The practical feasibility of assessing food purchases

A comparison between the quantitative assessment using the DGE Ernährungskreis and the qualitative assessment using the FSA-NPS DI[1]

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Abstract

Automatically stored shopping receipts can be used to evaluate food choices. In a case analysis, digital shopping receipts were collected over 6 months in a food retail app. The food purchased was evaluated using the DGE Nutrition Circle *(DGE Ernährungskreis)* and the Food Standard Agency National Profiling System Dietary Index (FSA-NPS DI). The aim was to show the limits, possibilities and potential for optimization in the practical feasibility of nutritional assessment of food purchases using these two tools. There were some limitations in the assessment of the quantitative assessment by the *DGE Ernährungskreis*. Nevertheless, a trend in purchasing behavior was discernible in the assessment. In future, this assessment could be presented graphically in an app for easier understanding when communicating with consumers. In addition to the quantitative assessment, the FSA-NPS DI should also include a qualitative assessment of the nutritional profile of the purchase. The final step would be the generation of personalized recommendations to improve the nutritional quality of the purchase in order to support consumers in improving their personal shopping behavior. This practicable assistance for improving individual shopping behavior should be developed using modern IT methods and be usable at the point of sale and is a task for further research.

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Introduction

Increasingly, shopping receipts, which are automatically stored in the corresponding apps of food retailers, are being used as digital markers for individual food selection behavior [1] and for evaluating food choices [2]. The aim of this paper is to demonstrate the limits, possibilities and potential for optimization in the practical feasibility of nutritional assessment of food purchases using digital receipts from the German Nutrition Society (*Deutsche Gesellschaft für Ernährung*, DGE) Nutrition Circle (*DGE Ernährungskreis*) [3] and the Food Standard Agency National Profiling System Dietary Index (FSA–NPS DI) [4]. These indices were chosen because the *DGE Ernährungskreis* is an instrument that is familiar to the German population to some extent and can be depicted graphically. The FSA–NPS DI was chosen because the study by Wu et al. [2] showed that it is a suitable indicator for drawing conclusions about food intake using shopping data. After evaluating the receipts, it makes sense to display the results graphically on the smartphone (in an app) in a user–friendly way and thus show the users their previous individual shopping behavior.

Method

As part of a case analysis, digital shopping receipts of a family of 4 were collected in a food retail app over a period of 6 months. The food items from the receipts were transferred to an Excel database and filled with the nutritional information needed to calculate the FSA–NPS DI. The nutritional information was taken

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[1] This short paper is the updated version of the poster of the same name from the DGE Congress in Kassel in March 2024.

DGE-Ernährungskreis	Food name as per receipt	Weight (in g)	consumable (in g)	BLS	Energy kcal/100g	Protein g/100g	Fat g/100g	Dietary fibre g/100g	Sugar (total) g/100g	Total salt g/100g
Group 5.1	Nürnberger Rostbratwürste	200	200	Rostbratwurst grilled sausage	329,00	16,51	29,49	0,06	0,26	1,50
Group 2	Weinsauerkraut	400	350	Sauerkraut made with wine	17,00	1,52	0,31	2,14	0,74	0,90
Group 1.1	Bio Kindermüsli Apfel	375	375	Fruit muesli	333,00	10,35	5,69	10,30	12,41	0,11
Group 2	Paprika rot	386	296	Sweet pepper red	37,00	1,30	0,50	3,59	6,40	0,01
Group 3	Mango Bio Stk	500	350	Mango	59,00	0,60	0,45	1,70	12,19	0,01
Group 4.2	Bioland Mozzarella	200	125	Mozzarella	263,00	17,12	20,99	0,00	0,00	0,44
No classification	Haribo Phantasia	175	175	Gum drops	348,00	6,60	0,00	0,10	74,67	0,16
No classification	Rügenwalder Veg. Nuggets	180	180	*Manufacturer information*	203,00	14,00	10,00	6,40	0,60	1,60
No classification	Hefe 42g	42	42	Yeast	288,00	35,60	1,50	21,00	3,84	0,13
	Datteln mit Speck	100	100	Date fried	284,00	2,02	0,51	8,79	65,70	0,01
Group 2 + 5.1		50	50	Pork bacon (ham) fried	160,00	22,05	7,98	0,00	0,00	0,10

Tab. 1: **Example of a section of the database created with purchased foods and their nutritional values**

from the Federal Food Code (*Bundeslebensmittelschlüssel*, BLS) [5]. In addition, the foods were categorized into the corresponding food groups of the *DGE Ernährungskreis* (◆ Table 1). These steps were carried out manually.

The total amount of food was then evaluated using the *DGE Ernährungskreis* and FSA-NPS DI. In both assessments, it is not relevant for how many people purchases were made, as both calculations were based on percentages of the total purchase.
The implementation of the assessment is explained in more detail below.

Quantitative assessment

The *DGE Ernährungskreis* was used as a target value in comparison to the total purchase (actual value). The percentage quantities of the individual food groups were derived on the basis of the quantities given in the *DGE Ernährungskreis*. As the quantities are usually given in a range (women, not physically active, to men, physically active), the corresponding mean values of the individual categories were used. ◆ Table 2 shows the guideline values and the percentage share of the *DGE Ernährungskreis* for the corresponding food group.

In the case of compound foods, the individual components were assigned separately to the corresponding groups (see example ◆ Table 1).
The percentage shares of the individual food groups in the total purchase were then calculated. The basis for the calculation was the total weight (in g) of all food items on the receipts. In this

case, the purchase included all receipts collected over a period of six months. As a result, foods such as sweets, which could not be assigned to any group, could not be included in the quantitative assessment.
The *DGE Ernährungskreis* does not provide any information about the nutritional composition of the foods within the groups. Therefore, the *DGE Ernährungskreis* has potential in disease prevention, but a differentiated view concerning the physiological effect of the overall purchase appears to be useful [6].

Qualitative assessment

In order to be able to take into account the qualitative nutritional points in the assessment, the total purchase was also assessed using the FSA-NPS DI. The individual nutrition index, which is created on the basis of the FSA score of the food consumed, is a valid measuring instrument for assessing the nutritional quality of the purchase.
This index characterizes the quality of the diet at the individual level regarding nutrient intake. In a study [2] in which various indices for the quality of food shopping were compared in relation to the nutritional quality of the food purchased, it was shown that the FSA-NPS DI proved to be a suitable instrument for mapping shopping behavior. The FSA-NPS DI is calculated as shown in ◆ Figure 1.

Food Group	Food products	Subgroup	Orientation value in g (average)	Frequency	Consumption in g / day	DGE Ernährungskreis in per cent
Group 1	Cereals, cereal products, potatoes	Bread, cereal products	250	1	250	16,19
		Pasta, potatoes, rice	225	1	225	14,57
Group 2	Vegetables, salad		400	1	400	25,91
Group 3	Fruit		250	1	250	16,19
Group 4	Milk- and milkproducts	Milk- and milkproducts	225	1	225	14,57
		Cheese	55	1	55	3,56
Group 5	Meat, sausage and eggs	Meat and sausage	450		64	4,15
		Fish	115		16	1,04
		Eggs	3		24	1,55
Group 6	Oil and fat		35	1	35	2,27
Group 7	Beverages	are not (yet) considered in the elaboration				

Tab. 2: **Guideline values for food selection according to the *DGE Ernährungskreis* (modified according to [3])**

$$\text{FSA-NPS DI} = \frac{\sum_{i=1}^{n} = \text{FSA-NPS}_i \, E_i}{\sum_{i=1}^{n} E_i}$$

Fig. 1: **Calculation Food Standard Agency National Profiling System Dietary Index** (FSA-NPS DI) [4]
E_i: total energy of the purchase in kcal; FSA-NPSi: calculated values of the Nutri-Score in relation to the entire purchase

Results

When creating the database, it became clear that the product details on the purchase receipts were incomplete. Not all purchases could be allocated as the food was not sufficiently named. The quantities (in g) of fruit and vegetables were also often missing. Therefore, a more detailed listing of the foods on the receipts by the food retailer would be desirable in order to prevent these limitations in the calculation basis.

Not all products were listed in the BLS. In this case, nutritional information from alternatives or nutritional information from product manufacturers was used. Despite some estimates, further calculations were carried out using this information. The subsequent quantitative assessment of food purchases using the *DGE Ernährungskreis* is therefore only of limited significance, but a trend in purchasing behavior can be identified and this can be clearly presented to consumers. Sweets and fatty snacks such as potato chips are excluded, as these discretionary foods are not shown in the *DGE Ernährungskreis*. For the assessment of shopping receipts, it would be useful to introduce an additional category that considers these. Information on the consumption of convenience foods would also be desirable, as it is not sufficient to consider these only as compound foods due to their often high salt and fat content. It therefore makes sense to assess the quality of purchases as well.

The qualitative assessment (FSA-NPS DI) of the purchase has the same limitations in the database as the quantitative assessment using the *DGE Ernährungskreis*. The assessment of the FSA-NPS DI considers the foods' nutritional profiles. However, this index only represents a number. It is difficult for consumers to interpret. The *DGE Ernährungskreis*, on the other hand, is an instrument that can be used graphically to show consumers in a simple and understandable way what the actual state of their previous purchases is. ◆ Figure 2 shows an example of this.

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Abb. 2: **Quantitative assessment of a test person's shopping (right) compared to the *DGE Ernährungskreis* (left)** (*DGE Ernährungskreis*®, © German Nutrition Society e. V. (*Deutsche Gesellschaft für Ernährung* [DGE]), Bonn [3])

Conclusion

Various studies show that providing nutritional information at the point of sale can lead to healthier shopping behavior [7]. It would, therefore, make sense to display the evaluation graphically in a shopping app so that consumers can assess their previous purchases while shopping. In addition to the quantitative view (*DGE Ernährungskreis*) in graphical form, a qualitative view of the nutritional profile of the purchase should be included. The FSA-NPS DI – if implemented in a consumer-friendly way – can close this gap, as it takes into account parameters such as salt and fiber. The neglect of ready meals and sweets in evaluating the till receipt represents a limitation of the *DGE Ernährungskreis*.

Nevertheless, the *DGE Ernährungskreis* is suitable as a tool for assessing shopping behavior, especially with regard to the graphic representation. An app in which the receipts are stored could also provide a graphical representation of the quantitative assessment. This would be easy for consumers to understand.

Generating personalized recommendations to improve the nutritional quality of shopping is the next step in helping consumers to improve their shopping behavior. This approach is suitable for providing nutritional and shopping recommendations directly at the point of sale. These can then be implemented directly. The recommendations could be made on the basis of previous shopping behavior. This is because recommendations that consumers feel are tailored to them are better received and applied than general recommendations [8].

Of course, there are a number of factors that make it difficult to assess the impact of shopping behavior on actual eating habits: food waste, out-of-home consumption and, for example, food purchased from other supermarkets. In order to take these factors into account, it would make sense to ask about them in the app. The diet should also be queried. For example, if there is a vegetarian or vegan lifestyle, allergies or intolerances, the corresponding food groups should not be taken into account. In further steps, an app could be developed that is individually tailored to consumers, maps their shopping habits and provides personalized recommendations for future purchases so that they can access them quickly and easily at the point of sale.

Disclosures on Conflicts of Interest and the use of AI
The authors declare that there is no conflict of interest and that no AI applications were used in the preparation of the manuscript.

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