



# Food costs for vegetarian, vegan and omnivore child nutrition: is a sustainable diet feasible with Hartz IV?

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## Abstract

A plant-based diet is becoming increasingly important. However, the question arises whether such a diet is affordable for socially disadvantaged families in Germany. Therefore, in the present study, the costs of a vegetarian, vegan and omnivore diet were calculated using data from three-day weighed dietary records of 390 participants (6–18 years) of the VeChi Youth study and compared with the standard rates of *Arbeitslosengeld-II* (ALG-II) for food. The total cost of food (€/day and €/1000 kcal) differed significantly between the diets (all  $p < 0.01$ ). The vegetarian diet was associated with the lowest food costs. Costs for vegan and omnivore diets did not differ significantly. The ALG-II standard rate for food is not sufficient for the nutrition of children and adolescents, regardless of the type of diet and also despite additional subsidies for lunch in school and day-care. This is especially relevant for boys from the age of 10 onwards.

**Keywords:** Child Nutrition, Vegetarian, Vegan, Sustainable Nutrition, Unemployment, Food Costs, Health Economics

## Citation

Hohoff E, Zahn H, Weder S, Fischer M, Längler A, Michalsen A, Keller M, Alexy U: Food costs for vegetarian, vegan and omnivore child nutrition: is a sustainable diet feasible with Hartz IV? *Ernährungs Umschau* 2022; 69(9): 136–40.

The English version of this article is available online:

DOI: 10.4455/eu.2022.027

## Peer reviewed

Manuscript (original) received: 05 April 2022

Revision accepted: 13 July 2022

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## Introduction

Aspects of sustainability are becoming increasingly important for dietary recommendations of professional societies in German-speaking countries [1]. A central challenge is to combine an environmentally compatible and mainly plant-based diet with affordability, even among socially disadvantaged populations [1]. However, in recent years, prices for fruit and vegetables have increased [2]. In particular for socially disadvantaged families with children, this, among other factors, can be a barrier to switching to a plant-based diet, since food choices depend not only on taste preferences but also on price [3]. For families dependent on financial support from the state, the standard rates for Unemployment Benefit II (*Arbeitslosengeld-II*; ALG-II) in Germany were last raised on 1 January 2022 [4]. Hence, parents have a daily budget for their child's nutrition of € 3.25 for children under six years or € 3.55 for children between 6 and 13 years and € 4.29 for adolescents [5]. In addition, the proportion of ALG-II recipients at the *Tafel Deutschland e.V.*<sup>1</sup> has increased, over the last years [6].

Therefore, the aim of this study was to calculate food costs [1] of children and adolescents following a vegetarian, vegan or omnivore diet and [2] to compare them with the standard rates of ALG-II.

<sup>1</sup> The *Tafel* collect good quality food that is left over in food retailers and restaurants and would otherwise end up in the garbage. They distribute it for free or a symbolic amount to socially and economically disadvantaged people. There are currently more than 940 *Tafel* in Germany. All of them are nonprofit organizations.

## Method

The analysis was based on data from the VeChi Youth study, a cross-sectional study among children and adolescents aged 6 to 18 years, conducted in Germany from October 2017 to January 2019 [7]. The recorded food items were linked to the minimum retail food prices collected in 2021 [8].

The individual daily total food costs (€/day) were calculated from the determined food prices (€/100 g) and the recorded intake amounts (g) as individual mean values from three recorded days. As energy intake differs with age as well as sex, the variables were standardised to 1000 kcal energy intake/day. In addition, the proportional costs of food groups (in %) to the total costs per day were determined.

In order to compare the food costs (€/1000 kcal) with the ALG-II standard rate, these were extrapolated using the reference values for the daily energy intake [D-A-CH] of children and adolescents at an activity level of PAL (Physical Activity Level) = 1.4.

According to the *Bildungs- und Teilhabepaket*<sup>2</sup> of the German Federal Ministry of Labor and Social Affairs (*Bundesministerium für Arbeit und Soziales*), eligible children receive free access to lunch at school or day-care [9]. Therefore, additional calculations were made to account for this complimentary meal (25 % of energy intake on 252 days/year).

The Winkler Index was used to determine the socio-economic status [10].

All statistical analyses were performed using SAS<sup>®</sup> 9.4. The significance level was set at a p-value ≤ 0.05.

## Results

The present analyses included three-day weighed dietary records (one per participant) from 390 study participants (boys n = 169; 43.3 %) aged 6 to 18 years. Of these, 110 followed a vegan (28 %), 145 a vegetarian (37 %) and 135 an omnivore (35 %) diet. The socioeconomic status of the study participants differed significantly between the diets (Fisher's Exact Test, p = 0.016). Children and adolescents who followed a vegan diet were more often from families of a middle social class and less often from families of a high social class than other participants. Vegan participants had a significantly lower BMI-SDS<sup>3</sup> (-0.58; p = 0.028) than vegetarian and omnivore participants.

Total food costs standardised to 1000 kcal were highest for vegans [2.98 (2.51; 3.52) €/1000 kcal], followed by omnivores [2.83 (2.30; 3.24) €/1000 kcal] and vegetarians [2.52 (2.12; 3.16) €/1000 kcal]. The total cost of food per day (€/day) and standardised to 1000 kcal (€/1000 kcal) differed significantly between the diets (all p ≤ 0.01). However, the pairwise comparison showed no significant difference in total costs between vegan and omnivore participants (analysis of covariance, adjusted for age and socioeconomic status).

Protein rich foods (sum of legumes/nuts, dairy alternatives, meat alternatives, dairy products [vegetarians and omnivores only] and meat/fish [omnivores only]) contributed about a quarter of total food costs, regardless of the type of diet (♦ Figure 1). For

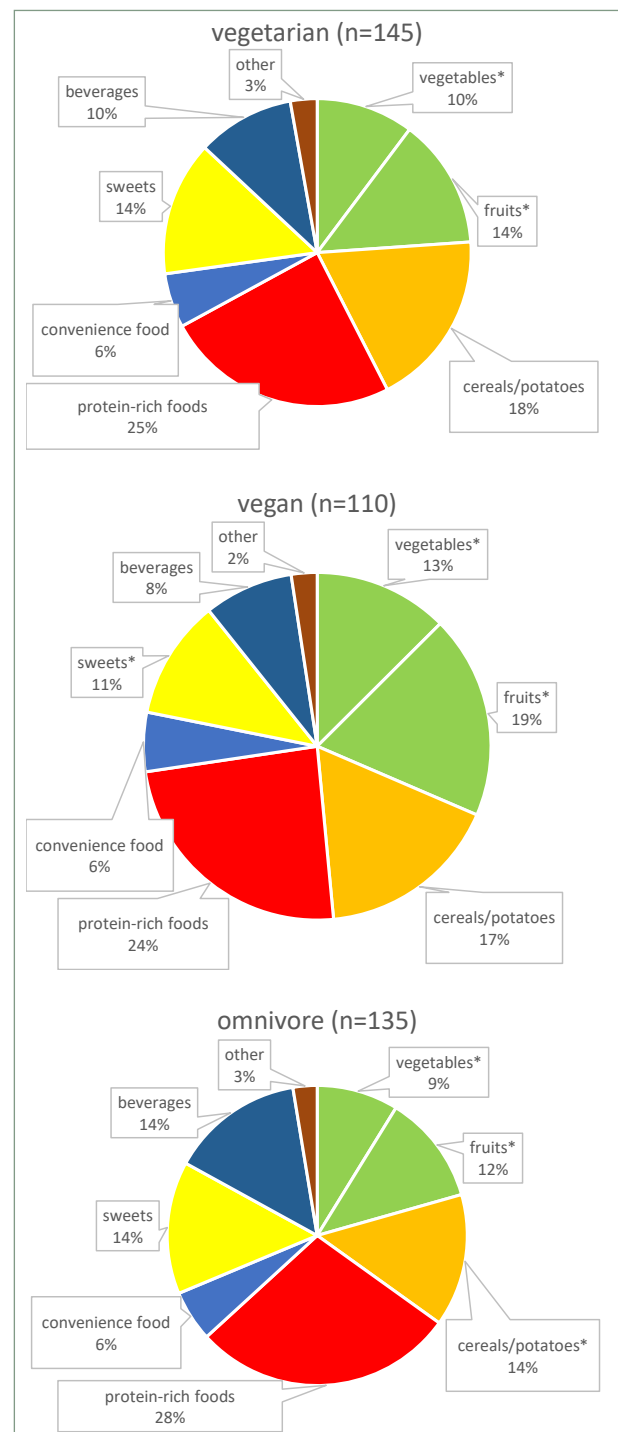


Fig. 1: Percentage costs of food groups in % of the total daily food costs of the participants of the VeChi Youth study (n = 390), stratified by diet type  
\* significant differences p ≤ 0.05

<sup>2</sup> These are additional benefits for children, such as participation in a free lunch at school or kindergarten, subsidising the costs of tutoring or membership fees in a sports club.

<sup>3</sup> BMI-SDS = Body-Mass-Index Standard-Deviation-Score



age	energy per day (PAL 1,4)		vegetarian		vegan		omnivore		ALG-II standard rate for food <sup>1</sup>	
	boys	girls	2,52€/1000kcal	2,98€/1000kcal	2,98€/1000kcal	2,83 €/1000kcal	2,83 €/1000kcal	2,83 €/1000kcal		
<b>food costs per day (PAL 1,4)</b>										
1 to <4 years	1200 kcal	1100 kcal	3,02 €	2,77 €	3,58 €	3,28 €	3,40 €	3,11 €	3,25 €	3,25 € <6 years
4 to <7 years	1400 kcal	1300 kcal	3,53 €	3,28 €	4,17 €	3,87 €	3,96 €	3,68 €	3,25 €	
7 to <10 years	1700 kcal	1500 kcal	4,28 €	3,78 €	5,07 €	4,47 €	4,81 €	4,25 €	3,55 €	3,55 € 6-13 years
10 to <13 years	1900 kcal	1700 kcal	4,79 €	4,28 €	5,66 €	5,07 €	5,38 €	4,81 €	3,55 €	
13 to <15 years	2300 kcal	1900 kcal	5,80 €	4,79 €	6,85 €	5,66 €	6,51 €	5,38 €	4,29 €	4,29 € 14-17 years
15 to <19 years	2600 kcal	2000 kcal	6,55 €	5,04 €	7,75 €	5,96 €	7,36 €	5,66 €	4,29 €	
<b>food costs per year (PAL 1,4) with subsidies for lunch at school and day-care<sup>2</sup></b>										
1 to <4 years	1200 kcal	1100 kcal	913,25 €	837,14 €	1.079,95 €	989,96 €	1.025,59 €	940,13 €	1.186,25 €	3,25 € <6 years
4 to <7 years	1400 kcal	1300 kcal	1.065,46 €	989,35 €	1.259,94 €	1.169,95 €	1.196,52 €	1.111,06 €	1.186,25 €	
7 to <10 years	1700 kcal	1500 kcal	1.293,77 €	1.141,56 €	1.529,93 €	1.349,94 €	1.452,92 €	1.281,99 €	1.295,75 €	3,55 € 6-13 years
10 to <13 years	1900 kcal	1700 kcal	1.445,98 €	1.293,77 €	1.709,92 €	1.529,93 €	1.623,85 €	1.452,92 €	1.295,75 €	
13 to <15 years	2300 kcal	1900 kcal	1.750,39 €	1.445,98 €	2.069,91 €	1.709,92 €	1.965,72 €	1.623,85 €	1.565,85 €	4,29 € 14-17 years
15 to <19 years	2600 kcal	2000 kcal	1.978,70 €	1.522,08 €	2.339,90 €	1.799,92 €	2.222,12 €	1.709,32 €	1.565,85 €	

<sup>1</sup>ALG-II standard rate: <6 years 285 €, 6-13 years 311 €, 14-17 years 376 € [1], of which the share for food and non-alcoholic beverages amounts to 34,70% [2]  
<sup>2</sup>reference: 252 work days 2022 in North Rhine-Westphalia

**Tab. 1: Daily food costs for children and adolescents, estimated using the food costs of the VeChi Youth Study (€/day) and the D-A-CH reference values (PAL = 1.4) for energy intake compared to the ALG-II standard rates for food D-A-CH = Germany, Austria, Switzerland; PAL = Physical Activity Level red background = ALG-II standard rates < estimated food costs**

omnivores, this included almost exclusively meat and dairy. Together with the costs of cereals/potatoes, vegetables and fruit, protein-rich foods accounted for about two-thirds of the costs, and even three-quarters in the case of vegan diets. The proportion of costs for sweets was significantly lower for vegans than for vegetarians and omnivores.

The comparison of the ALG-II standard rate for food with the calculated actual food costs (♦ Table 1), showed that the ALG-II standard rate for food is not sufficient, except of vegetarian children in the age group 1 to < 4 years and omnivore girls in the age group 1 to < 4 years.

Furthermore, our analyses showed that the ALG-II standard rate is too low also for families receiving a subvention for school/day-care lunch from the age of 10 onwards, with the exception of vegetarian girls. For vegan girls, a deficit was already found from the age of 7 onwards, for vegan and omnivore boys from the age of 4 onwards.

## Discussion

In our analysis, the vegetarian diet was associated with the lowest food costs. A vegan diet was not significantly more expensive than an omnivore diet. Our results are consistent with those of a recent study by Kabisch et al [11], which examined food costs for four-week sample menus using minimum retail prices.

It is not possible to identify individual food groups, which are responsible for the observed cost differences, since the shift from animal to plant-based foods affects the intake of different food groups. The high cost share of fruits and vegetables confirms the current state of the literature [12, 11].

Regardless of the type of diet, our analysis showed, in line with the results of Kabisch et al. [11], that the ALG-II standard rate for food is

not sufficient to cover the real food costs. The financial gap occurs especially among children and adolescents from the age of 10 onwards, since the standard rates of the different age groups do not reflect the age-specific progression of the reference values for energy intake of the DGE [13]. Thus, the energy requirement from 1 to 17 years increases by a factor of 2.2 for boys and 1.8 for girls, while the ALG-II standard rate only increases by a factor of 1.3. Taking into account energy intake of participants as well as the subvention of school/day-care lunch, our results showed, even for the least expensive diet, the vegetarian diet, a difference of € 0.41 (10–13 years) to € 1.13 (17 years) per day from the standard rate for boys with low physical activity (PAL = 1.4). The highest deviation was seen in vegan boys aged 15 and older, with 2.12 €/day.

It should be taken into account that our calculations of the subvention for lunch refer to 252 working days in 2022, of which only 193 are school days in North Rhine-Westphalia. Sickness days and corona-related cancellations of lessons can additionally worsen the situation for families who receive ALG-II.

This study confirms the result of a cost calculation and subsequent comparison with the ALG-II standard rate based on the *Optimierten Mischkost* (= Optimised Mixed Diet) from 2007 [14] and supports the recommendation of the *Wissenschaftlichen Beirat für Agrarpolitik, Ernährung und gesundheitlichen Verbraucherschutz* (WBAE) of the BMEL to review the calculation of standard rates for living costs [15].



A strength of our study is the detailed dietary data assessment, which allows estimating current and brand-specific food intake of children and adolescents as well as calculating minimum sales prices of food from supermarkets. However, additional costs for nutrition, e. g. for purchasing, storage and preparation, as well as the costs of food supplements were not taken into account. Hence, the actual differences between the ALG-II standard rates and the food costs can be even higher. On the other hand, the ranges of food costs for all three types of diet suggests that savings are possible by choosing cheaper alternatives. Whether food costs are associated with the quality of the diet should be evaluated in further analyses.

## Conclusion

A plant-based diet is not necessarily associated with higher costs. However, for families who are dependent on ALG-II, food costs are higher than the standard rates, regardless of the type of diet and even if they can get free lunches at school and day-care. In view of the current rising food prices, the situation is expected to worsen in the near future.

### Acknowledgements

The present analysis was financially supported by the EDEN Foundation, Bad Soden, Germany. The VeChi-Youth study (data collection, baseline data analysis) was commissioned by the 14th DGE Nutrition Report 2020 and published by the German Nutrition Society (DGE e. V.) and financially supported by the Federal Ministry of Food and Agriculture (BMEL), Germany. We thank the study participants of the VeChi-Youth study and their parents for their willingness to participate in the study. Our special thanks also goes to the staff of the study centers, whose helpfulness and commitment were indispensable for the conduct of the study.

### Conflict of Interest

The authors declare no conflict of interest.

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