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A new approach to specify additional social benefit rates for a wholesome diet in Germany

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Summary

Current Unemployment Benefits II Regulations in Germany lay down that no additional social benefits will be paid when nutrition is switched to a wholesome diet for medical reasons. This regulation is based on calculations performed with the so-called "shopping basket method". This article presents a new approach, using a statistical model to determine possible additional social benefits, instead of the "shopping basket method". On the basis of German Consumer Panel Research Data from the year 2011, the actual consumption behaviour of 13,131 households is investigated by regression analysis, in order to identify whether households with lower income and comparatively healthy food purchases pay more or less for this than lower income households with average purchasing behaviour.

The results show that the purchases of foods of lower energy density and higher densities of water soluble vitamins and trace elements are linked to greater expenditures. In contrast, higher densities of minerals and fat soluble vitamins were linked to reduced expenditures. The overall conclusion of the simulations was that shopping baskets of higher nutritional physiological quality were more expensive, so that there are additional needs for a wholesome diet.

Keywords: social benefit rates, socio-cultural subsistence level, wholesome diet, nutrient density, energy density, empirical analysis

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Question and objective

Current Unemployment Benefits II (ALG II) regulations in Germany lay down that the payment for nutrition will not be increased when nutrition is switched to a more wholesome diet for medical reasons (e.g. allergies, diabetes, AIDS etc.). This decision was based on calculations using the "shopping basket method", in which prices are assigned to items in a shopping basket of food prepared by experts. However, already in the early 1990s, the shopping basket method was replaced by the so called "statistical method" for general calculations of ALG II rates in Germany. The shopping basket method requires normative specifications in detail, in contrast, the Federal Constiutional Court has reminded that a socio cultural subsistence level must be granted, which has encouraged the use of the so-called "statistical model" [1]. This model infers the need from the observed expenditure behaviour of lower income groups and thus considers actual consumption habits of the population which is in accordance with the principle of a socio-cultural subsistence level.

The objective of the present study is to determine possible additional needs for a wholesome diet, using the statistical model. On the basis of representative German Consumer Panel Research Data from the year 2011, the actual consumer behaviour for foods is analysed. It is investigated whether households with lower income which purchase comparatively healthy food pay more or less for this than households with average purchasing behaviour. The specific focus is on price-sensitive purchasing behaviour, as expected for recipients of ALG II.

First, it is addressed how to measure the nutritional physiological quality of food shopping baskets. Then the underlying data and the statistical procedure are described, and results are reported. The results are then dis-

cussed in the context of previous German studies on the costs of a healthy diet.

Measurement of the nutritional physiological quality of food shopping baskets

There are a wide variety of different indices for the evaluation of the nutritional physiological quality of food (cf. Drescher et al. [2]; Thiele et al. [3]). All these evaluations focus directly or indirectly on achieving the necessary quantities of nutrients, coupled to appropriate energy supplies [4]. On this foundation, the present analysis uses indices for nutrients and energy density. These are also used by nutritional scientists to assess the effects of specific foods on human health [5].

The expression "nutrient density" means the content of a specific nutrient with respect to the energy content of a food or group of foods. In contrast, "energy density" is defined as energy content per unit weight of a food or group of foods.

$$\text{nutrient density} = \frac{\sum_{j=1}^{k} \text{nutrient}_j \text{ (mg resp. µg)}}{\sum_{j=1}^{k} \text{energy}_j \text{ (kcal)}}$$

$$\text{energy density} = \frac{\sum_{j=1}^{k} \text{energy (kcal)}}{\sum_{j=1}^{k} \text{weight (100 g)}}$$

where $\sum_{j=1}^{k}$ = total of all foods (j = 1, …k)

This study employs 13 nutrient density indices for vitamins, four for minerals, six for trace elements, as well as an energy density index. While the nutrient density indices provide a measure of the supply of micronutrients, the energy density index is a measure of the overall supply of the macronutrients fat, carbohydrate and protein, all of which supply energy.

Macronutrients influence nutritional quality not only through the quantity of energy that they supply, but also through their composition. For example, the proportion of unsaturated fatty acids is an important aspect in fat nutrition. A high proportion of polyunsaturated fatty acids, together with a low proportion of saturated fatty acids, reduces the risk of cardiovascular diseases (e. g. myocardial infarction) [6]. For this reason, the density of unsaturated fatty acids was used in this analysis as an additional indicator of food quality.

For carbohydrates, the emphasis is on polysaccharides and fibre, whereas moderate sugar intake is recommended. The basis of this recommendation is that foods containing polysaccharides and fibre exhibit lower energy density than foods with high levels of sugar, but have higher levels of satiation, and usually high levels of micronutrients [5]. Because of this correlation, the content of polysaccharides and fibre is already considered indirectly in the indices for nutrients and energy density. For this reason, no additional indicator was calculated for carbohydrate composition.

On the basis of the calculated indices, the analysis examined to what extent the relative nutrient and energy density differed between the shopping baskets in individual empirically observed households. From the point of view of nutritional physiology, a shopping basket is regarded as better if its nutrient density is comparatively high and its energy density comparatively low. This procedure for the observation of actual consumer behaviour has the advantage that it considers the situation within Germany and thus fulfils the demands that the composition of a wholesome diet should be adapted to the normal nutritional habits of the population (cf. [7]: definition of wholesome diet, Point 4).

Data

In order to determine the nutritional physiological quality of food consumption and the corresponding costs, Consumer Panel Research Data from 2011 provided by the German Society for Consumer Research (GFK[1]) were linked to nutrient data (German Food Database, BLS 3.01). The consumer data contain information on the price and quantities of a total of 12,408,473 food purchases for home consumption in 13,131 representative German households. The BLS lists the nutrient content of foods. In order to avoid overestimating nutrient intake, allowance was made for food waste, which is inevitable for some fresh foods (e. g. fruit, vegetables, potatoes and fish). The analysis included all food items except for alcoholic drinks and baby food.

Aside from the quantities, prices and nutrients, the data provide information on where the foods were bought (discounter shop, speciality shop) and whether the brands were manufacturer's or retail brands. Furthermore, additional information on socio-economic characteristics (e. g. income, education, age), as well as some attitude variables of the subjects (e. g. on price consciousness) are included in the data set.

In the course of the analysis for 2011, the individual purchases and their characteristics were aggregated for the 13,131 households, giving the total expenses, as well as the purchased quantities and the nutrient content of the foods. On this basis, nutrient and energy density

[1]For a description of the GFK Consumer Panel Research Data, see [8].

fat soluble vitamins	water soluble vitamins	minerals	trace elements
vitamin A	thiamine (B_1)	potassium	iron
vitamin D	riboflavin (B_2)	calcium	iodine
vitamin E	niacin (B_3)	magnesium	fluoride
vitamin K	pantothenic acid (B_5)	phosphorus	zinc
	pyridoxine (B_6)		copper
	biotin (B_7)		manganese
	folic acid (B_9)		
	cobalamin (B_{12})		
	vitamin C		

Tab. 1: **Nutrients incorporated in the nutrient indices**

indices were calculated, incorporating all foods purchased by the household. Because of high correlations between specific nutrients, they were added together to give the groups shown in ◆Table 1. The nutrient indices were calculated on this basis.[2]

With only a few exceptions, all nutrients were considered for which the German Nutrition Society (DGE) has issued reference values [5]. Only sodium and chloride were excluded, as these tend to be supplied in excessive levels in cooking salt and this may be unfavourable. If sodium and chloride had been included in an overall mineral density index, this would have given a contrary effect. In addition, the trace elements selenium, chromium and molybdenum had to be excluded, as no relevant information is available.

[2]One consequence of the addition is that nutrients that occur naturally in foods in large quantities are dominant within a single index. In response to this, standardised nutrient densities are used in a follow-up study. These results are included in an article submitted to the journal Public Health Nutrition. This showed that this alternative approach does not change the general direction of the results in ◆Tables 2–4, possibly because the nutrients in each group are closely correlated with each other.

Statistical methods and results

Using regression analyses, correlations were investigated between expenses for foods and their nutritional physiological quality (energy and nutrient densities, as well as the density of unsaturated fatty acids), together with control variables which influence the level of expenditure (socio-economic characteristics and price variables). In this way, it can be determined whether – and to what extent – the expenses under otherwise the same conditions differ between households with a shopping basket that is more favourable in the context of nutritional physiology (higher nutrient density and lower energy density) and households with a "less healthy shopping basket".

The socio-economic variables considered were net household income, household size, age and level of education. The price variables provided information about the price segment in which the households purchase and included the proportion of purchases in discount shops, the proportion of retail brands in overall purchases, as well as self-information from the housekeeping person about the importance of price conscious purchasing (very important, important, less important, not at all important).

◆Table 2 shows the results on the quality of the foods with respect to nutritional physiology.

◆Table 2 shows that the various characteristics of nutritional physiological quality have different influences on the expenses for food. The negative sign of the variable energy density makes it clear that households with a food shopping basket with lower energy density spent more on food. With increasing density of water soluble vitamins, trace

	reg. coeff.		t-value
energy density	–0.375	***	–14.641
density of fat soluble vitamins	–1.091	**	–2.282
density of water soluble vitamins	0.119	***	3.545
density of minerals	–15.798	***	–7.283
density of trace elements	0.316	*	1.718
density of unsaturated fatty acids	0.397	*	1.756
R^2 korr. 0.26			

[1]Net household income, household size, age, level of education, proportion of discount shop purchases and proportion of retail brands in overall purchases, personal information about price conscious purchasing

*** Maximum probability of error 1 % , ** 5 %, * 10 %

R^2 corr. = corrected R^2; reg. coeff. = regression coefficients

Tab. 2: **Influence of the characteristics of nutritional physiological quality on the expenses for food of 13,131 households, allowing for control variables[1]**
(results of a regression analysis)

Percentile values	energy density (kcal/100 g)	fat soluble vitamins (µg/kcal)	water soluble vitamins (µg/kcal)	minerals (mg/kcal)	trace elements (µg/kcal)	unsaturated fatty acids (mg/kcal)
10 %	82.54					
25 %	99.22					
50 % (= median)	118.31	5.56	55.40	2.37	14.00	22.62
75 %		6.61	70.73	2.66	16.00	25.28
90 %		7.92	88.29	2.97	18.55	27.88

Tab. 3: **Selected percentile values for various characteristics of nutritional physiological quality, presented in the form of energy and nutrient densities** (calculated on the basis of the GFK Consumer Panel Research Data 2011)

elements or unsaturated fatty acids, the cost of the food shopping basket also increased. In contrast, the densities of minerals and fat soluble vitamins had a significant negative influence – the higher the densities, the cheaper the shopping basket.

In order to answer the question whether the purchase of a shopping basket with better nutritional physiological value is generally more favourable than for average nutrition, simulations were performed using the results of the regression, and thus to compare the expenditures from a reference household with an average shopping basket with those from a comparator household with a relatively "healthier" shopping basket.

The reference household selected was a one-person household with a low income of 875 €, corresponding to the lowest 20 %[3]. The percentile was based on the income limit used for the calculation of the ALG-II-rate [7]. The householder was assumed to be 56 years old[4], with an intermediate level of school education, high price consciousness, and relatively high proportions of both discount shop purchases (75 %) and retail brand purchases (38 %).[5]

To characterise the mean shopping basket, median values were taken for the characteristics of nutritional physiological quality. According to our definition, the shopping basket was relatively "healthier" when the energy density relative to the average shopping basket was reduced to the 25 %- (or 10 %-) percentile, while the densities of the other characteristics (for fat soluble vitamins, water soluble vitamins, etc.) are raised to the 75 %- (or 90 %-) percentile. For example, the percentiles shown in ◆Table 3 imply that 25 % of the households (= 3,283 households) purchase foods with energy density under 99.22 kcal/100 g. 10 % of the households (= 1,313 households) purchase foods with energy density under 82.54 kcal/100 g. The median energy density for all households was 118.31 kcal/100 g.

The reason that the energy densities were relatively low was that the food shopping baskets contained both food and drinks; the energy density of drinks is low, due to their high water content.[6] Even though the energy and nutrient densities of foods and drinks are very different, it was decided to include both groups, as it was important to include nutrients and energy from drinks in the evaluation of the overall nutritional quality. For example, mineral water is the second most important source of calcium [9].

On the basis of the percentile limits, it was analysed whether households in Germany which purchase relatively healthy foods – as measured on the basis of energy and nutrient density – pay more for their shopping basket. ◆Table 4 shows that food costs increase by 6.1 % when the nutritional physiological quality is decreased to the 25 %-percentile of energy density and simultaneously increased to the 75 %-percentile of nutrient densities – both relative to the reference household. An additional improvement to the 10 %-percentile for energy density and the 90 %-percentile for nutrient densities (both relative to the reference household) increased the expenses by 10.6 %.

For the statistical model based on the observation of actual consumption behaviour, higher nutritional physiological food quality was exclusively measured from the relatively high nutrient and energy densities – in comparison to the shopping basket of the average for the population. No specific inferences can be made about improvements in the nutrient supply relative to reference values [5]. It can however be assumed that individuals in households in Germany which purchase foods with more favourable energy and nutrient densities more often reach the reference

[3]The level of income for the one-person households was calculated from the GFK data.

[4]The age for the one-person households was calculated from the GFK data.

[5]The proportions were calculated from the GFK data and always represent the 75 %-percentile values.

[6]If drinks are excluded, the mean energy density is increased to about 171 kcal/100 g.

nutritional physiological quality	increased expenses (%)	increase relative to ERS (= 135,63 €/month)	transferred to ERS (€/month)
reference (= median values)			135.63
improved quality 1[1])	6.1	+ 8.27	143.90
improved quality 2[2])	10.6	+ 14.38	150.01

[1]25 %-percentile for energy density and 75 %-percentile for nutrient densities
[2]10 %-percentile for energy density and 90 %-percentile for nutrient densities (◆ Table 3)
ERS = standard rates (here for nutrition)

Tab. 4: **Relative increase in the expenditure for food shopping baskets with different nutritional physiological qualities and transfer to the current ALG-II-standard rates (ERS) for nutrition**

values than do average households. Relative to the current ALG-II-standard rates (ERS) for nutrition of 135.63 € [10], the percentage increases in nutritional physiological quality corresponded to an additional need of 8.27–14.38 € per month. If these results are considered, the monthly ERS would have to be increased to 143.90 € or 150.01 €. Thus, it can be concluded in general that food shopping baskets of relatively high nutritional physiological quality – as measured on the basis of energy and nutritional density – were more expensive than food shopping baskets of average nutritional physiological quality.

Discussion and conclusions

Several national and international studies have been performed on the costs of a healthier diet (i. a. [11–13]). The results of these studies are ambiguous, possibly because they employed different definitions of a "healthier diet", as well as different methods. In recent years, there have been three studies in Germany on the costs of healthy nutrition. Karg et al. [14] and Wagner et al. [15] evaluated a shopping basket put together by experts, with prices from the German "Income and Consumption Survey". They then compared the resulting expenses with those from average nutrition. If intermediate prices are used, a wholesome diet is more expensive. Lower costs were only found if the prices were exclusively in the lower price segment – which may not be feasible in practice.

On the basis of their own survey, Mertens et al. [16] compared the nutritional habits of women on a wholesome diet with those on a mixed diet. They found that the wholesome diet was cheaper, mainly because it involved eating less meat. Kersting and Clausen [17] focussed on the costs of healthy nutrition for children. As in Karg et al. [14], a shopping basket was prepared according to the principles of a wholesome diet (in this case, an optimised mixed diet for children) and evaluated with prices that they had ascertained themselves. They concluded that nutrition in accordance with the principles of an optimised mixed diet cannot be covered by the ALG-II-benefits for children, even with price conscious purchasing.

The previous studies for Germany have already shown that healthier nutrition orientated towards conventional consumption behaviour – i.e. including meat for example –, and which otherwise considers normal purchasing behaviour and prices, is more expensive than average nutrition.

The present study employs typical shopping baskets that were in fact consumed and which had different nutritional physiological values. It was assumed that purchasing was price conscious. Both the food baskets and prices were taken from direct observations of households. The results supported the hypothesis derived from previous studies by showing that healthier nutrition is more expensive than average nutrition; when actual consumption behaviour was considered then the expenses for a shopping basket of higher nutritional physiological quality are higher than that for an average shopping basket – to a statistically significant level.

The standard rate for nutrition in the ALG-II-regulations is supposed to cover a minimum subsistence level for average nutrition. On the basis of these results, as well as those from previous studies, it can be concluded that these benefits are not adequate if nutrition has to be switched to healthier food for medical reasons. The standard rate reflects the average purchasing behaviour of persons of low income, corresponding to the poorest 20 % of persons living alone [7]. Because of their income, such persons are forced to purchase in a cost conscious manner and are comparable to the reference household used in this study – both with respect to their purchasing behaviour and their consumption behaviour. The results of this study show that such households have 6.1–10.6 % greater expenses when they purchase a shopping basket of higher nutritional physiological quality.

On the other hand, the direction of the individual results was not unambiguous. An increase in mineral density alone or of fat soluble vitamins alone led to a reduction in expenses. As an improvement in the remaining components led to a stronger converse effect, the net result was an increase in total expenses. Thus, if the study is focussed on an improvement in general nutritional quality, our results indicate that there are additional needs. If however, the nutritional physiological quality is specifically related to individual deficient nutrients (e.g. vitamin D), or to a specific improvement in the fatty acid pattern, this would have to be analysed in additional studies.

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Conflict of Interest
The author declares no conflict of interest according to the guidelines of the International Committee of Medical Journal Editors.

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