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Customers Purchasing Organic Food - Do They Live Healthier? Results of the German National Nutrition Survey II

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Author's contribution

This work was carried out in collaboration between all authors. Author IH headed the project. Author MEW conducted the analysis and interpretation and drafted the manuscript. Author FW was involved in the early work and assisted with the interpretation of the results. Author TH was in charge of data management. All authors were involved in the critical revision of the manuscript for important intellectual content. All authors read and approved the final manuscript.

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ABSTRACT

Aims: Using national food consumption data this paper addresses issues whether buyers of organic food make healthier food choices and pursue a healthy lifestyle concerning smoking, physical exercise and body weight compared to non-buyers.
Study Design: The German National Nutrition Survey II (NVS II) is a nationwide food consumption study providing additional information on social demographics, health, and lifestyle aspects as well as anthropometric measurements. Using data of several assessment tools, a comparison was conducted between buyers and non-buyers of organic food.
Place and Duration of the Study: From November 2005 to November 2006, data collection took place in about 500 randomly chosen sample points across Germany.
Methodology: 13,074 participants aged 18-80 years were divided into groups of buyers (44.9%) and non-buyers (55.1%) of organic food. According to their purchase frequency, the organic food buyers were further differentiated into intensive, occasional or infrequent purchase groups. A diet history method was applied to assess food consumption, trained staff measured BMI while questionnaires were used for social demographic description and healthy lifestyle factors.
Results: Buyers of organic food consumed 17% more fruit and 23% more vegetables as well as

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less meat/sausages (25%) and soft drinks (58%) than non-buyers did (P< .001, resp.). These results are more pronounced for women and for intensive buyers. Additionally, buyers of organic food exhibit healthier lifestyle characteristics in respect to smoking behaviour, physical activity, and body weight compared to non-buyers.
Conclusion: German buyers of organic food demonstrate health behaviours complying better with the recommendations for a healthy lifestyle compared with non-buyers. Independent of the discussion whether organically produced food exerts additional health effects, buyers of organic food make healthier food choices than non-buyers, thereby benefiting for their overall health.

Keywords: Food consumption survey; organic food; food choice; healthy lifestyle.

1. INTRODUCTION

Data on market statistics exhibit raising growth of the global organic market although the numbers vary a lot between countries and regions [1]. The enormous increase of organic markets in many countries prompted numerous studies to gain more insights in the supply as well as the demand sector. In the latter case, a multitude of studies concentrate on customers' perception toward organic food and the factors explaining customers' decision-making process [2-13]. Summarizing these studies reveals that customer motivation for buying organic food is not homogenous. However, some motives are consistent, such as a high concern regarding personal and environmental health, including the aspect of food safety, and animal welfare [6,8,14-16].

In the focus of marketing research, these customer attitudes and motivations are relevant in order to understand and manage developments in the organic markets. From a public health point of view, interests concentrate on the connection of this health driven customer decision and other healthy lifestyle aspects. Emerging questions are whether organic food buyers compared to non-buyers make healthier food choices and whether health consciousness of organic buyers stated as purchase motivation is related to smoking, physical activity and body weight. These lifestyle factors are fundamental behaviour connected to risk management of major chronic diseases and therefore important indicators of overall health behaviour [17,18].

So far, there are only few studies investigating whether and how the stated interest in health of organic food buyers reflects in lifestyle behaviour. Regarding food choice, a study in Great Britain showed that, compared to official census data, 274 regular customers of organic food, who completed a diet diary, consumed more vegetables, fruit and cereals as well as less animal products with the exception of fish [19]. A Norwegian study obtained similar results studying 63,808 pregnant women by means of a food frequency questionnaire. Women with frequent organic food consumption were more in line with public recommendations for healthy eating [20].

Two other studies, conducted in Germany respectively Denmark, investigated eating habits using household panel data and expenditures on organic or conventional food. Households with heavy expenditure on organic food complied closer with the recommendations for a healthy diet [21,22]. However, the data resulted from food purchase of entire households rather than food consumption of individuals. The terms 'consumer' and 'purchaser' are often used synonymously in literature. Hughner et al. [10] emphasise the incorrect terminology in their overview on studies regarding the decision-making process for buying organic food. They mention that in all studies the term' consumer' is used relying on purchase data. In consequence, they demand the accurate differentiation between 'purchasers' (or 'customers') and 'consumers' of organic food as well as additional research on food consumption.

The French study of the Nutrinet-Santé cohort is the only study published so far comparing organic food consumer and non-consumer based on the assessment of food consumption of a large general population (n=54,311) [23]. For Germany, the National Nutrition Survey II (NVS II), a representative food consumption study, offers the required data for a sample of more than 13.000 participants. Besides the data on food consumption, the survey provides information on social demographics, health and lifestyle aspects as well as anthropometric measurements [24,25] and therefore allows the examination of differences in food choice as well as lifestyle characteristics between buyers and non-buyers of organic food in Germany.

2. METHODOLOGY

2.1 Data Collection and Description of Variables

The baseline study NVS II was commissioned by the Ministry of Food, Agriculture and Consumer Protection and the dietary assessment referred to in the present study was undertaken from 2005 until 2006 [24]. At about 500 randomly chosen sample points across Germany, the local register offices randomly selected 14-80 year old participants of which 18-80 year old participants were integrated in this evaluation. Computer assisted personal interviews were conducted at study centers to obtain basic socio-demographic information followed by a computer assisted diet history interview. The diet history method is a dietary assessment instrument asking directly for the habitual food consumption [26,27]. As software DISHES (Diet Interview Software for Health Examination Studies) was used, a program developed by the Robert Koch-Institute, Berlin [28,29]. The standardized interviews lead participants through the sequence of meals of a day followed by questions on the frequencies of consumed food. Participants also completed a questionnaire on health-related aspects and leisure time activities. Additionally, anthropometric measurements were conducted at the study centers [24]. During data assessment, participants and interviewers were not aware of the future research question regarding organic purchase. This diminishes a possible response bias.

There was no specific differentiation for the consumption of organically or conventionally produced food. By means of a questionnaire, participants were classified into buyers and non-buyers based on the question: Do you buy organic food? (yes/no). Furthermore, buyers were asked to give detailed information on the frequency of their purchase of twelve organic food items. The frequencies were coded with points and a ratio was achieved by dividing the sums of points by the number of given answers to correct for the possibility that no answer was given or a person did not eat/drink a food item. Based on the ratios buyers were divided in either the intensive, occasional or infrequent purchase group.

Social class was defined as an interrelation of several factors, so an index was generated based on the degree of education, the employment status of the household's principle earner, and the monthly net income of the household. Individuals were classified according to these characteristics by a point system [24]. The answers to four questions, (1) arrangement of food items perceived as important for a healthy diet, (2) classification of probiotic yoghurt, (3) classification of ACE-beverages and (4) comprehension of the 5-a-day campaign, from the questionnaire were combined to a 'NVS II nutrition knowledge index'. Information about smoking (yes/no) and physical activity (yes/no) was retrieved according to statements from a questionnaire. Body Mass Index (BMI) was calculated dividing weight into kilograms by height in square meters. In order to classify the BMI, the WHO definition was employed [30].

The consumption of fruit, vegetables, meat and sausages as well as sweets and soft drinks serves as indicator for a healthy food pattern. Food consumption data were evaluated and compared with the dietary guidelines of the German Nutrition Society [31,32].

2.2 Data Analysis

For descriptive analysis, Pearson's Chi-square test was applied to 2x2 contingency tables, testing for independence of two criteria. For multiple comparisons, the Bonferroni correction was subsequently used. Food consumption was calculated as arithmetic mean (± standard error of mean). The presentation of the means instead of medians was chosen because several food groups were consumed by less than 50% of the participants. Consumption data did not show normal distribution and could not be normalized by log-transformation, thus non-parametric tests were carried out. The Mann-Whitney-Wilcoxon test was applied to compare food consumption of buyers and non-buyers of organic food. Kruskal-Wallis test was used to compare more than two groups.

Statistically significant differences were defined at the p-level of ≤ 0.05. Calculations were performed with SAS program version 9.2. (SAS Institute Inc., Cary, North Carolina, USA).

3. RESULTS

Of the 13,074 participants 44.9% stated to purchase organic food whereas, 55.1% did state not to do so. The frequency of purchasing organic food revealed a proportion of 5.1% intensive, 26.2% occasional and 13.6%

infrequent buyers summing up to the 44.9% of total buyers.

3.1 Social Demographic Description

More women (54%) than men participated in the NVS II; sex difference was even more pronounced regarding buyers of organic food with 61% being female. The more intense the organic purchase the higher the proportion of women: 67% intensive, 61% occasional and 59% infrequent buyers of organic food were female. In the non-buyer group, sex difference was almost balanced (49% female vs. 51% male).

The comparison of age categories revealed that the proportions of the youngest (age 18-24) and the senior participants (age 65-80) were bigger in the non-buyer-group than in the buyer-group and vice versa in the age groups of 35-50 and 51-64 years. There was no difference in the age group of 25-34 years (Fig. 1). The group of intensive buyers reached the highest average age of 52.4 years compared to 49.5 years for the occasional buyers, 47.9 years for the infrequent buyers and 48.4 years for the non-buyers (P< .001, resp.).

Regarding social class affiliation more buyers of organic food belong to the two upper classes (60%) compared to non-buyers (44%) (Fig. 2). The proportions of the two lowest classes sum up to 14% for buyers and to 24% for non-buyers. Every social class is represented in the three frequency groups of organic food purchase (intensive, occasional, infrequent).

3.2 Food Consumption

Analyses of the diet history interviews revealed that mean usual consumption of fruit of participants buying organic food was 17% higher than the consumption of non-buyers (P < .001) (Fig. 3, by sex). Half of the organic food buyers (50%) met the dietary guideline of the German Nutrition Society of 250 g fruit per day [31,32], while 40% of the non-buyers met the guideline (P < .001). Regarding the frequency of the organic purchase 65% of the intensive, 52% of the occasional and 42% of the infrequent buyers met the recommendation (P < .001, resp.). Differentiated by sex 54% of all female organic

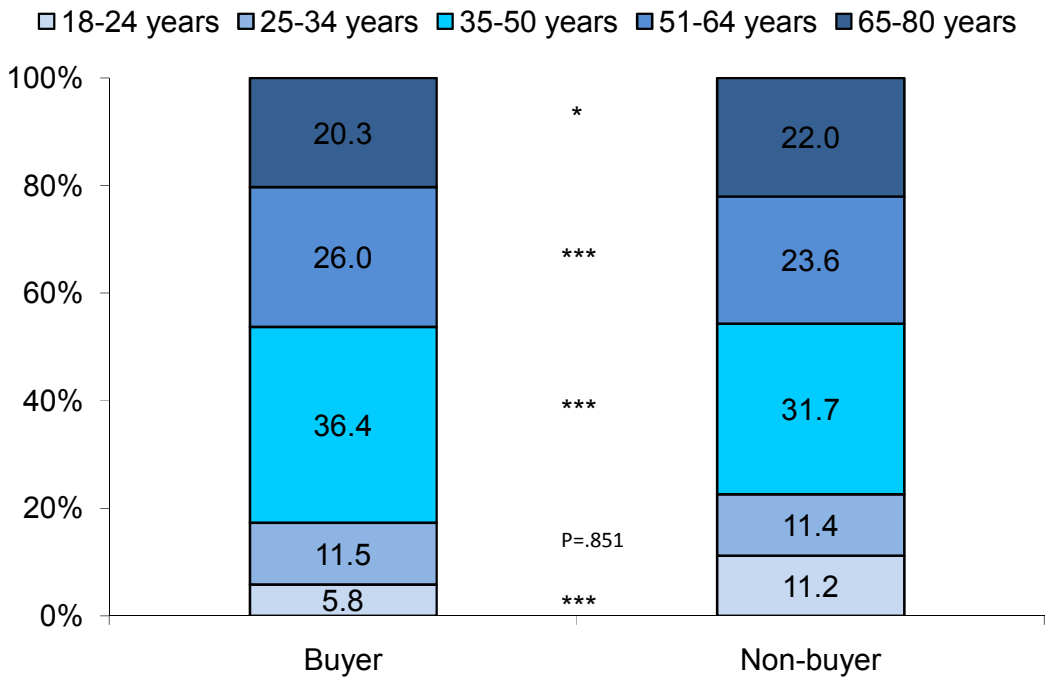

Fig. 1. Buyer (n= 5875) and non-buyer (n= 7199) of organic food by age group
**** P < .001, * P <.05*
Comparisons are based on Chi square test, Bonferroni correction

buyers and 44% of all male organic buyers consumed at least 250 g/d fruit (non-buyers: 45% for women and 36% for men). There were significant differences between female organic buyers and non-buyers as well as between the male organic buyers and non-buyers (P < .001, resp.).

For women and men, mean consumption of vegetables was 23% higher for the organic food buyer group than for the non-buyer group (P < .001) (Fig. 3, by sex). The German dietary guideline for vegetable consumption of at least 400 g per day [31,32] was reached by 18% of all organic food buyers and by 10% of all non-buyers (P < .001). The proportion of meeting the recommendation within the three frequency groups of organic food purchase was 27% for intensive, 19% for occasional and 14% for infrequent buyers (P < .001, resp.). Differentiated by sex, 20% of the women and 16% of the men of the organic food buyers met the recommendation compared to 11% female and 10% male non-buyers (differences between female buyers and non-buyers as well as male buyers and non-buyers: P < .001, resp.).

Organic food buyers consumed 25% less meat and sausages than non-buyers of organic food (P < .001) (Fig. 3, by sex). The German dietary guideline for meat and meat products is 300 to 600 g per week [31,32]. Of all organic food buyers, 48% exceed the recommendation compared to 64% of the non-buyers (P < .001). This was the case for 33% of the intensive buyers compared to 48% of the occasional and 53% of the infrequent buyers (P < .001, resp.). The proportion of women exceeding the recommendation was 35% for organic food buyers and 45% for non-buyers (P < .001) while the proportion of men exceeding the recommendation was 68% for buyers of organic food and 81% for non-buyers (P <.001).

All men regardless of buying organic food and in which frequencies, consumed comparable amounts of sweets while organic food buying women ate fewer sweets (45 g/d) than non-buying women (48 g/d) (P < .05) (Fig. 4). Female intensive buyers consume the least sweets (41 g/d), followed by female occasional buyers (45 g/d) and female infrequent buyers (48 g/d) (P < .001, resp.). Buyers of organic food consumed 58% less soft drinks (like soda and ice tea) than non-buyers (P < .001) (Fig. 4, by sex).

However, a high proportion of all participants did not drink soft drinks at all: 77% of organic food buyers and 65% of non-buyers (P <.001). Considering only the consumers of soft drinks,

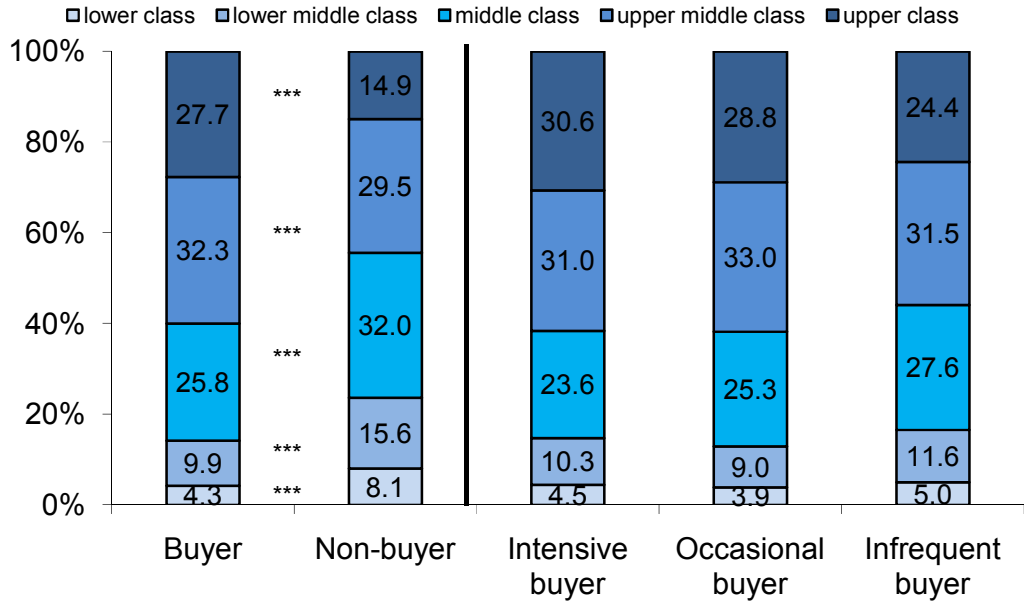

Fig. 2. Buyer (incl. sub-groups) and non-buyer of organic food by socialclass, intensive (n= 661), occasional (n= 3428), infrequent (n=1786)

**** P < .001; Comparisons are based on Chi square test, Bonferroni correction.*

the recorded quantities of the buyers were still 37% less than the quantities of the non-buyers of organic food (P < .001). The average soft drink consumption of women buying intensive, occasional and infrequent organic food were 163 ml/d, 226 ml/d and 260 ml/d, while women belonging to the non-buyer group consumed 313 ml/d (P< .001, resp.). The corresponding consumption in men was 345 ml/d (intensive), 310 ml/d (occasional), 329 ml/d (infrequent) and 505 ml/d for non-buyers (P < .001, resp.).

Altogether, organic food buyers more often met the food-based dietary guidelines of the German Nutrition Society [31]. Consequently, the absolute nutrient intake as well as nutrient densities of buyers of organic food corresponded better to the recommendations than those of the non-buyers [33] (data not presented).

3.3 Health Aspects and Anthropometric Measurements

Buyers of organic food more often were non-smokers and vegetarians and indicated more often to be physically active (Table 1). In addition, organic food buyers more often were interested in nutrition information and achieved a higher score in the NVS II nutrition knowledge index. More frequently, they stated to be satisfied with their personal health status. Within the buyer group, the proportion of normal body weight was higher and the proportions of overweight and of obese participants lower than in the non-buyer group. This was also the case for women and men respectively (with the exception of the male overweight participants) (Fig. 5).

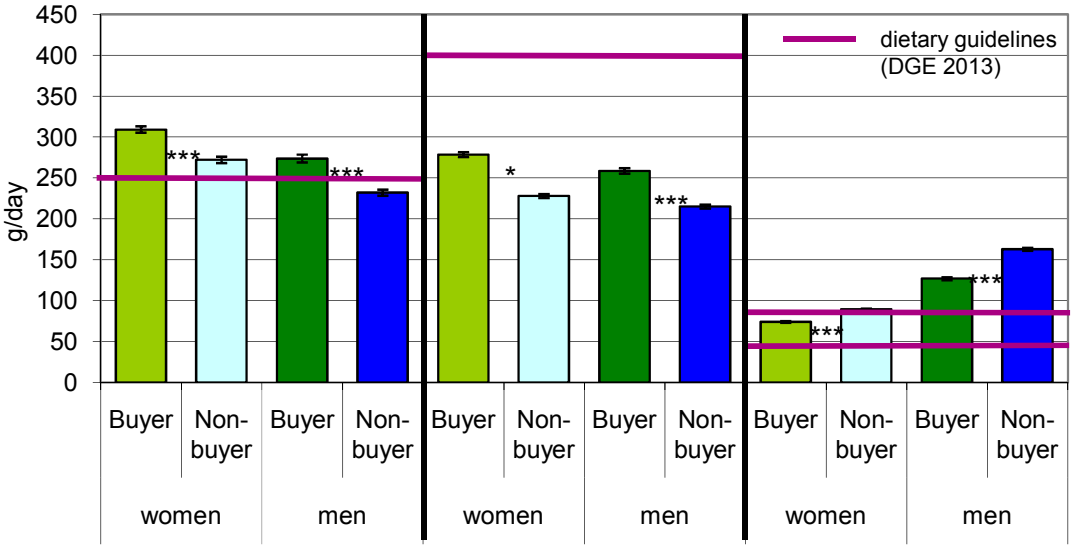

Fig. 3. Mean consumption (± SE) of fruit, vegetables and meat/sausages of buyer and non-buyer of organic food, by sex Buyer: women (n=3577), men (n= 2298); Non-buyer: women (n= 3536), men (n= 5961)

**** P < .001; Comparisons are based on Mann-Whitney-Wilcoxon test.*

Table 1. Lifestyle factors of buyers and non-buyers of organic food

Percentage of purchase group[1]	Buyers	Non-buyers
	n=5875	n=7199
Non smoker	80,0	71,0
Being physical active (yes/no)	66,0	52,0
Vegetarian	1,8	0,3
Interest in nutrition information	84,0	64,0
High score in the NVS II nutrition knowledge index	39,0	23,0
High satisfaction with personal health status	78,0	74,0

[1]*differences between the purchase groups in every case: P < .001; Comparisons are based on Chi square test*

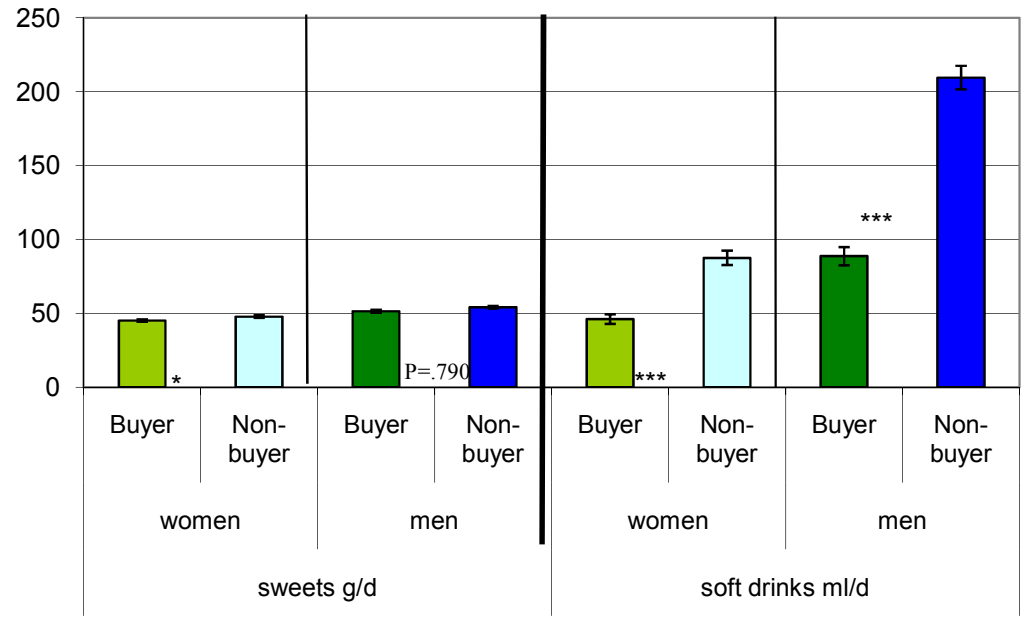

Fig. 4. Mean consumption (± SE) of sweets and soft drinks of buyer and non-buyer of organic food, by sex buyer: women (n=3577), men (n= 2298); non-buyer: women (n= 3536), men (n= 5961)

**** P < .001, * P <.05; Comparisons are based on Mann-Whitney Wilcoxon test.*

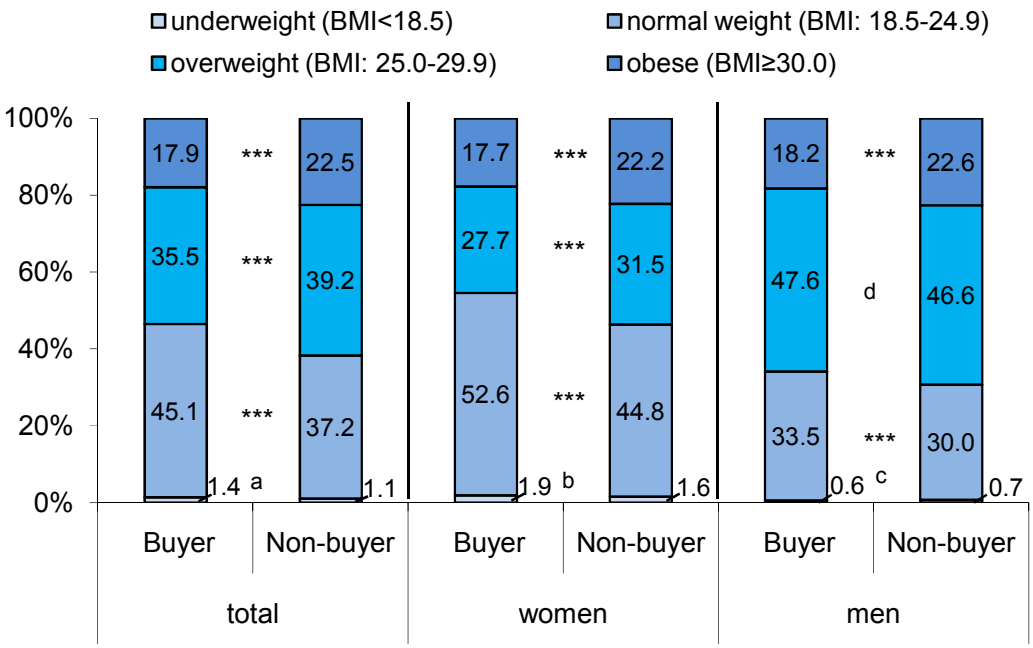

Fig. 5. Organic food buyer and non-buyer by body weight (BMI) and sex organic food buyer: women (n=3577), men (n= 2298);Non-buyer: women (n= 3536), men (n= 5961)

**** P < .001, [a]P=.178, [b] P=.277, [c]P=.675, [d]P=.473;*
Comparisons are based on Chi square test, Bonferroni correction

4. DISCUSSION AND CONCLUSION

With the data of the NVS II, the nationwide representative nutrition survey for Germany, a comparison between buyers and non-buyers of organic food was conducted focusing on food consumption and lifestyle factors. The results show that, compared to non-buyers, German buyers of organic food eat more fruit and vegetables, less meat and sausages and therefore demonstrate a more favorable food choice. This food pattern is more in line with national and international recommendations [31,34-38]. These results apply to both, women and men, while women do even better. The more intense the purchase of organic food the more favorable the food choice turns out to be. Additionally, buyers of organic food decide to lead a healthier lifestyle as indicated by lower body weight, higher level of physical activity and less smokers than non-buyers.

The French web-based cohort study from a large sample of volunteers identified five clusters, two of them comprising occasional and regular organic food consumers [23]. The comparison of food consumption, assessed with three 24-h recalls, between non-consumers and consumers of organic food revealed that food patterns of organic food consumers show a higher agreement with dietary guidelines, which gets even better with increasing frequency of consumption. In addition, the presented results regarding body weight were confirmed by the French study.

A higher percentage of normal body weight in the organic food group was also found in the Norwegian study with pregnant women [39]. In 1998, a comparison in the Netherlands between a sample of 271 customers of health food stores and a nationwide household sample (n=581) showed that organic food buyers displayed the lowest BMI [40].

Healthy food choices, normal body weight, being physically active, as well as non-smoking contribute substantially to a healthy lifestyle [18]. There is a robust understanding of links between healthy lifestyle factors and a lower risk of developing diabetes, heart disease, and cancer. In the EPIC-study, the lifestyle factors healthy diet, non-smoking, high level of physical activity and normal body weight are associated with a reduced risk of developing diabetes (93%), myocardial infarction (81%), stroke (50%) and cancer (36%) compared to participants who do not indicate any health factors [41]. Data of the NHANES study in the United States show the impact of three lifestyle factors (healthy diet, non-smoking and being physically active) with a risk reduction of 65% for cardiovascular disease and 83% for cancer [17]. Other studies also confirm these findings but are even more specific for special diseases like heart disease [42] and diabetes mellitus [43]. The four lifestyle factors (healthy diet, non-smoking, high level of physical activity and normal body weight) also proved responsible for a risk reduction of 66% regarding the endpoint all-cause mortality [44]. Ford et al. [17], found strong relationships for three lifestyle factors (healthy diet, non-smoking and being physically active) and all-cause mortality with an 82% risk reduction compared to participants without an indication of health factors.

The outcome is not to be confused with the question whether health effects of organically produced food compared to conventionally produced food are evident. Related research concentrates on differences in health effects of foods from the two farming systems and is discussed elsewhere [45-51]. Instead, the data set of the NVS II allows the comparison of food consumption and lifestyle factors of buyers and non-buyers of organic food. The results show overall better health behaviour of buyers of organic food.

The presented finding that for the German population from 2005-2006 45% are buyers and 55% were non-buyers differs from results of the 'Ökobarometer'. The 'Ökobarometer' is an annual assessment initiated by the Federal Ministry of Food, Agriculture and Consumer Protection of Germany. For the years 2005 and 2007 the data collection indicated about 75% of the interviewed participants (about 1.000 participants starting at age 14) buying organic food in different frequencies [52,53]. In contrast, the German household study with a sample of 13,000 totaled 50% as buyers for 2008 [21] showing an increase from 36% of the same household panel in 2005 [54]. Thus, the finding of the present study that 45% of for the German population bought organic food in the year 2006 is in a comparable range with the household study 2008 regarding sample size and percentage of organic purchase.

Socio-demographics are used to test how the profile of the organic buyers of the NVS II compares to other international and German studies. The finding that women are generally

more engaged in health and nutrition has often been demonstrated [10,14,23,55,56]. Participants with a higher social status, i.e. higher level of education and income, have also more often been linked to intensive organic purchase behavior [2,23,54,57,58], while age is a factor with no clear association [10,14,39,54]. In summary, concerning socio-demographic variables the findings of the present study are in concordance with other studies on organic buyers.

All 13,074 participants underwent a personal interview regarding their usual food consumption of the last four weeks using the diet history method. The advantage of this dietary assessment method is the focus on long-term dietary habits while limitations comprise the cognitive effort to remember all consumed food and beverages of the last four weeks [26,59]. Especially the answers for inhomogeneous food groups, like vegetables and pastries, may be affected by either social desirability or incapability of memorizing complexity [60]. As the limitation of this assessment method applies to both study groups, it should not affect the comparison between buyers and non-buyers of organic food.

As strengths of the presented study has to be seen the sample size of 13,074 participants and the representative database for Germany. Together with the French cohort [23], two studies with the general population are available being in accordance regarding the main results that consumers buying organic food display dietary patterns more in line with dietary guidelines. Additionally, with both studies body weight was assessed demonstrating that buyers of organic food display lower body weight than non-buyers. A limitation of both studies is the cross-sectional design. The data only represent a situation for a specific moment. Therefore, causes and effects cannot be differentiated. Whether the effort for a healthier nutrition leads to the purchase of organic food or buying organic food leads to healthy choices cannot be determined and causalities cannot be deduced.

The results of the presented study demonstrate for the German population that buyers of organic food make healthier food choices and their lifestyle is closer in line with recommendations for a healthy living. In doing so, subjects probably reduce their personal risk regarding several major diseases. Whether consumption of organic food has an additional positive influence on health is still under scientific debate. From a public health point of view, organic food buyers lead a way of life closer to the recommendations for a healthy lifestyle and thereby profit by scientifically well-established health benefits and risk reductions.

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COMPETING INTERESTS

The authors have declared that no competing interests exist.

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