made here between exclusively internal communications and those that are both internal and external, i.e. that are meant not only for employees of the company but also for customers of the establishment and other external stakeholders. For ease of communication, the results of the analysis can be broken down into a traffic light system comprising three areas (top third = green, middle third = yellow, bottom

EXAMPLES OF ANALYSIS AND OPTIMISATION

Example 1:
Esterházy braised beef (200g), boiled potatoes (250g), red cabbage (200g)
(HP: 13.4, EP: 409, CF: 5.8 kg CO_2e)
Analysis: portion contains too much protein (50g) and fat (39g), carbohydrates ok, 923 kcal
Recommendation: reduce meat portion to 100-120g, expand gravy with further component (cocktail tomato, prunes, etc.)
(HP → > 14.2, EP → < 230, CF → < 3.4 kg CO_2e)

Example 2:
Potato-pumpkinseed-patty with mixed salad and yogurt/mayo dressing
(HP: 7.5, EP: 32, CF: 0.7 kg CO_2e)
Analysis: unbalanced recipe – too much fat (47g), lacking in carbohydrates (43g) and protein (9g)
Recommendation: replace yogurt/mayo dressing with a curd/3.5% yogurt dressing (50g/50g), enlarge salad portion (150-200g)
(HP → > 10, EP → < 70, CF → < 1.1 kg CO_2e)

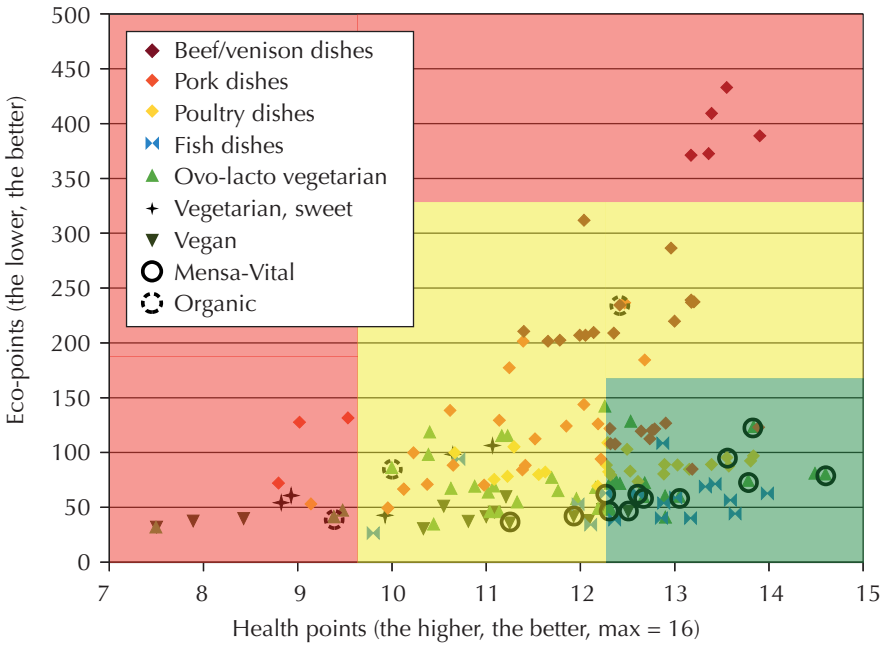
Example 3:
Organic dish: pasta (200g dry weight) with tomato sauce (43g tomato purée) and grated cheese (20g) (HP: 9.4, EP: 41, CF: 0.6 kg CO_2e)
Analysis: portion provides too much energy (1,040 kcal) and too few vitamins
Recommendation: pasta (dry weight) 130g, cheese 30g, tomato purée 80g
(HP → 10.7, EP → 44, CF: 0.8 kg CO_2e)

HP = health points, EP = eco-points, CF = carbon footprint

third = red) – see figure 8. Recipes that are above average in terms of nutritional and environmental quality are marked ‚green', those that are average are ‚yellow' and those that are below average are ‚red'. Similar concepts, albeit focusing solely on health aspects, have been successfully adopted by the work canteens of BMW and can be found in all refectories of the universities in Berlin (FAZ 2013, Peinelt/Pflug 2013).

Communicating the nutritional quality and environmental impact of each specific dish is not a must, however. If customers don't respond well to the labels or if labels are difficult to use (e.g. in old people's homes, hospitals) then the pool of recipes can be modified internally so that ‚red' recipes are removed from the offering entirely. If this were the case, appropriate publicity could be used to communicate the overall gains in terms of nutritional quality and environmental impact. In any case, to assure the credibility of the communication, it is advisable for the catering establishment to obtain a related certification.

Fig. 8: Potential categorisation of recipes according to traffic light colours, 155 different recipes



Recipes are **below average** in terms of nutritional quality and environmental impact
Recipes are **average** in terms of nutritional quality and environmental impact
Recipes are **above average** in terms of nutritional quality and environmental impact

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