

Functional foods with cardioprotective effects

An analysis of willingness to pay in the German general population

Jenny Hofmann⁺, Franziska Jung⁺, Claudia Wiacek, Peggy G. Braun, Claudia Luck-Sikorski⁺⁺, Steffi G. Riedel-Heller⁺⁺

Abstract

Worldwide cardiovascular diseases are the number one cause of death of most people. Foods, which aim for a healthier way of eating and lessen the risk of cardiovascular diseases, are playing a more and more important role. The aim of this study is an analysis of the general German population regarding its acceptance towards functional foods with cardioprotective effects and their willingness to pay for this type of food.

In sum 1 007 people were questioned via telephone interviews about their general health behavior, knowledge about, attitudes toward and willingness to pay for functional foods with cardioprotective effects. Willingness to pay was analyzed by the van Westendorp method.

Participants showed little knowledge about cardioprotective foods. The analysis of willingness to pay suggests, that an interest by the general public for this kind of product does exist. The amount of interest differs between sex and income. The results indicate that the advantages of functional foods with cardioprotective effects have to be better communicated to overcome possible doubts and concerns. **Keywords:** functional food, cardioprotection, cardiovascular diseases, willingness to pay, consumer acceptance

Introduction

Cardiovascular diseases (CVD) are the number one cause of death. According to the Global Burden of Disease (GBD) study 17 million people die each year from CVD and that amounts to 31.5% of all death cases [1]. It is estimated that CVD alone are causing costs of € 210 billion in the EU region [2]. 53% (€ 111 billion) of those are direct costs of the general health system [2].

Multiple factors play a role in the development of cardiovascular events. These events can be cate-

gorized into behavioral risk factors (unhealthy nutrition, low physical activity, consume of tobacco and alcohol), cardiometabolic diseases (e.g. hypertonie), diabetes mellitus type 2 and fat metabolism disorder [3, 4]. In the year 2015, diet-based factors had the biggest impact on the cardiovascular risk of mortality in both sexes in the EU [2].

The term cardioprotection sums up mechanisms that foster a healthy state of the heart by reducing or even preventing myocardial damages [5]. The main components of a cardioprotective nutrition are complex carbohydrates, nuts, fruits, vegetables, fish, lean meat, red wine and other products rich in unsaturated fatty acids [6]. These foods are often low in energy density and rich in micronutrients with antioxidant capabilities [6].

Furthermore, tailor-made functional foods (known since the mid 1980s) while serving as a source of energy and nutrition (e.g. n-3 fatty acids) can have additional positive effects on physiological functions of the body (cardiovascular system) and thus yield benefits for preventing CVDs [7, 8].

Consumer acceptance of this type of food is not well-known, but it can be assumed that price is an important factor for willingness to pay. From a consumer point of view a lower food price is connected with

Citation:

Hofmann J, Jung F, Wiacek C, Braun PG, Luck-Sikorski C, Riedel-Heller SG (2018) Functional foods with cardioprotective effects. An analysis of willingness to pay in the German general population. *Ernahrungs Umschau* 65(3): 54–63

This article is available online:
DOI: 10.4455/eu.2018.011

—
⁺ divided first authorship
⁺⁺ divided last authorship

higher returns because ones budget can be allocated for other expenses [9]. In addition, consumers in Germany expect a minimum base quality from all foods guaranteed by federal and local state control mechanisms, laws and general rules of food safety. If on the other hand price is perceived as an indicator for higher product quality (e.g. taste, easy to digest) higher prices can be seen positive by consumers. Higher prices are also accepted when associated with ethical standards in food production.

Until now very few studies exist that examine consumers' willingness to pay for functional foods. A study by SIEGRIST et al. [10] showed that consumers from China had a much higher willingness to buy functional foods and beverages than their German counterparts (65% vs. 16.3%–28.9%, respectively). One characteristic of the German consumers in this study was that a stated health benefit of a food product even lessened the willingness to buy. 42% of the participants showed a lesser willingness to buy for yoghurt that could reduce the risk of CVDs than for yoghurt without additional health benefits. The authors believe that the German consumers either do not believe the stated health benefit or that they are afraid that the benefits come with lesser preferred taste of the yoghurt.

A recently published market analysis about functional cardioprotective foods in Germany has shown that this market has substantial potential because of low market penetration of functional foods (1.6% with milk and egg products, 1.9% with meat products) [11]. There is no information about the willingness to pay for these kinds of foods. With regards to consumption data of regular eggs and sausages and cold meat it is obvious that these foods should not be lost out of sight while developing functional foods – especially because of the negative physiological effects of their regular counterparts. Enhancement of car-

dioprotective characteristics can be obtained by enrichment with vitamin D in eggs (by utilization of ultra-violet light in henhouses) or by adding polyunsaturated fatty acids to the poultry feed [12]. An optimization of the fat content in sausages and cold meat is possible by using polyunsaturated fatty acids.

Aim of this study

The presented work examines the attitudes of the German population towards functional foods with cardioprotective effects and discusses the willingness to pay for two specific products of this kind.

Method

Sample

The sample is based on a representative computer-assisted telephone interview study conducted by USUMA GmbH (a social research and market analysis company) in Germany. The interviews were conducted by specifically trained personnel. The sampling was based on landline users without any mobile phone users. In due consideration of the Gabler-Häder-procedure it was possible to include even consumers without listings in telephone books. This procedure is a custom-made sampling design that generates more telephone numbers by omitting or adding new digits to already listed numbers. Usually, the last two existing digits are omitted or changed [13]. Phone numbers from all over Germany were drawn by regional stratifications and the Kish-Selection-Grid¹ was used to ensure a random sample of the contacted households without any selection from the interviewer and therefore to allow for representativeness.

Overall 2,045 people were contacted. Due to refusal, absence or breaking off the interview, the final sample consists of 1,007 people (49.8%). The study was approved by the Ethics Board of the medical department of the University of Leipzig.

Scales and tools for data collection

Besides socio-demographic data, state of knowledge and level of awareness regarding cardioprotective foods were questioned (e.g. if the participants even know the term “cardioprotective food”). Subsequently, a standardized definition of the term (♦ overview 1) was presented to all participants to ensure that the state of knowledge was the same in the entire sample and that there is no unknown ongoing consumption of cardioprotective food. On a scale from 1–5 (1 = never, 5 = always) participants were asked how often they buy cardioprotective food. Food patterns and diets were surveyed (no restrictions, vegan, vegetarian).

Willingness to pay was inquired by employing vignettes² for two fictional specific type of functional foods with cardioprotective effects. The used vignettes were a package of a sausage product and a box containing 10 eggs, both products enriched with functional ingredients (♦ box). The participants were either questioned about the sausage product or the eggs (sausage product n = 500, eggs n = 500). The sampling was conducted with regard to prior inquired food patterns and was further randomized with computer assistance to ensure normal distribution.

The analysis of willingness to pay was conducted with the van Westendorp method³ (price-sensitivity-measurement) [14] and consisted of four questions (♦ overview 1). No pre-defined price scale was presented and thus the participants were not influenced in answering

¹ Randomization procedure that states which people to contact with regard to household size.

² A vignette is a description of a fictional product in a social-scientific study.

³ Method for direct measurement of willingness to pay and price sensitivity of consumers.

the questions. They were only cued by a price set point as an orientation (average, market-conform price of sausage products and eggs without any cardioprotective effects based on own research). The van Westendorp method was chosen because it is easily applicable during a telephone interview and it is very robust with regard to extreme outliers (i.e. extreme price points) [14]. A so-called “psychological price” is ascertainable which takes into account that a “low price” reflects “a low product quality” and thus delivers an indicator for perceived product quality. The van Westendorp method is an established price-model that is often used in market research [15]. Furthermore, a brief questionnaire with six questions regarding health-conscious food patterns was used – the Health-Diet Awareness/Interest Index which was translated into German (♦overview 1) [16]. Filling out this questionnaire was done by responding to certain statements or questions on a scale from 1–5 (1 = fully disagree, 5 = fully agree). Cronbach’s Alpha⁴ for reliability was calculated ($\alpha = 0.824$) and yielded a good internal consistency. For further analysis, sum scores were calculated based on the replies to all six questions. The higher the sum score the more health conscious the food and diet patterns of the respondents are.

Data Analysis

All data were analyzed using STATA Version 14.0 [17] and SPSS Version 23 [18]. Cases with missing values were excluded from further analysis, thereby reducing the sample size. Missing value analysis concerning socio-demographic data showed no patterns with regard to education or sex. The variable for education was based on the German education system (no diploma, diploma after 8/9 years, diploma after 10 years and diploma after 12/13 years). Statistical analysis of these socio-demographic variables included linear regressions to test for possible cor-

Vignettes: product specification

Sub-sample “sausage product”: “It is a sausage (250 g pack) with reduced fat content and additional fiber or protein source. About 1/3 of the fat content of the meat was replaced by vegetable proteins. The meat content of the product remains the same. For comparison: a usual 250g pack of a sausage product costs € 2.00 on average.”

Sub-sample “eggs”: “These are eggs with a high vitamin D₃ content to naturally counteract vitamin D deficiency. For this purpose, chickens in barn systems are exposed to light similar to natural UV- containing sunlight. For comparison: a 10-pack of free-range eggs costs € 1.60 on average.”

relation between socio-demographic status and willingness to pay or rather to find any other relationship between the variables mentioned above. Question for price “expensive” was chosen as dependent variable (♦overview 1), since this is the highest possible price consumers were willing to pay. Independent variables were sex, age, income, education, and the sum score of the “Health-Diet Awareness/Interest Index” (♦overview 1). For each sub-sample (sausage product vs. eggs) separate linear regressions were performed.

Results

Descriptive analysis

♦Table 1 gives an overview of all socio-demographic characteristics of the sample. Since only cases were included that had answered all four questions regarding price, the sample size had to be reduced down to $n = 467$ overall (sub-sample “sausage product” $n = 234$; sub-sample “eggs” $n = 233$). There are no significant differences between the two sub-samples regarding any socio-demographic characteristic. Sum score “health consciousness” has a mean value of 20.7 over the entire sample (sub-sample “sausage product”: 20.9; sub-sample “eggs”: 20.4), which demonstrates an overall high level of health consciousness.

The majority of the respondents in both sub-samples does not know what the term “cardioprotective food” actually means (♦table 2). After giving them a standardized explanation of the term, still 56.8% of the respondents in sub-sample “sausage product” say that they do not buy this type of food. In the sub-sample “eggs” 62.8% do not buy functional food. Only shy of a quarter or a fifth, respectively are sometimes, often or always buying (functional) food with cardioprotective effects (“sausage product”: 23.2%; “eggs”: 18.2%).

Analysis of willingness to pay

♦Table 3 shows the mean prices in € gained from the four price questions during the van Westendorp method (willingness to pay). ♦Figure 1 and 2 show the relative frequencies of the stated prices that were used to calculate an optimal price and a consumer accepted price range for the products (fat-reduced sausage product and eggs as Vitamin-D₃-source). The optimal price for eggs with cardioprotective effects was € 2.20 with a price range of € 1.90–2.50. The cardioprotective sausage product has an optimal price of € 2.80 and a price range of € 2.00–3.00.

⁴ Cronbach’s Alpha describes how questions and statements of a scale relate to each other.

**OVERVIEW 1: SUMMARY OF SCALES AND ITEMS
 AS PART OF THE STUDY DESIGN**

socio-demographic information & dietary habits

Do you know the term “cardioprotective food”?

Definition: Cardioprotective food may be fortified with specific vitamins or minerals or may include fewer unhealthy ingredients. Some researchers believe that cardioprotective food may help to maintain a healthy heart and promote wellbeing and overall health. Often, those products are characterized by low levels of cholesterol, low levels of saturated fat or contain less salt than usual food products. These products are generally low in cholesterol, fat or salt.

How often do you buy cardioprotective food products?

willingness to pay – analysis

1. At which price are you beginning to experience the product as cheap? [cheap]
2. At which price are you beginning to experience the product as expensive? [expensive]
3. At which price are you beginning to experience the product as too expensive – so that you would never consider buying it yourself? [too expensive]
4. At which price are you beginning to experience the product as too cheap – so that you have doubts about the health benefit? [too cheap]

Health-Diet Awareness/Interest Index

1. My eating habits are healthier than others I know.
2. I consider myself health conscious.
3. I am interested in using food to maintain good health.
4. I am interested in using food to prevent disease.
5. I am knowledgeable of the health benefits of the foods I eat.
6. I usually look for health information when I buy food products.

Regression analysis of willingness to pay

◆ Table 4 shows the model of relationships between the socio-demographic variables and willingness to pay.

Regression analysis showed that only sex and income have an influence on willingness to pay for a cardioprotective sausage product ($R^2 = 0.10$; $F(5, 222) = 4.91$; $p \leq 0.001$). The female respondents are willing to pay a higher price than their male counterparts and the higher the household income, the higher the willingness to pay. It is important to mention that willingness to pay does not increase proportionally to the household income. Willingness to pay was the lowest for respon-

dents with a monthly household income between € 1,500–2,000. Willingness was slightly higher in the household with lower and higher household income (◆ figure 3). No significant differences were shown for age, education and health consciousness in the sample. In the sub-sample “egg” none of the mentioned socio-demographic variables had any significant influence ($R^2 = 0.01$; $F(5, 228) = 0.59$; not significant).

Influence of sex on willingness to pay can be shown with further analysis. ◆ Table 5 clearly shows that women expect a higher “best” price if they do not want to question the product’s health benefit (“too cheap” € 1.55 and “best” € 2.63

compared to € 1.44 and € 2.43 for men, respectively). In addition, female respondents are willing to pay a higher price even if this price is perceived as “expensive” (◆ Table 5). Calculations of effect sizes (Cohen’s effect size⁵) of the significant price questions show small and medium effects ([19], p. 606). Because there are no significant differences in the sub-sample “eggs” no analysis of influence of socio-demographic factors on willingness to pay was performed.

Discussion

State of knowledge and buying behavior

The aim of this study was to measure the attitude of the German population towards (functional) food with cardioprotective effects. It was shown that on average only 19.5% of the respondents knew the term “cardioprotective food”. This is similar to the findings of MENRAD and SPARKE that showed that 20.7% of their respondents had heard of the term “functional food” [20]. Although consumers are more and more confronted with the subject of cardioprotection, one should be refrained from using wordings that are too “scientific”, when talking about benefiting factors for the heart’s health of food and dieting patterns. Terms that are too scientific or incomprehensible may hinder the consumer from buying and might increase their skepticism towards functional foods, even if the product is perceived positively with regard to price or taste.

With regard to buying behavior the results of this study indicate that more than half of the respondents do

⁵ Cohen’s effect size (d) describes the effect size of mean differences between two groups and helps to interpret the significant differences of mean values; d between 0.2 and 0.3 indicates a small effect, d between 0.5 and 0.8 indicates a medium effect and d > 0.8 indicates a large effect.

Variable	Sub-sample „sausage product“		Sub-sample „eggs“		German general public
	n = 436	%	n = 435	%	%
gender					
female	210	48.2	221	50.8	51.0
male	226	51.8	214	49.2	49.0
age (years)					
< 20	12	2.9	9	2.2	18.8
21–40	92	22.1	82	20.3	24.3
41–60	154	36.9	164	40.5	31.0
61–80	147	35.3	131	32.4	20.8
education					
highschool students	3	0.7	/	/	3.5
8/9 years of school	95	21.8	98	22.5	37.0
10 years of school	136	31.2	145	33.3	28.8
12/13 years of school	200	45.9	192	44.1	25.8
no educational qualification	2	0.5	/	/	4.1
„Who is responsible for food shopping?“^a					
	overall		men		women
myself	550		259		291
partner/husband	168		122		46
children	1		1		0
parents	36		23		13
other	2		0		2
Health-Diet Awareness/Interest Index – overall sample					
range (sumscore): 6–30					
M(SD): 20.7 (5.2)					

Table 1: Summary of socio-demographic characteristics of the overall sample
^a multiple responses allowed
 M = mean value; SD= standard deviation

not buy functional foods with cardioprotective effects. Results from a survey from 2013 showed that (projected for 70.21 million people) 84% of the German population have never bought functional food [21]. The differences might exist on one hand because of the difference in marketing of each product (e.g. different health claims) and on the other hand because of an increase in overall revenue for functional foods in the last couple of years.

Willingness to pay

The consumption of functional foods was very low in our study in comparison to regular types of food. A previous study by ONWEZEN and BARTELS showed that the more

common reasons for market failure of functional foods were the consumers’ unwillingness to pay for higher prices, the low trustworthiness, the low state of knowledge about food with health benefits, and concerns regarding taste and the natural quality of these products [22]. Consumers are therefore not per se reluctant to pay a higher price for additional benefits of these types of foods with health-benefiting effects. MORO et al. compared willingness to pay for functional products in Italian consumers [23]. They found that factors like age, income, education, life style and health status have an influence on consumers’ willingness to pay. 45–64 year old persons spent more money on functional food than

their younger counterparts. In the present study no significant differences in willingness to pay between age groups could be shown. It can be assumed that this is caused by the type of food und its functionality. Differences in willingness to pay between the sexes were very small in the study of MORO et al., nevertheless women showed a higher willingness to pay than men. Our data confirms these findings. Women tend to spend more on products with cardioprotective effects compared to men, and they even expect higher prices for not doubting the health benefits and by that being stopped from the purchase. Studies confirm that women are the most likely buyers of functional foods because they are more

often in charge of doing grocery shopping [24].

Similar to the work of MORO et al. [23] the present study could show that a higher monthly household income is associated with a higher willingness to pay. The increase of willingness to pay for functional foods is not proportional to household income. Respondents with a monthly household income of € 1,500–2,000 showed a decrease in willingness to pay.

With regard to health consciousness respondents did not show a significant influence on willingness to pay for the used vignettes of functional foods with cardioprotective effects.

Implications for bringing cardioprotective foods to market

In addition to higher prices, lack of trust, lack of knowledge and general concerns are additional reasons that stop consumers from buying functional foods. Since consumers still feel uninformed – despite more and more information about the ingredients from the selling companies – about the functional quality of food they have doubts about the health benefits of functional foods. The perception of benefits is strongly associated with the original food product. The more unhealthy it is perceived (e.g. a sausage product with a high level of saturated fatty acids or food with a high level of salt), the lower is the acceptance of this food according to BECH-LARSEN and GRUNERT [25]. Further demands in quality and consumer wishes must be taken into consideration when manufacturing and marketing functional foods. Convenience, environment-friendliness, look and taste are important factors that influence market success of functional foods [26, 27].

Another reason for not-buying can be the lack of knowledge to be at risk with a cardiovascular disease. FREWER et al. reported, that 80% of their respondents believe that they are eating healthy and that there is

	Sub-sample “sausage product” n (%)	Sub-sample “eggs” n (%)
Do you know the term “cardioprotective food”?		
yes	82 (18.8)	88 (20.2)
no	354 (81.2)	347 (79.8)
How often do you buy cardioprotective food products?^a		
never	240 (56.9)	262 (62.8)
seldom	84 (19.9)	79 (18.9)
sometimes	65 (15.4)	55 (13.2)
often	23 (5.5)	15 (3.6)
always	10 (2.4)	6 (1.4)

Table 2: Knowledge and buying frequency of functional food with cardioprotective effects

^a all participants received a definition beforehand

Question	Sausage product (250 g pack) n = 234 M (SD) [€]	Eggs (10-pack) n = 233 M (SD) [€]
1. cheap	2.52 (0.65)	2.21 (0.74)
2. expensive	3.09 (0.86)	2.70 (0.96)
3. too expensive	3.72 (1.25)	3.26 (1.49)
4. too cheap	1.49 (0.48)	1.41 (0.51)

Table 3: Willingness to pay for two functional food products with cardioprotective effects (sausage product and eggs)

M = mean value; SD = standard deviation

no need for buying functional foods [28]. It can be assumed that the higher the knowledge about functional ingredients and their positive effects on overall health, the higher the probability that consumers will buy functional foods [20]. The results of the present study indicate that one’s own risk to acquire a cardiovascular disease is underestimated and that the importance of nutrition regarding a “heart healthy” way of life is not present in people’s minds. Public health initiatives should therefore focus mostly on awareness and prevention of cardiovascular diseases. Despite of these seemingly negative attitudes towards cardioprotective foods, this study with its analysis of willingness to pay could show some interest of German consumers in two fictional, but producible products with cardioprotective effects.

The results of the present study lay a good groundwork for further

consumer acceptance studies to deepen the understanding of reasons for buying or not buying cardioprotective foods. These studies could deliver more findings if consumers underestimate the risk of acquiring a cardiovascular disease or if they just do not see the urgency to consume cardioprotective foods for prevention. By breaking down these factors, consumer groups could be identified and new market segments could be constituted. In addition, it has to be evaluated if the present price ranges for the two products with cardioprotective effects can yield profitability with the additional manufacturing costs. Beyond that it must be checked how to overcome the lack of knowledge about cardioprotective foods, how to clear misconceptions and how to reduce fears. According to VECCHIO et al., additional information about the food increases willingness to pay for these foods [29].



Fig. 1: Willingness to pay for eggs with cardioprotective effects

The lines are based on the relative frequencies (in %) and were calculated for each of the four price queries. The calculated price range is based on the following intersections: “too cheap” and “expensive” (intersection 1, lower price limit) as well as “cheap and too expensive” (intersection 2, upper price limit). The optimum price is calculated from the intersection of the two lines “expensive” and “cheap”.

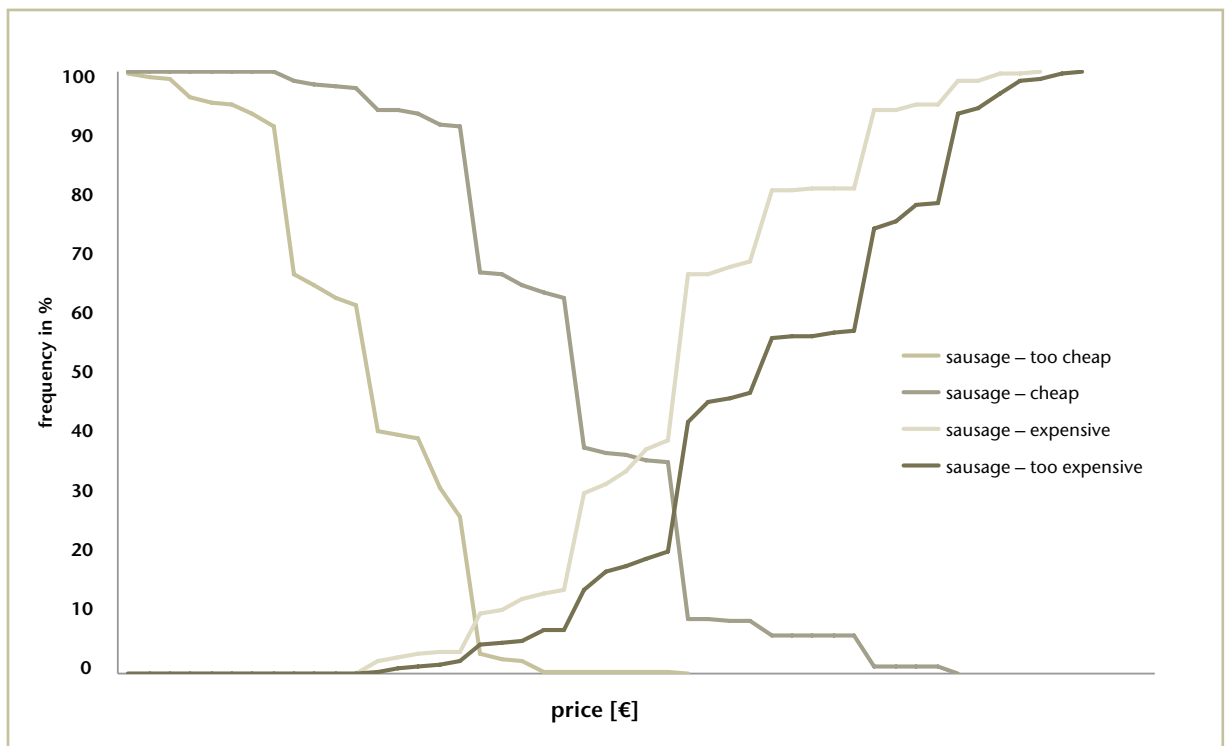


Fig. 2: Willingness to pay for a sausage product with cardioprotective effects

The price range, as well as the optimum price were calculated based on relative frequencies and depend on the intersections (see ♦ Figure 1 for more details).

	Sausage product (n = 228)	Eggs (n = 233)
age	0.002 ^{n. s.}	-0.002 ^{n. s.}
gender (1 = male)	0.433 ^{***}	0.065 ^{n. s.}
education	-0.003 ^{n. s.}	-0.005 ^{n. s.}
income	0.116 ^{***}	0.048 ^{n. s.}
health awareness	0.013 ^{n. s.}	0.011 ^{n. s.}

Table 4: Results of the regression analyses regarding the sub-samples “sausage product” and “eggs” (coefficients and p-values)

The price query “expensive” (At which price are you beginning to experience the product as expensive?) was used as the dependent variable.

n. s. = not significant, *** = $p \leq 0,001$

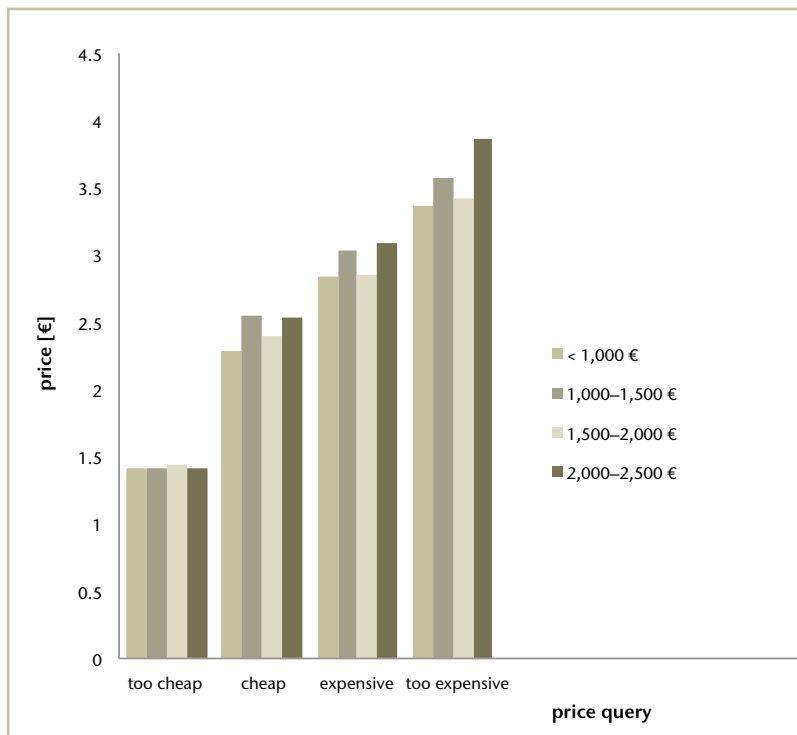


Fig. 3: Differences in willingness to pay with regard to monthly household-income (sub-sample “sausage product”)

The bars represent all four price queries of the van Westendorp analysis mentioned above (means in €).

Price	Men M (SD) [€]	Women M (SD) [€]	p-value and effect size (d_{Cohen})
too cheap	1.44 (0.49)	1.55 (0.47)	n. s.
cheap	2.43 (0.64)	2.61 (0.65)	* $d = 0.279$
expensive	2.92 (0.72)	3.27 (0.97)	** $d = 0.414$
too expensive	3.48 (1.01)	3.96 (1.32)	*** $d = 0.412$

Table 5: Gender-differences in willingness to pay (sub-sample “sausage product”)

All four price queries of the van Westendorp analysis are displayed (means in €).

d = Cohen’s effect size; M = mean value; n. s. = not significant;

SD = standard deviation;

* = $p \leq 0.05$; ** = $p \leq 0.01$; *** = $p \leq 0.001$

Limitations

In this study the sample was grouped into different age categories, but the older age group was larger than the younger age group and therefore representativeness could not be guaranteed. With regard to future population development, the older age group is the better focus group for cardioprotective foods and therefore should be further examined regarding its attitudes and state of knowledge.

Another limitation of this study could be the usage of the term “cardioprotective foods”. Despite an increasing usage of this technical term in mass media, misunderstandings about the meaning of the term could have existed which became noticeable by the low state of knowledge in the study’s sample.

The decision to employ two fictional foods as an example for cardioprotective food could have had an influence on the results.

Conclusion

Functional foods that aim to enhance nutrition with specific health-benefiting ingredients and to prevent cardiovascular diseases play a more greater role. Especially with innovative food types knowledge about ingredients and effectiveness are of paramount importance in the decision to buy or not to buy. This study shows that in addition to educating about the positive effects of these products, one must guarantee for a high level of transparency regarding the manufacturing process and the ingredients to reduce possible barriers and fears. By increasing acceptance, willingness to pay could be increased and larger consumer groups could be reached.

It is worth considering that cardioprotective foods could provide an opportunity to influence cardiovascular health positively. They should not replace a healthy way of living, e.g. regular organic food. Knowledge about prevention and treatment of

cardiovascular diseases plays a vital role and should be further funded with means of public health initiatives.

Acknowledgement

This work was supported by the Federal Ministry of Education and Research (BMBF), Germany, grant number: 01EO1501 and the nutriCARD competence cluster (grant number: 01EA1411B).

Conflict of Interest

The authors declare no conflict of interest.

B. Sc. Jenny Hofmann¹

M. Sc. Franziska Jung UCE^{1,2}

Dr. Claudia Wiacek^{2,3}

Prof. Dr. Peggy G. Braun^{2,3}

Prof. Dr. Claudia Luck-Sikorski^{1,4}

Prof. Dr. Steffi G. Riedel-Heller⁵

¹ Integriertes Forschungs- und Behandlungszentrum Adipositas-Erkrankungen (IFB) Medizinische Fakultät der Universität Leipzig

² Kompetenzcluster für Ernährung und Kardiovaskuläre Gesundheit (nutriCARD) Halle-Jena-Leipzig

³ Institut für Lebensmittelhygiene Veterinärmedizinische Fakultät der Universität Leipzig

⁴ SRH Hochschule für Gesundheit Neue Str. 28–30, 07548 Gera

⁵ Institut für Sozialmedizin, Arbeitsmedizin und Public Health (ISAP), Medizinische Fakultät der Universität Leipzig

References

- Townsend N, Wilson L, Bhatnagar P et al. (2016) Cardiovascular disease in Europe: epidemiological update 2016. *Eur Heart J* 37: 3232–3245
- Wilkins E, Wilson L, Wickramasinghe K et al. (2017) European cardiovascular disease statistics 2017. Brussels: European Heart Network. URL: www.ehnheart.org/cvd-statistics.html Zugriff 31.05.17
- Deutsche Herzstiftung e. V. Deutscher Herzbericht 2016. Frankfurt/Main (2016)
- Stang A, Stang M (2014) An inter-state comparison of cardiovascular risk factors in Germany: towards an explanation of high ischemic heart disease mortality in Saxony-Anhalt. *Dtsch Arztebl Int* 111: 530–536
- Kubler W, Haass M (1996) Cardioprotection: definition, classification, and fundamental principles. *Heart* 75: 330–333
- Sivasankaran S (2010) The cardio-protective diet. *Indian J Med Res* 132: 606–616
- Hasler CM (1998) Functional foods: their role in disease prevention and health promotion. The Institute of Food Technologists' expert panel on food safety and nutrition. *Food Technology* 52: 63–70
- Shahidi F (2004) Functional foods: their role in health promotion and disease prevention. *J Food Sci* 69: R146–R149
- Loose SM. Der Preis als Kaufbarriere? Eine Analyse der Preisbereitschaft für gesunde Lebensmittel. In: Hoffmann S, Schwarz U, Mai R (Hg). *Angewandtes Gesundheitsmarketing*. Springer Gabler, Wiesbaden (2012), S. 209–222
- Siegrist M, Shi J, Giusto A et al. (2015) Worlds apart. Consumer acceptance of functional foods and beverages in Germany and China. *Appetite* 92: 87–93
- Bratzke F, Ritschel F, Wache R et al. (2018) Market analysis of potentially cardio-protective foods in context of legal health and nutrition claims. Focus: meat, dairy and egg products. *Ernahrungs Umschau* 65(1): 2–11. e1–e12
- Kühn J, Schutkowski A, Hirche F et al. (2015) Non-linear increase of vitamin D content in eggs from chicks treated with increasing exposure times of ultraviolet light. *J Steroid Biochem Mol Biol* 148: 7–13
- Gabler S, Häder S. Ein neues Stichprobendesign für telefonische Umfragen in Deutschland. In: Gabler S, Häder S, Hoffmeyer-Zlotnik JHP (Hg). *Telefonstichproben in Deutschland*. VS Verlag für Sozialwissenschaften, Opladen (1998), S. 69–88
- van Westendorp PH. A new approach to study consumer perception of price. *Proceedings of the 29th ESOMAR Congress, Amsterdam* (1976)
- Lipovetsky S (2011) Pricing models in marketing research. *IIM* 3: 167–174
- Teratanavat R, Hooker NH (2006) Consumer valuations and preference heterogeneity for a novel functional food. *J Food Science* 71: S533–S541
- Stata Statistical Software. Release 13. StataCorp (2013)
- SPSS. IBM Corp (2015)
- Bortz J, Döring N. *Forschungsmethoden und Evaluation für Human- und Sozialwissenschaftler*. 4. Aufl., Springer Verlag, Berlin (2006)
- Menrad K, Sparke K (2006) Consumers' attitudes and expectations concerning functional food. URL: www.wz-straubing.de/fachhochschule-weihenstephan/download/bericht_functionalfood_1.pdf Zugriff 28.06.17
- GfK (2013) Anzahl der Konsumenten von Functional Food in Deutschland nach Verwendungshäufigkeit im Jahr 2013 (in Millionen Personen). URL: <https://de.statista.com/statistik/daten/studie/290862/umfrage/konsumenten-von-functional-food-in-deutschland-nach-verwendungshaeufigkeit/> Zugriff 28.06.17
- Onwezen MC, Bartels J (2011) Which perceived characteristics make product innovations appealing to the consumer? A study on the acceptance of fruit innovations using cross-cultural consumer segmentation. *Appetite* 57: 50–58
- Moro D, Veneziani M, Scokai P et al. (2015) Consumer willingness to pay for catechin-enriched yogurt: evidence from a stated choice experiment. *Agribusiness* 31: 243–258
- Procher V, Vance C. Who Does the Shopping? – German Time-use Evidence, 1996–2009. *Ruhr Economic Paper No. 393*, Bochum (2013)
- Bech-Larsen T, Grunert KG (2003) The perceived healthiness of functional foods. *Appetite* 40: 9–14
- Urala N, Lähteenmäki L (2003) Reasons behind consumers' functional food choices. *Nutrition & Food Science* 33: 148–158
- Potratz B, Wildner S (1999) Functional food – Eine Frage des Alters? [Verbrauchereinstellungen zu Functional Food]. Universität Kiel, URL: www.uni-kiel.de/agrarmarketing/Lehrstuhl/wildupota.PDF Zugriff 21.06.17
- Frewer L, Scholderer J, Lambert N (2003) Consumer acceptance of functional foods: issues for the future. *Brit Food J* 105: 714–731
- Vecchio R, van Loo EJ, Annunziata A (2016) Consumers' willingness to pay for conventional, organic and functional yogurt: evidence from experimental auctions. *Int J Consum Stud* 40: 368–378

DOI: 10.4455/eu.2018.011

Copyright!

Reproduction and dissemination – also partial – applicable to all media only with written permission of Umschau Zeitschriftenverlag GmbH, Wiesbaden.