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Consumers' meal perception

The relationship between perceived health and environmental friendliness of meals among consumers

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Abstract

Food consumption comprises a significant portion of the total environmental impact of households. At the same time, there is a link between a high consumption of energy-dense foods and the obesity epidemic. One way to prevent these major challenges is to change towards more healthy and sustainable diets. However, the perception of meals does not only depend on consumers' liking of the meals, but also on the perceived healthiness and the perceived environmental friendliness. This study investigates the relationship between the perceived environmental friendliness and the perceived healthiness of meals among consumers. Over 1100 visitors from the canteen Polyterasse at the ETH Zurich answered questions on taste experience, perception of environmental friendliness, healthiness and nutrition, environmental and healthiness attitudes as well as socio-demographics. It was found consumers tend to rate healthier meals as environmentally friendlier. Furthermore, the ingredients' origin (e.g. regionality) and seasonality were important predictors of perceived environmental friendliness while the ingredients' content (e.g. vitamin, fat or protein) also predicted the perceived healthiness of meals among consumers. Consumers' knowledge of the objective environmental impact of the meals were relatively accurate. In contrast, there were large gaps in consumers' knowledge about meals' nutrition. Thus, a practical nutrition education program (e.g. traffic light) on nutrition value might increase one's understanding of nutrition knowledge. In addition, the findings of this study suggest practical implications should include a combination between healthy diet and environmental claims. As a consequence, healthier, tasty climate-friendly meals can be introduced. Meals' seasonality and regionality should also be highlighted in information campaigns.

Zusammenfassung

Der Konsum von Lebensmitteln trägt einen grossen Anteil zu der totalen Umweltbelastung von Haushalten bei. Es besteht ein Zusammenhang zwischen kalorien- und energiereichem Konsum von Lebensmitteln und Fettleibigkeit. Eine mögliche Umgehung dieser Problematik könnte eine gesündere und umweltfreundlichere Ernährung darstellen. Die Wahrnehmung der Konsumenten hängt nicht nur vom Geschmack, sondern auch sowohl von der wahrgenommenen Gesundheit als auch von der wahrgenommenen Umweltfreundlichkeit einer Mahlzeit ab. An diesem Punkt setzt die vorliegende Arbeit an, indem sie darauf abzielt, diesen Zusammenhang zwischen der wahrgenommenen Umweltfreundlichkeit und der wahrgenommenen Gesundheit von Mahlzeiten genauer zu beleuchten. Es wurden über 1100 Besucher der Mensa Polyterasse an der ETH Zürich zum Geschmackserlebnis, zur Wahrnehmung der Gesundheit, zur Umweltfreundlichkeit und zum Nährwert einer Mahlzeit befragt. Des Weiteren wurden die Teilnehmenden zu umweltfreundlichen und gesunden Verhaltenseinstellungen als auch zu demografischen Variablen interviewt. Die Studie konnte aufzeigen, dass die Konsumenten gesunde Mahlzeiten als umweltfreundlicher wahrnehmen. Zudem beeinflusste die Herkunft (z.B. lokal oder regional) aber auch die Saisonalität der Ingredienzen die wahrgenommene Umweltfreundlichkeit. Darüber hinaus konnten vor allem Inhalte von Mahlzeiten (z.B. Vitamine, Fette oder Proteine) die Wahrnehmung der Gesundheit vorhersagen. Des Weiteren kristallisierte sich heraus, dass das Konsumentenwissen über tatsächliche Umweltbelastungen der Mahlzeiten relativ akkurat ist. Im Gegensatz dazu fehlte jedoch spezifisches Wissen über die Nährwerte von Mahlzeiten der Konsumenten. Demnach könnte eine Einführung eines Bildungsprogramms über die Nährwerte einer Mahlzeit (z.B. Ampelsystem) das Konsumentenwissen erhöhen. Weiter zeigen die vorliegenden Befunde auf, dass eine kombinierte gesunde und umweltfreundliche Ernährung einen nachhaltigeren Ernährungsstil hervorrufen kann. Ernährungsstil hervorgerufen werden kann. In diesem Rahmen sollten die Saisonalität und die Regionalität der Mahlzeiten durch Informationskampagnen hervorgehoben werden.

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1 Introduction

Can a healthy diet be an environmentally sustainable diet (see e.g. Macdiarmid, 2012)? Food production and consumption have a strong and ever-growing global impact on the environment and human health, often driven by dietary changes (Popkin, Adair, & Ng, 2012). Most of these changes are related to agricultural policies (i.e. more agricultural research and infrastructure) around the world (Popkin, 2011). More than 25 % of all greenhouse gas emissions (GHGE) are caused by global agriculture and food production (Tilman & Clark, 2014; Tukker & Jansen, 2006). Particularly in Switzerland, a third of the total environmental impact and 16% of the GHGE are caused by nutrition. Meat and dairy consumption make up the dominant share in this calculation (Hertwich et al., 2009; Tukker et al., 2011). Researchers suggest each person on the planet should not emit more than 2.7 tons of CO_2-emissions in general (WBGU, 2009). However, in many industrial countries, the total GHGE per year and capita greatly exceed the limit. For example, in Switzerland each resident emits the equivalent of 12.8 tons of CO_2-emissions (Jungbluth, Itten, & Stucki, 2012). Furthermore, diet shifts in global food demand as well as population size are increasing. The irreversible consequences will result in destroyed tropical forests, savannahs and grasslands, which threaten species with extinction (Tilman & Clark, 2014). It is supposed both absolute and relative impacts of food consumption will rise because of population and wealth growth. The latter can especially lead to a higher impact of diets richer in meat and dairy (McMichael, Powles, Butler, & Uauy, 2007; Myers & Kent, 2004).

Global agriculture is impacting poor diets and insecure food supplies (Godfray, 2014; Tilman & Clark, 2014). More than two billion people are overweight or obese because of the global transition towards diets high in processed foods, refined sugars, refined fats, oils and meats (Ng et al., 2014; Tilman & Clark, 2014). These dietary shifts and increasing body mass indices (BMI) are progressing along increased global incidences of chronic non-communicable diseases, particularly Type II diabetes, coronary heart disease and some cancers. If this dietary trend continues, two-thirds of the global burden of disease will manifest in the form of non-communicable diseases (Chopra, Galbraith, & Darnton-Hill, 2002; Hu, 2011; Nishida, Uauy, Kumanyika, & Shetty, 2004).

However, healthy eating has become an integral part of consumer policy in Europe (Orquin, 2014). According to Chrysochou, Askegaard, Grunert and Kristensen (2010), healthy eating is a multifaceted topic. Most of the discussions concern the nutritional aspects of food, such as how to reduce the intake of saturated fats and sugars and increase the intake of fibre and protein (Chrysochou et al., 2010). Communicating the healthfulness of foods using nutrition

labels, nutrition and health claims, or front-of-pack nutrition labels has become a popular policy approach (Cowburn & Stockley, 2005).

As food is a necessity to live, it is impossible to completely avoid GHGE in this sector. Nevertheless, dietary choices form an important factor on overall sustainable consumption. Consumers make daily food choices and therefore, important environmental decisions. According to Jungbluth et al. (2012), key players like households and private persons could, through a combination of sustainable food consumption patterns such as the reduced consumption of animal products and avoiding food waste, achieve an overall reduction of 12% of the annual per capita GHG emissions. Sustainable consumer behaviour through refined nutrition could reduce the environmental impact by approximately 40% (Jungbluth, Doublet, & Flury, 2013). Canteens or restaurants are other places where sustainable consumer behaviour plays an important role. A change in individual behaviour and lifestyle is inevitable (Linz, 2013) to reach a reduction in GHGE. Jungbluth et al. (2012) also sees households and private individuals as key players for reaching sustainable development goals in Switzerland.

To the best of the researcher's knowledge, few studies have examined the factors that induce more sustainable and healthier food choices. Little research exists regarding the perception of healthiness and environmental impact. Given this, the aim of the present study is to examine the relationship between the perceived environmental friendliness (EF) and the perceived healthiness of meal choices. Moreover, the relationship between the perceived EF and the objective environmental impact are investigated as well as the perceived nutritional value of food products and their perceived healthiness. This study also examines the relation between the perceived EF and the taste experience of food products.

The following sections give an overview of sustainable development, environmental impact of foods, the healthiness of foods and product perception. The second chapter will present a theoretical outline on food products, theories of evaluating food choices and consumers' perception of the healthiness and environmental impact of food products. The fourth chapter relays the specific research questions and hypotheses while its following chapter will explain the methodology of the study in detail. The results of the study will be presented in the sixth chapter. In the final discussion, the implications for practical application and future research will be presented.

1.1 Sustainable development

Before the discussion of the theoretical approaches, some definitions need to be made. In particular the explanation of the concept of sustainability should be clarified. The concept

defined in the Rio Declaration[1] is based on two pillars. Firstly, the equity between and within generations and, secondly, the equal status of social, economic and environmental goals (ARE, 2004). It must be possible the needs of all people at present and in the future is ensured. Earth should to be protected in a way that guarantees conditions of dignity and security for people over the long term. Sustainable development is often described schematically using three circles for the target dimensions of the environment, economy and society (see Figure 1) (ARE, 2004).

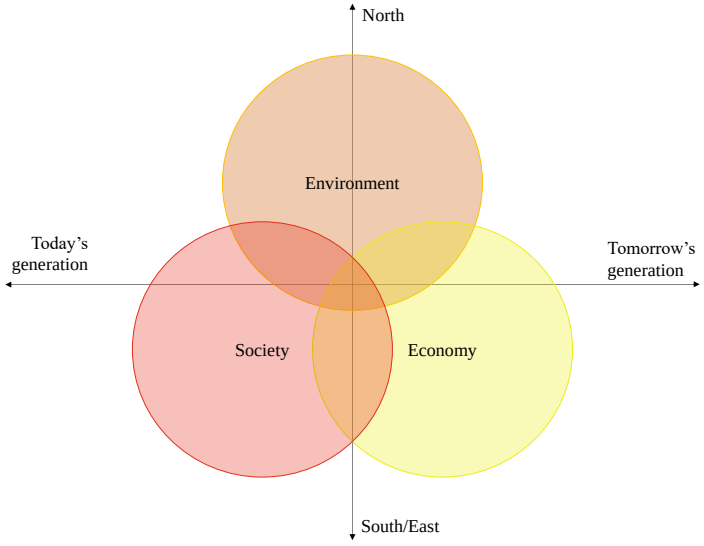

Figure 1. The sustainable development model (ARE, 2004)

Figure 1 illustrates that economic, social and environmental processes interlinked. The actions of both public and private agents must take the interplay between these three dimensions of environment, economy and society into account. Sustainable development goes beyond environmental conservation. The effects of today's actions must be factored into future generations as to satisfy their needs. Sustainable development means a long-term structural change in our economic and social systems. It contains a reduction of the consumption of the environment and resources to a permanently affordable level. It must ensure the economic output potential and social cohesion are considered. The North/South axis (see Figure 1) describes the global interdependencies. Sustainable development should bring about a long-term improvement in the quality of life for the majority of the human race (ARE, 2015).

1.2 Assessing the environmental impact of foods

The complexity of global supply chains, production technologies and consumption patterns of the modern economy are resulting in enormous environmental impact. To achieve the most effective improvement strategies and avoid burden when shifting from one environmental

[1] Interdepartamentaler Ausschuss Rio 2001

impact to another, all impacts occurring throughout the entire value chain, should be accounted for (Hellweg & i Canals, 2014, p. 1109). The environmental issues and their complexity make it necessary to develop methodologies to specifically evaluate the environmental impact of a product or a service in the most objective way (Baroni, Cenci, Tettamanti, & Berati, 2007, p. 280). One methodology to calculate the environmental impact of foods is the life cycle assessment (LCA).

LCA is a holistic method that assesses the overall environmental burden of a food product by calculating the environmental impact associated with production, packaging, conservation and transportation (Jungbluth, 2000; Jungbluth, Tietje, & Scholz, 2000). Two types of environmental impact are considered during the life cycle of a product: the use of resources such as land or fossil fuels and the emission of pollutants such as ammonia or methane (Guinée, 2002). LCA relates the environmental impact to a functional unit (de Vries & de Boer, 2010). For example, functional units in LCA studies of agricultural production are kilogram of fat–protein corrected milk, kilogram of grain produced, kilogram of meat produced (de Boer, 2003) or kilogram of carbon. Carbon footprint determines the direct and indirect GHG emissions of a product over its life cycle (Jungbluth et al., 2012). The metrics for the assessment is the global warming potential (GWP) which is measured in most cases in the unit of kilogram of carbon dioxide equivalents per functional unit (kg CO2-eq). Different greenhouse gases are expressed using a measure called carbon dioxide equivalent, e.g. methane (CH_4) and dinitrogen monoxide (N_2O) (Jungbluth et al., 2013). Carbon dioxide equivalent allows the comparison of warming potential between different greenhouse gases. For example, releasing one kg of CH_4 into the atmosphere is equivalent to releasing 25 kg of CO_2. This reflects the higher radiative forcing caused by methane compared to carbon dioxide. de Vries and de Boer (2010) analysed 16 studies related to LCA. They found most studies evaluated five categories- land use, primary energy use, climate change, eutrophication and acidification.

According to Hellweg and i Canals (2014), LCA consists of four phases (see Figure 2). The first stage includes the description of the goal and scope, which contains the definition of the objectives of the study and setting the system boundaries. The inventory analysis, which assembles inputs and outputs for each process in the life cycle and summarizes them across the whole system, is a part of the second phase. The third stage is grouping emissions and resources according to their impact categories. This Life-Cycle Impact Assessment (LCIA) converts emissions and resources to common impact units and makes them comparable. In the final phase the interpretation of the inventory and impact assessment is presented in order to answer the objectives of the study.

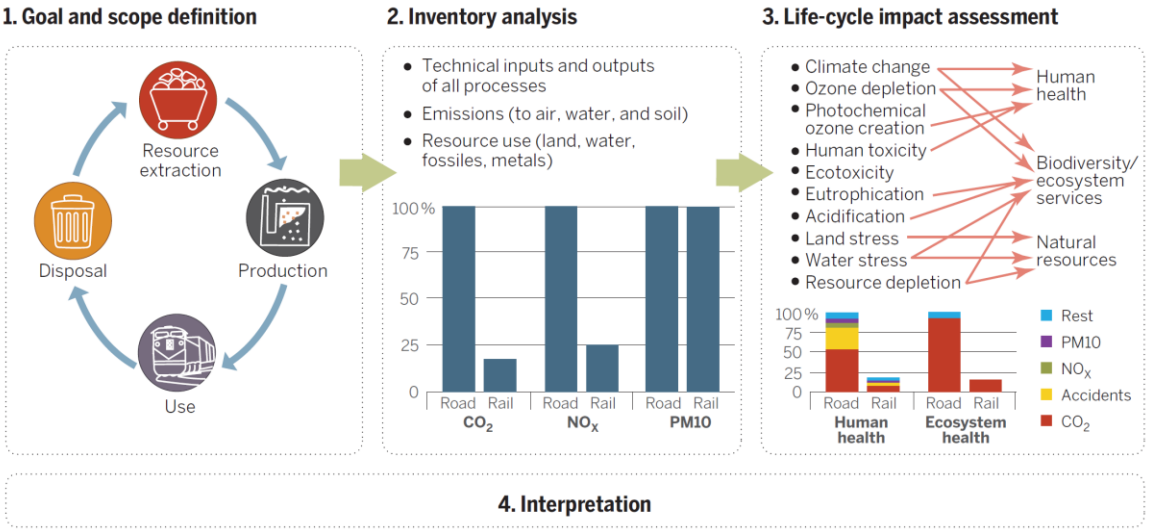

Figure 2. The four phases of LCA using the example of freight transportation (Hellweg & i Canals, 2014)

To compare the consumers' assessments with an objective evaluation, the ecological impact of the product (e.g. meals) is estimated using LCA. In this study, the LCA was conducted in order to compare different restaurant meals (e.g. from the canteen) regarding their kilogram of carbon dioxide equivalents per functional unit. LCA scores will be compared to the participants' subjective environmental impact values.

1.3 The healthiness of foods

There is sufficient evidence to link high consumption of energy-dense foods to the global obesity epidemic (WHO, 2003). Diets have become more energy-rich in the past three decades, but nutrient-poor (Alexy, Sichert-Hellert, & Kersting, 2002; Drewnowski, 2005; Luzzi & James, 2001). Only a few studies have explored the concept of nutritious food, despite the nutrient density approach towards dietary guidance and public health (Drewnowski, 2005).

To measure the healthiness of foods, many factors need to be taken into account. The nutrient profiling is a popular method to accurately and objectively measure the healthiness of foods. "Helping consumers make more healthful food choices is one application of nutrient profiling" (Drewnowski & Fulgoni, 2008, p. 23). For instance, the EU initiative will develop a food profiling system to determine which foods will qualify or be disqualified from making a nutrition or health claim (Drewnowski & Fulgoni, 2008; Tetens, Oberdörfer, Madsen, & de Vries, 2007). According to Tetens et al. (2007), food categories based on their nutrient content could have potential useful applications (e.g. consumer education, dietary guidance and nutrition labelling).

The definition of nutrient-dense food depends on the domain. Nutrient density often means diet composition, as indexed by the percentage of energy from carbohydrate, protein, and fat (Willett, 2013). According to Drewnowski (2005, p. 724), nutrient-dense foods encompass

grains, meats and dairy products, vegetables and fruit. The Food and Agriculture Organization of the United Nations (FAO) believes the nutrient-to-calorie ratio provides a more direct comparison between the intake of essential nutrients and the amount of energy the food provides (Drewnowski, 2005; WHO, 1998). The most established definition of nutrient-dense food is given by the Food and Drug Administration in the United States (FDA) (Drewnowski & Fulgoni, 2008). According to the FDA, "healthy" foods have to contain at least 10% of the reference daily intake (RDI) or the daily reference value (DRV) per reference, amounting to one or more of the six nutrients: protein, fibre, vitamins A and C, calcium, and iron40; it also has to be low in fat (<3 g), saturated fat (<1 g), cholesterol (<60 mg), and sodium (<480 mg) (FAO, 2015). Therefore the FDA definition excludes health claims for some fruit and vegetable products with added oils, salt, sauces or syrups and for some breakfast cereals (Drewnowski & Fulgoni, 2008). For the RDI in Switzerland, the DACH[2] values (a food association from Germany, Austria and Switzerland) can be consulted (SGE, 2016).

There are many ways to assess the overall nutrient quality of food. For example, the Nutrient Rich Food index (NRF) encourages nine nutrients (protein, fibre, vitamins and minerals) and suggests thee three nutrient limitations (saturated fat, added sugar and sodium). The higher the NRF, the healthier the food (Drewnowski, 2009). It seems these twelve nutrients (protein, fibre, vitamin A, C and E, calcium, iron, potassium, magnesium as well as saturated fat, added sugar and sodium) are important for measuring the healthiness of foods. In this study, the perception of five of these twelve nutrients were closely examined (i.e. the perception of vitamins, minerals, protein, fat and fibre content of meals) to compare the healthiness of restaurant meals (e.g. canteen). Furthermore, this study tries to explore the relationship between the perceived EF and the perceived healthiness of meals among consumers.

1.4 The product

Certain characteristics can be of particular importance for food products- e.g. cost, size and sensory property. In the current literature, (Masterson & Pickton, 2010) a product is defined as a bundle of characteristics of benefits to the consumer. The product as a whole can be divided into three different dimensions- the core value of the product, the actual product and the augmented product (see Figure 3).

[2] http://www.fooddach.org/

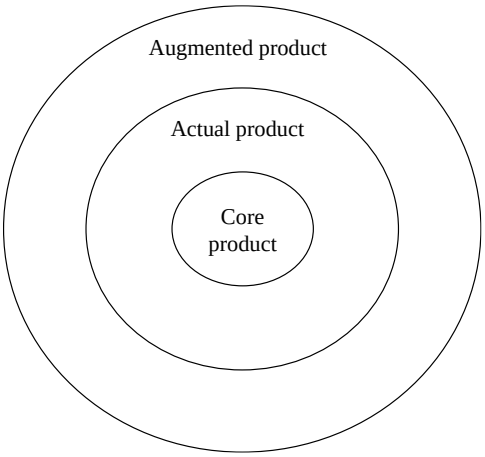

Figure 3. Product values (Armstrong & Kotler, 2011)

As seen in Figure 3, the core product summarizes the basic value of a product, derived from the main characteristics of a product (Masterson & Pickton, 2010). However, the core benefits of a product need to be turned into an actual product. Attributes that account for the actual product are product quality, packaging and product design (e.g. labelling) and brand identity (Armstrong & Kotler, 2011). The augmented product is built around the actual product's values (e.g. product support services such as warranty, after sales service and product support) (Armstrong & Kotler, 2011; Schleenbecker & Hamm, 2013).

Beck, Kahl and Liebl (2012) categorised the product quality of organic food products into nutrition, health, sensory properties and organic properties (e.g. ethical properties). Such ethical properties are for example fair trade or animal welfare. The basic value of the product quality includes nutrition and health attributes. Sensory properties and ethical properties however, can be understood as added values (Beck et al., 2012; Schleenbecker & Hamm, 2013). The sensory properties describe shape, colour, taste, smell and texture. Additionally, the sensory characteristics can be classified as hedonic characteristics, similar to aspects of nutrition and health (Brunsø, Fjord, & Grunert, 2002). Ethical properties express the 'image impact' of the product on consumers. Both the basic and the added product value contain attributes of product quality.

Products can be distinct in search, experience and credence characteristics. Credence characteristics are especially important for organic products (e.g. animal welfare). Experience characteristics on the other hand, can only be estimated after experiencing the product (e.g. taste). Search characteristics however, can be experienced prior to purchase (e.g. appearance of the product) (Grunert, Bredahl, & Brunsø, 2004; Schleenbecker & Hamm, 2013).

Both experience characteristics and value of the product quality seem to be important factors for products' purchase or evaluation. This study explores both the sensory and non-sensory perceptions of meals (see Chapter 2.1).

2 Background and theoretical framework

The following chapter will highlight theoretical approaches, such as factors influencing consumer behaviour and individual characteristics affecting information processing in the process of purchasing food products. Furthermore, important knowledge factors which influence our purchase decisions will be discussed. This theoretical background will be used to derive the research questions and the hypotheses.

2.1 Product characteristics

The characteristics of products are important determinants of consumers' attitudes towards sustainable behaviour and consumption patterns (Lin & Huang, 2012; Tanner & Kast, 2003). In this regard, Schleenbecker and Hamm (2013) examined almost 50 studies that investigate consumers' perceptions of organic product characteristics. In several studies they found health and sensory properties are important product characteristics. In focus group discussions, Chang and Zepeda (2005) found sensory parameters, such as taste, flavour, texture, smell and look are the most important product attributes when people buy food, including organic food. These findings are supported by Magnusson, Arvola, Koivisto Hursti, Åberg and Sjödén (2001). They found taste and health are the two most important purchase criteria for organic products. Other important aspects are long shelf-life and the core quality of the organic product.

Past research indicated the influence of package elements, especially package labels on how consumers evaluate a food product as well as how much of it they consume (Bublitz, Peracchio, & Block, 2010). For instance, organic claims bias calorie judgments. In this context, Schuldt and Schwarz (2010) asked participants to rate the organic- versus non-organic-labelled cookie on a computer screen. They found participants inferred an organic-labelled cookie was lower in calories and could therefore be consumed more frequently. Nevertheless, Lee, Shimizu, Kniffin and Wansink (2013, p. 34) noted the presence of an organic claim did not always lead to a more positive product rating by consumers.

Schuldt and Hannahan (2013) revealed organic foods were perceived as healthier than conventional foods, but less tasty. Chernev and Gal (2010) supported this view- they recently demonstrated consumers tend to underestimate the calorie content of combinations of healthy and indulgent products. At the same time, nutritional claims (e.g. 'low fat' or 'no cholesterol' labels) affect consumer perceptions- consumers perceive foods with such claims as lower in calories and fat than foods without such claims (Andrews, Netemeyer, & Burton, 1998; Wansink & Chandon, 2006).

Van Doorn and Verhoef (2011) argued most of the literature focuses on the impact of consumers' socio-demographic properties, health consciousness and environmental concerns as motivations to purchase organic food. However, prior literature has only partially explored the reasons behind consumers' willingness to pay (WTP) for organic food. Ultimately consumers are unwilling to pay a price premium for organic food. The authors proposed a framework to explain the organic claim using WTP through individuals and other motives (such as health perceptions, pro-social factors and perceived quality) (van Doorn & Verhoef, 2011). Therefore, non-sensory attributes of foods are becoming increasingly prominent. Non-sensory attributes describe factors such as nutritional value, the absence of food additives and residues or the process through which a food is produced (Torjusen, Lieblein, Wandel, & Francis, 2001).

As aforementioned, one aim of this study is to explore how consumers rate their meals' EF, healthiness, nutrition and taste experience. If there is no specific information about foods (i.e. sensory or non-sensory), how will the consumers meal perception manifest? The present research tries to examine both the sensory (e.g. taste) and the non-sensory characteristics (e.g. EF and healthiness) of foods, as they seem to be important factors to evaluating and purchasing a product (i.e. different canteen meals).

2.2 Consumers' knowledge of the environmental impact of food products

Knowledge about food products may influence consumers' behaviour as well as their purchase decisions. At the same time, a lack of knowledge or misconceptions could lead to wrong perceptions and judgments regarding the environmental and health impacts of food. Much research has been conducted to understanding the ways consumers perceive foods that include health or environmental quality claims (Lyon, 2006). Food products from the region (i.e., avoiding products from overseas), reducing meat consumption, purchasing seasonal foods and preferring organic products could cut down the environmental impact (Jungbluth et al., 2012).

2.2.1 Organic products

Studies in Europe and North America proposed several reasons for the consumer's move towards purchasing organic products (Lockie, Lyons, Lawrence, & Grice, 2004; Magnusson, Arvola, Hursti, Åberg, & Sjödén, 2003; Michaelidou & Hassan, 2008; Shepherd, Magnusson, & Sjödén, 2005; Squires, Juric, & Bettina Cornwell, 2001). Consumers typically cited benefits related to health, ethical, moral, political or religious motives, food safety, environmental sustainability and personal values as chief factors, when asked why they prefer organic foods to conventional alternatives (Michaelidou & Hassan, 2008; Mondelaers, Verbeke, & Van Huylenbroeck, 2009; Yiridoe, Bonti-Ankomah, & Martin, 2005). These perceived benefits are

consistent with the intended meaning of the organic claim (Magnusson, Arvola, Hursti, Åberg, & Sjödén, 2003). The demand among the consumers probably comes from the adaptation between their personal values and the pro-environmental ethics communicated by the organic claim. Consumers high in environmental concern perceived organic foods in a positive way (Schuldt & Hannahan, 2013). Moreover, Magnusson et al. (2003) postulated that health and environmental friendly behaviour are both important predictors of the purchase frequency of organic foods. Further studies reveal consumers perceive organic production as very relevant to environmental friendliness. Consumers seemed to overestimate the environmental impact of some vegetable categories (e.g. green beans, potatoes and tomatoes) in comparison to the objective LCA-measures (Bauer, Heinrich, & Schäfer, 2013; Tobler, Visschers, & Siegrist, 2011b). At the same time, Bauer et al. (2013) argued consumers perceived 'organic' labelled products as environmentally friendlier than the same brand without a label.

However, Tobler, Visschers and Siegrist (2011a) showed that buying organic food was not perceived as very environmentally beneficial among consumers, compared to other environmentally friendly food consumption patterns (e.g. 'Eat only seasonal fruits and vegetables'). An older study from Padel and Foster (2005) found consumers do not trust organic labels as a guarantee that a product is actually organic.

Two recent reviews identified numerous studies that found consumers refer to environmental motives when buying organic food. However, health issues seemed to be more important (Schleenbecker & Hamm, 2013; Shafie & Rennie, 2012). Summed up, the perception of organic foods is influenced by environmental and health benefits, among others. Furthermore, Story, Kaphingst, Robinson-O'Brien and Glanz (2008, p. 254) argue that changes in dietary and lifestyle patterns could produce substantial gains in the population's health and environment.

2.2.2 Meat products

Because meat and dairy consumption causes a dominant share of the environmental impact of food production and consumption (Tukker & Jansen, 2006), consumers' knowledge regarding meat products is an important factor. Truelove and Parks (2012) asked participants to estimate the impact of various behaviours which influence climate change. The questioned participants indicated meat consumption was one of the least influential behaviours on climate change. Additionally, the participants did not see reducing meat consumption as an effective measure for reducing global warming (Truelove & Parks, 2012). Other studies supported this view. It could be demonstrated that consumers estimated reduced meat consumption as least beneficial for the environment while assessing the perception of various food-related environmental impacts (Lea & Worsley, 2008). Consumers seem to be little aware of the

environmental impact of meat consumption. They consider the impact of meat, in relation to other food-related sustainable issues, as one of the smallest factors. Other studies suggest vegetarians' main motivations for avoiding meat are health and animal welfare-based rather than environmental concerns, although vegetarians appear to be environmentally conscious (Fox & Ward, 2008).

2.2.3 Seasonal food

Next to meat products, seasonal foods also influence the environmental impact. Tobler et al. (2011a) found that only eating seasonal vegetables and fruits was seen as good for the environment. Local off-season vegetables need to be heated in a greenhouse to have the appropriate temperature to grow in Switzerland. In many cases, the GHGE of a heated greenhouse in winter and spring in northern countries is bigger than the transport of a vegetable from southern countries (e.g. Spain), where the vegetables are grown outside (Stoessel, Juraske, Pfister, & Hellweg, 2012). Off-season vegetables often pollute the environment more than domestically grown, seasonal vegetables. The environmental impact increases if these off-season vegetables are transported by plane (e.g. asparagus or beans in winter). The transport distance and heating of greenhouses can be reduced by eating more seasonal and locally grown vegetables (Jungbluth et al., 2012).

2.2.4 Mode of transportation

Food packaging tends to be relatively less important regarding the environmental impact of food products (Jungbluth et al., 2000). The mode of food transport however, takes an important role regarding the environmental impact of foods. In this context, Tobler et al. (2011b) showed, unlike the LCA results, consumers rated truck or ship transportation as slightly less harmful than air transportation. They concluded consumers pay more attention to the distance rather than to the mode of transportation (truck, ship or plane). Jungbluth et al. (2000) postulated the main impact on the environment comes from the mode of transport and not from the transport distance. To sum up, various misconceptions about the impact of food production and consumption on climate change may influence consumer's perception regarding their environmental and health judgments as well as food choices.

2.3 Attitudes and information processing

Attitudes are general evaluations that people hold in regard to themselves, other people, objects and issues (e.g. individuals' attitude towards the environment) (Petty & Cacioppo, 1986). Past research has shown environmentally-friendly attitudes influence consumer behaviour only

when they are not strongly associated with habits that result in climate-unfriendly behaviour (Magnusson et al., 2001). Furthermore, attitudes derive from value orientations. Behind pro-ecological attitudes, there are often altruistic and moral value orientations (de Groot & Steg, 2007; Steg & Vlek, 2009). Attitudes, knowledge, norms and value orientation are parts of the individual characteristics of people. They may be important for evaluating the environmental impact and healthiness of foods. For this reason, health and environmental attitudes were considered in this study (see Chapter 5.2). However, in real world situations, knowledge about all relevant alternatives, possible consequences and probabilities are hardly ever given. Therefore, the rationality of consumers is often "bounded" (Simon, 1979). Consumers' judgements are often unsystematic or "irrational," thus consumers rely on heuristics in many decision-making situations (Gigerenzer and Gaissmaier, 2011). According to Gigerenzer and Gaissmaier (2011, p. 454), a heuristic is "a strategy that ignores part of the information, with the goal of making decisions more quickly, frugally, and/or accurately than more complex methods". Therefore, a heuristic is a cognitive tool, which individuals use as a rule of thumb for judgments. This bounded rationality or these unsystematic evaluations may influence consumers' meal evaluations.

Irmak, Vallen and Robinson (2011) summarized consumers often use product attribute information as cues for judgment. Such cues may affect consumer evaluations of the healthfulness of foods (e.g. nutrition information- presented by food labels, meal sizes, nutrient content claims, health benefit claims and brand names). Moreover, recent research showed that consumers tend to classify foods into dichotomous categories of "good" and "bad" (Oakes & Slotterback, 2001; Rozin et al., 1996). For instance, Oakes (2005) found that snacks which tend to be seen as "good" in terms of health (e.g. raisins) promote less weight gain, than "bad" snacks (e.g. potato chips), even when they provided the same number of calories. This categorical thinking can result in false conclusions regarding foods' nutritional value (Irmak et al., 2011), health value or environmental friendliness value.

Information can be processed in different ways- either in a deep processing or in a superficial processing fashion. The Elaboration Likelihood Model (see Figure 4) reveals these two information processes in one model. According to this model, information processing is based on the individual's ability and motivation and can be the result in two routes- the central or the peripheral path (Petty and Cacioppo, 1986).

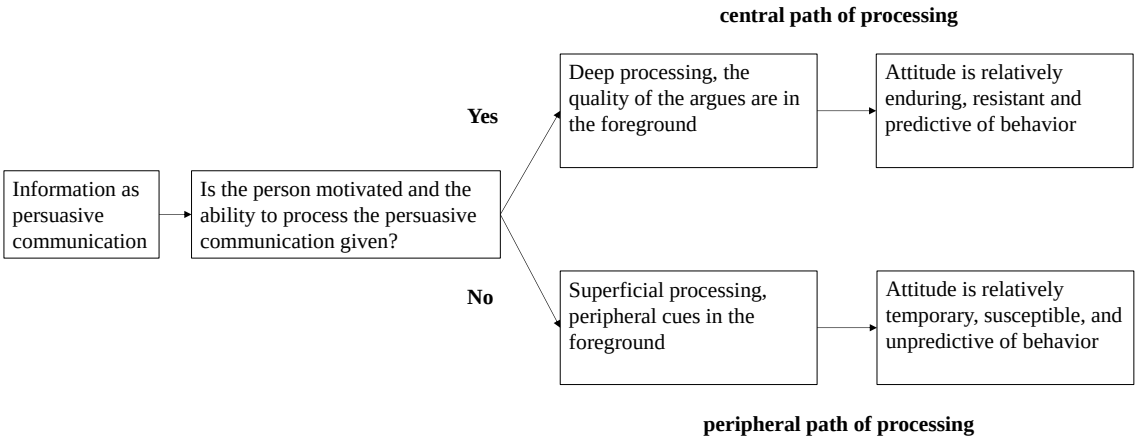

Figure 4. Central and peripheral routes to persuasion on the elaboration likelihood continuum (Petty & Cacioppo, 1986)

The central route results in the thoughtful consideration of arguments, whereas the peripheral route leads to affective associations or simple inferences tied to peripheral cues in the persuasion context. The central route occurs when the elaboration likelihood is high. If the motivation and the ability of the individual is given, the quality of the arguments are in the foreground. However, if the elaboration likelihood is low, the peripheral route occurs. In this case, the motivation and ability of the individuals are low. In addition, the information is processed superficially. Individuals consult the attractiveness and credibility of the source. These two routes of persuasion have different consequences. The central route appears to be more persistent, resistant and predictive of behaviour, in attitude change, than changes induced via the peripheral route (Petty & Cacioppo, 1986, p. 191). In this context, the model from Petty and Cacioppo (1986) is described as a conflict between two routes regarding consumer judgment about food healthfulness (Orquin, 2014). One view shows consumers process nutrition and health information systematically, by consideration of nutrition labels and comparing nutritional values for different products. The other view assumes consumers rely on heuristics and categorical thinking about food healthfulness (Rozin, Ashmore, & Markwith, 1996).

One aim of the present study is to explore the relationships between the perceptions of healthiness, EF and nutrition among meals. To estimate foods' perception, cognitive information processing is necessary. However, information about foods are often missing (e.g. in restaurants), or the individual's ability and motivation to assess this information is not given. Therefore, it is not very likely an effortful judgment process is based on healthiness, EF or nutrition information. It is rather more likely that health (Orquin, 2014) as well as environmental evaluations of foods, may be based on simple heuristics. Therefore, nonlinear information processes rely on heuristics and categorical thinking. This approach to problem solving is not necessarily optimal but it often delivers good results (Jonas, Stroebe & Hewstone, 2014).

2.3.1 Halo effect

An important effect related to heuristic processing is the halo effect. This implies an initial impression of a person or object promotes subsequent evaluations which may be unwarranted (Asch, 1946; Kelley, 1950; Nisbett & Wilson, 1977; Snyder, Tanke, & Berscheid, 1977; Thorndike, 1920). The halo effect has also been applied in nutritional judgments to explain consumers' tendency to see foods bearing "healthy" advertising claims (e.g., "no fat" or "no cholesterol") in an unrealistic positive light and why this is generalized to other aspects of these foods. For example, Chandon and Wansink (2007) showed individuals are more likely to underestimate the caloric content of meals because of the halo health effect.

Past research shows consumers' knowledge (i.e., lower level of cognitive resources) affect consumers' decisions (Park, Iyer, & Smith, 1989). This low-involvement level is characterized by little information search and little consideration in brand and product choice (Silayoi & Speece, 2004). Graham, Orquin and Visschers (2012) support this finding. In their review, eye-tracking studies indicated consumer attention to packaged food products may be limited to very few packaging elements because they are unconcerned with paying more attention (e.g. brand, flavour and product images). The halo effect accompanies this limited cognitive involvement of people and makes them prone to such behaviour (Lee et al., 2013). Consistent with dual-process models (e.g. Chaiken, 1980; Petty & Cacioppo, 1986), people make judgments based on heuristics, when an object belongs to a product category whose 'members' have judgment-relevant attributes- unless people deliberately avoid such automatic influences on judgment (Lee et al., 2013, p.34). Health claims (e.g. high in calcium) induce consumers to rate a product healthier and make them more likely to purchase it. Roe, Levy and Derby (1999) showed the presence of health claims increased the probability of limited consumers' information search from the nutrition facts panel. Such results suggest health claims help generate a halo effect. This means consumers make automatic extrapolations about a given product's healthfulness, if claims for health benefits are featured on the package (Lee et al., 2013, p. 34). Orquin (2014) argues consumers in general use simplistic and categorical thinking about food and nutrition (see Chernev & Gal, 2010; Oakes & Slotterback, 2001; Rozin et al., 1996).

In sum, information about healthiness or EF of foods are often missing. Prior research however, showed consumers operate with simplistic and categorical thinking about food and nutrition (Chernev & Gal, 2010; Oakes & Slotterback, 2001; Rozin et al., 1996). Thereby, consumers rely on "fast and frugal" decision strategies like heuristics (i.e. halo effect) for food choices (Scheibehenne, Miesler, & Todd, 2007; Schulte-Mecklenbeck, Sohn, de Bellis, Martin, & Hertwig, 2013) or food evaluations.

3 Summary

As described above, both the consumer and product characteristics influence product and food evaluations. A number of types of purchase decisions exist. On the one hand there is the extensive buying decision in which a comprehensive information search will be made. On the other hand, there exists the limited buying decisions, where heuristics such as simplistic and categorical thinking are used. Additionally, food knowledge plays an important factor regarding consumer decisions. Scheibehenne et al. (2007) showed humans base their decisions on a few important pieces of information. Connors, Bisogni, Sobal and Devine (2001, p.192) found one strategy people use to deal with complex food choices is "to keep it real simple."

Much research has been conducted into investigating the ways consumers perceive and evaluate foods that include health or environmental quality claims. As the food market has grown over the past few years across the globe, dietary choices form an important impact on overall sustainable consumption. Consumers make food choices and by extension, important environmental decisions on a daily basis. Many factors influence consumer behaviour. Cues such as nutrition information, meal sizes, brand name, nutrient content and health benefit claims all affect consumers' evaluations. Furthermore, consumers tend to classify foods into dichotomous categories of "good" and "bad." Such categorical thinking may result in false conclusions regarding foods' healthiness, environmental friendliness and nutritional value.

The purpose of this present research is to examine the consumers' perception towards food. Special attention is paid to the assessment of foods' healthiness, environmental friendliness or nutritional value. How do consumers perceive meals' using the variables of environmental friendliness, healthiness or nutritional value? What are the crucial factors for the evaluation of meals and which factors are weighted the heaviest?

4 Research framework

Humanity faces two severe, closely related global problems. First, more and more people are suffering from obesity and its consequences due to consuming more "empty calories." Second, our unsustainable food consumption increases greenhouse gas emissions and other types of environmental degradation (Tilman & Clark, 2014). Recent studies show shifting towards healthier diets is related to lower global warming potential (Tukker et al., 2011). To reduce these problems, consumers should make more sustainable and healthier food choices.

To improve consumers' ability to make healthier and environmental friendlier food choices, it is necessary to explore these underlying relationships. This research aims to examine the relationship between the perceived healthiness and environmental friendliness of foods among consumers. Furthermore, research-based recommendations are fundamental to changing our food policy and approach, for example labels could be modified to improve consumers' understanding of health, EF or nutrition claims to select foods. The first research question explores one of these relationships- What is the association between the perceived environmental friendliness and the perceived healthfulness of foods (e.g. meals)?

The literature describes that for the majority of people, aspects of taste and sensory appeal seem to be the most important factors underlying food choice, followed by concerns about health, weight control, nutritional value and cost (Scheibehenne et al., 2007). There are studies which also show the halo effect influences the consumers' tendency to see foods bearing "healthy" advertising claims in an unrealistically positive light. This is generalized to other aspects of these foods (Lee et al., 2013; Schuldt & Hannahan, 2013). In addition, Magnusson et al. (2001) found that taste and health are the two most important purchase criteria for organic products. Given this situation, the researcher assumes that consumers' perception of environmental friendliness is related to the perceived healthiness of a meal. The first hypothesis is as follows:

> **H1:** The perceived environmental friendliness is positively related to the perceived healthiness of meals.

Another aim of this study is to explore the relationship between taste experience of food products and their perceived environmental friendliness. Therefore, the second research question is: what is the relationship between the perceived environmental friendliness and the taste experience of food (e.g. meals)?

There is little evidence that shows the relation between customer satisfaction and environmentally friendly offers in restaurants (Visschers & Siegrist, 2015). The trend nowadays

is to act 'green'. Recent research suggested consumers tend to have a positive attitude towards restaurants that serve local and organic products who that try to act 'green' in other areas (Schubert, Kandampully, Solnet, & Kralj, 2010). However, detailed information on the climate friendliness of the offered meals in restaurants is often missing (e.g. canteens) (Visschers & Siegrist, 2015). Therefore, the sensory appeal is an important criterion in the meal choice for a consumer (Scheibehenne et al., 2007; Steptoe, Pollard, & Wardle, 1995). According to Drewnowski (1997), consumers prefer energy-dense foods, such as dairy and meat (Drewnowski, 1997). However, meat and dairy products have a high environmental impact (i.e. cause higher GHGE, Tukker et al., 2011; Tukker & Jansen, 2006). Thus, climate-friendlier meals are less likely to include these products (Visschers & Siegrist, 2015). Furthermore, eating meat is associated with high hedonic values among consumers (Graça, Oliveira, & Calheiros, 2015; Lea & Worsley, 2008). Consumers' preference portrayed meat substitutions as less attractive, in particular, meals in a complete vegetarian meal style (Schösler, Boer, & Boersema, 2012; Verbeke, 2015). Hence, the second hypothesis is:

> **H2**: The perceived environmental friendliness is negatively related to the taste of meals.

Previous research found consumers rated food as unhealthy because the taste experience was better. The authors argued foods considered unhealthy lead to higher taste perception (Raghunathan, Naylor, & Hoyer, 2006). Therefore, the researcher assumes the perceived healthiness may influence the perceived taste experience. Thus the third hypothesis is:

> **H3**: The perceived healthiness is negatively related to the meal's taste experience.

As outlined, consumers prefer energy-dense foods (i.e. food rich in fat and sugars) (Drewnowski, 1997). The nutritional value however, is a good balance of all necessary daily nutrients. The goal is to stimulate people to follow dietary recommendations (Zandstra, De Graaf, & Van Staveren, 2001). The fourth research question therefore is: what is the relationship between perceived nutritional value, taste experience and perceived healthiness of foods (e.g. meals)?

In this context, a study asked Belgian consumers about their willingness to compromise on taste for health among functional foods (i.e. foods with specific health benefits). The consumers' willingness to compromise on taste for health in the case of functional foods decreased over time (Verbeke, 2006). Consumers expected low-fat foods to be healthy but not pleasure-giving. The reverse was found for high-fat foods, which were expected to be unhealthy

but pleasure-giving (Tuorila, Cardello, & Lesher, 1994). A general health interest predicts a higher consumption of vegetables and a lower intake of fat (Zandstra et al., 2001). Consumers were most concerned about reduction in the taste quality of the diet, when they were asked about adopting a reduced fat healthier diet (Lloyd, Paisley, & Mela, 1993; Zandstra et al., 2001). It is likely people consume foods they evaluate as tasty (Zandstra et al., 2001). Thus the hypotheses are:

> **H4**: The perceived nutritional value is positively related to the perceived healthiness of meals.
>
> **H5**: The perceived nutritional value is negatively related to the meals' taste experience.

A fourth aim of this study is to explore the relationship between the environmental friendliness and the nutritional value of foods (e.g. meals). A large number of studies tried to investigate if there is a difference between the actual nutritional value of organically and conventionally grown food (Bourn & Prescott, 2002). It is popular in the media to depict organic food as more nutritious than conventional food (Smith, 1993). National Association of Sustainable Agriculture Australia (NASAA, 2000) highlighted the claim that organic vegetables may have a considerably higher mineral content than similar conventional foods from a supermarket (as cited in Bourn & Prescott, 2002). Vieux, Soler, Touazi and Darmon (2013) assumed healthy diets (i.e. high nutritional quality) are supposed to be more environmentally friendly because they rely mainly on plant-based foods with lower GHGEs per unit weight than animal-based foods. However, they found diets high in nutritional quality were not with the lowest GHGEs. Nevertheless, the researcher assumes the perceived environmental friendliness and the perceived nutritional value of meals are related. Thus the sixth hypothesis is:

> **H6:** The perceived environmental friendliness is positively related to the perceived nutritional value of meals.

To summarize the outlined hypotheses, the researcher assumed the following model. Figure 5 shows the relation between the constructs.

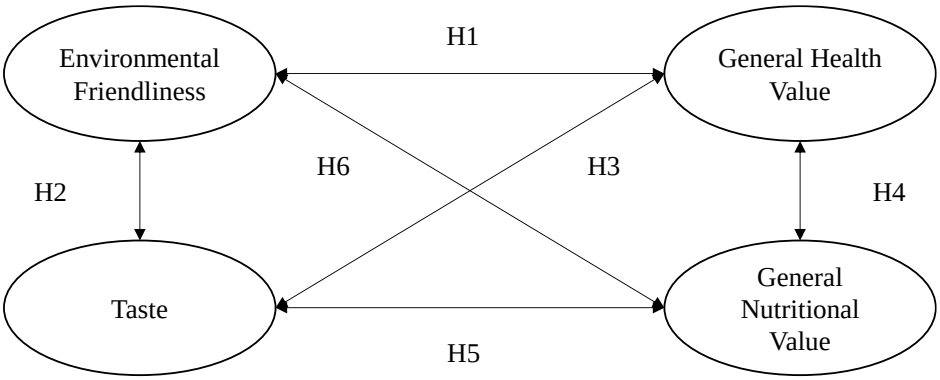

Figure 5. Initial structural model in a path diagram.

A final aim of this study is to investigate how the perceived and the actual environmental impact are connected. The last research question examines the relationship between the perceived environmental friendliness and the actual environmental impact of food products (e.g. meals).

Past studies about consumers' perception and behaviour related to sustainable food has focused on the consumption of organically produced food (Magnusson et al., 2003). However, the environmental friendliness (EF) assessment of a product requires the attention of additional product features such as transportation, conservation and packaging (Jungbluth, 2000; Tobler et al., 2011b). However, the EF assessment of a food product is a challenge for consumers. Tanner and Jungbluth (2003) argue that the environmental impact of a food product is not directly observable. Therefore, it is a rather complex procedure. Moreover, food products rarely fulfil all ecological requirements. This is why consumers have to weigh various characteristics to make an appropriate EF decision (Tobler et al., 2011b). Under this view the researcher presumes the last thesis as followed:

H7: The perceived environmental friendliness is not related to the actual environmental impact.

5 Methods

In this chapter, the sampling methods and methodology are discussed. First, the setting is presented, followed by the questionnaire, objective data (LCA scores) and population sample.

5.1 Location

The Canteen Polyterrasse has around 650 seats. In the summer, there is a terrace with 500 additional seats. The canteen serves around 2'200 meals on a daily basis. The lunch menu consists of four different hot meals (Home, Garden, Local and Street). The price range depends on the status of the visitors (student, employee or guest).[3]

5.2 Questionnaire

The questionnaire on environmental, health, nutrition value and taste perception criteria as well as demographic variables was printed on paper. The questionnaire was a two-sided survey with 43 questions. There were a German and an English version of the questionnaire. Each questionnaire was marked with a four-digit barcode, to check each distributed questionnaire. Filling out the questionnaire took approximately five to ten minutes (see Appendix A). Participants were asked to fill out the questionnaire based on the meal they just consumed.

5.2.1 Meal choice

The canteen Polyterrasse offers four specific hot meals during every lunch break (Home, Garden, Local, and Street). In this first question the participants were requested to specify their meal choice.

5.2.2 Consumers' general meal perception

Visitors of the canteen were asked to answer four different general questions towards the consumed meal. Eleven-point scales were used. The scales ranged between zero and ten with the anchors "very low" (0) to "very high" (10).

One question dealt with *taste experience*. Participants were asked how satisfied they were with the taste of their meal in general, compared to other meals at the canteen (the higher the value on the scale, the better the taste experience). Another question referred to the *perceived healthiness* of meals. Participants were asked to rate the perceived healthiness of the meal they consumed compared to other meals at the canteen (the higher the value on the scale, the higher

[3] http://www.gastro.ethz.ch/locations/eth_zentrum/mensa/index_EN

the perceived healthiness). A further question addressed the *perceived environmental impact* (recoded in environmental friendliness) of meals. Participants were asked to rate the perceived environmental impact (the higher the value on the scale, the higher the environmental impact). The *perceived nutrition value* of meals was the next question. Similar to the first three questions, participants were asked to rate the nutritional value (the higher the value on the scale, the more positive the nutritional value).

5.2.3 Consumers' specific meal perception

In a third section, the respondents had to answer several specific questions about healthiness, environmental impact and nutritional value of their meals. These 15 items were rated on seven-point Likert scales (higher scores indicate higher expressions) with an added option "I don't know" (8). The endpoints were classified as "very low" (1) and "very high" (7).

Five items were related to the perceived specific healthiness of meals (e.g. "Its vitamin and mineral content"). Five other items referred to the specific environmental impact (e.g. "The seasonality of its vegetables") and five further items questioned the specific nutritional value (e.g. "Its fat content").

5.2.4 Consumer's attitudes and behaviour

In the forth section of the questionnaire, participants were requested to specify their attitudes towards healthiness and environment. For the *self-reported environmental-friendly behaviour*, participants were asked in five questions about their daily behaviour (e.g. "I choose organically produced foods"). The questions could be rated on seven-point Likert scales (higher scores indicate higher expressions) with the endpoints "does not apply at all" (1) and "fully applies" (7).

Participants were requested to specify their *health attitude* (e.g. "I am very particular about the healthiness of food") in five further questions. For this purpose, the health scale (with a Cronbach α of .89) from Roininen, Lähteenmäki and Tuorila, (1999) was consulted. Items were scaled on a seven-point Likert scale with the anchors "fully disagree" (1) and "fully agree" (7).

The participants were asked to give their opinion on two statements regarding *environmental attitudes* (e.g. "At the food shop I try to search for labels that guarantee a sustainable food production"). The rating scale for these two statements were on seven-point Likert scales with the endpoints "does not apply at all" (1) and "fully applies" (7).

5.2.5 Socio-demographic characteristics

Finally, participants answered socio-demographic questions. After gender (female = 0, male = 1) and status at the university (student = 1, employee = 2, external or guest = 3), the birth year was asked. Participants named their weight (in kilograms) and height (in centimetres). Influencing factors such as a vegetarian or vegan diet, following a diet or other factors that could limit their meal choice (medicine, religious guidelines or allergies) were recorded. Additionally, the sample population's field of study, specifically whether students were in the fields of food and environmental sciences, was recorded (yes = 1, no = 0). In the end, the frequency of visits to the canteen (once a month = 1, once a week = 2, more than once a week = 3, every weekday = 4) and whether the participants already completed the questionnaire before (yes = 1, no = 0), were asked.

5.3 Life cycle assessment (LCA)

Besides survey data, objective data was provided, including the CO_2-eq per meal. The environmental impact of a product during its entire life cycle is measured by LCA. With the aggregation of several environmental issues or single environmental issues, such as carbon footprint- the environmental impact can be measured (Jungbluth, Büsser, Frischknecht, Leuenberger, & Stucki, 2011).

In order to improve the sustainability in the gastronomy sector a programme called "ONE TWO WE" was initiated. This programme was the result of a collaboration between the LCA consultancy ESU-services Ltd., the canteen operator SV Group and the World Wildlife Fund (WWF) in Switzerland. Within a LCA study, the environmental impacts of all food purchases of the Swiss canteen operator SV Group were analysed. At the same time, a set of improved options in logistics, canteen operation, food supply and food range were proposed (Jungbluth, Doublet, & Flury, 2013). In this study, the ESU-services Ltd. provided the data processor and the SV Group made the LCA calculations (see Appendix C).

5.4 Procedure

The study took place in the Canteen Polyterrasse at ETH. The questionnaires were distributed during lunchtime over 12 days (for more details see Appendix C). Approximately 20 to 30 questionnaires per meal type were spread every survey day. The visitors, which consumed one of these four meals, were randomly selected. They were asked if they wanted to participate in a scientific survey on the subject of "eating at the canteen." Afterwards, participants were verbally informed, that the scientific survey was part of a master thesis on the subject of

'Sustainable Catering at the ETH Zurich.' Participants completed the questionnaire at their own pace. The completed questionnaires could be deposited in a red ballot box next to the main exit of the canteens to ensure the anonymity of the participants. As a small thank you participants could choose between an Appenzeller Biber (a cookie) or pen.

5.5 Sample

During the data collection period, the research group distributed between 310 and 525 questionnaires at the Canteen Polyterrasse. This resulted in a total of 1265 distributed questionnaires, of which 1138 were filled and returned complete. This corresponds to a response rate of 90% (see Table 1). Thirty-seven questionnaires were excluded from the analysis due to too many blank and skipped response fields. Appendix C contains an overview of the meals in detail.

Table 1.

Numbers of meals chosen by participants over the 12-day survey period at the Canteen Polyterrasse

	Number of respondents	Number of respondents per day	Range
Home	334	27.80	(21, 33)
Local	116	23.20	(14, 23)
Garden	333	27.75	(23, 35)
Street	318	26.50	(14, 37)

Note. $N = 1101$.

Table 1 shows the number of returned questionnaires per meal. For the "Home" meal, 30.3% of the total number of returned questionnaires were counted. Only 10.6% of all questionnaires address the "Local" meals. Because this meal changes twice per week, the "Local" meals were only questioned on five different days. "Garden" meals accounted for 30.2% of the returned questionnaires. In total, 28.9% of the participants were questioned on assessing the perception of the "Street" meal. In total, the simple size consisted of 1101 respondents who returned valid and completed questionnaires.

The age of the participants ranged between 17 and 72 years. The participants' mean age was 24.66 years ($SD = 6.3$), which is considered very young. However, for a study at a technical university this is not surprising. Almost a third of the sample was women (27.3%), corresponding to the proportion of female students at the ETH Zurich. An annual report from 2014 indicated 30.6% of ETH students are women (ETH Zürich, 2015).

The participants' mean BMI was 22.21 (*SD* = 2.70) which lies within the normal range (BFS, 2012). The variable BMI showed a significant difference ($F(1,546) = 39.92$, $p < 0.001$, $\eta p^2 = .07$) between the sexes. Females had significantly lower BMI than males, which corresponded with Swiss statistics (BFS, 2012).

The majority (90.0%, *n* = 984) of participants were students. Approximately one-tenth were ETH employees (8.4%, *n*= 92). Only a small percentage (1.6%, *n* = 17) were guests or external people. Students from the food and environmental sciences (8.6%, *n* = 94) were slightly underrepresented in the population sample of ETH students (10.5%). There were significantly ($\chi^2(1) = 46.64$, p < .001, Cramér's V = .207) more women who were found to study food and environmental sciences. More than 8% (*n* = 90) of the whole population sample were vegetarian or vegan. One-tenth of the participants were on a diet (*n* = 109). Four percent of the participants (*n* = 47) indicated other factors such as medicine, religious guidelines or allergies to have influenced their meal choice. Only 6.5% (*n* = 71) completed the questionnaire more than once.

5.6 Data analysis

The questionnaires were read by a document scanner (Canon ImageFormula DR-9080C) and imported with the corresponding scan software (CapturePerfect 3.0.7409.122). With the recognition software Remark Office (Remark 8.4 Build 127), the marked response fields in the questionnaires were recognized and corrected in case of deviations. The data was then analysed in R (Version 3.1.3, RStudio Inc.) and SPSS (Version 22.0, SPSS Inc.). The next sections explain the chosen statistical methods.

5.6.1 Exploratory factor analyses (EFA)

First, a factor analysis was conducted. To test the construct validity, confirmatory factor analysis, using the R package "Lavaan," was performed on the items that assessed respondent's detailed perception of their meal to see whether the expected constructs were confirmed. Spearman (1904) conceptualized this analytic tool which is today known as factor analyses. There are two classes of factor analyses- exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) (Thompson, 2004).

One purpose of the EFA is to evaluate the dimensionality of a set of multiple indicators (e.g. items from a questionnaire). Therefore, the smallest number of interpretable factors were uncovered to explain the correlations among them. The EFA serves to reduce the data complexity. For example, reducing a large set of intercorrelated indicators (e.g. items) to a smaller set of composite variables. These composites (e.g. factor scores) can be used as units of analyses in following statistical tests. EFA includes four main steps. The first step elects a

specific method to estimate the factor model. Second, the appropriate number of factors are selected. In a third phase the determination of a technique to rotate the initial factor matrix to foster the interpretability of the solution is be conducted. Finally, a method to compute factor scores need to be selected (Brown, 2006, p. 20-21). In order to obtain the composite variables and evaluate the dimensionality of data, the researcher conducted an exploratory factor analysis. Six latent factors ('Environmental attitude,' 'Perceived meat value,' 'Perceived specific environmental friendliness (EF) value,' 'Perceived specific health value,' 'Health attitude' and 'Perceived specific nutritional value') were identified by the exploratory factor analysis (see Appendix D and Chapter 6.2).

5.6.2 Structural equation model (SEM)

In a second step, the validity of these six factors was assessed. For this purpose, a confirmatory factor analysis (CFA) was used (Guay, Morin, Litalien, Valois, & Vallerand, 2015). However, some authors consider many psychological instruments to fail and not reach a commonly accepted level fitting to the data usually advocated in CFA research (Guay et al., 2015; Marsh et al., 2009).

SEM models combine path models and confirmatory factor models. They can be seen as CFA with multiple regressions. Moreover, SEM is a confirmatory technique, used for exploratory purposes (Schreiber, Nora, Stage, Barlow, & King, 2006). Therefore, SEM models incorporate both latent and observed variables (Qureshi & Kang, 2015). Joreskog, Keesling and Wiley were involved in the development of SEM models in the early 1970s. This approach became known as the linear structural relations (LISREL) model (Lomax & Schumacker, 2012). SEM is widely used in many fields of science. This method is a multivariate, statistical technique. It is often applied to study relationships between latent variables (or constructs) and observed variables that constitute a model. Such latent variables cannot be directly measured but are of interest. At the same time, observed variables can directly be measured by a researcher. These observed variables are used to represent and measure latent variables (Qureshi & Kang, 2015, p. 167). The technique of SEM consists of two components- a measurement model and a structural model. The first component includes a confirmatory factor analysis (CFA) that investigates how well latent variables are represented by the observed variables. The second component incorporates multiple regression analysis and path analysis. It also illustrates how the latent variables are related (Chen, Zhang, Liu, & Mo, 2011; Qureshi & Kang, 2015).

The main advantage of SEM is the opportunity to model complex dependencies and latent variables (Nachtigall, Kroehne, Funke, & Steyer, 2003). SEM has attributes that assist the estimation of multiple and interrelated dependence relationships. It possesses the advantage to

represent unobserved concepts in these interrelated relationships and account for measurement error (Hair, 2014). Therefore, it is a good technique and method to analyse the expected assumptions and hypotheses.

The independent latent variables are also called exogenous variables. This research's exogenous variables emerged from the EFA. The dependent latent variables are called endogenous variables. Exogenous variables represent constructs that exert an influence on other constructs and are not influenced by other factors in the quantitative model. The exogenous variables affect endogenous variables (or constructs) (Schreiber et al., 2006, p. 325).

Figure 6 shows the expected relations between the exogenous and the endogenous variables.

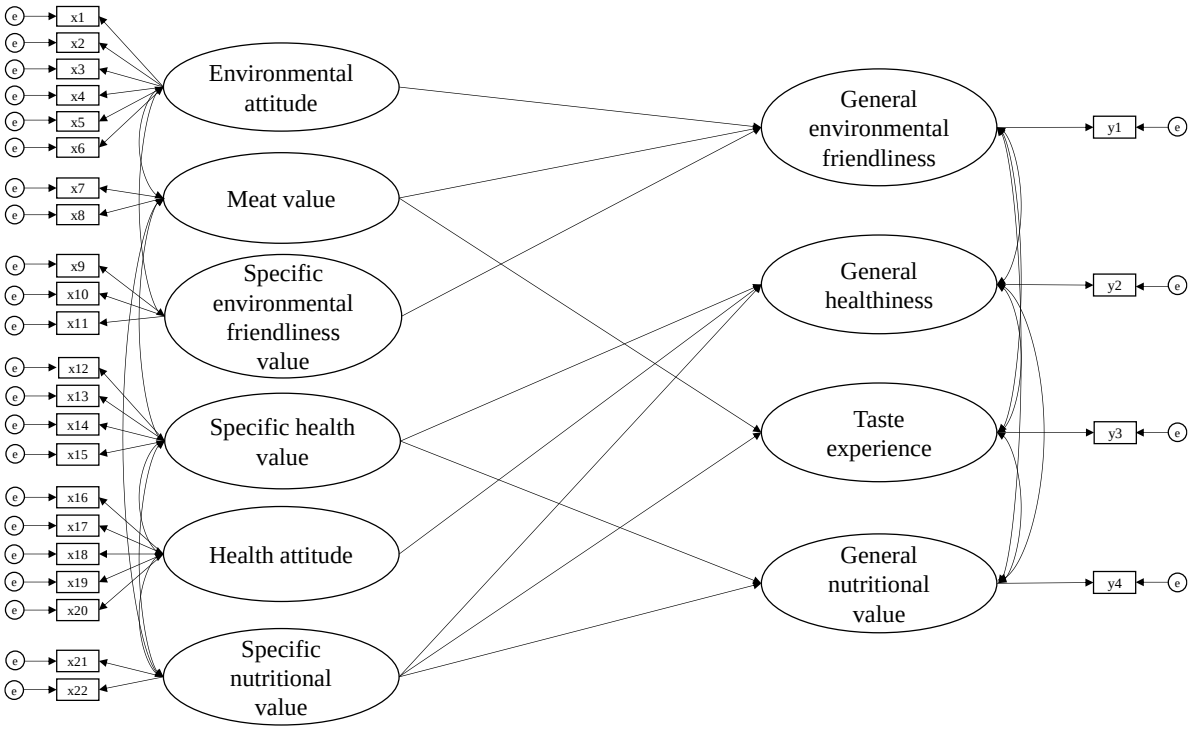

Figure 6. Measurement and structural Model: Exogenous (left side) and endogenous (right side) variables with observed variables (rectangular box), e = error.

The factors from the EFA are the exogenous variables (e.g. 'Environmental attitude'). These exogenous variables manifested in 22 different items (rectangular boxes) from the questionnaire (see left side of Figure 6). The exogenous variables affect and predict the dependent, endogenous variables, which were measured by four different items (e.g. 'perceived general healthiness', see right side of Figure 6).

The key difference between the EFA and CFA is the exploratory analysis. It does not place a priori restrictions between the observed and the latent variable. In the CFA, the researcher must make these restrictions to specify in advance several key aspects of the factor model (i.e. number of factors and patterns of indicators) (Brown, 2006, p. 20).

One purpose of this study is to test the identified latent constructs on their validity. This research assumed the perceived general EF (environmental impact was recoded) was predicted by three exogenous variables. According to the literature, the exogenous variables perceived meat value (Dagevos & Voordouw, 2013; Hertwich et al., 2009; Tilman & Clark, 2014; Tukker et al., 2011) and perceived specific EF value (Lea & Worsley, 2008; Tobler et al., 2011a) predict perceived EF. Furthermore, the environmental attitude (Kuhlemeier, Van Den Bergh, & Lagerweij, 1999; Laroche, Bergeron, & Barbaro-Forleo, 2001; Magnusson et al., 2003) influences and predicts the perceived general EF of meals.

The endogenous variable perceived in general healthiness will be predicted by two exogenous variables. As noted in the literature, the nutritional claim influences the health claim (Bailey et al., 2015; de Boer & Bast, 2015; Pludowski et al., 2013). Therefore, perceived specific nutritional value, perceived specific health value and the health attitude may affect the endogenous variable perceived general healthiness.

The independent variable perceived specific nutritional value affects the taste experience (Drewnowski & Almiron-Roig, 2010). The perceived meat value further predicts the endogenous variable taste perception (Grunert et al., 2004). Therefore, it is reasonable to assume that perceived specific nutritional value and perceived meat value are predictors of the meals' taste experience.

Two exogenous variables predict the endogenous variable and perceived general nutritional value. The perceived specific health value (Oakes, 2004) and the perceived specific nutritional value (Kang, Jun, & Arendt, 2015; Oakes, 2004) influence the dependent variable perceived general nutritional value.

5.6.3 Correlation and coherence analyses

Several correlation and coherence analyses were conducted. To explore the simple relation between the research's latent endogenous (IV) and exogenous (DV) variables, Spearman's rank correlations were calculated. To see if the exogenous variables could predict the four endogenous variables in addition to some meal characteristics and socio-demographic characteristics, multiple hierarchical regression analyses were undertaken. Additionally two dummy variables were constructed to check if the content of vegetarian, meat or fish dishes influenced the consumers' perception (independent of the meal names). The meal characteristics and socio-demographic characteristics (first step) as well as the six dependent variables (second step) illustrated the predictors.

5.6.4 Analyses with aggregated data

Because the objective data (CO_2-eq) were not based on individual levels, but rather on meal level, the subjective data was aggregated per meal and date, resulting in 41 cases/meals (the "I don't know" options were not considered). The range of the returned and filled out questionnaires per meal and date varied between 14 and 37 (M = 26.39). With this data set the consumers' perception of the four different meals (IV) were explored with ANCOVAS. The four latent factors- taste experience, perceived general healthiness, perceived general EF and perceived general nutritional value constituted the dependent variables. Additionally, the influencing factors were included as covariates (see Chapter 6.1). Further correlation analyses between the objective environmental impact and the four independent variables were conducted. This was thereby drawing on Spearman's rank correlation.

6 Results

In this chapter, the results of this study are presented. In the first section, the canteen assortment will be highlighted. Second, the descriptive statistics of the dependent variables are described. In the next section, the factor analysis will be discussed, followed by a test of the structural equation model. Hierarchical regression analyses will be introduced in order to check which factors predict the dependent variables. Finally, the objective data of the meals, gathered by the SV Group's Life Cycle Analysis, are displayed.

6.1 Canteen assortment

In this section, the popularity of the different meals is discussed. Following this, the factors that influenced the different meal choices of the participants are examined. Finally, the frequency of the visitors is investigated more closely.

6.1.1 Popularity of the different meals

The meals of the canteen Polyterrasse were not consumed with equal frequency. According to the SV-Group, the most frequently consumed and sold meals during the survey period were the meals "Home" (48.3%) and "Garden" (24.8%). The "Street" (21.2%) meal placed third. Only few people however, chose the "Local" meal (5.7%). One reasonable explanation could be the higher price of this meal. At the same time, the age and the meal choice varied significantly ($\chi^2(3) = 40.67$, $p < .001$). In other words, "Local" meal consumers were older compared to consumers of the other three meals. The number of sold meals differed significantly from each other ($\chi^2(3) = 123.43$, $p < .001$).

There is a significant difference between gender and meal choice ($\chi^2(3) = 68.45$, $p < .001$). Women (46%) chose the vegetarian meal (Garden) more often while men (36.2%) preferred meat dishes (Home). There was no statistically significant gender difference in the choice of the other two meals.

6.1.2 Influencing factors

Almost 10% ($n = 109$) of the participants indicated they were following a diet that influenced their meal choice. More than 4% of the participants ($n = 47$) chose their meal because of the intake of medicine, religious dietary guidelines or allergies. This means only a small part of the sample (14.2%, $n = 156$) could not choose spontaneously, but was restricted in their meal choice. More than 8% of the sample were vegan or vegetarian ($n = 90$). That share exceeds the average Swiss vegan-vegetarian population of approximately 5% (BAG, 2015).

6.1.3 Visiting frequency

The majority of the participants visited the Canteen Polyterrasse more than once per week (46.3%). Almost a third (31.0%) even stated they visited the canteen every weekday. Only 15.3% of the surveyed participants visit the canteen once a week. The rest of the participants (7.4%) patronize the canteen once a month. There was a significant difference between gender and frequency of visits ($\chi^2(3) = 29.12$, $p < .001$). Men visit the canteen more often (almost every weekday) than women. Expressed in numbers, more than 80% of the men indicated visiting the canteen more than once per week. Only 70% of the women visited the canteen more than once per week.

6.2 Exploratory factor analysis

As outlined in Chapter 5.6, the factorability of the 27 items on the detailed perception of the meals and on respondents' attitudes was examined in a first step. Several well-recognized criteria for the factorability of a correlation were used. The Kaiser-Meyer-Olkin (KMO) measure showed a sampling adequacy of .80, above the recommended value of .60 (Kaiser, Rice, Little, & Mark, 1974). A minimum Kaiser–Meyer–Olkin score is considered necessary to reliably use factor analysis for data analysis (Frohlich & Westbrook, 2001, p. 189).

Bartlett's test for sphericity is a measure of the degree to which the correlation matrix to be factored differs from an identity matrix (Tobias & Carlson, 1969). The Bartlett's test of sphericity (Bartlett, 1950) was significant (χ^2 (351) = 8998.19, $p < .001$), indicating the variables are correlated (Janssens, Wijnen, De Pelsmacker, & Van Kenhove, 2008). The communalities showed to be under .40 for five items. A communality of less than that may either not be related to the other items, or suggest an additional factor that should be explored (Costello & Osborne, 2005, p. 4). Therefore, the factor analysis was conducted with the remaining 22 items.

To examine the number of factors, the parallel analyses suggested by Horn (1965) was conducted. The method compares the scree plot obtained from the data to a scree plot obtained from simulated data sets of the same dimension. However, the simulated data set is generated from a population where all variables are uncorrelated (Hayton, Allen, & Scarpello, 2004; Horn, 1965; Zhang & Savalei, 2015). This method recommends to extract the number of original data's own values that are greater than the corresponding simulated data's own values (Zhang & Savalei, 2015).

The conducted parallel analysis of the researcher's data extracted a six-factor solution ('Environmental attitude,' 'Perceived meat value,' 'Perceived specific environmental friendliness value,' 'Perceived specific health value,' 'Health attitude' and 'Perceived specific

nutritional value'). Two oblique methods, varimax and oblimin, were used one after-the-other to rotate the factor loading matrix. The six-factor solution with the oblimin rotation explained 51% of the variance. An oblimin rotation provided the best-defined factor structure, thus the final solution was conducted with the oblimin method (see Appendix D, Table 16).

As outlined above, five items were eliminated because they did not contribute to a simple factor structure and failed to meet a minimum criteria of showing a primary factor loading of .40 or above (Hair, 2014). The item "Its bitterness" loaded above .30 but showed a communality less than .30. The item "Its saltiness" had a negative loading of -.36 on the factor 'Perceived specific health value.' "Its savouriness" had similar factor loadings (.39). The item "The presence of organically produced ingredients" had factor loadings of .35 on the factor 'Perceived specific EF value'. Possible reasons for a low communality and bad loadings for the above mentioned items could be high, missing values. For example 32% of the participants did not know if their meal contained organically produced ingredients. A further explanation may be problems of comprehension. Perhaps it was hard for some participants to rate the bitterness or the saltiness of their meals. Finally, the item "I eat little meat (max. once or twice a week)" had a factor loading of .39 on the 'Environmental attitude' factor (which was well defined by 6 other items). In addition, this item had a floor effect, with 49.8% of participants reporting not applying this behaviour at all.

A principle axis (PA) factoring was used because the researcher was most interested in identifying the underlying constructs in the data. Additionally, the oblique rotation ("oblimin"), which allows correlation between the factors, was conducted. All items had primary loadings over .42 and only two items had a cross-loading above .30 ("Its fat content" and "Its nutritiousness"). The textual meaning of the item "Its fat content" however made more sense on the 'Perceived specific health value' factor. The item "Its nutritiousness" had a strong primary loading of .65 on the 'Perceived specific health value' factor (see Appendix D, Table 16).

Internal consistency for each of the scales was examined using Cronbach's alpha. The alphas ranged from moderate to good (George & Mallery, 2003). The Cronbach's α for 'Perceived specific nutritional value' was .53 (2 items), for 'Perceived specific health value' .77 (4 items), and for 'Perceived meat value' .73 (2 items). The Cronbach's alphas were .61 (3 items) for 'Perceived specific EF value' and .85 for 'Environmental attitude' (six items). The last latent factor 'Health attitude' (five items) showed an alpha of .76. For any of the scales no substantial increase in alpha was achieved by eliminating more items (see Appendix B, Table 14).

6.3 Structural equation model

A structural equation model was further applied to check for construct validity and test all hypotheses (see Chapter 5.6). The fittingness of all models was evaluated running various indexes operationalized in R using the "Lavaan" package (see Rosseel, 2012). After the first calculation, some modifications were made. In particular, some correlations between the observed variables were included in the improved model.

The standardized item-estimations X_{16} and X_{17} were positively correlated (r = .35). It can reasonably be assumed the items "healthiness has little impact on people's food choice" and "concern about the healthiness of foods" correlated. Furthermore, the standardized item-estimations X_{13} and X_{21} were positively correlated (r = .33). The standardized observed variables X_2 and X_{20} were positively correlated (r = .32) too. It is logically sound if the content of calories is higher, it will lead to an increased feeling of being full. It can also be said that the nutrition content and the satiety of meals are related. Moreover, the observed variables X_7 and X_{11} were negatively correlated (r = -.30). The item X_{11} assessed "The presence of ingredients that come from far overseas." For the item X_7 "Its protein content," a few examples were given to the respondents (i.e. fish). It can reasonably be assumed that fish came mostly from overseas and this may explain the negative relation to the item X_{11}.

In the same way, two cross loadings were included in the improved model. The standardized estimations of the observed variables "Its fat content" and "Its nutritiousness" correlated positively to the latent exogenous variable perceived specific nutritional value. Figure 8 shows the improved model (see Appendix E).

To handle the missing data (missing at random, MAR), the estimation full information maximum likelihood (FIML) was used (Kline, 2011). The endogenous variables were not normally distributed, thus a robust estimation for the standard errors was used. The maximum likelihood robust "MLR" estimates maximum likelihood parameter with standard errors and a chi-square test statistic that is robust to non-normality and non-independence of observations (Rosseel, 2010). The standard errors covariance matrix of the maximum likelihood estimators is normally obtained by inverting the associated information matrix. However, robust errors replace this covariance matrix by a sandwich-type covariance matrix (Rosseel, 2012).

Chi-square tests of exact fit are of little relevance for the evaluation of the goodness of fit of a single model (Guay et al., 2015). Especially when a large sample size is used, chi-square nearly always rejects the model (Bentler & Bonett, 1980; Hooper, Coughlan, & Mullen, 2008; Iacobucci, 2010; Jöreskog & Sörbom, 1993). Thus, in this research the focus lies on approximate fit indexes that are sample size independent (e.g. Guay et al., 2015; Hu & Bentler, 1999; Marsh,

Hau, & Grayson, 2005; Marsh, Hau, & Wen, 2004). The literature suggests a model demonstrates reasonable fit when the ratio between the adjusted chi-square value and its degrees of freedom does not exceed 3.0 (Iacobucci, 2010; Kline, 2011: $\chi^2 / df \leq 3$.). The comparative fit index (CFI), the Tucker-Lewis Index (TLI), and the root mean square error of approximation (RMSEA) are additional fit indexes. Values greater than .90 for CFI and TLI are considered as an adequate model fit, however values approaching .95 are preferable. RMSEA values smaller than .06 support a good model fit (Guay et al., 2015, p. 63).

As outlined above, the chi-square test rejected the hypothesized model, because the sample size was very large ($\chi^2(274) = 1263.33$, $p < .001$). Moreover, the ratio between the chi-square value and its degrees of freedom was 4.61. Besides, the comparative fit index (CFI = .89) and the Tucker-Lewis Index (TLI = .86) showed moderate fit indexes (Jackson, Gillaspy Jr, & Purc-Stephenson, 2009). The root mean square error of approximation (RMSEA = .057) suggested a reasonable model fit. Figure 7 shows the results obtained from the analyses of SEM.

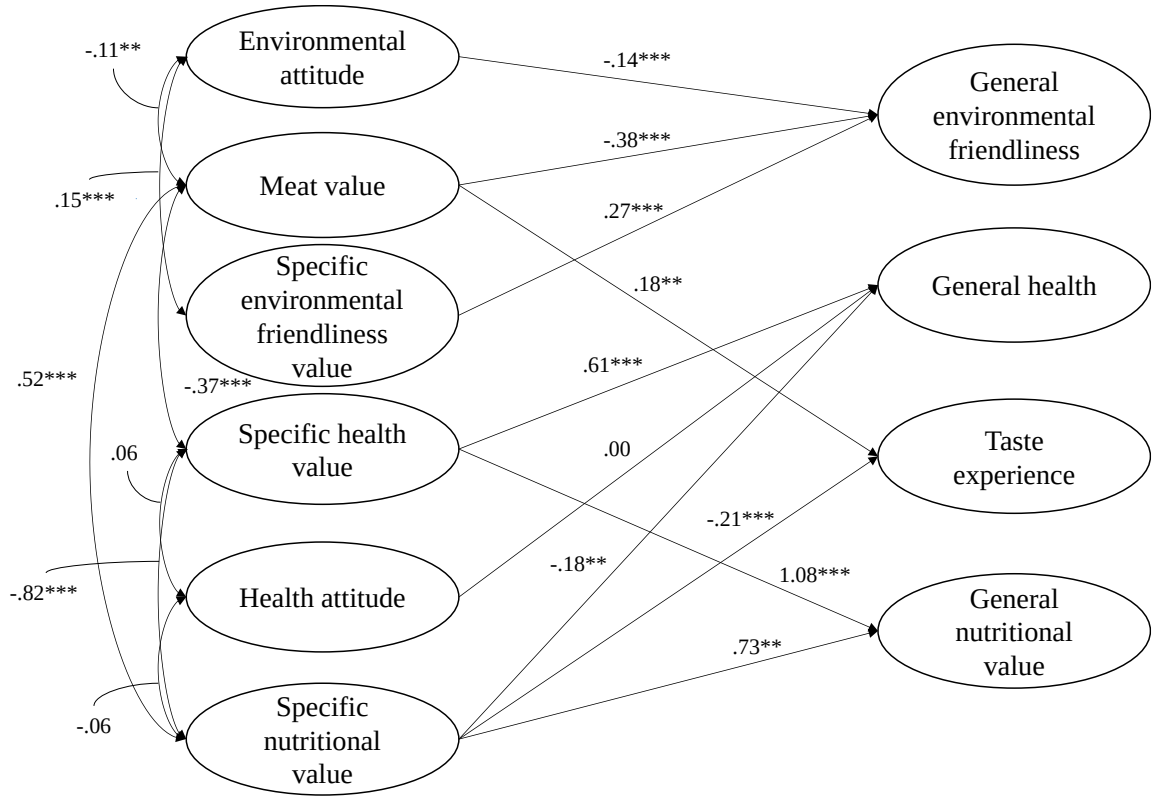

Figure 7. Standardized solutions from the structural equation model to verify the construct validity, * $p < .05$, ** $p < .01$, *** $p < .001$.

Figure 7 demonstrates that almost all exogenous variables influenced the endogenous variables. One exception is health attitude, which did not predict the perceived general healthiness estimation of the consumed meal. It is possible this exogenous construct measured something else than the perceived general health awareness. This construct was further not correlated with the exogenous variables perceived specific health value and perceived specific

nutritional value. This indicates the exogenous construct health attitude manifests something else (discriminant validity). Moreover, the relatively large standardized parameters of perceived specific health value and perceived specific nutritional value on perceived general nutritional value imply these two exogenous constructs measured the same (convergent validity). The large covariance between these two independent variables confirms this. In summary, the results indicated exogenous variables predicted endogenous constructs accurately. Therefore the construct validity is given.

6.4 Descriptive statistics

Table 2 illustrates the descriptive statistics of the dependent variables- perceived taste, perceived general EF**,** perceived general healthiness and perceived general nutritional value of the consumed meal.

Table 2.

Descriptive statistics of the dependent variables

	N	Missing	*M*	*SD*	Skewness (*SE*)	Kurtosis (*SE*)
Perceived taste experience	1101	0	6.48	1.78	-0.73 (0.07)	0.61 (0.15)
Perceived general healthiness	1101	0	5.61	2.26	-0.25 (0.07)	-0.64 (0.15)
Perceived general EF	1101	0	5.79	2.07	0.05 (0.07)	-0.73 (0.15)
Perceived general nutritional value	1101	0	4.69	1.94	-0.48 (0.07)	-0.21 (0.15)

Note. Rating scale range from 0 to 10.

Three of the four dependent variables (perceived taste experience, perceived general healthiness and perceived general nutritional value) held asymmetric distributions. Three variables (perceived general healthiness, perceived general EF and perceived general nutritional value) were negatively skewed, corresponding with the high mean. The kurtosis for three variables (perceived general health, perceived general EF and perceived nutritional value) are platykurtic. "The platykurtic distribution is characterized by a low degree of peakedness," (Sheskin, 2004, p. 22).

In other words, the distribution curves are short and relatively dispersed, meaning many scores are around the middle score (Jackson, 2014). The mean of the perceived taste compared to the other three means was high, whereas the mean of the perceived general EF was rather low.

In Table 3, the descriptive statistics of the six independent variables are shown. The majority of the variables (perceived specific nutritional value, perceived specific health value,

perceived specific EF value and environmental attitude) were skewed negatively. Additionally, four latent variables were characterized by a platykurtic distribution. Only one factor (perceived health attitude) showed a relatively normal distributed curve. Compared to the other five latent variables, perceived specific nutritional value had the highest mean. Moreover, the mean of the perceived meat value was the lowest of all variables.

Table 3.

Descriptive statistics of the extracted factors (independent variables)

	N	Missing	*M*	*SD*	Skewness (*SE*)	Kurtosis (*SE*)
Perceived meat value	1018	83	3.83	1.78	-0.03 (0.08)	-1.22 (0.15)
Environmental attitude	1084	17	3.90	1.27	-0.14 (0.07)	-0.56 (0.15)
Perceived specific EF value	1101	0	4.26	1.27	-0.27 (0.07)	-0.38 (0.15)
Perceived specific health value	1039	62	4.27	1.11	-0.24 (0.08)	0.29 (0.15)
Health attitude	1074	27	4.02	1.09	-0.20 (0.08)	0.02 (0.15)
Perceived specific nutritional value	1009	92	5.12	1.08	-0.48 (0.08)	-0.06 (0.15)

Note. Rating scales range from 1 to 7.

To sum up, the distribution of the dependent variables do not perfectly reflect the assumptions of a normal distribution. Thus, for all further calculations, robust and non-parametric analyses were conducted.

Table 4 presents an overview of the intercorrelation between the dependent and independent variables. What was interesting, was that taste experience showed a significant positive correlation with perceived general healthiness and perceived specific health value of the consumed meal. Perceived taste was positively correlated with perceived nutritional value, perceived meat value and perceived general value. Surprisingly, there was a significant positive relation between perceived general healthiness and perceived general EF as well as perceived specific EF value. Perceived general nutritional value and perceived specific health value were both highly positively correlated with perceived general healthiness. Perceived meat value and perceived specific nutritional value negatively correlated with the dependent variable perceived general healthiness of meals.

Table 4.

Overview of the Spearman intercorrelations between the dependent and independent variables

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Taste	-									
2. General healthiness	.28***	-								
3. General EF	-.03	.21**	-							
4. General nutritional value	.25***	.40***	-.02	-						
5. Meat value	.11***	-.27***	-.32***	.04	-					
6. Environmental attitude	-.01	.08*	-.04	.05	-.09**	-				
7. Specific EF value	.10***	.10**	.18***	.09**	-.01	.09**	-			
8. Specific health value	.16***	.75***	.23***	.45***	-.25***	.12***	.12***	-		
9. Health attitude	-.06*	.03	-.04	-.05	-.07*	.31***	-.01	.06	-	
10. Specific nutritional value	.11**	-.31***	-.17***	.07*	.33***	.00	.09**	-.30***	-.03	-

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 4 also shows the endogenous variable perceived general EF was negatively correlated with perceived meat value and perceived specific nutritional value. At the same time, the independent variables perceived specific EF value and perceived specific health value were positively correlated with perceived EF of meals. The significant positive intercorrelation between perceived general nutritional value and perceived specific health value is another interesting observation. There was, a significant positive correlation between perceived meat value and perceived specific nutritional value. Perceived specific health value on the other hand, was negatively correlated with perceived meat value. The results of the correlational analysis also showed health attitude and environmental attitude were positively correlated. Finally, the independent variables perceived specific health value and perceived specific nutritional value were negatively correlated. The remaining correlations from Table 4 did not show statistically significant relationships. Overall, correlations need to be interpreted with caution. Correlations only describe linear relationships and no causation (Simon, 1954; Wright, 1921). Reasonable explications and interpretations for these correlations were made in the discussion.

6.5 Hierarchical regression analyses

Four observed variables (X_9, X_{10}, X_{11}, and X_{22}) had significant missing data (over 10%). Therefore, a data imputation was performed. For this purpose, the Expectation-Maximization (EM) algorithm was used. To check if the missing data was completely at random (MCAR), the Little MCAR test was used. If the test shows no significance, the missing data is completely at random, χ^2 (28) = 38.93, p = .08 (Little, 1988). Data EM algorithm predicts the missing values and has some advantages. It minimizes bias and uses the available data that would otherwise be discarded (Scheffer, 2002, p. 156).

6.5.1 Perceived general environmental friendliness

To see what the specific predictors of the meal's perceived general EF were, a regression analysis was performed. Table 5 provides the results obtained from the preliminary regression. In a first step, the demographics and the different meal types were tested. More than ten percent of the variance of perceived general EF could be explained by the demographics and the different meals. In a second step the six independent perception and attitude variables were included in the model. This improved the model significantly and explained an additional seven percent of the variance of perceived general EF.

Table 5.

Hierarchical regression analyses predicting perceived general environmental friendliness

	Step 1			Step 2		
Predictors	*B*	*SE B*	β	*B*	*SE B*	β
Constant	3.93***	0.39		4.08***	0.70	
Gender (1=male)	0.27	0.15	.06	0.13	0.15	.03
Age	0.00	0.02	.00	0.01	0.01	.03
Field of study FS/ES[1]	-0.26	0.24	-.04	-0.08	0.23	-.01
Complete (1=yes)[2]	0.48	0.28	.06	0.45	0.27	.05
Employee[3]	0.15	0.30	.02	0.23	0.29	.03
External[3]	0.31	0.65	.02	0.35	0.63	.02
Local[4]	0.13	0.25	.02	-0.37	0.25	-.06
Garden[4]	0.83	0.32	.19**	0.57	0.31	.13
Street[4]	0.04	0.19	.01	0.27	0.19	.06
Vegi[5]	0.78	0.27	.18**	0.18	0.29	.04
Fish[5]	-0.08	0.23	-.01	0.01	0.23	.00
Meat value				-0.19	0.05	-.16***
Environmental attitude				-0.14	0.05	-.08*
Specific EF value				0.34	0.05	.21***
Specific health value				0.20	0.07	.11**
Health attitude				-0.06	0.06	-.03
Specific nutritional value				-0.17	0.07	-.09*
R^2		.12			.19	
ΔR^2		.12***			.07***	
F(*df1*,*df2*)		10.59*** (11,867)			13.18*** (6,861)	

Note. $N = 880$, [1]FS/ES = Food / Environmental Science (1 = yes, 0 = no), [2]Already completed the questionnaire, [3]Dummy variable with being a student as a reference group, [4]Dummy variable with being Garden as a reference group, [5]Dummy variable with being meat meals as reference group,
* $p < .05$, ** $p < .01$, *** $p < .001$.

The results obtained from the analysis suggest perceived meat value and perceived environmental attitude predicted perceived general EF of consumed meals negatively. This influenced the latent variable perceived specific EF value- the dependent variable perceived

general EF as significantly positive. What is interesting is the perceived specific health value positively affected the perceived general EF. Surprising was the independent variable perceived specific nutritional value influenced the perceived general EF significantly negatively. Explanations and interpretations will be made in the discussion.

6.5.2 Perceived general healthiness

Another regression analyses was done to see what the specific predictors of the dependent variable- perceived general healthiness, were. Table 6 shows the results obtained from the hierarchical regression. As the first step using the control variables, the demographics and different type of meals were tested. As shown in Table 6, almost a third of the variance of the perceived general healthiness were explained though these variables. The latent exogenous variables were included as a next step. Also here, the six independent variables improved the model significantly by explaining almost a third of the criterions' variance. Both coefficients of determination implied large effects (Cohen, 1992).

Table 6.

Hierarchical regression analyses predicting perceived general healthiness

	Step 1			Step 2		
Predictors	*B*	*SE B*	β	*B*	*SE B*	β
Constant	4.92***	0.39		0.67	0.54	
Gender (1=male)	0.31	0.15	.06*	0.08	0.12	.02
Age	0.00	0.02	.00	0.00	0.01	.01
Field of study FS/ES[1]	0.47	0.24	.06*	0.26	0.18	.03
Complete (1=yes)[2]	0.03	0.27	.00	-0.19	0.21	-.02
Employee[3]	-0.41	0.29	-.05	-0.16	0.22	-.02
External[3]	0.98	0.65	.05	0.85	0.48	.04
Local[4]	1.12	0.25	.15***	-0.16	0.20	-.02
Garden[4]	-0.70	0.31	-.14*	-0.51	0.24	-.10*
Street[4]	-1.47	0.18	-.30***	-0.43	0.15	-.09**
Vegi[5]	2.40	0.27	.52***	0.79	0.22	.17***
Fish[5]	-0.32	0.23	-.04	0.02	0.18	.00
Meat value				-0.01	0.04	-.01
Environmental attitude				-0.05	0.04	-.03

	Step 1			Step 2		
Predictors	*B*	*SE B*	β	*B*	*SE B*	β
Specific EF value				0.06	0.04	.03
Specific health value				1.38	0.06	.67***
Health attitude				-0.06	0.05	-.03
Specific nutritional value				-0.17	0.05	-.08**
R^2		.28			.60	
ΔR^2		.28***			.32***	
F(*df1*,*df2*)		30.91*** (11,867))			114.44*** (6,861)	

Note. *N* = 880, [1]FS/ES = Food / Environmental Science (1 = yes, 0 = no), [2]Already completed the questionnaire, [3]Dummy variable with being a student as a reference group, [4]Dummy variable with being Garden as a reference group, [5]Dummy variable with being meat meals as reference group,
* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 6 shows that being male and students from the FS/ES were positively related to the healthiness perception of meals. Additionally, the independent latent variable perceived specific health value changed the perceived general healthiness significantly positively. At the same time, the independent variable perceived specific nutritional value was negatively related to the criterion perceived general healthiness. Health attitude did not influence the perceived general healthiness significantly. Further interpretations are given in the following chapter.

6.5.3 Taste experience

In a third hierarchical regression analysis, it was checked to see if the independent variables had an influence on the criterion perceived taste experience. The same approach was used as above. In a first step the demographical variables and meal types were tested. Only a small share of the variance of the perceived taste experience explained the control variables. Second, the six independent variables were included in the model. Ten percent of the variance of the criterion was explained through these six exogenous variables. The results obtained from the regression analysis are presented in Table 7.

Table 7.

Hierarchical regression analyses predicting taste experience

	Step 1			Step 2		
Predictors	*B*	*SE B*	β	*B*	*SE B*	β
Constant	6.68***	0.36		2.76***	0.63	

	Step 1			Step 2		
Predictors	*B*	*SE B*	β	*B*	*SE B*	β
Gender (1=male)	-0.13	0.14	-.03	-0.17	0.14	-.04
Age	-0.01	0.01	-.03	-0.01	0.01	-.03
Field of study FS/ES[1]	-0.10	0.22	-.02	-0.13	0.21	-.02
Complete (1=yes)[2]	-0.03	0.25	.00	-0.04	0.24	-.01
Employee[3]	-0.17	0.27	-.03	-0.15	0.26	-.02
External[3]	0.33	0.60	.02	0.22	0.57	.01
Local[4]	0.68	0.23	.11**	0.17	0.23	.03
Garden[4]	-0.21	0.29	-.05	-0.05	0.28	-.01
Street[4]	0.49	0.17	.12**	0.90	0.17	.23***
Vegi[5]	0.05	0.25	.01	-0.27	0.26	-.07
Fish[5]	-0.18	0.21	-.03	0.18	0.21	.03
Meat value				0.08	0.05	.08
Environmental attitude				0.01	0.05	.01
Specific EF value				0.17	0.05	.12**
Specific health value				0.53	0.07	.32***
Health attitude				-0.09	0.06	-.05
Specific nutritional value				0.17	0.06	.11**
R^2		.03			.13	
ΔR^2		.03**			.10***	
F(*df1*,*df2*)		2.53** (11,867)			15.93*** (6,861)	

Note. $N = 880$, [1]FS/ES = Food / Environmental Science (1 = yes, 0 = no), [2]Already completed the questionnaire, [3]Dummy variable with being a student as a reference group, [4]Dummy variable with being Garden as a reference group, [5]Dummy variable with being meat meals as reference group,
* $p < .05$, ** $p < .01$, *** $p < .001$.

As Table 7 shows, three predictors were significantly related to taste experience. Interestingly, the perceived specific EF value and the perceived specific health value determined the endogenous variable perceived taste experiences significantly positively. Moreover, the exogenous variable perceived specific nutritional value influenced the perceived taste experience significant positive. Additionally explanations and reasons for that result are given in the discussion.

6.5.4 Perceived general nutritional value

The last hierarchical regression analysis was conducted to check if the six independent predictors influence the dependent variable perceived general nutritional value. For the demographical variables and different meal types were controlled in a first step. Almost a tenth of the variance of the criterion explained these variables. In a second step, the six predictors were included in the model. This step improved the model significantly by explaining 26% of the variance of perceived general nutritional value. Table 8 provides the results from the regression analysis.

Table 8.

Hierarchical regression analyses predicting perceived general nutritional value

	Step 1			Step 2		
Predictors	*B*	*SE B*	β	*B*	*SE B*	β
Constant	5.80***	0.38		-0.41	0.60	
Gender (1=male)	0.22	0.15	.05	0.20	0.13	.05
Age	-0.01	0.01	-.02	-0.01	0.01	-.03
Field of study FS/ES[1]	0.29	0.23	.04	0.10	0.20	.01
Complete (1=yes)[2]	-0.37	0.27	-.05	-0.45	0.23	-.06*
Employee[3]	-0.40	0.29	-.06	-0.34	0.25	-.05
External[3]	-0.25	0.63	-.01	-0.45	0.54	-.03
Local[4]	0.93	0.24	.15**	0.35	0.22	.05
Garden[4]	-0.62	0.31	-.15*	-0.21	0.27	-.05
Street[4]	-0.79	0.18	-.19***	-0.14	0.16	-.03
Vegi[5]	1.01	0.26	.25**	0.27	0.25	.07
Fish[5]	-0.43	0.22	-.07	-0.01	0.20	.00
Meat value				0.11	0.04	.10*
Environmental attitude				0.02	0.05	.01
Specific EF value				-0.04	0.05	-.03
Specific health value				1.03	0.06	.58***
Health attitude				-0.12	0.05	-.07*
Specific nutritional value				0.41	0.06	.23***
R^2		.08			.33	

	Step 1			Step 2		
Predictors	*B*	*SE B*	β	*B*	*SE B*	β
ΔR^2	.08***			.25***		
F(*df1*,*df2*)	6.84*** (11,867)			54.84*** (6,861)		

Note. N = 880, [1]FS/ES = Food / Environmental Science (1 = yes, 0 = no), [2]Already complete the questionnaire, [3]Dummy variable with being a student as reference group, [4]Dummy variable with being Garden as reference group, [5]Dummy variable with being meat meals as reference group,
* $p < .05$, ** $p < .01$, *** $p < .001$.

As seen in Table 8, four predictors influenced the perceived general nutritional value significantly. Especially the independent variables perceived specific health value and perceived specific nutritional value were significantly positively related to the perceived general nutritional value. Additionally, the predictor perceived meat value took a positive influence on the criterion perceived nutritional value. On the reverse side, the predictor variable health attitude was affecting the perceived general nutritional value significantly negatively. For more interpretations and reasonable explanations see the subsequent chapter.

6.6 Differences in perceptions between the four meal types

This section evaluates the consumers' perception of the four different meals regarding the perceived general healthiness, perceived taste and perceived general nutritional value. The next paragraphs explains the results closer. The four meals differ significantly regarding the perception of the general healthiness among the participants, ($F(3,37) = 9.42$, $p < .001$, $\eta_p^2 = .43$). Table 9 illustrates the outcome more in detail.

Table 9.

Descriptive statistics of perceived general healthiness of the four meals

			CI 95%	
	M	*SE*	*LL*	*UL*
Home	5.12	0.24	4.60	5.65
Local	6.29	0.52	4.85	7.73
Garden	6.89	0.19	6.46	7.32
Street	4.59	0.48	3.53	5.66

Note. N = 41, scale range from 1 to 10, Cl = confidence interval; LL = lower limit, UL = upper limit.

As can be seen from the table above, "Garden" meals were perceived healthier than the two other meals (Home and Street). "Local" meals are second in line regarding the perceived general healthiness. "Home" and above all "Street" meals are perceived as the unhealthiest meals. Post hoc analyses indicated that especially "Garden" meals were perceived significant

healthier compared to "Home" and "Street" meals. No statistical differences in the perceived general healthiness were found between "Local" and "Garden" meals. Correspondingly, none of the influencing factors had an effect on the perceived general healthiness.

The meals from the canteen Polyterrasse differ statistically significant regarding the perceived taste experience ($F(3,37) = 3.74$, $p = .019$, $\eta_p^2 = .23$). Table 10 shows the results in detail.

Table 10.

Descriptive statistics of taste experience of the four meals

			CI 95%	
	M	*SE*	*LL*	*UL*
Home	6.24	0.12	5.97	6.51
Local	6.82	0.28	6.03	7.61
Garden	6.26	0.20	5.82	6.70
Street	6.84	0.13	6.55	7.13

Note. $N = 41$, scale range from 1 to 10, Cl = confidence interval; LL = lower limit, UL = upper limit.

The table above shows no big differences in the means of the different meals. However, it can be seen that "Street" meals were perceived better in taste than "Home" meals. If the post hoc analyses were considered, there are no statistical differences between the four meals. Furthermore, none of the influencing factors affected the perceived taste experience.

Assessing the nutritional value, the meals differ significantly ($F(3,37) = 5.46$, $p = .003$, $\eta_p^2 = .31$). The results of the ANCOVA are summarized in Table 11.

Table 11.

Descriptive statistics of perceived general nutritional value of the four meals

			CI 95%	
	M	*SE*	*LL*	*UL*
Home	5.70	0.15	5.38	6.03
Local	6.56	0.10	6.27	6.84
Garden	6.13	0.13	5.83	6.42
Street	5.33	0.28	4.73	5.94

Note. $N = 41$, scale range from 1 to 10, Cl = confidence interval; LL = lower limit, UL = upper limit.

From the table above we can see that "Local" and "Garden" meals were perceived as richest in nutrition, followed by the "Home" and "Street" meals. Further Bonferroni analysis implied that especially "Street" meals were perceived as significant poorer in nutrition than "Local" meals. The latter two meals did not differ statistically significantly. The influencing

factors did not affect the perceived nutritional value either. More interpretations will be given in the discussion

6.7 Assessment of the environmental impact

This paragraph examines the relationship between the actual environmental impact and the four general perception variables from the survey. The correlation between perceived general EF and environmental impact (kg CO_2-equivalent) was highly significant (r_s = -.59, p < .001). The perceived general healthiness was also significant negatively correlated to the actual environmental impact (r_s = -.45, p = .003). The perceived taste experience (r_s = .16, p = .31) and the perceived general nutritional value (r_s = -.11, p = .47) however, were not statistically significantly correlated to the actual environmental impact. To see how the number of sold meals are related to the four endogenous variables, further correlation analyses were calculated. The relation between the total number of sold meals and the perceived general nutritional value was significant negative (r_s = -.38, p = .01). Also the perceived general healthiness was significant negatively correlated to the number of sold meals (r_s = -.38, p = .02). Not statistically significant were the relations between perceived taste experience (r_s = -.27, p = .09) and the perceived general EF (r_s = -.15, p = .36) in regard to the number of sold meals.

In a next step, the four meals were compared on their actual environmental impact. The meals were significantly different regarding the objective environmental impact (F(3,37) = 8.93, p < .001, η_p^2 = .42). Table 12 gives an overview of objective environmental impacts of the meals.

Table 12.

Descriptive statistics of the objective environmental impact on the four meals

			CI 95%	
	M	*SE*	*LL*	*UL*
Home	3.10	0.16	2.74	3.45
Local	3.36	0.27	2.62	4.10
Garden	2.13	0.04	2.04	2.22
Street	2.63	0.21	2.16	3.10

Note. N = 41, scale range from 1 to 10, Cl = confidence interval; LL = lower limit, UL = upper limit.

As shown in Table 12 "Home" and "Local" meals typically had the highest impact on the environment. Compared to that "Garden" meals, had the lowest environmental impact (probably because they are vegetarian). Surprisingly, "Street" meals were third in line. Further, post hoc analyses indicated that "Garden" meals had significant lower environmental impact than "Home" and "Local" meals.

Regarding the perceived general EF among participants, the meals differed statistically significant ($F(3,37) = 17.09$, $p < .001$, $\eta_p^2 = .58$). Table 13 gives an overview of the ANCOVA analysis.

Table 13.

Descriptive statistics of perceived general EF of the four meals

			CI 95%	
	M	*SE*	*LL*	*UL*
Home	4.24	0.14	3.93	4.56
Local	4.24	0.34	3.31	5.18
Garden	5.66	0.10	5.43	5.88
Street	4.23	0.21	3.76	4.70

Note. $N = 41$, scale range from 1 to 10, Cl = confidence interval; LL = lower limit, UL = upper limit.

Similar to the objective data, "Garden" meals were, compared to the other three meals, rated as the environmental friendliest. "Home", "Local" and "Street" meals however did not differ in their means. The influencing factors did not affect the perceived general EF (see section 6.2.4). More potential explanations are integrated into the discussion.

7 General discussion

In this section the results will be summarized and interpreted in the context of current research. Limitations, further research and strengths of the study will then be discussed. The implication for practical application will be presented before a final conclusion will be drawn.

7.1 Relationship between health and EF perception of meals

Consumers make daily food choices and therefore important environmental and health decisions. To improve consumers' ability to make healthier and environmental friendlier food choices, it is crucial to understand these underlying relationships. However, as outlined above very little is known about the relationship between the perceived EF and perceived healthiness of foods. Given this position, the first hypothesis assumes that the perceived environmental friendliness is positively related to the perceived healthiness of meals. The findings of the present confirm this relationship.

7.1.1 Perceived general environmental friendliness

The correlation analyses showed a significant positive relation between the dependent variables perceived general EF and perceived general healthiness (r_s = .21). This correlation means environmental friendly meals were perceived as healthy among consumers. However, according to the item sequence in the questionnaire is the explanation that the perceived general healthiness of a meal influenced the perceived general EF more likely. Therefore, no causal conclusions can be made.

Further results from the regression analyses also support and confirm the found association between perceived general EF and perceived healthiness of meals. It could be shown that the perceived specific health value and the perceived specific nutritional value influenced the perceived general EF. In other words, the meal was rated as environmental friendlier, when the participants perceived the meals low in fat content, high in healthiness, high in nutrition and high in vitamin and mineral content. Moreover, the lower the meals were rated in satiety and in calories, the more participants perceived their meals as environmental friendly. However, the results showed rather small effects. It seems that consumer tend to generalise their general health perception of foods to the perceived general EF of foods. A possible explanation might be that the consumers rely on simple heuristics (i.e. health halo effect). These results corroborate the ideas of Schuldt and Hannahan (2013), who suggested that foods bearing "healthy" in a positive light, consumers generalize this to other aspects of these foods. In addition, the perceived environmental attitude influenced the perceived general EF of meals significantly negative. That is the higher the environmental interest (e.g. "I eat only seasonal fruits and vegetables"), the

higher the perceived environmental impact of meals. One possible explanation might be that consumers who show daily environmental friendly behaviours rate meals' environmental impact more accurate. Nevertheless, the found regression coefficient is small (β = -.08). Already small differences become significant if the sample size is big enough (Sullivan & Feinn, 2012).

The next paragraphs highlight further results found. The regression analyses showed that the perceived meat value had a negative influence on the perceived general EF of meals. That is the higher the participants' ratings of the meat and protein content of their meal, the higher the perceived environmental impact of the meal. This result may be explained by the fact that the consumers are aware that meals with meat content impact the environment badly. These findings are in line with those of previous studies, which argued that meat consumption is related to higher environmental impact (Dagevos & Voordouw, 2013; Hertwich et al., 2009; Tilman & Clark, 2014; Tukker et al., 2011). Another important finding was that the perceived specific EF value influenced the perceived general EF positively. On one side, high values on regionality and seasonality of ingredients increased the perceived general EF ratings. On the reverse side, high values on the presence of ingredients from overseas resulted in lower perceived general EF ratings among consumers. That is, regional, seasonal and domestic ingredients influence the perceived general EF of meals among consumers positively and need therefore to be highlighted in information campaigns. It is possible, therefore, that consumers are were well aware that the seasonality and the regionality are important criteria for a sustainable and environmental friendly diet. These results seem to be consistent with other research, which found that consumers rated domestic products as more environmental friendly than imported products (Tobler et al., 2011b). The idea that eating seasonal vegetables are better for the environment (Jungbluth et al., 2012) can be confirmed.

Summed up, there are important factors which influence the perceived general EF of meals. It seems that especially perceived meat content, seasonality and regionality of the ingredients as well as fat, mineral and vitamin content of meals are the most important determinants of the perceived general EF of meals among consumers. Moreover, given the first hypothesis that perceived EF and the perceived general healthiness of meals are positively related could be confirmed. Furthermore, only 19% of the variance of the perceived general EF of meals could be explained by the six predictors. That is implying that further constructs needed to be examined. Nevertheless, respondents did generalize the perceived healthiness of their meal to the perceived environmental friendliness of meals. Still, further empirical longitudinal research needs to examine the impact of the health halo effect as well as the links between perceived EF and perceived healthiness of meals.

7.1.2 Perceived general healthiness

A large number of people are overweight or obese because of an increasing demand for diets high in processed foods, refined sugars, refined fats, oils and meats (Ng et al., 2014; Tilman & Clark, 2014). As outlined above, there is evidence for the relationship between perceived EF and perceived healthiness among meals. However, what are the protruding factors influencing the perception of healthy meals?

The correlation analyses showed that especially perceived general nutritional value influenced the general healthiness perception of meals significantly positive That is, higher ratings of nutritional content of a meal resulted in a healthier meal perception among consumers. But, the opposite explanation could be truth. Namely, that perceived general healthiness of meals affected the perceived nutritional value of meals.

Further, regression analyses illustrated that especially the perceived specific health value predicted the general health perception of meals positive. That means, if visitors perceived their meals as healthy and nutritiousness as well as high in vitamins and minerals but low in fat content, meals were perceived in general as healthy. Another important finding was that the perceived specific nutritional value influenced the perceived general healthiness of meals negatively. In other words, high health ratings resulted, when the meals calories and the meals satiety perception was low. Moreover, the outlined evidence from above match those observed in earlier studies. The three most mentioned components for a healthy diet were avoiding fat, salt and sugar (Paquette, 2005). Besides, nutrient-dense foods (i.e. lean meats, fat-free and low-fat dairy products) were often used from institutions to describe and define healthy diets (Drewnowski & Fulgoni, 2008).

One unanticipated finding was that perceived meat value as well as perceived specific EF value showed significant Spearman's rank correlations with perceived general healthiness of meals. These unexpected findings suggest on the one side that meals were perceived as healthy if ratings on regionality and seasonality of its components were high and if ratings on ingredients from overseas were low. A recent study showed that a new diet (Nordic diet) based on regional foods according to seasonality is healthy (Poulsen et al., 2014). Additionally, a healthier meal perception emerged when the participants perceived the protein and meat content as low. These results are in accordance with recent studies indicating that consumption of meat is related to different diseases (Hiscott, 2015; Inoue-Choi, Sinha, Gierach, & Ward, 2016; Klurfeld, 2015; McEvoy, Temple, & Woodside, 2012). However, both found relations were supressed in the regression analysis. This may be explained by the fact that the influence of perceived meat value

as well as perceived specific EF value on perceived general healthiness of meals were explained by other variables in the regression model.

The following paragraphs discuss other important findings. Contrary to expectations the health attitude did not influence the perceived healthiness of meals. This result may be explained by the fact that consumers with high health interests dispose more health knowledge and rate their meals thus more precise regarding to the perceived general healthiness. However, to examine this assumption objective health data of the meals are necessary.

Altogether, factors like vitamin and mineral content, fat and calorie content as well as protein content influence meals' health perception among consumers. Moreover, a large part of the variance (60%) was being explained by these predictors. However, more evidence is needed to undermine this direct path between these endogenous constructs.

7.2 Taste experience

The sensory appeal is an important criterion in the meal choice for a consumer (Scheibehenne, Miesler, & Todd, 2007; Steptoe, Pollard, & Wardle, 1995). In this regard consumers prefer mostly energy-dense foods (e.g. diary and meat foods) (Drewnowski, 1997). The second hypothesis, which considers that the perceived general EF is negatively related to the taste experience of meals, was not confirmed by the findings.

Surprising is that the perceived general EF and the taste of meals were not correlated (r_s = .03). These results match those observed in earlier studies. Visschers and Siegrist (2015) argued that the taste experience may be too far detached from the environmental impact to use the former to evaluate the latter. Further findings of this study suggest the contrary to the second hypothesis. It could be shown that the perceived specific EF value influenced the taste perception positively. In other words, if the canteen visitors perceived the ingredients of the meals as regional, seasonal and domestic, higher taste experience of the just consumed meal resulted. Nonetheless, some of these items had high missing's (14% - 21%). A possible explanation for this might be that the participants had less information or knowledge about the regionality, seasonality or domestically of their meals. Besides, the results showed that the perceived specific EF value influenced the taste experience of foods positively, however the perceived general EF did not affect the taste experience. This might be explained through other predictors which are in fore by assessing the general environmental friendliness (e.g. climate change) compared to the evaluation of specific facets of the environmental friendliness (i.e. seasonality or regionality). Taken together is that consumers rely on different heuristics when evaluating general meal perceptions in comparison to specific meal perceptions. Moreover, the Spearman's rank correlations between the perceived meat value and the perceived taste experience were positive.

Therefore, participants rated the meal high in taste, when the meat and protein content of a meal were high. But the found correlation was rather small (r_s = .11). Nevertheless, these results are in accord with recent studies indicating that beef flavour is an important factor of eating quality (Dashdorj, Amna, & Hwang, 2015). Further, researchers argued that meat consumers are appreciating meat in general because of its taste (Verbeke & Viaene, 1999). However, these findings were not supported by the results of the regression analyses where the perceived meat value did not predict the perceived taste experience among consumers. A possible explanation could be that the perceived meat value was supressed by other predictors in the regression model.

Further, Magnusson et al. (2001) found that taste and health are the two most important purchase criteria for organic products. Thus, the third hypothesis of this study dealt with the relationship between the perceived general healthiness and the taste experience of meals. The correlation analysis showed that the perceived general healthiness and the taste experience are positively related. That is the respondents perceived their meals as tasty, when it was perceived as healthy. But, as mentioned above, correlations do not support casual relationships. From the regression analysis occurred a similar picture. The perceived specific health value predicted the taste experience positively. In other words, the higher the perception in healthiness, nutritiousness, vitamins and minerals, the tastier the meal perception among consumers. At the same time, higher ratings in taste experience resulted when canteen visitors perceived their meals low in fat. These findings do not support the third hypothesis which assumed that the perceived healthiness is negative related to the taste experience of meals. Furthermore, these results are not in agreement with Binkley and Golub (2011). They argued that many people view less healthy choices as more tasteful. Nevertheless, the perceived specific nutritional value influenced the meals' taste experience positively. That means, high ratings in satiety and in calories resulted in better taste perception among consumers. After all, the specific nutritional value related negatively to the perceived healthiness of meals (see previous section 7.1). Therefore, this is some evidence which supports the third hypothesis partially. That corresponds with the ideas of Raghunathan et al. (2006), who argued that consumers support the unhealthy = tasty intuition. This study showed that consumers considered unhealthy meals to be higher in taste perception.

Summed up, the found evidence suggest that the perceived EF as well as the perceived healthiness of meals are related to the meals' taste experience. In particular, the ingredients' origin (i.e. local or domestic), the ingredients' seasonality, but also the meals' satiety are factors which influence the taste perception among consumers. Additionally, vitamin and minerals, fat and calorie content seemed to influence the meals' taste experience among participants. But the

results are inconsistent and do not support the hypotheses (H2 und H3) unambiguously. Quite the opposite was the case. It seemed that the perceived specific EF value and the perceived specific health value affected the meals' taste experience positively. However, only a small part of the variance (13%) of the meals' taste experience is explained by the predictors. It is possible that judgments of tastiness may be prone to contextual impacts (e.g. Raghunathan et al., 2006). Drewnowski (1997, p. 239) argued that taste responses are affected by a range of genetic, physiological, metabolic and socioeconomic factors. Besides, the visual influences may affect the meals' ratings of the flavour of a dish (Michel, Velasco, Gatti, & Spence, 2014). This suggests further constructs with more explanation power.

7.3 Perceived general nutritional value

As outlined before, consumers prefer energy-dense foods (i.e. rich in fat and sugars) (Drewnowski, 1997). Nevertheless, the goal is to stimulate people to change their diet towards dietary recommendations (Zandstra et al., 2001). Therefore, the fourth hypothesis assumed that the perceived general nutrition value is positively related to the general health perception of meals.

The results from the regression analysis on perceived general nutritional value support this fourth assumption. The perceived specific health value influenced the perceived nutritional value positively. If the participants rated the healthiness, nutritiousness, minerals and vitamins of their meals high, then were the perceived nutrition values high. Furthermore, if the meal was perceived low in fat, then high nutritional values emerged. The correlation analysis showed the higher the ratings on the perceived general nutrition value, the higher the perceived general healthiness of meals among participants (r_s = .40). On the reverse side, the Spearman's rank correlations between specific nutritional value and the perceived general healthiness of meals were negative. In other words, the higher the participants' perception in calories and satiety, the unhealthier the ratings of their meals. A possible explanation for this might be, as mentioned earlier in this discussion, that consumers rely on different heuristics and predictors if they evaluate general meal perceptions in comparison to specific meal evaluations. Especially for the term 'nutritional value' which is applied on a broad basis and therefore defined in a vague manner. Nonetheless, the found coefficient is rather small.

Further interesting findings form the regression analyses were that the perceived specific nutritional value was positively related to the general nutritional value. That means that the more participants rated their meals rich in nutrition, the higher they perceived the calories and satiety of their meals. Also this corresponds with the results from the correlation analyses. These findings showed that the participants hold some misconceptions about nutritional value and do

not account all necessary daily nutrients. These results match those observed in earlier studies. Jones and Richardson (2007) argued that people often use one item on the nutrition label (usually fat) to rate the healthiness of a food or meal. Other researchers found that consumers' knowledge and understanding of nutrition labelling and consumers' awareness of nutrition labelling usefulness were not enough to apply the information from the nutrition labelling in daily life (K.-A. Lee, Lee, & Park, 2010). Therefore, a practical nutrition education program (e.g. traffic light) on nutrition value may increase nutrition's knowledge as well as nutrition labelling use.

Another research question tried to explore the relationship between nutritional value and taste experience of meals. Thus the fifth hypothesis assumed that the nutritional value is negatively related to the taste experience of meals among consumers. However, the results obtained from the correlation analysis showed the contrary. Therefore participants, who perceived meals higher in nutrition had higher values on the taste experience of their meals. This evidence was also supported by the regression analysis, which found, as outlined above, a positive influence from the perceived specific nutritional value towards the perceived taste experience. That implies that participants rated their meals high in taste if the calories content was high. At the same time, higher taste ratings emerged when meals are perceived high in satiety. These results are in line with those of previous studies. Binkley and Golub (2011, p.65) argued that people who ranked taste as important consumed more foods high in fat and sweeteners (see e.g. Nayga Jr., Tepper, & Rosenzweig, 1999). Besides consumers tended to rank taste over nutrition (Blanck et al., 2007). But, the mentioned studies interrogated only American households or adults. This differs from the present sample, which is mostly consisting of well-educated and undergraduate students. It may be that cultural differences (see e.g. van Trijp & van der Lans, 2007; Williams, 2005) as well as education and prior knowledge (see e.g. Wardle, Parmenter, & Waller, 2000) influence the nutritional value perception.

A further aim of this study was to explore the relationship between the perceived EF and the perceived nutritional value of foods. Hence, the sixth hypothesis of this study proposed that the perceived EF was positively related to the perceived general nutritional value of meals. The found results are rather weak, and do not support this assumption. Weak Spearman's rank correlations were found between perceived specific EF value and perceived nutritional value (r_s = .09) and can therefore be neglected. However, other interesting results were found in the regression analysis. It showed that the perceived meat value predicted the perceived nutritional value positively. The canteen visitors rated the nutritional value higher, if the meat and the protein content of their meal were perceived as higher. Van Wezemael and colleagues (2014) examined consumers' preferences for nutrition and health claims on beef. Although beef

contains important nutrients, consumer perceptions of the nutritional value of beef are not always positive. In other words, the findings of this present study do not support the sixth hypothesis adequately.

The following paragraph illustrates other important findings. It seemed that the health attitude predicted the perceived general nutritional value negatively. That is, if the health attitude was more positive, the participants perceived the nutrition of foods as less important. However, the found regression coefficient is close to zero (β = -.07) which means that consumers with high interest in nutrition evaluate their meals not healthier than consumers with a less interest in nutrition.

In sum, several relationships were examined. In particular items to healthiness, satiety, fat content, calorie content as well as mineral and vitamin content turned out to be important for the evaluation of the perceived general nutritional value. Furthermore, the findings confirmed only the fourth hypothesis, which assumed that perceived healthiness and the perceived nutritional value are positively related. The remaining two hypotheses (H5 and H6) could either not be confirmed or the found effects were too small. Nevertheless, the found evidence provides a good base for future research. Especially, further analyses with objective data of the nutritional values of the consumed meals would be necessary. Thus, more exploration is required to determine the efficacy of perceived nutritional value (e.g. nutrition profiling).

7.4 Assessment of the environmental impact

Knowledge about food products may influence consumers' behaviour as well as food evaluation. After all, the actual EF assessment of a food product is a challenge for consumers and often not directly observable. For this reason the last research question attends to the question how the perceived EF and the actual environmental impact are related. Thus, the last hypothesis was that the perceived environmental friendliness do not cohere with the actual environmental impact.

Surprisingly, the correlation between perceived general EF and environmental impact (CO_2-equivalent) was highly significant (r_s = -.59). This result indicates that the participants of this study rated the environmental friendliness of their meal relatively accurate. In other words, meals with large objective environmental impact were perceived low in EF. Thus, this evidence does not support the seventh hypothesis. However, there is no perfect correlation between the perceived EF and the environmental impact of meals, which implies that the participants still have a lack of knowledge. This is in agreement with the findings obtained from Tobler et al. (2011b), who showed that consumers' EF assessments and the LCA results differ. Nevertheless, the finding of this study showed that participants seemed to have some knowledge about the

environmental impact of meals. One reasonable explanation may be the place where the study was performed. Canteens of universities normally show well-educated visitors.

Besides, the perceived healthiness of meals is negatively related to the actual environmental impact. That is, meals perceived as healthier are objectively spoken environmental friendlier. In this context Macdiarmid (2012) arose the question if one's dietary lifestyle can be both healthful and sustainable at the same time. The author suggested different proposals which are reducing meat intake and reducing overconsumption by eating sufficient to maintain a healthy weight. Both could have benefits for health and the environment. Nevertheless, to examine if the sustainable meals of the present study are objective healthy, further research is needed.

7.5 Evaluation of the meals

The visitors seemed to be satisfied with the offer of the canteen. Thus, the taste experiences were rated high. "Home" followed by "Garden" and "Street" meals were consumed most frequently, whereas "Local" meals were fourth in line. The next paragraph evaluates the consumers' perception towards the four different meals.

"Garden" meals and vegetarian dishes influenced consumers' general EF perception significantly positive as shown by the findings from the ANCOVA analysis, the participants perceived "Garden" meals as environmental friendlier than the "Home", "Local" and "Street" meals. These results are in agreement with the ideas of Macdiarmid (2012), who suggested that a plant-based diet is beneficial for consumers' health and for the environment. In addition, balanced plant-based diet provides all required nutrients for a healthy life (Appleby, Thorogood, Mann, & Key, 1999; de Vries & de Boer, 2010). This findings are in line with the objective LCA scores. "Garden" meals were according to the LCA the environmental friendliest meals. "Street" meals are second in line according to the LCA. A possible explanation for this is that "Street" meals often contain vegetarian dishes. Recent studies indicated that vegetarian diets display the lowest GHGE (Tilman & Clark, 2014). Furthermore, showed the LCA for "Home" and "Local" meals the highest impact on the environment. One reason may be that these meals always contain meat or fish.

In addition, the consumers' health perception differed between the four meals. The analysis indicated that "Garden" meals were perceived the healthiest among the visitors. This corresponds with previous research, which showed that a plant-based diet is beneficial for consumers' health and nutrition as well as for the environment (de Vries & de Boer, 2010; Macdiarmid, 2012). This evidence was supported by further findings, which showed that especially vegetarian dishes influenced the consumers' health perception of meals significantly

positive. No statistical differences were found between "Local" and "Garden" meals regarding the perceived healthiness. The participants perceived above all "Street" meals significant unhealthier than the other two mentioned meals. One possible explanation could be that "Street" meals are quite often high fat foods (e.g. French fries as a side dish).

Further interesting findings are that especially "Local" and "Street" meals were perceived tastier than the "Home" and "Garden" meals. The ingredients of "Local" meals are local and often organic (Schmits, 2014). Thus, a reasonable explanation may be that hedonists believe that premium products must be better and taste better (Bourn & Prescott, 2002). The high ratings in taste of "Street" meals are in turn explained by the high ratings in calories content and satiety of meals. If the perceived importance of taste increases, consumers will consume a more tasteful diet which is higher in fat and sugar (Nayga Jr. et al., 1999).

Surprisingly, "Local" followed by "Garden" meals were perceived as highest in nutrition among the visitors of the canteen. More females consumed "Garden" meals, whereas older consumers preferred "Local" meals. A possible explanation for this might be that age and gender influence nutrition choices. Previous studies have found that age is associated with better nutrition choices. Moreover, tend women to be more concerned with nutrition values than men (Binkley & Golub, 2011). At the same time, "Street" meals were perceived significantly lower in nutrition than the other three meals. One possible explanation could be that "Street" meals were perceived as fattier than the other three meals. This may follow from the fact that "Street" meals often are fast foods (e.g. burger or pizza).

Further analyses showed that the number of sold meals influenced the meal perception. In particular, the correlation analyses indicated that perceived general nutritional as well as perceived general healthiness are negative related to the purchase of meals. That is consumers choose rather meals which are perceived as unhealthy and low in nutrition (e.g. see Binkley & Golub, 2011; Nayga Jr. et al., 1999; Tuorila et al., 1994). In addition, the taste experience and the perceived general EF were negatively related to the number of sold meal, however the found Spearman's rank correlations are insignificant.

Taken together, "Garden" meals scored well in perceived general EF, in perceived general healthiness and in perceived general nutritional value. "Garden" meals came off worst only in taste perception. "Local" meals were perceived high in nutrition and high in healthiness. Additionally, "Street" meals only scored high in taste experience. "Home" meals, however, were perceived averagely regarding these four aspects among the consumers. In conclusion, further research is necessary to underline these findings more in detail.

7.6 Practical implications

The results of this study revealed a positive relationship between perceived environmental friendliness and healthiness of meals. Furthermore, it could be shown that the environmental impact was very accurately perceived among the participants. In other words, the participants are mostly aware of the environmental impact of the meals they just consumed. Nevertheless, the most frequent meals consumed at the canteen Polyterrasse, the "Home" meals, mostly include meat products. In comparison to this, various studies indicated that a reduction in meat consumption is most efficient to reduce the GHGE (Baroni et al., 2007; de Vries & de Boer, 2010; Pimentel & Pimentel, 2003; Reijnders & Soret, 2003; Tilman & Clark, 2014). Additionally, reducing meat consumption may be an economic advantage for the canteens and prior studies have noted that overconsumption in meat is harmful for the health (Van Wezemael et al., 2014). But unfortunately, several reports have shown that consumers are not willing to reduce meat consumption (Lea, Crawford, & Worsley, 2006; Schösler et al., 2012). Taken together, the findings of this study suggest, that information campaigns should put the main emphasis on health benefits. Consumers perceived meals as environmental friendlier, when they were also perceived as healthier. These results suggest that simple heuristics may influence participants' meal evaluations (i.e. health halo effect). Evidently, the perceived health benefit influences the perceived environmental friendliness of meals positively. Further evidence supports this statement. This study has shown that especially vegetarian dishes, with lower environmental impact, were as perceived healthier as well as environmental friendlier. In addition, objective environmental friendlier meals were perceived as healthier among consumers. Based on the findings, the prospective selection of advertising messages, social interaction and so forth should entail the issues of health consciousness, healthy lifestyle and environmental attitudes (e.g. see Chen, 2009).

However, public communication (e.g. information campaigns) are not sufficient (Atkin, 1981) to promote environmental friendly behaviour. Obviously, there is a need for more options towards sustainable behavioural changes. Past research explored several diet changes to meet health and sustainability challenges. Such strategies are smaller portions of meat, smaller portions and eating more vegetable protein and meatless meals (i.e. "veggie-days") (de Boer, Schösler, & Aiking, 2014; Schösler, de Boer, & Boersema, 2013). Therefore, more climate-friendly meals should be introduced. Past studies have shown that the taste experience has an important influence on the food choices (Nayga Jr. et al., 1999). The present research has also displayed that the perceived taste of "Garden" meals come off badly, compared to the other meals. Thus the attention on these climate-friendly meals should revolve around the perceived

taste experience. This study has identified two important predictors, which affected the perceived taste experience. The perceived healthiness of meals (e.g. vitamin content) as well as the perceived specific environmental friendliness values of meals (e.g. seasonality of ingredients) of meals proved to be important for the formation of to the consumers' taste. Especially the vitamin, mineral and fat content as well as the regional, seasonal and the domestic sourced ingredients predicted the perceived taste experience among consumers. As a consequence, climate-friendly meals messages should advertise in the future with healthy, nutritional and environmental claims.

Still, the present study showed that factual knowledge, especially about meal-specific environmental as well as nutritional aspects, is missing. It seems that consumers rather choose meals which are perceived as unhealthy as well as low in nutrition. Furthermore, tend especially young consumers to estimate the meals' nutrition values inaccurate. There is no green label available in Switzerland that indicates the environmental footprint of food. Prior research suggested that factual knowledge about foods is crucial for consumers who want to adopt an environment-friendlier lifestyle, even if many food choices are habitual or affect driven (Köster, 2009; Siegrist, Visschers, & Hartmann, 2015, p. 37). Therefore, there is a definite need for traffic light systems or environmental labelling of foods (e.g. notation system). Past research suggested that traffic light systems helped the consumer to guide their attention to the important nutrients. In the same way, it improved the accuracy of the healthiness ratings of nutrition labels (Jones & Richardson, 2007). Further studies showed that an economic index (i.e. considers nutritional quality aspects through the products' price) for the environmental labelling of food could guide consumers towards lower impacts for a given expenditure (van der Werf & Salou, 2015). Thus to consider the zeitgeist, mobile applications, which simplify the consumers' access to make sustainable and healthy food choices, should be introduced too (e.g. eaternity[4]).

The findings of this study suggest that practical implications should include a combination between healthy diet and environmental claims. The focus of campaigns to reduce GHGE may lay in reducing meat and dairy as well as in promoting health benefits (see Macdiarmid, 2012). A further way to reduce the environmental impact of foods may be to offer more tasty climate-friendly meal choices. Similar arguments hold true for eating only seasonal, local and regional foods. In conclusion, these results provide opportunities for influencing behavioural changes in consumers towards a sustainable and healthy food choice. Besides, the named implications should complement the already broad offer of the SV-Group.

[4] http://www.eaternity.org/

7.7 Limitations and future research

This present study faced several limitations. First, the study took place at a university canteen. Therefore, the sample consisted solely out of students. At the same time, the questioned visitors were rather young and as outlined above, well-educated. Thus, the generalization of the results found to other canteens with different clientele is restricted. Further, the explanatory power of this survey is limited, because the sample was not selected completely at random. In fact, the choice of the sample was based on availability of the participants, which is called a convenient sample. Despite the fact that the survey was anonymous, social desirable responding could not been avoid totally. Further studies should take this bias into account and may insert some control questions.

Even though the construct validity of the survey was good, another restriction was the low internal reliabilities of a few constructs in this survey. The cause lies in high missing values of some specific items, which may narrow the explanatory power of the survey. Especially for specific nutritional and environmental questions (e.g. "The presence of organically produced ingredients") the participants showed problems of comprehension. At the same time, items referring to health attitude did not measure the named construct adequately. For further studies pre-test should be conducted previously to prevent such problems. Additionally, the taste experience was dependent from the food habits. Thus, the relationship between perceived taste and visiting frequency was positive. Consumers with high visiting frequency (e.g. every weekday) rated their meals better in taste. Future research may measure the perceived taste experience differently. For example, measuring the taste experience with more than one item to get an accurate rating, or consumers assess the taste, of randomly assigned meals, blind.

LCA methods are also reported to have a few limitations (e.g. Ayres, 1995; Finnveden, 2000). Especially LCA results for livestock products are to be enjoyed with caution, because the results do not include environmental consequences for land-use changes (de Vries & de Boer, 2010, p. 9). Nevertheless, LCA is the only tool available for comparing the environmental impact of products (Finnveden, 2000).

The study utilized a cross-sectional design and the study's analyses are mostly based on correlational and regressional data. Therefore, the problem of third variables, which may cause the observed associations, cannot be ruled out. Additionally, the chosen methods do not solve the problem of causation. Due to that future research should use empirical longitudinal designs with more explanatory power. Moreover, research using consistent methods, better assessment tools, and longer survey durations and targeting diverse populations is needed (Seymour, 2009).

7.8 Conclusion

Our daily food choices have huge environmental impacts. At the same time, global transition moves towards diets high in processed and energy-dense foods. As a consequence, many people have become overweight or obese. Bringing together these major challenges, the question is raised whether a healthy diet can also be an environmentally sustainable diet. Thus, to support more sustainable and healthier food choices, one prime goal of this present study was to examine the relationship between consumers' perception of the environmental friendliness and the perception of healthiness of their meals. This study's results indicated that perceived EF and perceived healthiness are positively related, which may be explained by a health halo effect. Besides, the participants seemed well-informed about the environmental impacts of their consumed meals. However, factual knowledge about meal-specific environmental as well as nutritional aspects is partially missing among consumers. Obviously, public information activities over the last years have not sufficiently transferred such important information.

The findings of this study show an important contribution to the understanding of how healthiness and environmental friendliness perceptions are related. At the same time, an unattended perspective of the gastronomy with the focus on consumers' behaviour was highlighted. The collaboration with the SV-Group, the ETH Seed Sustainability and the World Food System Center made it possible to perform a local survey with a large sample size, which raised the practical relevance of this evidence enormously. The advantage of this interdisciplinary approach was the combination of subjective and objective data measurements. Thus, the design of the project contributes to a comprehensive understanding of the studied aspects. A further important contribution of this study bared that perceived nutrition value as well as perceived taste influence the consumers' meal perception.

This research serves as a base for future studies and provides a further step to close the research gap. Taken together, these results suggest more investigations towards interventions which consider the trade-off between sustainable and healthy diets.

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Appendix A

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Scientific survey on "Eating" at the canteen Polyterrasse

Thank you for your time and for completing the questionnaire!

- Please use a black or blue pen (no pencil).
- Please complete all the questions carefully and tick only one answer per question, unless otherwise indicated.
- The completed questionnaire can be thrown in a red ballot box next to the main exit of the canteen (close to the dishes return station).
- Your answers will be managed strictly confidential!

The questionnaire will be read electronically. Therefore it's important to follow the guidelines below.

That's perfect!

☐ ☒ ☐ ☐ ☐ ☐

Please don't!

☐ ☐ ☐ ☐ ☒ ☐

Corrections can be made like this:

checked/ticked wrong — new valid answer

The survey falls within the scope of the research project „sustainable catering at the ETH Zurich" under the leadership of ETH Seed Sustainable and World Food System Center in collaboration with the SV Group.

Gian-Andrea Egeler, ETH Zürich, Institute for Environmental Decisions (IED), Consumer Behaviour, CHN J76.2

		Home	Local	Garden	Street
1.	**Which meal did you just consume?**	☐	☐	☐	☐

Please note that the following questions are about the meal you just consumed.

	Compared to other meals in the canteen…	**very low**										**very high**
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
2.	**…how satisfied are you with the taste of your meal in general?**	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3.	**…how healthy, do you think, is your meal?**	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4.	**…how high, do you think, is the environmental impact of your meal?** (environmental impact is the overall environmental burden (e.g. greenhouse gases) of a food product including production, packaging, conservation and transportation)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5.	**…how high, do you think, is the nutritional value of your meal?** (the nutritional value is the ratio of the nutrients contained in a food in relation to its energy content)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

	Compared to other meals in the canteen, how do you rate this meal regarding the following aspects?	**very low**						**very high**	**Don't know**
		1	2	**3**	**4**	**5**	**6**	**7**	
6.	Its fat content.	☐	☐	☐	☐	☐	☐	☐	☐
6.1	Its satiety.	☐	☐	☐	☐	☐	☐	☐	☐
6.2	Its savouriness (e.g. aroma).	☐	☐	☐	☐	☐	☐	☐	☐
6.3	Its bitterness.	☐	☐	☐	☐	☐	☐	☐	☐
6.4	Its saltiness	☐	☐	☐	☐	☐	☐	☐	☐
7.	Its healthiness.	☐	☐	☐	☐	☐	☐	☐	☐
7.1	Its nutritiousness.	☐	☐	☐	☐	☐	☐	☐	☐
7.2	Its vitamin and mineral contents.	☐	☐	☐	☐	☐	☐	☐	☐
7.3	Its calories.	☐	☐	☐	☐	☐	☐	☐	☐
7.4	Its protein content (e.g. meat, fish, tofu).	☐	☐	☐	☐	☐	☐	☐	☐
8.	The regionality of its different components.	☐	☐	☐	☐	☐	☐	☐	☐
8.1	The seasonality of its vegetables.	☐	☐	☐	☐	☐	☐	☐	☐
8.2	Its meat content.	☐	☐	☐	☐	☐	☐	☐	☐
8.3	The presence of ingredients that come from far overseas.	☐	☐	☐	☐	☐	☐	☐	☐
8.4	The presence of organically produced ingredients.	☐	☐	☐	☐	☐	☐	☐	☐

9.	**To what extent do the following behaviours apply to you in your daily life?**	**does not apply at all**						**fully applies**
		1	**2**	**3**	**4**	**5**	**6**	**7**
9.1	I eat little meat (max. once or twice a week).	☐	☐	☐	☐	☐	☐	☐
9.2	I eat only seasonal fruits and vegetables.	☐	☐	☐	☐	☐	☐	☐
9.3	I choose organically produced foods.	☐	☐	☐	☐	☐	☐	☐
9.4	When shopping, I prefer regional foods.	☐	☐	☐	☐	☐	☐	☐
9.5	I avoid foods, which are transported by air.	☐	☐	☐	☐	☐	☐	☐

10.	**To what extent do you agree with the following statements?**	**fully disagree**						**fully agree**
		1	**2**	**3**	**4**	**5**	**6**	**7**
10.1	The healthiness of food has little impact on my food choice.	☐	☐	☐	☐	☐	☐	☐
10.2	I eat I eat what I like and I do not worry much about the healthiness of food.	☐	☐	☐	☐	☐	☐	☐
10.3	It is important for me that my diet is low in fat.	☐	☐	☐	☐	☐	☐	☐
10.4	I am very particular about the healthiness of food.	☐	☐	☐	☐	☐	☐	☐
10.5	It is important for me that my diet is high in fibre.	☐	☐	☐	☐	☐	☐	☐

11.	**To what extent do the following statements apply to you?**	**does not apply at all**						**fully applies**
		1	**2**	**3**	**4**	**5**	**6**	**7**
11.1	In my daily life I try to behave as environmental friendly as possible.	☐	☐	☐	☐	☐	☐	☐
11.2	At the food shop I try to search for labels that guarantee a sustainable food production.	☐	☐	☐	☐	☐	☐	☐

12. **Personal details**

12.1 Gender: female ☐ male ☐

12.2 Status: student ☐ employee ☐ external/guest ☐

12.3 Birth year:	1	9		
12.4 Weight				kg
12.5 Height				cm

13. **Which factors had an influence on your meal choice?** (multiple answers allowed) — correct

13.1 Diet (e.g. to keep weight) ☐

13.2 Medicine, religious dietary guidelines, allergies (lactose, gluten, etc.) ☐

13.3 I'm a vegetarian/ vegan. ☐

14. **Do you study food sciences or environmental sciences?** yes ☐ no ☐

15. **How often do you visit the canteen?**

Once a month	Once a week	More than once a week	Every weekday
☐	☐	☐	☐

16. **Did you already complete this questionnaire during the last two weeks?**

yes	no
☐	☐

Appendix B

Table 14

Overview of the items' descriptives.

Items pro Construct	*M*	*SD*	r_{pbis}
Environmental attitude (Cronbach's α = .85, *N* = 6, *M* = 3.90, *SD* = 1.27)			
When shopping, I prefer regional foods. (x_3)	4.52	1.68	.67
At the food shop I try to search for labels that guarantee a sustainable food production. (x_6)	3.90	1.71	.67
I avoid foods, which are transported by air. (x_4)	3.88	1.71	.64
I choose organically produced foods. (x_2)	4.08	1.54	.61
In my daily life I try to behave as environmental friendly as possible. (x_5)	3.41	1.83	.60
I eat only seasonal fruits and vegetables. (x_1)	3.63	1.61	.56
I eat little meat (max. once or twice a week).[2]	3.18	2.08	.38
Perceived specific health value (Cronbach's α = .77, *N* = 4, *M* =4.27, *SD* = 1.11)			
Its healthiness.(x_{12})	4.46	1.46	.75
Its nutritiousness. (x_{13})	4.77	1.22	.43
Its vitamin and mineral contents. (x_{14})	4.09	1.50	.65
Its fat content. (x_{15}) *	3.74	1.56	.43
Its savouriness (e.g. aroma).[2]	5.00	1.30	.20
Perceived meat value (Cronbach's α = .73, *N* = 2, *M* = 3.83, *SD* = 1.78)			
Its protein content (e.g. meat, fish, tofu).(x_7)	4.30	1.76	.59
Its meat content. (x_8)	3.35	2.23	.59
Health attitude (Cronbach's α = .76, *N* = 5, *M* = 4.02, *SD* = 1.09)			
I am very particular about the healthiness of food. (x_{19})[1]	4.17	1.46	.65
I eat I eat what I like and I do not worry much about the healthiness of food. (x_{17}) * [1]	4.52	1.58	.59
It is important for me that my diet is low in fat. (x_{18})[1]	3.17	1.54	.49
The healthiness of food has little impact on my food choice. (x_{16}) * [1]	3.24	1.58	.49
It is important for me that my diet is high in fibre. (x_{20})[1]	5.02	1.45	.45

Items pro Construct	*M*	*SD*	r_{pbis}
Perceived environmental friendliness value (Cronbach's α = .57, *N* = 3, *M* = 4.26, *SD* = 1.27)			
The regionality of its different components (x_9)	3.94	1.74	.55
The seasonality of its vegetables. (x_{10})	4.20	1.71	.43
The presence of ingredients that come from far overseas. (x_{11})	4.50	1.83	.21
The presence of organically produced ingredients.[2]	3.57	1.68	.24
Perceived specific nutritional value (Cronbach's α = .53, *N* = 2, *M* = 5.12, *SD* = 1.08)			
Its calories. (x_{21})	4.97	1.36	.36
Its satiety. (x_{20})	5.27	1.28	.36
Its bitterness.*[2]	2.37	1.40	-.03
Its saltiness.*[2]	4.54	1.40	.25

Note. All items (with exeptions1) were measured on 7-Point Likert scales, higher score indicate higher expressions.
*Item was recoded.
[1]Item was from Roininen et al. (1999). The remaining items were construct by myself.
[2]Items were excluded from the analyses.

Appendix C

Table 15.

Descriptives related to the number of sold meals and environmental impact ratings of the meals on offer per day during our survey.

Day	Meal line[#]	Nr. of distributed questionnaires	Nr. of sold meals	Environmental impact		
				Meat in meal	Fish in meal	CO_2-eq (in kilograms)
1	Home	24	737	no	yes	3.08
	Local	14	147	yes	no	2.73
	Garden	29	435	no	no	4.53
	Street	14	227	no	no	2.53
2	Home	33	677	yes	no	3.63
	Garden	24	224	no	no	3.38
	Street	37	378	yes	no	3.23
3	Home	27	827	yes	no	3.13
	Garden	23	351	no	no	2.83
	Street	27	259	yes	no	2.73
4	Home	23	690	yes	no	2.73
	Local	20	156	yes	no	2.63
	Garden	29	478	no	no	3.03
	Street	28	307	yes	no	2.53
5	Home	30	781	yes	no	3.08
	Garden	29	385	no	no	3.03
	Street	28	249	no	no	2.33
6	Home	28	716	yes	no	2.18
	Garden	30	438	no	no	2.73
	Street	28	378	yes	no	2.13
7	Home	28	549	no	yes	2.38
	Local	18	171	no	yes	4.53
	Garden	28	419	no	no	2.03
	Street	25	388	yes	no	3.83
8	Home	31	715	yes	no	2.53
	Garden	23	218	no	no	2.53
	Street	26	297	no	no	1.88
9	Home	21	633	yes	no	2.08
	Local	22	238	yes	no	3.63
	Garden	35	457	no	no	2.08
	Street	25	454	no	yes	1.98

Day	Meal line[#]	Nr. of distributed questionnaires	Nr. of sold meals	Environmental impact		
				Meat in meal	Fish in meal	CO_2-eq (in kilograms)
10	Home	28	807	yes	no	3.38
	Garden	27	383	no	no	2.41
	Street	26	398	yes	no	2.73
11	Home	31	746	yes	no	3.23
	Local	23	280	no	yes	3.48
	Garden	31	196	no	no	2.13
	Street	26	84	no	no	2.28
12	Home	30	514	yes	no	3.13
	Garden	25	314	no	no	2.08
	Street	28	257	yes	no	2.08

Note. $N = 41$, [#] these are the English names of the four meal lines as they are used in the university canteen.

Appendix D

Table 16.

Factor loading matrix.

	Environmental Attitude	Specific Health Value	Meat Value	Health attitude	Specific Environmental Friendliness Value	Specific Nutritional Value
When shopping, I prefer regional foods. (x_3)	.78					
At the food shop I try to search for labels that guarantee a sustainable food production. (x_6)	.74					
I avoid foods, which are transported by air. (x_4)	.73					
I choose organically produced foods. (x_2)	.68					
In my daily life I try to behave as environmental friendly as possible. (x_5)	.62					
I eat only seasonal fruits and vegetables. (x_1)	.56					
Its healthiness.(x_{12})		.84				
Its vitamin and mineral contents. (x_{14})		.75				
Its nutritiousness. (x_{13})		.65				-.*36*
Its fat content.* (x_{15})		.46				-.*42*
Its protein content (e.g. meat, fish, tofu).(x_7)			.88			
Its meat content. (x_8)			.68			
I am very particular about the healthiness of food. (x_{19})				.74		
I eat I eat what I like and I do not worry				.71		

	Environmental Attitude	Specific Health Value	Meat Value	Health attitude	Specific Environmental Friendliness Value	Specific Nutritional Value
much about the healthiness of food.* (x_{17})						
It is important for me that my diet is low in fat. (x_{18})				.58		
It is important for me that my diet is high in fibre. (x_{20})				.55		
The healthiness of food has little impact on my food choice.* (x_{16})				.55		
The regionality of its different components (x_9)					.87	
The presence of ingredients that come from far overseas. (x_{11})					.51	
The seasonality of its vegetables. (x_{10})					.48	
Its calories. (x_{22})						.66
Its satiety. (x_{21})						.59
% explained variance	.13	.10.	.10	.06	.06	.06

Note. The italic factor loadings are factor loadings over.30, the other are suppressed, the values in parentheses (x) are related to the observed variables, *Item was recoded.

Appendix E

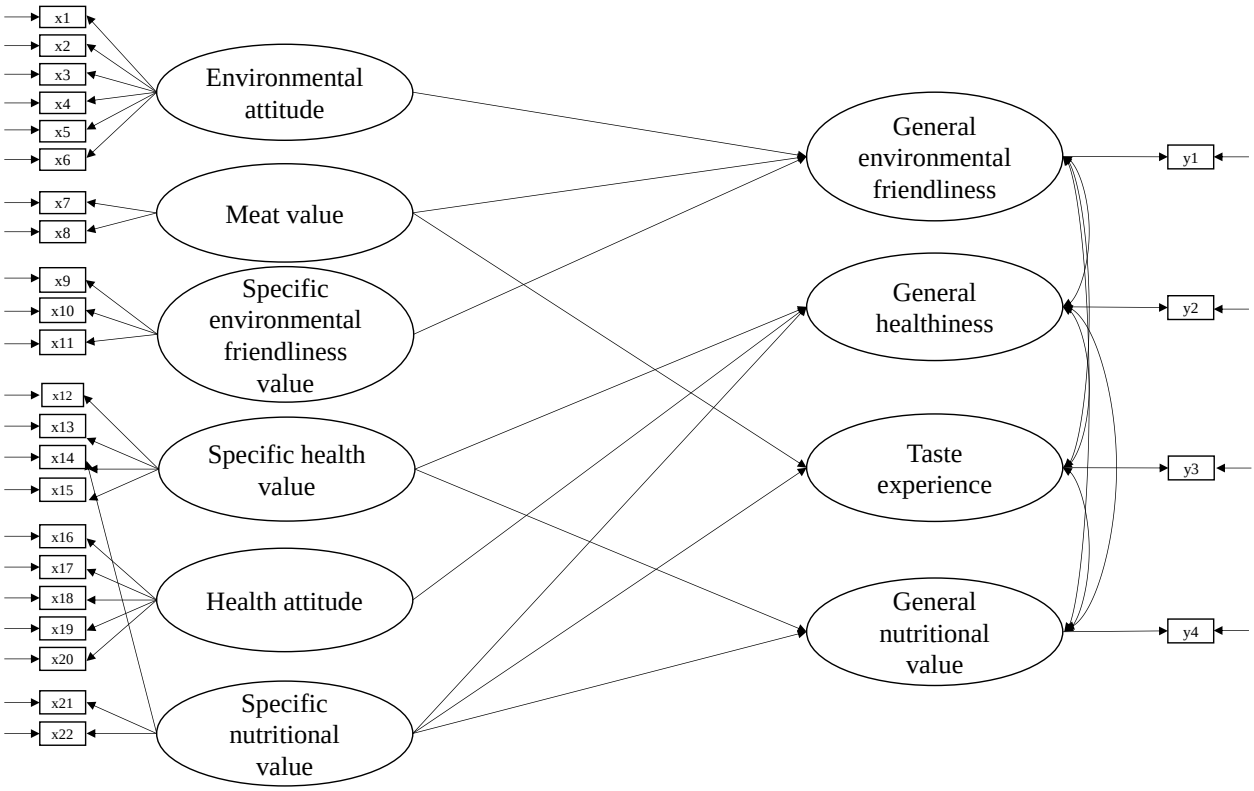

Figure 8. Improved structural equation model with exogenous (left side), endogenous (right side) and observed (rectangular box) variables.

Project partners

World Food System Center

The WFS Center was established in late 2011 to build on the expertise of the ETH Zurich to address the challenges at the nexus of global food and nutrition security, food production and processing and environmental, economic and social wellbeing. The Center brings the broad expertise of the ETH Zurich and eawag under one roof while forging new synergies and relationships with key external partners. Furthermore the Center forms a platform for interdisciplinary teams to collaborate on research, education and outreach activities in line with strategic focus areas. Another focus are the multi- and transdisciplinary approaches to addressing these challenges through research, education, and outreach activities that contribute to sustainable food security.[5]

ETH Seed Sustainability

The ETH Seed Sustainability platform was found in 2001 as a student initiative. Since 2010 this platform is leaded by the ETH Sustainability a coordination office for Sustainability from the ETH Zurich. Seed Sustainability encourages student research in sustainability-related topics, promotes successful cooperation between scientific theory and practice, and unites the needs and expectations of research, education and industry. Seed Sustainability accompanies the research process from beginning to end. A carefully conducted evaluation brings together the best possible partners for a specific issue. An ongoing coaching process ensures that the project achieves its goal with optimum results.[6]

SV Group

The SV Group operates in domains like business catering, care catering, event catering, hotel management and gastronomy in Switzerland, Germany and Austria. The SV Group with headquarter in Dübendorf has around 8000 employees. In Switzerland, with 300 services, the SV Group counts to the leaders in the collective catering. [7]

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[5] http://www.worldfoodsystem.ethz.ch/
[6] http://www.seed.ethz.ch/ueber_uns/index
[7] http://www.sv-group.ch/de.html

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