

**Factors influencing consumers' gaze and purchase
behavior for food products labeled
with nutrition and health claims**

**Dissertation zur Erlangung des akademischen Grades
Doktor der Wirtschafts- und Sozialwissenschaften (Dr. rer. pol.)**

Vorgelegt im Fachbereich Ökologische Agrarwissenschaften
der Universität Kassel

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Witzenhausen, November 2019

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Dissertation an der Universität Kassel

Fachbereich Ökologische Agrarwissenschaften

Fachgebiet Agrar- und Lebensmittelmarketing

Dissertationsort: Witzenhausen

Datum der Disputation: 21. Januar 2020

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Declaration of originality

This dissertation contains three scientific articles written by the author of this dissertation as first author. The articles are published in peer-reviewed Q1 journals of which all are listed in Web of Science by Clarivate Analytics (formerly Thomson Reuters):

1. Steinhauser, J., & Hamm, U. (2018). Consumer and product-specific characteristics influencing the effect of nutrition, health and risk reduction claims on preferences and purchase behavior – A systematic review. *Appetite*, *127*, 303–323. <https://doi.org/10.1016/j.appet.2018.05.012>.
2. Steinhauser, J., Janssen, M., & Hamm, U. (2019). Consumers' purchase decisions for products with nutrition and health claims: What role do product category and gaze duration on claims play? *Appetite*, *141*, 104337. <https://doi.org/10.1016/j.appet.2019.104337>.
3. Steinhauser, J., Janssen, M., & Hamm, U. (2019). Who buys products with nutrition and health claims? A purchase simulation with eye tracking on the influence of consumers' nutrition knowledge and health motivation. *Nutrients*, *11*(9), 2199. <https://doi.org/10.3390/nu11092199>.

I declare that this thesis is my own work. Information derived from the published and unpublished work of others has been acknowledged in the text. This work or parts thereof have not been submitted in any form for another degree at any university or other institute of tertiary education.

Declaration of own contribution to the published scientific articles

Erklärung über den Eigenanteil an den veröffentlichten wissenschaftlichen Schriften innerhalb meiner Dissertationsschrift gemäß § 7a der Besonderen Bestimmungen des Fachbereiches Ökologische Agrarwissenschaften zu den Allgemeinen Bestimmungen für Promotionen an der Universität Kassel (AB-PromO) vom 16.01.2019.

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Thema der Dissertation: Factors influencing consumers' gaze and purchase behavior for food products labeled with nutrition and health claims

2. Nummerierte Aufstellung der eingereichten Schriften

(Titel, Autoren, wo und wann veröffentlicht bzw. eingereicht):

Nr. 1 Consumer and product-specific characteristics influencing the effect of nutrition, health and risk reduction claims on preferences and purchase behavior – A systematic review

Autoren: Johann Steinhauser, Ulrich Hamm

Journal: Appetite

Eingereicht: 4. Juli 2017

Veröffentlicht: Jahr: 2018, Jahrgang: 127, Seiten: 303–323.

Nr. 2 Consumers' purchase decisions for products with nutrition and health claims: what role do product category and gaze duration on claims play?

Autoren: Johann Steinhauser, Meike Janssen, Ulrich Hamm

Journal: Appetite

Eingereicht: 30. Januar 2019

Veröffentlicht: Jahr: 2019, Jahrgang: 141, Artikelnummer: 104337.

Nr. 3 Who buys products with nutrition and health claims? A purchase simulation with eye tracking on the influence of consumers' nutrition knowledge and health motivation

Autoren: Johann Steinhauser, Meike Janssen, Ulrich Hamm

Journal: Nutrients

Eingereicht: 15. August 2019

Veröffentlicht: Jahr: 2019, Jahrgang: 11, Artikelnummer: 2199.

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List of abbreviations

AARS	Average adjusted R-squared
AFVIF	Average full collinearity variance inflation factor
AOI	Areas of interest
APC	Average path coefficient
ARS	Average R-squared
AVE	Average variance extracted
AVIF	Average block variance inflation factor
CASI	Computer-assisted self-interview
Cr α	Cronbach's alpha
CR	Composite reliability
EFSA	European Food Safety Authority
ELM	Elaboration Likelihood Model
GoF	Tenenhaus GoF
MNL	Multinomial logit
N	Sample size
NHR claims	Nutrition, health and risk reduction claims
NLBCDR	Nonlinear bivariate causality direction ratio
PLS	Partial least squares
RSCR	R-squared contribution ratio
SD	Standard deviation
SE	Standard error
SEM	Structural equation modeling
SMI	SensoMotoric Instruments GmbH

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S-O-R Stimulus-Organism-Response

SPR Simpson's paradox ratio

S-R Stimulus-Response

SSR Statistical suppression ratio

VIF Variance inflation factor

1 Introduction

1.1 Nutrition and health claims in practice and research

The growing interest of consumers in healthy living and eating provides new opportunities in food marketing. As food products compete on the shopping shelf for the attention of consumers, manufacturers use this trend in the communication for their products. By labeling so-called nutrition and health claims on the front of a food package, the goal is to catch the attention of consumers by highlighting the health-related aspects of the food to ultimately convince the consumers to purchase it. According to EU Regulation No. 1924/2006, Art. 2, par. 2.4–2.6, these claims are categorized into nutrition, health and risk reduction claims (NHR claims). Nutrition claims highlight positive nutritional characteristics present in the food, while health claims connect a nutrient to a positive health effect. Risk reduction claims go one step further by giving information about a nutrient's ability to reduce the risk of a certain disease. The use of nutrition and health claims is a widely used practice in many countries, as up to one-third of the food packages in grocery stores are labeled with them (Al-Ani, Devi, Eyles, Swinburn, & Vandevijvere, 2016, p. 1087; Hieke et al., 2016, p. 12; Pravst & Kušar, 2015, p. 9363; Devi et al., 2014, p. 257; No, Kelly, Devi, Swinburn, & Vandevijvere, 2014, p. 78; Hughes, Wellard, Lin, Suen, & Chapman, 2013, p. 2156; Colby, Johnson, Scheett, & Hoverson, 2010, p. 94).

Nutrition and health claims must be distinguished from nutrition labels, e.g. 3g fat in 100g, which are located on the back of food packages in form of a nutrition table or sometimes on the front in form of the GDA (Guideline Daily Amount). Such information is regulated by law and is intended to help consumers assess the food's nutritional composition. In this dissertation such nutrition labels are not considered.

Studies on nutrition and health claims often report that their effect on consumers' preference and purchase behavior is positive, as was shown in a recent literature review (Kaur, Scarborough, & Rayner, 2017, p. 15). However, various recent studies reported a negative effect of nutrition and health claims on preference and purchase behavior (Bialkova, Sasse, & Fenko, 2016, p. 45; Fenko, Kersten, & Bialkova, 2016, p. 82; Aschemann-Witzel & Grunert, 2015, p. 90; Orquin & Scholderer, 2015, p. 149; van Buul

& Brouns, 2015, p. 1558; Maubach, Hoek, & Mather, 2014, p. 75; Lähtenmäki, 2013, p. 196; Norton, Fryer, & Parkinson, 2013, p. 104). This contradiction in the obtained results of nutrition and health claim studies has been pointed out in the literature review of Kaur et al. (2017, p. 1), as well as in other articles (Bruschi, Teuber, & Dolgoplova, 2015, p. 80; Hieke et al., 2015, p. 67; Annunziata & Vecchio, 2013, p. 353). A few studies tested nutrition and health claims versus the so-called taste claims to investigate differences in their effect on preferences and purchase behavior. A taste claim refers to the food product's taste and is not regulated by law (Bialkova et al., 2016, p. 44; Choi, Paek, & Whitehill King, 2012, p. 422; Kim, Cheong, & Zheng, 2009, p. 531; van Trijp & van der Lans, 2007, p. 307).

Previous research pointed to certain factors, which might determine the effect of nutrition and health claims on consumers' evaluations and purchase behavior, thus are worth to be investigated: the perceived healthiness of the product category (Aschemann-Witzel & Grunert, 2017, p. 127; Stancu, Grunert, & Lähtenmäki, 2017, p. 92; Bialkova et al., 2016, p. 45; Fenko et al., 2016, p. 90; Talati, Pettigrew, Dixon et al., 2016, p. 2) and consumers' nutrition knowledge and health motivation (Hung, Grunert, Hoefkens, Hieke, & Verbeke, 2017, p. 35; Bialkova et al., 2016, p. 40; Fenko et al., 2016, p. 90; Mitić & Gligorijević, 2015, p. 349; van Buul & Brouns, 2015, p. 1558). Consumers typically do not consider food products' individual nutritional compositions, but rather divide food in healthy and unhealthy foods (Chandon, 2013, p. 9; Chernev, 2011, p. 762; Carels, Konrad, & Harper, 2007, p. 450; Niva, 2007, p. 388; Oakes & Slotterback, 2005, p. 679; Rozin, Ashmore, & Markwith, 1996, p. 445). Nutrition knowledge is defined as a "scientific construct that nutrition educators have created to represent individual's cognitive processes related to information about food and nutrition" (Axelson & Brinberg, 1992, p. 239). Health motivation is defined as a "consumers' goal-directed arousal to engage in preventive health behaviors" (Moorman & Matulich, 1993, p. 210).

Differences in the results are further due to different experimental designs. The authors of the literature review (Kaur et al., 2017, p. 16) called for more realistic experimental designs, as previous studies indicated that claims might be less important for consumers than studies with artificial designs would suggest. Similarly, other researchers concluded to examine nutrition and health claims on actual packages in more natural settings (Lähtenmäki, 2013, p. 200; Hieke & Taylor, 2012, p. 148) and to measure their effect

with actual purchase behavior (van Buul & Brouns, 2015, p. 1559; Wills, Storcksdieck genannt Bonsmann, Kolka, & Grunert, 2012, p. 234).

Instead of forced exposure to nutrition and health claims, a more realistic experiment further allows the examination of consumers' behavior towards a package labeled with a claim (Bialkova et al., 2014, p. 66). To gain insight into whether consumers notice claims at all and whether this visual attention influences subsequent purchase decisions, the gaze behavior of consumers can be measured with eye tracking (Ares et al., 2013, p. 139). At the point of sale, visual attention to a food package and its attributes naturally precedes any subsequent behavior such as purchase or no purchase (Duerrschmid & Danner, 2018, p. 291; Meyerding & Merz, 2018, p. 782; Meißner, Musalem, & Huber, 2016, p. 1). The authors of a recent literature review (van Loo, Grebitus, Nayga, Verbeke, & Roosen, 2018, p. 549) and other authors (Peschel, Orquin, & Mueller Loose, 2019, p. 2; Duerrschmid & Danner, 2018, p. 292; Meyerding & Merz, 2018, p. 772; Orquin & Mueller Loose, 2013, p. 190) who investigated visual attention on food packaging pointed at the lack of research regarding the effect of visual attention towards package labels such as nutrition and health claims on the choice of food. Additionally, it was asked to investigate visual attention on food package labels between product categories different in their perceived healthiness (Graham, Orquin, & Visschers, 2012, p. 381).

The contrary results in the research on the effect of nutrition and health claims on consumers' preferences and purchase behavior are problematic. It is uncertain whether nutrition and health claims have a positive effect on consumers' preferences and purchase behavior. Moreover, it is uncertain how consumer and product-specific characteristics as well as the study design influence this effect. Marketers and policymakers cannot make their decisions based on ambiguous research results because it could lead to wrong decisions and therefore to detrimental effects regarding sales or consumer protection. The issue of contrary results in this field of research raises the question of why the results are contrary. The need for an analysis is evident, which investigates this issue with several research methods: a literature review and a following empirical study with a realistic experimental design comprising a purchase simulation, eye tracking and a questionnaire.

1.2 Research objectives

The overall research objective of this dissertation was to investigate factors which influence consumers' gaze and purchase behavior for food products labeled with nutrition and health claims. With regard to this objective, the following research questions were formulated.

1. Purchase decision:

Do nutrition, health, and taste claims labeled on the front of food products have an effect on the purchase decision of consumers?

2. Visual attention:

- a. To what extent do consumers look at the claims while shopping?
- b. Does gaze duration on claims have an effect on the purchase decision?

3. Perceived healthiness of the product category:

Does the perceived healthiness of product categories lead to differences regarding

- a. the gaze duration on claims, and
- b. the purchase decision for products labeled with claims?

4. Nutrition knowledge and health motivation:

What effects do consumers' nutrition knowledge and health motivation have on

- a. the gaze duration on claims, and
- b. the purchase decision for products labeled with claims?

The overall research objective and the research questions were addressed with several research methods. A literature review was performed in previous research on the effect of nutrition and health claims on consumers' preferences and purchase behavior. The findings of this literature review built the basis for the following empirical study. This study was conducted in a German city with a sample size of 156 participants. It was a purchase simulation combined with eye tracking and a questionnaire. The data collection took place together with another study that also used the methods of purchase simulation, eye tracking and a questionnaire. However, the research objective of that study was different as it investigated the role of price in consumers' purchase decisions on organic food, see Rödiger and Hamm (2019); Rödiger, Moreno-Esteva, Janssen, and Hamm (2019).

1.3 Structure of the dissertation

The structure of this dissertation is organized as follows:

Chapter 2 introduces the theoretical and methodological framework of this dissertation. The categorization in factors influencing consumer behavior is outlined and the underlying Stimulus-Organism-Response (S-O-R) model for this dissertation is presented. The construct ‘visual attention’ is explained in detail and the chapter finishes with an overview of the study’s mixed-method approach.

Chapter 3 is a literature review in which previous empirical research was compiled and critically evaluated in respect to the lack of consensus in the reported results on nutrition and health claims. Several factors were found which influenced the effect of nutrition and health claims either positively or negatively on the preferences and purchase behavior for such labeled products. The factors were categorized into consumer and product-specific characteristics. This chapter contributes to the overall research objective by showing which of these factors are worth for further investigation in an empirical study.

Chapter 4 presents results of an empirical study conducted in Germany, in which different research methods were applied, namely a purchase simulation together with eye tracking and a subsequent questionnaire. The chapter addresses the first three research questions of this dissertation. The effect of nutrition and health claims on the purchase decision and the visual attention on these claims were analyzed. It was further investigated whether the perceived healthiness of the product categories led to differences regarding the effect of claims on the purchase and gaze behavior.

Chapter 5 contains further analyses of the empirical study and addresses the fourth research question of this dissertation. The influence of consumers’ nutrition knowledge and health motivation on the purchase decision for products labeled with nutrition and health claims was investigated. Furthermore, it was analyzed whether the visual attention towards these claims was a mediator between the consumer characteristics on one side and the purchase behavior on the other. With the use of structural equation modeling, all above-mentioned relationships were analyzed in one model.

Chapter 6 contains the discussion of this dissertation. Regarding the overall research objective and the individual research questions, the key findings are discussed and compared to previous research. Additionally, the merits of this dissertation such as the combined use of several research methods including eye tracking are presented. The chapter finalizes with the mention of limitations.

Chapter 7 concludes the findings of this dissertation. Policymakers are given implications for consumer protection and consumer information on the restricted use of claims and on general food labeling. Recommendations are made for marketers regarding product labeling with different claim types and addressing certain consumer groups with such claims. Lastly, suggestions for future research are given.

Chapter 8 contains a summary in English and German language in which the research objective and the research questions of this dissertation are presented, the study design is described and the main findings are summarized.

2 Theoretical and methodological framework

2.1 Top-down and bottom-up factors on consumer behavior

The determinants of consumer behavior are typically divided into two categories: top-down and bottom-up factors (Hoch & Ha, 1986, p. 222; Bobrow & Norman, 1975, p. 140). The first one comprises consumer-specific characteristics and the second stimulus-specific characteristics. This differentiation helps to categorize determinants and has been applied in the research on food products and visual attention (Duerrschmid & Danner, 2018, p. 288; Bialkova, Grunert, & van Trijp, 2013, p. 67; van Herpen & van Trijp, 2011, p. 148; Theeuwes, 2010, p. 79).

The bottom-up factors of interest in this dissertation are the nutrition and health claims labeled on food packages with respect to other product-related attributes, predominantly the perceived healthiness of the product category. As top-down factors, consumers' health motivation and nutrition knowledge are of interest. These factors are hypothesized to influence gaze and purchase behavior for food products. To combine these factors into one model, the Stimulus-Organism-Response (S-O-R) paradigm was used, which has been applied in various fields of consumer research explaining consumers' purchase behavior (Vieira, 2013, p. 1421; Mehrabian & Russell, 1974, p. 8).

2.2 Stimulus-Organism-Response paradigm as framework

The S-O-R paradigm constitutes that stimuli (S) such as 'nutrition and health claims' on one side and response (R) such as 'purchase behavior' on the other are linked by processes inside the consumer's organism (O). According to Goodwin (2015, p. 203), the S-O-R paradigm was introduced by Robert S. Woodworth who criticized the existing S-R models neglecting the organism in between stimuli and response: "To identify the object with the stimulus is to assume in the organism the ability to perceive the object on receiving the stimulus. The behaviorist tacitly assumes in the organism this process of perception intervening between stimulus and response." (Woodworth, 1948, p. 136). Woodworth explicitly referred to the sense organs as enabling the consumer to perceive the stimuli. Besides other processes inside the consumer such as cognitive or affective nature, the sense organs are part of the organism (Buxbaum, 2016, p. 7). Today's research on package labeling still assumes that consumers have looked at a certain stimulus and

attributes measured effects to this assumed visual attention. In today's textbooks, the sense organs are even left out in S-O-R models, e.g. in Kotler, Armstrong, and Opresnik (2018, p. 158); Foscht, Swoboda, and Schramm-Klein (2017, p. 30); Kroeber-Riel and Gröppel-Klein (2013, p. 52).

Technological advance offers researchers new ways of decoding processes that are happening inside the consumer's organism. As visual attention towards a stimulus is an indicator for its cognitive processing, the use of eye tracking to measure consumers' visual attention is promising (Meyerding, 2018, p. 28; Eckstein, Guerra-Carrillo, Miller Singley, & Bunge, 2017, p. 87; Mele & Federici, 2012, p. 265; Rayner & Castelano, 2008, p. 13). With the use of statistical methods, the influence of visual attention on a response such as purchase decision can be investigated.

S-O-R models should not be seen as flow charts with a sequential path through three stand-alone realms. Jacoby (2002, p. 53) argues that stimuli, organism and response are overlapping, because certain constructs do not fit exclusively in one realm. Visual attention is such a construct. Visual attention towards a claim is a necessity for its processing inside the organism, thus visual attention can be seen as a precursor to the processing. On the other hand, visual attention might also be seen as the result of processes inside the organism. For example, motivation to eat healthy might steer the attention to nutrition and health claims. Taken together, the best approach to incorporate visual attention in S-O-R modeling is to understand visual attention as part of interrelated processes inside the organism, which is in accordance with the key literature on eye tracking (Duchowski, 2007, p. 262). In this view, the S-O-R model in Figure 1 constitutes the theoretical framework of this dissertation.

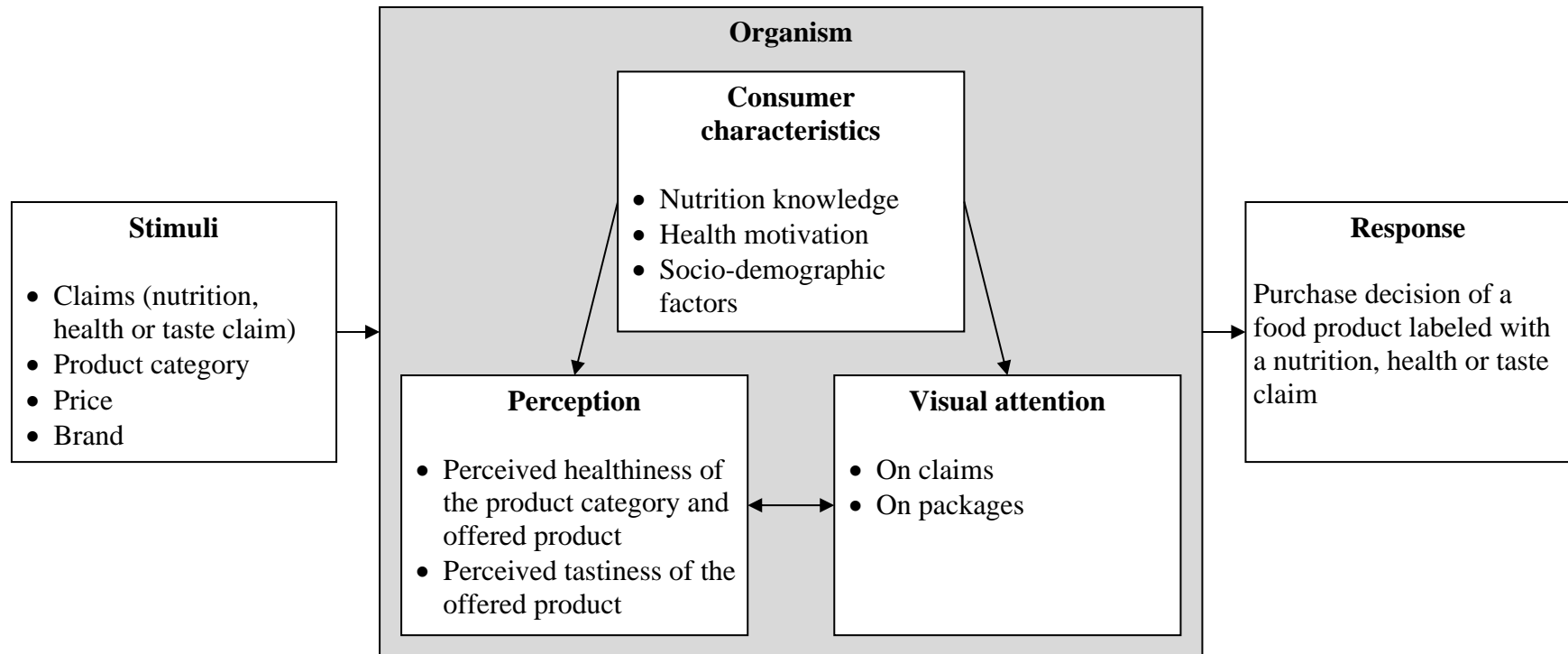


Figure 1: Theoretical framework of this dissertation based on the Stimulus-Organism-Response model

Based on Buxbaum (2016, p. 8), Jacoby (2002, p. 53) and Woodworth (1948, p. 136)

2.3 Characteristics and measurement of visual attention

When consumers perform a task, like grocery shopping, they first engage in a so-called orientation-attention search process in which they get an overview over the visual scene, such as the product alternatives offered on a shopping shelf. Then their visual attention changes to a so-called discover-attention in which consumers focus on single attributes of the stimuli (Clement, Aastrup, & Forsberg, 2015, p. 188). During this information acquisition, the visual attention is driven by stimuli and by consumers' individual characteristics (Fenko, Nicolaas, & Galetzka, 2018, p. 58; Meißner et al., 2016, p. 2). In other words, bottom-up and top-down factors influence and compete with each other for the control over visual attention (Orquin, Bagger, & Mueller Loose, 2013, p. 712; Corbetta & Shulman, 2002, p. 201; Yantis, 2002, p. 125). Salient stimuli grab consumers' visual attention but consumers also direct their visual attention towards stimuli which are most informative for them (Bialkova & van Trijp, 2010, p. 1043; Serences et al., 2005, p. 114; Kahneman, 1973, p. 56).

An investigation of the bottom-up effect of food packages labeled with nutrition and health claims on consumer's visual attention can be achieved through a purchase simulation combined with eye tracking. Together with a subsequent questionnaire, the characteristics of the consumers can be identified and thus the top-down effect can be measured. Both effects are investigated in this dissertation.

Humans see when light reaches the retina located at the back of the eyeball. On its way the light travels first through the cornea, which is the front of the eye covering the anterior chamber, iris and pupil. When light travels through the cornea, a reflection is created on the cornea, the so-called corneal reflection. Infrared cameras mounted in the inside of eye tracking devices use this corneal reflection to track the pupil (Duerrschmid & Danner, 2018, p. 282; Holmqvist et al., 2011, p. 21). Humans constantly have to move their eyes because they can only see sharply when light hits the small pit in the retina called fovea which makes up 2% of their visual field (Balcombe, Fraser, & McSorley, 2015, p. 450). Light reaching the retina outside the fovea renders the peripheral vision, which outlines the scenery and is sensitive to movement, but is poor in acuity (Pieters & Wedel, 2008, p. 49; Duchowski, 2007, p. 55). There are two predominant types of eye movements (Rayner, 2009, p. 1458). The fixation is the period of time, approximately 150 ms – 600 ms long, during which the eyes remain relatively still and focus on one location. The saccade is a rapid motion from one fixation to another with a duration of 10 ms – 100 ms

(Duchowski, 2007, p. 42). Visual information is acquired only during fixations whereas humans are virtually blind during saccades (Rayner, 2009, p. 1458; Duchowski, 2007, p. 42). Furthermore, fixations are a good indicator of visual attention (Meyerding, 2018, p. 31; Balcombe et al., 2015, p. 451; Chandon, Hutchinson, Bradlow, & Young, 2009, p. 3; Pieters & Wedel, 2008, p. 50). Eye tracking is a method for the objective and direct measurement of consumers' eye fixations (Duerrschmid & Danner, 2018, p. 280; Jones & Richardson, 2007, p. 239).

Eye fixations are usually made subconsciously so that consumers are not aware of their gaze behavior (Piqueras-Fiszman, Velasco, Salgado-Montejo, & Spence, 2013, p. 329; Chandon et al., 2009, p. 3; Kahneman, 1973, p. 51). Since consumers only have a limited ability to register and to remember what and for how long they paid attention to during a task or are unwilling to disclose certain information (social desirability bias), the method of eye tracking can overcome these limitations of consumer research (Meyerding & Merz, 2018, p. 783; Meyerding, 2016, p. 106; Graham et al., 2012, p. 379; Crowne & Marlowe, 1960, p. 354).

There are two types of eye tracking systems, stationary and head-mounted (Holmqvist et al., 2011, p. 51; Duchowski, 2007, p. 54). A stationary eye tracking system is placed in front of the participant, which is usually in the form of a small rectangular device attached to the bottom of a computer monitor. Stimuli for investigation are limited to two-dimensional objects which can be displayed on a computer monitor such as images, websites or advertisements. A head-mounted eye tracking system consists of eye tracking glasses worn on the head like normal glasses which are wirelessly connected to a computer. The use of this system is required for experiments in three-dimensional environments in which participants can move around freely.

There are many advantages of the stationary system over the head-mounted system. In a stationary system, the participants are seated in front of the monitor equipped with the eye tracking device and the system will conduct the programmed study without the presence of an interviewer. Even the calibration of the eye tracking device to the participants' individual eye characteristics will be performed fast and automatically by the system. With a head-mounted system, the interviewer has to adjust the eye tracking glasses to each participant individually and correct any preexisting eyesight problems of

the participant by mounting optical lenses on the eye tracking glasses. Also, the calibration must be performed manually by the interviewer, whereby the whole set-up before the start of the actual experiment takes around 10 – 15 minutes for each participant. After an eye tracking study has been carried out, the collected data of a stationary system does not require any data preparation prior to the analysis. However, the output of a mobile system is different, as it is a video captured by the glasses' 'scene camera' which is overlaid by a cursor indicating where the participant was looking at (Holmqvist et al., 2011, p. 51). The data preparation is labor-intensive because it requires the manual 'mapping' of every gaze point from the video onto a static picture resembling the experiment's scenery (Clement, 2018, p. 69; Duerrschmid & Danner, 2018, p. 307; SensoMotoric Instruments GmbH, 2016, p. 191).

Besides the higher workload, a head-mounted system is also more susceptible to a loss in data quality, due to reasons such as changes in ambient lighting or participants touching and readjusting the glasses (Fenko et al., 2018, p. 63). The major issue in the data quality of today's head-mounted eye tracking systems is the parallax error (Clement, 2018, p. 69; Mansouryar, Steil, Sugano, & Bulling, 2016, p. 197; Narcizo & Hansen, 2015, p. 72; Kassner, Patera, & Bulling, 2014, p. 7; Holmqvist et al., 2011, p. 60): The scene camera of the eye tracking glasses is located above the participant's eye to avoid the obstruction of the participant's visual field. This results in the optical path of the scene camera to the stimuli being different from the optical path of the eyes to the stimuli. The eye tracking system is manually calibrated for each participant so that the two optical paths meet at the participant's actual gaze point on a stimulus. This calibration is performed in a certain distance between participant and stimuli (the calibration panel). Any change in distance in the following experiment leads to the two paths meeting in a point which is not the actual gaze point, thus creating offset gaze points. There is a built-in algorithm in the eye tracking system to automatically detect and adapt to a change in distance, but it is far from being perfect. Therefore, it is essential to monitor the data collection and critically inspect the raw data hereafter for quality issues, which results in the exclusion of participants. The proportion of excluded participants depends on the level of data quality required for the specific research purpose (e.g. notice of advertising banners in grocery stores versus labels on food packages) and can range from one-third to two-thirds (Orquin & Holmqvist, 2018, p. 1647; Burmester & Mast, 2010, p. 7; Wang et al., 2010, p. 412; Simola, Holmqvist, & Lindgren, 2009, p. 105; Mullin, Anderson, Smallwood, Jackson, & Katsavras, 2001, p. 374; Schnipke & Todd, 2000, p. 273; Sibert & Jacob, 2000, p. 285).

The disadvantages of stationary eye tracking relate to the restrictions that the participants must remain at one location and look at stimuli presented on a two-dimensional plane. Participants seated in front of a computer monitor tend to look more at the center of its screen, the so-called central bias (Holmqvist et al., 2011, p. 397). By comparing the results from stationary and head-mounted eye tracking systems, previous research has shown that participants look differently at identical stimuli (tested: shelf of consumer goods, advertisements) when presented on a monitor or in a real-life experience (Clement, 2018, p. 69; Suurmets & Clement, 2016).

Head-mounted eye tracking has a key advantage as it expands the applicability of eye tracking into natural environments beyond the limitations of stationary eye tracking (Meyerding & Merz, 2018, p. 782; Graham et al., 2012, p. 379; Holmqvist et al., 2011, p. 51). While wearing eye tracking glasses, participants are able to behave naturally in a given situation. In an experiment comprised of a shopping environment with a task to purchase food products, participants are able to move unrestrictedly in front of the shelves. Additionally, the products can be taken off the shelves and turned to further inspect the package labeling if desired. To measure gaze behavior in such an experiment, the use of a head-mounted eye tracking system is necessary and therefore this system was used in this dissertation.

2.4 Overview of the study's mixed-method approach

A crucial limitation in the validity of most study results on nutrition and health claims are their unrealistic study designs. Studies often relied on online surveys in which claims were written under photos of the package and the tested nutrition and health claims were either rejected by the EFSA or were illegally formatted. Therefore, the overall endeavor of this dissertation was to design a more realistic study. A close-to-realistic purchase simulation was chosen to investigate the effect of nutrition and health claims on the actual purchase decision (1st research question). Instead of asking for preferences and willingness to pay, the participants in this study were asked to purchase products with their own money. The tested products were unobtrusively labeled with either a nutrition, health or taste claim. The nutrition and health claims examined in the study fully complied with the EU Regulation No. 1924/2006 Art. 5 par. 1.b. and EU Regulation No. 1169/2011 annex XIII part A and were authorized for use by the EFSA (2019), according to EU Regulation No. 1924/2006, Art. 10 par 1.

Orange juice and milk chocolate served as the two product categories to investigate the role of perceived healthiness of the product category (3rd research question). Previous studies have shown that orange juice is generally perceived as healthy while chocolate is perceived as an unhealthy food product (Belei, Geyskens, Goukens, Ramanathan, & Lemmink, 2012, p. 902; Chernev, 2011, p. 762; Lalor, Kennedy, & Wall, 2011, p. 757; Siró, Kápolna, Kápolna, & Lugasi, 2008, p. 463; Bech-Larsen & Grunert, 2003, p. 11).

To examine participants' visual attention on the claims and whether this attention influenced the purchase decision, the method of eye tracking had to be incorporated into the study design (2nd research question). As in a normal shopping situation, the participants in this study moved freely in front of several shopping shelves filled with three-dimensional packages of food. Thus, a stationary eye tracking system could not have been used and instead a head-mounted eye tracking system was applied (SMI Eye Tracking Glasses 2 Wireless). Eye movements depend on the task given to the participants. This was impressively shown in early research on eye tracking (Yarbus, 1967, p. 174, 192) and further studies have proven this (Duerrschmid & Danner, 2018, p. 289, 294). Therefore, it is crucial to give participants a task, otherwise participants create their own task or look around aimlessly which makes the gaze behaviors of the participants incomparable (Holmqvist et al., 2011, p. 77). The task in this study stayed the same for all participants and was read out aloud to them. They were told to go shopping for orange juice and milk chocolate in the laboratory's shopping area and to take as much time as they would usually need for their shopping. Further, they were asked to choose one product per category and pay with their own money.

Eye tracking can give answers to 'what-questions' such as what consumers look at and to what extent they do so but cannot answer 'why-questions' such as why the consumers look at claims (Duerrschmid & Danner, 2018, p. 290; Meyerding & Merz, 2018, p. 782; Graham et al., 2012, p. 379). Therefore, the participants filled out a questionnaire after the completion of the purchase simulation, which included questions on nutrition knowledge and health motivation (4th research question). An overview of all variables covered in this computer-assisted self-interview (CASI) is given in Table 1.

The first part of the questionnaire comprised of questions about the tested products such as perceived healthiness and tastiness of the products, the trust and belief in the tested claims and the importance of certain product attributes during the everyday purchase of orange juice and milk chocolate. The items of these variables were 7-point Likert scales

which were adapted from Bruschi et al. (2015, p. 83), van Herpen and van Trijp (2011, p. 151), Ares, Giménez, and Gámbaro (2009, p. 52) and Singer, Williams, Ridges, Murray, and McMahon (2006).

In the second part, the level of nutrition knowledge of the participants was measured with a multiple-choice test. The ten questions were divided into two knowledge domains (Wansink & Cheney, 2005, p. 388): (i) knowledge about calorie content and nutritional composition of food and (ii) knowledge about the relationship between food intake and disease. The items were adapted from Dickson-Spillmann, Siegrist, and Keller (2011, p. 619), Dallongeville, Marécaux, Cottel, Bingham, and Amouyel (2001, p. 28) and Parmenter and Wardle (1999, p. 303, 307). The level of health motivation of the participants was rated on 7-point Likert scales, ranging from 1 = strongly disagree to 7 = strongly agree. The five questions were related to the personal importance of following a healthy diet. The items were adapted from Aschemann-Witzel (2009, p. 125), Lone, Pence, Levi, Chan, and Bianco-Simeral (2009, p. 93) and Roininen, Lähteenmäki, and Tuorila (1999, p. 76).

Sociodemographic questions were asked in the last section of the questionnaire. The whole questionnaire is presented in the dissertation's Appendix.

In all, the study design consists of a purchase simulation together with eye tracking and a subsequent questionnaire, thereby representing a methodological triangulation to investigate the effect of nutrition and health claims on food packages on consumers' purchase decisions. An overview of the methods used is given in Table 1.

Eye tracking is an innovative method and by combining it with other methods, its potential to give new insights in the research on nutrition and health claims is promising (Duerrschmid & Danner, 2018, p. 308; Holmqvist et al., 2011, p. 95). An approach with a single method can only explain consumer behavior from a certain angle (Duerrschmid & Danner, 2018, p. 309). Eye tracking on its own shows what consumers look at on stimuli like food packages. Embedded in a shopping task for food, the combination of the two methods can reveal which product attributes (e.g. label, logo, price) drew the attention of consumers and how this gaze behavior might have influenced the purchase decision. An additional questionnaire can reveal underlying reasons for the observed gaze and purchase behavior, especially the characteristics of the consumers.

Table 1: Combination of different methods in the dissertation

Method of data collection	Details and variables	Method of data analysis
Eye tracking	<ul style="list-style-type: none"> • Measurements of gaze behavior: ‘Dwell time’, ‘Net dwell time’, ‘Visual intake time’, and ‘Visual intake count’ • Gaze behavior on: claims, package fronts, price tags, nutrition tables, brand names, additional package sides, whole packages 	<ul style="list-style-type: none"> • Univariate (descriptive) • Bivariate (t-tests, chi-square) • Multinomial logistic regression models (MNL) • Structural equation modeling (SEM)
Purchase situation	<ul style="list-style-type: none"> • Participants purchased one product in each product category • Three product alternatives per product category (orange juice and milk chocolate) were offered • Rotation of the three different claim types (nutrition, health or taste claim) among the three product alternatives • Additional and hereof independent rotation of three different price levels among the three product alternatives 	
Questionnaire	<ul style="list-style-type: none"> • General purchase behavior regarding the product categories • Attitude towards the product categories and the products offered • Perceived healthiness of the product categories and the products offered • Perceived tastiness of the products offered • Paying attention to nutrition and health claims on healthy versus unhealthy food • Perceived presence of claims • Trust and belief in the tested claims • Familiarity with the content of the claims • Nutrition knowledge • Health motivation • Importance of certain product attributes • Socio-demographic variables 	

2.5 Methods of data analysis

Univariate methods were applied to show descriptive statistics about the gaze behavior of the participants in respect to the so-called areas of interest (AOI). These areas are certain regions (e.g. package front) or attributes (e.g. claim) on the stimulus which are defined by the researcher with respect to the objective of analysis (Holmqvist et al., 2011, p. 187; Jacob & Karn, 2003, p. 584).

The gaze on an AOI can be quantified with several gaze variables based on different algorithms to detect eye fixations and saccades in the eye tracking data obtained. The determination of the start and the end of a fixation can be ambiguous, because even during a fixation the eyes never stay absolutely still (occurrence of ocular tremor and drift) and the saccades are preceded and succeeded by microsaccades and glissades (Holmqvist et al., 2011, p. 377). Thus, the measured fixations are an approximation based on the proprietary algorithm in the eye tracking software. Additionally, there is an ongoing discussion about how much acquisition of visual information actually happens right before and after a fixation (Irwin & Brockmole, 2004; Rayner, 1998, p. 373). Nevertheless, cognitive elaboration continues during any form of eye movement (Rayner, 2009, p. 1458). It can be assumed that during the saccade between two fixations within the same AOI, the participant continues to elaborate on the visual information seen in this AOI. This assumption cannot be made when the saccade appears between two fixations in two different AOIs.

Therefore, to circumvent any of these issues, the ‘dwell time’ was used for most of the analyses: The dwell time represents the sum of all the visit’s durations within an AOI such as a claim. In other words, the time starts counting when the participants’ eyes enter the AOI and the time stops counting when the participants’ eyes leave the AOI. The dwell time is the sum of these individual visits. In the key literature on eye tracking, the dwell time is listed as a commonly used variable in eye tracking research (Duerrschmid & Danner, 2018, p. 284; Holmqvist et al., 2011, p. 386).

In addition to ‘dwell time’, ‘net dwell time’, ‘visual intake time’ and ‘visual intake count’ were used in the structural equation modeling as it was beneficial in terms of statistical modeling to use more than one variable to represent gaze behavior. These variables are based on slightly different computations, however the differences between them are very

small (Zemblys, Niehorster, Komogortsev, & Holmqvist, 2018; SensoMotoric Instruments GmbH, 2016, p. 333, 368).

For bivariate methods, t-tests and chi-square were applied. T-tests were used to analyze differences between the claim types or the product categories regarding means of gaze durations or means of evaluation variables such as the perceived healthiness of the product (variables from the first part of the questionnaire; see Chapter 2.4). Non-parametric chi-square tests were chosen to examine differences between the claim types and the product categories on the share of product purchases. Hence, the expectancy value for each claim type not influencing the share of purchases was compared to the actual share of purchases.

Multinomial logistic regression (MNL) was applied to analyze the influence of gaze behavior towards claims on the purchase decision. For each product category one MNL model was calculated. Each model consisted of three independent variables, specifically the gaze duration on the nutrition, health or taste claim. The dependent variable was the purchase decision comprised of three categories, i.e. the purchase of a product labeled with the nutrition, health or taste claim. MNL was chosen for the reason that it allows to test a nominal dependent variable with more than two categories compared to a binary logistic model in which the dependent variable has only two categories (Field, 2018, p. 916; Long & Freese, 2014, p. 386). In addition, the independent variables in MNL are metric or can be a combination of metric and nominal variables. MNL is based on the random utility theory, thus consumers choose the alternative which provides the highest utility for them (Klein, 2011, p. 48; Temme, 2007, p. 327). The utility U of alternative j for consumer i is defined of measured attributes of the alternative (deterministic component V) and factors which are unobservable by the researcher (random component \mathcal{E}). The latter includes factors such as unobserved attributes and measurement errors (Baltas & Doyle, 2001, p. 115).

$$U_{ij} = V_{ij} + \mathcal{E}_{ij} \quad (1)$$

Structural equation modeling (SEM) was applied to investigate the relationship between consumer characteristics (nutrition knowledge and health motivation) and gaze duration on claims regarding the purchase decision of products labeled either with a nutrition or a health claim. The influence of product attributes on the purchase decision was also part of the investigation. Therefore, SEM deemed to be the most appropriate method to calculate all these relationships within one model. Several constructs in the model were nominal, thus the software WarpPLS 6.0 was used because it is capable of modeling non-linearity among the constructs and allows the inclusion of metric and nominal constructs. WarpPLS uses the partial least squares (PLS) method for its path modeling which is a variance-based estimation approach to maximize the explained variance of the dependent constructs (Hair, Sarstedt, Ringle, & Gudergan, 2018, p. 18).

3 Consumer and product-specific characteristics influencing the effect of nutrition, health and risk reduction claims on preferences and purchase behavior – a systematic review

This chapter represents the article published by the author of this dissertation and Professor Dr. Ulrich Hamm as a co-author. Any reference to this chapter should be cited as:

Steinhauser, J., & Hamm, U. (2018). Consumer and product-specific characteristics influencing the effect of nutrition, health and risk reduction claims on preferences and purchase behavior – A systematic review. *Appetite*, 127, 303–323.
<https://doi.org/10.1016/j.appet.2018.05.012>.

Keywords:

Health claim; Nutrition claim; Consumer behavior; Nutrition knowledge; Health motivation; Perceived healthiness.

Journal Metrics for 2018:

Journal Impact Factor: 3.501

5-Year Impact Factor: 4.077

Quartile: Q1

Source: Web of Science - Journal Citation Reports by Clarivate Analytics.

3.1 Abstract

The research on nutrition, health, and risk reduction claims (NHR claims) shows a lack of consensus as to whether these claims have a positive or negative effect on consumers' preferences and purchase behavior. This issue has been highlighted by many authors. Therefore, a comprehensive literature review was performed to find reasons for contradictory results. First, a theoretical framework was developed which divided the determinants of the effects of NHR claims on consumers' preferences and purchase behavior into consumer and product-specific characteristics. Additionally, a categorization for the different NHR claim types was constructed to make the studies comparable. Afterwards, the scientific literature from the 1980s until May 2017 was scanned and 66 articles were found to be relevant. Consumer-specific characteristics such as nutrition knowledge, health motivation, familiarity, and socio-demographic characteristics were found to influence the NHR claim effect. Important product-specific characteristics were the perceived healthiness of the food product, the interaction between the product and the nutrient in the NHR claim, and the interaction between the claimed benefit and the NHR claim type. The consumer's nutrition knowledge and the product's perceived healthiness were deemed to be the most promising determinants for further investigation.

3.2 Introduction

Consumers' interest in leading a healthy lifestyle and their relationship with food is unabatedly high (Strijbos et al., 2016, p. 13; Boer & Bast, 2015, p. 61). Pointing out a food product's health-related characteristics by using nutrition, health, and risk reduction claims (NHR claims) is considered an advantageous strategy for food companies (Hoefkens & Verbeke, 2013, p. 83; Muth et al., 2013, p. 279; Krystallis & Chrysochou, 2011, p. 213) and is a widely used practice (Al-Ani et al., 2016, p. 1091; Hieke et al., 2016, p. 12; Pravst & Kušar, 2015, p. 9363; Devi et al., 2014, p. 257; No et al., 2014, p. 78; Hughes et al., 2013, p. 2156; Colby et al., 2010, p. 94). Following EU Regulation No. 1924/2006 which harmonized the law concerning NHR claims in the EU, this review article distinguishes between nutrition, health, and risk reduction claims. Based on EU Regulation No. 1924/2006, Art. 2, par. 2.4–2.6, a nutrition claim indicates that a food has a certain nutritional characteristic, while a health claim indicates a relationship between

the food and a health effect on the body, and a risk reduction claim indicates that the consumption of the food reduces the risk of developing a disease.

While food companies expect NHR claims to have positive effects on consumers' preferences and purchase behavior, some recent studies have shown that the use of NHR claims should be well-considered. Newer studies have shown that they can actually lead to negative evaluations and purchase behavior towards these products (Aschemann-Witzel & Grunert, 2015, p. 90; van Buul & Brouns, 2015, p. 1558; Lähteenmäki, 2013, p. 196; Berning, Chouinard, & McCluskey, 2011, p. 368; Lähteenmäki et al., 2010, p. 235). The lack of consensus in the studies' results about the effect of NHR claims has been pointed out by many authors (Hieke et al., 2015, p. 67; Annunziata & Vecchio, 2013, p. 353; Lähteenmäki, 2013, p. 199; Kim et al., 2009, p. 528; Ares & Gámbaro, 2007, p. 148; van Kleef, van Trijp, & Luning, 2005, p. 300; Williams, 2005, p. 262). In a recent literature review on NHR claims, the authors examined articles for effects of NHR claim labeled products on purchase and/or consumption compared to products without NHR claims (Kaur et al., 2017, p. 1). They found that NHR claim labeling resulted in an increase of purchase and/or consumption of food products in 20 studies. However, in eight studies it showed mixed effects, and in two studies, negative effects. This review article investigates the reasons *why* different studies on NHR claims came to such incongruent results.

The review searched for and analyzed the determinants of the effects of NHR claims on **consumers' preferences and purchase behavior**. This review not only gives reasons for the incongruence in the results, but can also be used as a basis for designing new studies. The focus of this review is on NHR claims that are presented in a written (explicit) and not in a pictorial or symbolic (implicit) form, like a heart shaped logo. Furthermore, we excluded nutrition labels on the back of food products such as nutrition fact tables, ingredient lists, or front-of-pack labels like Guideline Daily Amounts (GDA) or Multiple Traffic Lights. While nutrition labels refer to several nutrients, an NHR claim only focuses on one single nutrient (Talati, Pettigrew, Hughes et al., 2016, p. 57).

3.3 Theoretical framework

In this review paper, a theoretical framework is used which divides the determinants of the NHR claim effects into two categories. This is based on pioneering studies in which the determinants of the search for information and its processing are also divided into two

categories (Hoch & Ha, 1986, p. 222; Bobrow & Norman, 1975, p. 140). The top-down category contains the determinants of consumer-specific characteristics like nutrition knowledge, whereas the bottom-up category combines the determinants of stimulus-specific characteristics like the perceived healthiness of a food product (Hoch & Ha, 1986, p. 222; Bobrow & Norman, 1975, p. 140). Both the determinants of the top-down category and the bottom-up category influence consumer perception. This basic categorization was also applied in the research field about information on food products (Bialkova et al., 2013, p. 67; van Herpen & van Trijp, 2011, p. 148). In Figure 2, the review's framework is shown with the determinants of the NHR claim effects being listed and divided into two categories, namely the consumer and product-specific characteristics. The effect of NHR claims is on consumers' preferences and purchase behavior.

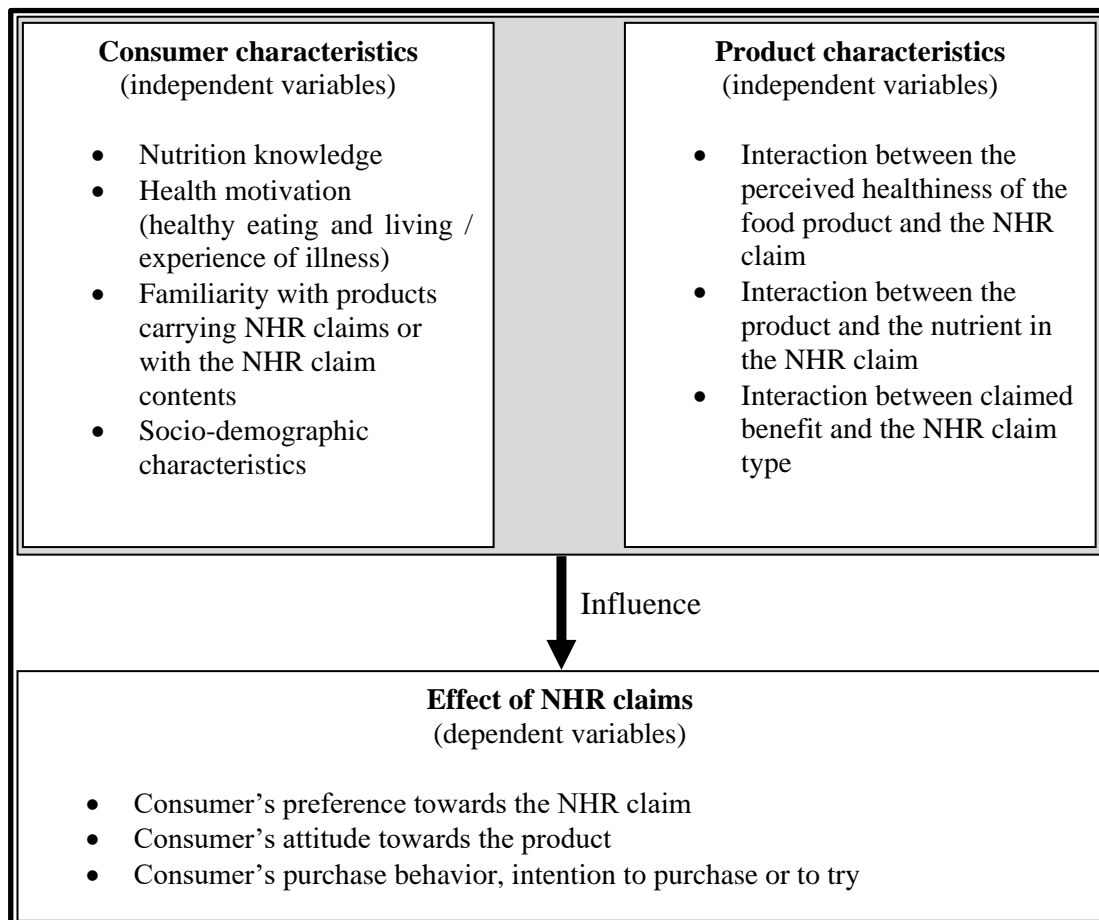


Figure 2: Conceptual framework on the influence of consumer and product-specific characteristics on the effect of NHR claims on consumer preferences and purchase behavior

In the last few years, researchers have started to invest more interest in how the effects of NHR claims are influenced by consumer characteristics (Hung et al., 2017, p. 35; Bialkova et al., 2016, p. 40; van Wezemael, Caputo, Nayga, Chrysochoidis, & Verbeke, 2014, p. 174; Aschemann-Witzel & Hamm, 2010, p. 49; Verbeke, Scholderer, & Lähteenmäki, 2009, p. 685). Based on models about information processing such as the Elaboration Likelihood Model (ELM) (Petty & Cacioppo, 1986b, p. 126), a consumer may process information differently depending on his level of motivation and ability (Grunert, Scholderer, & Rogeaux, 2011, p. 270; Balasubramanian & Cole, 2002, p. 113; Schmidt & Spreng, 1996, p. 247; Petty & Cacioppo, 1986a, p. 111). This approach when transferred to the research field about how information on the food packages influences a consumer's decision-making process, resulted in two consumer characteristics, namely, health motivation and nutrition knowledge (Moorman & Matulich, 1993, p. 210; Moorman, 1990, p. 365). Research has shown a strong positive relationship between motivation and knowledge (Holbrook, Berent, Krosnick, Visser, & Boninger, 2005, p. 765; Moorman, 1990, p. 373; Batra & Ray, 1986, p. 433; Petty & Cacioppo, 1986a, p. 81; Lutz, MacKenzie, & Belch, 1983, p. 534; Wood, 1982, p. 808; Petty, Cacioppo, & Goldman, 1981, p. 853). Health motivation is an important determinant, along with nutrition knowledge, because the latter is not sufficient on its own. Even though a consumer has a certain level of nutrition knowledge, it might not be used or transformed into a behavior such as choosing a healthier kind of food (Cornish, 2012, p. 293). A certain level of health motivation is necessary for consumers to actually apply their nutrition knowledge in a decision-making process regarding the choice of food (Bialkova et al., 2016, p. 40; Miller & Cassady, 2012, p. 137; Miller, Gibson, & Applegate, 2010, p. 111).

Besides these consumer characteristics, familiarity and socio-demographic characteristics will also be included in the review process as previous research revealed that these consumer characteristics are important for the formation of food preferences and attitudes (Fenko et al., 2016, p. 90; Giacalone & Jaeger, 2016, p. 121; Borgogno, Favotto, Corazzin, Cardello, & Piasentier, 2015, p. 139; Dobrenova & Terlutter, 2015, p. 572; Giacalone et al., 2015, p. 16; Liu, Hoefkens, & Verbeke, 2015, p. 104; Verbeke et al., 2009, p. 686; Siró et al., 2008, p. 464; Verbeke, 2005, p. 54).

As introduced in the framework in Figure 2, the article then goes on to focus on product characteristics. Typically, the studies in the NHR claim field mainly focused on NHR

claim characteristics (e.g. nutrition or health claims and to a minor extent on consumer characteristics), while mostly overlooked product characteristics. NHR claims were mostly tested on food products perceived as healthy (e.g. fruit juice) in comparison to products perceived as unhealthy or as hedonic (e.g. potato chips) (Cornish, 2012, p. 292). However, NHR claims are widely used on food products with an unfavorable nutrition value (Hughes et al., 2013, p. 2156; Colby et al., 2010, p. 94; Zwier, 2009, p. 109; Elliott, 2008, p. 266). It has been suggested that the interaction or match-up effects between the NHR claim and the food products determine the direction of the effect of NHR claims (Masson, Debucquet, Fischler, & Merdji, 2016, p. 626; van Wezemaal et al., 2014, p. 173; Verbeke et al., 2009, p. 685; Siró et al., 2008, p. 462; Wansink, van Ittersum, & Painter, 2004, p. 340).

3.4 Methodology of the review process

To achieve this paper's aim, all studies in the field of NHR claims published in academic journal articles were first retrieved, then searched for determinants of the NHR claim effect. Four databases (Thomson Reuters Web of Science, Science Direct, EBSCO, AgEcon) were scanned with a Boolean term restricted to the title, the abstract, and the keywords of articles. The restriction was necessary so that the search output only listed articles about NHR claims; thus, related topics like nutrition labels were not included. The search term had to cope with the various names given to NHR claims. In some cases, the term 'risk reduction claim' might be used, in others 'reduction of disease risk claim', or – especially in US articles – a 'health claim' might be called a 'structure function claim' and a 'risk reduction claim' might be called a 'health claim'. However, other terms for these claims like 'nutrition label' (e.g. Barreiro-Hurlé, Gracia, & de-Magistris, 2010a, p. 221) were not included in this search term because their usage is rare. The final search term used was:

((Title-Abstr-Key("nutrition claim*")) OR (Title-Abstr-Key("health claim*")) OR (Title-Abstr-Key("risk reduction claim*")) OR (Title-Abstr-Key("reduction of disease risk claim*")) OR (Title-Abstr-Key("structure function claim*")) OR (Title-Abstr-Key("health label*"))) AND (consum*)

Besides the lack of unified terms for NHR claims, another problem became apparent while scanning the articles: the different and sometimes even contrary definitions or

categorizations of NHR claims made it difficult to compare studies and their results. Based on EU Regulation No. 1924/2006 and the *Codex Alimentarius Commission's Guidelines for Use of Nutrition and Health Claims*, Figure 3 shows a categorization of the NHR claim types. This categorization depicts a balance between a very high degree of detail, which would lead to incomprehensibility, and a very low degree of detail, which would lead to inaccuracy. Additionally, this categorization is the basis for the comparison of the studies referred to in this review paper as well as in its summary table in the article's Appendix (Table 5). For better illustration, Table 2 gives examples for the different NHR claim types.

NHR Claims	1. Nutrition claims
	<p>indicate that a food has a certain nutritional characteristic</p> <p>1.1 without mentioning any nutrient.</p> <p>1.2 with mention of the nutrient</p> <p style="padding-left: 20px;">1.2.a containing a nutrient.</p> <p style="padding-left: 20px;">1.2.b containing a nutrient in reduced or increased amount.</p> <p style="padding-left: 20px;">1.2.c not containing a nutrient.</p>
	2. Health claims
	<p>indicate a relationship between the food and a health effect on the body</p> <p>2.1 without mentioning any nutrient</p> <p style="padding-left: 20px;">2.1.a and without mentioning any effect on the body.</p> <p style="padding-left: 20px;">2.1.b and with mention of an effect on the body.</p> <p>2.2 with mention of the nutrient</p> <p style="padding-left: 20px;">2.2.a and without mentioning any effect on the body.</p> <p style="padding-left: 20px;">2.2.b and with mention of an effect on the body.</p>
	3. Risk reduction claims
	<p>indicate that the consumption of the food reduces the risk of developing a disease</p> <p>3.1 without mentioning any nutrient.</p> <p>3.2 with mention of the nutrient.</p>

Figure 3: Categorization and definition of NHR claim types based on EU Regulation No. 1924/2006 and Codex Alimentarius Commission (2013)

Table 2: Examples of the NHR claim types

NHR claim type	Example	Legal status in the EU
Nutrition Claims	1.1 natural	allowed - (EU No. 1924/2006 Annex)
	1.2.a contains calcium	allowed - (EU No. 1924/2006 Annex)
	1.2.b increased calcium	allowed - (EU No. 1924/2006 Annex)
	1.2.c fat free	allowed - (EU No. 1924/2006 Annex)
Health Claims	2.1.a healthy	not allowed, because a specific health benefit and the nutrient the health benefit is based on is missing (EU No. 1924/2006 Art. 10 par. 3)
	2.1.b supports bone density	not allowed, because the nutrient the health benefit is based on is missing (EU No. 1924/2006 Art. 10 par. 3)
	2.2.a live healthy with calcium	not allowed, because a specific health benefit is missing (EU No. 1924/2006 Art. 10 par. 3)
	2.2.b calcium is needed for the maintenance of normal bones	allowed - (EU No. 432/2012 Annex)
Risk Reduction Claims	3.1 lowers the risk of developing osteoporosis	not allowed - because the nutrient the health benefit is based on is missing (EU No. 1924/2006 Art. 10 par. 3)
	3.2 calcium helps to reduce the loss of bone mineral in post-menopausal women. Low bone mineral density is a risk factor for osteoporotic bone fractures.	allowed - (EU No. 1228/2014)

The output lists of the databases were screened manually and only peer-reviewed, English-language, journal articles published from the 1980s until May 2017 were included if they presented empirical results about the effect of NHR claims relating to the consumer. According to the aim of the review paper, the identified articles were searched for determinants of the NHR claim effects. Cited articles which proved to be relevant were added as well. In total, 66 articles reported product and consumer-specific characteristics in combination with consumer behavior regarding the effect of NHR claims relevant to this review paper. The article selection process is shown in Figure 4.

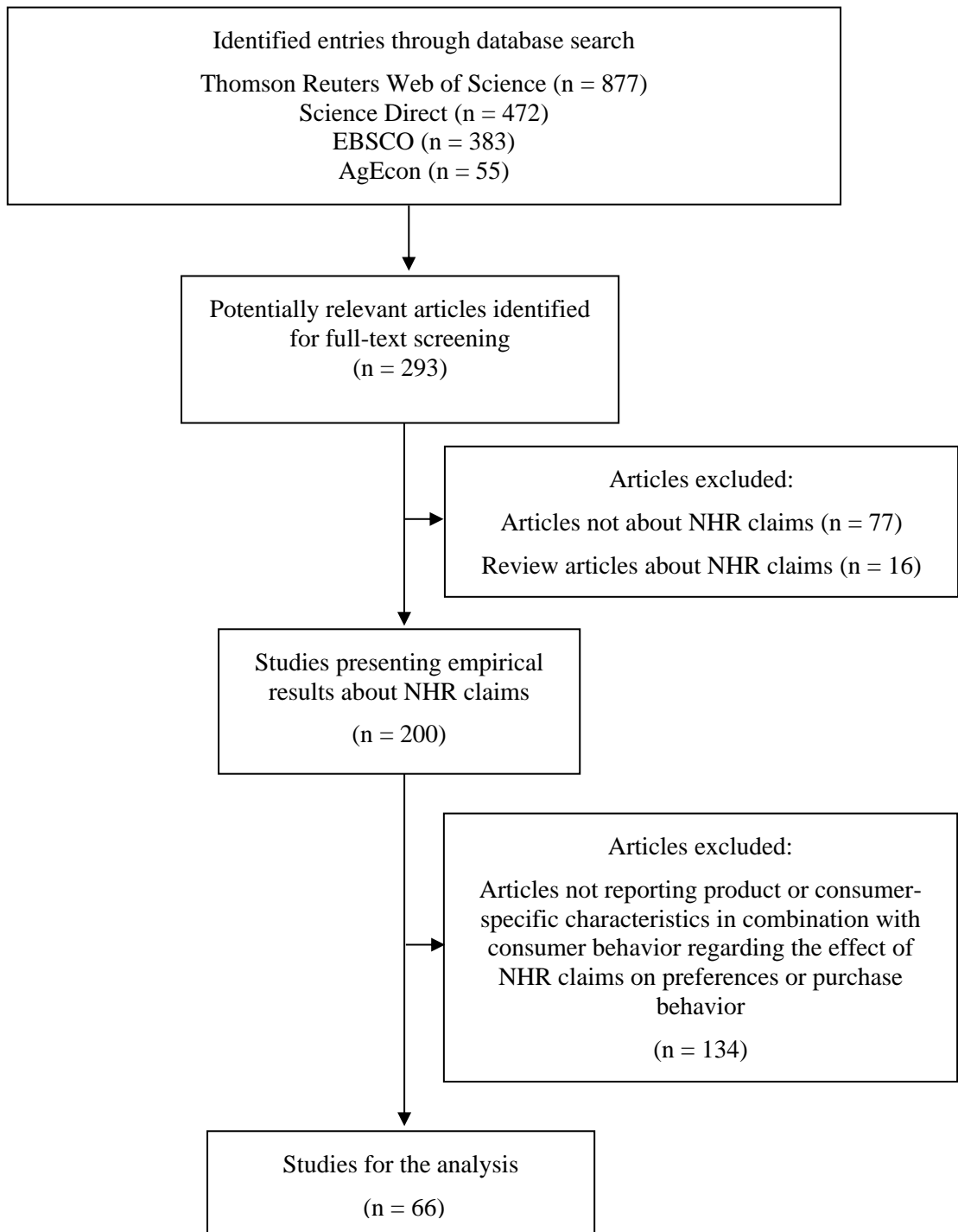


Figure 4: Article selection process

3.5 Overview of the results

Several studies compared the effect of NHR claims on consumer behavior in different countries and came to very different conclusions (Aschemann-Witzel & Grunert, 2015, p. 90; van Wezemaal et al., 2014, p. 173; Lähteenmäki, 2013, p. 198; Wills et al., 2012, p. 232; Lähteenmäki et al., 2010, p. 234; Saba et al., 2010, p. 389; Williams, Ridges, Batterham, Ripper, & Hung, 2008, p. 642; van Trijp & van der Lans, 2007, p. 319). Even the perceived healthiness of unmodified staple food products without any NHR claims on them was evaluated differently across countries (Lähteenmäki et al., 2010, p. 234; Saba et al., 2010, p. 389; Jesionkowska, Sijtsema, Konopacka, & Symoneaux, 2009, p. 86; Arvola et al., 2007, p. 204; Bech-Larsen & Grunert, 2003, p. 13).

Beside the country effect, the use of different NHR claim types as well as different combinations of NHR claims and products made the studies and their results difficult to compare (van Buul & Brouns, 2015, p. 1558; Wills et al., 2012, p. 234; Ares & Gámbaro, 2007, p. 148; van Kleef et al., 2005, p. 300). One reason why researchers used different NHR claim types is that country-specific legal rules apply, so the claims' wording must be different. Certain types of claims are not allowed in some countries, such as the risk reduction claim in India, Mexico, Russia, etc. (Boer & Bast, 2015, p. 65). Conversely, in the USA, a type of risk reduction claim is allowed that communicates a relationship between a nutrient's consumption and its effect on reducing the risk of developing a disease which is partly agreed on by the scientific community. This type of claim is called a qualified health claim because qualifiers (e.g. unlikely, uncertain) are added, which are used to emphasize the claim's partial scientific support (Berhaupt-Glickstein & Hallman, 2017, p. 2811, 2820). Despite the EU Regulations and an EU-wide official register listing all approved NHR claims, most studies in EU countries not only tested unlisted NHR claims, but also NHR claims in an illegal format such as those not listing the nutrient responsible for the claimed health effect in the NHR claim.

Even if the same types of NHR claims and the same products are used, a minor difference in the topic of the NHR claims might have a differential influence (e.g. a nutrition claim about the reduction of a negatively perceived ingredient, like fat, versus a fortification with a positively perceived ingredient, like vitamin C). The differences in study designs and methodologies exacerbate the difficulty of their comparison (Masson et al., 2016,

p. 619; van Buul & Brouns, 2015, p. 1558; Wills et al., 2012, p. 234), making it difficult to integrate them into this review.

In addition to these drawbacks, several authors found that consumers' health motivation and nutrition knowledge greatly determine the effect of nutrition and health related information such as NHR claims and suggested that these should be the focus of future research (Hung et al., 2017, p. 35; Fenko et al., 2016, p. 90; Mitić & Gligorijević, 2015, p. 349; van Buul & Brouns, 2015, p. 1558; van Wezemael et al., 2014, p. 174; Ares et al., 2009, p. 56). Nutrition knowledge and health motivation are widely considered the main consumer characteristics which influence consumer information processing regarding nutrition labels and NHR claims (Carrillo, Fiszman, Lähteenmäki, & Varela, 2014, p. 653; Lähteenmäki, 2013, p. 199; Hieke & Taylor, 2012, p. 125, 137; Miller & Cassady, 2012, p. 130; Rogeaux, 2010, p. 284; Andrews, Netemeyer, & Burton, 2009, p. 42; Balasubramanian & Cole, 2002, p. 113). Upon transfer to the NHR claim field, the same positive relationship as shown by the pioneer studies between motivation and knowledge were also reported between health motivation and nutrition knowledge: a person, who is more motivated to live and eat healthy, is usually more knowledgeable in nutrition as well (Hung et al., 2017, p. 39; Miller & Cassady, 2015, p. 213; Grunert et al., 2011, p. 270; Grunert, Fernández-Celemín, Wills, Storcksdieck genannt Bonsmann, & Nureeva, 2010, p. 276; Bower, Saadat, & Whitten, 2003, p. 73).

Other authors indicated that the perceived healthiness of the food product or the product category determines the effect of an NHR claim and therefore should be taken into account in future research (Fenko et al., 2016, p. 90; Masson et al., 2016, p. 626; Talati, Pettigrew, Dixon et al., 2016, p. 2; Orquin & Scholderer, 2015, p. 153; Fernqvist & Ekelund, 2014, p. 348; van Wezemael et al., 2014, p. 173; Carrillo, Varela, & Fiszman, 2012a, p. 115; Choi et al., 2012, p. 424; Graham et al., 2012, p. 381; Nocella & Kennedy, 2012, p. 576; Wills et al., 2012, p. 232; Miller, Seiders, Kenny, & Walsh, 2011, p. 129).

Based on the review's framework, the two determinants, consumer-specific characteristics like nutrition knowledge or health motivation, and product-specific characteristics like the product's perceived healthiness, will be analyzed in detail in the two following sections.

3.6 Consumer-specific characteristics influencing the effect of NHR claims

3.6.1 Influence of nutrition knowledge

Nutrition knowledge is defined as a “scientific construct that nutrition educators have created to represent individual’s cognitive processes related to information about food and nutrition” (Axelson & Brinberg, 1992, p. 239). When consumers look at a product package, they use internal and external information. At the point of sale, the external information the consumer can use is limited to the package (e.g. the nutrition facts panel, the ingredient list or claims such as NHR claims) (Miller & Cassady, 2015, p. 208; Andrews et al., 2009, p. 41). The internal information is the knowledge of the consumer (Aschemann-Witzel & Grunert, 2015, p. 91), and is a key variable that influences the search and processing of information (Batra & Ray, 1986, p. 433; Petty & Cacioppo, 1986a, p. 111). Like other types of knowledge, nutrition knowledge can also be split into subjective nutrition knowledge, which is what the consumers believe they know about nutrition, and objective nutrition knowledge, which is what the consumers actually know about nutrition (Brucks, 1985, p. 1). There is a difference between subjective and objective nutrition knowledge (Moorman, Diehl, Brinberg, & Kidwell, 2004), and as one study showed, less than half of the participants who claimed to have a high nutrition knowledge (subjective) actually had high nutrition knowledge (objective) (Bower et al., 2003, p. 68). Therefore, we indicate the type of measurement of nutrition knowledge used in different studies.

In one study, consumers with high objective nutrition knowledge evaluated food products with an NHR claim as healthier and had a higher purchase intention than consumers with low objective nutrition knowledge (Ares, Giménez, & Gámbaro, 2008, p. 667). The reason given is that only the consumers with high nutrition knowledge understood the health effects of the added nutrients mentioned in the NHR claims. In two other studies, consumers with a higher objective nutrition knowledge stated that they read the health claims on products more often than consumers with low objective nutrition knowledge (Petrovici, Fearne, Nayga, & Drolias, 2012, p. 777; Szykman, Bloom, & Levy, 1997, p. 233).

Other authors report different results: Consumers with high objective nutrition knowledge evaluated the products with NHR claims less favorably (Andrews, Burton, & Netemeyer,

2000, p. 37; Andrews, Netemeyer, & Burton, 1998, p. 69) than consumers with low objective nutrition knowledge. Participants who attended a course about nutrition, and therefore were regarded as a consumer group with high nutrition knowledge, evaluated products labeled with NHR claims negatively if the nutrition facts table depicted the product as inferior in its nutritional quality (Walters & Long, 2012, p. 352). After children participated in a course about nutrition, the NHR claims on printed food packages had less impact on their choice of the products (Miller et al., 2011, p. 128). In another study in which participants were asked about their subjective nutrition knowledge, it was concluded that consumers with low nutrition knowledge belong to the vulnerable part of society (lower income, older) and that they have a higher interest in NHR claims than consumers with high nutrition knowledge (Cavaliere, Ricci, & Banterle, 2015, p. 49).

In further studies, it was reported that the level of objective nutrition knowledge had no influence on the perception of NHR claims (Orquin, 2014, p. 278) and on the purchase behavior of food products labeled with NHR claims (Lalor, Kennedy, & Wall, 2009, p. 131). Similarly, subjective nutrition knowledge had no influence on the purchase intention of products carrying an NHR claim (Coleman, Miah, Morris, & Morris, 2014, p. 169). In a study in which consumers had to state how often they use NHR claims while shopping, there was no difference in the stated usage between the objective nutrition knowledge groups (Barreiro-Hurlé et al., 2010a, p. 226).

3.6.2 Influence of health motivation

Health motivation is defined as “a consumer’s goal directed arousal to engage in preventive health behaviors” (Moorman & Matulich, 1993, p. 210). In general, consumers’ motivation or involvement changes according to their expectation that something will “have significant consequences for their own lives” (Apsler & Sears, 1968, p. 162). Consequently, the more consumers are motivated, the more likely they are to engage and spend more time searching for and processing relevant information (Dutta-Bergman, 2005, p. 3; Keller et al., 1997, p. 258). Accordingly, the level of health motivation or health consciousness represents how much consumers are interested in maintaining good health, for example by eating a healthy diet or searching for health-related information (Dutta-Bergman, 2005, p. 3). A prominent reason for higher health motivation is consumers experiencing a disease in their own bodies or in that of family or friends (Lähteenmäki, 2013, p. 199).

The more consumers were interested in eating a healthy diet, the higher were the perceived healthiness and perceived health benefits of the products with NHR claims (Dean et al., 2012, p. 134). Purchase intention or greater likelihood of choosing products with NHR claims increased correspondingly (Dean et al., 2012, p. 134; Aschemann-Witzel & Hamm, 2010, p. 53; Sabbe, Verbeke, Deliza, Matta, & van Damme, 2009, p. 90). The more consumers indicated concern about their health by doing things like eating a healthy diet or trying to protect themselves from a disease, the higher their purchase intention for a product labeled with a health claim (Bower et al., 2003, p. 70, 72) and the more consumers trusted NHR claims (Russo France & Fitzgerald Bone, 2005, p. 47). Consumers who were more concerned about their health and a healthy diet had a higher preference and purchase intention towards products with an NHR claim (Kähkönen & Tuorila, 1999, p. 89). In other studies, consumers were asked directly about their NHR claim usage: Consumers who expressed greater concern about health issues like leading a healthier lifestyle, or agreed that food has an important impact on their health, or believed that food is effective in preventing diseases, were more likely to answer that they use NHR claims (Cavaliere et al., 2015, p. 47; Barreiro-Hurlé et al., 2010a, p. 227; Szykman et al., 1997, p. 235).

Studies in which manipulated packages labeled with NHR claims on the front were sent to consumers, showed different results. Kemp, Burton, Creyer, and Suter (2007, p. 71) assessed consumers' motivation to processing nutrition and health-related information by letting consumers rate how interested they were in, or how often they read, such information on packages. Consumers with lower motivation were more likely to be affected by the NHR claims, and finally, more likely to have a higher purchase intention for products with NHR claims (Kemp et al., 2007, p. 67). In addition, consumers with higher motivation were less likely to rely solely on NHR claims, but also on using the nutrition facts panel (Kemp et al., 2007, p. 68). In an older mail survey with the same measurement, the motivation had no influence on the effect of the NHR claims (Keller et al., 1997, p. 265). In a study in which advertisements were tested with the same measurement for health motivation as was previously used, health motivation had no influence on the effect of NHR claims on product evaluations or purchase intention (Chrysochou & Grunert, 2014, p. 1215). NHR claims on packages had no influence on the purchase intention of health-conscious consumers. Details on the measurement of

health-consciousness were not given by the authors beyond the use of a self-assessed questionnaire (Wansink, Park, Sonka, & Morganosky, 2000, p. 90).

As previously mentioned, one prominent reason for higher health motivation is personal illness. People suffering from an illness are more motivated to elaborate deeply on relevant information such as NHR claims (Lähteenmäki, 2013, p. 199; van Kleef et al., 2005, p. 304; Petty & Cacioppo, 1986b, p. 144, 1986a, p. 81; Petty et al., 1981, p. 853). Studies confirm that consumers who personally, or whose friends or relatives are suffering from diseases are also more motivated to search for health-related information on the product (Bhaskaran & Hardley, 2002, p. 596; Feick, Herrmann, & Warland, 1986, p. 187) and have higher preferences towards food claiming to have an additional health benefit (Verbeke, 2005, p. 54).

Products with NHR claims relating to a personally relevant disease were considered more attractive and convincing, which led to higher purchase intentions than products with NHR claims relating to a personally irrelevant disease (van Kleef et al., 2005, p. 307). In this study, a disease was considered personally relevant if the participants themselves, or someone in their close environment, suffered from it. In the following studies, consumers with a self-reported need to pay attention to a certain aspect of their health, such as their blood cholesterol, preferred the products with NHR claims referring to such a disease (Lyly, Roininen, Honkapää, Poutanen, & Lähteenmäki, 2007, p. 251) and perceived these products as more beneficial to themselves than consumers without these health problems (Dean et al., 2007, p. 194). A later study confirmed these results by showing that the more relevant a certain disease was to consumers, the more they perceived a product with an NHR claim about this disease as healthier or more beneficial to them, thus increasing their purchase intentions towards this product (Dean et al., 2012, p. 132). Additionally, Dean et al. (2012, p. 132) showed, that these three ratings were greatly increased if the disease was personally relevant as compared to being relevant to those close to oneself.

Consumers who already had a disease or had been told they were at risk of developing a disease such as coronary heart disease, answered that they use NHR claims more often (Szykman et al., 1997, p. 235). Consumers who perceived their own health status to be poor, generally had an increased interest in NHR claims (Cavaliere et al., 2015, p. 50). In line with these results, consumers with relatives or friends suffering from a disease stated in focus group interviews that they were more positive towards products with NHR claims referring to these diseases (Lalor, Madden, McKenzie, & Wall, 2011, p. 58).

3.6.3 Influence of familiarity

Familiarity is the previous experience consumers have with something such as a product category or an NHR claim. Past consumer research shows that there is a positive connection between familiarity and preference (Giacalone & Jaeger, 2016, p. 121). Studies about NHR claims unanimously reported that consumers were more likely to have higher preferences towards products with NHR claims if the mentioned nutrient in the NHR claim was familiar to them (e.g. calcium and vitamin C were more accepted than less known nutrients like bioactive peptides or β -glucan) (Miklavec, Pravst, Grunert, Klopčič, & Pohar, 2015, p. 30; Carrillo, Varela, & Fiszman, 2012b, p. 215; Krystallis & Chrysochou, 2012, p. 98; Krutulyte et al., 2011, p. 16; Lähteenmäki et al., 2010, p. 237; Ares et al., 2009, p. 53; Grunert et al., 2009, p. 275; van Trijp & van der Lans, 2007, p. 319). This suggests that consumers use their previous experience and knowledge when they see an NHR claim. Two studies confirmed this result by showing that if consumers were familiar with the link between a nutrient and its health effect, then different wordings of NHR claims or the addition of more information in the NHR claim such as going from a nutrition to a health or risk reduction claim, did not have any effect on their evaluations (Lähteenmäki et al., 2010, p. 239; Urala, Arvola, & Lähteenmäki, 2003, p. 825). Also, NHR claims lead to better evaluations on product categories which have typically been carriers for NHR claims or have been the target of health-related marketing efforts like breakfast cereals, yogurts and margarine (Dean et al., 2012, p. 134; Lalor, Kennedy et al., 2011, p. 760; Saba et al., 2010, p. 391; Verbeke et al., 2009, p. 689; Williams et al., 2008, p. 642; van Kleef et al., 2005, p. 302, 307).

Moreover, cross-border studies show that the longer consumers were familiar with NHR claims or a certain type of NHR claim within a country, the more positive their evaluations were towards these NHR claims. This was reported in studies across European countries and can be justified by the existence of different laws in these countries (e.g. some countries did not allow risk reduction claims) prior to EU Regulation No. 1924/2006. This led to a difference in consumers' familiarity towards NHR claims between countries (Lähteenmäki, 2013, p. 198; Grunert et al., 2011, p. 276; Saba et al., 2010, p. 391). In comparison to European consumers, US consumers have more positive attitudes towards NHR claims which can be due to the fact that US consumers have been familiar with NHR claims since the 1980s, whereas European consumers have been

familiar with them since the 2000s (Aschemann-Witzel & Grunert, 2015, p. 98; Bech-Larsen & Grunert, 2003, p. 12). For example, a study across five European countries in 2013 with around 400 products checked per country showed that 22% of the products carried a nutrition claim, 11% carried a health claim, and 1%, a risk reduction claim (Kaur et al., 2016, p. 1391). A study in which all packaged products in six grocery stores in one US city were checked prior to the year 2010 showed that 37% of the products carried a nutrition claim, 3% carried a health claim, and 4%, a risk reduction claim (Colby et al., 2010, p. 94). Therefore, the combination of different laws governing the use of NHR claims with different eating habits and different marketing activities lead to a different familiarity with NHR claims (Carrillo et al., 2014, p. 653; van Wezemael et al., 2014, p. 169; Block et al., 2011, p. 7; Lyly et al., 2007, p. 243). Consequently, the comparison of results between countries is not only questionable, especially between the USA and Europe (van Trijp & van der Lans, 2007, p. 306), but also over time (Skaczkowski, Durkin, Kashima, & Wakefield, 2016, p. 232).

3.6.4 Influence of socio-demographic characteristics

Researchers found that older consumers were more interested in or had higher preferences for food products labeled with NHR claims (Cavaliere et al., 2015, p. 47; Dean et al., 2012, p. 134; Sabbe et al., 2009, p. 90; Verbeke, 2005, p. 54; Bower et al., 2003, p. 72; Kähkönen & Tuorila, 1999, p. 88). In addition, older consumers had a greater intention to buy or try food products labeled with NHR claims (Baglione, Tucci, & Stanton, 2012, p. 463; Ares et al., 2009, p. 54; Siegrist, Stampfli, & Kastenholtz, 2008, p. 529; Bower et al., 2003, p. 72; Kähkönen & Tuorila, 1999, p. 88). Other studies demonstrated that age had no impact on the preference towards or purchase decision for products with NHR claims (Aschemann-Witzel & Hamm, 2010, p. 55; Urala & Lähteenmäki, 2007, p. 8; Urala et al., 2003, p. 823).

Women were more interested in or had higher preferences for food products labeled with NHR claims (Cavaliere et al., 2015, p. 49; Sabbe et al., 2009, p. 84; Verbeke, 2005, p. 54; Urala et al., 2003, p. 823; Kähkönen & Tuorila, 1999, p. 86). In addition, women had a greater intention to buy or try food products labeled with NHR claims (Vecchio, van Loo, & Annunziata, 2016, p. 375; Lynam, McKevitt, & Gibney, 2011, p. 2218; Ares et al., 2009, p. 53; Bower et al., 2003, p. 72; Kähkönen & Tuorila, 1999, p. 86). Dean et al. (2007, p. 195) reported an interaction between gender and the claimed benefit of NHR claims regarding the preferences for products with NHR claims, namely, men preferred

cholesterol-lowering products, whereas women preferred added-fiber products. Other studies showed that gender had no effect on the preference, on the intentions to purchase, or on the purchase decision of products with NHR claims (Aschemann-Witzel & Hamm, 2010, p. 55; Lyly et al., 2007, p. 253; Urala & Lähteenmäki, 2007, p. 8).

Consumers with lower education or lower income were more interested in food labeled with NHR claims (Cavaliere et al., 2015, p. 44; Barreiro-Hurlé et al., 2010a, p. 227) or were more likely to limit their information search to only the front of a package with an NHR claim label on it (Roe, Levy, & Derby, 1999, p. 98). In other studies, education proved to have no effect on preferences towards food with NHR claims or on willingness to purchase such food (Vecchio et al., 2016, p. 375; Contini et al., 2015, p. 111; Urala & Lähteenmäki, 2007, p. 8).

Review results on the influence of consumer-specific characteristics are compiled in Table 3.

Table 3: Summary on the influence of consumer-specific characteristics

Influence of nutrition knowledge		
Higher nutrition knowledge leads to higher preferences or higher purchase intentions towards NHR claim products	Higher nutrition knowledge leads to lower preferences or lower purchase intentions towards NHR claim products	No effect
Ares et al., 2008, p. 667 Petrovici et al., 2012, p. 777 Szykman et al., 1997, p. 235	Andrews et al., 1998, p. 69 Andrews et al., 2000, p. 37 Cavaliere et al., 2015, p. 49 Miller et al., 2011, p. 128 Walters & Long, 2012, p. 352	Barreiro-Hurlé et al., 2010a, p. 226 Coleman et al., 2014, p. 169 Lalor et al., 2009, p. 131 Orquin, 2014, p. 278
Influence of health motivation		
Higher health motivation leads to higher preferences or higher purchase intentions towards NHR claim products	Lower health motivation leads to higher preferences or lower purchase intentions towards NHR claim products	No effect
Aschemann-Witzel & Hamm, 2010, p. 53 Barreiro-Hurlé et al., 2010a, p. 227 Bower et al., 2003, p. 70, 72 Cavaliere et al., 2015, p. 47 Dean et al., 2007, p. 194 Dean et al., 2012, p. 132, 134 Kähkönen & Tuorila, 1999, p. 89 Lalor, Madden et al., 2011, p. 58 Lyly et al., 2007, p. 251 Russo France & Fitzgerald Bone, 2005, p. 47 Sabbe et al., 2009, p. 90 Szykman et al., 1997, p. 235 van Kleef et al., 2005, p. 307	Kemp et al., 2007, p. 67	Chrysochou & Grunert, 2014, p. 1215 Keller et al., 1997, p. 265 Wansink et al., 2000, p. 90

Influence of familiarity		
Familiarity leads to higher preferences or higher purchase intentions towards NHR claim products	Familiarity leads to lower preferences or lower purchase intentions towards NHR claim products	Familiarity has no effect
Ares et al., 2009, p. 53 Carrillo et al., 2012b, p. 215 Dean et al., 2012, p. 134 Grunert et al., 2009, p. 275 Krutulyte et al., 2011, p. 16 Krystallis & Chrysochou, 2012, p. 98 Lähteenmäki et al., 2010, p. 237 Lalor, Kennedy et al., 2011, p. 760 Miklavec et al., 2015, p. 30 Saba et al., 2010, p. 391 van Kleef et al., 2005, p. 302, 307 van Trijp & van der Lans, 2007, p. 319 Verbeke et al., 2009, p. 689 Williams et al., 2008, p. 642	None	None
Influence of socio-demographic characteristics		
Older consumers have higher preferences or higher purchase intentions towards NHR claim products	Younger consumers have higher preferences or higher purchase intentions towards NHR claim products	Age has no effect
Ares et al., 2009, p. 54 Baglione et al., 2012, p. 463 Bower et al., 2003, p. 72 Cavaliere et al., 2015, p. 47 Dean et al., 2012, p. 134 Kähkönen & Tuorila, 1999, p. 88 Sabbe et al., 2009, p. 90 Siegrist et al., 2008, p. 529 Verbeke, 2005, p. 54	None	Aschemann-Witzel & Hamm, 2010, p. 55 Urala et al., 2003, p. 823 Urala & Lähteenmäki, 2007, p. 8

Women have higher preferences or higher purchase intentions towards NHR claim products	Men have higher preferences or higher purchase intentions towards NHR claim products	Gender has no effect	Gender and content of NHR claims have an interaction effect on preferences towards NHR claim products
Ares et al., 2009, p. 53 Bower et al., 2003, p. 72 Cavaliere et al., 2015, p. 49 Kähkönen & Tuorila, 1999, p. 86 Lynam et al., 2011, p. 2218 Sabbe et al., 2009, p. 84 Urala et al., 2003, p. 823 Vecchio et al., 2016, p. 375 Verbeke, 2005, p. 54	None	Aschemann-Witzel & Hamm, 2010, p. 55 Lyly et al., 2007, p. 253 Urala & Lähteenmäki, 2007, p. 8	Dean et al., 2007, p. 195
Higher education or income leads to higher preferences or higher purchase intentions towards NHR claim products	Lower education or income leads to higher preferences or higher purchase intentions towards NHR claim products	Education or income has no effect	
None	Barreiro-Hurlé et al., 2010a, p. 227 Cavaliere et al., 2015, p. 44	Contini et al., 2015, p. 111 Urala & Lähteenmäki, 2007, p. 8 Vecchio et al., 2016, p. 375	

3.7 Product-specific characteristics influencing the effect of NHR claims

3.7.1 Influence of the perceived healthiness of the food product

The role of perceived healthiness is an important determinant that influences the effect of NHR claims (Bialkova et al., 2016, p. 39). Based on the theoretical background of attitude models in which attitudes towards a certain product are mediated by product related beliefs, it can be assumed that the perceived healthiness of a product mediates the effect of NHR claims on dependent variables (Burton, Andrews, & Netemeyer, 2000, p. 238; Ajzen & Fishbein, 1980). Furthermore, consumers do not consider the specific nutritional composition of a food product, but rather tend to categorize the food as either healthy or unhealthy, which is closely connected to product categories (Bucher, Müller, & Siegrist, 2015, p. 408; Chandon, 2013, p. 8; Gravel et al., 2012, p. 878; Chandon & Wansink, 2011, p. 130; Carels et al., 2007, p. 450; Niva, 2007, p. 388). This consumer behavior can be considered as a heuristic to simplify decision making (Tversky & Kahneman, 1974).

In two studies in North America, at least half of the food products in supermarkets which had an NHR claim on their packages, could be considered poor in nutritional quality such as being too high in sugar, saturated fat, sodium, etc. (Colby et al., 2010, p. 95; Elliott, 2008, p. 266). In New Zealand, one-third of the products considered unhealthy carried an NHR claim (Al-Ani et al., 2016, p. 1087). In another study from New Zealand, most of the breakfast cereals which were considered less healthy carried NHR claims (Devi et al., 2014, p. 259). In a study across 16 countries, 30% of unhealthy or hedonic products carried an NHR claim (Mayhew et al., 2016, p. 998). In Australia, one-third of products with NHR claims would not have passed the regulation, under proposal at the time, regarding nutrient profile criteria for the use of NHR claims (Hughes et al., 2013, p. 2157). Based on this Australian interim regulation, in a study across five European countries, it was reported that around one-third of the products carrying an NHR claim were considered so unhealthy that they were not allowed to carry an NHR claim (Kaur et al., 2016, p. 1392). In the European Union, such nutrient profiles were to be established by 2009 according to Art. 4 of the European Regulation No. 1924/2006. They were, however, never established and it is questionable that they ever will be (Kaur et al., 2016, p. 1389; Miklavec et al., 2015, p. 27; Pravst & Kušar, 2015, p. 9364; Lähteenmäki, 2013, p. 197). Consequently, the use of NHR claims is allowed independently of the product's nutritional quality. These results point out that NHR claims are not only labeled on

nutritionally favorable products, but also on hedonic products or products which can be considered nutritionally poorer.

3.7.1.1 Main and interaction effects

In some studies about NHR claims, a main effect of the product's perceived healthiness was found (Choi et al., 2012, p. 432; Ares et al., 2008, p. 665; Siegrist et al., 2008, p. 528; van Kleef et al., 2005, p. 302). The product's perceived healthiness was sometimes actually the greatest influence on the preferences or purchase intention (versus main effect of NHR claim or interaction effect) (Huang & Lu, 2016, p. 208; Annunziata & Vecchio, 2013, p. 351; Krutulyte et al., 2011, p. 14; Saba et al., 2010, p. 389; Hailu, Boecker, Henson, & Cranfield, 2009, p. 260; Williams et al., 2008, p. 641; Ares & Gámbaro, 2007, p. 150, 157; Bech-Larsen & Grunert, 2003, p. 13). If a significant main effect of an NHR claim was reported as well, then the effect of the NHR claim was mostly smaller than the main effect of the product's perceived healthiness (Ares et al., 2008, p. 665; Williams et al., 2008, p. 641; Bech-Larsen & Grunert, 2003, p. 13). Only van Kleef et al. (2005, p. 302) and Siegrist et al. (2008, p. 528) showed that the main effect of the NHR claim was the largest effect. Additionally, in many studies a significant interaction between the product's perceived healthiness and the NHR claim was shown (Huang & Lu, 2016, p. 208; Choi et al., 2012, p. 432; Krutulyte et al., 2011, p. 14; Kim et al., 2009, p. 544; Ares et al., 2008, p. 665; Siegrist et al., 2008, p. 528; Ares & Gámbaro, 2007, p. 150; Bech-Larsen & Grunert, 2003, p. 13). The interaction suggests that NHR claims do not have the same effect on products which differ in their perceived healthiness. On the contrary, only Williams et al. (2008, p. 641) and van Kleef et al. (2005, p. 303) reported very small or no interaction effects between an NHR claim and perceived healthiness.

Overall, these results suggest that the effects of a product carrying an NHR claim are dependent on the product's perceived healthiness and on the specific combination of the product and the NHR claim. This will be elaborated in the following.

3.7.1.2 A match-up of NHR claim and perceived product healthiness leads to positive results

Many studies have shown that the presence of an NHR claim leads to higher preferences if it is on a healthy product as opposed to being on an unhealthy product (Fenko et al., 2016, p. 86; Choi et al., 2012, p. 432; Lähteenmäki et al., 2010, p. 234; Aschemann & Hamm, 2009, p. 820; Hailu et al., 2009, p. 260; Siegrist et al., 2008, p. 528; Williams et

al., 2008, p. 641; Ares & Gámbaro, 2007, p. 150; Dean et al., 2007, p. 192; van Kleef et al., 2005, p. 302; Kozup, Creyer, & Burton, 2003, p. 25). A positive effect resulting from the labeling of NHR claims which refer to healthiness on healthy products is called a match-up. This effect is in line with other results affirming that taste claims labeled on hedonic products (Fenko et al., 2016, p. 86) and their use in advertisements (Choi et al., 2012, p. 432) lead to higher preferences. On the other hand, NHR claims on unhealthy products lead to lower preferences (Bialkova et al., 2016, p. 44) and lower purchase intentions (Kähkönen & Tuorila, 1999, p. 87).

These results are confirmed by three studies with focus group interviews (Chan, Patch, & Williams, 2005; Patch, Tapsell, & Williams, 2005; Balasubramanian & Cole, 2002). Consumer search for or interest in information about nutrition depends on the food category. The consumers stated that they are not interested in or even ignore this kind of information if the food category is perceived as unhealthy. Consumers explained that as soon as they begin seeking gratification by eating treats like candy, they no longer care about healthiness because such a product should only meet hedonistic needs and therefore only the taste is important (Chan et al., 2005, p. 150; Balasubramanian & Cole, 2002, p. 122). Consumers wanted to see enrichments in healthy staple foods and regarded unhealthy food as less suitable for enrichments (Patch et al., 2005, p. 83). These results are in line with a similar approach, namely, when consumers were asked at the point of sale whether or not they looked for nutrition information before putting a product into the shopping cart. The information on the products perceived as the healthiest was mentioned most often as having been looked at (Grunert, Wills, & Fernández-Celemín, 2010, p. 180, 187).

There are several explanations why a match-up leads to positive results. Supposing that information is stored and retrieved in the consumer's mind in the form of an associative network, consumers can process matching information faster and more effortlessly, which results in a more pleasant experience (Fenko et al., 2016, p. 89; Choi et al., 2012, p. 424). Accordingly, a match-up utilizes synergetic effects between a healthy food and a health claim: If a product perceived as healthy was advertised with its strengths, namely its healthiness, the use of NHR claims leads to positive effects. Similarly, a hedonic product benefits by advertising its deliciousness, for example with a taste claim (Choi et al., 2012, p. 436). Another explanation for the positive effects of a match-up is that food perceived

as healthy was seen as a more credible food for carrying NHR claims than food perceived as unhealthy (Lalor, Kennedy et al., 2011, p. 758), suggesting that NHR claims will be better accepted on healthy food products (Siró et al., 2008, p. 463). Finally, due to marketing activities, consumers are simply more familiar with seeing NHR claims on healthy food (Siegrist et al., 2008, p. 529). Indeed, there was a strong match-up between claims and product category in US magazine advertisements, so NHR claims are mostly seen on healthy food and taste claims on hedonic food (Kim et al., 2009, p. 541).

3.7.1.3 A mismatch of NHR claim type and perceived product healthiness leads to positive results

In contrast, other studies have shown that the presence of an NHR claim leads to higher preferences if it is on an unhealthy product as opposed to being on a healthy product (Maubach et al., 2014, p. 73; Carrillo et al., 2012b, p. 215; Gravel et al., 2012, p. 882; Krutulyte et al., 2011, p. 16; Miller et al., 2011, p. 127; Barreiro-Hurlé, Gracia, & de-Magistris, 2010b, p. 440; Steenhuis et al., 2010, p. 708; Ares et al., 2008, p. 665; Hartmann, Lensch, Simons, & Thrams, 2008, p. 138; Wansink et al., 2004, p. 344; Bech-Larsen & Grunert, 2003, p. 13). These results show the positive effect of a so-called mismatch between food and claim. On the other hand, a mismatch also leads to higher preferences when a healthy product was advertised with a taste claim rather than an NHR claim (Kim et al., 2009, p. 544).

An explanation for the positive effects of a mismatch is that a food product cannot further gain in consumer preference by emphasizing its already established characteristics like healthiness by the use of NHR claims, but by emphasizing other characteristics, like taste (Bech-Larsen & Grunert, 2003, p. 13; Kähkönen, Tuorila, & Lawless, 1997, p. 129). A health enhancement could even make consumers suspicious, as they might question the purpose of making a healthy food even healthier (Lähteenmäki, 2013, p. 198). Therefore, consumers might perceive the enrichment of an unhealthy product as more reasonable than that of products which are already perceived as healthy (Bech-Larsen & Grunert, 2003, p. 13). This was confirmed in a focus group study when the consumers mentioned that improving a healthy product, for example by adding healthy nutrients, was deemed unnecessary. They preferred to see nutritious enhancements in unhealthy products as a form of counteracting the effect of unhealthy components like fat and sugar, so that they could finally “buy a clean conscience” (Lampila, van Lieshout, Gremmen, & Lähteenmäki, 2009, p. 125). In general, the consumption of unhealthy foods induces guilt,

but consumers can justify their behavior by eating unhealthy food if it is nutritionally enhanced, such as candy with a low-fat nutrition claim. This was acknowledged by consumers (Cornish, 2012, p. 296) and was empirically suggested by Wansink and Chandon (2006, p. 610) and Miller et al. (2011, p. 130). Even in the rare case that consumers realized that besides the added healthy ingredients, the food was poor in its nutritional quality, consumers mentioned that the added healthy nutrient outweighed the negative effect of unhealthy ingredients (Cornish, 2012, p. 296). Therefore, consumers justify eating unhealthy food by choosing the product containing added nutrients (Cornish, 2012, p. 296).

3.7.2 Influence of an interaction between the product and the nutrient in the NHR claim

In several studies, researchers reported that there are interaction effects between the product and the nutrient in the NHR claim which result in NHR claims leading to more positive evaluations when there is a match-up between these two (Krutulyte et al., 2011, p. 14; Ares & Gámbaro, 2007, p. 150; Dean et al., 2007, p. 192; Teratanavat & Hooker, 2006, p. 539). A match-up occurs if the connection between the product and the nutrient is reasonable for the consumer because of familiarity due to marketing activity, or more importantly, to the nutrient being naturally inherent to the product. For example, an NHR claim about omega-3 fatty acid leads to higher preferences for a fish product than for a bread, which would be better advertised with an NHR claim about fiber (Krutulyte et al., 2011, p. 15; Verbeke et al., 2009, p. 688). Consumers in a focus group interview confirmed that promoting a nutrient which is naturally inherent to a product is more likely to be acceptable (Lampila et al., 2009, p. 125).

3.7.3 Influence of an interaction between the claimed benefit and the NHR claim type

Studies also demonstrated that a match-up between the NHR claim type and the claimed benefit lead to higher preferences. If the NHR claim was about a serious topic, especially a physiology-based benefit like protection against cancer, osteoporosis or cardiovascular diseases, then a 'stronger' NHR claim type such as a risk reduction claim lead to higher preferences. However, if the topic was less severe, like stress, appearance or lack of energy, a 'softer' NHR claim type like a health claim lead to higher preferences (Lynam

et al., 2011, p. 2217; Siegrist et al., 2008, p. 528; van Trijp & van der Lans, 2007, p. 319; van Kleef et al., 2005, p. 307).

Review results on the influence of product-specific characteristics are compiled in Table 4.

Table 4: Summary on the influence of product-specific characteristics

Influence of the perceived healthiness of the food product	
Match-up leads to positive results (a product perceived as healthy is labeled with an NHR claim)	Mismatch leads to positive results (a product perceived as unhealthy is labeled with an NHR claim)
<p>Ares & Gámbaro, 2007, p. 150 Aschemann & Hamm, 2009, p. 820 Balasubramanian & Cole, 2002, p. 122 Bialkova et al., 2016, p. 44 Chan et al., 2005, p. 150 Choi et al., 2012, p. 432 Dean et al., 2007, p. 192 Fenko et al., 2016, p. 86, 89, 90 Hailu et al., 2009, p. 260 Kähkönen & Tuorila, 1999, p. 87 Kozup et al., 2003, p. 25 Lähteenmäki et al., 2010, p. 234 Patch et al., 2005, p. 83 Siegrist et al., 2008, p. 528 van Kleef et al., 2005, p. 302 Williams et al., 2008, p. 641</p>	<p>Ares et al., 2008, p. 665 Barreiro-Hurlé et al., 2010b, p. 440 Bech-Larsen & Grunert, 2003, p. 13 Carrillo et al., 2012b, p. 215 Gravel et al., 2012, p. 882 Hartmann et al., 2008, p. 138 Kim et al., 2009, p. 544 Krutulyte et al., 2011, p. 16 Maubach et al., 2014, p. 73 Miller et al., 2011, p. 127 Steenhuis et al., 2010, p. 708 Wansink et al., 2004, p. 344</p>
Influence of an interaction between the product and the nutrient in the NHR claim	
Match-up leads to positive results (the connection between the nutrient and the product is reasonable for the consumer)	Mismatch leads to positive results (the connection between the nutrient and the product is unreasonable for the consumer)
<p>Ares & Gámbaro, 2007, p. 150 Dean et al., 2007, p. 192 Krutulyte et al., 2011, p. 14 Lampila et al., 2009, p. 125 Teratanavat & Hooker, 2006, p. 539 Verbeke et al., 2009, p. 688</p>	<p>None</p>

Influence of an interaction between the claimed benefit and the NHR claim type	
Match-up leads to positive results (the more severe the topic the 'stronger' the NHR claim type is)	Mismatch leads to positive results (the less severe the topic the 'stronger' the NHR claim type is)
Lynam et al., 2011, p. 2217 Siegrist et al., 2008, p. 528 van Kleef et al., 2005, p. 307 van Trijp & van der Lans, 2007, p. 319	None

3.8 Discussion and conclusions

Following the remarks and findings of many studies which state that the results of NHR claim effects are incongruent, the aim of this review was to search for reasons and finally analyze the determinants of NHR claim effects on consumer preferences and purchase behavior. Firstly, a theoretical framework was built based on pioneer studies and previously addressed research requests by other authors, especially in the area of nutrition knowledge, health motivation, and interaction effects between the product and the NHR claim. The determinants were categorized in consumer and product-specific characteristics.

Only a few publications were found that examined the influence of nutrition knowledge on the effect of NHR claims and their results do not show consensus. However, it can be acknowledged that a slim majority of studies reported that higher nutrition knowledge lead to lower preferences or lower purchase intentions towards NHR claim products. Nevertheless, this research showed that nutrition knowledge had an effect and therefore confirmed that consumers tried to link external information to internal information, meaning they tried to link the NHR claims to their existing nutrition knowledge (Svederberg & Wendin, 2011, p. 6; Lähteenmäki et al., 2010, p. 236). Health motivation was a more prominent variable. By far, most studies indicated that higher health motivation lead to higher preferences or higher purchase intentions towards NHR claim products. In accordance, the experience of a disease had positive effects on consumers' relationships with NHR claims. Many studies revealed that the more familiar consumers are with the nutrient in the NHR claims or with certain food categories being advertised with NHR claims, the higher the preferences and purchase intentions towards NHR claim products were. Most of the studies came to the conclusion that older consumers and women have a higher preference towards products with NHR claims than younger consumers and men.

The number of studies investigating the influence of the perceived healthiness of the product on the NHR claim effect might be substantial, but their findings are contradictory. Half of the studies report that NHR claims on products perceived as healthy had more positive effects, the so-called match-up, whereas the other half of the studies showed that NHR claims on products perceived as unhealthy resulted in more positive effects, the so-called mismatch. Regardless this great contradiction, two conclusions can be drawn. First,

the effects of a product carrying an NHR claim were dependent on the product's perceived healthiness and largely depended on interaction effects between the claim and the product. Second, NHR claims on nutritionally unfavorable products could potentially mislead the consumer by making them appear healthier. Fewer researchers addressed other interaction effects which influence the NHR claims. Across the board, it was shown that the connection between the product and the nutrient named in the NHR claim should be reasonable, like the nutrient being naturally inherent to the product. Also, the type of NHR claim should be chosen in coherence with the gravity of the claim's topic.

In summary, all these product-specific influences suggest that study results might be limited to the tested product categories or even the tested product claim combination, thus making it difficult to generalize. Additional limitations of this review are the exclusion of studies in which NHR claims presented in a pictorial or symbolic form were tested. Further, only studies which reported the effects of NHR claims on consumers' preferences and purchase behavior, were included in this review. Other effects, such as trust or understanding of NHR claims, were not included.

Taken together, these findings demonstrate that the analyzed consumer and product-specific characteristics are responsible for the incongruence of the results in the field of NHR claims. Subsequent research in this field should check for these characteristics. As for consumer characteristics, the findings of this review suggest that nutrition knowledge seems to be a decisive factor and should therefore be examined in further studies. In addition, certain product characteristics seem to be responsible for the incongruent results and have the most influence on the NHR claim effect. The findings show that NHR claims were mostly tested on food products perceived as healthy. However, research on NHR claims combined with unhealthy or hedonic products is scarce. Thus, the latter food products should be the subject of further research, especially in view of the fact that, in practice, around one-third of the products labeled with NHR claims belong to this nutritionally unfavorable category. Additionally, the effects of NHR claims should be examined among countries with different laws governing the use of NHR claims, such as the USA versus the EU. On a wider level, research is also needed to examine the effects of NHR claims in emerging countries, e.g. China and India.

3.9 Acknowledgments

The authors are very grateful to the reviewers, which helped to improve the text significantly. The authors thank Anne Christopherson for proofreading the manuscript. The study reported in this paper received no specific grant from any funding agency in the public, commercial or not-for-profit sectors. The authors had no conflicts of interest in writing this paper.

3.10 Appendix

Table 5: List of the studies reporting product and consumer-specific characteristics influencing the effect of NHR claims, which are relevant for this review

Annotation: A product concept is neither a food package nor a picture of the front of a package but is a mixture of elements like a photo or a drawing of the food combined with the name or brand of the product including an NHR claim. Other front-of-package elements can be part of a product concept, whereas elements mostly found on the back of a product, like nutrition tables, are not part of a product concept.

Authors	Country	NHR claim type			Tested products	Stimuli: advertisement, package, product concept	Presentation of stimuli: three dimensional, printed, on computer monitor	Influence of consumer-specific characteristics examined	Influence of product-specific characteristics examined	Kind of research	Number of participants
		Nutrition claim	Health Claim	Risk Reduction Claim							
Andrews et al., 1998	USA	1.2.c	2.1.a	-	margarine	advertisement	printed	nutrition knowledge		offline questionnaire	365
Andrews et al., 2000	USA	1.2.b	2.1.a	-	soup	advertisement	printed	nutrition knowledge		offline questionnaire	366
Ares & Gámbaro, 2007	Uruguay	1.2.a	-	-	cream soup, dulce de leche, honey, marmalade, vegetable, yogurt	product concept	printed		product's perceived healthiness, interaction between product and nutrient in the claim	offline questionnaire + conjoint analysis	200
Ares et al., 2008	Uruguay	1.2.b	-	-	mayonnaise, milk desserts, pan bread, yogurt	product concept	printed	nutrition knowledge	product's perceived healthiness	offline questionnaire + conjoint analysis	104
Ares et al., 2009	Uruguay	1.2.a	2.2.b	3.2	milk dessert	product concept	printed	familiarity, age, gender		offline questionnaire + conjoint analysis	82
Aschemann & Hamm, 2009	Germany	1.2.a	2.2.b	3.2	muesli, pasta, yogurt	package	three-dimensional package (not virtual)		product's perceived healthiness	offline questionnaire + choice experiment	210
Aschemann-Witzel & Hamm, 2010	Germany	1.2.a	2.2.b	3.2	muesli, pasta, yogurt	package	three-dimensional package (not virtual)	health motivation, age, gender		offline questionnaire + choice experiment	210

Authors	Country	NHR claim type			Tested products	Stimuli: advertisement, package, product concept	Presentation of stimuli: three dimensional, printed, on computer monitor	Influence of consumer-specific characteristics examined	Influence of product-specific characteristics examined	Kind of research	Number of participants	
		Nutrition claim	Health Claim	Risk Reduction Claim								
Baglione et al., 2012	USA	1.2.a	2.2.b	-	mushrooms	product concept	on computer monitor	age		online questionnaire	512	
Balasubramanian & Cole, 2002	USA	participants were asked about their thoughts regarding NHR claims without mentioning any products							product's perceived healthiness		focus group interview	48
Barreiro-Hurlé et al., 2010a	Spain	participants were asked about their behavior regarding NHR claims without mentioning any products							nutrition knowledge, health motivation, education		offline questionnaire	800
Barreiro-Hurlé et al., 2010b	Spain	1.2.b, 1.2.c	-	3.2	plain yogurt, pork sausage	package	front of package was printed		product's perceived healthiness	offline questionnaire	800	
Bech-Larsen & Grunert, 2003	Denmark, Finland, USA	-	2.2.b	3.2	juice, spread, yogurt	product concept	printed		product's perceived healthiness	offline questionnaire + conjoint analysis	1500	
Bialkova et al., 2016	Germany	1.2.b	2.1.a	-	cereal bar, potato chips	package	front of package was shown on monitor		product's perceived healthiness	offline questionnaire	240	
Bower et al., 2003	UK	1.2.b	-	3.1	spread	product concept	printed	health motivation, age, gender		offline questionnaire	70	
Carrillo et al., 2012b	Spain	1.2.a, 1.2.b, 1.2.c	2.2.b	-	biscuits	product concept + package	printed + three-dimensional package (not virtual)	familiarity	product's perceived healthiness	offline questionnaire	90	
Cavaliere et al., 2015	Italy	1.2.a, 1.2.b, 1.2.c	2.1.b	-	participants were directly asked about specific NHR claims without mentioning any product			nutrition knowledge, health motivation, age, gender, education		offline questionnaire	240	
Chan et al., 2005	Australia	1.2.b, 1.2.c	-	-	several products were provided from a list for consideration during the interview but not stated in the article				product's perceived healthiness	focus group interview	36	
Choi et al., 2012	USA	1.1, 1.2.a, 1.2.b	2.2.a, 2.2.b	-	multigrain cereal, yogurt, multigrain granola bars, whole-wheat bread, frozen vegetable,	advertisement	on computer monitor		product's perceived healthiness	online questionnaire	461	

Authors	Country	NHR claim type			Tested products	Stimuli: advertisement, package, product concept	Presentation of stimuli: three dimensional, printed, on computer monitor	Influence of consumer-specific characteristics examined	Influence of product-specific characteristics examined	Kind of research	Number of participants
		Nutrition claim	Health Claim	Risk Reduction Claim							
					ice cream, chocolate chip cookies, frozen fried chicken wings, potato chips, cola						
Chrysochou & Grunert, 2014	Denmark	1.2.a	2.2.b	-	cheese, yogurt	advertisement	on computer monitor	health motivation		online questionnaire	572
Coleman et al., 2014	UK	1.2.a	2.2.b	3.2	white bread	product concept	on computer monitor	nutrition knowledge		focus group interview + online survey	20 + 122
Contini et al., 2015	Denmark + Italy	-	2.2.b	3.2	virgin olive oil	product concept	on computer monitor	education		online survey + choice experiment	2024
Dean et al., 2007	Finland, Germany, Italy, UK	1.2.a	2.2.b	-	bread, pasta, biscuits	product concept	printed	health motivation, gender	product's perceived healthiness, interaction between product and nutrient in the claim	offline questionnaire	2094
Dean et al., 2012	Finland, Germany, Italy, UK	1.2.a	2.1.b	3.2	bread, cake, cereal-containing yogurt	product concept	printed	health motivation, familiarity, age		offline questionnaire + conjoint analysis	2385
Fenko et al., 2016	Netherlands	-	2.1.a	-	apple juice, chocolate cookie	package	1 st printed pictures of the package +2 nd three-dimensional package (not virtual)	product's perceived healthiness		offline questionnaire	209
Gravel et al., 2012	Canada	-	2.2.b	-	oatmeal-raisin cookie	food product without any packaging	three-dimensional package (not virtual)	product's perceived healthiness		tasting + offline questionnaire	352
Grunert et al., 2009	Denmark, Finland, Iceland, Norway, Sweden	-	2.1.b, 2.2.b	3.2	participants were directly asked about specific NHR claims without mentioning any products			familiarity		online survey + choice experiment	4612
Hailu et al., 2009	Canada	-	2.1.a, 2.1.b	3.1	yogurt, ice-cream, pill	product concept	printed	product's perceived healthiness		offline questionnaire + conjoint experiment	267

Authors	Country	NHR claim type			Tested products	Stimuli: advertisement, package, product concept	Presentation of stimuli: three dimensional, printed, on computer monitor	Influence of consumer-specific characteristics examined	Influence of product-specific characteristics examined	Kind of research	Number of participants
		Nutrition claim	Health Claim	Risk Reduction Claim							
Hartmann et al., 2008	Germany	1.2.a, 1.2.c	2.1.b	-	bonbon (candies)	front of package	printed		product's perceived healthiness	offline questionnaire + choice experiment	814
Kähkönen & Tuorila, 1999	Finland	1.2.b	-	-	chocolate bar, frankfurter, margarine, yogurt	product concept without graphical elements	printed	health motivation, gender	product's perceived healthiness	offline questionnaire	253
Keller et al., 1997	USA	1.2.b	-	-	frozen meal-based chicken dinner	package	three-dimensional package (not virtual)	health motivation		mail survey	464
Kemp et al., 2007	USA	1.2.b	-	-	frozen dinners	package	three-dimensional package (not virtual)	health motivation		mail survey	186
Kim et al., 2009	USA	1.2.b	-	-	wine, chocolate, cracker, potato chips, fruity snack, jello, pizza snack, peanuts, cereal, soymilk, fruit juice, soup, oatmeal, instant breakfast	advertisement	on computer monitor		product's perceived healthiness	offline questionnaire	408
Kozup et al., 2003	USA	-	-	3.2	frozen lasagna dinner	front of package	printed		product's perceived healthiness	mail survey	292
Krutulyte et al., 2011	Denmark	1.2.a	-	-	yogurt, muesli, fish balls, tuna salad, baby food, rye bread, bacon liver pate	participants were asked about specific product NHR claim combinations without showing graphical elements		familiarity	product's perceived healthiness, Interaction between product and nutrient in the claim	mail survey	959
Krystallis & Chrysochou, 2012	Greece	1.2.a	-	-	chips, croissants	front of package	on computer monitor	familiarity		choice experiment incl. offline questionnaire	140
Lähteenmäki et al., 2010	Denmark, Finland, Iceland,	1.2.a	2.2.b	3.2	yogurt, bread, pork chops	product concept	on computer monitor	familiarity	product's perceived healthiness	online survey	4612

Authors	Country	NHR claim type			Tested products	Stimuli: advertisement, package, product concept	Presentation of stimuli: three dimensional, printed, on computer monitor	Influence of consumer-specific characteristics examined	Influence of product-specific characteristics examined	Kind of research	Number of participants
		Nutrition claim	Health Claim	Risk Reduction Claim							
	Norway, Sweden										
Lalor et al., 2009	Ireland	-	2.2.b	-	yogurt, cheese, milk, breakfast cereal	participants were given lists of health claims and products to evaluate on		nutrition knowledge	online survey	226	
Lalor, Kennedy et al., 2011	Ireland	-	2.1.b	3.1	yogurt, breakfast cereal, pasta, chocolate	product concept	printed		offline questionnaire	665	
Lalor, Madden et al., 2011	Ireland	participants were asked about their thoughts regarding NHR claims without mentioning any products						health motivation, familiarity		focus group interview	35
Lampila et al., 2009	Finland, France, Netherlands	participants were asked about their thoughts regarding NHR claims without mentioning any products							interaction between product and nutrient in the claim	focus group interview	130
Lyly et al., 2007	Finland, France, Sweden	-	2.2.b	-	apple-pear beverage, shrimp-dill ready-to-eat frozen soup	product concept	printed	health motivation, gender	product tasting incl. questionnaire	1157	
Lynam et al., 2011	Ireland	1.2.a	2.2.b	3.2	milk, yogurt, spread, juice, cereal, juice	product concept	printed	gender	interaction between claimed benefit and claim type	offline questionnaire	400
Maubach et al., 2014	New Zealand	1.2.a	-	3.2	breakfast cereals	front of package	on monitor		product's perceived healthiness	online questionnaire incl. choice experiment	768
Miklavc et al., 2015	Slovenia	1.2.a	2.2.b	-	yogurt	product concept	printed	familiarity		offline questionnaire incl. conjoint	371
Miller et al., 2011	USA	1.2.b	2.1.a	3.2	breakfast cereals	front and back of a package	front and back were printed on one card to resemble a package	nutrition knowledge	product's perceived healthiness	offline questionnaire	124
Orquin, 2014	Denmark	1.1, 1.2.a, 1.2.b, 1.2.c	2.1.b, 2.2.b	-	yogurt, cheese, milk, butter	front and back of a package	front and back were shown simultaneously on the monitor	nutrition knowledge		online survey	1329
Patch et al., 2005	Australia	participants were asked about their thoughts regarding NHR claims by exemplary using margarine, fermented milk drink and bread to which nutrients were added							product's perceived healthiness	focus group interview	42

Authors	Country	NHR claim type			Tested products	Stimuli: advertisement, package, product concept	Presentation of stimuli: three dimensional, printed, on computer monitor	Influence of consumer-specific characteristics examined	Influence of product-specific characteristics examined	Kind of research	Number of participants
		Nutrition claim	Health Claim	Risk Reduction Claim							
Petrovici et al., 2012	UK	participants were asked about their behavior regarding NHR claims without mentioning any products						nutrition knowledge		offline questionnaire	302
Russo France & Fitzgerald Bone, 2005	USA	-	2.2.b	3.2	dietary supplements	front and side panel of package	printed	health motivation		offline questionnaire + open-ended questions	359
Saba et al., 2010	Finland, Germany, Italy, UK	-	2.1 b	3.2	bread, cake, yogurt	product concept	on monitor	familiarity		offline questionnaire + conjoint analysis	2392
Sabbe et al., 2009	Belgium	-	2.2.b	-	fruit juice	food product without any packaging	three-dimensional package (not virtual)	health motivation, age, gender		tasting + offline questionnaire	86
Siegrist et al., 2008	Switzerland	-	2.1.b	3.1	yogurt, chocolate, soup	product concept	printed	age	product's perceived healthiness, interaction between claimed benefit and claim type	offline questionnaire	249
Steenhuis et al., 2010	The Netherlands	-	2.1.a	-	chocolate mousse cake	food product without any packaging	three-dimensional package (not virtual)		product's perceived healthiness	tasting + offline questionnaire	36
Szykman et al., 1997	USA	participants were asked about their thoughts regarding NHR claims without mentioning any products						nutrition knowledge, health motivation		telephone interview	1812
Teratanavat & Hooker, 2006	USA	-	-	3.1	tomato juice	product concept without graphical elements	printed		interaction between product and nutrient in the claim	mail survey + choice experiment	1704
Urala et al., 2003	Finland	1.2.a	-	3.2	-	only the NHR claim was shown without any product	printed	age, gender		offline questionnaire	958
Urala & Lähteenmäki, 2007	Finland	participants were asked about their thoughts regarding NHR claims without mentioning any products						gender, education		mail survey	2269
van Kleef et al., 2005	Denmark	-	2.1.b	3.1	brown bread, bar of chocolate, chewing gum,	product concept	on monitor	health motivation, familiarity	product's perceived healthiness,	offline questionnaire	174

Authors	Country	NHR claim type			Tested products	Stimuli: advertisement, package, product concept	Presentation of stimuli: three dimensional, printed, on computer monitor	Influence of consumer-specific characteristics examined	Influence of product-specific characteristics examined	Kind of research	Number of participants
		Nutrition claim	Health Claim	Risk Reduction Claim							
					margarine, meat replacer, pills, ice-cream, soup, tea, yogurt				interaction between claimed benefit and claim type		
van Trijp & van der Lans, 2007	Italy, Germany, UK, USA	1.2a	2.1b, 2.2.a, 2.2.b	3.2	yogurt	product concept	on monitor	familiarity	interaction between claimed benefit and claim type	online survey	6367
Vecchio et al., 2016	Italy	-	2.2.b	3.2	yogurt	product concept without graphical elements	on monitor	gender, education		questionnaire + Vickrey fifth-price full bidding auctions	100
Verbeke, 2005	Belgium	participants were asked about their thoughts regarding NHR claims without mentioning any products							age, gender	offline questionnaire	215
Verbeke et al., 2009	Belgium	1.2.b	2.2b	3.2	fruit juice, cereals	product concept	printed	familiarity	interaction between product and nutrient in the claim	offline questionnaire	341
Walters & Long, 2012	USA	1.1	-	-	granola bars, lemonade, vanilla yogurt, salad dressing	product concept	printed	nutrition knowledge		offline questionnaire	106
Wansink et al., 2000	USA	1.2.a	-	3.2	nutrition bar	package	three-dimensional package (not virtual)	health motivation		open-ended questions, offline questionnaire	142
Wansink et al., 2004	USA	-	2.1.a	-	main dish, dessert	food product without any packaging	three-dimensional package (not virtual)		product's perceived healthiness	tasting, offline questionnaire	324
Williams et al., 2008	Australia	-	2.1.b	3.1	brown bread, bar of chocolate, chewing gum, margarine, meat replacer, pills, ice-cream, soup, tea, yogurt	product concept	printed	familiarity	product's perceived healthiness	offline questionnaire	149

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4 Consumers' purchase decisions for products with nutrition and health claims: what role do product category and gaze duration on claims play?

This chapter represents the article published by the author of this dissertation and Associate Professor Dr. Meike Janssen together with Professor Dr. Ulrich Hamm as co-authors. Any reference to this chapter should be cited as:

Steinhauser, J., Janssen, M., & Hamm, U. (2019). Consumers' purchase decisions for products with nutrition and health claims: What role do product category and gaze duration on claims play? *Appetite, 141*, 104337.
<https://doi.org/10.1016/j.appet.2019.104337>.

Keywords:

Health claims; Nutrition claims; Eye tracking; Visual attention; Consumer behavior; Purchase decision.

Journal Metrics for 2018:

Journal Impact Factor: 3.501

5-Year Impact Factor: 4.077

Quartile: Q1

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4.1 Abstract

Labeling food packages with nutrition and health claims is a widely used practice. This study aims to contribute to the literature by examining the gaze and purchase behavior of consumers regarding food products with nutrition and health claims. A close-to-realistic purchase situation with three-dimensional food packages with nutrition, health, and taste claims was simulated while the participants' eye movements were measured using head-mounted eye tracking glasses. In the purchase situation, two food categories with differing perceived healthiness were offered, orange juice and milk chocolate. In total, 156 consumers participated in this study which was undertaken in Germany. The findings indicate that each claim was noticed by at least 85% of the participants and health claims were looked at longer than nutrition or taste claims. Furthermore, when compared to other participants, the longer a participant looked at a specific claim, the more likely the participant was to purchase the respective product. Even though the product category had no effect on the gaze duration on claims, it affected the purchase behavior. Nutrition claims were preferred for orange juice while taste claims were preferred for milk chocolate. Health claims were preferred for neither. Marketers can benefit from this study, as it shows the gaze duration on claims influenced the purchase likelihood. Another important finding is that there are great differences between product categories regarding the type of claim consumers prefer.

4.2 Introduction

The use of nutrition and health claims as a tool to highlight health-related aspects of food products is a widely used practice in North America and Europe (Al-Ani et al., 2016, p. 1087; Hieke et al., 2016, p. 12; Pravst & Kušar, 2015, p. 9363; Devi et al., 2014, p. 257). These claims are short phrases printed on the front of food packages indicating the nutritional and health-related qualities of a food product. A nutrition claim states that a food is endowed with a certain beneficial nutritional characteristic. A health claim additionally states that this nutritional characteristic has a beneficial health effect on the body. The third category, as per EU Regulation No. 1924/2006, Art. 2, par. 2.4–2.6, is the risk reduction claim which states a reduction in the risk of developing a disease. Due to the infrequent use of risk reduction claims in European countries (Kaur et al., 2016, p. 1391; Pravst & Kušar, 2015, p. 9363) as well as internationally (Mayhew et al., 2016, p. 1002), this type of claim was not included in this present work.

Previous literature described nutrition and health claims as highly successful tools to promote sales (Nestle, 2007, p. 22; Wansink, 2005, p. 20). Most consumer research studies showed that nutrition and health claims had a positive effect on preferences and purchase behavior (Kaur et al., 2017, p. 15). However, in recent years a number of studies have revealed that nutrition and health claims also led to negative evaluations and lower purchase intentions of products by consumers (Bialkova et al., 2016, p. 45; Aschemann-Witzel & Grunert, 2015, p. 90; Orquin & Scholderer, 2015, p. 149; van Buul & Brouns, 2015, p. 1558; Maubach et al., 2014, p. 75; Lähteenmäki, 2013, p. 196; Lähteenmäki et al., 2010, p. 235) or to a decrease in purchases (Kiesel & Villas-Boas, 2013, p. 162; Berning et al., 2011, p. 368). The discrepancy in the reported effects of nutrition and health claims, ranging from positive to negative, has been pointed out by researchers such as Kaur et al. (2017, p. 1), Hieke et al. (2015, p. 67), Bruschi et al. (2015, p. 80) or Lähteenmäki (2013, p. 199).

In several studies, researchers suggested that the perceived healthiness of the product category determines the direction of the effect of nutrition and health claims on consumers' evaluations and purchase behavior (Aschemann-Witzel & Grunert, 2017, p. 127; Stancu et al., 2017, p. 92; Bialkova et al., 2016, p. 45; Fenko et al., 2016, p. 86; Masson et al., 2016, p. 626; Talati, Pettigrew, Dixon et al., 2016, p. 2; Lähteenmäki, 2013, p. 196). However, these studies are still in disagreement as to whether nutrition or health claims lead to higher purchases and better evaluations of products which are perceived as healthy or unhealthy. In this context, some of these studies further analyzed the influence of taste claims and whether taste claims or nutrition and health claims had a greater influence on evaluations and purchase behavior. Compared to a nutrition or health claim, a taste claim simply refers to the taste of a food product, such as 'great taste' (Bialkova et al., 2016, p. 44; Choi et al., 2012, p. 422) and is not regulated by law.

One conclusion reached by researchers was that future research on nutrition and health claims should examine such claims on authentic packages in more realistic and natural settings (Kaur et al., 2017, p. 16; Lähteenmäki, 2013, p. 200; Hieke & Taylor, 2012, p. 148). The effects of nutrition and health claims should be measured with actual behavior and not just self-reported preferences (van Buul & Brouns, 2015, p. 1559; Wills et al., 2012, p. 234). As consumers may not look at the attributes of a food package, e.g. nutrition tables or health claims, in the way they report in questionnaires, researchers

suggested investigating the actual visual attention of consumers on food products (Ares et al., 2013, p. 139).

Based on a Stimulus-Organism-Response (S-O-R) paradigm, products labeled with different claims are stimuli with visual distinctiveness; hence, they may cause a bottom-up effect on the attention of the consumer, the so-called organism (Duerrschmid & Danner, 2018, p. 288; van der Laan, Hooge, Ridder, Viergever, & Smeets, 2015, p. 46). Before consumers form a purchase decision, they usually look at the products; thus visual attention is the starting point of any subsequent behavior (Duerrschmid & Danner, 2018, p. 291; Meyerding & Merz, 2018, p. 782; Meißner et al., 2016, p. 1). Eye tracking is an appropriate method to measure the gaze behavior of consumers (Talati, Pettigrew, Hughes et al., 2016, p. 64; Abrams, Evans, & Duff, 2015, p. 28). A considerable amount of research on visual attention on food labels has been conducted (Greibitus & Davis, 2017; Bialkova et al., 2013; Piqueras-Fiszman et al., 2013). Insight into the current state of eye tracking research regarding food packaging was given by a recent literature review (van Loo et al., 2018, p. 546). The authors stated, that within this area of eye tracking research, “only a few studies have focused specifically on food choice” (van Loo et al., 2018, p. 549). Several other authors confirmed that more research is needed to find out how visual attention on labels such as nutrition and health claims influences a subsequent product choice (Peschel et al., 2019, p. 2; Duerrschmid & Danner, 2018, p. 292; Meyerding & Merz, 2018, p. 772). This gave reason to opt for a choice test – using real food packages labeled with claims – in combination with eye tracking.

The overall aim of the present work was to analyze the effects of claims on purchase behavior in a real-life shopping experiment by examining consumers’ gaze behavior regarding different product categories and claim types. The present study is innovative for two reasons. Firstly, it went beyond previous survey-based research on claims. Instead of relying on the assumption that study participants noticed a claim, the method of head-mounted eye tracking was capable of showing to what extent consumers looked at claims in a real-life shopping environment and in what way the visual attention on these claims affected the purchase decision. Secondly, the study investigated the influence of the perceived healthiness of product categories on the purchase decisions for products labeled with claims. This is a contribution to the existing research as it could help to explain the observed contradiction in the results of previous studies.

Therefore, the research questions were: (1) To what extent do consumers look at claims while shopping? (2) Do nutrition, health, and taste claims have an effect on the purchase decision? (3) Does gaze duration on claims have an effect on the purchase decision? (4) Regarding the analyses (1) to (3), what are the differences between product categories and claim types?

4.3 Literature Review

Previous research has shown that consumers did not acknowledge the nutritional composition of a specific food product, but tend to categorize a food product either as healthy or unhealthy (Larkin & Martin, 2016, p. 91; Orquin & Scholderer, 2015, p. 149; Belei et al., 2012, p. 902; Gravel et al., 2012, p. 878). Due to this dichotomized perception of food by consumers, using the terms healthy and unhealthy for food products is common throughout the literature (Fenko et al., 2016, p. 90; Talati, Pettigrew, Dixon et al., 2016, p. 2; Bruschi et al., 2015, p. 80; Choi et al., 2012, p. 426; Lalor, Kennedy et al., 2011, p. 757).

Previous studies mostly tested nutrition and health claims on food perceived as healthy, whereas product categories perceived as unhealthy were not in the focus of research (Cornish, 2012, p. 292). However, across different product categories and across different countries, the study findings showed that one-third to half of the products which were considered of poor nutritional quality carry a nutrition or a health claim (Al-Ani et al., 2016, p. 1087; Kaur et al., 2016, p. 1392; Mayhew et al., 2016, p. 998; Devi et al., 2014, p. 259). According to Art. 4 of EU Regulation No. 1924/2006, so-called nutrient profiles were to be established by 2009 to prevent the use of nutrition and health claims on food with poor nutritional quality. However, these nutrient profiles still have not been established (Kaur et al., 2016, p. 1389; Pravst & Kušar, 2015, p. 9364). Therefore, labeling nutrition and health claims on products which can be considered nutritionally poor is allowed in the European Union. Orquin and Scholderer (2015, p. 153) remarked that nutrition and health claims on 'unhealthy' products should be further studied, especially to determine whether these claims can outweigh a food product's nutritionally poorer composition, eventually misleading consumers.

Study results are very different regarding whether nutrition and health claims on 'healthy' (Bialkova et al., 2016, p. 44; Fenko et al., 2016, p. 86; Choi et al., 2012, p. 432) or on

'unhealthy' food (Maubach et al., 2014, p. 73; Gravel et al., 2012, p. 882) lead to positive consumer evaluations or purchase intentions. It can be argued that nutrition and health claims on 'unhealthy' food – a so-called mismatch – lead to positive preferences because food perceived as unhealthy can potentially benefit from highlighting the health aspects of the food (Bech-Larsen & Grunert, 2003, p. 13; Kähkönen et al., 1997, p. 129). Labeling nutrition and health claims on 'unhealthy' food seemed to be more reasonable for consumers than labeling them on 'healthy' food because that food is already perceived as healthy (Krutulyte et al., 2011, p. 16). Moreover, seeing 'healthy' food with these claims might trigger consumers to question why a product which is already 'healthy' needs to be labeled with a nutrition or health claim (Lähteenmäki, 2013, p. 198). Several studies showed that consumers preferred a nutritional enhancement in 'unhealthy' food because it reduced consumer's guilt for eating unhealthily (Cornish, 2012, p. 296; Lampila et al., 2009, p. 125). Thus, nutrition and health claims on 'unhealthy' food can act as a form of justification (Belei et al., 2012, p. 901). On the other hand, advertising a food product with its strength – a so-called match-up – might lead to positive preferences due to the synergetic effects between a claim and a food product, i.e., a 'healthy' food benefits from relating it to healthiness through a health claim (Choi et al., 2012, p. 436). Also, studies showed that consumers saw 'healthy' foods as more acceptable and even more credible carriers for health claims than 'unhealthy' foods, while nutrition and health claims on 'unhealthy' foods might induce skepticism and distrust (Lalor, Kennedy et al., 2011, p. 758; Siró et al., 2008, p. 463).

The interplay of match-up and mismatch effects is not limited to nutrition and health claims but extends to taste claims and 'unhealthy' food. The taste of food is generally among the most important decisional aspects for consumers' purchase decisions (Fenko et al., 2016, p. 82; Bruschi et al., 2015, p. 83). Research showed that taste claims on 'unhealthy' products (Fenko et al., 2016, p. 86; Choi et al., 2012, p. 432) and 'healthy' products (Kim et al., 2009, p. 544) both lead to higher preferences. On the contrary, nutrition and health claims lead to a loss in perceived tastiness (Liem, Toraman Aydin, & Zandstra, 2012, p. 197; Sabbe et al., 2009, p. 90). Simply calling a product 'healthy' already had negative effects on its anticipated pleasantness (Wardle & Huon, 2000, p. 42). If consumers longed for 'unhealthy' food, they explained that they only cared about taste, while issues such as health took a backseat (Chan et al., 2005, p. 150; Balasubramanian & Cole, 2002, p. 122) and they did not want to see nutritional modifications in 'unhealthy' food (Patch et al., 2005, p. 83). In other words, research showed that consumers were

unwilling to compromise taste for health (Verbeke, 2006, p. 130). Thus, it can be assumed that, especially for ‘unhealthy’ food whose mere purpose of consumption is pleasure, the taste is so important that nutrition and health claims which signal less tastiness could have a negative effect on its preference (Berning et al., 2011, p. 364). Further research is needed to understand the influence of the perceived healthiness of food products on the effect of nutrition and health claims (Choi et al., 2012, p. 424).

4.4 Methods

4.4.1 Overview of the study and its mixed-method approach

A combination of a purchase simulation with head-mounted eye tracking glasses and a questionnaire was used to achieve the research aims. The purchase simulation allowed for the analysis of the effect of different claims on consumers’ shopping and purchase behavior. In what way the different claim types have an influence herein was addressed by rotating the claims on the products. Additionally, the products were from two product categories with different perceived healthiness to check for the influence of the category. Up to this point, any measured effects would be based on the assumption that the claims were responsible because the participants had seen the claims, as is common practice in research. However, the use of eye tracking devices in a purchase simulation overcomes the limitation of assuming that participants looked at the stimuli (Meyerding & Merz, 2018, p. 782).

Generally speaking, eye tracking is a method for collecting data about the movements of the eye. While registering the participant’s eye movements, the eye tracking system also records the participant’s visual field. The outcome is a video for each participant in which their recorded visual field is overlaid with their eye movements. The result of this recording is the information about where the participant looked. This method of eye tracking works because humans only see 2% of their visual field sharply. So, to acquire information from an object such as a food package, consumers must purposefully move their eyes with great frequency (Balcombe et al., 2015, p. 450). Visual attention is a good indicator of what information is acquired and most likely processed (Ares, Mawad, Giménez, & Maiche, 2014, p. 29). However, looking at a certain object does not necessarily mean elaborating on the object. Nonetheless, there is a close relationship between gaze and mind because consumers mostly process the information which they

are looking at in that specific moment (Duchowski, 2007, p. 3). Thus, eye tracking measures visual attention, which sheds light on how consumers cognitively process visual information.

By recording participants' eye movements, it was possible to examine whether consumers actually noticed the nutrition and health claims on the package fronts and whether looking at them had an effect on the participant's behavior. Head-mounted eye tracking glasses allowed to further research the effects of nutrition and health claims in a close-to-realistic shopping environment. With these glasses, the participants were able to move freely in front of shopping shelves and look at the packages from different angles, take them off the shelf or turn them over to read further information on their sides. Showing frontal photos of the package on a computer monitor is a limitation of previous research and was acknowledged as such (Piqueras-Fiszman et al., 2013, p. 337). To the authors' knowledge, to date no study has used head-mounted eye tracking glasses in a close-to-realistic shopping environment and measured the effects of nutrition and health claims on consumer behavior.

Eye tracking data can answer questions such as where consumers looked and for how long but not those questions about the underlying reasons behind the gaze behavior (Duerschmid & Danner, 2018, p. 290). Therefore, a questionnaire was part of the experiment following the purchase simulation with the eye tracking glasses. This is seen as a promising combination of methods to gain greater insight into consumer behavior (Holmqvist et al., 2011, p. 95). The self-administered questionnaire, which participants filled out on a computer, comprised the following variables measured on 7-point Likert scales. Perceived healthiness of the product category, of the offered brands and the offered brands in comparison to familiar brands (1 = very unhealthy; 7 = very healthy) were adapted from Ares et al. (2009, p. 52). On a scale from 1 = very unimportant to 7 = very important, participants indicated to what extent certain product attributes are important during the everyday purchase of orange juice and milk chocolate; adapted from Bruschi et al. (2015, p. 83). After defining nutrition and health claims in an easily understood way, the participants were asked whether they pay attention to nutrition and health claims (either on 'healthy' or on 'unhealthy' food) on a scale from 1 = strongly disagree to 7 = strongly agree. Similarly, the belief in the claimed health benefit of the offered health claims was measured; item adapted from Singer et al. (2006). The trust in the shown nutrition and health claims was measured on a scale from 1 = very untrustworthy to 7 =

very trustworthy; adapted from van Herpen and van Trijp (2011, p. 151). Finally, a few socio-demographic questions were asked.

4.4.2 Study design and data collection

4.4.2.1 Participants

All participants were recruited in the pedestrian area of a German city's main shopping promenade. The medium-sized German city of Kassel (199,062 inhabitants) has an average population with average purchase power (age: 18–44: 49%, 44–80: 51%; household size: 1.9; monthly household net-income: €1821.5; Kassel - Department of Statistics (2018)). Recruiters stood at predefined spots where they were instructed to approach every third person passing by, resulting in a convenience sample. Participants were recruited on every day of the week and during the entire day to ensure a representative sample of shoppers.

After the recruiter approached a person they asked if the person wanted to take part in a study about food. After completion of the task, participants received a remuneration of 10 euro. If the person declined, the recruiter asked why and wrote down the reason given as well as the assumed sex and estimated age of the person. If the person was interested in taking part, they were asked two screening questions; did they go grocery shopping at least occasionally and did they purchase orange juice and chocolate at least occasionally. If the person replied positively, they were asked to follow the recruiter to the nearby university building in which the experiment took place. A total of 5,112 of the people approached declined participation (reason in descending order: lack of time, disinterest in the subject, generally unwilling to participate in studies, sickness, concern about data privacy) or deemed to be unsuitable for taking part in the experiment (reason in descending order: language difficulties, not purchasing the requested products, medical condition related to the requested products or their ingredients, severe medical condition related to eyesight).

The recruiters were university students instructed not to reveal the study's specific purpose and to avoid discussions on certain topics such as consumer behavior, health claims or healthiness of food products. Due to the complexity of the experiment, it was conducted by two scientific assistants. For the analyses, a sample with 156 participants was used whose characteristics are displayed in Table 6.

Table 6: Socio-demographic characteristics of the sample

Characteristic	Description	Sample ¹	Population country ²
Age (N = 153)	<45 years	53.6 %	44.1 %
	>=45 years	46.4 %	55.9 %
	18-24	17.0 %	9.8 %
	25-44	36.6 %	31.6 %
	45-64	34.6 %	38.2 %
	65-80	11.8 %	20.4 %
	∅	41.2	44.3
Sex (N = 156)	Female	49.0 %	51.2 %
	Male	51.0 %	48.8 %
Educational level (N = 156)	Highest level of education		
	No school graduation	1.9 %	4.1 %
	9 years of schooling	14.0 %	33.2 %
	10 years of schooling	22.9 %	28.4 %
	University-entrance qualification	61.1%	34.3 %
Household size (N = 156)	Number of household members		
	1	48.4 %	41.1 %
	2	24.8 %	34.0 %
	3	16.6 %	12.3 %
	4	6.4 %	9.3 %
	>=5	3.8 %	3.4 %
	∅	1.9	2.0
Children (N = 156)	Number of children in the household		
	0	73.9 %	71.7 %
	1	15.3 %	14.6 %
	2	7.6 %	10.3 %
	>=3	3.2 %	3.3 %
	Households with children	26.1 %	28.3 %

Income (N = 156)	The net-income of the household		
	< 900 €	35.0 %	10.02 %
900 – 1500 €	17.8 %	18.97 %	
1500 – 2600 €	23.6 %	31.28 %	
2600 – 4500 €	15.3 %	26.94 %	
4500 – 6000 €	5.1 %		
> 6000 €	2.5 %	12.79 %	

Note:

¹ Source: Based on the information participants gave in a self-administered computer assisted interview at the end of the experiment. Information about race or ethnicity was not collected.

² Source: Destatis (2017): German population 18 years until 80 years of age in 2017; own calculations based on Federal Statistical Office Germany.

4.4.2.2 Instruments and procedures

Eye movements were recorded using a head-mounted eye tracking device (SMI Eye Tracking Glasses 2 Wireless, Table 7) which recorded both of the participants' eyes. A head-mounted eye tracking device is susceptible to a loss in recording quality due to environmental influences such as variations in lighting and fluctuating distances between stimuli and participant which are notable in an in-store environment. To avoid the eye tracking system losing track of the eyes and the occurrence of the parallax error (Mansouryar et al., 2016, p. 197; Narcizo & Hansen, 2015, p. 71), the study was performed in a laboratory which permitted the semblance of a shopping experience within a controlled environment.

Table 7: Technical data of the SMI Eye Tracking Glasses 2 (SensoMotoric Instruments GmbH, 2017)

Manufacturer	SensoMotoric Instruments GmbH, Germany
Model	SMI ETG 2w
Human interface design	Non-invasive video-based glasses-type eye tracker
Calibration	1-/3-point calibration
Sampling rate	60 Hz binocular
Gaze tracking accuracy	0.5° over all distances
Gaze tracking range	80° horizontal, 60° vertical
Scene camera	Resolution: 1280x960p @24 fps; 960x720p @30 fps; HDR (high dynamic range) mode with high sensitivity for low light
Scene camera field of view	Field of view: 60° horizontal, 46° vertical
Eyewear compatibility	Works with contact lenses and most vision correction spectacles; Snap-on corrective lenses from +/- 4 diopter available

Two pilot tests with 16 and 18 participants respectively were conducted to check the eye tracking part of the experiment. Claims on food packages are relatively small objects to examine with head-mounted eye tracking systems, thus keeping the quality of the recorded eye tracking data high was of utmost importance. Several improvements were made, some of which are listed below. The lighting in the room had to be kept bright and stable, while sunlight had to be blocked out. The calibration of the eye tracking glasses to the participants' individual eye characteristics (3-point) was performed in front of a shopping shelf with dish detergent (points were glued on the products) instead of a blank poster with only the calibration points printed on it. This ensured that the calibration was performed approximately at the same distance as the participants would naturally stand in front of the product shelves. This resulted in an enhanced eye tracking quality in the subsequent shopping task. To analyze gaze behavior on the level of individual attributes labeled on food packages, rectangular and solid packages proved to be better than round or baggy packages. Abrupt changes in distances (parallax error) and looking through the eye tracking glasses close to their edges led to a loss in recording quality. To minimize this, each product category was placed in an individual shopping shelf with the products at its center and at the same eye level.

After the participants entered the laboratory, they were briefly introduced to the experiment which was presented as a simple shopping task including eye tracking. The study's specific purpose was not revealed. The eye tracking glasses were handed to the participants with the instructions to wear them as they would normal glasses. Any pre-existing eyesight problems of the participants were corrected by mounting SMI's optical lenses on the eye tracking glasses. Then, the eye tracking glasses were calibrated to the participants' individual eye characteristics. As soon as these requirements were satisfied, the interviewer continued with reading the task instructions to the participant:

Translation into English: Imagine that you are shopping now in a normal grocery store. Behind the next wall, you will find the grocery store in which you are going to shop and pay with your own money. You need these groceries: orange juice and chocolate. You buy one product each, thus one container of orange juice and one bar of chocolate. Choose the products you would choose in your normal shopping situation. Take as much time as you usually need. The shopping basket is to your right and here we go.

The stimuli were three-dimensional food packages placed on shopping shelves. Each participant was asked to purchase one product in each product category (orange juice and chocolate), for a total of two purchased products. Three alternatives were offered in each product category. The participants placed their purchased products in the provided shopping basket. After the participants finished their shopping, the eye tracking glasses were removed and the participants were seated in front of a computer to fill out the questionnaire. At the end, the participants were debriefed and given their remuneration. Besides the pilot tests solely for the eye tracking part of the experiment, one final pilot test including the whole experiment (eye tracking and questionnaire) was conducted with 14 participants. The comprehensibility of the instructions and the correct interpretation of the items were improved where necessary.

4.4.2.3 Stimuli

4.4.2.3.1 Tested product categories

Orange juice and milk chocolate were the tested product categories as they differ in their perceived healthiness. The reason for consuming chocolate is purely hedonic, while the health aspect is irrelevant (Di Monaco, Ollila, & Tuorila, 2005, p. 9). Chocolate is seen and used by researchers as an ‘unhealthy’ food product category in their studies (Belei et al., 2012, p. 902; Chernev, 2011, p. 762; Lalor, Kennedy et al., 2011, p. 757). The opposite applies to orange juice which is seen and used as a ‘healthy’ food product category by researchers (Chernev, 2011, p. 762; Siró et al., 2008, p. 463; Bech-Larsen & Grunert, 2003, p. 11). Besides their differences in perceived healthiness, milk chocolate and orange juice are very familiar to many consumers.

4.4.2.3.2 Tested nutrition, health, and taste claims

As pointed out in previous studies, the familiarity of the ingredients mentioned in nutrition and health claims might influence the effect nutrition and health claims have on consumers’ evaluations (Lähteenmäki et al., 2010, p. 236; Ares et al., 2009, p. 53; Bech-Larsen & Scholderer, 2007, p. 233). Consequently, any possible interferences had to be eliminated by using familiar ingredients in the claims. Research showed that consumers were very familiar with vitamin C and calcium (Masson et al., 2016, p. 623; Krystallis & Chrysochou, 2012, p. 99; Bech-Larsen & Scholderer, 2007, p. 233) including German consumers (Bornkessel, Bröring, Omta, & van Trijp, 2014, p. 334). Health claims about

vitamins referring to a benefit to the immune system and health claims about calcium referring to a benefit to the bones were also among the most commonly used health claims in the EU (Hung et al., 2017, p. 42). Therefore, **vitamin C** and **calcium** were used as ingredients for the claims.

Furthermore, study results showed that the carrier-ingredient fit could have an influence on the effects of nutrition and health claims on preferences (Aschemann-Witzel & Grunert, 2017, p. 127). Research found that fruit is mainly associated with vitamins whereas dairy products are associated with calcium (Masson et al., 2016, p. 623). To avoid inadvertent influences, a carrier-ingredient fit between the tested ingredients and the tested product categories was established: the claims about calcium were labeled on **milk chocolates** and the claims about vitamin C were labeled on **orange juices**. To avoid further inadvertent influences, all tested claims were framed positively (Lähteenmäki, 2013, p. 197; Kahneman & Tversky, 1979, p. 279).

An overview of the tested claims is given in Table 8. The tested nutrition claims were labeled on food products which contained the mentioned nutrient in a sufficient amount and therefore complied with the rules of EU Regulation No. 1924/2006 Art. 5 par. 1.b. and EU Regulation No. 1169/2011 annex XIII part A. The tested health claims were authorized for use by the EFSA as stated in the online *EU Register of nutrition and health claims made on foods* (EFSA, 2019), according to EU Regulation No. 1924/2006, Art. 10 par 1. Taste claims are not subject to regulation.

If neither a nutrition nor a health claim was labeled on the package, a taste claim was present. This is common practice in the research area of nutrition and health claim research (Wong et al., 2014, p. 947; Choi et al., 2012, p. 426; Aschemann & Hamm, 2009, p. 820) and counters the mere label effect. The mere label effect is a positivity bias towards a product that occurs solely because of the presence of any label or claim on a package front (Andrews et al., 2009, p. 42).

The three claims, **nutrition, health, and taste** were rotated among the three product alternatives in each product category, creating six choice sets per product category. Thus, in every choice set, one package carried a taste claim, one package carried a nutrition claim, and one package carried a health claim. Each participant was given one choice set for each of the two product categories and the choice sets were equally distributed among the participants.

Table 8: Claims used in the study on the front of the packages

	Orange juice	Milk chocolate
Nutrition claim	Rich in vitamin C	Rich in calcium
Health claim	Vitamin C contributes to the normal function of the immune system	Calcium is needed for the maintenance of normal bones
Taste claim	Simply delicious	Simply delicious

4.4.2.3.3 Package and shelf design

To make the purchase simulation as realistic as possible, the product alternatives were adapted from existing product packages. Since grocery shopping is characterized by habitual processes, familiar brand names and packages might influence consumers' choice and the way they look at the packages (Graham et al., 2012, p. 379; Pieters, Rosbergen, & Wedel, 1999, p. 435). Therefore, brands unfamiliar to the participants were tested which has also been done and is recommended by previous researchers (Peschel et al., 2019, p. 2; Singer et al., 2006, p. 94). Brands from other German-speaking countries were used, specifically store brands from Austria and Switzerland which were not sold in Germany. The packages were of average design and were typical for the food category. The claims were well-incorporated into the front package design to avoid participants noticing them and thus becoming more engaged than they would have been in a normal purchase situation (Orquin & Scholderer, 2015, p. 146). The study of the effects of nutrition and health claims on the participant's behavior was performed without any forced exposure to the claims which was a common practice in previous studies in this research area (Aschemann-Witzel & Hamm, 2010, p. 50). The claims were written with a font size of at least 14. The surface size of the claims on each brand stayed the same irrespective of the type of the claim (nutrition, health or taste claim). Thus, a health claim did not span larger across the surface area of the product's front than a nutrition or a taste claim. The presentation order of the three brands in each product category on the shelf was not rotated. To avoid any bias due to upper or lower shelf-placement, both product categories were placed in individual shopping shelves and on the same eye level. To more clearly illustrate, photographs of the two shelves with the products in one model choice set are shown in Figure 5 and Figure 6.



Figure 5: The shelf with orange juices showing one model choice set

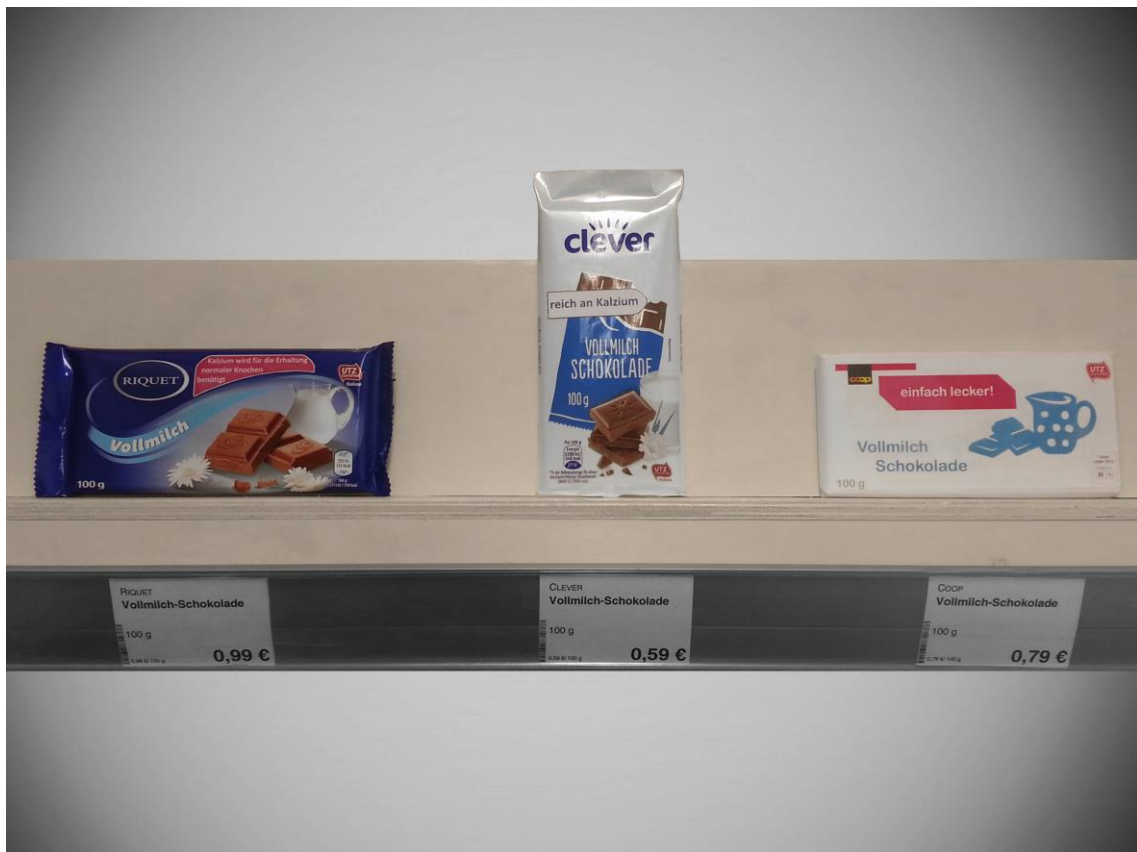


Figure 6: The shelf with milk chocolates showing one model choice set

Besides differences in the graphical layout of the packages, all other attributes were identical. The product name (“100% orange juice”; “milk chocolate”), package size, ingredient list, and all other mandatory information were matched. Following the introduction of EU Regulation No. 1924/2006 Art. 7, every nutrient referred to in a nutrition and health claim must be additionally included in the nutrition facts table with the amount present in the product. The nutrition facts tables were made identical across each product category and represented the usual amounts for these products. Any optional / marketing information such as certification labels or logos (e.g. UTZ, Rainforest Alliance) were either removed or matched along all products within one product category. Since the participants were told to purchase the groceries, the shopping shelves included the price tags in the label strips. The three different price levels rotated among the three product alternatives per category. The prices (orange juice: €1.09; €1.29; €1.49; milk chocolate: €0.59; €0.79; €0.99) are within the typical price range for these product categories in Germany, which were validated by an inventory in different shops.

4.4.2.4 Data analysis methods

To start with, univariate methods were used to show descriptive statistics about the participants' gaze behavior at the areas of interest. The areas of interest are defined as regions or elements on the stimuli which are of importance for the present research (Holmqvist et al., 2011, p. 187). Analyzing mean gaze durations and proportions of participants gazing at an area of interest is a typical approach in eye tracking research (Duerrschmid & Danner, 2018, p. 284; Ares et al., 2014, p. 31; Holmqvist et al., 2011, p. 419; Jacob & Karn, 2003, p. 582). After this, paired sample t-tests were applied to check for differences between claim types and product categories on mean gaze duration. The differences in the purchase frequencies of the products were analyzed with non-parametric chi-square tests. For a combined analysis of the different claim types and gaze duration on the purchase decision, two multinomial logistic regression models were calculated; one model for each product category.

The analyses were performed with the gaze duration on the respective area of interest, such as the package or claim, if not otherwise specified. The so-called 'dwell time' was used for the analyses. Dwell time is the sum of all durations from the fixations and saccades in a certain area of interest. Once the eyes of a participant gaze on a certain area of interest, the time starts counting and stops when the participants' eyes leave this area of interest. The sum of all the visits' durations is the dwell time. The dwell time, also referred to as gaze duration or glance duration, is a common measure in eye tracking research (Duerrschmid & Danner, 2018, p. 284; Holmqvist et al., 2011, p. 386; Jacob & Karn, 2003, p. 581).

4.5 Results

First, the average gaze durations of participants on the packages and on the different claim types, as well as the average time of the purchase decision for each product category, are illustrated. Then the differences in purchase frequencies between the claim types and between the product categories are shown. Results from the questionnaire are then used to explain the differences in the results obtained regarding claim type and product category. Finally, whether the gaze duration on claims affected the purchase decision is analyzed.

4.5.1 Gaze duration on claims and products

The gaze duration on the claims varied considerably across the participants (Table 9). Each claim was looked at by at least 85% of the participants.

Table 9: Gaze durations on claims

	Min	Max	Mean	SD	SE	Median	Share of participants with zero views
Orange juice (N = 156)							
Taste claim	0 ms	4381 ms	946 ms	758 ms	60	796 ms	8.9%
Nutrition claim	0 ms	5775 ms	1162 ms	906 ms	72	946 ms	6.4%
Health claim	0 ms	4945 ms	1373 ms	1187 ms	94	1028 ms	5.7%
Milk chocolate (N = 156)							
Taste claim	0 ms	3900 ms	1019 ms	795 ms	63	879 ms	12.7%
Nutrition claim	0 ms	3966 ms	1145 ms	855 ms	68	962 ms	7.6%
Health claim	0 ms	8049 ms	1543 ms	1533 ms	122	1111 ms	14.6%

In both product categories, participants spent more time looking at health claims than they did the two other claim types. For orange juice, participants spent, on average, 0.95 seconds looking at taste claims, 1.16 seconds looking at nutrition claims, and 1.37 seconds looking at health claims. The gaze duration differences among the claim types were significant (paired sample t-tests). For milk chocolate, participants spent 1.02 seconds looking at the taste claim, 1.15 seconds at the nutrition claim, and 1.54 seconds at the health claim. Again, all differences were significant.

Between the two product categories, there was no significant difference in participants' gaze duration on claim types, i.e. the gaze duration on, e.g. the nutrition claims, was the same for orange juice and milk chocolate (Table 10). In both categories, participants spent around a third of their time looking at the claims in relation to the time spent on the package fronts. Considering the gaze duration on all the package sides together (orange juice: front, back, left, right; milk chocolate: front, back), there was no significant difference between the product categories in the amount of time participants looked at the packages; on average 15.79 seconds for orange juice and 16.72 seconds for milk chocolate. Including gaze duration on price tags and on objects other than the packages, e.g. the shelf itself, the whole purchase decision took, on average, 19.78 seconds for milk chocolate and 18.56 seconds for orange juice with no significant difference between the two. Further results show that participants looked significantly longer at the nutrition tables on orange juice than the ones on milk chocolate, but significantly shorter at the

brand names as well as the brand logo on orange juice compared to milk chocolate (Table 10).

Table 10: Comparison of gaze durations between orange juice and milk chocolate (paired sample t-tests)

		Orange juice Means (SD)	Milk chocolate Means (SD)	t value	Effect size r
Gaze durations on claims [in ms]	Taste claims	946 (758)	1019 (795)	-.9539	n.s.
	Nutrition claims	1162 (906)	1145 (855)	.2028	n.s.
	Health claims	1373 (1187)	1543 (1533)	-1.4257	n.s.
	All 3 claims combined	3481 (2254)	3707 (2515)	-1.1186	n.s.
Aggregated gaze duration on the package fronts of the three products per category [in ms]		9764 (5691)	12298 (6930)	-5.5146 ***	.4050
Aggregated gaze duration on the price tags of the three products per category [in ms]		2714 (1916)	2902 (2209)	-1.2725	n.s.
Aggregated gaze duration on the nutrition tables of the three products per category [in ms]		2289 (5675)	1316 (4122)	2.6730 **	.2099
Aggregated gaze duration on the brand name of the three products per category [in ms]		1536 (1106)	2191 (1172)	-6.7362 ***	.4759
Aggregated gaze duration on the additional package sides of the three products per category (right + left + back for orange juice; back for milk chocolate) [in ms]		6022 (10449)	4420 (10205)	2.0221 *	.1603
Aggregated gaze duration on the whole packages of the three products per category [in ms]		15786 (13444)	16718 (14305)	-.9835	n.s.
Aggregated gaze duration during the whole purchase decision per category [in ms]		18562 (14189)	19775 (15415)	-1.2644	n.s.

Note: N = 156; Significance $p < .001 = ***$; $p < .01 = **$; $p < .05 = *$; $p < .1 = (*)$

4.5.2 Effect of different claim types on purchase decision

Besides the effect on gaze duration, the different claim types also affected the purchase decision (Figure 7). The so-called expectancy value was 33.33% for a claim not influencing the purchase decision because the three claim types were equally present in each product set. For each claim type, whether the share of purchases was significantly different from the expectancy value was tested.

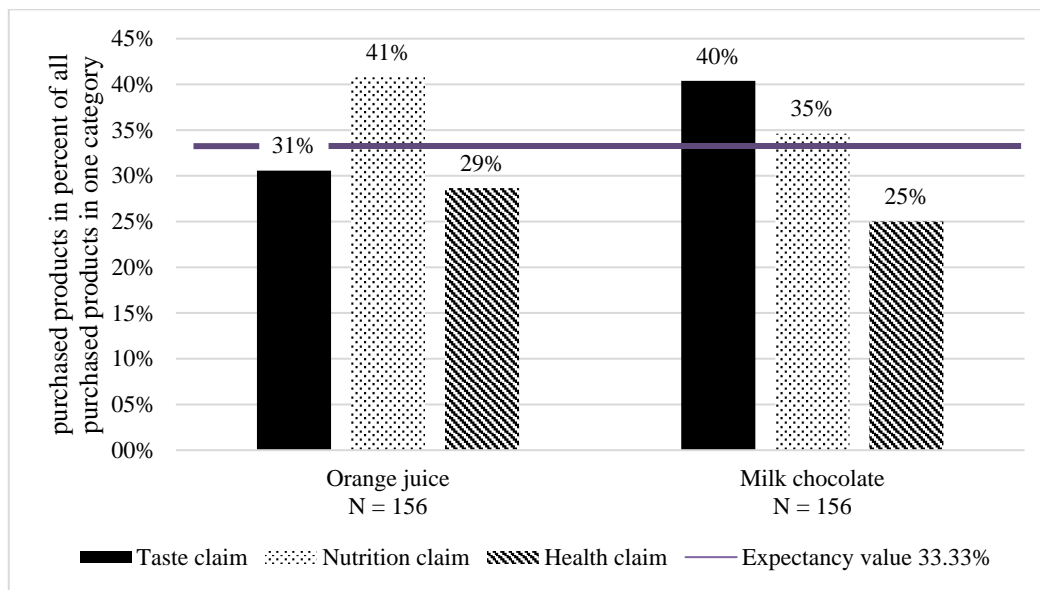


Figure 7: Share of purchases by claim type

In the product category ‘orange juice’, participants bought products labeled with the nutrition claim significantly more often ($\chi^2 (1) = 4.1407, p = .0419$). The taste claim and the health claim had no significant effect, i.e. the share of purchases was not significantly different from the expectancy value (Table 11). In the category ‘milk chocolates’, participants bought products labeled with the taste claim significantly more often ($\chi^2 (1) = 3.4904, p = .0617$). Products labeled with a health claim were significantly less preferred ($\chi^2 (1) = 4.8750, p = .0272$). The nutrition claim did not show any effect compared to the expectancy value.

Table 11: Comparison of share of purchases by claim types and product categories (chi-square tests)

	Share of purchases	chi-square
Orange juice		
Taste claim	30.57%	0.4601
Nutrition claim	40.76%	4.1407 *
Health claim	28.66%	1.4100
Milk chocolate		
Taste claim	40.38%	3.4904 (*)
Nutrition claim	34.62%	0.1154
Health claim	25.00%	4.8750 *
Orange juice vs. milk chocolate		
Taste claim	30.57% vs. 40.38%	6.816 **
Nutrition claim	40.76% vs. 34.62%	2.832 (*)
Health claim	28.66% vs. 25.00%	1.231

Note: N = 156; Significance $p < .001 = ***$; $p < .01 = **$; $p < .05 = *$; $p < .1 = (*)$

There were also significant differences between the product categories. A taste claim on milk chocolate led to a significantly larger share of purchases than a taste claim on orange juice. Conversely, a nutrition claim on orange juice led to a larger share of purchases than a taste claim on milk chocolate. Regarding health claims, there was no significant difference in the share of purchases between the product categories.

4.5.3 Participants attitudes towards the two product categories

As shown so far, there was a difference in gaze durations between the two product categories as well as a difference in purchases in combination with different claim types. In line with a priori assumptions, there was a significant difference in consumer perception of the two product categories as the following results demonstrate. Participants perceived orange juice, on average, healthier than milk chocolate (Table 12). Likewise, participants perceived the offered brands of orange juices healthier than the offered brands of milk chocolates. Participants further said they paid more attention to nutrition and health claims labeled on 'healthy food' compared to 'unhealthy food'. Thus, participants not only perceived orange juice as healthier, but also cared more about nutrition and health claims on orange juice. However, the actual purchase and gaze behavior of the participants did not fully correspond with the stated consumer perceptions. Participants' gaze duration on the nutrition and health claim showed no

difference between the two categories and products labeled with the health claim were the least preferred for purchase in both categories. In accordance with the stated perceptions, participants bought orange juice more often when it was labeled with a nutrition claim.

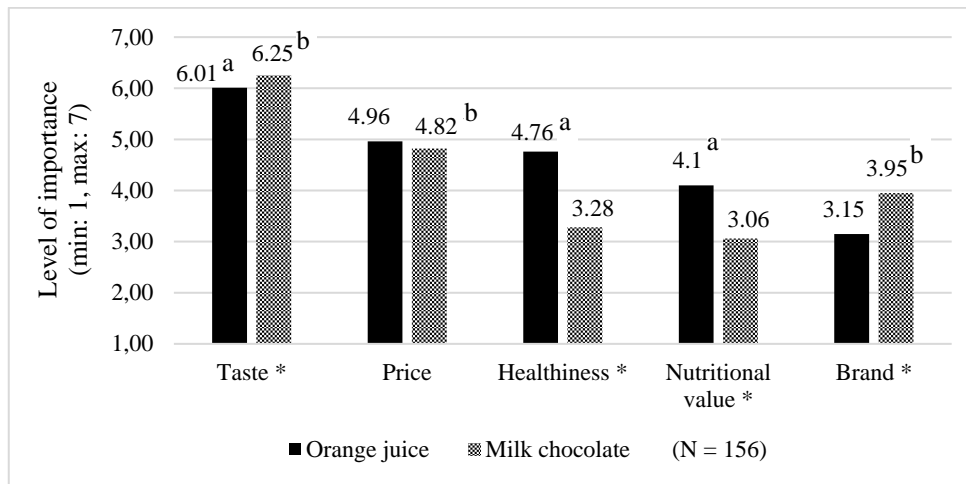
Table 12: Consumer perceptions of the two product categories (paired sample t-tests)

	Means (SD)	t value	Effect size r
I. Perceived healthiness of the product category			
Orange juice vs. milk chocolate	4.68 (1.316) vs. 3.24 (1.469)	9.671 ***	.6122
II. Perceived healthiness of the offered brands			
Orange juice vs. milk chocolate	4.09 (1.242) vs. 2.85 (1.249)	10.179 ***	.6317
III. Perceived healthiness of the offered brands in comparison to familiar brands			
Orange juice vs. milk chocolate	3.69 (1.062) vs. 3.316 (1.061)	3.766 ***	.2887
IV. Paying attention to nutrition and health claims on healthy vs. unhealthy food			
“Healthy food” vs. “unhealthy food”	3.91 (2.110) vs. 3.34 (2.139)	3.830 ***	.2932

Note: N = 156; Significance $p < .001 = ***$; $p < .01 = **$; $p < .05 = *$; $p < .1 = (*)$
 7-point Likert scales; wording I: “How healthy do you think orange juice (milk chocolate) is on average?” with 1 = very unhealthy, 7 = very healthy; II: “How healthy do you think the offered orange juice (milk chocolate) brands are?” with 1 = very unhealthy, 7 = very healthy; III: “How healthy do you think the offered orange juice (milk chocolate) brands are in comparison to other orange juice (milk chocolate) brands you are familiar with?” with 1 = very unhealthy, 7 = very healthy; IV: “On healthy (unhealthy) food I pay a lot of attention to nutrition & health claims” with 1 = strongly disagree, 7 = strongly agree.

Additionally, participants were asked how important the following attributes were when shopping for orange juice and milk chocolate: Taste, price, healthiness, nutritional value, and brand. The means are shown in Figure 8. Taste was reported as being more important for the purchase of milk chocolate than for orange juice. This corresponds with the purchase behavior as taste claims on milk chocolate led to a significantly larger share of purchases than on orange juice (Table 11). Price was rated the second most important attribute in both categories, followed by healthiness, nutritional value, and brand, which is reflected in the longer gaze durations on price tags in comparison to nutrition tables or brand names (Table 10). For the following attributes, there is a difference in the ranking between the categories: Healthiness and nutritional value are more important than the brand for the purchase of orange juice, whereas for milk chocolate, the brand is more important than healthiness and nutritional value (Figure 8). This is in accordance with the gaze duration as participants looked longer at nutrition tables than at brand names on

orange juices, while the opposite was true for milk chocolates (Table 10). The differences in ratings and gaze durations are also in accordance with the observed share of purchases by claim type and product category.



Note: The attributes were rated on a 7-point Likert scale, ranging from 1 = very unimportant to 7 = very important.
 a the letter 'a' indicates a significant difference with the next attribute following in the rating within orange juice: taste – price – healthiness – nutritional value – brand ($p < .05$);
 b the letter 'b' indicates a significant difference with the next attribute following in the rating within milk chocolate: taste – price – brand – healthiness – nutritional value ($p < .05$);
 * the asterisk * indicates a significant difference between the two product categories within the same attribute ($p < .05$).

Figure 8: Importance of product attributes within one product category and between the two product categories (paired sample t-tests)

Participants were further asked to rate their level of trust in the claims tested in the purchase situation. The nutrition and health claims on orange juice were trusted significantly more than the respective claims on milk chocolate (Table 13). However, the low levels of trust in both categories show that participants were rather unsure whether to trust or distrust the claims. The belief in the claimed health benefit was significantly higher for health claims on orange juice than on milk chocolate. The lower levels of trust and belief towards claims on milk chocolate are in accordance with the share of purchases in that nutrition claims on milk chocolate led to a lower share of purchases than for orange juice (Table 11). In both categories, participants trusted the health claims more than the nutrition claims. However, this did not correspond with the purchase behavior since health claims led to the lowest share of purchases in both categories. The reason for this could be the low level of belief in the claimed health benefit: for orange juice, the participants on average neither agreed nor disagreed to believe in the claimed health

benefit and for milk chocolate, they even disagreed to believe in the claimed health benefit.

Table 13: Consumer perceptions of the claims tested in the experiment (paired sample t-tests)

	Orange juice Means (SD)	Milk chocolate Means (SD)	t value	Effect size r
I. Trust in the shown nutrition claims	3.91 (1.642)	2.91 (1.638)	7.530 ***	.5163
II. Trust in the shown health claims	4.45 (1.820)	3.97 (2.115)	3.638 ***	.2797
III. Belief in the claimed health benefit of the offered health claims	3.54 (1.78)	2.12 (1.473)	10.307 ***	.6365

Note: N = 156; Significance $p < .001 = ***$; $p < .01 = **$; $p < .05 = *$; $p < .1 = (*)$
 7-point Likert scales; wording: I: “How trustworthy do you think the nutrition claim ‘rich in vitamin C’ on orange juice (‘rich in calcium’ on milk chocolate) is?” with 1 = very untrustworthy, 7 = very trustworthy; II: “How trustworthy do you think the health claim ‘Vitamin C contributes to the normal function of the immune system’ on orange juice (‘Calcium is needed for the maintenance of normal bones’ on milk chocolate) is?” with 1 = very untrustworthy, 7 = very trustworthy; III: “Imagine you are eating the offered orange juices (milk chocolates). Do you expect positive effects on the function of your immune system (on maintaining your bones)?” with 1 = strongly disagree, 7 = strongly agree.

4.5.4 Effect of gaze duration on claims on purchase decision

The results presented above show that the gaze durations on claims do not allow a conclusion towards the share of purchases to be reached; for instance, although health claims were looked at the longest (Table 9), orange juices and milk chocolates labeled with health claims were the least preferred in purchases (Table 11). For the analysis of a direct relationship between the participants’ individual gaze durations on claims and their purchase decision, multinomial logistic regression models were used. Separate models for each product category were calculated. The dependent variable was the purchase decision. Thus, the dependent variable had three categories: a product labeled with a nutrition claim, a health claim or a taste claim. The three independent variables were the gaze durations on each claim type.

For both models, multicollinearity of the three gaze variables was checked. The tolerance values were between 0.69 and 0.79 and the VIF values were between 1.32 and 1.45, thus far below the thresholds that indicate a multicollinearity problem (Urban & Mayerl, 2011, p. 232; Menard, 2002, p. 76). Furthermore, the variance proportion showed that no gaze

variable had high proportions on the same eigenvalue, as this would indicate that the regression coefficients' variances are dependent (Field, 2018, p. 418).

Table 14 shows the parameter estimates of the two models. In both models, the reference category was 'taste claim'. It was found that the longer a participant looked at a specific claim (nutrition, health or taste) compared to other participants, the more likely the participant was to purchase the product with the respective claim. This relationship was significant across the three claim types and the two product categories.

Table 14: Multinomial logistic regression models on claim types

		Coefficients B	
		Model 1: Purchase of orange juice	Model 2: Purchase of milk chocolate
Purchase of nutrition claim vs. taste claim	Intercept	.4385	-.1590
	Gaze duration on nutrition claim	1.1994 ***	.6204 *
	Gaze duration on health claim	-.3433	.2916 (*)
	Gaze duration on taste claim	-1.1782 ***	-1.0406 ***
Purchase of health claim vs. taste claim	Intercept	.1557	-.4448
	Gaze duration on nutrition claim	.0053	.5898 (*)
	Gaze duration on health claim	.3537 (*)	.4282 *
	Gaze duration on taste claim	-.7469 *	-1.3232 ***

Note: Significance $p < .001 = ***$; $p < .01 = **$; $p < .05 = *$; $p < .1 = (*)$
 Model 1: $N = 156$; $R^2 = .1816$ (Cox & Snell), .2049 (Nagelkerke).
 Model $\chi^2(6) = 31.4594$, $p = .00002$
 Model 2: $N = 156$; $R^2 = .1546$ (Cox & Snell), .1748 (Nagelkerke).
 Model $\chi^2(6) = 26.1988$, $p = .0002$

4.6 Discussion and conclusions

The purpose of this study was to investigate the role of product category and gaze duration in consumers' purchase decisions for products with nutrition, health, and taste claims. The originality of this study lies in the fact that a combination of a close-to-realistic purchase simulation with eye tracking and a subsequent survey was used.

4.6.1 Visual attention on claims

Each claim was noticed by around 90% of the participants. However, the amount of time the participants looked at a claim differed significantly among the claim types with health claims being looked at the longest, followed by nutrition, and finally, by taste claims. The different lengths of the health, nutrition, and taste claims, with nine to ten, three, and two

words respectively, as well as the different complexity in processing their information might have played a role in this result. When the participants' gaze duration on an individual level was considered rather than sample means, it was found that the longer a participant looked at a certain claim, the more likely they were to purchase the respective product. This relation between a longer gaze duration on claims and a higher purchase likelihood was found for every claim type for both of the product categories. This result adds value to the existing research on nutrition and health claims as it shows, for the first time, a direct relationship between consumers looking at a claim on three-dimensional products and purchasing the respective product. The implication of this result is that a claim must capture the consumer's attention so that they look at the claim longer, which eventually increases the likelihood of the product being purchased. To increase visual attention on a package label, the visual density of information, the so-called visual clutter, around the label should be decreased (Bialkova et al., 2013, p. 71) or the label's surface size should be increased (Peschel et al., 2019, p. 4).

4.6.2 Product category and claim types

Previous studies yielded contradicting results about the influence of the perceived healthiness of product categories on the purchase decision for products labeled with claims. This study tested nutrition, health, and taste claims on three-dimensional packages of orange juice and milk chocolate. It was found that these two categories differed in perceived healthiness for the participants. The purchases of the products were not equal across the different claim types and categories. Orange juices were bought significantly more often with a nutrition claim labeled on the front of the package compared to the labeling with a taste or a health claim. In contrast, milk chocolates were bought significantly more often with a taste claim compared to a nutrition or a health claim.

The results for orange juice support results of previous studies which found that a nutrition claim on a 'healthy' food leads to positive evaluations or an increase in purchases (Bialkova et al., 2016, p. 44; Fenko et al., 2016, p. 86; Orquin & Scholderer, 2015, p. 152; Choi et al., 2012, p. 432). Likewise, the results for milk chocolate support previous studies showing that a taste claim on 'unhealthy' food leads to positive evaluations (Fenko et al., 2016, p. 86; Choi et al., 2012, p. 432) while a nutrition or a health claim on an 'unhealthy' food leads to neutral or even negative effects on

preferences, purchase intentions, and actual purchases (Bialkova et al., 2016, p. 44; Kiesel & Villas-Boas, 2013, p. 162).

Additionally, the product's healthiness and nutritional value were rated higher in importance when shopping for orange juice than for milk chocolate. When shopping for milk chocolate, the brand was rated even higher in importance than healthiness and nutritional value. This was confirmed with the purchase behavior (nutrition and health claims were less preferred to taste claims on milk chocolate) and with the gaze duration (participants looked longer at nutrition tables on orange juice and longer at the brand on milk chocolate). This is in line with studies showing that consumers stated they cared more about taste than health attributes when looking for 'unhealthy' food (Chan et al., 2005, p. 150; Balasubramanian & Cole, 2002, p. 122). Therefore, the results of the present study provide a further argument in favor of advertising a food product with its strength; a taste claim on chocolate and a nutrition claim on orange juice. In other words, the so-called match-up of claim and product category leads to positive effects.

Health claims were looked at the longest. However, in terms of purchases, orange juices and milk chocolates labeled with a health claim were the least preferred choices. The prominent dislike of health claims on milk chocolates is in line with the lower ratings in trust and belief of the participants compared to orange juice, which in turn is in line with previous studies showing that nutrition and health claims on 'unhealthy' food might induce skepticism and distrust (Lalor, Kennedy et al., 2011, p. 758; Siró et al., 2008, p. 463). Therefore, this study – as it was a close-to-realistic purchase simulation – adds weight to the argument that health claims might not have a positive effect on evaluations or purchase decisions (Lähtenmäki, 2013, p. 199; Lähtenmäki et al., 2010, p. 236).

4.6.3 Conclusions

The results of previous research on nutrition and health claims are contradictory. So far, it has been difficult to draw general conclusions about the impact of claims on consumer purchasing, consumption or even public health. At the same time, stakeholders from the food sector and the policy sector remain very interested in nutrition and health claims (Hieke et al., 2015, p. 71). The authors of a recent review article suggested testing the claims in more natural situations as the few previous studies conducted in such environments indicated that nutrition and health claims might play a much smaller role than studies conducted in more artificial settings would suggest (Kaur et al., 2017, p. 16).

The present study used a close-to-realistic environment to investigate the effect of different claim types on actual behavior, i.e. the purchase decision and visual attention. The authors recommend continuing research on the effect of nutrition and health claims in close-to-realistic experiments. Based on the results, a recommendation for marketers is to not use health claims because they do not lead to an increase in purchases. The best alternative is the use of nutrition claims which simply state a nutritional benefit of the food. In the case of 'unhealthy' products, the use of taste claims is advisable. Previously, it was pointed out that nutrition and health claims might deceive consumers by outweighing the poor nutritional quality in some food categories (Talati, Pettigrew, Dixon et al., 2016, p. 1; Orquin & Scholderer, 2015, p. 153). Whether nutrition or health claims led to a deception about the milk chocolate's nutritional quality is unknown in this present study. However, the results of the purchase simulation showed that nutrition and health claims were the least preferred claims on milk chocolate.

4.7 Limitations

Wearing the eye tracking glasses and knowing that one's eye movements are being observed could potentially influence one's behavior (Meyerding & Merz, 2018, p. 782; Graham et al., 2012, p. 379). Consumers may try to alter their behavior including their natural gaze behavior, e.g. looking less at the graphical elements and longer on more 'sensible' elements such as nutrition tables. However, gaze behavior is a subconscious process which is difficult to override (Jacob & Karn, 2003, p. 589). Avoiding looking at something which attracts attention is rather painful and there is no reason for a participant to execute such a behavior, especially when the participant was unaware of the study's aim and was instructed to buy the product which they would buy in the supermarket. Since orange juice and milk chocolate were used as two product categories with differing perceived healthiness, it is unknown whether the findings can be generalized to other product categories. The differences in gaze duration obtained on the three different claim types might be due to the differences in word count of the claims and the different complexity in processing them. Furthermore, the experiment was conducted in one German city with a convenience sample unrepresentative of the German population, e.g. participants with university-entrance qualification were overrepresented (61.1% vs. 34.3%) and participants aged 45 years or older were underrepresented (46.4% vs. 55.9%). Thus, it is unclear whether the findings can be generalized to all German consumers.

4.8 Acknowledgments

The authors are very grateful to the reviewers who helped to improve the text significantly. Additionally, the authors thank Manika Rödiger for the successful collaboration during the conduction of the study and the preparation of the eye tracking data. The authors also thank Anne Christopherson for proofreading the manuscript. This research did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors. The authors had no conflicts of interest in writing this paper.

4.9 Compliance with ethical standards

The study was in accordance with the ethical standards defined in the 1964 Helsinki Declaration and the study design was approved by the university authorities. Informed consent was obtained from all participants involved in the study. No data was collected that could reveal the identity of the participants.

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5 Who buys products with nutrition and health claims? A purchase simulation with eye tracking on the influence of consumers' nutrition knowledge and health motivation

This chapter represents the article published by the author of this dissertation and Associate Professor Dr. Meike Janssen together with Professor Dr. Ulrich Hamm as co-authors. Any reference to this chapter should be cited as:

Steinhauser, J., Janssen, M., & Hamm, U. (2019). Who buys products with nutrition and health claims? A purchase simulation with eye tracking on the influence of consumers' nutrition knowledge and health motivation. *Nutrients*, *11*(9), 2199.
<https://doi.org/10.3390/nu11092199>.

Keywords:

Health claims; Nutrition knowledge; Eye tracking; Visual attention; Consumer behavior; Purchase decision.

Journal Metrics for 2018:

Journal Impact Factor: 4.171

5-Year Impact Factor: 4.813

Quartile: Q1

Source: Web of Science - Journal Citation Reports by Clarivate Analytics.

5.1 Abstract

Nutrition and health claims are seen as a way of promoting healthy aspects of food. However, the results of previous studies have been contradictory regarding the effect of these claims on purchase. This study aims to achieve a better understanding of how the consumer characteristics ‘nutrition knowledge’ and ‘health motivation’ influence the purchase of products with nutrition and health claims and what role gaze behavior plays. We included gaze behavior in our analysis as visual attention on the claims is a precondition to its influence on the purchase decision. In a close-to-realistic shopping situation, consumers could choose from three-dimensional orange juice packages labeled with nutrition, health, and taste claims. In total, the sample consisted of 156 consumers. The data was analyzed with a structural equation model (SEM) linking the purchase decision for products with claims to gaze data recorded with a mobile eye tracker and consumer and product-related variables collected via the questionnaire. Results showed that the variables in the SEM explained 31% (8%) of the variance observed in the purchase of products with a nutrition (health) claim. The longer a consumer looked at a specific claim, the more likely the consumer would purchase the respective product. The lower the price and the higher the perceived healthiness and tastiness of the product further heightened its likelihood of being purchased. Interestingly, consumers with higher nutrition knowledge and/or higher health motivation looked longer at the nutrition and health claims; however, these consumer characteristics did not show an effect on the purchase decision. Implications for policymakers and marketers are given.

5.2 Introduction

In today’s grocery stores, consumers encounter a great variety of food products and their packages are full of information. Manufacturers want their food products to attract consumers’ attention (Clement et al., 2015, p. 188). Since the interest in leading a healthy lifestyle has been growing (Strijbos et al., 2016, p. 13; Boer & Bast, 2015, p. 61), the use of nutrition and health claims seems promising for manufacturers. Such claims link the food product to healthiness by stating positive nutritional characteristics or naming an explicit health benefit of the nutrients it contains. Around one-third of the products in grocery stores are labeled with nutrition and health claims (Al-Ani et al., 2016, p. 1087; Hieke et al., 2016, p. 12; Pravst & Kušar, 2015, p. 9363; Devi et al., 2014, p. 257; No et al., 2014, p. 78).

Research on nutrition and health claims has shown both positive and negative effects for these claims on consumers' preferences and purchase behavior (Bialkova et al., 2016, p. 45; Fenko et al., 2016, p. 82; Aschemann-Witzel & Grunert, 2015, p. 90; Orquin & Scholderer, 2015, p. 149; van Buul & Brouns, 2015, p. 1558; Maubach et al., 2014, p. 75; Kiesel & Villas-Boas, 2013, p. 162; Norton et al., 2013, p. 104; Berning et al., 2011, p. 368). The discrepancy in the effects reported by previous studies has been commented on by other authors (Kaur et al., 2017, p. 1; Hieke et al., 2015, p. 67; Annunziata & Vecchio, 2013, p. 353). They suggested that an explanation for the discrepancy might be that different consumer groups react differently to nutrition and health claims. The characteristics of consumers might influence the effect of nutrition and health claims on their preferences and/or purchase behavior and should be included in future research (López-Galán & de-Magistris, 2019, p. 11; van Wezemael et al., 2014, p. 174; Verbeke et al., 2009, p. 685; Kemp et al., 2007, p. 68). Several recent articles pointed to consumers' nutrition knowledge and health motivation as promising independent variables for future research (Hung et al., 2017, p. 35; Bialkova et al., 2016, p. 40; Fenko et al., 2016, p. 90; Mitić & Gligorijević, 2015, p. 349; van Buul & Brouns, 2015, p. 1558; van Wezemael et al., 2014, p. 174; Aschemann-Witzel & Hamm, 2010, p. 49; Kemp et al., 2007, p. 68).

Nutrition knowledge is defined as a "scientific construct that nutrition educators have created to represent individual's cognitive processes related to information about food and nutrition" (Axelson & Brinberg, 1992, p. 239). Health motivation is defined as a "consumers' goal-directed arousal to engage in preventive health behaviors" (Moorman & Matulich, 1993, p. 210). Earlier studies have shown that consumers with higher nutrition knowledge (Petrovici et al., 2012, p. 777; Szykman et al., 1997, p. 235) or higher health motivation (Cavaliere et al., 2015, p. 47; Barreiro-Hurlé et al., 2010a, p. 227) stated they read claims more often than those less knowledgeable, and motivated. Consumers with higher health motivation had a higher purchase intention and likelihood of choosing products with nutrition or health claims (Dean et al., 2012, p. 134; Aschemann-Witzel & Hamm, 2010, p. 53; Sabbe et al., 2009, p. 90). However, other studies have shown no influence of nutrition knowledge (Coleman et al., 2014, p. 169) or health motivation (Chrysochou & Grunert, 2014, p. 1215; Wansink et al., 2000, p. 90) on the purchase intention for these products. The present study went one step further by including both of these two consumer characteristics in a close-to-realistic shopping experiment and by

analyzing their influence on actual purchasing behavior for products with nutrition and health claims.

In addition, we took into consideration the fact that nutrition knowledge and health motivation might influence consumers' visual attention towards nutrition and health claims during their purchase decision. Previous studies have shown that motivation influences visual attention on food packaging. A higher motivation towards healthy living or a higher product involvement mostly showed an increase in visual attention on certain package labels (Fenko et al., 2018, p. 63; Behe, Bae, Huddleston, & Sage, 2015, p. 16; van Loo et al., 2015, p. 223; Orquin, 2014, p. 271; Bialkova & van Trijp, 2011, p. 597; Visschers, Hess, & Siegrist, 2010, p. 1099). The effect of topic-relevant knowledge on visual attention has not been investigated in the context of food like it has been in other fields such as art, chess or sports (Holmqvist et al., 2011, p. 383, 396, 413; Reingold & Charness, 2009, p. 348; Vogt & Magnussen, 2007, p. 98; Memmert, 2006, p. 626). Before consumers decide to purchase a food product, they normally look at the product they are going to purchase; thus visual attention usually precedes the purchase decision (Duerschmid & Danner, 2018, p. 291; Meyerding & Merz, 2018, p. 782; Orquin & Mueller Loose, 2013, p. 190; Chandon et al., 2009, p. 1). Previous research has shown that visual attention influences food choice, in that the more visual attention a package or a certain label on a package receives, the more likely it is that this product will be chosen (Peschel et al., 2019, p. 5; Meyerding & Merz, 2018, p. 782; van Loo et al., 2018, p. 549; Gidlöf, Anikin, Lingonblad, & Wallin, 2017, p. 36; Gere et al., 2016, p. 6; Pärnamets, Johansson, Gidlöf, & Wallin, 2016, p. 227; van Loo et al., 2015, p. 223; Orquin & Mueller Loose, 2013, p. 201). The eye movements, and consequently the visual attention to stimuli, can be measured with an eye tracking device. In the present study, head-mounted eye tracking glasses were used to ensure that consumers were able to act naturally in front of a shopping shelf with three-dimensional food packages.

Besides consumer characteristics, the food product's attributes also influence shopping for food. Therefore, the most important product attributes were incorporated into the study. According to previous research, these are price, brand, perceived tastiness, and the healthiness of the products (Bruschi et al., 2015, p. 83; Jacobs, Beer, & Larney, 2011, p. 518; Grunert, Wills et al., 2010, p. 180; Hartmann et al., 2008, p. 135; Teratanavat & Hooker, 2006, p. 534).

The overall aim of the present work was to analyze the factors which influence the purchase decision for food products with nutrition and health claims. The main research questions were the following:

- (1) What effects do consumers' nutrition knowledge and health motivation have on the purchase decision for products labeled with nutrition and health claims?
- (2a) What effects do consumers' nutrition knowledge and health motivation have on visual attention on food packages?
- (2b) How does visual attention on claims mediate the effect of nutrition knowledge and health motivation on the purchase decision?
- (3) What effects do price, brand, perceived tastiness, and healthiness have on the purchase decision for products labeled with nutrition and health claims?

The study is innovative because it has gone beyond previous survey-based research on claims. With the use of head-mounted eye tracking glasses, this purchase simulation analyzed the influence of nutrition knowledge and health motivation on gaze behavior and the influence of these three constructs on the purchase decision. Typical product attributes influencing the purchase for food were incorporated in the study. The data was analyzed with a structural equation model.

In a recent review article on nutrition and health claims, the authors concluded that the studies conducted in more natural settings indicated that nutrition and health claims might play a much smaller role than studies conducted in more artificial settings would suggest (Kaur et al., 2017, p. 16). Therefore, these authors, along with others, advocated for researching the effects of nutrition and health claims on actual behavior with real three-dimensional packages in a purchase situation embedded in a more realistic environment (van Buul & Brouns, 2015, p. 1559; Lähteenmäki, 2013, p. 200; Hieke & Taylor, 2012, p. 148). In the present study, we followed these recommendations and tested the nutrition and health claims in a close-to-realistic shopping experiment.

5.3 Theoretical framework

According to the Elaboration Likelihood Model (ELM) of Petty and Cacioppo (1986b, p. 126), consumers' motivation and ability influence the elaboration of information

(Schmidt & Spreng, 1996, p. 247; Batra & Ray, 1986, p. 433; Petty & Cacioppo, 1986a, p. 111). Consumers' 'motivation' comprises the personal relevance to the information's topic, while 'ability' comprises the topic-relevant knowledge of the consumer (Petty & Cacioppo, 1986b, p. 126). Additionally, the visual attention towards information can be incorporated into the ELM (Graham et al., 2012, p. 380). Firstly, visual attention naturally precedes the elaboration of information such as package labels and is an indicator for the elaboration of the information which is gazed at (Meyerding, 2018, p. 28; Velazquez & Pasch, 2014, p. 579; Bialkova & van Trijp, 2010, p. 1043; Duchowski, 2007, p. 3; Henderson & Hollingworth, 1998, p. 270; Rayner, 1998, p. 372; Just & Carpenter, 1980, p. 330, 350). Secondly, motivation and knowledge are factors known to influence consumers' visual attention (Duerschmid & Danner, 2018, p. 288; Fenko et al., 2018, p. 58; Meißner et al., 2016, p. 2; Clement et al., 2015, p. 188; Orquin et al., 2013, p. 712; Orquin & Mueller Loose, 2013, p. 192; Corbetta & Shulman, 2002, p. 201). Furthermore, previous research has shown that visual attention is a precondition to making purchase decisions (Peschel et al., 2019, p. 5; Meyerding & Merz, 2018, p. 782). Overall, visual attention mediates between the two consumer characteristics 'motivation' and 'knowledge' on one side and 'purchase behavior' on the other.

While gazing at a product package, consumers use both internal and external information. At the point of sale, the external information the consumers can use is limited to the labels on the package such as the ingredient list or nutrition and health claims (Miller & Cassady, 2015, p. 208; Andrews et al., 2009, p. 41). The internal information is the knowledge of the consumer about product-specific attributes (Aschemann-Witzel & Grunert, 2015, p. 91). Pioneer studies have shown that consumers with higher topic-relevant knowledge process and interpret information differently (Alba & Hutchinson, 1987, p. 419; Batra & Ray, 1986, p. 433; Petty & Cacioppo, 1986a, p. 112; Brucks, Mitchell, & Staelin, 1984, p. 20; Wood, 1982, p. 806). Topic-relevant knowledge on its own does not necessarily lead to a determined behavior. For example, knowing that certain eating habits are unhealthy might not result in giving them up (Cornish, 2012, p. 293). However, consumers who are more motivated, for example, to lead a healthier lifestyle might be more inclined to change their behavior. Thus, motivation and knowledge are usually seen as two closely related constructs (Miller & Cassady, 2015, p. 213, 2012, p. 137; Miller et al., 2010, p. 111; Batra & Ray, 1986, p. 433). Research has also shown that motivation influences consumers' engagement and time spent searching

for information (Bialkova et al., 2016, p. 40; Dutta-Bergman, 2005, p. 3; Keller et al., 1997, p. 258; Apsler & Sears, 1968, p. 162).

ELM has been applied in many research studies on the influence of food labeling on consumer behavior with the consumer characteristics ‘nutrition knowledge’ and ‘health motivation’ representing ‘ability’ and ‘motivation’ (Moorman & Matulich, 1993, p. 210; Moorman, 1990, p. 365). ‘Nutrition knowledge’ and ‘health motivation’ are the key variables which influence the processing of information on food packages, especially the information related to nutrition and health such as nutrition labels or nutrition and health claims (Lähteenmäki, 2013, p. 199; Hieke & Taylor, 2012, p. 137; Miller & Cassady, 2012, p. 130; Grunert et al., 2011, p. 270; Andrews et al., 2009, p. 43; Balasubramanian & Cole, 2002, p. 113).

The designated roles of nutrition knowledge and health motivation as part of the ELM, with their influence on visual attention and purchase decision, can be comprised under the term ‘top-down factors’, which represent the characteristics of the consumer. Accordingly, there are also ‘bottom-up factors’ representing the characteristics of the product (Bobrow & Norman, 1975, p. 140), which include consumers’ perception of the product guided by its characteristics and attributes (Hoch & Ha, 1986, p. 222). In the present study, we included the following bottom-up factors in the analysis: price, brand, perceived tastiness, and healthiness, as these aspects are among the most important factors for the purchase of food (Bruschi et al., 2015, p. 83; Grunert, Wills et al., 2010, p. 180; Hartmann et al., 2008, p. 135). The conceptual model of this study is depicted in Figure 9.

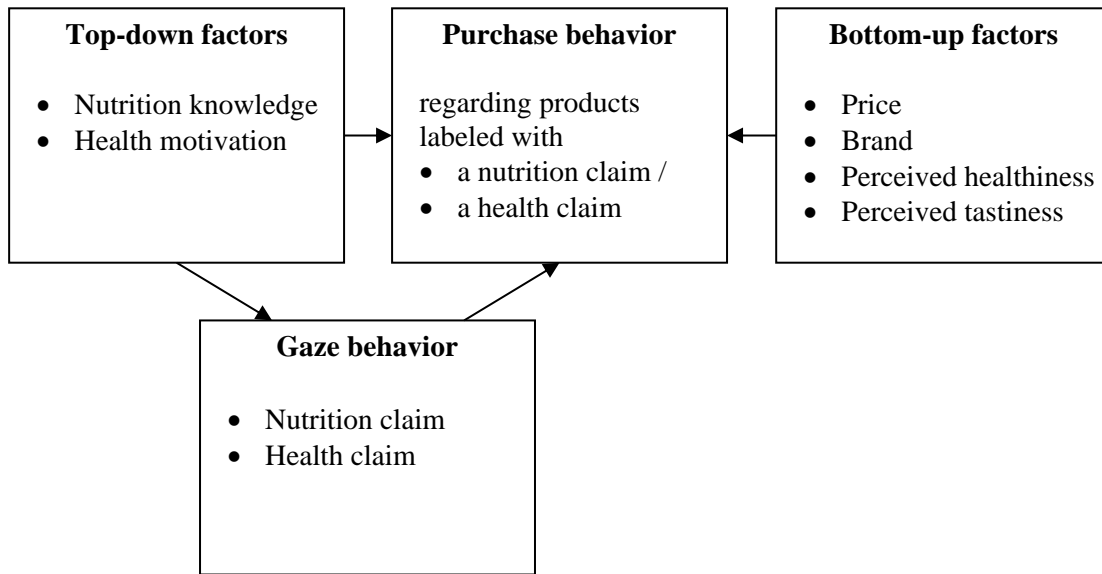


Figure 9: Conceptual model of the study

5.4 Methodology

5.4.1 Eye tracking

With eye tracking, certain limitations of conventional research methods can be overcome such as the limited ability of consumers to remember what they paid attention to during the purchase process or the unwillingness of consumers to disclose certain information. In research on nutrition and health claims, consumers might estimate the attention paid to these claims wrongly in post-purchase questionnaires, whereas eye tracking shows directly how long consumers visually attend to these claims (Meyerding & Merz, 2018, p. 781). Although eye tracking is an objective method of measuring the visual attention of consumers (Orquin, 2014, p. 271), it cannot explain why consumers looked at certain product elements (Duerrschmid & Danner, 2018, p. 290; Meyerding & Merz, 2018, p. 782; Graham et al., 2012, p. 379; Holmqvist et al., 2011, p. 71). An additional interview with the consumers could provide information about the underlying reasons for the gaze behavior of consumers. Hence, the combination of an eye tracking task with a subsequent questionnaire seems promising (Duerrschmid & Danner, 2018, p. 309; Meyerding & Merz, 2018, p. 782; Holmqvist et al., 2011, p. 95).

A head-mounted eye tracking system was chosen for this present study because it expands the use of eye tracking into far more true-to-life surroundings than a stationary eye

tracking system with a monitor or a wall projection (Meyerding & Merz, 2018, p. 782; Graham et al., 2012, p. 379; Holmqvist et al., 2011, p. 51). Previous eye tracking research yielded differences in the gaze behavior between the two different systems (Clement, 2018, p. 69; Suurmets & Clement, 2016). The application of a head-mounted eye tracking system is more appropriate for measuring gaze behavior in a shopping experiment for food. With the use of a head-mounted eye tracking system in this present study, participants were able to move freely in front of a shopping shelf, look at the products from different angles, and take products off the shelf for closer inspection.

5.4.2 Study design and stimuli

When the participants entered the laboratory (one by one), they were briefed about the shopping task in the laboratory's simulated grocery store. After the successful calibration of the eye tracking system (SMI Eye Tracking Glasses 2 Wireless, 60 Hz), the interviewer proceeded by reading the task instructions to the participant. The participants were told to imagine they were going shopping for orange juice and to buy one of the orange juices offered. Afterwards, they would pay with their own money. The participants were instructed to choose the product they would purchase in a normal shopping situation. Further, they were told to take as much time for their shopping as they would usually need. In the present study, the briefing of participants was deemed important as other authors have emphasized that giving a task to the participants of an eye tracking experiment is necessary to prevent participants not only from guessing the purpose of the experiment, but also from looking aimlessly at the stimuli without knowing what to do, rendering the patterns of the participants' gaze behaviors impossible to compare (Duerschmid & Danner, 2018, p. 289, 294; Holmqvist et al., 2011, p. 77).

During the shopping simulation, the participants stood in front of a shopping shelf filled with three brands of orange juices. Each participant was told to purchase one brand. To make the experiment look as realistic as possible, the stimuli were three-dimensional food packages with real brands. To eliminate the influence of well-known brands on the product choice and thus habitual purchase decisions, brands from another German speaking country (Austria) were chosen for the shopping task. The nutrition and health claims were well-incorporated into the package design to avoid any forced exposure. One product alternative was labeled with the nutrition claim, another alternative with the health claim, and a third alternative with a taste claim. Offering one alternative labeled

solely with a taste claim ('Simply delicious') is common practice in research on nutrition and health claims as it counters the mere label effect (Wong et al., 2014, p. 946; Choi et al., 2012, p. 426; Aschemann & Hamm, 2009, p. 820; van Trijp & van der Lans, 2007, p. 306; Andrews et al., 2000, p. 34; Andrews et al., 1998, p. 66). The three claims 'nutrition', 'health' and 'taste', were rotated among the three product brands across the sample. Also, three price levels were rotated among the three product brands. All the other product attributes such as the nutrition table, ingredient list, etc. were made identical among the three brands. The tested nutrition and health claims conformed, in content, wording, and use for the product category orange juice, to EU regulations No. 1924/2006 Art. 5 par. 1.b. and EU Regulation No. 1169/2011 annex XIII part A and listed in the *EU Register of nutrition and health claims made on foods* (EFSA, 2019). The nutrition and health claims are shown in Table 15.

Table 15: Nutrition and health claims used in the study

Orange juice	
Nutrition claim	Rich in vitamin C
Health claim	Vitamin C contributes to the normal function of the immune system

After the participants finished their purchase, the eye tracking glasses were taken off and the participants filled out a self-administered computer assisted interview. Finally, the participants were debriefed and given their remuneration. All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the ethical standards defined in the 1964 Helsinki Declaration and the study design was approved by the university authorities. No data was collected that could reveal the identity of the participants.

5.4.3 Measures & variables

The constructs of the conceptual model and their indicators are shown in Table 16.

Table 16: Overview of the constructs and their indicators in the model

Construct	Indicator
Nutrition knowledge	<p><i>Indicator 1:</i> Knowledge about the calorie content of various foods. Measured with three questions resulting in a metric indicator ranging from 1 to 3.</p> <p><i>Indicator 2:</i> Knowledge about the nutritional composition of various foods. Measured with five questions resulting in a metric indicator ranging from 1 to 5.</p> <p><i>Indicator 3:</i> Knowledge about the relationship between food intake and disease. Measured with two questions resulting in a metric indicator ranging from 1 to 2.</p>
Health motivation	<p>Each of the five indicators were measured on a 7-point Likert scale with 1 = strongly disagree, 7 = strongly agree.</p> <p><i>Indicator 1:</i> I pay a lot of attention to healthy foods.</p> <p><i>Indicator 2:</i> A healthy diet is very important to me.</p> <p><i>Indicator 3:</i> I pay close attention to the health benefits of food.</p> <p><i>Indicator 4:</i> I always eat what I want without worrying about the health of my diet.</p> <p><i>Indicator 5:</i> I inform myself very often about nutrition.</p>
Gaze on claim	<p><i>Indicator 1:</i> ‘Dwell time’ on specific claim, measured in seconds.</p> <p><i>Indicator 2:</i> ‘Net dwell time’ on specific claim, measured in seconds.</p> <p><i>Indicator 3:</i> ‘Visual intake time’ on specific claim, measured in seconds.</p> <p><i>Indicator 4:</i> ‘Visual intake count’ on specific claim, measured in counts.</p>
Perceived healthiness of product	<p>The two indicators were measured separately for each of the three products tested in the purchase simulation.</p> <p><i>Indicator 1:</i> How healthy are the orange juices you just looked at? 7-point Likert scale with 1 = very unhealthy to 7 = very healthy.</p> <p><i>Indicator 2:</i> How healthy are the offered orange juices compared to the orange juices you are familiar with? 7-point Likert scale with 1 = much healthier to 7 = much healthier.</p>
Perceived tastiness of product	<p>The indicator was measured separately for each of the three products tested in the purchase simulation.</p> <p><i>Indicator:</i> How do you rate the taste of the offered orange juices? 7-point Likert scale with 1 = very bad taste to 7 = very good taste.</p>
Price for product	The indicator is a metric variable ranging from €1.09 to €1.49.
Brand 1 for product	The indicator is a dichotomous variable representing the purchase of brand 1 vs. the two other brands.

Brand 2 for product	The indicator is a dichotomous variable representing the purchase of brand 2 vs. the two other brands.
Purchase product	The indicator is a dichotomous variable representing the purchase of a product with the specific claim vs. the purchase of a product with the two other respective claims.

5.4.4 Participants

All participants were recruited in a medium-sized city in central Germany (Kassel) with average purchase power (Table 17). The recruiters were positioned at predefined spots in the pedestrian area of the city's main shopping promenade. They systematically approached every third person passing by, resulting in a random sample. To further ensure a representative sample of shoppers, the recruitment took place every day of the week and during the whole daytime. In order to take part in the study, the individuals approached had to fulfill two screening criteria, i.e. they had to go grocery shopping at least occasionally, and they had to purchase orange juice at least occasionally. A remuneration of €10 was offered for participating in the experiment. There was no limitation regarding the recruitment of participants with impaired vision because SMI's optical lenses could be attached to the eye tracking glasses. At no time did the recruiters reveal the purpose of the study. Instead, they provided a vague cover story of a shopping task for food. The recruitment yielded a sample of 156 participants usable for further analyses whose characteristics are displayed in Table 17.

Table 17: Socio-demographic characteristics of the sample

Characteristic	Description	Sample	Population city *
Age (N = 156)	Average	41.2	42.6
	18–44	53.9 %	48.8 %
	45–64	34.2 %	33.8 %
	>65	11.9 %	17.4 %
Sex (N = 156)	Female	49.4 %	51.0 %
	Male	50.6 %	49.0 %

Households (N = 156)	Average number of household members	1.9	1.9
	1-Person households	48.7 %	51.9 %
	Households with children	25.6 %	17.2 %
	Households with 3 or more children	3.2 %	12.5 %
Household income (N = 156)	Average monthly disposable household income	1796.8 €	1821.5 €

* Source: Kassel - Department of Statistics (2018)

5.4.5 Data analysis

The participants' gaze behavior on the claims was first analyzed with descriptive methods. Hereafter, it was tested for differences in the frequencies of purchases of products labeled with a nutrition, health or taste claim with non-parametric chi-square tests. To examine the relationships between the constructs depicted in the theoretical framework (Figure 9), structural equation modeling (SEM) was applied. As introduced in Table 16, several of these constructs were dichotomous. The software WarpPLS 6.0 was used because it utilizes a partial least squares (PLS) regression procedure to model non-linearity among the constructs irrespective of their measurement; metric, nominal or even dichotomous (Kock, 2017, 2014, 2010, p. 2). PLS-SEM uses a variance-based algorithm (versus a covariance analysis algorithm) which maximizes the explained variance of the dependent constructs in the path model (Hair, Hult, Ringle, & Sarstedt, 2017, p. 82).

5.5 Results

5.5.1 Gaze duration on claims

Participants spent on average 0.95 seconds ($SD = 0.76$ s) looking at the taste claim, 1.16 seconds ($SD = 0.91$ s) looking at the nutrition claim, and 1.37 seconds ($SD = 1.19$ s) looking at the health claim. Paired sample t-tests revealed that the gaze durations were significantly different between the claim types. A possible explanation is that the tested claims were different in length, with the taste claim being the shortest and the health claim being the longest. Research on eye tracking has shown that consumers cognitively process information in that moment they are looking at it (Meyerding, 2018, p. 28; Ares et al.,

2014, p. 29; Velazquez & Pasch, 2014, p. 579; Bialkova & van Trijp, 2010, p. 1043; Duchowski, 2007, p. 3); so the differences in gaze durations across the claim types might be attributed to different levels of complexity of information processing.

5.5.2 Purchase decision

With chi-square tests, whether the share of purchases of orange juices with a specific claim type was significantly higher or lower than the so-called expectancy value was analyzed, which represents the assumption for a specific claim type not having an effect on the purchase decision. This value is 33.33% because the three claim types were equally present in each product set. Orange juices labeled with the nutrition claim (40.8%) were bought significantly more often ($\chi^2(1) = 4.1407, p = .0419$). However, the shares of purchases for orange juices labeled with the taste claim (30.6%) or the health claim (28.7%) were not significantly different from the expectancy value.

5.5.3 Structural equation model

The prerequisites for running the SEM analysis were met: collinearity among the latent constructs was low and all estimated measurement errors were lower than their estimated corresponding composite weights. After the SEM was run, the obtained indices confirmed the overall good fit of the model with the data (Table 18). It is of special interest that the values for the average block variance inflation factor (AVIF) and average full collinearity variance inflation factor (AFVIF) were both far below 3.3, thus fulfilling the recommendation for models with many single-indicator variables (Kock, 2018, p. 63). To check the internal consistency of the variables, composite reliabilities were used, as they were deemed to be an appropriate approach for estimating the reliabilities in a PLS-based structural equation model (Peterson & Kim, 2013, p. 197; Sijtsma, 2009, p. 118; Tenenhaus, Vinzi, Chatelin, & Lauro, 2005, p. 164). As shown in Table 19 and Table 20, all variables had acceptable internal consistency. Further, the square root of the average variance extracted (AVE) for each variable exceeded the correlations between one variable with the other variables, thus showing discriminant validity (Fornell & Larcker, 1981, p. 46).

Table 18: Model fit and quality indices

Index	Value	Criteria
Average path coefficient (APC)	0.137 (p = 0.020)	P values lower than 0.05 are recommended (Kock, 2011, p. 8)
Average R-squared (ARS)	0.142 (p = 0.017)	
Average adjusted R-squared (AARS)	0.114 (p = 0.037)	
Average block variance inflation factor (AVIF)	1.303	Values lower than 3.3 are recommended (Kock & Lynn, 2012, p. 558)
Average full collinearity variance inflation factor (AFVIF)	2.281	
Tenenhaus GoF (GoF) – measure of the model’s explanatory power	0.359	small ≥ 0.1 , medium ≥ 0.25 , large ≥ 0.36 (Wetzels, Odekerken-Schröder, & van Oppen, 2009, p. 187; Tenenhaus et al., 2005, p. 173)
Sympson’s paradox ratio (SPR)	0.850	Values higher than 0.7 are recommended (Kock & Gaskins, 2016, p. 204; Pearl, 2009, p. 173; Wagner, 1982, p. 47)
R-squared contribution ratio (RSCR)	0.988	Values higher than 0.9 are recommended (Kock, 2018, p. 64)
Statistical suppression ratio (SSR)	0.750	Values higher than 0.7 are recommended (MacKinnon, Krull, & Lockwood, 2000, p. 2)
Nonlinear bivariate causality direction ratio (NLBCDR)	0.975	Values higher than 0.7 are recommended (Kock, 2018, p. 65)

Table 19: Correlations, composite reliabilities, Cronbach α and average variances extracted – nutrition claim

Variable	CR	Cr α	1	2	3a	4a	5a	6a	7a	8a	9a
1. Nutrition Knowledge	0.729	0.712	(0.691)								
2. Health motivation	0.902	0.860	0.058	(0.808)							
3a. Gaze on claim - NC	0.995	0.993	0.145 (*)	0.236 **	(0.99)						
4a. Healthiness - NC	0.724	0.619	-0.182 *	-0.212 **	-0.243 **	(0.851)					
5a. Tastiness - NC	1	1	-0.052	-0.126	-0.243 **	0.64	(1)				
6a. Price - NC	1	1	0.114	-0.124	-0.083	0.087	0.035	(1)			
7a. Brand 1 - NC	1	1	0.043	-0.01	-0.199 *	0.109	0.152 (*)	0.052	(1)		
8a. Brand 2 - NC	1	1	-0.061	-0.064	0.069	-0.024	-0.024	0.003	-0.522	(1)	
9a. Purchase - NC	1	1	-0.042	0.061	0.188 *	0.244 **	0.238 **	-0.39	-0.02	0.078	(1)

Significance $p < .001 = ***$; $p < .01 = **$; $p < .05 = *$; $p < .1 = (*)$; Square roots of average variances extracted (AVE) are shown on diagonal; NC = Nutrition claim.

Table 20: Correlations, composite reliabilities, Cronbach α and average variances extracted – health claim

Variable	CR	Cr α	1	2	3b	4b	5b	6b	7b	8b	9b
1. Nutrition Knowledge	0.729	0.712	(0.691)								
2. Health motivation	0.902	0.860	0.058	(0.808)							
3b. Gaze on claim - HC	0.993	0.990	0.163 *	0.146 (*)	(0.986)						
4b. Healthiness - HC	0.754	0.675	-0.101	-0.205 *	-0.116	(0.869)					
5b. Tastiness - HC	1	1	-0.035	-0.114	-0.054	0.658	(1)				
6b. Price - HC	1	1	-0.042	0.087	-0.048	-0.059	0.034	(1)			
7b. Brand 1 - HC	1	1	-0.031	0.012	-0.065	0.158 *	0.193 *	0.017	(1)		
8b. Brand 2 - HC	1	1	0.146 (*)	0.02	0.235 **	0.083	0.042	-0.001	-0.529	(1)	
9b. Purchase - HC	1	1	0.065	-0.035	0.124	0.052	0.147 (*)	-0.191 *	0.021	0.034	(1)

Significance $p < .001 = ***$; $p < .01 = **$; $p < .05 = *$; $p < .1 = (*)$; Square roots of average variances extracted (AVE) are shown on diagonal; HC = Health claim.

Regarding the purchase of products labeled with a nutrition claim, the analysis provided the following results. Nutrition knowledge and health motivation had significant positive effects on the gaze on the nutrition claim and explained 11.2% of its variance (Table 21), i.e. consumers with higher nutrition knowledge and higher health motivation looked at the nutrition claim longer. However, neither consumer characteristic showed an effect on the purchase decision. Neither the direct effect nor the total effect of nutrition knowledge and health motivation on purchase was significant (Table 22). Gaze, by contrast, had a significant positive effect on purchase, in that the longer a consumer gazed at the nutrition claim, the more likely the product with a nutrition claim was bought. Gaze accounted for 4.6% of the variance observed in the purchase decision for products with a nutrition claim. The model shows that gaze behavior is neither a mediator between nutrition knowledge and purchase decision, nor between health motivation and purchase decision. When it comes to the product attributes included in the model, perceived healthiness and tastiness both had a significant positive effect, whereas price had a significant negative effect on the purchase decision. Together, the product attributes explained 25.1% of the variance in the purchase of products with nutrition claims. Interestingly, brand had no effect on purchase. In total, consumer characteristics and product attributes were able to explain 30.5% of the variance in the variable ‘purchase of products with a nutrition claim’. The calculated model and its path coefficients are depicted in Figure 10.

Regarding the purchase of products labeled with a health claim, the model could only explain 8.1% of the variance. The same significant influencing factors were identified with the exception that perceived healthiness had no significant influence on the purchase of products with a health claim (Table 22 and Table 23).

Table 21: Path coefficients and their effect sizes – nutrition claim

	Gaze on nutrition claim	Purchase decision for product with nutrition claim
1. Nutrition Knowledge	0.240 (0.063) ***	0.023 (0.001)
2. Health motivation	0.209 (0.049) **	0.031 (0.002)
3a. Gaze on claim - NC		0.245 (0.046) ***
4a. Healthiness - NC		0.248 (0.060) ***
5a. Tastiness - NC		0.152 (0.036) *
6a. Price - NC		-0.398 (0.155) ***
7a. Brand 1 - NC		0.051 (0.001)
8a. Brand 2 - NC		0.102 (0.008)

Significance $p < .001 = ***$; $p < .01 = **$; $p < .05 = *$; $p < .1 = (*)$; Effect sizes are shown in brackets.

Table 22: Total effects and their effect sizes – nutrition and health claim

	Purchase decision for product with nutrition claim	Purchase decision for product with health claim
1. Nutrition Knowledge	0.082 (0.003)	0.058 (0.004)
2. Health motivation	0.082 (0.005)	-0.012 (0.001)

Significance $p < .001 = ***$; $p < .01 = **$; $p < .05 = *$; $p < .1 = (*)$; Effect sizes are shown in brackets.

Table 23: Path coefficients and their effect sizes – health claim

	Gaze on health claim	Purchase decision for product with health claim
1. Nutrition Knowledge	0.174 (0.034) *	0.038 (0.002)
2. Health motivation	0.172 (0.033) *	-0.032 (0.001)
3b. Gaze on claim - HC		0.114 (0.014) (*)
4b. Healthiness - HC		-0.094 (0.005)
5b. Tastiness - HC		0.218 (0.032) **
6b. Price - HC		-0.194 (0.037) **
7b. Brand 1 - HC		0.009 (0.001)
8b. Brand 2 - HC		0.005 (0.001)

Significance $p < .001 = ***$; $p < .01 = **$; $p < .05 = *$; $p < .1 = (*)$; Effect sizes are shown in brackets.

5.5.4 Additional results

We carried out additional analyses to provide further insights into the results of the SEM. The finding that nutrition knowledge and health motivation had a positive influence on gaze duration on both types of claims led to the assumption that more knowledgeable and health-motivated consumers might seek more product information in general, and thus look longer at product packages. A correlation analysis with the variable ‘total gaze duration on all three packages’ confirmed this assumption for nutrition knowledge ($r = .260$, $p < .01$) and health motivation ($r = .250$, $p < .01$).

Since previous studies had suggested more knowledgeable and health-motivated consumers might be more skeptical about nutrition and health claims, we also tested this relationship. In the questionnaire, the participants were asked to rate the credibility of the given nutrition and health claims on a 7-point Likert scale. However, the correlation analysis found no significant relationships, neither with nutrition knowledge (nutrition claim: $r = -.096$; health claim: $r = .007$; all $ps > .1$) nor with health motivation (nutrition claim: $r = -.039$; health claim: $r = .136$; all $ps > .1$).

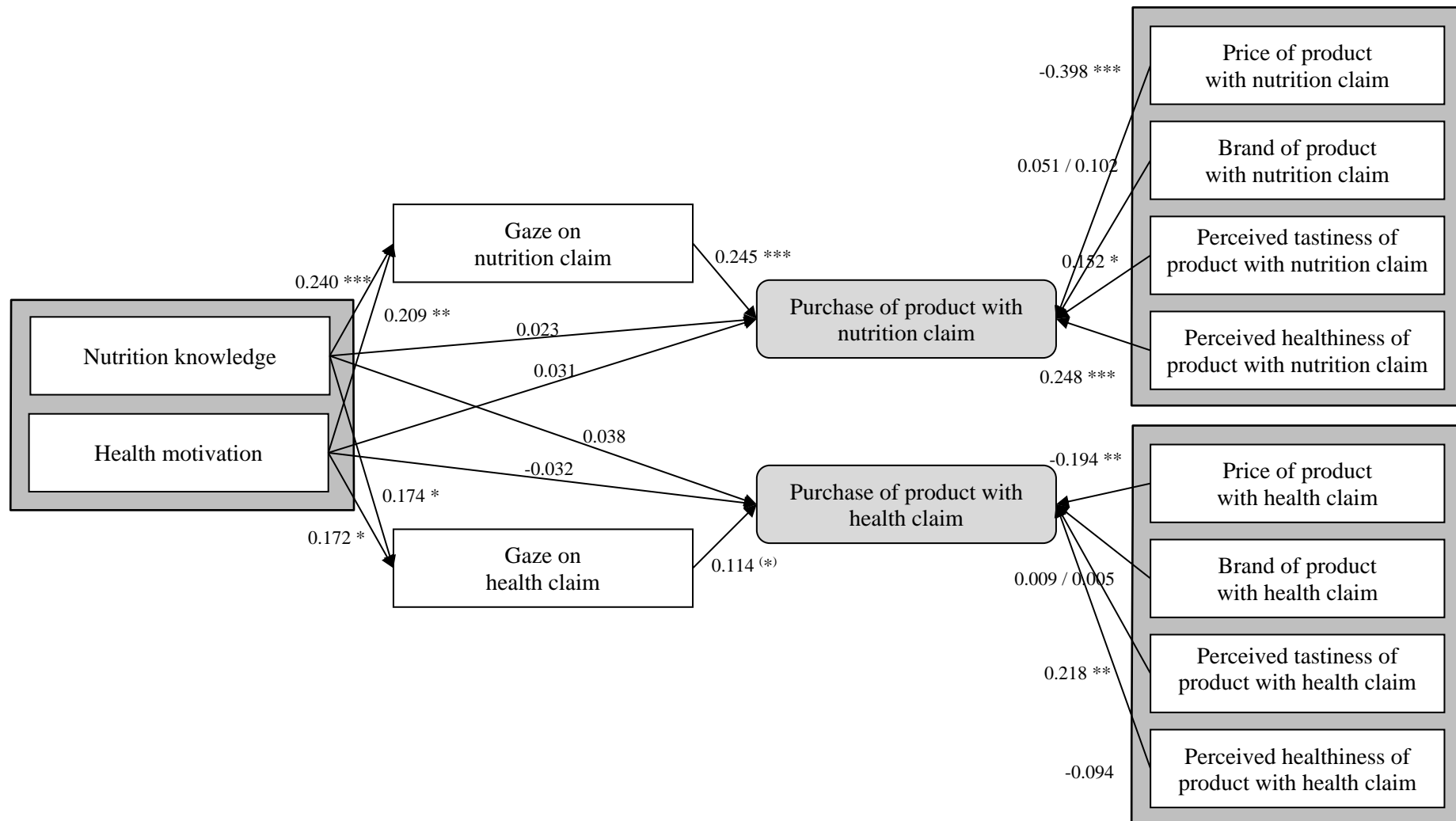


Figure 10: The structural equation model including its path coefficients and their significance

Significance $p < .001 = ***$; $p < .01 = **$; $p < .05 = *$; $p < .1 = (*)$

5.6 Discussion and conclusions

The purpose of this study was to investigate the role of consumers' nutrition knowledge and health motivation together with gaze behavior in purchase decisions for products with nutrition and health claims.

5.6.1 Influence of consumer characteristics

To measure the influence of nutrition knowledge and health motivation on gaze duration and purchase behavior, a structural equation model was used. Its theoretical framework was based on the Elaboration Likelihood Model: Consumers with higher nutrition knowledge and higher health motivation will contemplate nutrition and health claims to a higher degree. With the use of eye tracking, this study was able to show that consumers with higher nutrition knowledge and higher health motivation looked at nutrition and health claims to a greater extent when making a purchase decision compared to other consumers.

Since there is a strong relationship between visual attention and elaboration (Eckstein et al., 2017, p. 87), one can say that higher attention means a higher elaboration of certain information. Therefore, the results obtained by this study are in line with the Elaboration Likelihood Model, in that knowledge and motivation led to a different elaboration. However, the results of the present study do not support the suggestions of previous researchers that health motivation and nutrition knowledge might influence the choice of food products labeled with nutrition or health claims. Consumers with higher health motivation and higher nutrition knowledge were indeed, more interested in the nutrition and health claims. Also, they looked longer at the packages in general. These consumers might have understood that all product alternatives – no matter the type of claim – offered just the same nutritional composition and health benefits. Previous researchers suggested that one explanation could be that these consumers were too skeptical about the nutrition and health claims (Fenko et al., 2016, p. 81; Lalor et al., 2009, p. 131; Keller et al., 1997, p. 266). However, in the present study, health motivation and nutrition knowledge did not correlate with the credibility of the claims, nor did they have an effect on the purchase of products labeled with claims. Perhaps higher motivation or knowledge does not always translate into a change in purchase behavior, let alone eating behavior, as reported in other research (Cornish, 2012, p. 293; Lalor, Kennedy et al., 2011, p. 755).

The structural equation model further showed that an increase in visual attention on the nutrition claim (health claim) led to an increase in the purchase likelihood of the product labeled with the nutrition claim (health claim). This is in line with previous eye tracking research that determined that consumers who look at a product package or at its elements longer will be more likely to choose this product (Peschel et al., 2019, p. 5; Gidlöf et al., 2017, p. 36; Gere et al., 2016, p. 6; van Loo et al., 2015, p. 222). The purchase decision for products with a nutrition claim (health claim) was explained to 4.6% (1.4%) by gaze on the respective claim.

5.6.2 Influence of product attributes

The present analysis showed that, besides gaze behavior, product attributes also influenced the purchase decision. In the nutrition claim model, price had the greatest effect on the purchase decision (15.5%), followed by perceived healthiness (6%), and perceived tastiness (3.6%). In the health claim model, price had the greatest effect on the purchase decision (3.7%) followed by perceived tastiness (3.2%). This result is consistent with previous research findings suggesting that foods are chosen mainly based on price, taste, and healthiness (Di Vita, Blanc, Brun, Bracco, & D'Amico, 2019, p. 14; Steenhuis, Waterlander, & Mul, 2011, p. 2223; Vassallo et al., 2009, p. 453, 458; Hartmann et al., 2008, p. 135; Lappalainen, Kearney, & Gibney, 1998, p. 470; Steptoe, Pollard, & Wardle, 1995, p. 282). Often enough, price is the most decisive aspect for food purchases, especially in Germany (Castro, Majmundar, Williams, & Baquero, 2018, p. 9; Mueller Loose, 2012, p. 218; Brunsø & Grunert, 1998, p. 149).

5.6.3 Implications

The findings of the study have several implications for policymakers and marketers alike. Consumers with high nutrition knowledge and health motivation looked at the nutrition and health claims longer but did not buy these products more often than less knowledgeable and motivated consumers did. For food companies, the present findings imply that, to target consumer groups with higher health motivation and nutrition knowledge, it is not enough to label products with nutrition and health claims. These consumers might critically evaluate such claims and rely on other product attributes when deciding which food product to choose. In addition, health claims were less preferred than nutrition claims in our study, so marketers planning to introduce a health claim are

advised to pretest whether consumers would actually prefer a health claim or nutrition claim on that particular product.

The findings of the present study showed that nutrition claims have an effect on food choice. In the experiments, the participants could choose among three products with identical nutrition profiles, but the nutrition claim product was still preferred. Apparently, the nutrition information on the back of the package was not enough to make consumers realize the three products were identical. Policymakers should consider introducing mandatory standardized nutrition information on the package front. The format of the nutrition information should be as easy to understand as the nutrition claim tested in our study.

5.6.4 Mixed-methods approach

The originality of this study lies in the mixed-methods approach. The two consumer characteristics ‘nutrition knowledge’ and ‘health motivation’ were measured with a questionnaire, the purchase decision in a close-to-realistic purchase simulation, while eye tracking glasses recorded the gaze behavior. The nutrition and health claims were unobtrusively incorporated on real food packages which were placed on a shopping shelf. The claims were not forcefully exposed to the participants, unlike this widespread practice in previous studies within this research area (Bialkova et al., 2014, p. 66; Aschemann-Witzel & Hamm, 2010, p. 50). The combination of eye tracking and questionnaire data led to a better understanding of the influence of consumer characteristics on the gaze and purchase behavior for products with nutrition and health claims than did the use of only one method on its own (Meyerding & Merz, 2018, p. 782).

5.7 Limitations and future research

Unknown food brands were used in the purchase simulations to avoid consumers purchasing their favorite brands or relying on previous experiences since grocery shopping is usually a low-involvement situation (Peschel et al., 2019, p. 6). However, this limits the generalizability of the results to shopping decisions without well-known brands. In an experiment with familiar brands and packaging designs, the consumers might have looked differently at the products and the claims. In future research, the study design could be expanded to include familiar brands in the testing of nutrition and health claims.

The nutrition and health claims for orange juice tested in the present study referred to vitamin C which German consumers are very familiar with (Bornkessel et al., 2014, p. 334). Vitamin C is a natural component of orange juice. Previous studies showed that familiarity with the product and the ingredient mentioned in the claim as well as a natural fit of the ingredient-product combination has a positive influence on the effect of nutrition and health claims on preferences and purchases (Aschemann-Witzel & Grunert, 2017, p. 127; Lähteenmäki et al., 2010, p. 234, 237; Ares et al., 2009, p. 53; Bech-Larsen & Scholderer, 2007, p. 233). Nutrition and health claims about vitamins and their reference to the benefits for the immune system are among the most preferred (Cavaliere et al., 2015, p. 47) and widely used claims in the European Union (Hung et al., 2017, p. 42; Hieke et al., 2016, p. 12; Pravst & Kušar, 2015, p. 9362). Therefore, it needs to be recognized that the results of the present study are limited in its generalizability to products and ingredients consumers are very familiar with. Future research could test different products or a combination of novel products and claims.

The explanatory power of the study would have been higher if more different product categories had been included. However, the preparation of the data collected with a head-mounted eye tracking system is very labor-intensive. Previous researchers have pointed to this issue as the main determinant for the limited sample size of studies with a head-mounted eye tracking system (Clement, 2018, p. 69; Duerrschmid & Danner, 2018, p. 307). In the future, once computer software will carry out the nowadays labor-intensive stage of data preparation, it will be possible to conduct larger experiments with more products.

Lastly, previous research suggested that the effect of nutrition and health claims on preferences and purchases cannot easily be transferred between different countries (Aschemann-Witzel & Grunert, 2015, p. 90; van Wezemael et al., 2014, p. 173; Lähteenmäki et al., 2010, p. 234). Future studies could test the robustness of the results obtained in this study in different countries.

5.8 Author Contributions

J.S. carried out the conceptualization, conducted the study and drafted the manuscript. M.J. carried out the review and editing of the manuscript; J.S. conducted the statistical analyses with the contribution of M.J.; U.H. supervised the research project. All authors approved the final manuscript.

5.9 Funding

This research received no external funding.

5.10 Acknowledgments

The authors thank Manika Rödiger for the successful collaboration during the conduction of the study and the preparation of the eye tracking data. The authors also thank Anne Christopherson for proofreading the manuscript.

5.11 Conflicts of Interest

The authors declare no conflict of interest.

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6 Discussion

6.1 Incongruence of previous study results on nutrition and health claims

Results of previous studies are inconsistent as to whether nutrition and health claims have a positive or negative effect on consumers' preferences or purchase behavior. The investigation of this problem formed the overall research aim of this dissertation. In this regard, the existing literature on nutrition and health claims was systematically reviewed and 66 articles were found to be of relevance. The findings of the literature review suggested several reasons for the contrary results on claims. Firstly, the design of the empirical studies was very different, which made their findings difficult to compare (Chapter 3.5). Only a few studies tested nutrition and health claims on three-dimensional packages while most of the studies relied on the display of a product photo combined with a claim on the product photo or beneath the photo, e.g. in Stancu et al. (2017, p. 83); Wong et al. (2014, p. 947); Lähteenmäki et al. (2010, p. 233); Ares et al. (2009, p. 52); van Kleef et al. (2005, p. 301). This is referred to as forced exposure towards the claims and it is indicated that nutrition and health claims play a much smaller role in studies with more realistic designs (Kaur et al., 2017, p. 16).

In addition, the use of unauthorized claims and illegally worded claims in European studies – despite the decisions by EFSA and the EU regulations on nutrition and health claims – exacerbate the comparison of the findings. Since consumers will not encounter such claims in the market, the generalizability of study results regarding illegal claims to a normal shopping situation is impossible. Therefore, the relevance of studies with illegal claims for the decision making of policymakers and marketers is questionable. As discussed in Chapter 3.5, most of the studies on nutrition and health claims tested illegal claims. To highlight this issue, several examples of illegal claims tested in European studies after the implementation of EU Regulation No. 1924/2006 are listed in Table 24.

Table 24: Examples of illegal claims tested in European studies

Claim	Study
“This product reduces the risk of colorectal cancer”	Strijbos et al., 2016, Appendices A
“Keeps your stomach healthy”	Orquin & Scholderer, 2015, p. 149
“Keeps the stomach in balance with 3 active probiotic cultures/no added sugar”	Orquin, 2014, p. 279
“Fruit juice enriched with calcium reduces risk in the development of osteoporosis”	Hoefkens & Verbeke, 2013, p. 85

“Contributes to general well-being”	Annunziata & Vecchio, 2013, p. 349
“This product will strengthen your bones and teeth”	Lalor, Kennedy et al., 2011, p. 757
“This milk helps build healthy bones because it contains calcium”	Lynam et al., 2011, p. 2216
“Reduces the risk of cardiovascular diseases”	Barreiro-Hurlé et al., 2010b, p. 432
“This bread contains omega-3 which helps to keep arteries clean”	Lähteenmäki et al., 2010, p. 238

Besides the differences in study design, there are consumer and product-specific characteristics which influence *the effect of nutrition and health claims on preference and purchase*. Studies unambiguously showed that familiarity with the nutrient in the claims lead to higher preferences or higher purchase intentions towards nutrition and health claim products. However, the influence of consumer’s health motivation and especially nutrition knowledge remains unclear (Chapter 3.6). On the product’s side, the perceived healthiness of the product category seemed to be a determining factor, yet the study findings concerning this are contradictory (Chapter 3.7.1). The latter is especially important because studies showed that around one-third of food products labeled with nutrition and health claims belongs to the category of food perceived as unhealthy.

Based on these findings in the literature review, the subsequent empirical study was designed accordingly: The study was a close-to-realistic purchase simulation with three-dimensional packages labeled with claims which were authorized, in legal format and familiar to the consumers. The nutrition knowledge and health motivation of consumers as well as the perceived healthiness of the product category are considered to be the most promising factors for an investigation and have therefore been included in the study.

6.2 Effect of nutrition, health and taste claims on purchase

To enhance the realism of the purchase simulation, the participants were told to use their own money to purchase their preferred alternatives among the offered food products. The package fronts were labeled either with a nutrition, a health or a taste claim (Figure 5 and Figure 6). The findings showed that these claims influenced the purchase decision of the participants (**1st research question**). Orange juices were bought significantly more often when the package front was labeled with a nutrition claim in comparison to a health or taste claim. The participants bought milk chocolates significantly more often with a taste claim on its package front than with a nutrition or health claim (Chapter 4.5.2). Products

of both categories were bought the least with a health claim on the package front (Table 12).

Contrary to literature in which nutrition and health claims were described as successful tools to promote sales (Nestle, 2007, p. 22; Wansink, 2005, p. 20), the findings of this study showed that such a general statement about the effect of nutrition and health claims on purchase cannot be made. Moreover, the findings resemble the current research situation, particularly the ambiguous effect of nutrition and health claims on the purchase decision.

The shares of purchases in this study were unequal across the claim types and the two product categories. Only the health claims on the packages led to the same result: Products labeled with a health claim had the lowest purchase shares compared to nutrition and taste claims across both product categories. The tested health claims referred to the “normal function of the immune system” and the “maintenance of normal bones”. An explanation for the low preference for products with health claims might be that consumers dislike being reminded of sickness during the purchase of food. Sickness is always associated with a negative overtone, so the reference to a certain sickness could have created a feeling of negativity within the participant that negatively influenced the perception of the particular food product.

Since this result was obtained in a close-to-realistic purchase simulation, it emphasizes the findings of recent research that health claims might not have a positive but perhaps a negative effect on the purchase decision (Bialkova et al., 2016, p. 45; Orquin & Scholderer, 2015, p. 149; van Buul & Brouns, 2015, p. 1558; Kiesel & Villas-Boas, 2013, p. 162).

6.3 Influence of the perceived healthiness of the product category

Besides the low preference for health claims, the differences in the share of purchases for products labeled either with a nutrition or a taste claim across the two product categories can be explained differently. Consumers tend to overlook the specific nutritional composition of food products and categorize food into healthy and unhealthy (Larkin & Martin, 2016, p. 91; Orquin & Scholderer, 2015, p. 149; Belei et al., 2012, p. 902; Gravel et al., 2012, p. 878). Even though the tested product categories milk chocolate and orange juice are not per se healthy or unhealthy, previous research and this study (Table

12) found that consumers perceived orange juice as a healthy product category and milk chocolate as an unhealthy product category (Belei et al., 2012, p. 902; Chernev, 2011, p. 762; Lalor, Kennedy et al., 2011, p. 757).

Orange juices were bought significantly more often with a nutrition claim labeled on the front of the package and milk chocolates were bought significantly more often with a taste claim. This result supports the findings of previous research that a nutrition claim on food perceived as healthy and a taste claim on food perceived as unhealthy are the combinations which lead to positive evaluations or increases in purchases (Bialkova et al., 2016, p. 44; Fenko et al., 2016, p. 86; Orquin & Scholderer, 2015, p. 152; Choi et al., 2012, p. 432).

Besides the differences in the perception of healthiness, the participants in this study further distinguished between orange juice and milk chocolate (Chapter 4.5.3). The participants were asked about the importance towards certain attributes (taste, price, healthiness, nutritional value, and brand) in their everyday shopping for orange juice and milk chocolate. Healthiness and nutritional value were rated as more important for the purchase of orange juice than for milk chocolate. On the contrary, the attribute taste was more important for the purchase of milk chocolate than for orange juice (Figure 8). These different levels of importance correspond with the purchase behavior as a nutrition claim on orange juice and a taste claim on milk chocolates led to significantly larger shares of purchases than other combinations. This result is in line with the findings of previous studies with focus group discussions (Chan et al., 2005, p. 150; Balasubramanian & Cole, 2002, p. 122): The participants stated that they are not interested in information about nutrition and healthiness when shopping for 'unhealthy' food because such food is only consumed for its hedonic value, thus the focus is on tastiness. Other studies showed that nutrition and health claims had negative effects on the perceived tastiness of the food (Liem et al., 2012, p. 197; Sabbe et al., 2009, p. 90). Therefore, nutrition and health claims could have a signaling effect that the food is less tasty, which could adversely affect food products purchased mainly for their sensory pleasure (Berning et al., 2011, p. 364).

Furthermore, participants in this study rated the tested nutrition and health claims as more trustworthy on orange juice than the respective claims on milk chocolates (Table 13). Similarly, previous studies suggested that nutrition and health claims labeled on 'healthy' food are more trustworthy because 'healthy' food products are perceived as more credible

for carrying nutrition and health claims (Lalor, Kennedy et al., 2011, p. 758; Siró et al., 2008, p. 463). The lower ratings of trust in the nutrition and health claims on milk chocolates in the present study are also in line with the share of purchases in that the nutrition claim on milk chocolates led to a lower share of purchases than for orange juices.

All these findings can be related to the so-called match-up effect between claim type and product category. A match-up is based on the idea that synergetic effects are created when a product's strengths are emphasized. Products perceived as healthy would benefit from emphasizing their healthiness whereas products perceived as unhealthy could be connected with pleasure and tastiness (Choi et al., 2012, p. 436). Overall, the present study showed that the effect of different claim types on the purchase decision was determined by the perceived healthiness of the product carrying the claim (**3.a research question**).

6.4 Visual attention on nutrition, health and taste claims

During the purchase simulation the participants wore eye tracking glasses, thus allowing to investigate their gaze behavior. Of particular interest was the visual attention towards the tested nutrition, health and taste claims which were labeled on the front of the product packages. In order to avoid biases due to familiar and preferred brands, the tested brands came from Austria and Switzerland and were unknown to the German consumers. Furthermore, the claim types rotated between the three alternative brands in each product category.

The eye tracking data revealed that each claim type was looked at by at least 85% of the participants (Chapter 4.5.1). The mean gaze durations for the claim types ranged from 0.95 seconds to 1.54 seconds, with the significant longest gaze duration on health claims, followed by nutrition and finally, by taste claims (**2.a research question**), (Table 9). There were no significant differences of gaze duration for each claim type between the product categories (**3.b research question**), (Table 10).

The differences in gaze duration between the claim types might be partly influenced by the different lengths of the health, nutrition, and taste claims, with nine to ten, three, and two words respectively (Table 8). However, the difference in the lengths between the taste and nutrition claim are negligible, yet nutrition claims were significantly looked at longer. Health claims, on the other hand, are three times longer than the nutrition claims,

but did not even come close to receiving a three times longer gaze duration (1.2 seconds on nutrition claim versus 1.4 seconds on health claim for orange juice). Therefore, the different lengths of the claim types cannot be the sole explanatory factor.

Research on eye tracking has established the so-called eye-mind assumption, i.e. humans cognitively process the information which they are looking at right in that moment (Meyerding, 2018, p. 28; Ares et al., 2014, p. 29; Velazquez & Pasch, 2014, p. 579; Bialkova & van Trijp, 2010, p. 1043; Rayner & Castelhana, 2008, p. 13; Duchowski, 2007, p. 3; Just & Carpenter, 1980, p. 331). Processing the relationship between a nutrient and its effect on the body, as expressed in a health claim, is more complex than the reference to a nutrient alone (nutrition claim) or the mere statement of good taste (taste claim). Therefore, the different gaze durations on the three claim types might be due to different complexities in cognitively processing them together with their different lengths.

The eye tracking data further revealed how long the participants looked at product attributes other than the claims or at the whole package with its sides. The aggregated gaze duration on the whole packages of the three products per product category was 15.8 seconds for orange juices and 16.7 seconds for milk chocolates; the aggregated gaze duration on the three claim types per product category was 3.5 seconds for orange juices and 3.7 seconds for milk chocolates (Table 10). Thus, the participants looked at the claims on average for 22% of their time looking at the packages of orange juices and milk chocolates, respectively.

According to eye tracking research, humans direct more of their visual attention towards the attributes which are more relevant for them to complete a task, such as deciding on which food product to purchase (Duerrschmid & Danner, 2018, p. 289, 294; Kim et al., 2012, p. 8; Bialkova & van Trijp, 2010, p. 1043; Duchowski, 2007, p. 26; Yantis, 2000, p. 93; Kahneman, 1973, p. 56). In this respect, the ratio of 22% looking at the claims compared to looking at the whole packages shows that participants attributed a fairly high amount of their attention towards the claims. However, it is wrong to jump to conclusions about the relationship between visual attention and preference solely based on the data provided by eye tracking (Orquin, 2014, p. 271; Holmqvist et al., 2011, p. 238).

Statistical analyses in combination with the eye tracking and purchase data can reveal whether this visual attention on claims had an influence on the purchase decisions. An

MNL model was used to calculate the direct effect of participants' individual gaze behavior on their subsequent purchase decision (Chapter 4.5.4). The results showed that the longer a participant looked at a specific claim (nutrition, health or taste), the more likely the participant was to purchase the product with this respective claim (**2.b research question**). The positive influence of a longer gaze duration on the purchase likelihood was significant for each claim type in both product categories (Table 14).

In summary, the present study showed that the different claim types which were unobtrusively labeled on real packages were mostly noticed during a purchase simulation and received on average different amounts of visual attention. On an individual participant level, it was shown that the visual attention on these claims influenced the purchase decision. A longer gaze duration on a certain claim led to an increase in the purchase likelihood for this correspondingly labeled product.

6.5 Influence of consumer characteristics

According to the literature review, nutrition knowledge and health motivation were deemed to be promising factors on the consumer side which might influence the gaze and purchase behavior regarding products labeled with nutrition and health claims. Therefore, these consumer characteristics were measured with a questionnaire after the purchase simulation. A structural equation model was calculated to investigate these relationships (Chapter 5.5.3). Only the purchase for orange juice was included in this model because this analysis focused solely on the consumer side and not on differences between product categories. The findings showed that consumers with higher nutrition knowledge and higher health motivation looked longer at the nutrition and health claims on orange juices compared to other consumers during the purchase decision (**4.b research question**), (Figure 10).

Based on the eye-mind assumption, as discussed in the previous Chapter 6.4, a higher visual attention on an information is an indicator for a higher cognitive elaboration of that information (Meyerding, 2018, p. 28; Eckstein et al., 2017, p. 87; Just & Carpenter, 1980, p. 331). According to the research on the Elaboration Likelihood Model (ELM), consumers' motivation and ability influence the elaboration of information (Schmidt & Spreng, 1996, p. 247; Batra & Ray, 1986, p. 433; Petty & Cacioppo, 1986b, p. 126, 1986a, p. 111). Therefore, these findings are in line with the ELM, in that an increase in

nutrition knowledge and higher health motivation was accompanied by an increase of attention towards nutrition and health claims.

Moreover, the results of this study confirm previous research without the use of eye tracking. With survey methods such as questionnaires or telephone interviews, consumers were directly asked about their interest or their use of nutrition and health claims on food products during shopping. Consumers with a higher motivation to eat or live healthy stated to be more interested in nutrition and health claims (Cavaliere et al., 2015, p. 47) or stated to use nutrition or health claims more often than those less motivated during grocery shopping (Barreiro-Hurlé et al., 2010a, p. 227). Similarly, consumers with a higher nutrition knowledge stated to use nutrition and health claims more often than those less knowledgeable during grocery shopping (Petrovici et al., 2012, p. 777; Szykman et al., 1997, p. 235).

However, the findings of the present study showed that consumers' nutrition knowledge and health motivation did not influence the purchase decision of products labeled with claims (**4.a research question**), (Figure 10). Consumers with a higher nutrition knowledge and health motivation attributed more attention towards claims because they might have been more interested in them. Additional findings showed that these consumers looked at the whole packages longer than the less knowledgeable and motivated consumers (Chapter 5.5.4). It appears that the gaze behavior of these consumers represents a higher interest in the food package and the information labeled on it. Pioneer research connected to the ELM showed that these characteristics led the consumers to not only understand the information better related to their interests and knowledge but also to interpret and critically evaluate that information (Batra & Ray, 1986, p. 433; Petty & Cacioppo, 1986a, p. 111; Brucks et al., 1984, p. 20; Wood, 1982, p. 806). Accordingly, these consumers might have understood that the nutrient mentioned in the nutrition and health claim is naturally inherent to the product and that the product alternatives had the same nutritional composition. All product alternatives offered the identical health benefits irrespective of the labeling with nutrition and health claims.

Taken together, certain consumer groups are more interested in the information labeled on food packages such as nutrition and health claims. The study confirmed this by showing that a higher nutrition knowledge and higher health motivation led to an increase of visual attention towards these claims. However, these consumer characteristics did not show an influence on the purchase decisions for products labeled with nutrition and health

claims. Perhaps higher interest and knowledge led to a better understanding that besides the differences in labeling of the products with a nutrition or health claim, the nutritional composition and health benefits were identical across all products.

6.6 Merits and limitations of the present research

The literature review of this present research is the first which systematically analyzed previous studies on nutrition and health claims to find reasons for the incongruent nature of their results presented on the effect on consumers' preferences and purchase behavior. The findings of this review were used for the subsequent empirical study but is also beneficial for further research on nutrition and health claims. It gives an overview of factors which influence the effect of nutrition and health claims.

The originality of the empirical study lies in the combined use of several methods to investigate the effect of nutrition and health claims on the purchase and gaze behavior: a purchase simulation combined with eye tracking and a subsequent questionnaire. Instead of the usual self-reported willingness to purchase in previous research, this study examined the effect of nutrition and health claims on actual purchase. In a close-to-realistic purchase simulation consumers were asked to purchase their preferred products with their own money. The study design included the use of real product packages from German-speaking countries other than Germany. The claims were labeled on the front of the packages and were unobtrusively integrated into the individual packaging design. Therefore, there was no forced exposure to the claims unlike in previous studies within this research area. The claims were labeled on product categories which differed in their perceived healthiness to prove that this factor determines whether a claim has a positive or negative influence on the purchase decision. Moreover, emphasis was given to the legal correctness of the claims and the usage for the tested product categories. Therefore, the performed modifications on the package labeling are directly applicable on the respective product categories in the EU market.

This study went one step further by recording the gaze behavior of the consumers during the purchase decision with a head-mounted eye tracking system. The mobility of a head-mounted eye tracking system allowed to measure visual attention in a natural environment with three dimensional packages placed on a shopping shelf. Consumers were able to act as natural with the packages as they would do during their normal grocery shopping, such

as looking at the packages from different angles or taking them off the shelf for further inspection. All consumers were given the same purchase task and thus the patterns of gaze behavior were comparable. The use of eye tracking allowed to gain insight whether consumers noticed the claims and whether the gaze behavior influenced the purchase decisions. With the use of statistical analyses, this is the first study that showed a direct influence of visual attention to claims on the purchase of products.

The methodological triangulation of a purchase task and eye tracking with an additional questionnaire made it possible to discover underlying reasons for consumers' purchase and gaze behavior. It was revealed that visual attention towards claims labeled on food packages can be explained with certain consumer characteristics. Overall, the findings of the study are a contribution to the existing literature on claims because it showed the influence of certain factors on consumers' gaze and purchase behavior for food products labeled with nutrition and health claims.

Despite the contributions to the research on nutrition and health claims, the present study had some limitations. The sample size of 156 participants was too small to perform a full discrete choice experiment in which the relative importance of claims and prices across the products could have been estimated. These two attributes, claim and price, rotated among the product alternatives creating 36 choice sets per product category. Due to quality issues with the eye tracking data obtained, which are common (Orquin & Holmqvist, 2018, p. 1647), many participants had to be excluded from the final sample, resulting in multiple choice sets suffering from complete data loss. The reduction in sample size due to these issues with the eye tracking data had a negative impact on the final sample. Quota sampling was applied, yet participants with university-entrance qualification and participants younger than 45 years were overrepresented in the final sample.

A major source of limitation was the use of mobile eye tracking. The experiment had to be designed within the capabilities of the eye tracking system. As discussed in Chapter 2.3, mobile eye tracking is very susceptible to changes in ambient lighting and changes in distances between participant and objects (see: parallax error) with the result of a loss in data quality. The quality of eye tracking data required depends on the size of the stimuli which are of interest for the research purpose. Mobile eye tracking can be applied in a grocery store to investigate gaze behavior in respect to objects of large surface size such as advertising banners or the upper versus lower shelf-placement of products. However,

in order to investigate gaze behavior towards labels on individual food packages, the use of a mobile eye tracking system in a grocery store would be unable to provide the required data quality. Many small tests with students and two larger pilot tests with regular shoppers as participants were conducted to adjust the study design and to improve the quality of the eye tracking data, for a summary see Chapter 4.4.2.2. Despite all the efforts in designing the study, the mobile eye tracking system proved to be very unreliable during the main data collection, because of which 94 participants had to be excluded from the final sample due to unsatisfactory data quality.

In addition to data quality issues, the high price of a mobile eye tracking system and the technical knowledge required for its handling during the experiment limit its application in a larger study with more participants. This experiment was conducted in one German city, so it is unclear whether the results obtained can be generalized to consumers from other parts of Germany.

The explanatory power of this study would have been higher if more product categories had been tested in the study. However, the use of a head-mounted eye tracking system limited the scale of the study in terms of tested product categories and tested claims. In this experiment, the participants spent on average about one minute on the actual shopping of the products, but the so-called ‘mapping’, the manual data preparation of the eye tracking data, took several hours for such a short shopping time. Previous researchers have already highlighted that the current state of technology of mobile eye tracking is not feasible for large-scale studies (Clement, 2018, p. 69; Duerrschmid & Danner, 2018, p. 307; Fenko et al., 2018, p. 63).

To counter the mere-label effect in the experiment, one product in each product category was labeled with a taste claim as a control group in comparison to the other products which were labeled either with a nutrition or health claim. There was no product alternative offered without a claim. Therefore, the share of purchases obtained for products with a nutrition or health claim can only be interpreted in relation to the presence of a taste claim on the non-nutrition/health claim alternative. Likewise, combinations of different claim types were not included in the experiment, such as the labeling of a product with a taste claim together with a nutrition claim.

The information provided in the nutrition tables and ingredient lists on the packages was composed to be identical across all alternatives in each product category. In other words, the presented nutritional composition of the food was the same for every alternative regardless of the claim type. The study design did not include any products labeled with a nutrition or a health claim that were at the same time superior in their nutritional composition to a product labeled with a taste claim. If a product with a nutrition/health claim had been ‘actual healthier’ than the other alternatives according to the manipulated nutrition tables, it might have influenced the purchase decision of the consumers. Perhaps a ‘healthier’ nutritional composition would have increased the positive influence of a nutrition claim on the share of purchases for orange juices. Especially for consumers with higher health motivation and higher nutrition knowledge, such a difference in the presented nutritional composition of the product alternatives could have influenced their purchase decision.

However, the change of a product’s nutritional composition was not included in the experiment because such a modified product can be considered as a functional food and this was not part of the research. Functional food is a food that has been modified in its nutritional characteristics by adding certain nutrients to the food (Grunert et al., 2009, p. 270). This research focused on the communication with nutrition and health claims without the manufacturer having to change anything about the product’s nutritional composition. Moreover, the rotation of three different levels of nutritional composition among the three product alternatives (in addition to the rotation with claim types and prices) would have increased the number of the already existing choice sets by a factor of six. For an experiment with real packages and mobile eye tracking, this would have gone beyond technical feasibility.

The questionnaire completed by the participants after the purchase decision contained several questions on socio-demographic characteristics. These characteristics did not prove to have significant relationships with the gaze behavior on claims and did not prove to significantly influence the purchase of products labeled with claims. The reasons for this can only be speculated about. Perhaps the nutrition claims were equally important for different socio-demographic groups when purchasing orange juice whereas nutrition claims were equally unimportant when purchasing milk chocolate.

During the experiment participants might have become too conscious about wearing the eye tracking glasses which captured their eye movements and thus might have influenced

participants' gaze behavior (Meyerding & Merz, 2018, p. 782; Graham et al., 2012, p. 379). However, previous research showed that humans are unaware of their gaze behavior because humans perceive a smooth vision instead of separate fixations interrupted by saccades (Chandon et al., 2009, p. 3; Pieters & Wedel, 2008, p. 46). Besides this, gaze behavior is difficult to control (Pieters & Wedel, 2008, p. 50; Jacob & Karn, 2003, p. 589). After all, there is no reason for participants not to follow their natural gaze behavior and not to look at the objects of interest (Duchowski, 2007, p. 26), especially because the participants were unaware of the experiment's aim and were asked to purchase the products they would normally purchase when going for grocery shopping.

7 Conclusions

7.1 Implications for policymakers

The findings of the present research yield several implications for policymakers. According to Recital 10 and Art. 4 in EU Regulation No. 1924/2006, so-called ‘nutrition profiles’ were considered in order to prevent the use of nutrition and health claims on food categories with unfavorable nutritional compositions, but these nutrition profiles were not established yet. In previous research it was remarked that nutrition and health claims might counterbalance the poor nutritional composition of certain product categories, i.e. deceive consumers by making an ‘unhealthy’ product appear healthier than it actually is (Orquin & Scholderer, 2015, p. 153). In the present study it was shown that health claims labeled on products did not lead to a higher share of purchases for food categories perceived either as healthy or unhealthy (Chapter 4.5.2). Moreover, the labeling with nutrition and health claims on milk chocolates, a product category perceived as unhealthy and only consumed for its hedonic value, led to lower purchases compared to the labeling with a taste claim. Health claims on milk chocolates even led to the significant lowest share of purchases among the claim types. Instead, milk chocolates had the largest share of purchases when labeled with a taste claim.

When consumers purchase food, which is already perceived as unhealthy, they do so for hedonic reasons such as taste and not for health reasons. Thus, consumers preferred to buy milk chocolates with a taste claim rather than with a nutrition or health claim. There is little chance that nutrition and health claims have misled consumers if these claims have not positively influenced the purchase. Chances of misleading consumers are higher if these claims have an influence on the purchase, just as the nutrition claim positively influenced the purchases of orange juice in this study. Orange juice is perceived as a healthy product category and there are many other product categories besides juices that are also perceived as healthy. However, individual products in such a ‘healthy’ product category may have a poor nutritional composition due to the processing by the manufacturer. Consumers typically categorize food into groups of healthy and unhealthy food without considering the individual nutritional composition of a food product (Chapter 4.3). Therefore, an unfavorable composition of a ‘healthy’ product might go unnoticed, especially when such a product is labeled with a nutrition or a health claim. A product might belong to a healthy food category such as yoghurt, however when processed in a negative way, such as loading it with sugar, the finished product could

have a poor nutritional composition. The use of nutrition and health claims on a product with poor nutritional composition – apart from belonging to a food category considered as favorable in nutritional quality – can be questionable in terms of consumer protection. Therefore, the use of nutrition and health claims based on a system of permitted and prohibited food categories (as proposed in EU Regulation No. 1924/2006, Art. 4) is not ideal. Instead, policymakers are recommended to establish a regulatory framework in which the individual nutritional composition of a food is considered.

Moreover, banning certain food categories from a labeling with nutrition and health claims might deepen consumers' already existing and problematic categorization of food into groups of healthy and unhealthy food. Consumers could wrongly perceive that, if a product is allowed to carry nutrition and health claims, it is officially confirmed to belong to the 'healthy' group of food products and can be consumed without concern. Therefore, the recommendation is to combine a ban of nutrition and health claims with the so-called traffic light rating system. The traffic light rating system for food highlights a negative nutritional composition by marking certain nutrients with a red or orange color on the front of the packaging. If a product exceeds certain thresholds in its nutritional composition and is marked orange or red, it should not be allowed to carry nutrition or health claims.

Besides the regulations about the labeling with nutrition and health claims, policymakers are advised to invest in programs aimed at motivating and educating consumers about the use and understanding of current food labeling. The present study has shown that consumers with a higher nutrition knowledge and a higher health motivation looked at the nutrition and health claims as well as the whole product packages longer than consumers less knowledgeable and motivated. However, these consumer characteristics had no influence on the purchase decision for products labeled with nutrition and health claims (Chapter 5.6.1). Perhaps consumers with a higher nutrition knowledge and a higher health motivation might have understood that the nutrient mentioned in the claims is naturally inherent in all products of this product category and the products offered the same nutritional composition irrespective of the claims (Chapter 6.5). For policymakers, these results recommend increasing consumers' motivation to read the information presented on food packaging. Consumers' nutrition knowledge should also be improved so that they can interpret food labeling correctly. The mandatory labeling with nutrition

tables and ingredient lists already provides consumers with a lot of information for evaluating the nutritional composition of a food. All endeavors to inform consumers with the means of package labeling can only have the desired effect if consumers are motivated to look and knowledgeable to understand the labels. Endowed with motivation and knowledge, consumers are more likely to make informed choices about food.

In addition to these recommendations, which are based on the results of this study, policymakers are recommended to be cautious about the recent use of abbreviated health claims together with an asterisk pointing to the full health claims. The use of such an abbreviated health claim could undermine the regulations on health claims and is further discussed in Chapter 7.3.

7.2 Implications for marketers

Based on the findings of this study, implications for marketers can be given. The study showed that the labeling of packages with health claims led to the smallest share of purchases compared to the labeling with other claims. This result was consistent for both product categories tested: orange juice and milk chocolate. Based on this result, marketers are advised not to label their food products with health claims.

Moreover, the perceived healthiness of the product category influenced the purchase decision for products labeled with nutrition and taste claims. Orange juice is a product category perceived as healthy whereas milk chocolate is a product category perceived as unhealthy. The results showed that orange juices with a nutrition claim and milk chocolates with a taste claim led to the largest share of purchases. In sum, the claims had an influence on the purchase decision, however marketers need to be careful to make good use of these claims in order to increase sales. Different food products should be labeled with different claim types according to how consumers perceive the food products. A product perceived as healthy such as orange juice will likely benefit in terms of sales from the labeling of a nutrition claim. On the other hand, a product perceived as unhealthy and consumed for hedonic reasons should not be labeled with a nutrition or a health claim, but with a taste claim. In other words, the type of claim should underline the strengths of the product and the reasons why consumers consume it. Nevertheless, it is highly recommended to always pretest the combination of product and claim type prior to market launch.

The study findings further showed that consumer groups with higher nutrition knowledge and higher health motivation looked longer at the nutrition and health claims than other consumers. However, these consumer characteristics had no influence on the purchase behavior. Considering that more knowledgeable and more motivated consumers also looked longer at the whole packages, it can be assumed that these consumers are interested in gathering more information about food products than other consumers. Perhaps these consumers might have understood that the nutritional composition was identical across the alternatives labeled with different claims. Therefore, it is ineffective to address consumer groups with higher nutrition knowledge and higher health motivation by labeling food packages with nutrition and health claims, especially when the nutritional composition has not been improved compared to competing products.

Aside from grouping consumers, according to their nutrition knowledge and health motivation, the following results apply to the average consumer: The study has shown that a higher visual attention on claims led to a higher purchase likelihood of the respective product. The recommendations for marketers are to ensure that claims labeled on a package not only get noticed but to make every effort to increase the duration of consumers' visual attention on the claims. Examples for increasing visual attention towards a claim would be to decrease the visual information surrounding the claim (Bialkova et al., 2013, p. 71) or to increase the surface area of the claim covering the package (Peschel et al., 2019, p. 4).

7.3 Future research

Based on the findings in this dissertation, future research on nutrition and health claims should further investigate the factors which influence their effect on consumers' purchase decision. First and foremost, future studies should only test nutrition and health claims which are worded in compliance with the law. The relevant regulations on nutrition and health claims in the European Union are EU Regulation No. 1924/2006, Regulation No. 1169/2011, Regulation No. 432/2012, Regulation No. 1228/2014. Even if new ideas for nutrition or health claims are tested in studies, the format of the claims should be in accordance with the regulations, e.g. naming the nutrient in a health claim. This would substantially improve the comparability of future findings as most previous studies have tested illegal claims (examples are presented in Table 24). Policymakers and marketers

can only base their decisions on previous research if it is applicable to real market conditions under the regulatory framework.

This study showed that the perceived healthiness of the product category influenced the effect of nutrition, health and taste claims on purchase decision. However, only two product categories, orange juice and milk chocolates were tested. Thus, it could be investigated if these results can also be obtained for other product categories which are either perceived as healthy or unhealthy.

Consumers with a higher nutrition knowledge and a higher health motivation were looking longer at the nutrition and health claims as well as the whole packages, but these consumer characteristics had no influence on the purchase for products labeled with these claims. The interesting relationship between these two consumer characteristics, visual attention on food packaging and purchase behavior could be further explored. Investigating the effect of higher motivation to read and higher knowledge to understand food labels on consumers' gaze behavior towards food labeling and a subsequent influence on the purchase decision for food products is of particular interest for policymakers. The findings of such studies can be used to design information campaigns about food labeling and review the current labeling including nutrition and health claims to increase consumer protection.

The use of head-mounted eye tracking made it possible to monitor participants' visual attention during a close-to-realistic purchase simulation and directly measure if the visual attention on a stimulus had a certain effect on behavior, such as purchase decision. In combination with other research methods, head-mounted eye tracking is a powerful new tool to investigate the influence of food labels on consumers' behavior. Technological progress would lower the current high price of such a sophisticated system and reduce the intensity of labor during all stages of an experiment with head-mounted eye tracking.

The study was conducted in one German city with a sample size of 156 participants, after excluding participants due to insufficient quality of the eye tracking data obtained. With respect to the use of a head-mounted eye tracking system and its labor-intensive stages from data collection to data preparation, this was a large sample size. However, in order to perform advanced statistical analyses and still be able to achieve levels of significance, particularly with data obtained in a purchase simulation in which many choice sets were tested, a larger sample size would have been advantageous. With the upcoming

technological advances in head-mounted eye tracking, conducting eye tracking studies on a larger scale with more participants, more product categories and larger choice sets will become more feasible.

Future research may investigate ‘abbreviated health claims’ that have recently appeared on food packaging and are illegal if presented on their own, but they are linked by an asterisk to the full and legal health claim. An example of a drinking yoghurt with such a combination of an abbreviated health claim (“Support your immune system*”) and a full health claim (“*Vitamin B6 & D contribute to the normal function of the immune system”) on the front packaging is given in Figure 11. In this example it can be seen that the abbreviated health claim does not contain the nutrient or ingredient responsible for the named health effect. The ingredient mentioned below the abbreviated health claim is “L. CASEI DANONE” and is not registered in the *EU Register of nutrition and health claims made on foods* (EFSA, 2019). This ingredient most likely refers to a derivative of ‘*Lactobacillus casei*’, however all health claims containing this ingredient are classified as non-authorized for use (EFSA, 2019). In addition to the content, the two parts of the claim are not located in the same area of the packaging, in that the abbreviated health claim is placed in the middle of the packaging, while the full health claim is labeled in half the font size at the bottom corner of the packaging.



Figure 11: Abbreviated health claim with asterisk on the front packaging of ‘Actimel’ drinking yoghurt by the Danone company

Source: Own photocopy of a current ‘Actimel’ product sold in Germany by Danone S.A. in 2019

Note: The abbreviated health claim is “Support your immune system*” and the full health claim is “*Vitamin B6 & D contribute to the normal function of the immune system”

One can only speculate on the reasons for the introduction of such abbreviated health claims by food manufacturers. Perhaps the manufacturers think that the legal health claims are too cumbersome and therefore unattractive to consumers. On the other side, the main objective of introducing EU Regulation No. 1924/2006 with the required formatting and prior approval of nutrition and health claims, was to protect consumers from misleading claims, as stated in its Recital 15. Altogether, the use of such health claims is questionable in terms of consumer protection. It seems that manufacturers are trying to circumvent EU regulations by simply adding an asterisk to short and promising health claims. The use of such abbreviated health claims is of particular relevance as it is coming from Danone, one of the largest companies selling dairy products to consumers and known to be a frequent user of nutrition and health claims on its products. In other words, competitors are likely to follow and use such abbreviated health claims for their products.

The need to investigate these combinations of an abbreviated health claim with a full health claim is evident. For this purpose, the use of eye tracking technology can be especially beneficial as it would allow to find out whether consumers even look at the full health claim after looking at the abbreviated health claim. The visual attention given to

the abbreviated health claim in the middle of the package can be compared with the visual attention given to the full health claim in the bottom corner of the package. In this way, it can be analyzed whether consumers follow the asterisk at the end of the abbreviated health claim and search for the corresponding asterisk with the full health claim.

The recent introduction of abbreviated health claims on food packaging shows that nutrition and health claims are still regarded by manufacturers as an important communication tool. Otherwise, manufacturers would not have developed new ideas to circumvent EU regulations on health claims. The use of nutrition and health claims continues to be high on the agenda of manufacturers.

8 Summary

8.1 English Summary

Consumers have a growing interest in living and eating healthy. Manufacturers of food products try to make use of this by labeling their packages with so-called nutrition and health claims. According to EU Regulation No. 1924/2006, Art. 2 a nutrition claim indicates a positive nutritional characteristic of a food, whereas a health claim is about the relationship between a nutrient and a positive health effect for the body. The labeling of packages with nutrition and health claims is a widely used practice in European countries. Newer research on consumers' perception of nutrition and health claims show inconsistent results and raise questions to whether these claims have a positive or negative effect on consumers' purchase behavior. Therefore, the overall research objective of this dissertation was to investigate factors which influence consumers' purchase behavior for food products labeled with nutrition and health claims. As the visual attention towards food packages and its labels is the beginning of any subsequent behavior such as purchase behavior, the gaze behavior of consumers was included in this research.

The existing literature was scanned systematically regarding the effect of nutrition and health claims on preferences and purchase behavior. Several consumer and product-specific characteristics were found to influence this effect of nutrition and health claims. Since these factors might explain the incongruent results of previous studies, they were investigated in a following empirical study. Accordingly, several research questions were formulated. The 1st research question is: **Do nutrition, health, and taste claims have an effect on the purchase decision?** A taste claim refers to the food product's taste. It was included in this research because it serves as a control group compared to the nutrition/health claim and counteracts a possible negative bias due to the mere absence of a label with a claim. In order to investigate the effects of claims on the purchase decision, a close-to-realistic purchase simulation was designed in which three-dimensional food packages were placed on shopping shelves. The three claim types, nutrition, health and taste were labeled on the front of the food packages and rotated among three product alternatives in each product category. Within a laboratory, a shopping area was created that the study participants entered one by one. At the start of the experiment, each study participant was instructed to go shopping in this laboratory's shopping area. The task was to choose among the offered product alternatives and buy one product in each category.

The 2nd research question is: **To what extent do consumers look at the claims while shopping and does gaze duration on claims have an effect on the purchase decision?**

The gaze behavior was included in this research because the use of eye tracking made it possible to gain further insight into whether consumers noticed the claims and how the visual attention influences the purchase decision. The aim of the study design was to make the shopping situation as realistic as possible so that the consumer could behave naturally, e.g. take the products off the shelves and take a closer look at them. To ensure that consumers were able to move around freely, a mobile eye tracking system was used. During the purchase simulation described above, consumers wore eye tracking glasses which recorded their gaze behavior.

The 3rd research question is: **Does the perceived healthiness of product categories lead to differences regarding the gaze duration on claims and the purchase decision for products labeled with claims?** In this study the claims were labeled on packages of orange juice and milk chocolate. These two product categories were chosen because they differ in their perceived healthiness and are very familiar to consumers.

The 4th research question is: **What effects do consumers' nutrition knowledge and health motivation have on the gaze duration on claims and the purchase decision for products labeled with claims?** An interview with the consumers after the purchase simulation provided information about these two characteristics of the consumer, nutrition knowledge and health motivation. The data gathered in this questionnaire allowed to discover underlying reasons of consumers' purchase and gaze behavior.

The study was conducted in the medium-sized German city of Kassel. The city has an average population in terms of socio-demographic characteristics such as age, household size, education and income. Recruiters systematically approached every third person passing by a predefined spot in the pedestrian area of the city's main shopping promenade. This resulted in a random sample which yielded usable data of 156 participants for the analyses. After the participants were recruited, they were brought to the above-mentioned laboratory in which the study took place. In sum, the study consisted of a purchase simulation together with mobile eye tracking and a subsequent questionnaire.

The findings showed that most consumers noticed the nutrition, health and taste claims on food packages during the shopping. Consumers looked on average the longest at the

health claims, followed by nutrition and taste claims. This gaze behavior was the same for both tested product categories. The claims also influenced consumers' purchase decisions. However, the same claim types did not lead to the same share of product purchases because their influence on purchase depended on the perceived healthiness of the product category. A nutrition claim led to the largest share of purchases when labeled on orange juices whereas a taste claim led to the largest share of purchases on milk chocolates. For both categories, health claims did not yield larger shares of purchases and a health claim on milk chocolates even led to a significant smaller share of purchases compared to nutrition and taste claims. In addition, when consumers' individual gaze durations on claims were analyzed, it was found that the longer a consumer looked at a certain claim type, the more likely the consumer bought the respective product. Consumers with higher health motivation and higher nutrition knowledge looked longer at the claims as well as the whole packages, however, these consumer characteristics had no influence on the purchase of products labeled with claims.

In order to protect consumers from being misled by nutrition and health claims, it was proposed in EU Regulation No. 1924/2006 to prohibit certain food categories from carrying such claims. Based on the findings of this study, policymakers are recommended to shift their focus from certain product categories to the individual nutritional composition of food products. In this study, the nutrition and health claims on milk chocolates did not lead to an increase in purchases, so it is unlikely that consumers were misled by these claims. Milk chocolate is perceived as an unhealthy product category and the motive for its consumption is not health but taste. Thus, nutrition and health claims did not influence the purchase but only the taste claim led to a larger share of purchases for milk chocolate. In conclusion, the use of nutrition and health claims in food categories which are perceived as unhealthy might have little potential for misleading consumers, if these claims do not even convince consumers to buy 'unhealthy' products.

On the other side, the study showed that orange juice, a food category perceived as healthy, benefited from labeling with a nutrition claim regarding purchase. Consumers usually do not take into account the individual nutritional composition of a food but categorize it into healthy or unhealthy foods. Nutrition and health claims might emphasize this behavior to ignore the individual nutritional composition of a food, particularly for a 'healthy' product. This is detrimental in terms of consumer protection when a food belongs to a category perceived as healthy, but its individual nutritional composition is

unfavorable. Thus, policymakers should prohibit the use of nutrition and health claims based on the individual composition of food products rather than on food categories. It is suggested to combine such a ban with the introduction of the traffic light rating system, which already considers the individual nutritional composition and highlights unfavorable amounts of nutrients.

Policymakers are encouraged to increase consumers' motivation to read food labels and to make consumers more knowledgeable to interpret food labels correctly. The study has shown that consumers with a higher health motivation and nutrition knowledge read the claims and the whole packages more than other consumers. These consumers might have understood that the foods' nutritional compositions were the same across the offered alternatives and irrespective of the different claim labeling. Therefore, an influence of consumers' nutrition knowledge and health motivation on the purchase decision for products labeled with claims was not found in this study.

For marketers it is recommended to label the food products with the claims types which underline the characteristics and strengths of the specific product: orange juice is perceived as healthy and should therefore be labeled with a nutrition claim; milk chocolate is bought for its hedonic pleasure and should therefore be labeled with a taste claim. Based on these findings, the use of health claims is not recommended in any case. Additionally, the aim of the marketer should be to label the claims on the package in such a way that consumers look longer at them. The findings of this study showed that the longer a consumer looked at a claim the higher the likelihood was that this product was bought. Marketers are advised not to target consumer groups with higher health motivation and higher nutrition knowledge by labeling nutrition and health claims on the food packages. In this study, these consumers were either not interested in the nutrition and health claims tested or understood that besides the mere labeling with such claims the food did not offer a more favorable nutritional composition than the alternatives.

This dissertation is a contribution to existing research on nutrition and health claims because it was the first to systematically investigate factors which determine the effect of these claims on consumers' gaze and purchase behavior. The findings of this dissertation show which factors should be considered in future studies on nutrition and health claims. Further research could expand the generalizability of the obtained results by testing

claims on more product categories and conducting studies in more than just one German city. The originality of this present study lies in the combination of a close-to-realistic purchase simulation together with head-mounted eye tracking and a subsequent questionnaire. This innovative methodological triangulation provided new insights into the underlying factors regarding consumers' purchase and gaze behavior for products labeled with nutrition and health claims.

8.2 German Summary

Die Verbraucher haben ein wachsendes Interesse daran, gesund zu leben und sich gesund zu ernähren. Hersteller von Lebensmitteln versuchen, dies zu nutzen, indem sie ihre Verpackungen mit sogenannten Nutrition und Health Claims (nährwert- und gesundheitsbezogene Angaben) versehen. Gemäß EU-Verordnung Nr. 1924/2006 Art. 2 weist ein Nutrition Claim auf eine positive nährstoffbezogene Eigenschaft eines Lebensmittels hin, während es bei einem Health Claim um die Beziehung zwischen einem Nährstoff und einem positiven gesundheitlichen Effekt für den Körper geht. Die Kennzeichnung von Verpackungen mit Nutrition und Health Claims ist in den europäischen Ländern eine weit verbreitete Praxis. Neuere Untersuchungen zur Wahrnehmung von Nutrition und Health Claims durch die Verbraucher zeigen widersprüchliche Ergebnisse und werfen Fragen auf, ob sich diese Claims positiv oder negativ auf das Kaufverhalten der Verbraucher auswirken. Daher war das übergeordnete Forschungsziel dieser Dissertation, die Faktoren zu untersuchen, die das Kaufverhalten der Verbraucher für Lebensmittel beeinflussen, die mit Nutrition und Health Claims gekennzeichnet sind. Da die visuelle Aufmerksamkeit auf Lebensmittelverpackungen und deren Etiketten der Beginn eines jeden späteren Verhaltens, wie z.B. des Kaufverhaltens ist, wurde das Blickverhalten der Verbraucher in diese Untersuchung einbezogen.

Die vorhandene Literatur wurde hinsichtlich der Wirkung von Nutrition und Health Claims auf Präferenzen und Kaufverhalten systematisch durchsucht. Es wurde festgestellt, dass mehrere verbraucher- und produktspezifische Merkmale diese Wirkung von Nutrition und Health Claims beeinflussen. Da diese Faktoren die uneinheitlichen Ergebnisse früherer Studien erklären könnten, wurden sie in einer nachfolgenden empirischen Studie untersucht. Dementsprechend wurden mehrere Forschungsfragen formuliert. Die erste Forschungsfrage ist: **Haben Nutrition, Health und Taste Claims einen Einfluss auf die Kaufentscheidung von Verbrauchern?** Ein Taste Claim bezieht

sich auf den Geschmack des Lebensmittels. Er wurde in dieser Arbeit getestet, da er als Kontrollgruppe im Vergleich zu Nutrition/Health Claim dient und einem möglichen negativen Einfluss durch das bloße Fehlen eines Claims entgegenwirkt. Um die Auswirkungen von Claims auf die Kaufentscheidung zu untersuchen, wurde eine realitätsnahe Kaufsimulation entwickelt, bei der dreidimensionale Lebensmittelverpackungen in Verkaufsregalen platziert wurden. Die drei Claimtypen, Nutrition, Health und Taste Claim, waren auf der Vorderseite der Lebensmittelverpackungen angebracht und wechselten innerhalb jeder Produktkategorie zwischen drei Produktalternativen. Innerhalb eines Labors wurde ein Einkaufsbereich eingerichtet, den die Studienteilnehmer nacheinander betraten. Beim Start des Experiments wurde jeder Studienteilnehmer angewiesen, im Einkaufsbereich dieses Labors einzukaufen. Die Aufgabe bestand darin, unter den angebotenen Produktalternativen zu wählen und in jeder Kategorie ein Produkt zu kaufen.

Die zweite Forschungsfrage ist: **Inwieweit betrachten die Verbraucher die Claims beim Einkauf und wie wirkt sich die Blickdauer auf Claims auf die Kaufentscheidung aus?** Das Blickverhalten wurde in diese Arbeit einbezogen, da durch den Einsatz von Eyetracking weitere Erkenntnisse darüber gewonnen werden konnten, ob die Verbraucher die Claims wahrgenommen haben und wie die visuelle Aufmerksamkeit die Kaufentscheidung beeinflusst hat. Ziel des Studiendesigns war es, die Einkaufssituation so realistisch wie möglich zu gestalten, damit sich der Verbraucher natürlich verhalten kann, wie z.B. die Produkte aus den Regalen zu nehmen und genauer zu betrachten. Um sicherzustellen, dass sich die Verbraucher frei bewegen können, wurde ein mobiles Eyetracking-System eingesetzt. Während der oben beschriebenen Kaufsimulation trugen die Verbraucher eine Eyetracking-Brille, die ihr Blickverhalten aufzeichnete.

Die dritte Forschungsfrage ist: **Führt die wahrgenommene Gesundheit der Produktkategorien zu Unterschieden bei der Blickdauer auf Claims und der Kaufentscheidung für mit Claims gekennzeichnete Produkte?** In dieser Studie wurden die Claims auf Verpackungen von Orangensaft und Milkschokolade angebracht. Diese beiden Produktkategorien wurden ausgewählt, weil sie sich in ihrer wahrgenommenen Gesundheit unterscheiden und den Verbrauchern sehr vertraut sind.

Die vierte Forschungsfrage ist: **Welche Auswirkungen haben das Ernährungswissen und die Gesundheitsmotivation der Verbraucher auf die Blickdauer auf Claims und die Kaufentscheidung für mit Claims gekennzeichnete Produkte?** Ein Interview mit den Verbrauchern nach der Kaufsimulation lieferte Erkenntnisse über diese beiden Eigenschaften der Verbraucher, Ernährungswissen und Gesundheitsmotivation. Die in diesem Fragebogen erhobenen Daten ermöglichten es, die Gründe für das Kauf- und Blickverhalten der Verbraucher zu ermitteln.

Die Studie wurde in der mittelgroßen deutschen Stadt Kassel durchgeführt. Die Stadt hat eine durchschnittliche Bevölkerung in Bezug auf soziodemografische Merkmale wie Alter, Haushaltsgröße, Bildung und Einkommen. Die Rekrutierer sprachen systematisch jede dritte Person an, die an einer vordefinierten Stelle in der Fußgängerzone der Haupteinkaufsstraße der Stadt vorbeikam. Daraus ergab sich eine Stichprobe, die für die Auswertung brauchbare Daten von insgesamt 156 Studienteilnehmern beinhaltete. Nachdem die Teilnehmer rekrutiert wurden, wurden sie in das oben erwähnte Labor gebracht, in dem die Studie stattfand. Insgesamt bestand die Studie aus einer Kaufsimulation zusammen mit mobilem Eyetracking und einem anschließenden Fragebogen.

Die Ergebnisse zeigten, dass die meisten Verbraucher Nutrition, Health und Taste Claims auf Lebensmittelverpackungen bemerkten. Die Verbraucher betrachteten die Health Claims im Durchschnitt am längsten, gefolgt von Nutrition und Taste Claims. Dieses Blickverhalten war für beide getesteten Produktkategorien gleich. Die Claims beeinflussten auch die Kaufentscheidung der Verbraucher. Die gleichen Claimtypen führten jedoch nicht zu dem gleichen Anteil an Produktkäufen, da ihr Einfluss auf den Kauf von der wahrgenommenen Gesundheit der Produktkategorie abhing. Ein Nutrition Claim führte zu dem größten Anteil der Käufe, wenn er auf Orangensäften etikettiert war, während ein Taste Claim zu dem größten Anteil der Käufe bei Milkschokolade führte. Für beide Produktkategorien ergaben sich mit Health Claims keine erhöhten Kaufanteile, stattdessen führte ein Health Claim auf Milkschokolade sogar zu einem deutlich geringeren Kaufanteil im Vergleich zu einem Nutrition oder Taste Claim. Darüber hinaus wurden bei der Analyse der individuellen Blickdauer der Verbraucher auf Claims festgestellt, dass je länger ein Verbraucher einen bestimmten Claimtyp betrachtete, desto wahrscheinlicher war es, dass der Verbraucher das jeweilige Produkt gekauft hat. Verbraucher mit höherer Gesundheitsmotivation und höherem Ernährungswissen

betrachteten die Claims sowie die gesamte Verpackung länger, wobei diese Verbrauchereigenschaften keinen Einfluss auf die Kaufentscheidung von Produkten mit Claims hatten.

Um die Verbraucher vor Irreführung durch Nutrition und Health Claims zu schützen, wurde in der EU-Verordnung Nr. 1924/2006 vorgeschlagen, bestimmten Lebensmittelkategorien zu verbieten, solche Claims zu tragen. Basierend auf den Ergebnissen dieser Studie wird den politischen Entscheidungsträgern empfohlen, ihren Fokus von bestimmten Lebensmittelkategorien auf die individuelle Nährstoffzusammensetzung von Lebensmitteln zu verlagern. In dieser Studie führten die Nutrition und Health Claims auf Milkschokoladen nicht zu einem Kaufanstieg, so dass es unwahrscheinlich ist, dass die Verbraucher durch diese Claims irreführt wurden. Milkschokolade wird als ungesunde Produktkategorie wahrgenommen und das Motiv für ihren Konsum ist nicht Gesundheit, sondern Geschmack. Somit hatten Nutrition und Health Claims keinen Einfluss auf den Kauf, sondern nur der Taste Claim führte zu einem höheren Anteil der Käufe von Milkschokolade. Zusammenfassend lässt sich sagen, dass die Verwendung von Nutrition und Health Claims in als ungesund betrachteten Lebensmittelkategorien wenig Potenzial für Irreführung der Verbraucher haben könnte, wenn diese Claims die Verbraucher nicht einmal davon überzeugen, „ungesunde“ Produkte zu kaufen.

Auf der anderen Seite zeigte die Studie, dass Orangensaft, eine Lebensmittelkategorie, die als gesund wahrgenommen wird, von der Etikettierung mit einem Nutrition Claim im Hinblick auf den Verkauf profitiert. Die Verbraucher berücksichtigen in der Regel nicht die individuelle Nährstoffzusammensetzung von Lebensmitteln, sondern kategorisieren sie in gesunde oder ungesunde Lebensmittel. Nutrition und Health Claims könnten dieses Verhalten unterstreichen, die individuelle Nährstoffzusammensetzung eines Lebensmittels zu ignorieren, insbesondere bei einem „gesunden“ Produkt. Dies ist für den Verbraucherschutz nachteilig, wenn ein Lebensmittel zu einer Kategorie gehört, die als gesund wahrgenommen wird, aber seine individuelle Nährstoffzusammensetzung ungünstig ist. Daher sollten die politischen Entscheidungsträger die Verwendung von Nutrition und Health Claims auf der Grundlage der individuellen Zusammensetzung von Lebensmitteln und nicht auf der Grundlage von Lebensmittelkategorien verbieten. Es wird vorgeschlagen, ein solches Verbot mit der Einführung der Lebensmittelampel zu

kombinieren, da sie bereits die individuelle Nährstoffzusammensetzung berücksichtigt und ungünstige Nährstoffmengen aufzeigt.

Den politischen Entscheidungsträgern wird empfohlen, die Verbraucher mehr zu motivieren, die Lebensmitteletiketten zu lesen und die Verbraucher sachkundiger zu machen, um diese Information auch richtig zu interpretieren. Die Studie hat gezeigt, dass Verbraucher mit einer höheren Gesundheitsmotivation und besserem Ernährungswissen die Claims und die gesamte Verpackung länger betrachteten als andere Verbraucher. Diese Verbraucher haben vielleicht verstanden, dass die Nährstoffzusammensetzung der Lebensmittel über die angebotenen Alternativen hinweg und unabhängig von den unterschiedlichen Claimtypen gleich war. Daher konnte kein Einfluss von Ernährungswissen und Gesundheitsmotivation der Verbraucher auf die Kaufentscheidung für mit Claims bedruckte Produkte in dieser Studie nachgewiesen werden.

Für Vermarkter wird empfohlen, die Lebensmittel mit den Claimtypen zu kennzeichnen, die die Eigenschaften und Stärken des jeweiligen Produkts unterstreichen: Orangensaft wird als gesund wahrgenommen und sollte daher mit einem Nutrition Claim versehen werden; Milkschokolade wird zum Genuss und wegen ihres Geschmacks gekauft und sollte daher mit einem Taste Claim versehen werden. Aufgrund der Ergebnisse wird die Verwendung von Health Claims in keinem Fall empfohlen. Darüber hinaus sollte das Ziel des Vermarkters darin bestehen, die Claims auf der Verpackung so zu gestalten, dass die Verbraucher sie länger betrachten. Die Ergebnisse dieser Studie zeigten, dass je länger ein Verbraucher einen Claim betrachtete, desto höher war die Wahrscheinlichkeit, dass dieses Produkt gekauft wurde. Vermarktern wird empfohlen, Verbrauchergruppen mit höherer Gesundheitsmotivation und höherem Ernährungswissen nicht mit Nutrition und Health Claims auf Verpackungen anzusprechen. In der vorliegenden Studie waren diese Verbraucher entweder nicht an den getesteten Nutrition und Health Claims interessiert oder verstanden, dass das Lebensmittel neben der bloßen Etikettierung mit solchen Claims keine bessere Nährstoffzusammensetzung bot als die Alternativen.

Diese Dissertation ist ein Beitrag zur bestehenden Forschung der Nutrition und Health Claims, da sie als erste systematisch Faktoren untersucht hat, die die Wirkung der Claims auf das Blick- und Kaufverhalten der Verbraucher beeinflussen. Die Ergebnisse dieser Dissertation zeigen, welche Faktoren in zukünftigen Studien über Nutrition und Health Claims berücksichtigt werden sollten. Weitere Forschung könnte die hier gewonnenen

Erkenntnisse mit anderen Nutrition und Health Claims in zusätzlichen Produktkategorien untersuchen und Experimente in mehr als einer deutschen Stadt durchführen. Die Besonderheit dieser vorliegenden Studie liegt in der Kombination aus einer realitätsnahen Kaufsimulation mit mobilem Eyetracking und einem daran anschließenden Fragebogen. Diese innovative methodische Triangulation lieferte neue Erkenntnisse über die zugrundeliegenden Faktoren für das Kauf- und Blickverhalten der Verbraucher hinsichtlich Lebensmitteln, auf deren Verpackungsvorderseite Nutrition und Health Claims angebracht sind.

9 References

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10. Perceived presence of claims

“Do you remember which orange juices carried a nutrition or health claim on the package front? (Note: The claims have been removed on the photos shown here).”

	Yes. I know that this orange juice carried one of these claims.	No. I know that this orange juice did not carry one of these claims.
<i>[Photo of orange juice brand 1 was shown]</i>	<input type="radio"/>	<input type="radio"/>
<i>[Photo of orange juice brand 2 was shown]</i>	<input type="radio"/>	<input type="radio"/>
<i>[Photo of orange juice brand 3 was shown]</i>	<input type="radio"/>	<input type="radio"/>

“Do you remember which milk chocolates carried a nutrition or health claim on the package front? (Note: The claims have been removed on the photos shown here).”

	Yes. I know that this milk chocolate carried one of these claims.	No. I know that this milk chocolate did not carry one of these claims.
<i>[Photo of milk chocolate brand 1 was shown]</i>	<input type="radio"/>	<input type="radio"/>
<i>[Photo of milk chocolate brand 2 was shown]</i>	<input type="radio"/>	<input type="radio"/>
<i>[Photo of milk chocolate brand 3 was shown]</i>	<input type="radio"/>	<input type="radio"/>

16. Familiarity with the content of the claims

	Strongly disagree 1	2	3	4	5	6	Strongly agree 7
Before this study I already knew ...							
... that vitamin C is present in orange juice.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... that vitamin C contributes to the normal function of the immune system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... that calcium is present in milk chocolate.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... that calcium is needed for the maintenance of normal bones.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

17. Objective nutrition knowledge

Note: Rows were randomized

“A short nutrition quiz: Please tick whether you think the statements are true or false. Decide on an answer, even if you are not sure.”

	False	True
100g salami contains more calories than 100g ham.	<input type="radio"/>	<input type="radio"/>
Proteins are found exclusively in products of animal origin.	<input type="radio"/>	<input type="radio"/>
100g plain yoghurt contains more calories than 100g whipping cream.	<input type="radio"/>	<input type="radio"/>
Honey contains fat.	<input type="radio"/>	<input type="radio"/>
Whole grain contains fiber.	<input type="radio"/>	<input type="radio"/>

Omega-3 fatty acids belong to the group of saturated fatty acids.

Nutrition experts say that trans fatty acids lead to an increased risk of coronary heart diseases, such as heart attack.

“Please tick the correct answer. Decide on an answer, even if you are not sure. For each question there is only one correct answer.”

	Monounsaturated fatty acids	Polyunsaturated fatty acids	Saturated fats
Which fat should be avoided according to nutrition experts?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Sugar	Carbohydrates	Fat
What contains the most calories for every 100 grams?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Vitamin D	Vitamin E	Vitamin K
Which is an antioxidant vitamin?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

21. Household size

“How many people (including you) live in your household? (If you live alone or in a shared flat, you should enter a 1 here.)”

1	<input type="radio"/>
2	<input type="radio"/>
3	<input type="radio"/>
4	<input type="radio"/>
5	<input type="radio"/>
6 or more	<input type="radio"/>

22. Children

“How many are children?”

0	<input type="radio"/>
1	<input type="radio"/>
2	<input type="radio"/>
3	<input type="radio"/>
4	<input type="radio"/>
5 or more	<input type="radio"/>

23. Income

“What is your household net-income?”

This is the total amount of money available to all household members per month, including salary, pension, child benefits, interest income, etc. If you live in a shared flat, you should only enter your own income here.”

<hr/>	
< 900 €	<input type="radio"/>
<hr/>	
900 – 1500 €	<input type="radio"/>
<hr/>	
1500 – 2600 €	<input type="radio"/>
<hr/>	
2600 – 4500 €	<input type="radio"/>
<hr/>	
4500 – 6000 €	<input type="radio"/>
<hr/>	
> 6000 €	<input type="radio"/>
<hr/>	

24. Sex

“Please state your sex”

<hr/>	
Female	Male
<hr/>	
<input type="radio"/>	<input type="radio"/>
<hr/>	