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# **Consumer responses to personalized price promotions for food products**

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## List of abbreviations

AVE	Average Variance Extracted
BMI	Body Mass Index
EFA	Explanatory Factor Analysis
EU	European Union
CAC	Cognitive – Affective – Conative
CFA	Confirmatory Factor Analysis
CR	Composite Reliability
FAFH	Food Away From Home
FRL	Food-Related Lifestyle
NCD	Non-Communicable Disease
OECD	Organization for Economic Cooperation and Development
PAL	Physical Activity Level
PPP	Personalized Price Promotion
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
SEM	Structural Equation Modelling
TPR	Temporary Price Reduction
UPP	Untargeted Price Promotion
WHO	World Health Organization

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## **Abstract**

Reducing the price of lower-calorie foods consumed away from home is an important instrument to prevent excessive energy consumption and mitigate the negative impacts of obesity in countries with a high obesity rate such as Germany. However, the increasing heterogeneity in consumer responses to price promotion poses a great challenge and calls for more personalization in pricing strategies. Such approach has been to put to work in retail practice by targeting price promotions at individual consumers based on their purchase histories. Despite the growing applications of this promotional tool in major grocery chains, its effects on food consumption remain understudied in the literature and its potential to induce healthier food choices has not been fully exploited. This thesis addresses these overlooked topics by examining how consumers respond to personalized coupons for food products in comparison with untargeted inducements. Furthermore, this thesis explores individual differences in attitudes toward food and nutrition that determine the investigated promotional responses. For this purpose, both theoretical evidence and empirical data were collected using a literature review, a laboratory experiment and a field study. These analyses consistently show a higher response rate to personalized coupons than non-personalized coupons as well as the greater impact of the personalized approach on menu and calorie selection. Further empirical results underline the salience of attitudinal factors (e.g., convenience orientation, calorie knowledge and concerns, and perceived barriers to healthy eating) in determining promotional responses. This thesis not only contributes to the understanding of consumer response to price promotions but also sets a groundwork for developing and evaluating personalized price promotion for food products. It further highlights possibilities of using this approach to address the drawbacks of current price interventions and tackle the obesity epidemic.



## **Zusammenfassung**

Preisnachlässe für kalorienarme Lebensmittel, die außer Haus verzehrt werden, sind ein wichtiges Instrument, um übermäßigem Energieverbrauch vorzubeugen und die negativen Auswirkungen von Adipositas in Ländern mit hoher Adipositas-Prävalenz wie Deutschland zu reduzieren. Die zunehmende Heterogenität der Verbraucherreaktionen auf Preispromotionen stellt jedoch eine große Herausforderung dar und erfordert mehr personalisierte Preisstrategien. Ein solcher Ansatz wurde bereits in die Handelspraxis umgesetzt, indem Preisnachlässe auf einzelne Verbraucher anhand ihrer Kaufhistorie zugeschnitten wurden. Trotz der steigenden Anwendung dieses Ansatzes im Lebensmitteleinzelhandel werden seine Auswirkungen auf den Lebensmittelverzehr bislang wenig in der Literatur untersucht und sein Potenzial zur Förderung einer gesunden Lebensmittelauswahl wurde noch nicht ausgeschöpft. Diese Dissertation befasst sich mit diesen vernachlässigten Themen, indem untersucht wird, wie Verbraucher auf personalisierte Preisnachlässe für Lebensmittel im Vergleich zum nicht-personalisierten Ansatz reagieren. Darüber hinaus untersucht diese Arbeit individuelle Unterschiede in der Einstellung zu Lebensmitteln und Ernährung, die die untersuchten Verbraucherreaktionen bestimmen. Dazu wurden eine Literaturrecherche, ein Laborexperiment und eine Feldstudie durchgeführt, um sowohl theoretische als auch empirische Befunde zu diesem Thema zu generieren. Die durchgeführten Analysen zeigen eine höhere Einlösequote personalisierter Coupons als nicht personalisierte Coupons sowie einen stärkeren Einfluss des personalisierten Ansatzes auf die Menü- und Kalorienauswahl. Weitere empirische Ergebnisse betonen die Bedeutung von Einstellungsfaktoren (z.B. Convenience-Orientierung, kalorienbezogenes Wissen und Bewusstsein sowie wahrgenommene Hindernisse für eine gesunde Ernährung) bei der Bestimmung der Verbraucherreaktionen auf Preisnachlässe. Diese Dissertation trägt zum besseren Verständnis der Verbraucherreaktion auf individualisierte Preisnachlässe bei und legt

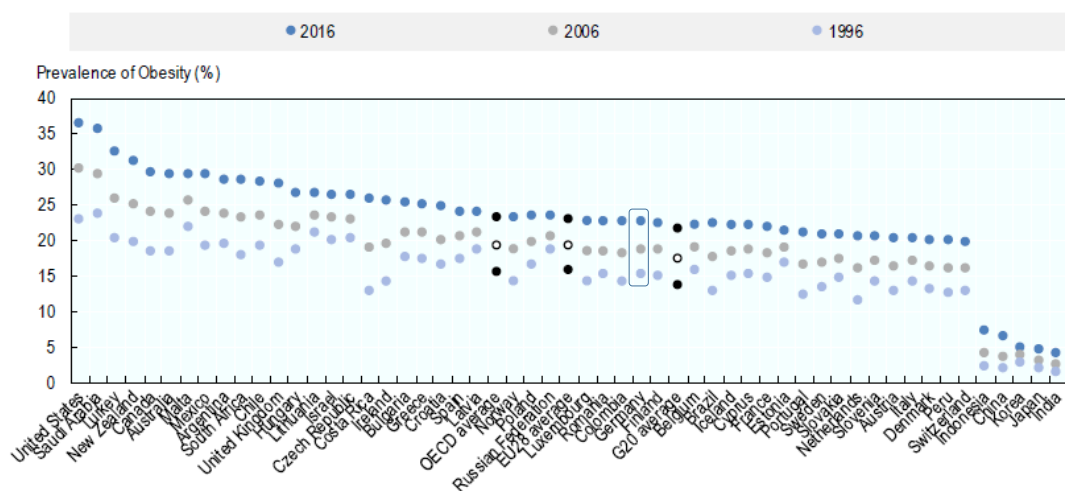
die Grundlage für die Entwicklung bzw. Bewertung personalisierter Preispromotionen für Lebensmittel. Darüber hinaus werden Möglichkeiten aufgezeigt, mit diesem Ansatz die Nachteile aktueller Preisinterventionen anzugehen und die Adipositas-Epidemie zu bekämpfen.

# 1 Introduction

## 1.1 Obesity, energy density, and food price

Obesity has become a global burden and a major public health challenge of the 21<sup>st</sup> century (Bayer et al., 2020). In 2016, nearly two billion people aged 18 years or older were obese. This number accounted for approximately 13% of the world's adult population, three times greater than the corresponding proportion in 1975 (World Health Organization, 2021). A persistent increase in obesity has been observed in many countries. According to OECD (2019), Germany is one of the countries having high obesity prevalence, with the measured obesity rate among adults lying around 25% in 2016 (Figure 1). Obesity is associated with reduced life expectancy and increased risks of non-communicable diseases (NCDs), which accounted for 71% of global deaths in 2016 (OECD, 2019; Seidell and Halberstadt, 2015). This creates a great impact on global and national healthcare systems. Effertz et al. (2016) estimate the healthcare cost of obesity in Germany at around EUR 29 billion, or 7.9% of the annual health expenditure. This epidemic is expected to cost this country nearly 10% of its health budget over the period of 2020 and 2050 unless effective actions are put in place (OECD, 2019).

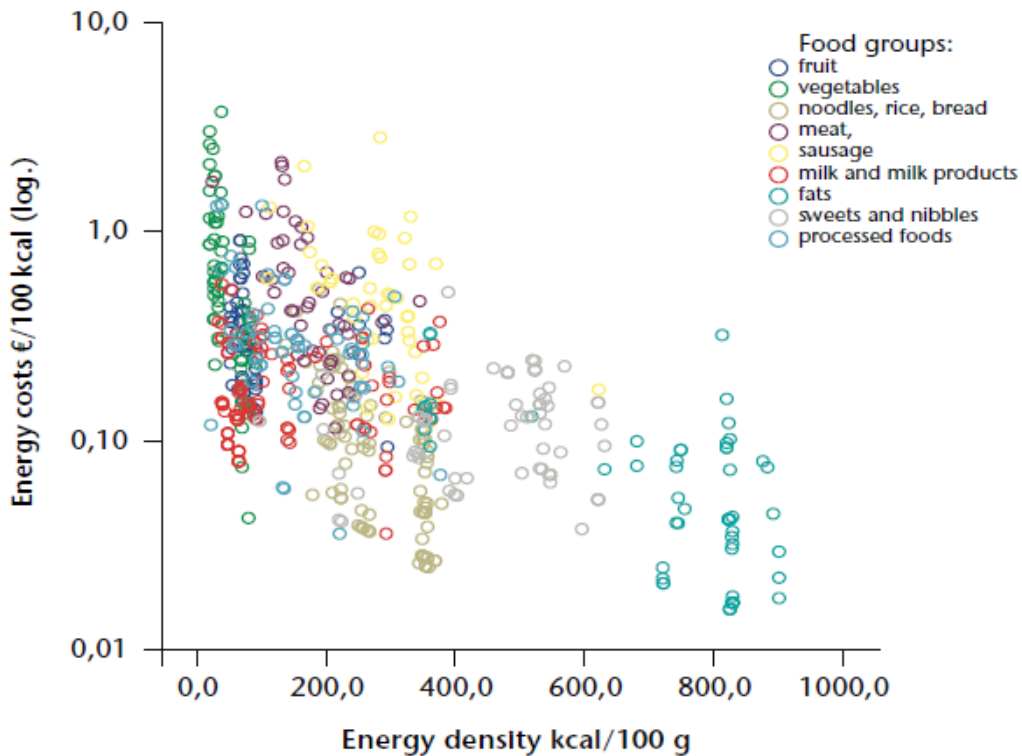
**Figure 1. Trends of obesity prevalence in adults between 1996 and 2016**



Source: OECD (2019, p. 48)

The rising prevalence of obesity is primarily driven by the imbalance between energy intake and output, which is a result of an increased sedentary lifestyle and excessive calorie intake. In developed countries, the calorie supply per capita per day has risen from 2700 kcal in 1961 to 3200 kcal in 2013 (OECD, 2019). Econometric studies suggest the excess of calorie intake is strongly associated with a significant decline in the relative price of food over time, especially among energy-dense foods (Chandon and Wansink, 2010). Foods with high energy density mostly have a high content of carbohydrates and fat (Westerhoefer, 2013). According to evidence from many countries including France and USA, the cost of dietary energy from this group of foods is lower than that from low-energy foods (Drewnowski and Darmon, 2005). A similar correlation between food cost and energy density is also observed in a study with 602 food samples in Germany (Westerhoefer, 2013). As illustrated in Figure 2, the energy costs of 100 kcal from fats and processed foods range between 1 to 50 cents. Meanwhile, consumers must pay ten times more to obtain the same amount of dietary energy from fruit and vegetables. Due to this inverse relationship, consumers are likely to choose energy-dense foods to cover their energy requirements. This consumption pattern is particularly widespread among households with limited financial resources (Westerhoefer, 2013).

Figure 2. Correlation between energy cost and energy density in foods



Source: Westerhoefer (2013, p. 34)

Another factor contributing to the obesity epidemic is the increasing availability and consumption of fast food. Fast food items are considered obesogenic due to their high content of energy, added sugars, processed starches, as well as saturated and trans fatty acids (OECD, 2019). Many authors point to the growing prevalence of fast food and food away from home (FAFH) as the most powerful predictor of obesity, even ahead of declining food prices. As one of the food categories most responsive to price changes (Andreyeva, Long, and Brownell, 2010), FAFH is not only increasingly available but also obtainable at a lower price (Powell, 2009). This leads consumers to consume and spend more on FAFH whereas household expenditure on at home food remains stable over the last decades (Chandon and Wansink, 2010). Such changes in consumption patterns result in a more prominent role of fast food and FAFH in the obesity epidemic. According to the estimation of Chou, Grossman, and Saffer (2004),

a 10% increase in the number of fast food restaurants is associated with a rise of 1.4 percentage points in the probability of being obese. Meanwhile, the obesity rate declines by 0.7% if the prices of fast food and FAFH increase by 10%. Preceding evidence indicates the importance of using food prices, especially the price of energy-dense fast food and FAFH, as an intervention to tackle obesity.

## **1.2 Personalizing price promotions for food products**

Price promotions are monetary incentives that induce consumers to purchase a product more frequently, more quickly, or in greater quantities (Hawkes, 2009; Laroche et al., 2003). The most common type of price promotions is price discounts, which are often offered in the form of temporary price reductions (TPRs) or via other instruments such as coupons, rebates or loyalty discounts (Chandon, 1995). With coupons, consumers get a discount when they bring the coupon to the store. Loyalty discounts require consumers to buy several units, which can be done over several shopping trips. With rebates, consumers get a discount in the form of refunds after paying the full price (Gedenk, Neslin, and Ailawadi, 2010). Coupons are an instrument widely used at fast food chains and restaurants to increase sales, reward existing customers, foster repeat purchases, and attract new customers. However, little attention has been paid to the effects of this promotional tool on FAFH consumption (Narasimhan, 1984; Taylor and Long-Tolbert, 2002). As a result, the focus of this thesis lies on price promotions in the form of discount coupons. Hereafter, the terms “promotion”, “price promotion”, “price discount”, “discount coupon” and “coupon promotion” are used interchangeably to refer to this focal concept of the thesis.

Price promotions have an important role in marketing programs. The impact of this instrument on short-term purchasing and consumption behaviors is one of the strongest among the marketing mix (Laroche et al., 2003). For example, 74% of

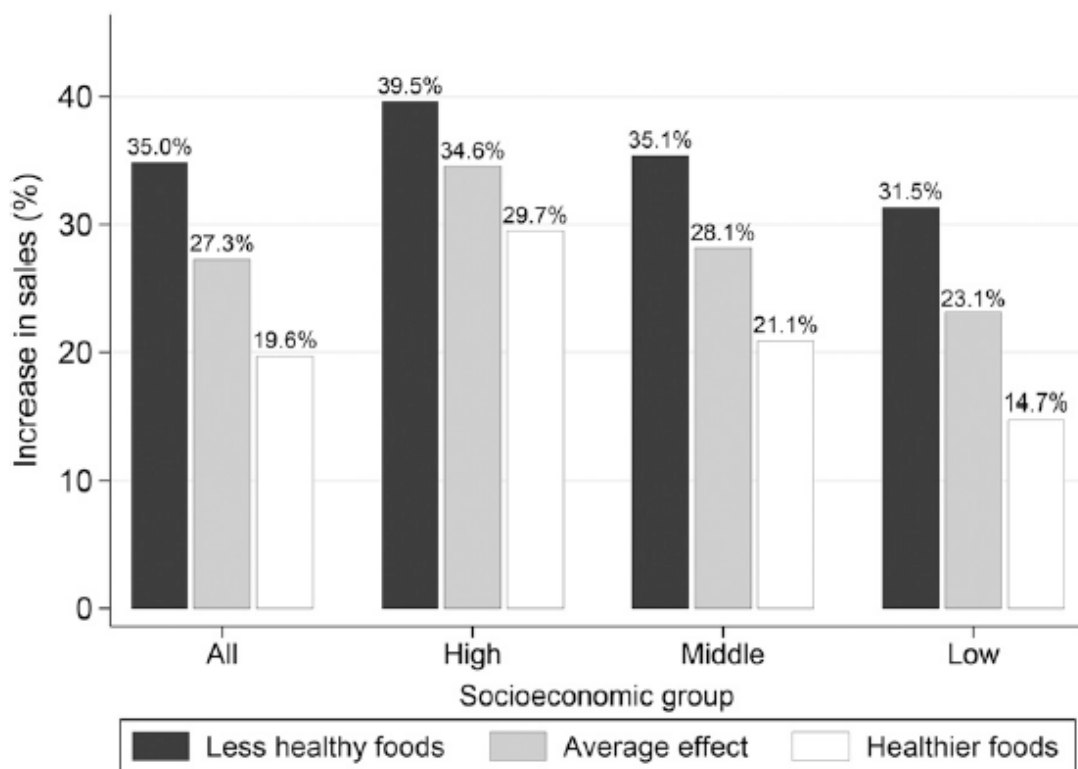
German respondents stated in a survey by UGW (2018) that their purchase decisions are strongly influenced by price discounts. On average, German households spend around 20% of their food expenditure on promoted products (Tedstone, Targett, and Allen, 2015). Since promotions make the promoted products cheaper, they induce consumers to buy more of them. Evidence on tuna products shows that nearly 30% of the incremental sales caused by price discounts in this category are attributed to consumption increase (Chan, Narasimhan, and Zhang, 2008). Subsequent to price promotions, the amount of food and beverages people buy increases by roughly 20% (Tedstone et al., 2015). Price promotions also have tremendous impacts on FAFH. French and Stables (2003) find that discounts in cafeterias increase the consumption of snacks, fruit and vegetables by more than 25%. Evidence from another field experiment in a restaurant setting indicates a much stronger effect of price changes compared to nutrition labeling (Horgen and Brownell, 2002).

Despite the proven impact of price promotions on food consumption, less attention has been paid to analyzing the nutritional effects of this marketing tool compared to other instruments such as e.g. food advertising (Chandon and Wansink, 2010). Prior research relevant to this topic is mostly carried out as intervention studies within the nutrition and public health communities (Hawkes, 2009). For instance, discounts on healthy food items or vouchers for healthy meals have been used to motivate more balanced food choices (W. Lu et al., 2016; McFadden et al., 2014). Similar approaches of reducing the price of healthy foods are deemed effective at various settings such as school cafeterias, vending machines, and restaurants (An et al., 2013; French et al., 2001; French, 2003; Nordström and Thunström, 2015). However, compared to policies such as food tax, calorie labeling and other information interventions, this promotional tool has not been widely implemented (OECD, 2019).

Despite evidence on the overall effectiveness of price discounts for healthy foods, it is questionable that all groups of consumers get the same benefits from the reduced

price of healthy items. By offering identical incentives to all consumers regardless of individual differences in their responsiveness to promotion, existing price interventions are likely to overlook the population at risk (Just and Gabrielyan, 2016; Steenhuis, Waterlander, and Mul, 2011). Particularly, such untargeted strategies are more beneficial to a group of consumers who are both health conscious and deal prone while remaining unattractive to individuals favoring an energy-dense diet (Dallongeville et al., 2011; Muller et al., 2017). A study on more than 11,000 products (60% of which are categorized as healthy foods) indicates that the effects of price promotions vary across food categories and socioeconomic groups of consumers (Nakamura et al., 2015). As illustrated in Figure 3, increased sales caused by price promotions are more prominent among less healthy foods than in the healthy category. Although this pattern is observed across all socioeconomic groups, the discrepancy grows larger with decreasing socioeconomic status of consumers.

**Figure 3. Effects of price promotions on sales of healthy and less healthy foods by sociodemographic group of consumers**



Source: Nakamura et al. (2015, p. 813)



The asymmetric effects of price promotions depending on a product's nutritional profile and consumers' socioeconomic status call for more personalization in reducing prices of healthy foods (Juhl and Jensen, 2014). Personalization has already taken place in other areas of healthy eating promotion, with increasing applications of personalized information programs or personalized nutrition (Brug, Oenema, and Campbell, 2003). In the food retail sector, grocery chains are also moving beyond the one-size-fits-all mentality and driving their promotions down to the individual level by implementing personalized price promotion (PPP) (Arora et al., 2008; Kharif, 2013; Rossi, McCulloch, and Allenby, 1996). This customization level is accomplished thanks to the unprecedented availability of purchase history data collected through loyalty cards or checkout scanners. Data in 2015 show that 85% of global consumers are participating in at least one loyalty program (Tuzovic and Mathews, 2017). In recent years, loyalty card holders have also been rewarded with points for buying healthy groceries or performing other healthy behaviors such as exercising (Mochon et al., 2017; Stourm et al., 2020). Nevertheless, the possibility of offering price discounts directly on healthy food items to encourage healthier food choices has not yet been explored.

In line with the increasing adoption of PPP at grocery chains, there is a growing interest in this topic in the food marketing literature. A number of studies have been conducted to examine the effects of personalized discounts or coupons targeting various food categories (Johnson, Tellis, and Ip, 2013; Osuna, González, and Capizzani, 2016; Zhang and Breugelmans, 2012; Zhang and Krishnamurthi, 2004; Zhang and Wedel, 2009). However, none of the current studies examine PPP for food products in the context of healthy eating promotion. Hence, existing evidence is limited to indicating how PPP changes consumers' buying decisions at grocery stores and subsequently affects the economic performance of food brands and stores. Despite much evidence on the effectiveness of this approach in inducing more choices of promoted products and adjusting purchasing behaviors, it remains unclear how PPP performs in the FAFH

setting and to which extent it could motivate consumers to switch to healthier foods. On the one hand, the preceding discussion indicates the potential of using personalization to enhance the effectiveness of current price reductions for healthy foods. On the other hand, it reveals the lack of connection between the economic and nutritional aspects of PPP for food products that have been examined in the literature. This implies the need for a holistic approach to understand the behavioral, economic, and dietary effects of this promotional tool more completely.

### **1.3 Consumer response to PPP for food products**

An important aspect of this thesis is measuring consumer response to PPP for food products. This investigation allows conclusions on the effectiveness of this personalization approach, compared to its untargeted counterparts. Furthermore, examining the way consumers respond to promotion and identifying factors influencing their decisions are fundamental steps to identify the elements subjected to modification and fine-tune future strategies accordingly to improve the accuracy of personalization (Arora et al., 2008; Just and Gabrielyan, 2016; Neslin et al., 1994).

Although various factors predicting consumer response to PPP has been demonstrated in previous research, most studies focus on promotion and product specific criteria such as timing strategy (Johnson et al., 2013), data source (Niraj and Siddarth, 2014), or discount level (Terui and Dahana, 2006). Consumer specific factors remain under-examined in this specific research area. According to Laroche et al. (2003), promotional responses is partly determined by consumers' psychological and lifestyle characteristics. Thus, it is necessary to not only identify which consumers are responsive to promotion but also understand how these individual traits influence the attitude formation process and subsequent actions. Particularly when it comes to price promotions targeting food products, attitudes toward food and nutrition are likely to be at play in explaining consumer responses (Asp, 1999; Laroche et al., 2003).

Since PPP for food products is a multifaceted topic whose effects have been investigated separately in various domains, consumer response to such price incentives has not been addressed holistically in the existing literature. Hence, a study examining how consumers respond to PPP for food products and identifying the determinants of their reactions is required.

#### **1.4 Research objectives**

The objective of this thesis is to address the research gaps relevant to PPP for food products which were indicated in the previous sections. First, there has been little attention paid to coupon promotions in the FAFH setting as well as their effectiveness in encouraging low-calorie choices and tackling excessive energy consumption. Second, the potential of personalizing discounts on nutritious foods to encourage healthy eating has been overlooked by researchers in nutrition and public health communities. Third, the dietary effects of PPP for food products remain unclear despite abundant evidence in the food marketing literature on how this approach induces changes in purchasing behaviors. Fourth, there is a lack of studies exploring individual specific factors that determine consumer response to PPP for food products.

Hence, this thesis aims to examine how consumers respond to PPP targeting low-calorie products in the FAFH setting, which effects such decisions have on consumers' food and energy intakes, and how individual differences in orientations toward food and nutrition affect promotional responses. In particular, the following research questions are investigated in this thesis.

1. How do consumers respond to PPP for low-calorie menus in the FAFH setting?
2. How do consumers' responses to PPP for low-calorie FAFH affect their menu choices and calorie intake?

3. Which lifestyle and psychological characteristics influence consumers' responses to PPP for low-calorie FAFH?

## **1.5 Structure of the thesis**

This thesis precedes as follows. Chapter 2 presents the existing theories relevant to consumer response to PPP for food products. More specifically, this chapter provides an overview of consumer response to price promotions (Section 2.1), outlines promotion and consumer specific factors that influence promotional responses (Section 2.2 and 2.3), as well as discusses the behavioral and dietary effects of price promotions (Section 2.4). Chapter 3 deals with methodological approaches used to answer the research questions in each investigating step of this thesis. Chapter 4 gives a summary of findings from this thesis, which are covered in three papers published in peer-reviewed journals. Chapter 5 provides generalizations and implications drawn from the findings. This chapter additionally indicates advantages and shortcomings of the methods used as well as highlights the thesis' contributions to the specific research area.

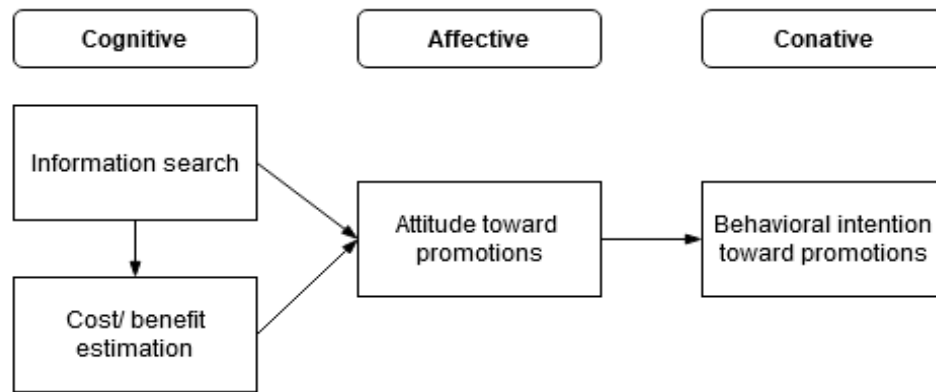
## **2 Literature review**

### **2.1 Consumer response to price promotion**

Given the importance of price promotion, several theoretical models have been developed to examine how consumers respond to this marketing tool. Focusing on two-for-one promotions and coupons, Laroche et al. (2003) propose a multidimensional framework to demonstrate the cognitive-affective-conative (CAC) patterns of promotional response (see Figure 4). This framework follows the hierarchy of effects model developed by Rosenberg (1956) and argues that the initial stage of promotional response is mental processing activities such as active information search about potential promotions. Consumers use retrieved information about promotion level and frequency to calculate the benefits and costs of taking a promotional offer and evaluate various possibilities to maximize utility. At this stage, affective factors such as positive feelings connected with using the promotion come into play and direct the actual behavior.

Consumer response to promotion has been measured in various ways by prior research. In Laroche et al. (2003), behavioral intention toward promotion is used to measure the conative element of the CAC model. Since intentions indicate how much effort people put into performing a behavior, intention is a strong predictor of actual behavior. In other words, “the stronger the intention to engage in a certain behavior, the more likely that performance” (Ajzen, 1991, p. 181). Similarly, Kitchen et al. (2014) support the use of coupon redemption intention to predict the actual behavior of redeeming. However, intentions are formed before the actual redemption, which is not always performed immediately, and therefore susceptible to changes in product availability or psychological inducements (Ramaswamy and Srinivasan, 1998). Given this apparent gap between intention and behavior, many studies focus on actual responses by examining coupon usage, actual redemption rates, or redemption decisions (Chandon, 1995).

**Figure 4. Cognitive - affective - conative framework of responses to price promotion**



Source: Own elaboration based on Laroche et al. (2003)

Research on consumer response to coupon promotions can be classified into two categories (Kitchen et al., 2014). The first models coupon usage intention or behavior based on promotion specific characteristics such as coupon value or expiration data. The second focuses on profiling consumers who are deal prone, namely responsive to promotion, to investigate the effects of antecedent and consumer specific determinants on promotional responses. Since both criteria are vital in predicting coupon redemption, this thesis takes both categories of predictors into account to provide a holistic view of consumer response to price promotion.

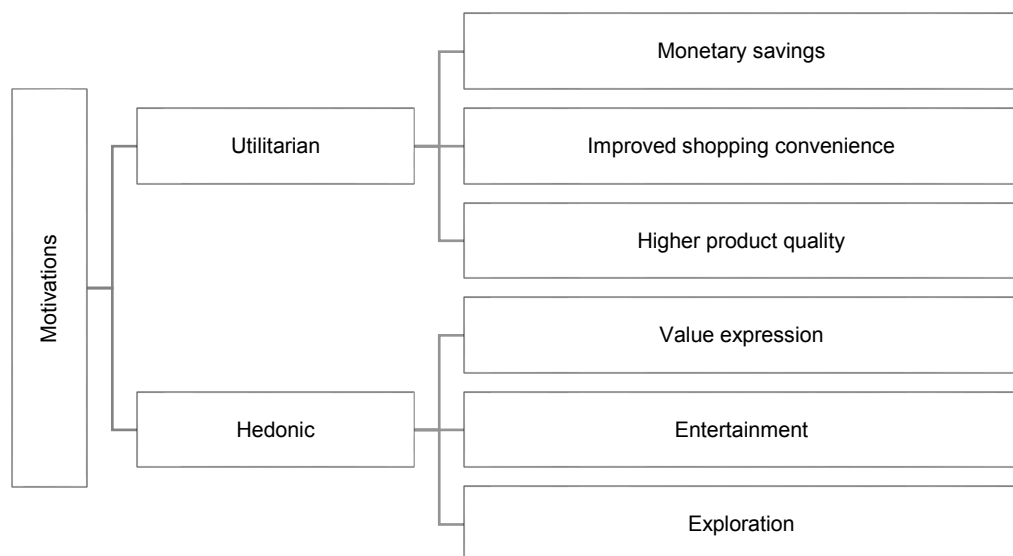
## **2.2 Promotion specific driving factors**

According to Laroche et al. (2003), the cognitive evaluation of a promotion's costs and benefits plays an important role in determining promotional response. Since this section concentrates on factors prompting consumers to use a promotion, benefits of promotion will be presented. In this respect, Chandon, Wansink, and Laurent (2000) proposes a multi-benefit framework to indicate the perceived utilitarian and hedonic benefits of sales promotion. As illustrated in Figure 5, utilitarian benefits consist of the monetary savings a promotion provides, the improved shopping convenience resulting from reduced search or decision costs, and the opportunity to upgrade to a product

with higher quality, which might be unaffordable without reductions in price. Hedonic benefits include not only the enhancement in self-perception of being a smart buyer (value expression), but also entertainment values coming from the excitement about promotions delivered in game or competition formats, and possibilities to explore new alternatives, owing to the ever-changing nature of promotions.

The mentioned benefits are applicable to both monetary and non-monetary promotions. When it comes to monetary or price promotion, Chandon et al. (2000) stress the importance of utilitarian benefits and put less emphasis on hedonic benefits. In other words, price promotions are perceived as offering more monetary savings and more opportunities to upgrade to a higher quality product. Given its focus on price promotion, this thesis discusses only the utilitarian benefits in further details.

**Figure 5. Multi-benefit framework of sales promotion**



Source: Own elaboration based on Chandon, Wansink & Laurent (2000)

The monetary savings of a promotion is the most frequently examined predictor of promotional response. These economic benefits are considered by some game theoretic and econometric studies as the only driver for consumers to take a deal (Chandon et al., 2000). With regard to coupon promotion, coupon value is vital in determining how attractive a promotion is from the perspective of consumers. Many

studies point to a positive relationship between coupon face value and redemption intention or redemption rate (Kitchen et al., 2014; Shoemaker and Tibrewala, 1985; Ward and Davis, 1978). The higher the coupon value, the more attractive the coupon characteristics are and the greater likelihood the coupon is redeemed (Bawa, Srinivasan, and Srivastava, 1997; Chen, Monroe, and Lou, 1998). At the same time, monetary considerations play a crucial role in determining food-related decisions and need to be taken into account when measuring consumer response to price promotion for food products (Furst et al., 1996).

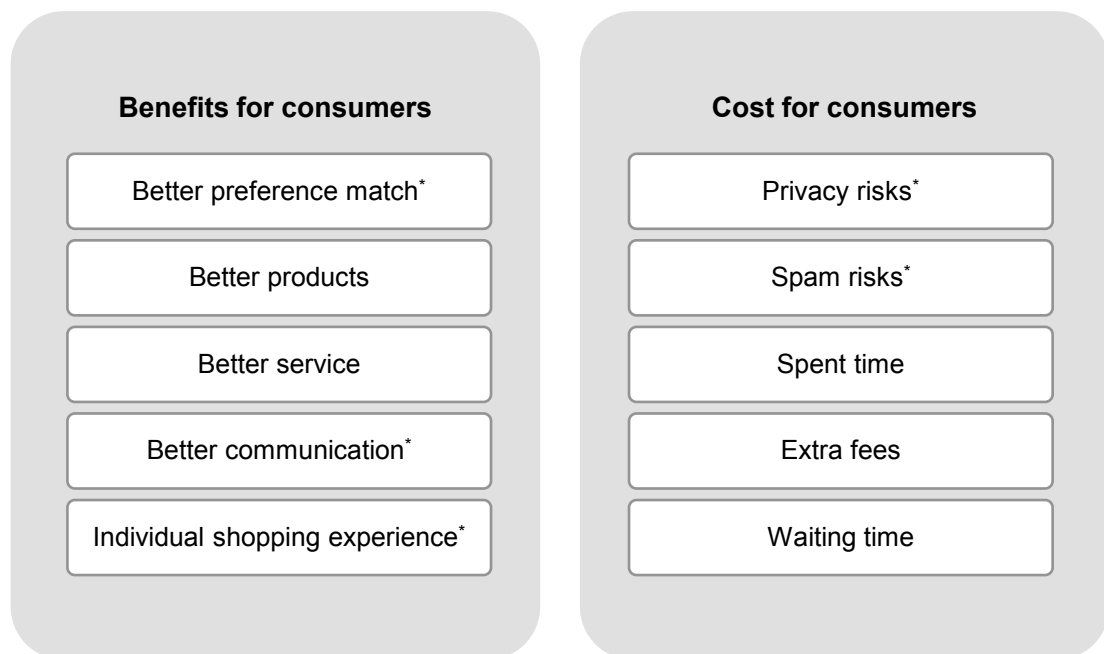
Along with monetary considerations, quality is another salient factor that people consider in their food choices. According to Grunert et al. (1996), food quality constitutes four aspects: taste, health, convenience, and process related attributes (e.g., organically or sustainably produced). Given the positive correlation between food price and quality, consumers have to pay a higher price to aim for a better quality (Judd, 2000). In this respect, price promotions can bring quality benefits to consumers by relaxing budget constraints and allowing consumers to buy a product with higher quality than their usual choices (Chandon et al., 2000). As a result, consumer response to a coupon is determined by not only its monetary savings but also whether this coupon enables them to pay for a food product that is tastier, healthier, more convenient, or more sustainable at a reduced price.

Apart from the economic and quality-related aspects, Chandon et al. (2000) emphasize the importance of convenience benefits in consumers' evaluation of price promotion. By signaling the availability and promotional status of a certain product, this marketing tool reduces the cost of information search and decision making, thus improving the convenience in shopping experience. Convenience benefits of price promotion can be increased to a greater extent when personalization is brought into play (Goldsmith, 1999). By observing consumers' prior behaviors and purchase histories, marketers can adjust their promotional offers to match consumers' preferences better (Acquisti,



2008). This creates more convenience for consumers in selecting an appropriate product and making purchase decisions. Moreover, most personalized offers are delivered to customers through emails or loyalty cards, which facilitates better communication (Stourm et al., 2020). In a framework demonstrating the values of personalizing the marketing mix, Vesanen (2007) supports the presence of similar values. Figure 6 illustrates the benefits and costs of personalization in respect to consumers. Accordingly, PPP brings about enhancements in preference match, communication, and shopping experience.

**Figure 6. Values of personalized marketing output**



\* Values relevant to PPP

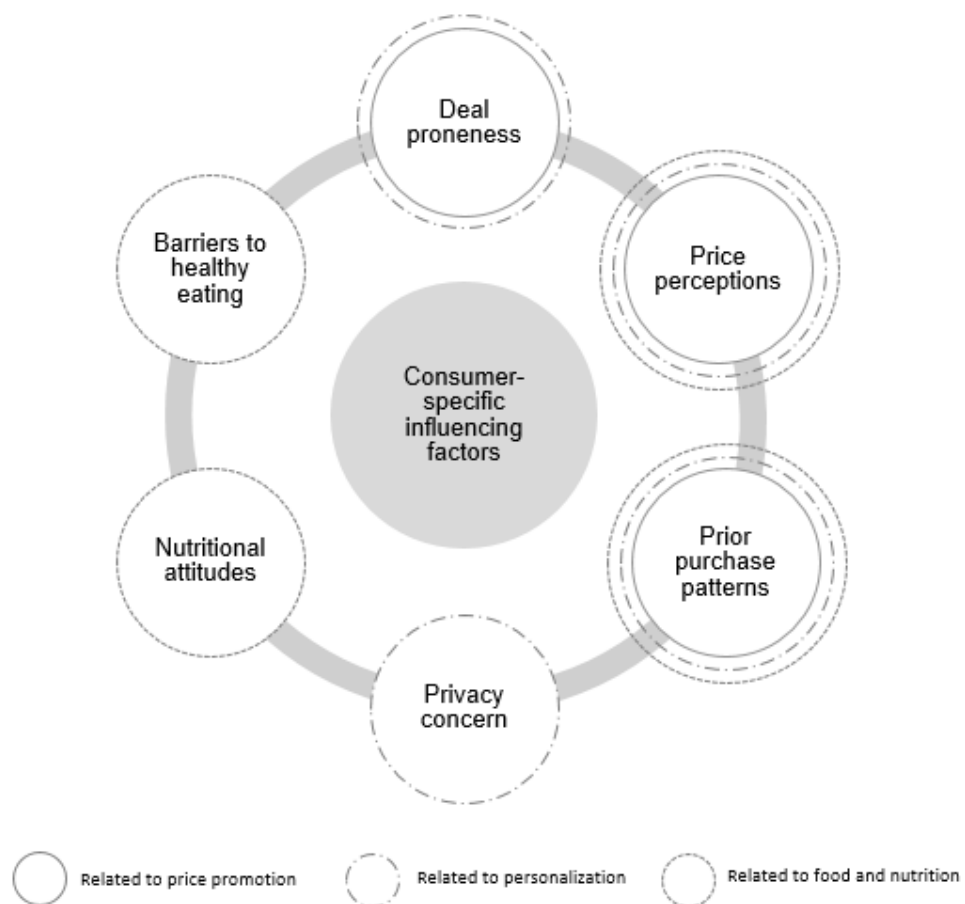
Source: Own elaboration based on Vesanen (2007, p. 414)

### **2.3 Consumer specific characteristics influencing PPP**

Another major body of research on consumer response to promotion involves studies examining the effects of consumer characteristics (Kitchen et al., 2014). In this regard, a vast array of factors have been investigated, including demographic, psychological, behavioral, and attitudinal determinants (Chandon, 1995). Despite the ubiquitous presence of demographic variables in the existing literature, several studies reveal that

psychological and lifestyle-related traits are stronger predictors of coupon usage and redemption behaviors (Mittal, 1994; Ramaswamy and Srinivasan, 1998). Lifestyle factors and psychological traits are at the same time meaningful indicators of food choice and dietary behaviors (Asp, 1999). As demonstrated in Figure 7, this thesis focuses on beliefs about and attitudes toward three topics: price promotion, personalization, food and healthy eating. These topics are selected since they constitute three dimensions of the focal concept of this thesis – personalized price promotion for food products.

**Figure 7. Consumer specific influencing factors used in this thesis**



Source: Own elaboration

There is a general consensus about the salience of deal proneness or promotion sensitivity in predicting promotional responses. Deal proneness constitutes a psychological propensity that motivates consumers to respond to a given promotional

offer and subsequently purchase the promoted product (DeiVecchio, 2005; Lichtenstein, Burton, and Netemeyer, 1997). Deal prone consumers are more likely to put emphasis on the psychological pleasure of paying less than the reference price of a product, thus showing high redemption intentions (Kitchen et al., 2014; Lichtenstein, Netemeyer, and Burton, 1990). Meanwhile, individuals less deal prone require more attractive incentives to redeem a coupon (DeiVecchio, 2005). Empirical evidence on PPP targeting food products reveals a positive correlation between coupon redemption rates and consumers' price cut elasticity, namely promotion sensitivity (Zhang and Wedel, 2009).

Besides promotion sensitivity, price perceptions are a salient determinant of consumer response to price promotions. For many consumers, price cue is a strong indicator of product quality (Blattberg and Neslin, 2002). People who believe that the price level of a product is positively associated with its quality tend to make negative product-related attributions about discounted products and are less likely to respond to price promotions (Lichtenstein, Ridgway, and Netemeyer, 1993; Palazon and Delgado-Ballester, 2009). With regard to food, price-quality inferences are a prevalent factor determining the way consumers select what to eat and how to react to discounts on foods. The belief that a lower price signals poorer quality applies to all dimensions of food quality, including the taste, healthiness and process-oriented attributes such as organic claims (Chandon and Wansink, 2010; Grunert et al., 1996). For instance, the "healthy is expensive" intuition is prevailing among consumers (Haws, Reczek, and Sample, 2017). Due to such assumptions, health-conscious and quality-oriented consumers are reluctant to react to a promotion even though it targets healthy foods (D. A. Cohen and Babey, 2012). Another issue relevant to price is the price fairness perception. This factor is connected directly with the price differentiation strategy of PPP. Although this differentiation enhances the targeting capability of personalized promotions, it raises concerns about discriminatory treatment among consumers

(Stourm et al., 2020). Upon figuring out that the offers they get are different, or in some cases, less beneficial than other people, consumers are likely to develop a negative perception of the promotion, and hence undesirable subsequent reactions (Feinberg, Krishna, and Zhang, 2002; Tsai and Lee, 2007).

Promotional response is heavily influenced by past behaviors. Regular buyers of a product are more likely than those with low purchase frequency to respond to promotions targeting that product (Shoemaker and Tibrewala, 1985). Frequent users of promotion are not only more receptive to promotion information but also have a higher likelihood to redeem a coupon and repurchase the promoted product (Bawa, Landwehr, and Krishna, 1989; Chandon, 1995). At the same time, coupon redemption intentions also correlate positively with prior store visit frequency (Bawa and Shoemaker, 1987). Similarly, past behaviors are a powerful predictor of food choice and dietary behaviors, which are characterized with a tremendous degree of habitual action (Orbell and Verplanken, 2010). Putting an emphasis on coupons for FAFH, Taylor and Long-Tolbert (2002) find the likelihood of coupon redemption to increase by 3% with each additional visit to a store of interest. Only a small proportion (2%) of customers with no prior purchase history redeem a coupon, compared to the rate of 14% among existing customers (namely, subjects making at least one purchase prior to the promotion). These findings support the use of past purchase history to condition promotional offers to individual consumers (Acquisti and Varian, 2005). Data on consumer's recent purchases provide valuable information to estimate their purchase frequency, product loyalty, brand preferences, and spending patterns, which will be used to predict future decisions (Arora et al., 2008; Taylor and Long-Tolbert, 2002). As a result, variables on last choices are included in numerous studies modeling PPP and targeting promotions (Ailawadi et al., 2007; Rossi et al., 1996; Zhang and Krishnamurthi, 2004; Zhang and Wedel, 2009).

According to Vesanen (2007)'s framework of personalization (Figure 6), a major cost for consumers in using personalized marketing services is privacy and spam risks. The premise of PPP is that the great amount of data collected and analyzed enhances the accuracy of customer targeting. However, such strategy of data exploitation does not always adhere to consumers' wishes to protect their privacy and personal information (Arora et al., 2008). The unprecedented amount of information retrieved for personalization raises concerns about potential loss of control over data use, which probably results in misuse of personal data or infringement of privacy (Stourm et al., 2020). Such concerns shape consumers' perception of a promotion and influence their promotional responses. In this respect, people tend to be more reluctant to use personalized coupons or participate in a loyalty program (Arora et al., 2008; Stourm et al., 2020).

Given the focus on food of this thesis, it is imperative to examine the determinants of food decisions made by individual consumers. As a complex decision-making process, food choice is determined by the interplay between physiological, demographic, and psychological aspects (Asp, 1999; Irala-Estévez et al., 2000). Apart from the cultural, demographic and physiological determinants, Asp (1999) highlights the growing salience of psychological and lifestyle-related characteristics in predicting individual food decisions and dietary behaviors. These predictors refer not only to the values consumers seek to express through food but also their attitudes toward nutritional aspects (Asp, 1999). According to Grunert et al. (2001), lifestyle and attitudinal traits related to food are expressed through cooking methods, ways of shopping, purchasing motives, consumption patterns, and perceptions of food quality.

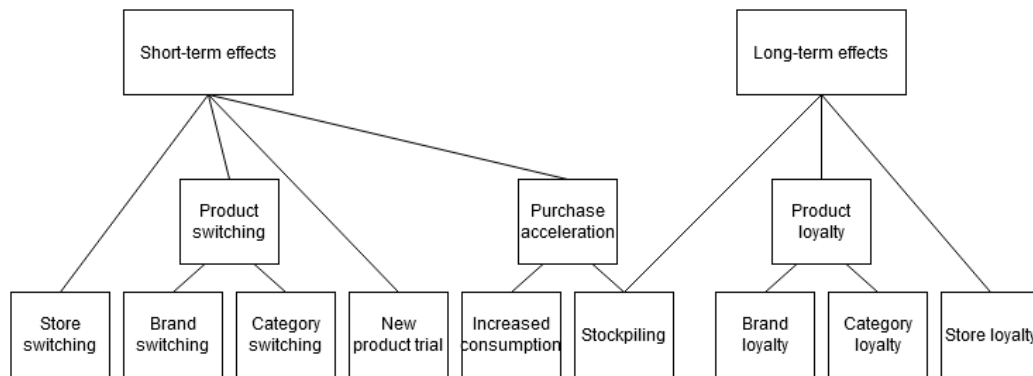
Asp (1999) argues that food decisions do not only affect the nutrient intake and diet quality of consumers but also influence their reactions to dietary guidance, thus determining the success or failure of nutritional interventions. Therefore, it is necessary to identify and remove perceived barriers that prevent an individual from choosing food

products meeting dietary recommendations. Barriers can be classified into obstacles related to food, consumer behavior, and dietary guidance. Food-related barriers include concerns about food safety, the effectiveness of food processing and preservation technologies. Barriers regarding dietary guidance occur when consumers receive insufficient information or do not have enough knowledge to act according to the recommendations. In addition, some barriers coming from the consumer side are associated with issues in changing food behavior, such as resistance to change, lack of motivation to change, and lack of confidence in being able to change (Asp, 1999).

#### **2.4 Effects of PPP for food products**

The effects of price promotions have been studied extensively in the existing literature. The conceptual framework proposed by Gedenk et al. (2010) is among the most influential theories examining how price promotions affect consumers' purchasing behaviors. As depicted in Figure 8, the authors distinguish between the short-term and long-term effects of promotion. Short-term effects involve behavioral changes that take place during the promotion. In this respect, price promotion can motivate consumers to visit a store running a promotion (store switching) and try a new product (new product trial). Product switching can also happen when consumers switch to the promoted brand or category. Furthermore, this marketing tool leads to purchase acceleration, which in turn can induce faster consumption the purchased product or stockpiling behaviors. Apart from immediate adjustments in consumer behavior, price promotions have long-term effects on the loyalty to a certain brand, category, or store. Changes that occur after price promotions also include potential decreases in reference price, thus making the product on sale appear expensive on future shopping trips (Blattberg and Neslin, 1989; Gedenk et al., 2010).

**Figure 8. Effects of price promotion**



Source: Adapted from Gedenk et al. (2010, p. 306)

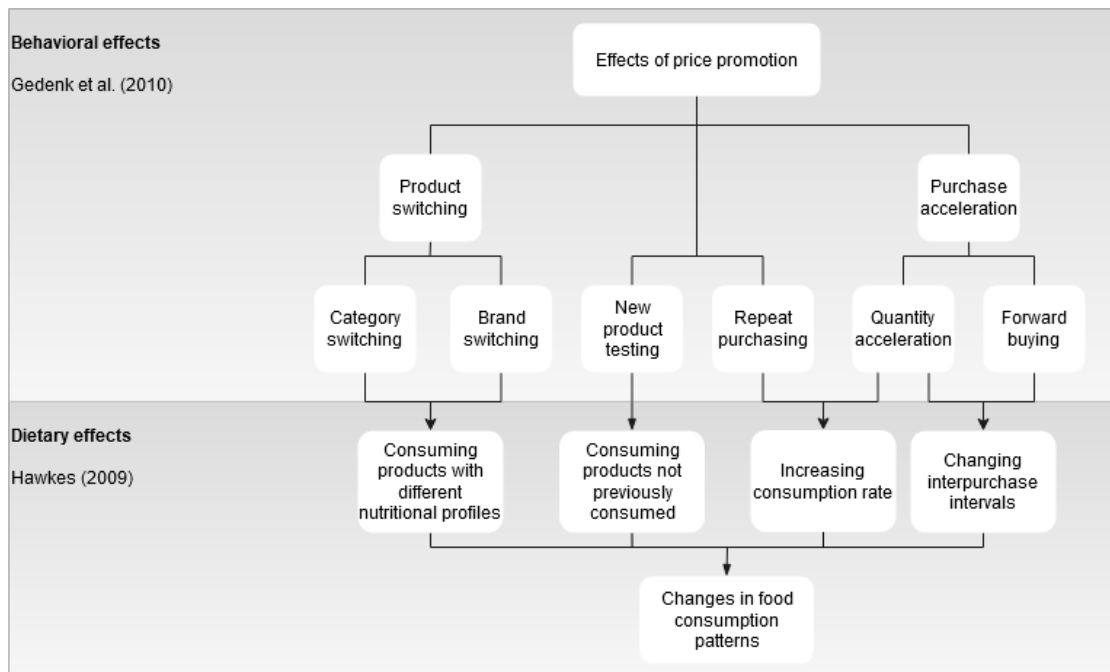
In contrast to the abundance of research on price promotions as an instrument to market food to consumers, little attention has been paid to their dietary impacts (Hawkes, 2009). As an attempt to address this research gap, Hawkes (2009) puts the framework of Gedenk et al. (2010) into the context of food consumption and describes how changes in purchase decisions lead to dietary adjustments (

Figure 9). According to this author, changes in food consumption are supposed to occur under four circumstances. First, as a result of category switching or brand switching, consumers might consume a product with a different nutritional profile than their prior choices. Second, price promotions motivate consumers to try a new product that they have not consumed previously. This action of new product trial intrinsically creates changes in nutrient intake. Third, repeat purchasing and quantity acceleration lead to an increased consumption rate of the product on sale. Fourth, the intervals between purchases are likely to change under the influence of quantity acceleration and forward buying.

The research of Taylor and Long-Tolbert (2002) provides empirical evidence to verify the preceding conceptual frameworks with respect to FAFH. On the one hand, they find that the interpurchase intervals following coupon redemption do not differ tremendously from the cycle prior to promotion. In other words, coupon use does not

delay or move future store visits and purchases forward. On the other hand, coupon redemption is salient in predicting the likelihood of repeat purchase in the period after promotion. Compared to people who did not respond to a promotion, coupon redeemers are around eight times more likely to make another purchase at the investigated store.

**Figure 9. Behavioral and dietary effects of price promotion**



Source: Own elaboration based on Gedenk et al. (2010) and Hawkes (2009)



### 3 Materials and methods

This section presents the research structure as well as methods used in each investigating step of this thesis (see Table 1). In the beginning, a literature review (Step 1) was conducted to identify relevant research gaps and synthesize theoretical evidence concerning the first research question. Based on findings from the first step, quantitative data was collected in a laboratory (Step 2) and a field experiment (Step 3) to provide empirical evidence for the pre-defined research questions.

**Table 1. Research structure and methodological approaches**

	<b>First step</b>	<b>Second step</b>	<b>Third step</b>
<b>Research question</b>	1	1, 2, and 3	1, 2, and 3
<b>Data type</b>	Secondary	Primary and quantitative	Primary and quantitative
<b>Data collection</b>	Literature review	Laboratory experiment	Field experiment
<b>Data sample</b>	1,269 articles	207 participants	165 participants
<b>Data analysis</b>	Qualitative synthesis of empirical evidence	Chi-square and non-parametric tests; SEM	Chi-square and non-parametric tests; mediation analysis with SEM

Source: Own elaboration

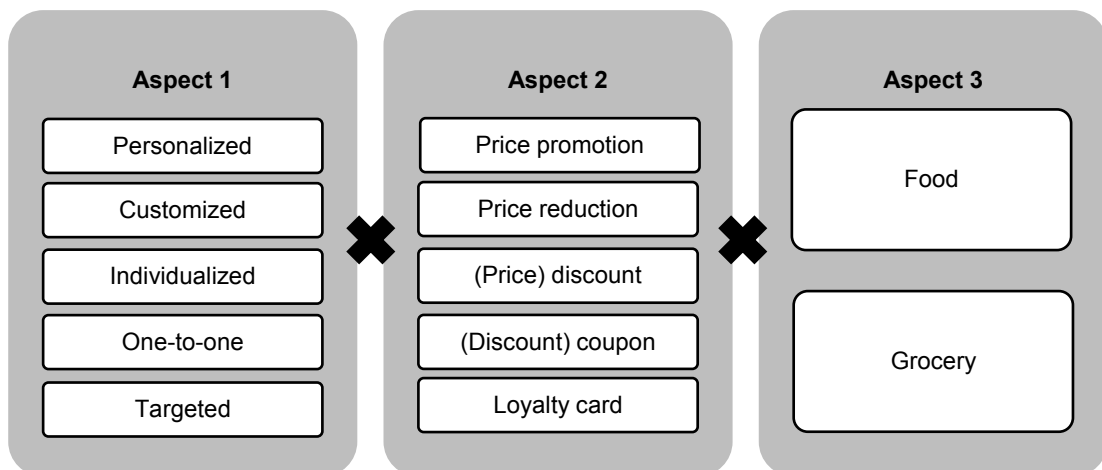
#### 3.1 Step 1: Literature review

The first step of this thesis involved a literature review in which the existing body of research related to PPP for food products was examined. The objective of this step was to synthesize evidence on the effects of PPP on food shoppers, stores, and brands in comparison to the untargeted approaches. The literature review also supported the identification of research gaps that need to be filled when investigating consumer response to PPP for food products.

### 3.1.1 Literature search and selection

To retrieve relevant literature, a collection of terms defining PPP for food products was created. As presented in Figure 10, this collection included sets of keywords depicting three aspects of the focal concept as well as their possible synonyms and spelling variants. Different combinations of these keywords were applied to search for peer-reviewed studies in bibliographic databases popular in the food marketing area, including Scopus, ScienceDirect, PubMed, and AgEcon. To reveal additional relevant studies that were left out during the database search, a further step of hand searching was conducted to look through references of the retrieved literature. The identified articles (n = 1,269) were examined more thoroughly to evaluate their eligibility for the qualitative synthesis. A qualified article must use empirical and primary data to examine promotional pricing strategies customized at the individual level and measure subsequent changes in food purchasing and consumption behaviors as well as the economic performance of food brands and stores.

Figure 10. Search terms for three aspects of the focal concept



Source: Own elaboration

### 3.1.2 Information extraction and evidence synthesis

A procedure of qualitative content analysis was applied to extract information from the eligible articles and synthesize findings of the included studies. According to guidelines

from Hsieh and Shannon (2005) as well as Krippendorff (2013), this step involved two coders extracting the articles' content independently based on pre-defined categories listed in Table 2. One of the coders was the author of this thesis.

The category system was comprised of both methodological and thematic topics of the examined studies. Methodological categories described the setting, collection method, data type, data period, and sample size of a study. Thematic categories included information on how the PPP approach examined in a given study was implemented and how it affected the food purchasing and consumption behaviors of consumers as well as the performance of food stores or brands in terms of sales, profits and customer relationship. Categories regarding the implementation of PPP were created based on insights from Arora et al. (2008), while the effect categories were derived from theoretical frameworks of Gedenk et al. (2010) and Hawkes (2009).

Coding results were subsequently compared between two coders using the intercoder reliability calculation tool ReCal, which was developed by Freelon (2010). For each category, the Krippendorff's alpha was calculated to evaluate the coding reliability. According to Carletta (1996), it is sufficient to draw tentative conclusions for categories with an  $\alpha$  value between 0.67 and 0.8 while a measure larger than 0.8 indicates good reliability. All categories examined in this literature review met the threshold of 0.67, with nine categories having  $\alpha > 0.8$ .

**Table 2. Category system for information extraction and evidence synthesis**

<b>Methodological categories</b>	<b>Thematic categories</b>
<ul style="list-style-type: none"> <li>• Country</li> <li>• Setting</li> <li>• Data period</li> <li>• Sample size</li> <li>• Collection method</li> <li>• Data type</li> </ul>	Implementation of PPP <ul style="list-style-type: none"> <li>• Targeting strategy</li> <li>• Promotion distribution</li> <li>• Promotion tool</li> <li>• Segmentation</li> </ul> Effects of PPP on consumers <ul style="list-style-type: none"> <li>• Purchasing behavior</li> <li>• Consumption behavior</li> </ul> Effects of PPP on food stores and brands

- 
- Sales and profits
  - Customer relationship
- 

Source: Own elaboration

### **3.2 Step 2: Laboratory experiment**

In the second step, a laboratory experiment was conducted to examine the effectiveness of PPP in encouraging low-calorie food choices in the fast food setting and compare the effects of this approach with untargeted promotions. Taking place at a behavioral laboratory in November 2016, this study used the Online Recruitment System for Economic Experiments (ORSEE) to recruit participants between 18 and 30 years old, given the increasing rate of obesity and fast food consumption among this age group (Greiner, 2015; Grunseit et al., 2019). An ethical approval for this experiment was issued by the Ethics Commission of the Technical University of Munich in October 2016.

#### *3.2.1 Experiment design*

The procedure of this experiment is as follows. Using an application simulating the self-ordering terminals at fast food chains, participants in this experiment answered some questions about their physical activity level (PAL) and deal proneness (Appendix 1). They subsequently selected a menu consisting of a main dish, side dish or drink, and received discount coupons that encouraged them to choose menu alternatives with fewer calories. They had the option to stay with their original selection or redeem the offered coupon. After making their choices and completing further questions about their attitudes toward food-related aspects (Appendix 2), each subject received €10 in cash.

The food items in this experiment and their calorie content were retrieved from the USDA National Nutrient Database for Standard Reference (United States Department of Agriculture, 2016). Pre-intervention questions about physical activities were derived

from dietary guidelines for energy intake of the German Nutrition Society (2015). Based on information about gender, job-related activities and free time activities, an individual's PAL value and accordingly recommended energy intake were computed. The guided value for energy intake of each subject was compared with the calorie amount of her or his chosen menu and used as a criterion for coupon personalization. Another determinant of coupon value was an individual's deal proneness, which was estimated using Likert-scale items developed by Lichtenstein et al. (1993). Subjects who were less responsive to coupon promotions while selecting too many calories are targeted with a more attractive coupon with a higher discount level. The post-intervention questionnaire was developed based on psychological scales and comprised of questions on consumers' food-related lifestyles, nutritional beliefs, eating behaviors, or healthy eating barriers. These statements came from various constructs developed by Diehl (1999), Garner et al. (1982), Gracey et al. (1996), O'Connell, Shannon, and Sims (1981), Pudal and Westenhoefer (1989), and Scholderer et al. (2004). All items were measured using a six-point Likert scale since it ensured higher level of discrimination and reliability than a five-point scale (Leung, 2011; Rungson, 2010).

The study participants (n = 207) were randomly assigned to a control group (n = 48) and an experimental group (n = 159). Control group members received identical coupons with the highest discount level (50%) for a menu comprising the lowest-calorie main dish, side dish and drink. In the experimental group, each individual obtained up to three coupons tailor-made to their menu selection, calorie needs and deal proneness. The discount size of a personalized coupon was determined based not only on consumer specific criteria such as deal proneness or the difference between energy needs and actual calorie selection but also on menu specific characteristics. The more healthy items and fewer calories a menu had, the higher the discount level. Coupons with the most attractive value were targeted at participants exhibiting low

responsiveness to coupon promotions yet excessive energy intake. Deal prone individuals with appropriate energy intake obtained the lowest discount levels. The other subjects received discounts at the medium level.

The aim of those personalized coupons was to encourage participants to reduce the amount of their selected calories by switching to lower-calorie alternatives of side items (i.e., side dish and drink). When a subject already selected the lowest-calorie side items, she or he was offered coupons with the same side items and another main dish containing fewer calories than the initial choice. Participants who picked the lowest-calorie menu were also rewarded with a coupon for their choices, yet with a face value lower than cross-selling coupons.

### 3.2.2 *Data analysis*

To compare the effects of personalized and non-personalized coupons, the Chi-square and Mann-Whitney-U test were used to measure between-group differences in dichotomous and continuous variables, respectively. The dependent variables included the coupon redemption rate, menu choices, switches among menu items, and changes in calorie selection. To evaluate the extent to which the control treatment differ from each discount level of the PPP approach, pairwise comparisons were conducted using the Mann-Whitney U test. In addition, Kruskal-Wallis test was applied to compare the universal differences in menu and calorie selection among these groups. The magnitude of treatment effects on the outcome variables was estimated according to guidelines from J. Cohen (1988). The rank biserial  $r$  indicates the effect size on continuous variables and the Cramer's  $V$  statistic measured that on dichotomous variables.

Hypotheses on the effects of consumers' lifestyle and psychological characteristics on the behavioral and dietary changes after coupon promotion were tested using a structural equation model (SEM). Out of items from the post-intervention questionnaire, latent variables such as calorie concern or perceived barriers to healthy

eating were extracted using the Diagonally Weighted Least Squares (DWLS) estimator. The Bartlett's test of sphericity and Kaiser-Olkin-Meyer measure were applied to evaluate the data suitability. Both tests indicated the data was appropriate for factor analysis. The final model's goodness of fit was evaluated using the Chi-square fit statistic, Comparative Fit Index (CFI), Tucker-Lewis-Index (TLI), Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Square Residual (SRMR), and Parsimonious Normed Fit Index (PNFI) (Tabachnick and Fidell, 2013).

### **3.3 Step 3: Field experiment**

Based on findings from the literature review and laboratory experiment, a field experiment was carried out to provide further empirical evidence on consumers' response to personalized coupons targeting low-calorie FAFH from a real-life setting. This study took place at the canteen of Campus Straubing for Biotechnology and Sustainability of the Technical University of Munich in November 2017, with an ethical approval issued by the university's Ethics Commission before the experiment.

#### *3.3.1 Experiment design*

The procedure resembled that of the laboratory experiment. In this field study, participants were recruited conveniently from canteen patrons whose food choices were not hypothetical as in the laboratory experiment. In other words, the subjects had to pay for what they selected. Each subject earned €8 as compensation for participating in this study and, if applicable, a discount corresponding with the redeemed coupon's value.

A menu in this experiment consisted of a main dish, side dish, dessert and drink. Food items were taken from the canteen's daily menus and their calorie content was computed based on labeled nutritional facts (in the case of drinks) or from the German Nutrient Database (BLS) using the PRODI<sup>®</sup> application (Poschwatta-Rupp, 2016). The

study sample included 165 adults assigned randomly to a control (n = 96) and experimental group (n = 69). The study design was similar to that of the laboratory experiment, with the experimental group receiving personalized coupons and the control group identical coupons for the lowest-calorie menu at the 50% discount level. The criteria for personalizing and assigning coupons to individual participants were similar to the laboratory experiment.

### 3.3.2 *Data analysis*

Methods for evaluating treatment effects and measuring the effect size on outcome variables were similar to those used in the laboratory experiment. In this field study, SEM was also applied to examine the correlations between consumers' nutritional attitudes and changes subsequent to coupon promotions. However, some modifications were made at this step to achieve a more rigorous analysis.

First, the SEM in this step included further latent variables exhibiting consumers' attitudes toward food aspects such as convenience orientation, quality preference, resistance to change eating habits and negative beliefs about healthy eating. Composite reliability (CR) and average variance extracted (AVE) were computed to evaluate the reliability and validity of extracted latent variables. The acceptable values for AVE and CR are 0.5 and 0.7, respectively (Fornell and Larcker, 1981).

Second, a procedure of measurement invariance testing was conducted to ensure the measurements were equivalent between the control and experiment group (Millsap, 2011). Model parameters were held constant between two groups in various nested models, which were compared with a configural model whose parameters were estimated freely across groups. The establishment of measurement invariance at the metric, scalar and strict level was tested by constraining the model's factor loadings, intercepts, and residual variances, correspondingly. Measurement invariance was established at a certain level if the corresponding constrained models were not significantly different from the configural model (Vandenberg and Lance, 2000).



Third, the examination of these causal relationships were extended to a mediation analysis to differentiate between the behavioral outcomes (i.e., coupon redemption decisions) and dietary outcomes (i.e., changes in menu and calorie selection). The effects of psychological predictors were estimated separately on an individual's decision to redeem a coupon and dietary adjustments that occurred owing to this decision. In other words, coupon redemption was examined as a factor mediating the causal path from the psychological predictors to dietary changes. The indirect effects of psychological variables on dietary outcomes were measured as the product of direct effects of the predictors on the mediator (coupon redemption) and that of the mediator on the outcome (Shrout and Bolger, 2002). The statistical significance of indirect paths was evaluated using the bootstrapping method (Beaujean, 2014; Preacher and Hayes, 2008). The nature of mediation was interpreted according to Zhao, Lynch, and Chen (2010).

## 4 Results

Findings from each investigating step in this thesis were presented in a scientific paper published in international peer-reviewed journals. This chapter provides a summary of results and contributions of these papers. The full version of these papers can be found in Appendix 3.

The doctoral candidate was the primary author of all three papers and was responsible for developing the research design, organizing and conducting the data collection as well as performing statistical analyses in the corresponding studies. Furthermore, the author of this thesis was in charge of writing and editing the manuscripts in agreement with the co-authors.

### 4.1 Paper 1

This section summarizes the paper “A systematic review on the effects of personalized price promotions for food products”, which was published in the *Journal of Food Products Marketing*.

*Nguyen, M. T. T., Emberger-Klein, A., & Menrad, K. (2019). A systematic review on the effects of personalized price promotions for food products. Journal of Food Products Marketing, 25(3), 257–275. DOI: 10.1080/10454446.2018.1529647.*

Thanks to advances in data analytics, food marketers and retailers are able to drive their pricing strategies down to the one-to-one level and offer personalized promotions to their customers (Colla, 2004). The PPP approach is considered more effective than untargeted promotions in customer targeting. It can be used to reward existing buyers, attract new customers, increase sales and maximize profits (Acquisti and Varian, 2005; Miguéis, Camanho, and Cunha, 2011). However, there has been no literature synthesizing research findings on this topic. Hence, the effectiveness of PPP in relation to untargeted approaches remains inconclusive. In addition, the increasing adoption of PPP at grocery stores (Kharif, 2013) raises the question about the extent to which this

promotional tool influences consumers' food choices and consumption patterns. To address relevant literature gaps, this paper examines evidence on the effects of PPP targeting food products on consumers, grocery stores and food brands.

Following guidelines for conducting systematic reviews, this paper identifies ten relevant articles as shown in Table 3. The qualitative synthesis of evidence from these articles reveals an overall better performance of PPP than untargeted strategies in terms of behavioral and economic effects. PPP induces consumers to not only buy more of a promoted product but also switch to the store, brand or category of interest more often (Khan, Lewis, and Singh, 2009; Venkatesan and Farris, 2012; Zhang and Breugelmans, 2012). This leads to increased sales and profits of the stores running PPP or the promoted brands as well as improvements in customer retention and acquisition (Khan et al., 2009; Terui and Dahana, 2006; Zhang and Breugelmans, 2012; Zhang and Krishnamurthi, 2004; Zhang and Wedel, 2009). In contrast to thorough investigations of consumers' buying decisions and subsequent economic influences, current research has overlooked the dietary consequences of changes induced by this promotional tool. In examining factors influencing the effectiveness of PPP, little emphasis has been placed on consumer characteristics such as promotion sensitivity while most studies focus on determinants such as targeting or timing strategy, data source, discount level and brand characteristics. A strong focus on grocery stores and packaged foods is observed in the literature, with no research evaluating PPP for FAFH. This literature review does not identify any study taking price unfairness perception and privacy concern into account despite proven evidence on their influences on how consumers respond to personalized pricing strategies (Arora et al., 2008; Stourm et al., 2020).

This paper presents the first synthesis of empirical evidence on PPPs targeting food products in relation to untargeted promotions. Findings of this literature review underline topics relevant to this marketing instrument yet have been overlooked by the

literature. The better performance of PPP compared to its non-personalized counterparts implies the use of this approach to tackle issues of current price reductions for healthy foods such as favoring the wrong target group instead of the population at risk (Dallongeville et al., 2011; Muller et al., 2017). Evidence on how promotion and product specific factors influence promotion effectiveness provides valuable implications for the development of future PPP strategies.

**Table 3. Summary of findings from the systematic review**

Author (Year)	Setting	Examined effects of PPP			Determinants of PPP effectiveness		
		Behavioral	Economic	Dietary	Product specific	Promotion specific	Consumer specific
Zhang and Krishnamurthi (2004)	Grocery store (online)	Purchase incidence and acceleration	Brand sales and profit	Unexamined		Promotion timing	
Terui and Dahana (2006)	Grocery store	Unexamined	Brand sales and profit	Unexamined		Discount level	
Khan et al. (2009)	Grocery store (online)	Purchase incidence and acceleration	Store profit	Unexamined		Promotion type and regularity	
Zhang and Wedel (2009)	Grocery store (online and offline)	Unexamined	Store sales	Unexamined		Promotion strategy	Promotion sensitivity
Venkatesan and Farris (2012)	Grocery store	Coupon redemption, purchase acceleration, etc.	Store sales, customer acquisition and retention	Unexamined		Promotion regularity	
Zhang and Breugelmans (2012)	Grocery store (online)	Store visit, purchase acceleration	Brand profit	Unexamined	Brand characteristics	Promotion timing	
Johnson et al. (2013)	Grocery store	Unexamined	Brand and store profit	Unexamined			
Niraj and Siddarth (2014)	Grocery store	Unexamined	Store sales and profit	Unexamined			Data source (within or cross chain)
Baik (2015)	Grocery store	Coupon redemption, store visit	Brand sales	Unexamined		Promotion strategy	
Osuna et al. (2016)	Grocery store	Coupon redemption	Unexamined	Unexamined	Category and brand characteristics	Promotion strategy	

Source: Own elaboration based on Nguyen, Emberger-Klein, and Menrad (2019)

## 4.2 Paper 2

This section provides a summary of the second paper, which was published in the *British Food Journal* with the title “Personalized coupons for lower-calorie fast-food choices among young German adults and the influence of consumers’ nutritional attitudes on promotion effectiveness”.

*Nguyen, M. T. T., Emberger-Klein, A., & Menrad, K. (2020). Personalized coupons for lower-calorie fast-food choices among young German adults and the influence of consumers' nutritional attitudes on promotion effectiveness. British Food Journal, 123(4), 1413–1432. DOI: 10.1108/BFJ-08-2020-0709.*

Despite the increasing heterogeneity in individual preferences and promotional responses, current strategies for reducing prices of healthy foods are limited to offering untargeted discounts to all consumers (Just and Gabrielyan, 2016). Such incentives are not likely to change the purchasing and consumption patterns of the population at risk while consumers with existing healthy diets benefit more from discounts on nutritious foods that they usually buy (Darmon et al., 2016; Muller et al., 2017). A possible way to tackle this issue is harnessing the advantages of PPP to target price reductions at individual consumers. However, there has been no empirical evidence to examine whether this approach can make more differences than untargeted interventions, especially in the FAFH setting. Another topic that remains under-examined is the role of consumer specific characteristics in determining their responses to discounts on healthy foods (Paper 1). To address these overlooked topics, this paper compares the effectiveness of personalized and non-personalized discount coupons in encouraging choices of lower-calorie fast food menus in laboratory conditions. Using the SEM method, this study also examines whether psychological characteristics such as perceived barriers to healthy eating or calorie-related knowledge and concerns predict an individual’s response to these price interventions.

Although both types of price intervention are deemed effective in inducing participants to redeem coupons for lower-calorie menus, the effect of PPP is significantly greater. Significant differences in menu switching behaviors are also observed between the two groups. Participants receiving personalized coupons are more likely to switch to the low-calorie side dish (i.e., salad) and drink (i.e., mineral water) while untargeted coupons induce more switches to low-calorie main dish (i.e., chicken wrap). The increase in the average number of healthy item per menu after coupon selection was higher among personalized coupon recipients, which is mostly attributed to the greater number of subjects switching from the no-healthy-item menu to alternatives with two or more low-calorie items. Consequently, a greater reduction in selected calories is observed in the personalized intervention group.

The promotional effects also differ between groups of participants receiving different discount levels (which were determined based on calorie need and deal proneness as described in Section 3.2). Compared to the untargeted treatment, personalized coupons with low and high discounts are redeemed at a higher rate, which leads to a greater selection of low-calorie menu items and a smaller amount of calories selected. Meanwhile, the distinctions between untargeted coupons and personalized coupons with medium-level discounts are marginal.

Coupon redemption and dietary changes are less likely to occur among individuals holding negative beliefs about healthy eating as well as perceiving high barriers in changing food habits, giving up on tasty food, or finding time to follow a healthy diet. Participants who underestimate the number of calories they initially ordered are also less likely to take advantage of the offered coupons to change their menu choices and reduce the amount of calories selected. No correlation is found between an individual's calorie concerns and changes subsequent to the interventions.

This paper gives first empirical insights into the effectiveness of PPP for low-calorie foods as an intervention to promote healthy eating in the FAFH setting. It also

addresses the lack of evidence on the influences of consumers' nutritional attitudes and perceptions on their responses to discounts on healthy foods. On the one hand, findings of this paper provide important implications for researchers to develop PPP as a pricing tool to tackle excessive energy consumption and obesity. On the other hand, limitations owing to its laboratory conditions suggest directions for future research. Studies in a real-life setting where the incentives are not hypothetical and actual energy intake can be computed are recommended.

### **4.3 Paper 3**

This section presents a summary of the paper "Some like it tailor-made: The effectiveness of personalized coupons for healthier food choices at a university canteen", which was published in the *International Journal of Consumer Studies*.

*Nguyen, M. T. T., Emberger-Klein, A., & Menrad, K. (2021). Some like it tailor-made: The effectiveness of personalized coupons for lower-calorie food choices at a university canteen. International Journal of Consumer Studies, 4(15), 56. DOI: 10.1111/ijcs.12723.*

As pointed out in Paper 1 and 2, PPP has the advantage of targeting shoppers individually according to their purchase histories and is likely to improve the targeting strategies of price reductions for healthy foods. However, the effectiveness of this approach has not been examined in a natural shopping environment and little is known about the influences of psychological predictors on consumer response to this promotional tool. This paper addresses these understudied topics by evaluating the effects of untargeted and personalized coupons for lower-calorie menus on food choice and energy intake of patrons of a university canteen. The interplay between nutritional attitudes, promotional responses and subsequent dietary outcomes is also investigated using SEM and mediation analysis (see Section 3.3).



This quasi-natural experiment shows that personalized discounts are significantly more effective than untargeted discounts in inducing the study participants to redeem the coupons, switch to menus with more low-calorie items and order fewer calories. The effects of intervention types on changes in the breakdown of menu types also differ significantly. Compared to the PPP group, there are more untargeted coupon recipients whose final menus contain all four items categorized as low-calorie. Nonetheless, this untargeted intervention barely affects menu choices with less than two low-calorie items. Conversely, personalized coupons motivate a significantly larger number of subjects whose initial menus contain only one or no low-calorie item to switch to alternatives less dense in energy. The percentage of participants switching to low-calorie alternatives of main dish, side dish, and dessert is also higher in the personalized treatment than the control group.

In line with the preceding findings, the SEM output indicates a significant and positive association between coupon redemption and subsequent dietary outcomes (i.e., calorie reduction and increased choices of low-calorie items per menu). Coupon redemption also correlates positively with an individual's calorie concerns and convenience orientation when it comes to eating. Meanwhile, participants exhibiting greater resistance to change eating habits are less likely to redeem the offered coupons. There is no causal relationship between factors such as perceived preferences for food quality or negative beliefs about healthy eating and coupon redemption. When the effect of coupon redemption is controlled, personalized coupons lead to a lower level of changes in menu and calorie selection than untargeted coupons while no direct correlation was found between the examined psychological variables and dietary outcomes. When the effect of coupon redemption is taken into account, this variable plays a significant role in mediating the indirect effects of convenience orientation, calorie concern and resistance to change on dietary changes. The indirect effects of quality preference and negative beliefs about healthy eating remain

insignificant. A competitive mediation pattern is observed in the case of personalized coupon, in which the direct and indirect effects of this predictor on dietary outcomes are both significant yet point to opposite directions under the mediation of coupon redemption.

Findings from this paper contribute further to the understanding of consumer responses to price reductions for healthy foods and the possibility of using PPP as healthy eating intervention. Implications from this study are of great importance for researchers and policy makers to develop price intervention strategies in the future.

## **5 Discussion**

This chapter discusses results from all three papers in this thesis as a whole. The discussion presents methodological and thematic considerations of this thesis to provide implications for future research.

### **5.1 Methodological discussion**

This thesis employs qualitative and quantitative research methods to answer the defined research questions in a holistic way. The initial stage of the research involves a systematic review to determine the state of the art regarding PPP for food products. Knowledge gained from this step is used to justify research objectives and narrow down research questions of subsequent studies (Hart, 2014). Theoretical findings from this literature review are subsequently elaborated in an empirical experiment conducted in the laboratory setting. This experiment is followed by a field study whose objective is to validate the laboratory evidence and answer questions not addressed previously. The sequential use of different methods enhances the validity and generalizability of research outcomes by enabling cross validation between methods. Furthermore, it allows the doctoral candidate to modify the strategy of a study according to implications derived from a previously applied approach (Cronholm and Hjalmarsson, 2011). This design is also intended to gain a wider array of insights, which might be missed with single method research (Venkatesh, Brown, and Bala, 2013). In the following sections, advantages and shortcomings of each method used in this thesis will be discussed.

#### *5.1.1 Systematic literature review and qualitative evidence synthesis*

The literature review in this thesis is conducted in a systematic procedure. According to Petticrew and Roberts (2008), systematic reviews are more suitable than narrative reviews in testing hypotheses and handling specific questions e.g., whether PPP has a greater effect on consumer responses to promotion than untargeted price promotion

(UPP). Given its objective of identifying and summarizing all relevant studies, a systematic review is an essential tool for limiting systematic bias in literature search and selection as well as synthesizing evidence reliably and accurately (Liberati et al., 2009). Since the guidelines for literature search, selection and analysis in a systematic review are more stringent than narrative reviews, this approach offers a sound methodological frame for carrying out rigorous and reproducible research (Petticrew and Roberts, 2008; Seuring and Gold, 2012).

Each step in this process adheres closely to scientific guidance from Petticrew and Roberts (2008) and Liberati et al. (2009). As the topic of interest is an interdisciplinary issue, the search strategy is designed to cover all relevant aspects. Search terms are constructed from keywords related to price promotion, personalization, and food. The literature is searched not only in databases specialized in agricultural economics, health and nutrition (e.g., AgEcon, PubMed) but also multidisciplinary databases, including Scopus and ScienceDirect.

The literature selection strictly follows inclusion and exclusion criteria developed rigorously in the beginning and modified consistently throughout the process. Apart from published articles, this literature review also include gray literature such as Baik (2015). This inclusion is intended to reduce publication bias, which arises from the higher likelihood for results that are statistically significant to be published or submitted for publication (Andrews and Kasy, 2019). The search and selection process is outlined stringently in accordance with the PRISMA statement developed by Liberati et al. (2009) to ensure the reporting transparency. As a reporting guideline with a high uptake in the research community, the PRISMA statement is also essential for interpreting and reproducing the findings of literature reviews (Page and Moher, 2017).

Content analysis is applied to analyze information from the eligible studies. According to Seuring and Gold (2012), using content analysis for literature reviews increases the research replicability as well as the traceability of findings and conclusions. This

approach offers an effective tool for extracting reliable and valid information from research documents in a structured and systematic way. In general, the analysis procedure involves a descriptive analysis of the collected materials and a category selection step to identify relevant analytic categories (Mayring, 2008). In this literature review, the descriptive analysis is conducted based on methodological categories describing the setting of and methods used in the included studies (see Table 2). Analytic categories are generated using both inductive and deductive approaches (Mayring, 2000). Dimensions related to the implementation of PPP are derived inductively from the retrieved materials and revised constantly throughout the content analysis. Meanwhile, categories demonstrating the economic and behavioral effects of PPP are determined prior to the analysis based on influential theories on sales promotion such as Blattberg and Neslin (1989) and Gedenk et al. (2010). To consider the dietary effects of PPP, the theoretical framework on sales promotions and food consumption from Hawkes (2009) is included.

In content analysis, it is imperative to involve several coders who read the eligible documents independently to extract relevant content and assign the retrieved information to appropriate categories (Seuring and Gold, 2012). This reduces the subjectivity in information extraction and the risk of missing important data. To ensure a rigorous analysis of evidence, the coding process of this literature review is conducted with two separate coders and the intercoder reliability is evaluated using the Krippendorff's alpha. Hayes and Krippendorff (2007) suggest using this statistic as a standard reliability measure since it measures agreement for different data structures and is more independent of the number of categories or coders than other indices. In this study, the alpha values of all analytic dimensions meet the threshold for satisfactory reliability (0.67) and the majority indicate good reliability (0.8). Tuomaala, Järvelin, and Vakkari (2014) argue that categories with satisfactory reliability can be further classified as lower and higher acceptability. In this literature review, all

satisfactory categories have an alpha value closer to 0.8. Hence, tentative conclusions drawn from these categories are highly acceptable.

To assemble pieces of information extracted from preceding steps, researchers can choose between a meta-analysis and a qualitative synthesis of evidence. Meta-analyses answer the review question by providing a statistical summary of research findings. This method is only feasible when the designs, interventions, and dependent variables are equivalent across the examined studies (Petticrew and Roberts, 2008). In the current review, elements of the included studies are too heterogeneous to permit a quantitative summary of the outcomes. As a result, a qualitative or narrative synthesis of evidence is applied. All relevant information is tabulated to provide a full description of the eligible studies in terms of their participants, methods and findings. Compared to meta-analyses, it is more difficult to detect the outcome patterns and reach certain conclusions with narrative syntheses, especially when the number of documents increases (Petticrew, 2003). However, tabulating the review findings is an effective way to increase the transparency, clarify contributions of each study to the research area of interest, and highlight the overlooked topics.

### *5.1.2 Laboratory and field experiments*

Laboratory experiments are a widely used quantitative method to test the causal effect of interest. In addition to its advantage of low implementation cost, a laboratory experiment offers more control over the decision environments than in a naturally occurring setting (Falk and Heckman, 2009). In the laboratory experiment of this thesis, participants choose the menus and coupons in separated booths. On the one hand, this environment allows the doctoral candidate to mitigate the influence of external cues or social interactions and focus on individual specific predictors. On the other hand, such a controlled condition is typically different from real-life situations and makes it more difficult to predict actual behaviors (Harrison and List, 2004). The hypothetical nature of decisions and interventions in the lab contributes further to its

methodological shortcomings. In the case of this thesis, subjects of the laboratory experiment do not pay for what they choose, nor do they get real discounts for changing their menu choices. Given the differential effects of real and hypothetical rewards on brain activities, decisions made in this experiment might not resemble behaviors observed in naturally occurring data (Xu et al., 2018). For these reasons, findings from lab experiments should be verified by field data to draw convincing conclusions from the study outcomes (Harrison and List, 2004).

Given limitations of a laboratory experiment, a quasi-natural or framed field experiment is carried out as a complementary approach in this thesis. In such a study, the subjects know they are taking part in an experiment but are not aware of the interventions (Harrison and List, 2004). As a less controlled variant of experiments, field studies allow the observation of subjects in a naturally occurring condition while maintaining controls over the testing environment to a certain extent (Harrison and List, 2004). Although the experiment takes place in the natural setting of a canteen, the study participants must follow an imposed set of rules in choosing menus, paying for the food, and filling out the questionnaire. Meanwhile, interactions between subjects are not constrained to keep the testing environment as similar to real-world situations as possible (Vlaev, 2012). Unlike the laboratory condition, subjects in this study pay for what they choose and receive real rewards for the healthy choices they make. In this way, the experimenters can observe decisions induced by real economic benefits and make strong inferences about the intervention effectiveness as well as causal effects of interest.

Despite their methodological differences, the empirical studies in this thesis have some advantages in common. First, menus in both experiments include items typical of the testing environments. To keep the choices as close to the reality as possible, items in the lab condition resemble those at fast food chains while items in the field experiment are selected from common dishes at the testing canteen. Calorie content of menu

items is derived from national databases such as the USDA National Nutrient Database and German Nutrient Databases (BLS). Both databases are updated regularly and considered as standard reference for determining energy and nutrient intake (Hartmann, Heuer, and Hoffmann, 2015; Montville et al., 2013). Second, calorie requirements are determined for individual subjects based on not only gender but also the physical intensity of their occupational and leisure activities (German Nutrition Society, 2015). Third, psychological variables are measured with multiple Likert-type items from various domains to address the multifaceted nature of PPP for healthy foods. For instance, deal proneness is determined using price perception and coupon proneness scales (Lichtenstein et al., 1993). Psychological statements in the post-intervention questionnaire stem from the Food-Related Lifestyle (FRL) instrument (Scholderer et al., 2004) and further scales on nutrition and eating behavior (Candel, 2001; Gracey et al., 1996; O'Connell et al., 1981).

Although menus in the lab and field experiments are different, the personalization strategy remains unchanged between these steps to allow the cross-validation of findings from these studies. Coupons in both studies are customized at the individual level according to menu choice, calorie need, and deal proneness. Since lifestyle and behavioral characteristics are strong predictors of food choices and promotional responses (Asp, 1999; Laroche et al., 2003), using these criteria to determine an appropriate discount level for each subject increases the targeting capability of PPP. The effectiveness of PPP with low and high discount levels over non-personalized coupons as pointed out in Section 3.2 demonstrates how meaningful it is to include deal proneness and calorie need as personalization criteria. This inclusion induces changes among the population at risk by targeting high discounts at consumers who order excessive calorie yet are unresponsive to price incentives. Less inducement is required among deal prone individuals with an appropriate calorie selection. Hence, a low discount level is sufficient to encourage them to make the change.



The settings of both studies do not permit the retrieval of data on prior food purchasing histories and consumption patterns of the study participants. Hence, coupon personalization is based on current menu choices instead of using purchase histories as previous practices of PPP (Arora et al., 2008). It is also not feasible to evaluate the effects of price interventions on energy intake in a longer term. Such effects are only estimated based on differences in the calorie amount of initial and final menu choices. Moreover, dietary outcomes are limited to changes in energy intake. Although calorie is an important indicator of food intake, it is better to examine the dietary effects in a broader context with other nutrient values taken into consideration.

### *5.1.3 Quantitative analysis of experiment outcomes*

In both experiments, the differential effects of PPP and UPP on coupon, menu and calorie selection are examined using statistical tests of independence. Chi-square tests are applied to categorical outcome variables, including coupon redemption decisions or menu types. For continuous variables such as calorie reduction, non-parametric tests are used since they make fewer assumptions about the sample size and data distribution (Siegel and Castellan, 2003). These tests indicate how likely the observed patterns of outcomes are and whether a treatment effect exists (Lakens, 2013). Apart from the statistical significance, this thesis reports the results' practical significance using effect size measures. Effect sizes are standardized metrics for quantifying the magnitude of reported effects (J. Cohen, 1988). They allow researchers to compare standardized effects across similar studies to draw meta-analytic inferences about a topic. Effect sizes are also useful for planning future research and estimating the required sample size of a new study (Lakens, 2013).

Psychological constructs and their correlations with outcome variables are evaluated using a SEM procedure. SEM is a multivariate method ubiquitous in psychology, consumer and marketing research (Baumgartner and Homburg, 1996; MacCallum and Austin, 2000). This method is well-suited to identifying and estimating causal

relationships among measured variables and hypothetical constructs that cannot be observed directly (latent variables) (MacCallum and Austin, 2000). Therefore, it allows the doctoral candidate to evaluate not only the measurement of latent psychological predictors but also their influences on the examined behavioral and dietary outcomes (Steenkamp and Baumgartner, 2000).

As mentioned in Section 5.1.2, the psychological items in this thesis stem from various scales and domains. Thus, there is no single theoretical grounding for including indicators and extracting constructs. For this reason, exploratory factor analysis (EFA) is conducted prior to the model estimation in Step 2 to explore the patterns among psychological indicators. This procedure uses the principal axis method for factor extraction and the oblimin method for rotation (Schumacker and Lomax, 2010; Winter and Dodou, 2012). The outcome of this model is used as empirical input for measuring the latent variables of SEM. Since both structural equation models in this thesis utilize data from similar questionnaires (Appendix 2), the measurement model in Step 3 is built upon the laboratory data, including some adjustments as described in Section 3.3.2. The models are assessed using multiple model fit indices as recommended by Tabachnick and Fidell (2013) and all of them exhibit an excellent statistical fit to the collected data.

Modifications made to the analysis in Step 3 contribute to the methodological rigor of the whole thesis in many ways. First, using the AVE and CR measures allows the doctoral candidate to evaluate the construct validity and reliability more systematically, thus identifying variables subject to modification. Second, results from the measurement invariance tests permit convincing inference about the examined effects. The establishment of measurement invariance in all investigated levels indicate the equivalence in psychological characteristics across groups. In other words, a construct can be meaningfully tested across these groups since it has the same meaning to subjects receiving personalized and untargeted coupons. As a result, the doctoral

candidate can be confident that differential effects observed in the data do not arise from the measurement of these constructs (Putnick and Bornstein, 2016). Third, the mediation analysis clarifies the causal paths between psychological predictors, coupon redemption and dietary outcomes. Further discussion on how meaningful the adjustment is in elaborating this interplay is presented in the following section. Fourth, the statistical significance of indirect paths in the mediation analysis is assessed based on bootstrapped confidence intervals. Bootstrap-based inferences about the indirect effects have advantages over approximations based on the initial mediation theory proposed by Baron and Kenny (1986) since they do not require the examined effects to follow a normal distribution (Preacher and Hayes, 2008; Shrout and Bolger, 2002).

## **5.2 Thematic discussion**

Table 4 presents the overview of research questions examined throughout this thesis and corresponding results. In general, the research questions deal with two major topics related to how consumers react to PPP for food products (Question 1 and 2) and how individual differences in nutritional attitudes and beliefs determine promotional responses (Question 3). In this respect, promotional responses refer to not only behavioral outcomes (coupon redemption or purchase incidence) but also subsequent dietary changes (menu choice and calorie selection). By focusing on both behavioral and nutritional aspects of promotional responses, this thesis contributes to the existing lack of research outcomes on dietary effects of food-related PPP as shown in Table 3.

**Table 4. Summary of research questions and findings**

<b>Question</b>	<b>Paper</b>	<b>Grouping or predicting variable</b>	<b>Outcome variable</b>	<b>Mediating variable</b>	<b>Findings</b>
1	1, 2, 3	Coupon type	Coupon redemption, purchase incidence		Higher response rate to PPP than UPP
2	2, 3	Coupon type	Menu and calorie selection		Greater effects of PPP than UPP
3	2	Barriers to healthy eating	Coupon, menu and calorie selection		Negative effect
3	3	Resistance to change habits	Coupon redemption		Negative effect
3	3	Resistance to change habits	Menu and calorie selection	Coupon redemption	Negative effect
3	3	Negative beliefs about healthy eating	Coupon redemption		No effect
3	3	Negative beliefs about healthy eating	Menu and calorie selection	Coupon redemption	No effect
3	2	Calorie underestimation	Coupon, menu and calorie selection		Negative effect
3	2	Calorie concern	Coupon, menu and calorie selection		No effect
3	3	Calorie concern	Coupon redemption		Positive effect
3	3	Calorie concern	Menu and calorie selection	Coupon redemption	Positive effect
3	3	Convenience orientation	Coupon redemption		Positive effect
3	3	Convenience orientation	Menu and calorie selection	Coupon redemption	Positive effect
3	3	Quality preference	Coupon redemption		No effect
3	3	Quality preference	Menu and calorie selection	Coupon redemption	No effect

Source: Own elaboration

The first research question is answered using both theoretical and empirical findings from all three papers. According to the literature review, PPP is more effective than UPP in encouraging consumers to redeem the offered coupons and purchase the promoted products (Khan et al., 2009; Venkatesan and Farris, 2012; Zhang and Breugelmans, 2012). A higher response rate to PPP is also observed in the two empirical studies, with both laboratory and field data revealing that personalized coupons are more likely to be redeemed than untargeted coupons. Consistency in theoretical and empirical evidence allows confident conclusions about the advantage of PPP over untargeted promotions in changing food purchasing behaviors. This provides more reasons to believe that PPP can address the shortcomings of current pricing practices for healthy foods, which are offering identical reductions to all consumers regardless of their differences in promotion responsiveness (Just and Gabrielyan, 2016; Steenhuis et al., 2011).

It is essential to examine whether the higher response rate to PPP actually translates into differences in dietary intake (Question 2). Since the dietary effects of PPP targeting food products have not been addressed by prior research (see Section 4.1), this question is handled only in Paper 2 and 3. Focusing on low-calorie foods consumed away from home, these papers measure the effects of PPP and UPP in different observation conditions (laboratory or field) and consumption situations (fast food and canteen food). In both studies, the personalized approach creates more favorable changes than non-personalized discounts in terms of chosen food items and menu types, thus reducing the number of calories ordered by a greater extent. The differential effects of coupon types are elaborated and verified in the mediation analysis of Paper 3. Given a smaller percentage of personalized coupons targeting the all-healthy-item menu, PPP leads to fewer adjustments than UPP in the final calorie selection. When taking the mediating effect of coupon redemption into account, this approach is overall more effective in inducing favorable dietary changes. With these findings, arguments

presented in the literature review regarding the potential use of personalized price interventions are empirically supported.

Further findings from the laboratory and field experiment provides explanations of why the PPP approach developed in this thesis outperforms UPP. This strategy incorporates individual differences in nutritional and lifestyle-related characteristics such as calorie need and promotion responsiveness into the coupon personalization. Using criteria such as calorie need and deal proneness addresses the multifaceted nature of PPP for food products and enhances the accuracy of consumer targeting by bringing the segmentation closer to one-to-one level (Arora et al., 2008; Goldsmith, 1999). Indeed, laboratory evidence from this thesis shows that UPP is not as effective as low-level discounting PPP in encouraging lower-calorie choices and reducing the number of selected calories (see Section 4.2). By distinguishing deal-prone individuals with an appropriate amount of selected calories from subjects who order excessive calories yet are less responsive to promotion, PPP ensures the coupons targeted at the population at risk (the latter group) are attractive enough to induce changes. At the same time, low discounts are sufficient to encourage the former group to respond to promotion. Although past purchase histories are not used as personalization criteria in this thesis (see Section 5.1.2), the coupons in both empirical studies are tailor-made to individual participants based on their initial menu choices. This strategy still allows the experimenter to reward subjects who select the lowest-calorie menu for the healthy choices they make. According to prior research, reward coupons are redeemed at a higher rate than cross-selling coupons, particularly for products frequently purchased and discounted as fast food or FAFH (Baik, 2015; Osuna et al., 2016). This explains the significantly higher response rate to PPP observed in both empirical studies.

The better performance of PPP over UPP is also attributed to differences between the two approaches in determining which menus to promote. UPP targets only one menu whose all elements are considered as low-calorie or healthy. Subjects whose initial

choices do not consist of any of these items have to compromise on the whole menu upon redeeming the offered coupons. Under such a circumstance, people are inherently less responsive to the inducement than when they have the option to change only a few elements as offered by the personalized treatment. According to both experimental and field data, untargeted coupons barely alter the decisions related to no- or one-healthy-item menus. Conversely, personalized coupons induce more subjects who initially choose such menus to switch to options with more elements considered as healthy. As a result, personalized coupons bring about a stronger rise in the average number of healthy items per menu than their untargeted counterparts.

Moreover, personalized coupons mainly encourage changes in tie-in elements of a menu bundle such as drinks and side dishes. Prior research argues that consumers perceive the main dish as an anchor (i.e., the element of utmost importance) when evaluating menu options (Hur and Jang, 2015). Hence, a coupon that does not require changing the bundle's anchoring item tends to be met with less psychological reactance and increases promotional responsiveness (Brehm, 1980). This argument is supported by evidence from both experiments in this thesis. Following coupon redemption, more changes in a menu's tie-in elements are observed among individuals receiving personalized coupons than the other subjects. Despite being perceived as less important than the anchoring element, these items contribute considerably to the healthiness and calorie content of a menu bundle. Therefore, such adjustments lead to significant distinctions in the final number of calories ordered by the treatment groups of both experiments.

Results of the third research question shed light on the interplay between promotional responses, subsequent dietary changes and individual differences in nutritional attitudes and beliefs. This is an attempt to address the lack of research on how consumer specific characteristics affect promotional responses when put into the setting of healthy eating promotion. Various psychological predictors are examined

using both laboratory and field data. Among the investigated factors, convenience orientation, calorie concern, calorie underestimation, barriers to healthy eating, and resistance to change are found to have significant effects on behavioral and dietary outcomes. This emphasizes the salience of consumer perception in determining promotional responses. The findings are in line with arguments from prior research regarding the necessity of taking individual differences in psychological traits into account when developing not only promotional instruments but also nutritional interventions (Just and Gabrielyan, 2016; Neslin et al., 1994).

Findings from both papers point to the lack of knowledge, motivation, or time, and especially the resistance to change as barriers that prevent an individual to react to monetary stimuli for healthier choices. Food choice in fast food restaurants or canteens are unlikely to change since consumers already develop a strong habit in such frequently repeated eating situations (Orbell and Verplanken, 2010). In such a habitual context, these cognitive obstacles are intensified, thus making unmotivated consumers more reluctant to perform the change (Hardcastle et al., 2015). In contrast to evidence indicating negative beliefs about healthy eating as a powerful predictor of dietary behaviors (Deshpande, Basil, and Basil, 2009), this thesis finds no effect of this factor on behavioral and dietary changes following PPP. Deshpande et al. (2009) examines decisions to follow a healthy diet, which requires much effort and deliberation. On the contrary, choices investigated in this thesis require a swift response and hence less deliberation. This explains inconsistencies in the outcomes of the two studies.

The effects of calorie-related determinants are consistent with findings from prior research. Evidence from laboratory data supports the prevailing tendency of calorie underestimation among consumers as pointed out in Livingstone and Black (2003). This factor influences consumers in a way that lead them to select more calories than they actually need, thus resulting in fewer favorable changes subsequent to PPP (Chandon and Wansink, 2007). Although no effect of calorie concern is observed in



the laboratory data, its strong correlations with coupon redemption and dietary outcomes are elaborated in the mediation analysis of Paper 3. Such findings are supported by evidence demonstrating the influences of consumer's knowledge and concerns about calories on decisions related to FAFH (Carrillo et al., 2012).

The positive effects of convenience orientation underlines the growing salience of convenience aspects in food choice (Conner, 1993). Moreover, this thesis supports the convenience benefits of price promotion proposed by Chandon et al. (2000). As observed in the field data, coupons are more favored among convenience-oriented consumers than those putting less emphasis on this aspect. An explanation for this finding is that convenience-oriented shoppers tend to be susceptible to marketing cues as a way to reduce their cognitive efforts in making choices, thus are more responsive to price promotions (DeVecchio, 2005; Mandrik, 1996).

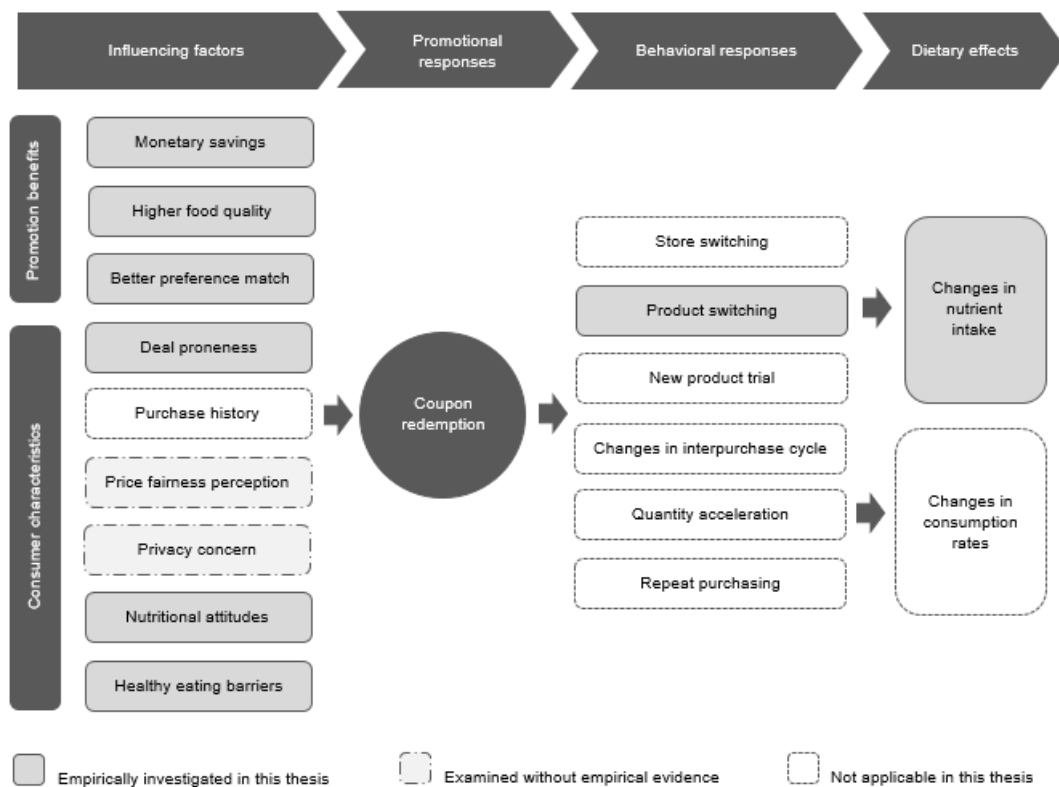
The insignificant effects of quality preference imply the need for more grounding theories to support the interplay between this psychological trait and promotional responses. In this thesis, this variable is constructed by preferences for health and process-related attributes of food quality. According to prior research, local or organic foods are often considered less energy dense than conventional options and buyers of such products tend to not only have lower BMI but also healthier dietary patterns (L. Lu and Gursoy, 2017; Prada, Garrido, and Rodrigues, 2017). Nonetheless, there is no evidence supporting the direct connection between consumer attitudes toward these process-oriented dimensions and choices of low-calorie food or responses to price promotion (Filimonau et al., 2018; Schifferstein and Oude Ophuis, 1998).

### **5.3 Implications for future research**

Figure 11 demonstrates a conceptual framework based on theoretical considerations presented in Chapter 2 and empirical findings from all three papers. This thesis puts consumers' reactions to PPP for food products in the center to indicate antecedent factors that determine such responses and evaluate behavioral and dietary changes

following the promotion. To address the multidimensionality of PPP for food products, the influencing factors and effect categories are derived from theories in various research topics, including price promotion (Chandon et al., 2000; Gedenk et al., 2010; Laroche et al., 2003), price promotion and food consumption (Hawkes, 2009; Taylor and Long-Tolbert, 2002), as well as food choice and dietary decisions (Asp, 1999; Grunert et al., 2001).

**Figure 11. Framework of consumer response to personalized price interventions**



Source: Own elaboration

Since this thesis focuses on coupon promotion, coupon redemption behavior is examined as the framework's central concept. The framework distinguishes between promotion and consumer specific influencing factors. Promotion specific determinants include utilitarian benefits of PPP for consumers such as monetary savings from the discounts, opportunity to upgrade to healthier and less energy dense foods, as well as enhancements in shopping convenience owing to the better match between the offers

and consumer preferences (Chandon et al., 2000). These factors are incorporated directly into the coupon personalization strategy in this thesis. Other criteria for personalizing the coupons are consumer specific traits such as deal proneness and purchase history, both of which are considered by prior research as powerful predictor of promotional response (Acquisti and Varian, 2005; DelVecchio, 2005). Although the use of purchase history is not feasible in this thesis, coupons are tailor-made on the current menu choice of an individual. Employed along with individual calorie needs, this indicator makes a meaningful criterion to segment consumers with different dietary patterns. The better performance of PPP over UPP observed in both laboratory and field data confirms the salience of the mentioned determinants in predicting promotional responses. This underlines the effectiveness of the targeting approach developed in this thesis. Future work applying similar strategies to customize price promotion offers are still needed to verify the outcomes of this thesis in other settings or in other countries and provide more evidence-based implications.

Other consumer specific predictors such as privacy concern and price fairness perceptions are increasingly mentioned in the literature as salient factors determining how consumers react to PPP (Acquisti, 2008; Arora et al., 2008; Stourm et al., 2020). Therefore, this thesis attempts to evaluate the effects of such predictors in the first investigating steps. However, the literature review does not identify any empirical research addressing these topics with regard to food. Settings of the laboratory and field studies do not facilitate an investigation into these factors either. Given the increasing awareness of personalized pricing practices and consequential concerns among consumers, it is imperative for future research to address this overlooked topic when examining PPP for food products (Bonatti and Cisternas, 2020; Stourm et al., 2020). Insights into consumer attitudes toward the data usage and targeting strategy of PPP are valuable input for researchers and policy makers to improve the quality of price interventions and identify potential regulation needs.

Further consumer characteristics that influence promotional responses are an individual's nutritional attitudes and perceived barriers to selecting healthy foods. The effects of these determinants are empirically validated in this thesis using both field and laboratory data, which implies the salience of psychological differences in consumer reactions to price interventions. Taking these into account tackles consumer heterogeneity and fine-tunes the targeting strategy of existing pricing practices for healthy foods (Neslin et al., 1994). These findings also suggest the simultaneous use of additional information cues such as a visually attractive calorie labelling system or a virtual nutritional assistant to boost the effects of price incentives (Drescher, Roosen, and Marette, 2014; Mohr, Dolgoplova, and Roosen, 2019). At the same time, nutrition information programs are necessary for reshaping consumer perceptions and mitigating the effects of perceived barriers or resistance to perform dietary changes (Kearney and McElhone, 1999; Lea and Worsley, 2003).

To provide a holistic view on PPP for food products, this thesis presents an evaluation of behavioral and dietary effects of the approach of interest subsequent to coupon redemption. As derived from conceptual frameworks of Gedenk et al. (2010) and Hawkes (2009), behavioral effects include not only switching behaviors but also further adjustments in purchasing patterns. Within the scope of this thesis, it is only possible to measure the product switching effects, which are indicated as changes in food items and menu choices. As a result, the evaluation of dietary effects is limited to immediate changes in calorie selection and intake. This shortcoming implies interesting directions for future research. A study with more access to purchase history data can examine whether PPP induces consumers to try a food product they never consume before or buy a promoted product again, which eventually brings about adjustments in food consumption (Hawkes, 2009). In the context of FAFH, an investigation into the store switching effect of PPP provides additional insights into consumers' evaluation of menu calories and subsequent food choices among different fast food chains

(Chandon and Wansink, 2007). Moreover, empirical studies in a naturally occurring setting are recommended to enable the use of purchase history data, the computation of actual nutrient intake, and the evaluation of dietary changes in a long term. Another interesting direction for future research is adapting personalized pricing strategies to the food retail sector. The increasing adoption of customer cards and loyalty programs at grocery stores is an excellent facilitator for introducing PPP to this area (Stourm et al., 2020). Given the vital role of groceries in food consumption, implementing this approach at supermarket chains is likely to make a substantial impact on healthy eating promotion agendas (Mah et al., 2019).

In summary, findings from this thesis underline the advantage of PPP for food products. Researchers and policy makers can harness the peculiar targeting capability of this approach by using it as a pricing strategy for promoting healthy food choices. Such possibility is facilitated by the increasing digitalization of food purchases at grocery and fast food chains in high income countries, including Germany (Kraak, 2020). This gives researchers more opportunities to understand consumers individually, adjust food prices at a more fine-grained level and tackle the limitations of untargeted strategies (e.g., offering irrelevant inducements or targeting the wrong population at risk) (Dallongeville et al., 2011; Muller et al., 2017). Given the close association between FAFH and excessive energy consumption, this cutting-edge intervention tool makes a potential solution to address obesity and diminish the economic burden of this ongoing epidemic on the healthcare systems of highly affected countries such as Germany (World Health Organization, 2015).

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## Appendices

### Appendix 1. Pre-intervention questionnaire in the lab and field experiments

1. Please specify your gender						
<input type="checkbox"/> Female	<input type="checkbox"/> Male					
2. Which of the following categories best describes your employment status?						
<input type="checkbox"/> Employed full time	<input type="checkbox"/> Employed part time					
<input type="checkbox"/> In vocational training	<input type="checkbox"/> Student					
<input type="checkbox"/> Home-maker	<input type="checkbox"/> Unemployed / Job-seeking					
3. Which of the following statements best describes your job-related activities?						
<input type="checkbox"/> My job requires intensively sitting activities						
<input type="checkbox"/> My job requires both sitting and standing activities						
<input type="checkbox"/> My job requires intensively standing and walking activities						
<input type="checkbox"/> My job requires strong physical activities						
4. Which of the following statements best describes your job-related activities?						
<input type="checkbox"/> Never						
<input type="checkbox"/> Less than 30 minutes per week						
<input type="checkbox"/> 30 minutes to less than 2 hours per week						
<input type="checkbox"/> 2 to less than 4 hours per week						
<input type="checkbox"/> 4 to less than 6 hours per week						
<input type="checkbox"/> More than 6 hours per week						
5. To what extent do the following statements reflect your behaviour?						
<i>Please select a value from 1 = very untrue to me to 6 = very true to me</i>						
	1	2	3	4	5	6
I always check prices when eating out/ eating at fast food restaurants.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I always search for special offers of (fast food) restaurants before eating there.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I look for special deals in newspaper or on the internet and plan to take advantage of them when I go shopping.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I plan before shopping but often end up buying products that are on sale.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## Appendix 2. Post-intervention questionnaire in the lab and field experiments

<b>1. To what extent do the following statements reflect your behavior?</b>						
<i>Please select a value from 1 = very untrue to me to 6 = very true to me</i>	1	2	3	4	5	6
I usually go to stores where I can quickly do my shopping.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I usually no decide what to buy before I go shopping for food.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Information from advertisements help me to make better decisions when shopping for food.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I compare labels to select the most nutritious food.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am willing to pay more for healthy food.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I usually compare the price between product variants to get the best value for money.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
At home I preferably cook meals that can be prepared quickly.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I often use ready-to-eat foods and instant mixes (e.g. baking mixes or powder soups) in my cooking.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I always plan what I am going to eat a couple of days in advance.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I only eat food that are familiar to me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I eat what is to me delicious and do not care how healthy it is.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I dislike everything that might change my eating habits.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I do not mind paying more money for regional products.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I prefer fresh food to canned or frozen products.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I always select organic food if I have the opportunity.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>2. To what extent do the following statements reflect you?</b>						
<i>Please select a value from 1 = very untrue to me to 6 = very true to me</i>	1	2	3	4	5	6
When eating, I first consider the taste.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I know the calorie content of the food and beverages I consume.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I count calories in order o keep my weight under control.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have trouble knowing how many calories I should consume in a day.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I do not have time to strictly follow advice on healthy eating.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I consider my weight when deciding what to eat.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I do not know which foods are healthy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>3. To what extent do the following statements reflect you?</b>						
<i>Please select a value from 1 = very untrue to me to 6 = very true to me</i>	1	2	3	4	5	6

It is not worthy to put much effort on keeping a healthy diet.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I find that a healthy diet is too expensive.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A healthy diet is an important determinant for a healthy life.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>4. Are you a vegan or vegetarian?</b>						
<input type="checkbox"/> Yes	<input type="checkbox"/> No					
<b>5. Are you following a special diet?</b>						
<input type="checkbox"/> Yes	<input type="checkbox"/> No					
<b>6. How many people are there in your family?</b> If you are living in a shared flat, please do not include your flatmate(s).						
<b>7. In your household, are you responsible for...</b>						
grocery shopping?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Shared responsibility			
cooking?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Shared responsibility			
<b>8. How often...</b>						
	<b>Never</b>	<b>Seldom</b>	<b>Usually</b>	<b>Often</b>	<b>Very often</b>	<b>Always</b>
do you check prices and then decide to buy or not to buy a food product?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
do you check ingredient lists and then decide to buy or not to buy a food product?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>9. What is the highest education level you have completed?</b>						
<input type="checkbox"/> Less than secondary school			<input type="checkbox"/> Secondary school without apprenticeship			
<input type="checkbox"/> Secondary school with apprenticeship			<input type="checkbox"/> High school or equivalent			
<input type="checkbox"/> High school with university entrance qualification			<input type="checkbox"/> Academic degree (Bachelor, Master, Diplom)			
<b>10. Which of the following ranges includes your total monthly household income?</b>						
<input type="checkbox"/> Under 900 Euro			<input type="checkbox"/> 900 to under 1,300 Euro			
<input type="checkbox"/> 1,300 to under 1,500 Euro			<input type="checkbox"/> 1,500 to under 2,000 Euro			
<input type="checkbox"/> 2,000 to under 2,600 Euro			<input type="checkbox"/> 2,600 to under 3,600 Euro			
<input type="checkbox"/> 3,600 to under 5,000 Euro			<input type="checkbox"/> More than 5,000 Euro			
<b>11. How old are you?</b>						
<b>12. Please enter your weight and height?</b>						
Your weight (in kg)			Your height (in cm)			



### Appendix 3: Full version of the published papers

This Appendix presents the full version of the following papers.

1. Nguyen, M. T. T., Emberger-Klein, A., & Menrad, K. (2019). A systematic review on the effects of personalized price promotions for food products. *Journal of Food Products Marketing*, 25(3), 257–275. DOI: 10.1080/10454446.2018.1529647.
2. Nguyen, M. T. T., Emberger-Klein, A., & Menrad, K. (2020). Personalized coupons for lower-calorie fast-food choices among young German adults and the influence of consumers' nutritional attitudes on promotion effectiveness. *British Food Journal*, 123(4), 1413–1432. DOI: 10.1108/BFJ-08-2020-0709.
3. Nguyen, M. T. T., Emberger-Klein, A., & Menrad, K. (2021). Some like it tailor-made: The effectiveness of personalized coupons for lower-calorie food choices at a university canteen. *International Journal of Consumer Studies*, 4(15), 56. DOI: 10.1111/ijcs.12723.

All papers were created within the scope of this thesis and published at peer-reviewed journals.



## A Systematic Review on the Effects of Personalized Price Promotions for Food Products

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# A Systematic Review on the Effects of Personalized Price Promotions for Food Products

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## ABSTRACT

Recent decades have witnessed the increasing adoption of personalized price promotion (PPP) at grocery stores. Despite the growing body of research debating whether PPP is more effective than untargeted price promotions, there is no literature synthesizing the relevant evidence on food products. Therefore, we conduct a systematic review to examine empirical findings on the effects of PPP targeting food products. Outcomes of 12 identified studies demonstrate larger sales and profit boosting effects of PPP than its non-personalized counterparts. Meanwhile, the results on how this approach influences consumer behavior are mixed. The effectiveness of PPP varies among different targeting strategies (e.g. reward or cross-selling) and information collection methods (e.g. using within- or across-chain data). The findings of this review have important managerial implications for the future evaluation and application of PPP as well as imply potential directions of further research on this topic.

## KEYWORDS

One-to-one marketing; personalization; personalized price promotion; food marketing; *enable* cluster

## Introduction

Price promotions in the food market have come a long way in recent decades. Food marketers are now able to move beyond the one-size-fits-all mentality of mass marketing and drive their promotions down to the individual level by implementing personalized price promotion (PPP). While traditional price promotions are becoming less effective due to their limited targeting capability (Arora et al., 2008; Jing & Lewis, 2011), PPP addresses the individual differences in consumer needs and tastes. This personalization approach represents the extreme form of market segmentation, in which each customer or household is regarded as a segment (Goldsmith, 1999; Kotler, 1989; Lampel & Mintzberg, 1996). This segmentation level is only accomplished thanks to the unprecedented adoption of scanner panel data and loyalty cards at grocery stores in the twenty-first century. These technologies help reduce the complexity as well as the cost of data retrieval and storage, thus enabling food retailers to accumulate a huge amount of customer data (Colla, 2004; Zhang, Liu, & Zhong, 2016). In

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practice, a growing number of retailers are adopting this promotion strategy, including Tesco, Safeway, and Kroger (Khalif, 2013; Rossi, McCulloch, & Allenby, 1996). After obtaining their customers' purchase histories, retailers determine which offers are best suited to each individual. They decide whether to target their promotions at new customers (cross-selling or competitive promotion) or existing buyers (reward or loyalty promotion). Afterwards, the customers receive the deals via mail or as checkout coupons in their shopping trips. At online stores, the offers are customized depending on previous transactions and communicated directly to shoppers on the website (Osuna, González, & Capizzani, 2016; Venkatesan & Farris, 2012).

Given the increasing adoption of PPP in practice, several authors see its advantage over untargeted price promotions in targeting individual consumers. The targeting capability of this approach enables the practicing firms to maximize their profits, increase their market shares, maintain a good customer relationship, and acquire new buyers for their products (Acquisti & Varian, 2005; Miguéis, Camanho, & Cunha, 2011). Although PPP requires high initial costs for software development and data acquisition, it minimizes the likelihood of distributing irrelevant offers to consumers, thus reducing the total cost of a promotional campaign (Arora et al., 2008; Zhang & Krishnamurthi, 2004). Firms adopting this approach achieve a competitive advantage over its rivals, especially when the market is heterogeneous and the barriers to personalization are high (Chen & Iyer, 2002). Despite the mentioned benefits, numerous researchers specify potential problems due to the peculiarities of PPP. For example, obtaining a substantial amount of customer data is in conflict with some consumers' wishes to protect their personal information and privacy although this procedure is a major cornerstone of PPP (Arora et al., 2008). In addition, consumers are likely to perceive price unfairness when they are aware of receiving less advantageous offers than other customers (Estalami, Tsai, & Lee, 2007; Feinberg, Krishna, & Zhang, 2002). Due to their privacy concerns and unfairness perception, consumers tend to be more reluctant to participate in a personalized promotion program. In turn, this phenomenon affects not only the profitability of marketing activities but also customer loyalty toward a brand or store (Feinberg et al., 2002).

The accelerating adoption of PPP in the food market raises the question of whether this strategy changes the food consumption patterns of consumers. According to Gittelsohn, Trude, and Kim (2017), there is a vast array of empirical studies examining the correlation between price promotions and the extent to which people consume certain types of food. For instance, Dong and Kaiser (2005) identify a positive association between coupon usage and cheese consumption. Harnack et al. (2008) as well as Olsho, Klerman, Wilde, and Bartlett (2016) find price promotions targeting healthy foods to induce the intake of fruit and vegetables while reducing the consumption of unfavorable products. In addition, literature reviews are conducted to synthesize

the empirical evidence on this topic. Hawkes (2009) indicates the effectiveness of price promotions in altering the way consumers select and consume food. McGill et al. (2015) point out that price interventions enable healthier food choices without widening the dietary gap among socio-economic groups. Nevertheless, these reviews cover only the outcomes of strategies treating all consumers alike and offering them identical price incentives while overlooking the effects of PPP on food consumption.

Despite the increasing body of research demonstrating the advantages and drawbacks of PPP, it is not yet possible to draw final conclusions from this debate due to the lack of literature synthesizing the relevant results. We, therefore, conduct a systematic review to examine evidence on how PPP for food products influences consumers and the practicing firms. Accordingly, the review explores scientific proof of this approach's effects on consumer shopping behaviors as well as brand and store performance. In order to address concerns about the data exploitation and targeting strategies of PPP, we include studies taking issues such as price fairness perception, privacy, and data protection into consideration. Besides, we aim to identify empirical findings on the possible association between PPP and consumers' food consumption patterns or diet quality. Another objective of this review is to measure the effectiveness of different PPP variants depending on their targeting strategies (reward or cross-selling), promotional tools (using price cuts or coupons), and data collection methods. In general, this review provides an insightful overview of existing evidence on the effects of PPP and highlights potential research directions. This allows not only contributions to the ongoing discussion among researchers but also managerial implications about the application and evaluation of PPP.

## **Methods**

We conducted a systematic review on scientific articles investigating the effects of PPPs for food products. To identify the relevant literature, we created a set of terms defining the PPP concept and used four popular bibliographic databases in the food marketing area (i.e. Scopus, ScienceDirect, PubMed, and AgEcon). In addition, we scrutinized relevant references to reveal additional publications that might have been left out during the initial database search.

### ***Eligibility criteria***

An article qualified for this review when it met the following criteria. First, the studies must be conducted with primary and empirical data on food products. Second, price promotions in the eligible studies must be customized at the individual customer or single household level. Third, we excluded studies focusing on the general pricing strategies instead of examining promotional elements such

as price reductions, or discount coupons. Fourth, the study must evaluate changes in the economic performance of food stores and brands adopting PPP, as well as alterations in consumers' shopping behaviors, food consumption patterns, diet quality, price fairness perception, or concerns about privacy and data protection.

The examination of the mentioned effects was based on the following insights into sales promotions. As stated by Gedenk, Neslin, and Ailawadi (2010) as well as Blattberg and Neslin (1989), the temporary nature of promotions induces consumers to immediately switch between brands (brand switching) or change to products they normally do not buy (category switching). Such monetary incentives additionally encourage consumers to shop at stores running promotion (store switching), increase their purchases of a product (purchase acceleration) or repurchase it in the future (repeat purchase). Such behavioral adjustments subsequently bring about changes in the economic performance of food stores and brands in terms of sales, profits, customer acquisition, and retention. Further literature such as Hawkes (2009) and Arora et al. (2008) was used as references for investigating how PPP is associated with food consumption, diet quality, price fairness perception as well as privacy and data protection concerns.

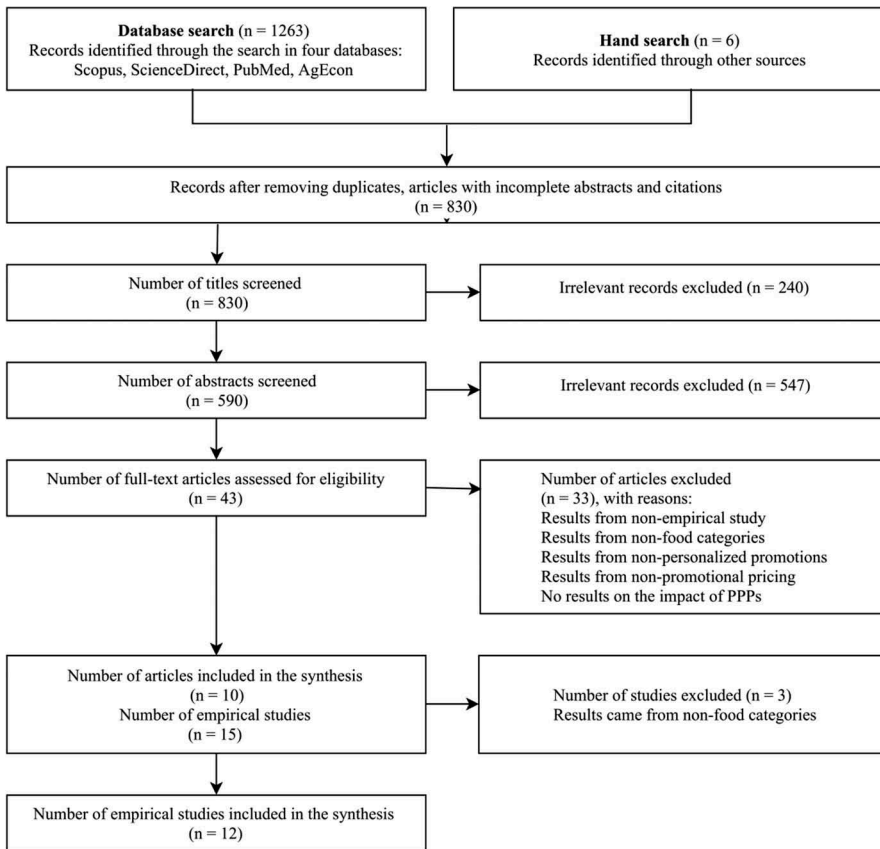
### **Data extraction and coding**

After the literature search, we removed duplicates and screened the articles according to the eligibility criteria (see Figure 1). In case an article reported findings from separate data sets, only studies that met these requirements were considered eligible. Records remaining from the filtering steps were included in the qualitative synthesis. This step involved two coders independently examining the content of eligible documents. The coding process followed guidelines for qualitative content analysis proposed by Hsieh and Shannon (2005) and Krippendorff (2013). We developed a coding category system based on the checklist of items outlined in the PRISMA statement for systematic reviews (Liberati et al., 2009) and the listed effect categories.

We compared results from the coders using ReCal—an online tool developed by Freelon (2010) to support researchers in measuring the inter-coder reliability. According to the coding quality in Table 1, the alpha values of 9 out of 15 included variables met the threshold of  $\alpha = 0.80$ , which indicated a good reliability of the coding. Although the Krippendorff's alphas of the other six variables did not reach this standard, they fell into the range of  $0.67 < \alpha < 0.80$ , which allowed tentative conclusions from the coding outputs (Krippendorff, 2013).

### **Results**

The literature search identified 1269 titles as potentially relevant for the review and 10 articles met the eligibility criteria. Four of them each reported findings from different studies. However, three studies did not fulfill the



**Figure 1.** Literature search and filtering process.

**Table 1.** Intercooder reliability.

Variables	Agreement percentage	Krippendorff's alpha
Setting	91.7%	0.822
Data collection	91.7%	0.758
Data type	91.7%	0.873
Promotion strategy	83.3%	0.731
Promotion tool	83.3%	0.754
Promotion distribution	91.7%	0.873
Analysis method	100%	1,000
Store visit probability	100%	1,000
Purchase probability	91.7%	0.768
Purchase expenditure	91.7%	0.816
Redemption rate	91.7%	0.768
Store revenue	91.7%	0.807
Brand revenue	91.7%	0.768
Store profit	91.7%	0.878
Brand profit	91.7%	0.852

inclusion requirements since their data came from non-food categories. Finally, there were 12 studies kept for the qualitative synthesis (see [Figure 1](#)).

### **Study characteristics**

Table 2 summarizes the characteristics of studies included in the synthesis. All were published from 2004 onwards, with nine studies conducted in the United States, two in Europe and one in Japan. Most of them examined packaged food categories such as butter, cheese, yogurt, frozen meat, canned fruit, etc. The datasets covered the period from 1985 to 2009, with sample sizes ranging from 129 to 2500 households. The majority used scanner panel data and information from loyalty programs of brick-and-mortar stores. A smaller proportion focused on online food retailers whereas one examined the impacts of PPPs in both settings. Besides, only three studies used the experimental approaches to gather the data.

Table 2 additionally demonstrates the implementation aspects of PPP in the included studies. In terms of promotion strategy, only one study focused on the cross-selling approach; the rest either investigated reward promotions or dealt with both strategies. Among online studies, the stores communicated their customized offers directly in their websites. Among brick-and-mortar stores, PPPs were distributed through mailing or as check-out coupons at points of sales. Regarding the segmentation method, most authors developed a joint model to optimize the promotion level based on individual customer responses. Information fed into such models included brand choice, purchase incidence, purchase quantity and expenditure, store visit incidence, category purchase incidence, or the timing aspects. Baik (2015) followed the Least Absolute Shrinkage and Selection Operator (LASSO) approach to estimate regression functions that best forecast the coupon receipt. Meanwhile, Terui and Dahana (2006) utilized the heterogeneous price threshold model to consider several pricing levels and consequently determine a customized threshold. In Venkatesan and Farris (2012) as well as Osuna et al. (2016), the retailers targeted customers based on their past spending, coupon redemption, or exposure to prior promotions.

### **Effects of PPP**

To evaluate the effects of PPP, ten studies applied simulation models while Baik (2015) and Osuna et al. (2016) used regression analyses. Most of the included studies examined PPP in relation to untargeted price promotion (UPP). Four studies compared different variants of PPP with each other (e.g. measuring the differential impacts of reward and cross-selling PPPs or scrutinizing the profitability of PPP integrated with the timing feature in comparison with the non-timing variant).

### **Effects on consumer behavior**

Among the eligible studies, five examined the behavioral impacts of PPP (Table 3). However, we identified no evidence on the repeat purchasing impacts of PPP



**Table 2.** Study characteristics and the implementation of PPP for food products.

Study	Study characteristics					Implementation of PPP			
	Country	Setting	Period	Sample size	Data collection	Data type	Strategy	Distribution	Segmentation
Zhang and Krishnamurthi (2004)	USA	Online	1997–1999	129 households	Observation	Online transactions	Cross-selling Reward	Online	Joint model of purchase incidence, brand choice, purchase quantity
Terui and Dahana (2006)	Japan	Offline	1990–1922	197 panels	Observation	Scanner data	Cross-selling Reward	Check-out	Heterogeneous price threshold model
Khan et al. (2009)	USA	Online	56 weeks	Not specified	Observation	Online transactions	Reward	Online	Joint model of purchase incidence and expenditure
Zhang and Wedel (2009)	USA	On and offline	1997–1999	244 households	Observation	Online transactions Scanner data	Cross-selling Reward	Online Check-out	Joint model of purchase incidence, choice and quantity
Venkatesan and Farris (2012)	USA	Offline	Before 2008	2500 households	Quasi-experiment	Shopper card	Cross-selling Reward	Mailing	Past spending, prior coupon redemptions, and exposure to prior campaigns
Zhang and Breugelmans (2012)	Europe	Online	2004–2006	2104 households	Natural experiment	Shopper card	Cross-selling Reward	Online	Joint model of store visit, shopping trip spending,
Johnson et al. (2013), Study 1	USA	Offline	1985–1988	970 households	Observation	Scanner data	Reward	Mailing	Joint brand choice and timing model
Johnson et al. (2013), Study 2	USA	Offline	2001–2006	500 households	Observation	Scanner data	Reward	Mailing	Joint brand choice and timing model
Niraj and Siddarth (2014), Study 1	USA	Offline	2001–2006	698 households	Observation	Scanner data	Reward	Mailing	Joint model of purchase decisions, category purchase incidence, brand choice, and purchase quantity
Niraj and Siddarth (2014), Study 2	USA	Offline	114 weeks	183 households	Observation	Scanner data	Reward	Mailing	Joint model of purchase decisions, category purchase incidence, brand choice, and purchase quantity
Baik (2015)	USA	Offline	Before 2008	2500 households	Observation	Scanner data	Cross-selling Reward	Mailing	Least absolute shrinkage and selection operator (LASSO)
Osuna et al. (2016)	Europe	Offline	2008–2009	893 promotions	Quasi-experiment	Shopper card	Cross-selling Reward	Check-out	Retailer's decision based on customer revenue contribution

among the eligible studies. In addition, there were inconsistencies concerning the effects of PPP on consumers' purchase decision. According to Khan, Lewis, and Singh (2009), PPP led to a 1.7% higher purchase incidence than the scenario with no customization. Meanwhile, evidence from Zhang and Krishnamurthi (2004) suggested a slightly lower incidence probability when adapting PPP to the stick butter category of an online retailer (0.41 compared to 0.42). Another effectiveness indicator for price promotions, specifically for discount coupon programs, is the rate of customers redeeming coupons. However, there was only one study of Venkatesan and Farris (2012) examining this impact factor. They found significantly positive effects of personalized coupon on the redemption rates.

Instead of comparing PPP with untargeted price promotions, Baik (2015) investigated how effectively different PPP variants work depending on their targeting strategies. Findings of this study showed a higher redemption rate for reward coupons (2.8%) than competitive coupons (0.98%). In their quasi-experiment, Osuna et al. (2016) also found that category and brand characteristics had a moderating effect on the association between targeting strategies and coupon redemption. They concluded that redemption rates are more significant among frequently promoted products, with higher impacts on reward coupons than cross-selling coupons. Redemption rates for reward coupons were higher among categories with high purchase frequency or brands regularly on sale. Cross-selling coupons were more effective among brands with high market shares, categories with high relative price, or products that are easy to store and not perishable.

Apart from examining the changing purchase and redemption patterns, Venkatesan and Farris (2012) found that personalized coupons have larger category switching effects than non-personalized coupons. They found similar influencing patterns of PPP on store visit probability. Zhang and Breugelmans (2012) analyzed the decisions made by customers of an online grocery retailer and detected an upward trend in store visit frequencies among members of its loyalty program. However, such positive effects differed among different PPP approaches. Baik (2015) pointed out that competitive promotions were more effective than reward promotions in inducing customers to visit a store.

In most cases, adjustments in purchase incidence and quantity translated into the changing spending patterns of customers during their shopping trips. According to Khan et al. (2009), Venkatesan and Farris (2012), and Zhang and Breugelmans (2012), PPP outperformed the non-personalized strategy in quantity acceleration. Particularly, Khan et al. (2009) and Zhang and Breugelmans (2012) respectively reported 1.2% and 0.9% increases in purchase expenditure. Meanwhile, the purchase quantity of the targeted brand decreased by one third in Zhang and Krishnamurthi (2004).

### ***Effects on the performance of food brands and stores***

In addition to the behavioral effects, Table 3 exhibits the influences of PPPs on the economic performance of food stores and brands. Five of the studies focused

**Table 3.** Suggestions for further analyses of PPP applications for food products.

Study	Comparison	Consumer behavior				Economic performance of brands and stores				
		Purchase incidence/ coupon redemption	Category purchase	Store visit	Purchase acceleration	Brand sales	Brand profit	Store sales	Store profit	Store's customer retention and acquisition
Zhang and Krishnamurthi (2004)	PPP <sup>1</sup> versus UPP <sup>2</sup>	↓			↓	↓	↑			
Terui and Dahana (2006)	PPP <sup>1</sup> versus UPP <sup>2</sup>				↑	↑				
Khan et al. (2009)	PPP <sup>1</sup> versus UPP <sup>2</sup>	↑			↑		↑	↑		
Zhang and Wedel (2009)	PPP <sup>1</sup> versus UPP <sup>2</sup>								↑	
Venkatesan and Farris (2012)	PPP <sup>1</sup> versus UPP <sup>2</sup>	↑	↑	↑	↑	↑	↑	↑		
Zhang and Breugelmans (2012)	PPP <sup>1</sup> versus UPP <sup>2</sup>			↑	↑		↑			↑↓
Johnson et al. (2013), Study 1	Temporal versus non-timing PPP <sup>1</sup>							↑		
Johnson et al. (2013), Study 2	Temporal versus non-timing PPP <sup>1</sup>							↑		
Niraj and Siddarth (2014), Study 1	PPP <sup>1</sup> versus UPP <sup>2</sup>							↑↓		↑↓
Niraj and Siddarth (2014), Study 2	PPP <sup>1</sup> versus UPP <sup>2</sup>							↑↓		↑↓
Baik (2015)	Competitive versus reward PPP <sup>1</sup>	↓		↑				↑	↑	
Osuna et al. (2016)	Competitive versus reward PPP <sup>1</sup>	↑↓						↓		

<sup>1</sup>Personalized price promotion

<sup>2</sup>Untargeted price promotion

on how this approach affects brand sales and profits. None of the studies investigated how PPP influenced the customer retention and acquisition of food brands. Another five studies examined the performances of retailers while two evaluated the effects of PPP from the perspectives of both stores and brands.

Given its ability to induce brand switching and spending acceleration, PPP has significant impacts on the improvement of brand sales and profits. However, findings in the included studies on how PPP influence brand sales were mixed. In comparison with the non-personalized approach, Zhang and Krishnamurthi (2004) exhibited an approximately 32% decrease in butter brands' sales when an online store adopted PPP, whereas, the sales of brands subsequent to PPP were 2% to 5% higher than the non-personalized scenario (Terui & Dahana, 2006). Osuna et al. (2016) drew their attention to reward and cross-selling personalized coupons. They pointed out that reward coupons generated more incremental sales among product categories that are highly fragmented, and not frequently purchased. Furthermore, returns from promotions dropped when the frequency of a brand being in promotion increased.

Terui and Dahana (2006) explored the PPP strategy on five brands of instant coffee in relative to untargeted pricing and reported increases in profits, varying from 2% to 6% across the examined brands. Assuming that the regular profit margin of a butter brand was 30%, Zhang and Krishnamurthi (2004) as well as Zhang and Wedel (2009) estimated substantial gains in profits, rising from minus \$23 under the case of non-customization to \$547 with PPPs. According to Johnson, Tellis, and Ip (2013), the increase in brand profit depends on the brand characteristics and timing factors. They introduced the concept of customized temporal discounts by incorporating the timing features into PPP. Comparing to the non-timing method, temporal PPP resulted in profit increases across various brands. However, the increase percentages varied across brands with low and high market shares. For both ketchup and yogurt, non-timing PPPs were less effective in boosting the profit of brands.

Regarding the effects of PPP on food stores, Khan et al. (2009) found this approach to outperform untargeted price promotions in improving store sales, with a difference of 12.2%. Results from Venkatesan and Farris (2012) demonstrated an increase in weekly trip revenue per customer in both approaches. Nevertheless, the increasing rate was higher among personalized (24%) than non-personalized promotions (11%). In addition, customers' contribution net of marketing increased by 14% over the weeks of the examined PPP campaign. This term referred to the difference between estimated customer contributions to a store's revenue and the associated marketing costs. Similarly, revenues of a grocery store examined in Zhang and Breugelmans (2012) improved by 6.3% when it switched from the conventional loyalty program to personalized reward point promotions with monetary values equivalent to those of previous offers. Such increasing rate was even higher (13.4%) during the first nine weeks of the program.

This gain was partly due to the improvement in customer acquisition, with the number of new customers switching to that store increasing by 12.4% per week and resulting in a 2.8% increase in sales. However, these authors also reported sales losses among the loyalty program's current members with a decrease of 2.4% in revenue contribution of this group. Such findings on the role of customer acquisition in the revenue improvement of retailers were consistent with those presented by Baik (2015). According to this study, the average weekly increases in sales among targeted promotions were approximately four times higher than that generated by reward promotions.

Studies included in this review demonstrated supportive findings on the profit boosting abilities of PPP on store performances. Examining the effects of PPPs for food products in the online setting, Khan et al. (2009) revealed an increase of 13.2% in store profit. Similarly, Zhang and Wedel (2009) pointed out an increase of 136.9% in the profit of an online grocery store thanks to PPP. In addition, the authors investigated the same chain's performance in the offline setting and found the profit to increase by a lower rate of 43.8%. According to Baik (2015), promotion strategy had different impacts on the profitability of various PPP types. While the profits a store gained from competitive promotions remained positive throughout successive promotion campaigns, returns from reward promotions decreased correspondingly (Baik, 2015).

Apart from its influences on revenues and returns of food stores, PPPs had halo or spillover effects on the sales of other non-promoted brands or products. Venkatesan and Farris (2012) studied this phenomenon and determined that a large proportion of increases in store revenue came from product categories that were not on sale during the promotion periods. Nonetheless, this did not necessarily mean that all forms of PPPs exhibited such effects. While cross-selling promotions positively affected the sales of non-promoted items, reward promotions were found to have negative spillover effects. Another interesting issue arising from Venkatesan and Farris (2012) was the exposure effect of promotions, which explained the sharp increase in store revenues coming from non-redeemers of personalized coupons. Accordingly, PPP had significantly positive exposure effects on store visit incidence and purchase expenditure among customers. This raised the customer contribution net of marketing to a higher rate (25%) compared with that under the scenario without exposure effect (14%).

Niraj and Siddarth (2014) provided insights into the efficiency of PPP from the perspectives of food stores and brands. The authors used within-chain and across-chain data to measure the impact of PPP on store and brand profits among two product categories—spaghetti sauce and yogurt. Results from across-chain data showed consistently higher profits for retailers and manufacturers in both categories compared with the non-customized approach. However, the differences in store profits between these approaches were only minor (i.e. 0.7% and 0.9% in the spaghetti sauce and yogurt categories, respectively). In terms of brand profits, the outcomes of

this approach were 8% and 14% better than non-customized promotions in these two product categories. Meanwhile, findings from these studies suggested that PPP was not as efficient as untargeted price promotions if it was implemented based on customer data of only one retail chain. Brand profits resulted from the former were 2.6 % and 1% lower than the latter among investigated food categories. Concerning retailers' performance, there were only minor discrepancies in store profits yielded from PPP using within-chain data and traditional promotions (0.5%) in the spaghetti sauce category. This number was much higher among yogurt products (8.3%).

## Discussion

### *Main findings of the review*

This review analyzes scientific articles investigating the effects of PPP for food products and identifies 12 eligible studies. Consistent with Blattberg and Neslin (1989) or Gedenk et al. (2010), findings from this review demonstrates the effectiveness of PPP in inducing the brand switching, category switching, store switching, and purchase accelerating behaviors of consumers. Such influences of PPP on consumer behavior are significantly larger than its non-personalized counterparts. Additionally, this review finds PPP to generally be more effective than untargeted price promotions in creating increases in store and brand sales. While this approach leads to improvements in store profits as well as their customer acquisition and retention activities, it is likely to influence the long-term profit of brands negatively, especially when a brand runs promotion too often. The effects on the customer retention and acquisition of a brand are nonetheless not specified in the investigated literature. Similarly, the included studies do not indicate whether PPP motivates consumers' repeat purchase decisions or shapes their concerns about price unfairness, privacy and data protection. Moreover, the studies included in this review fail to indicate alterations in consumers' food consumption patterns and diet quality following the implementation of PPP.

According to this review, the performance of a PPP campaign differs among various settings. In comparison to untargeted price promotions, PPP yields greater profits in both online and offline stores but these differences are much higher in the online market (Zhang & Wedel, 2009). Similarly, the effectiveness of PPP depends largely on the sources of data fed into the segmentation model. Utilizing information collected from different retail chains ensures the targeting ability of PPP and leads to higher brand or store profits than using within-chain data (Niraj & Siddarth, 2014). Another factor enhancing the performances of PPP is timing. Integrating this feature into PPP enables food marketers to decide the best time for delivering their special offers to certain customers and subsequently gain more profit (Johnson et al., 2013).

Targeting strategy is another key determinant of PPP's performance. Baik (2015) argues that the redemption rates of reward coupons are higher than cross-selling coupons. However, the strategy of targeting new customers is more effective in generating more sales, especially in the case of successive promotion campaigns. Osuna et al. (2016) demonstrates an increase in redemption rates for reward coupons when the purchase and promotion frequency as well as the number of items in a product category decreases. The explanation for this phenomenon lies in the nature of the two targeting strategies. Retailers use reward promotions as a way to surprise, delight and show appreciation to their loyal customers. Discounts in reward promotions are usually for products or brands frequently purchased in the past. Higher coupon redemption rates among a brand's regular buyers, however, do not necessarily translate into growing sales since loyal customers are likely to buy the items of interest even without promotion (Baik, 2015; Osuna et al., 2016). Meanwhile, the main objective of cross-selling promotions is to redirect customer attention to items with no or low previous purchase frequency. This strategy encourages customers to explore segments of a store they are unlikely to visit, induce them to try new products they have never bought before, or buy similar non-promoted products. Therefore, cross-selling promotions have a positive spillover effect on non-promoted products and increase their revenues even though they are not on sale (Baik, 2015).

### ***Limitations in the literature***

Apart from the identification of scientific evidence on how PPP influences consumer behaviors and the performance of food brands or stores, this review underlines the following gaps in the literature. First, the interest of examined studies is limited to the food retail sector, with no research on the adoption of PPP at food service establishments. This lack does not coincide with the large body of literature evaluating untargeted price promotions at fast food restaurants, school canteens, worksite cafeterias, vending machines, etc. (French, 2003; French et al., 2001; Nordström & Thunström, 2013; Richards & Padilla, 2009; Vermeer, Alting, Steenhuis, & Seidell, 2010).

Second, there is a strong focus on packaged foods among the reviewed studies. The perishability and short shelf life of fresh food have considerable influences on not only the purchasing behaviors of consumers but also their responses to promotions for such products (Chung & Li, 2013; Konuk, 2015; Tsiros & Heilman, 2005). As a result, consumer reactions to PPP for this category are likely to differ largely from that for packaged foods. Nevertheless, there is no literature found in this synthesis to examine the effects of PPP targeting perishable food products.

Third, the eligible studies overlook the dietary and nutritional consequences of PPP for food products. This outcome is not consistent with the substantial body of literature and well-established evidence on the equivalent effects of

untargeted price promotions (An, Patel, Segal, & Sturm, 2013; Harnack et al., 2008; Herman, Harrison, Afifi, & Jenks, 2008; Olsho et al., 2016; Schröder, Fito, & Covas, 2007). Hawkes (2009) discusses two scenarios in which sales promotions lead to changes in food consumption. First, price incentives induce brand or category switching, thus motivating shoppers to test a new product or buy substitutes with different nutrient profiles. Nevertheless, only the inclusion of a food product or category that is not regularly consumed can bring about significant changes in the nutrient intake. Promotion does not translate into nutritional differences when the switch happens between products with the comparable nutrition content. The second scenario is when consumers accelerate or repeat their purchase of a category since they create higher household inventories of the targeted product category. As a result, consumers are likely to eat more of the promoted foods, and gradually change their consumption patterns (Chandon & Wansink, 2002).

The last drawback of the existing literature is associated with the lack of evidence on controversial issues of PPP such as the price unfairness perception and privacy concerns. These problems are the topics of interest in several articles about personalization and PPP such as Acquisti (2008), Estalami et al. (2007), Feinberg et al. (2002), Miettinen and Stenbacka (2015) and Wu, Liu, Chen, and Wang (2012). Moreover, they are among the factors shaping consumer acceptance of PPP and determining how people react to the personalized marketing offers. Focusing on PPP for food products, none of the literature identified in this review provides insights into the influences of this strategy on consumers' fairness perception, data protection, and privacy concerns.

The limitations in the existing literature imply the need for further research to address the unsolved issues concerning PPP. In particular, results on how PPP affects consumers' price fairness perception and privacy concerns are beneficial to all stakeholders in the food value chain. They are additionally valuable for policy makers to examine the "consumer boundaries" of this approach and identify possibly subsequent regulation needs. Meanwhile, future examinations of the nutritional outcomes of food-related PPP allow researchers and practitioners to look beyond the behavioral and economic effects of this strategy. Such findings, together with evidence from the perishable and food service categories, are expected to complete the insights into the way PPP for food products affects stores, brands, and consumers in various aspects.

### ***Implications for future applications and analyses of PPP for food products***

An important managerial implication of this paper comes from the absence of PPP in the food service sector. This sector is relatively similar to food retail chains in the growing prevalence of retail or restaurant chains with well-established customer databases and checkout systems. Given such wide adoption of relevant technologies in the field of food service and the



profitability of PPP among grocery stores, food service operators have sufficient drivers and requisites for adapting PPP to their future promotion strategies. Another motivation lies in the proven effectiveness of untargeted price promotions in altering food choices at food service outlets points (Harnack et al., 2008; Nordström & Thunström, 2013).

The lack of studies on PPP for perishable food implies the need for empirical research on this topic. For example, by incorporating shelf-life information into PPP schemes, retailers can tailor their offers to not only individual customer needs but also the expiration date and inventory status of each product. This approach can substantially enhance the performance of grocery stores by enabling retailers to overcome challenges in price and inventory management of perishable foods as exhibited in Chung and Li (2013) as well as Tsiros and Heilman (2005).

In addition to possible applications of PPP in the food service sector and perishable food management, this review highlights implications for future applications and analyses of food-related PPP. Accordingly, PPP has other potentials beyond its economic benefits such as its adoption as an intervention tool to promote healthy eating. Given the influences of PPP on the way people purchase food, it is feasible to use this approach to direct food choices toward healthier diets. Such monetary intervention tool is among the crucial strategies to improve the nutritional quality of human life in the agenda of the World Health Organization (2016). Many studies have claimed the effectiveness of price promotions as nutritional interventions, including French et al. (2001), Kendrick (1998), Richards and Padilla (2009), etc. However, these studies focus on measuring the effects of untargeted price promotions on consumer behavior. This suggests an interesting research direction to explore whether PPP is as much effective as its untargeted counterparts in encouraging healthier food choices and improving the diet quality of consumers. Furthermore, the strong indicators of the connection between fast food, food away from home and energy-dense diets emphasize the necessity of using PPP as a cutting-edge solution for the ongoing obesity epidemic (Vermeer et al., 2010; World Health Organization, 2016).

The lack of evidence on data protection, privacy concern and perceived price fairness calls for further relevant studies. To overcome difficulties arising from consumers' negative perception of PPP, many authors propose solutions to deal with such issues. Miettinen and Stenbacka (2015) suggest that history-based information on purchase patterns is sufficient for customizing marketing offers while protecting the privacy of consumers. When personal data is required, marketers should develop an identity management system to give consumers control over what level of information is revealed (Acquisti, 2008). In terms of price unfairness perception, Estalami et al. (2007) present the idea of creating "segmentation fence" to reduce the likelihood of present customers being aware of more favorable deals offered to prospective customers. Taking these

managerial implications into account in allows food marketers to move their targeting strategies to the individual level while maintaining consumer acceptance of PPP.

## Conclusions

This paper is the first to systematically examine empirical evidence on the effects of PPPs for food products. Finding from this synthesis contribute to the price and food marketing research by enabling a thorough look at how this approach works and influences food stores, brands, or consumers. Moreover, the procedure of literature search and investigation strictly follows standards for conducting a systematic review. The selection process is based on predetermined eligibility criteria, which are rigorously developed and modified throughout the review. The coding process with two separate coders reduces the subjectivity in coding and prevents the coders from overlooking crucial information. The inter-coder reliability indices for most coding categories meet the Krippendorff's standards and allow confident conclusions from the review outputs.

Although inconsistencies in the qualification methods of included studies limit the nature of this review to a qualitative synthesis of the relevant findings, the outcomes have strong managerial implications for practitioners and researchers. The identified effectiveness of PPPs suggests its potentially wider adoption, for example in the food service sector or for the management of perishable foods. In addition, evidence on the varying effects of PPP across different targeting and timing strategies serves as valuable input for the development and implementation of this approach in the future.

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# Personalized coupons for lower-calorie fast-food choices among young German adults and the influence of consumers' nutritional attitudes on promotion effectiveness

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## Abstract

**Purpose** – Personalized price promotion (PPP) is a marketing instrument that addresses the limitations of untargeted promotions by tailoring the offers to individual customers based on their purchase histories. Current evidence on PPP is limited to its immediate effects on buying behaviors at grocery stores and food companies' economic benefits. Moreover, little is known about the role of consumer characteristics in determining how effectively this promotional tool works. Hence, we aim to assess the effectiveness of PPP in promoting healthy fast food and which consumer-specific factors affect its performance.

**Design/methodology/approach** – The authors conduct a laboratory experiment to examine the effects of personalized and non-personalized coupons for lower-calorie fast food menus on food and calorie selection. The coupon personalization is based on participants' menu choices, calorie needs and deal proneness. The authors additionally investigate how post-intervention changes are influenced by consumers' estimation of their selected calories, and their attitudes toward nutrition.

**Findings** – Recipients of personalized incentives are more likely than participants in the control group to redeem the offered coupons, select more healthy items and reduce their selected calories. Such changes are less likely among participants underestimating the calorie content of their menu choices and perceiving higher barriers to healthy eating. Personalized coupons perform better even among subjects receiving lower discounting levels than the control treatment.

**Originality/value** – As the first to evaluate the effectiveness of PPP in encouraging healthy food choices, this study highlights the potential of this cutting-edge price intervention and provides valuable implications for future research.

**Keywords** Personalized price promotion, Price reduction, Lower-calorie food, Healthy eating intervention, Fast food, Nutritional attitudes

**Paper type** Research paper



## 1. Introduction

Obesity is a public health concern due to its tremendous medical and economic consequences (Tremmel *et al.*, 2017). This epidemic is strongly associated with the shift towards energy density in food supply and consumption (Popkin and Ng, 2007). Due to the increasing availability of cheap and energy-dense foods, consumers are replacing low-calorie food items with high-calorie options to ensure their daily energy intake at a more affordable cost (Maillot *et al.*, 2007). Moreover, the rate of obesity is particularly accelerating among young adults whose diets are mainly characterized by the heavy consumption of fast food and food away from home (FAFH) (Grunseit *et al.*, 2019; Richards and Padilla, 2009). An effective instrument to address this issue is reducing the costs of dietary energy coming from healthy food items, specifically in the fast food and FAFH settings (World Health Organization, 2015). However, current price reductions are limited to offering identical incentives to all consumers regardless of their individual differences in promotion responsiveness (Just and Gabrielyan, 2016). Muller *et al.* (2017) find untargeted interventions to favor consumers who not only have existing healthy diets but also exhibit higher responsiveness to reductions in the price of nutritious food than other consumers.

The drawbacks of untargeted price reductions suggest the need of a more consumer-driven approach to address the heterogeneity in consumer responses (Andreasen, 2002; Just and Gabrielyan, 2016). The concept of individualization is increasingly applied in various healthy eating interventions such as tailored education or personalized nutrition programs (Brug *et al.*, 2003). To our knowledge, there is no prior research examining whether personalizing the monetary incentives for healthy food can address the limited targeting capability of price reductions. In practice, a similar approach has been put to work at grocery chains to tailor special offers to individual customers based on their purchase histories (Arora *et al.*, 2008; Venkatesan and Farris, 2012). This strategy is facilitated by the unprecedented availability of customer information and advances in data analytics (Rust and Huang, 2014; Shaffer and Zhang, 2002). In this manuscript, we refer to this practice as personalized price promotion (PPP).

There is an increasing body of literature on PPP in the area of food marketing. In a systematic review, Nguyen *et al.* (2019) examine empirical evidence on PPP for food products and reveal an overall better performance of this approach than non-personalized counterparts in changing the buying decisions of consumers. However, the studies identified by this systematic review are limited to investigating the immediate changes in purchasing behaviors and their influences on the economic benefits of food stores and brands. This implies a gap in the literature on PPP, particularly when it comes to using this promotional tool to target food products. According to Hawkes (2009), price promotions influence food consumption and diet quality in a way that they induce the switch to or accelerate purchases of a promoted product. As a price promotion instrument, PPP apparently has similar nutritional effects on consumers, which has been overlooked by prior research. In addition, it remains unclear to which extent PPP can change consumer decisions in regard to fast food and FAFH since current evidence is only available for foods at grocery stores.

Another limitation in the literature lies in the lack of evidence on the role of consumer-specific characteristics in determining the effectiveness of food-related PPP. Most studies focus on variables specific to a product or promotion campaign such as timing strategy, targeting strategy, data source, and discount level (Terui and Dahana, 2006; Johnson *et al.*, 2013; Niraj and Siddarth, 2014; Osuna *et al.*, 2016). Meanwhile, food choice is a complex decision-making process and determined by the interplay between the physiological, socio-demographic and psychological aspects of consumers (Irala-Estévez *et al.*, 2000). Hence, examining the effects of factors such as consumer attitudes toward food and nutrition is vital for understanding the underlying drivers of their responses to promotion and subsequently improve the promotion's effectiveness (Neslin *et al.*, 1994).

The preceding discussion indicates the need for an empirical study to not only address the overlooked topics regarding food-related PPP but also explore the possibility of using this emerging marketing tool to tackle the existing limitations of price interventions promoting healthy food choices. From this standpoint, this study aims to examine the effectiveness of personalized coupons for healthier choices in the fast food setting, compared to the untargeted approach. We estimate the effects of each coupon type by measuring the redemption rate and subsequent changes in menu or calorie selection. Another objective is to investigate the effects of consumer attitudes towards food and nutrition on how an individual reacts to the price interventions in this study. In other words, we aim to determine aspects subjected to modification, which helps improve the personalization strategy and address consumer heterogeneity (Neslin *et al.*, 1994). In this examination of psychological factors, we focus on the interaction between an individual's nutritional attitudes and their promotional responses.

## 2. Hypotheses

A major advantage of PPP lies in the use of purchase history data. Since consumer preferences are stable and often develop in predictable patterns, prior behaviors are important indicators of future choices (Simonson, 2005). Hence, PPP allows marketers to give promotional offers to the right customers based on what they usually buy (Osuna *et al.*, 2016). This enhances customer satisfaction and increases the response rate to promotion (Acquisti and Varian, 2005). Apart from the monetary savings they get from a deal, consumers also favor the exclusivity of a special offer tailor-made to them (Drèze and Nunes, 2009). As a result, exclusive offers such as personalized coupons are more likely to be redeemed than untargeted promotions (Feinberg *et al.*, 2002). These assumptions are in line with findings from Khan *et al.* (2009) and Venkatesan and Farris (2012) on higher response rates to PPP for food products, compared to non-personalized approaches. Thus, in this study, we hypothesize that:

*H1a.* Personalized coupons for lower-calorie menus lead to a higher rate of coupon redemption than untargeted coupons.

PPP does not only encourage consumers to switch to the promoted product but also induces repeated purchases and purchase acceleration behaviors (Nguyen *et al.*, 2019; Khan *et al.*, 2009; Zhang and Breugelmans, 2012). Such adjustments in food purchasing behaviors are likely to result in dietary changes in a long run. The switch between alternatives with different nutritional values leads to changes in nutrient intake (Hawkes, 2009). The accelerated or repeated purchases create higher inventories of a certain food, which stimulates shoppers to consume more of it and gradually alter their consumption patterns (Chandon and Wansink, 2002). Based on the preceding discussion, we assume that PPP for food products not only yields a higher redemption rate but also brings about more dietary differences than when untargeted strategies are in place. Focusing on calorie consumption in the fast food setting, we examine the following hypotheses in this study.

*H1b.* Personalized coupons for lower-calorie menus lead to a greater selection of healthy items per menu than untargeted coupons.

*H1c.* Personalized coupons for lower-calorie menus lead to greater reductions in selected calories than untargeted coupons.

The likelihood of adopting a certain behavior is determined by the relation between the costs and benefits resulting from this change (Riebl *et al.*, 2015). To understand the underlying drivers of consumer responses to price reductions on nutritious food, it is imperative to



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examine the perceived costs of and barriers to healthy eating. Given that food consumption is a habitual activity, preference for familiarity is a major barrier preventing consumers to respond to stimuli for dietary changes (Pang *et al.*, 2019; Orbell and Verplanken, 2010). Negative attitudes toward healthy eating is another recurrent theme since consumers tend to perceive nutritious food as less tasty and less appealing than unhealthy alternatives (Shepherd *et al.*, 2006; Lim *et al.*, 2019). Further hurdles include the perceived high costs of healthy food as well as the tremendous amount of time, effort and nutritional knowledge required to follow a healthful diet (Nestle *et al.*, 1998; Mete *et al.*, 2019). When such cognitive barriers outweigh the benefits people perceive of healthy eating, a behavioral adjustment is not likely to occur (Fishbein and Yzer, 2003; Bandura, 2004). This leads to the following hypothesis on how healthy eating barriers affect post-intervention changes in the present study.

*H2a.* Barriers to healthy eating correlate negatively with coupon redemption, healthy menu choices and calorie reduction.

Consumer concerns about and knowledge of calorie consumption play a substantial role in shaping choices of fast food and determining responses to nutritional interventions (Chernev and Chandon, 2015). Calorie-conscious individuals are more likely to reduce the amount of food eaten at a meal and choose items with lower calories (Wardle *et al.*, 2000; Piron *et al.*, 2010). Such consumers tend to use the information about food calorie to choose smaller portions and avoid energy-dense menu items (Larson *et al.*, 2018). Despite the increasing use of calorie information in food-related decision-making, the accuracy of consumers' evaluation of calorie intake is still questionable (Chernev and Chandon, 2015). Although calorie labeling is increasingly available at fast food chains, it typically presents the calorie content of individual menu items, rather than the overall count of the entire menu. As a result, it is difficult for consumers to estimate accurately the total calorie amount of their meal options. According to a review by Livingstone and Black (2003), people have the tendency to underestimate the amount of their calorie intake. Calorie underestimation influences the decisions of consumers in a way that leads them to select and consume more calories (Chandon and Wansink, 2007a, b). According to the described prior research, we hypothesize that:

*H2b.* Consumers' concerns about and knowledge of calorie consumption correlate positively with coupon redemption, healthy menu choices and calorie reduction.

*H2c.* Consumer underestimation of the amount of calories they selected correlates negatively with coupon redemption, healthy menu choices and calorie reduction.

### 3. Materials and method

#### 3.1 Design

We conducted a laboratory experiment to examine the effectiveness of personalized coupons for lower-calorie fast food menus, compared with their non-personalized counterparts. This study took place at the behavioral laboratory of a university in Southern Germany. We targeted young adults between 18 and 30 years old due to the heavy consumption of fast food and the accelerating obesity rates among this age group (Grunseit *et al.*, 2019). Participants were recruited using the Online Recruitment System for Economic Experiments (ORSEE) (Greiner, 2015). Participants' consent to the rules and policy of data protection was sought and the ethical approval was issued by the university's Ethics Commission before the experiment.

The experiment was carried out with the assistance of software designed in-house to simulate the self-ordering process at fast food restaurants. At the beginning, participants

answered some questions about their gender, price sensitivity, deal proneness, free time and job-related activities. Afterwards, they selected a menu combination consisting of fast food items categorized as a main dish, side dish or drink. We provided the subjects with one or multiple discount coupons for menu alternatives with fewer calories. Participants could choose whether to redeem the offered coupons or stay with their original choices. Subsequently, they filled out a post-intervention questionnaire about their socio-demographic characteristics and nutritional attitudes. Upon completion of the experiment, each person received €10 in cash.

Participants' nutritional attitudes were determined using statements from various scales on food-related lifestyles (Scholderer *et al.*, 2004), eating behaviors (Diehl, 1999; Pudel and Westenhöfer, 1989; Garner *et al.*, 1982), barriers to healthy eating (Gracey *et al.*, 1996), nutrition-related attitudes and beliefs (O'Connell *et al.*, 1981). From these scientifically validated scales, we selected items relevant to our study setting and theoretical hypotheses (see Table A1). All statements were estimated with a six-point Likert scale ranging from 1 (very untrue for me) to 6 (very true for me) to ensure a high level of reliability and discrimination (Rungson, 2010).

### 3.2 Menu development and calorie estimation

Table 1 presents the list of menu items in this experiment. We developed the menu based on the list of fast food from the USDA National Nutrient Database for Standard Reference (United States Department of Agriculture, 2016). The calorie content was derived from the same database. Dishes with the lowest calorie content in each category (i.e. chicken wrap, side salad, water or diet drink) were considered as healthy items.

The computation of individual calorie needs followed guidelines of the German Nutrition Society (2015). Accordingly, the questions about gender, job-related and free-time activities were used to identify the PAL (Physical Activity Level) values of each participant and

Menu items	kcal
<i>Main dish</i>	
Cheeseburger with bacon and large patty	898
Double cheeseburger	437
Cheeseburger with double decker bun	572
Royal cheeseburger with large patty	576
Crispy chicken Sandwich	420
Fish Sandwich with tartar sauce	374
Veggie-burger	369
Chicken nuggets in nine pieces	430
Chicken nuggets in six pieces	290
Grilled chicken wrap	273
<i>Side dish</i>	
French fries	480
Side salad	17
<i>Drinks</i>	
Coke 500 ml	207
Diet Coke 500 ml	0
Lemon soda 500 ml	197
Orange soda 500 ml	190
Apple soda 500 ml	106
Mineral water 500 ml	0

**Note(s):** Calorie content based on the USDA National Nutrient Database for Standard Reference

**Table 1.**  
List of menu items by  
category

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determine the guiding values for individual energy intake. We classified participants into different groups of PAL depending on whether their jobs required intensively sitting activities (PAL 1.4), both sitting and standing activities (PAL 1.6), intensively standing and walking activities (PAL 1.8), or strong physical activities (PAL 2.0). Individuals active in sports or other strenuous leisure activities (30–60 min, 4–5 times per week) received additionally 0.3 units to the above-mentioned PAL values (German Nutrition Society, 2015). Finally, we calculated the recommended calorie intake per meal based on the assumption that a meal contributed approximately 30% to the daily energy intake (Schwedhelm *et al.*, 2019; Huseinovic *et al.*, 2016).

### 3.3 Intervention

In this experiment, we aimed to promote menu alternatives with less calories than participants' initial choices. Participants were randomly assigned to a control and a treatment group. In the control group, every subject received the same coupon with a 50% discount on a menu comprising chicken wrap, salad and water or diet drink. Treatment group members gained different coupons tailored to their menu choices (see Figure 1).

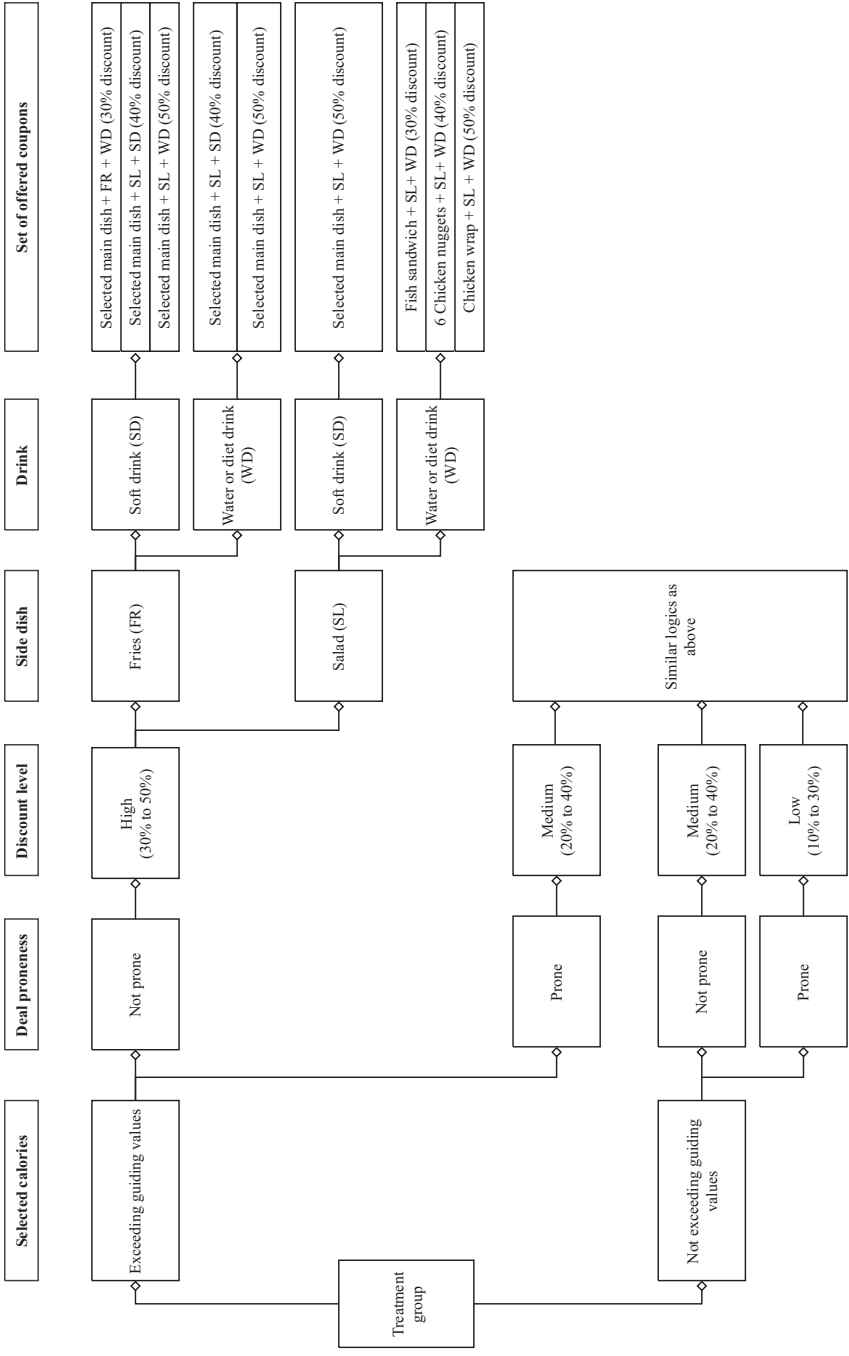
The personalized intervention aimed to encourage participants to reduce their selected calories by switching to lower-calorie side dishes and drinks before changing the main dishes of their choice. We only induced the change of main dishes when participants already chose a healthy side dish and drink. In this case, we offered coupons for a menu with salad, water (or diet drink) and one of the three main dishes containing the lowest calorie content (i.e. fish Sandwich, 6 chicken nuggets, or chicken wrap). When the chosen main dish was one of these three items, the coupons targeted at the other lower-calorie alternatives. For instance, participants selecting a menu with fish Sandwich, salad, and water received coupons for options with the lowest and second lowest calorie content (i.e. chicken wrap and six chicken nuggets, respectively). Individuals choosing the all-healthy-item menus were provided with reward coupons for what they picked while other participants obtained cross-selling coupons.

Subjects in the personalized treatment were divided into various groups based on their individual calorie needs and deal proneness. In practice, deal prone consumers can be identified based on their purchase and coupon usage histories (Kukar-Kinney and Xia, 2017). The experiment setting did not allow the collection of such longitudinal data. Hence, we used Likert-type items adapted from the price perception, coupon and sale proneness scales developed by Lichtenstein *et al.* (1993) to measure deal proneness. On a scale ranging from 1 (very untrue for me) to 6 (very true for me), participants specified the extent to which they check the price, search for special offers and order foods on sale when eating at fast food restaurants. Since subjects not responsive to price promotions tend to need more attractive incentives to take the offers (DelVecchio, 2005), we provided them with higher discount levels. Higher discounts were also targeted at participants whose selected calories exceeded their recommended energy intake. Accordingly, an individual who selected too many calories and yet was not responsive to promotion obtained coupons with the highest discounting levels (30–50%). The lowest discount levels (10–30%) were given to deal-prone subjects who chose an appropriate amount of calories. The other participants were offered medium-level discounts (20–40%). Apart from consumer-specific criteria, we also determined the discount size of personalized coupons based on characteristics specific to the promoted menus. Menus containing more healthy items and hence fewer calories were discounted at a higher level.

### 3.4 Statistical analysis

We compared the effects of non-personalized and personalized treatments on the coupon, menu and calorie selection of participants. The Pearson's Chi-square test was applied to dichotomous variables and Mann-Whitney *U* test to continuous variables with non-normal

# Coupons for lower-calorie fast-food choices



**Figure 1.** Coupon personalization based on calorie need, deal proneness, and menu choice

distribution. To estimate the effect size, we measured the Cramer's  $V$  statistics for dichotomous variables and rank biserial  $r$  for continuous variables. The calculation and interpretation of effect size followed the guidelines from [Cohen \(1988\)](#). We used the Kruskal–Wallis test to compare post-intervention changes in menu and calorie selection among groups of participants receiving various discount levels. Pairwise comparisons based on the Mann Whitney  $U$  test were additionally conducted to examine differences between the control treatment and each discount level of personalized coupons.

To investigate the hypotheses concerning cognitive barriers as well as calorie concern and estimation, we carried out a Structural Equation Modeling (SEM) procedure. We identified the significant latent variables out of psychological scales of the questionnaire and explored the effects of these constructs on post-intervention changes. The Diagonally Weighted Least Squares (DWLS) estimator was used for factor extraction due to its better performance than Maximum Likelihood (ML) for ordinal and non-normal data ([Li, 2016](#); [Míndrila, 2010](#)). To examine the suitability of data for factor analysis, we used the Kaiser-Olkin-Meyer measure and Bartlett's test of sphericity. As shown in [Table A1](#), the data was appropriate for factor analysis with an overall KMO of 0.8 and sufficient significant correlation suggested by results of the Bartlett's test ( $\chi^2 = 532.4, p < 0.001$ ). We computed indices such as the Chi-square fit statistic, Comparative Fit Index (CFI), Tucker-Lewis-Index (TLI), Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Square Residual (SRMR), and Parsimonious Normed Fit Index (PNFI) to examine whether the final model is a good fit to the data. Such indices were selected due to their insensitivity to model misspecification, parameter estimates and sample size ([Hooper et al., 2008](#)). In the present study, we used the following thresholds as indicators for the model's goodness-of-fit: CFI  $\geq 0.95$ , TFI  $\geq 0.95$ , RMSEA  $\leq 0.06$ , SRMR  $\leq 0.08$  and PNFI  $\geq 0.05$  ([Tabachnick and Fidell, 2013](#); [Byrne, 2016](#)).

## 4. Results and discussion

### 4.1 Participant characteristics

[Table 2](#) depicts the socio-demographic and lifestyle-related characteristics of study participants. Members of the control and treatment groups did not differ significantly in any of these characteristics since all  $p$ -values of significance tests were larger than 0.05. In total, 207 young adults (34.8% female,  $x_{\text{age}} = 22.6, SD_{\text{age}} = 3.5$ ) took part in this experiment. The majority had an academic degree (44.9%) or a German high school diploma with university entrance qualification (53.6%). The average household size was 2.4 ( $SD = 1.4$ ), with 38.6% having a net income of less than €900 per month. In terms of physical activity, only 2% of participants led a sedentary lifestyle with the PAL value of 1.4. The large proportion of subjects characterized by a high educational level, low income, and an active lifestyle resulted from the dominating number of students among the participants.

Nearly 12% of participants were considered overweight or obese and the average Body Mass Index (BMI) of this sample was 22.3 kg/m<sup>2</sup> ( $SD = 2.7$ ). This number was much lower than the overweight and obesity rate of German adults between the ages of 18 and 29 (26.2% among women and 33.9% among men) as reported in [Schienkiewitz et al. \(2017\)](#). Around 11% were vegan or vegetarian and 7% followed a specific diet at the time of the experiment. In line with findings from [Livingstone and Black \(2003\)](#), a large number of subjects underestimated the calorie content of their initial menu choices (42.0%), whereas 16.4% estimated accurately the amount of calories they ordered. The rest of participants either overestimated or had no idea of their menus' calorie content.

### 4.2 Treatment effects

[Table 3](#) presents the different effects of the personalized and non-personalized interventions on coupon, menu and calorie selection. Both intervention types motivated participants to

	Overall <i>n</i> = 207	Control <i>n</i> = 48	Personalized <i>n</i> = 159	<i>p</i> -value	Coupons for lower-calorie fast-food choices
Female, %	34.8	33.3	35.2	0.946 <sup>a</sup>	
Age ± SD	22.6 ± 3.5	22.5 ± 3.7	22.6 ± 3.4	0.819 <sup>b</sup>	
Household size ± SD	2.4 ± 1.4	2.3 ± 1.3	2.4 ± 1.4	0.535 <sup>b</sup>	
Education level, %				0.726 <sup>a</sup>	
Secondary school with apprenticeship	0.5	–	0.6		
High school or equivalent	1.0	–	1.3		
High school with university entrance qualification	53.6	58.3	52.2		
Academic degree (Bachelor, Master, Diploma)	44.9	41.7	45.9		
Net monthly income, %				0.574 <sup>a</sup>	
Under 900 Euro	38.6	37.5	38.9		
900 to under 1,500 Euro	25.1	25.0	25.2		
1,500 to under 2,600 Euro	14.5	20.8	12.6		
2,600 to under 3,600 Euro	8.7	2.1	10.7		
3,600 to under 5,000 Euro	7.3	6.3	7.6		
More than 5,000 Euro	5.8	8.3	5.0		
BMI ± SD	22.3 ± 2.7	21.7 ± 2.1	22.5 ± 2.9	0.085 <sup>b</sup>	
Overweight and obese (BMI ≥ 25 kg/m <sup>2</sup> ), %	11.6	4.2	13.8	0.115 <sup>a</sup>	
Among female	8.3	0.0	10.7		
Among male	13.3	6.3	15.5		
Physical activity level (PAL), %				0.264 <sup>a</sup>	
PAL 1.4	1.9	2.1	1.9		
PAL 1.6	70.1	79.2	67.3		
PAL 1.8	28.0	18.7	30.8		
Following a diet, %	6.8	4.2	7.6	0.624 <sup>a</sup>	
Being vegan or vegetarian, %	10.6	10.4	10.7	0.999 <sup>a</sup>	
Self estimation of initially selected calories, %					
Overestimation	29.5	22.9	31.5	0.574 <sup>a</sup>	
Underestimation	42.0	50.0	39.6		
Exact estimation	16.4	14.6	17.0		
No estimation	12.1	12.5	11.9		

**Note(s):** <sup>a</sup>Pearson's Chi-square test, <sup>b</sup>Mann–Whitney *U* test

**Table 2.**  
Participant characteristics

redeem the offered coupons, select more healthy items and reduce the amount of their selected calories. This outcome supports results from [An \(2013\)](#), [French \(2003\)](#), [Kellershohn \*et al.\* \(2017\)](#) and [Nordström and Thunström \(2015\)](#) on the effectiveness of price reductions to increase the selection of healthier meals at fast food restaurants and other FAFH settings. As proposed by hypothesis [H1a](#), the redemption rate of untargeted coupons (39.6%) was much lower than personalized coupons (79.9%). This difference was statistically significant ( $p < 0.001$ ) and the Cramer's *V* statistic of 0.4 indicated a medium effect size. These findings are in line with previous evidence that PPP has greater effects on coupon redemption and product switching decisions than its non-personalized counterparts ([Khan \*et al.\*, 2009](#); [Venkatesan and Farris, 2012](#)).

The difference in response rates to two interventions was mainly attributed to the fact that the majority of personalized coupons in this experiment induced the change of only side dish and drink (see [Figure 1](#)). When evaluating a menu bundle, consumers tend to consider the main dish an anchor item, which is typically not subjected to change, and the other menu items as tie-in elements ([Yadav, 1994](#); [Hur and Jang, 2015](#)). Compared to a discount offer that

	Control <i>n</i> = 48	Personalized <i>n</i> = 159	<i>p</i> -value	Effect size
Coupon redemption rate, %	39.6	79.9	<0.001 <sup>a</sup>	0.4 <sup>c</sup>
Switching to healthy main dish, %	27.1	12.0	0.021 <sup>a</sup>	0.2 <sup>c</sup>
Switching to healthy side dish, %	18.6	39.0	0.016 <sup>a</sup>	0.2 <sup>c</sup>
Switching to healthy drink, %	27.1	59.1	<0.001 <sup>a</sup>	0.3 <sup>c</sup>
Types of initial menu choices, %			0.292 <sup>a</sup>	
No healthy item	18.8	28.9		
1 healthy item	54.2	39.0		
2 healthy items	20.8	24.5		
3 healthy items	6.2	7.6		
Type of final menu choices, %			<0.001 <sup>a</sup>	0.3 <sup>c</sup>
No healthy item	16.7	3.8		
1 healthy item	37.5	28.9		
2 healthy items	6.2	35.2		
3 healthy items	39.6	32.1		
Increase in selected healthy items per menu ±SD	0.5 ± 0.9	0.9 ± 0.7	0.013 <sup>b</sup>	0.2 <sup>d</sup>
<i>Total selected calories ±SD, kcal</i>				
Before intervention	855.6 ± 316.3	916.2 ± 397.1	0.334 <sup>b</sup>	
After intervention	711.4 ± 401.2	654.0 ± 367.4	0.354 <sup>b</sup>	
Calorie reduction ±SD				
Absolute change, kcal	144.2 ± 251.4	262.2 ± 243.7	0.004 <sup>b</sup>	0.3 <sup>d</sup>
Percentage change, %	18.0 ± 27.7	27.6 ± 22.4	0.015 <sup>b</sup>	0.2 <sup>d</sup>
<i>Selected calories exceeding guiding values, %</i>				
Before intervention	68.8	61.0	0.422 <sup>a</sup>	
After intervention	54.2	32.1	0.009 <sup>a</sup>	0.2 <sup>c</sup>

**Table 3.**  
Treatment effects on  
coupon, menu and  
calorie selection

**Note(s):** <sup>a</sup>Pearson's Chi-square test, <sup>b</sup>Mann-Whitney *U* test, <sup>c</sup>Cramer's *V*, <sup>d</sup>Rank biserial *r*

requires them to choose another main dish, consumers are apparently more responsive to coupons with which they only have to change to tie-in items. This argument is further supported by findings of the present study on the switching behaviors among menu items. In comparison to the personalized treatment, the percentage of switching to a healthy main dish (chicken wrap) was significantly higher ( $p < 0.05$ ) in the control treatment (27.1%). Nonetheless, recipients of personalized coupons were more likely than subjects in the control group to change their choices to a healthy side dish (salad,  $p < 0.05$ ) or drink (water or diet drink,  $p < 0.001$ ).

Given that the breakdown of menu types was similar between the two groups prior to the intervention ( $p > 0.05$ ), this proportion differed significantly after coupon selection ( $p < 0.001$ ). Despite a strong rise in the percentage of menus containing three healthy items in both groups, the personalized treatment led to tremendous decreases in the number of menus with no or 1 healthy item, compared to the non-personalized counterpart. Moreover, personalized coupons induced more choices of two healthy-item-menus while the percentage of this menu type dropped from 20.8 to 6.2% subsequent to the control intervention. In average, each subject selected 0.9 (SD = 0.7) more healthy items upon exposure to personalized coupons, compared to the average increase of 0.5 items per menu (SD = 0.9) in the control group. Despite the small magnitude of treatment effect ( $r = 0.2$ ), the statistical significance of this between-group difference ( $p < 0.05$ ) still supports Hypothesis [H1b](#). Adjustments on menu choices brought about distinctions in the final calorie selection between the two interventions. Given decreases in the selected calories in both groups, the reduction was substantially

greater ( $p < 0.01$ ) among recipients of personalized coupons ( $\bar{x} = 262.2$ ,  $SD = 243.7$ ) than non-personalized coupons ( $\bar{x} = 144.2$ ,  $SD = 251.4$ ). Similarly, the percentage change subsequent to the personalized treatment ( $\bar{x} = 0.276$ ,  $SD = 22.4$ ) was significantly larger than in the control group ( $\bar{x} = 18.0$ ,  $SD = 27.7$ ,  $p < 0.05$ ). This led to a greater reduction in the number of participants selecting excessive calories in the personalized group ( $p < 0.01$ ). As a result, Hypothesis H1c is strongly supported.

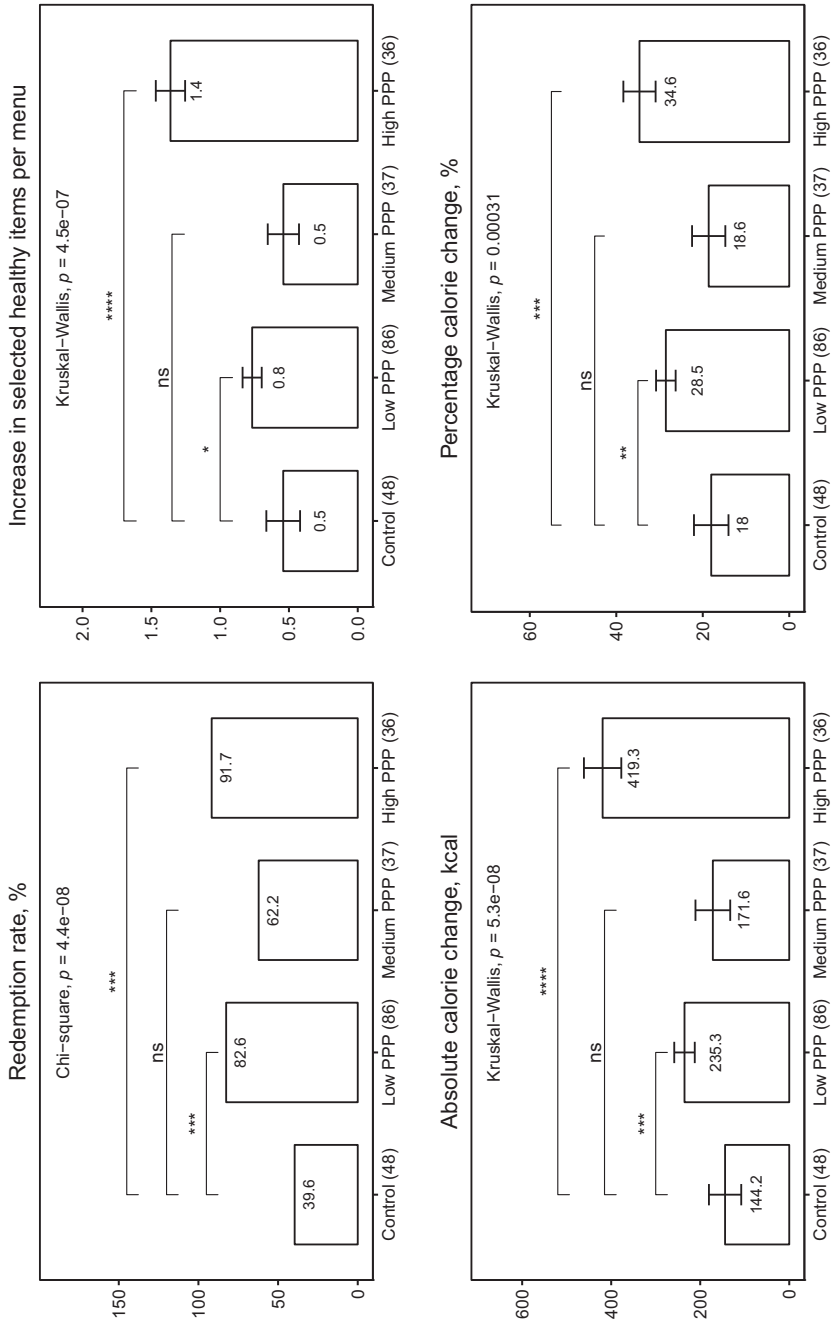
The favorable adjustments in food choice and calorie selection subsequent to PPP provides empirical evidence to support the discussion of [Nguyen et al. \(2019\)](#) regarding the effects of PPP for healthier foods on dietary changes. Given its peculiarity of treating each consumer as a segment, PPP can address the limited targeting ability of current price interventions ([Arora et al., 2008](#); [Chen and Iyer, 2002](#)). This strategy is likely to reduce the risk of overlooking the population at risk or targeting the inducements at irrelevant groups such as high-income and deal-prone consumers with a readily existing healthy diet ([Dallongeville et al., 2011](#); [Muller et al., 2017](#)). Moreover, the well-established checkout systems at fast food chains facilitate the growing digitalization of purchasing transactions in this sector. In turn, this creates important infrastructural developments for using PPP to tackle ongoing issues related to fast food consumption and obesity ([Nguyen et al., 2019](#)).

As described in [Section 3.3](#), participants in the personalized treatment were segmented into three groups obtaining various discount levels, depending on their calorie need and deal proneness. In [Figure 2](#), we compared the coupon, menu and calorie selection of subjects in the low ( $n = 86$ ), medium ( $n = 37$ ) and high discounting groups ( $n = 36$ ) with those receiving the control intervention. The global  $p$ -values indicated significant differences among 4 groups of participant in terms of redemption rates, increases in the number of chosen healthy items per menu as well as the absolute and percentage changes in selected calories ( $p < 0.001$ ). According to the pairwise comparisons between the control and each of the PPP groups in [Figure 2](#), recipients of personalized coupons discounted at the low and high levels were more likely than members of the control group to redeem the offered coupons, choose more healthy items and select fewer calories. Changes among subjects obtaining medium-level PPP were slightly greater than the untargeted intervention; however, the differences were not statistically significant ( $p > 0.05$ ).

The preceding outcome confirms the effectiveness of personalizing coupons based on deal proneness and calorie need. Such strategy ensured the population at risk (individuals who ordered excessive calories yet were not likely to take the deal) got incentives attractive enough to perform a change. Meanwhile, a low discount was sufficient to stimulate deal-prone consumers with an appropriate calorie selection, given that the monetary rewards they received (10–30%) were lower than the untargeted intervention (50%). However, the insignificant distinctions between the control and medium-level PPP group indicated a drawback in the segmentation strategy of this study. Members of both groups were more or less comparable in terms of their deal proneness and the degree to which their selected calories meeting the energy recommendation. Note that the discount levels in the medium-PPP group (20–40%) was lower than the control treatment (50%). This could explain why medium-level personalized coupons did not perform significantly better than non-personalized coupons despite the overall better performance of PPP. To address this limitation, the discounting levels in future PPP approaches should be differentiated more clearly between deal-prone consumers with excessive energy intake and those who select a suitable amount of calories yet are not responsive to promotion.

Another drawback of the treatment effect evaluation in our study is derived from its laboratory setting. Since the menu choices and inducements in this experiment are hypothetical, the stimulation on consumers' brain activities and decision-making behaviors tends to differ largely from real rewards ([Xu et al., 2018](#)). This setting, additionally, did not





**Figure 2.** Differences in treatment effects between the control group and PPP groups

**Note(s):** Pairwise comparisons based on Mann–Whitney U test  
 Significance levels: \*\*\*\*:  $p < 0.000$ , \*\*\*:  $p < 0.001$ , \*\*:  $p < 0.01$ , \*:  $p < 0.05$ , ns:  $p > 0.05$

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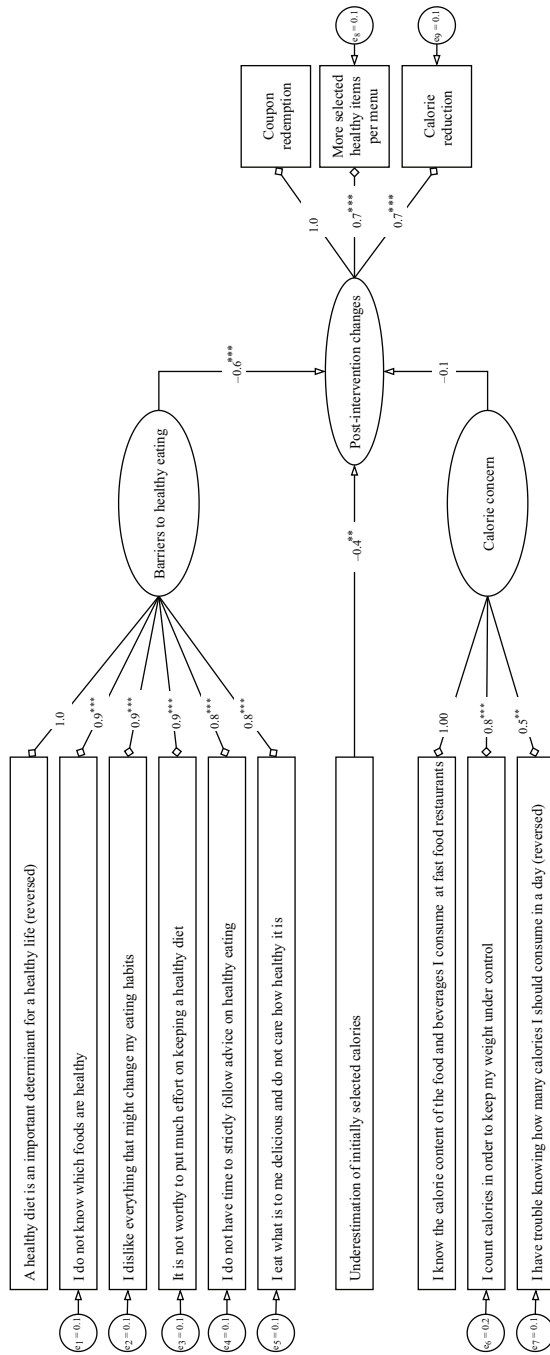
allow us to collect the pre-intervention purchase histories of participants and use them for personalization. At the same time, the computation of actual energy intake after the intervention was not feasible. Given the methodological issues of an experimental laboratory setting, it is recommended to examine the effects of personalized coupons in real-life shopping situations where both the purchases and the incentives are not hypothetical. A natural shopping environment simultaneously facilitates the collection of consumer buying histories and allows a behavior-based segmentation (Amue *et al.*, 2012).

#### 4.3 Effects of the psychological factors

The SEM in Figure 3 illustrates the associations between the nutritional attitudes of participants and changes in their coupon, menu and calorie choices after the intervention. The final model demonstrated an excellent fit to the data, with  $\chi^2 = 65.5$  ( $p > 0.05$ ), CFI = 1.0, TLI = 1.0, RMSEA = 0.03 (90% confidence interval ranging from 0.00 to 0.05), SRMR = 0.07, and PNFI = 0.85. In this model, we extracted 2 psychological factors from 9 indicators of the questionnaire. The first construct constitutes cognitive barriers to healthy eating such as the perceived unimportance of nutrition, lack of knowledge of foods' healthiness, aversion to changes in eating habits, perceived worthlessness of healthy eating, lack of time for healthy eating, and prioritization of taste over healthiness. The second latent variable (calorie concern) represents an individual's knowledge about the calorie content of fast food and food in general as well as the habit of counting calories. In addition, we included in this model an exogenous variable indicating whether participants underestimated the calorie content of their original choices. The post-intervention changes were measured by coupon redemption decisions as well as subsequent adjustments in the amount of selected healthy items and calories.

According to Figure 3, subjects perceiving more barriers to healthy eating were less likely to redeem the offered coupons, choose more healthy items and reduce their selected calories ( $p < 0.001$ ). This outcome is consistent with Hypothesis H2a. The statistical significance of this correlation implies the importance of cognitive obstacles such as the aversion to changing eating habits or the fear of having to compromise on taste when choosing nutritious food, etc. Therefore, future work on PPP for healthy food should include this psychological predictor in consumer segmentation and coupon personalization as well as offer more attractive monetary incentives to offset the undesirable effects of such hurdles. In a frequently repeated context such as eating at fast food restaurants, food choice is strongly influenced by past consumption habits, which is not likely to change immediately (Orbell and Verplanken, 2010). Therefore, researchers and policymakers should consider the use of mixed interventions to reshape consumer perception in a long run and reduce the barriers consumers perceive when deciding whether or not to react to price reductions on healthy food (Rothschild, 2000).

The path analysis found no effect of calorie concern on behavioral and dietary changes as proposed by Hypothesis H2b ( $p > 0.05$ ). The likelihood of coupon redemption, calorie reduction and healthier choices was significantly lower among participants underestimating the amount of calories they initially ordered ( $p < 0.01$ ). This result supports Hypothesis H2c as well as prior evidence on the calorie underestimation tendency of consumers and its influences on food choice (Chernev and Chandon, 2015; Chandon and Wansink, 2007a). More emphasis should be put on this phenomenon when developing future personalized interventions. Furthermore, it is imperative to provide consumers with calorie information of food items, allow them to access such data at the time of food selection and make it easier for them to estimate the calorie content (Chernev and Chandon, 2015). An interactive system of calorie estimation (Mohr *et al.*, 2019) or the traffic light labeling of fast food calorie (Montandon and Colli, 2016) could be used with personalized coupons to provide consumers



**Note(s):** Goodness-of-fit indices:  $\chi^2 = 65.52, p > 0.05$ , CFI = 1.00, TLI = 1.00, RMSEA = 0.03(90% CI 0.00 - 0.05), SRMR = 0.07, PNFI = 0.85  
 Significance levels:  $***p < 0.001$ ,  $**p < 0.01$ ,  $*p < 0.05$

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with accurate calorie information of their menu choices and further encourage them to switch to healthier options.

Coupons for  
lower-calorie  
fast-food  
choices

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## 5. Conclusions

This study addresses the lack of research on the nutritional effects of food-related PPP in the fast food setting and how the performance of this approach is influenced by consumer-specific factors. Our findings provide the first empirical evidence on the effectiveness of PPP for lower-calorie fast food in changing coupon redemption decisions, menu choices and the energy intake of young adults, compared to non-personalized price reductions. Evidence on the effectiveness of PPP highlights the importance of this cutting-edge promotional solution and serves as a bridge to connect two fundamental research areas in marketing and health promotion: personalization and price intervention. A major advantage of this study is the incorporation of individual calorie needs and deal proneness into the segmentation. The better performance of personalized coupons compared to untargeted coupons implies how meaningful this inclusion is in increasing the response rates and treatment effectiveness. The significant role of healthy eating barriers and the calorie underestimation bias in determining promotion effectiveness implies the possibility of incorporating such consumer attitudes into future personalization strategies targeting healthy food. Despite a couple of methodological shortcomings related to the sample, experiment setting and intervention design, the study outcomes set the first step towards enhancing the understanding of PPP as a promoting tool for healthier fast food choices. Our research provides valuable implications for researchers and policy makers to further use this approach to tackle obesity and excessive energy consumption.

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Statements (1 = very untrue of me, 6 = very true of me)	Sources	KMO
I know the calorie content of the food and beverages I consume	Garner <i>et al.</i> (1982)	0.7
I count calories in order to keep my weight under control	Pudel and Westenhöfer (1989)	0.7
I have trouble knowing how many calories I should consume in a day (reversed)	Gracey <i>et al.</i> (1996)	0.7
It is not worth putting much effort into maintaining a healthy diet	Gracey <i>et al.</i> (1996)	0.8
A healthy diet is an important determinant for a healthy life (reversed)	O'Connell <i>et al.</i> (1981)	0.8
I do not know which foods are healthy	Gracey <i>et al.</i> (1996)	0.9
I do not have time to strictly follow advice on healthy eating	O'Connell <i>et al.</i> (1981)	0.9
I dislike everything that might change my eating habits	Scholderer <i>et al.</i> (2004)	0.8
I eat what is delicious to me and do not care how healthy it is	Diehl (1999)	0.9
<i>Indicators of data suitability</i>		
Overall Kaiser-Meyer-Olkin (KMO)	0.8	
Bartlett's test of sphericity	$\chi^2 = 532.4, p < 0.001, df = 36$	

**Table A1.**  
Psychological  
statements and  
indicators of data  
suitability for SEM

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# Some like it tailor-made: The effectiveness of personalized coupons for lower-calorie food choices at a university canteen

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## Abstract

As an emerging marketing tool that targets shoppers individually based on their purchase histories, personalized price promotion is likely to address the limitations of untargeted price reductions. However, there is no prior evidence to support the effectiveness of this approach in promoting low-calorie food choices, and which consumer-specific characteristics influence its performance. In this study, we analyze the effectiveness of personalized and non-personalized coupons for lower-calorie menus at a university canteen. In addition, we examine the interaction between psychological factors and promotional responses, as well as subsequent dietary outcomes. Overall, personalized price promotion performs better than the untargeted approach in encouraging shoppers to redeem the offered coupons and make menu choices with more healthy items and fewer calories. Factors such as calorie concerns, convenience orientation, and the resistance to change eating habits have significant effects on coupon redemption. The role of coupon redemption in mediating the association between such psychological predictors and dietary changes proves the effectiveness of price reductions. This study highlights the potential of personalized price promotion as a healthy eating intervention and sets the groundwork for developing and evaluating this instrument.

## KEYWORDS

food away from home, healthy eating intervention, lower-calorie food, personalized price promotion, price reduction

## 1 | INTRODUCTION

Obesity has long been a public health concern, and prior research points to excessive energy intake as a major contributor to this epidemic (Loring & Robertson, 2014). Given the increasing supply and decreasing prices of foods high in calories, many consumers are replacing nutritious and low-calorie foods with energy-dense alternatives to ensure their calorie intake at an affordable cost (Loring & Robertson, 2014).

This change puts this group of consumers at greater risk of obesity and diet-related chronic diseases (Darmon & Drewnowski, 2008). Another factor often cited as a driver of obesity is the increasing consumption of food away from home (FAFH) (Mancino et al., 2009). As a result, reducing the price of healthy FAFH is an effective instrument in addressing obesity (French, 2003; World Health Organization, 2015).

By design, price interventions on the food market are developed under the assumption that all consumers benefit from the reduced

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price of healthy foods, without considering individual differences in promotion responsiveness (Just & Gabrielyan, 2016; Steenhuis et al., 2011). While consumers who already have healthy diets are more responsive to discounts on nutritious foods, reductions in the price of fruit and vegetables are less likely to bring about improvements in the diet quality of the population at risk (Darmon et al., 2016; Muller et al., 2017). This implies the need for more tailor-made strategies to tackle the limitations of untargeted price reductions. To our knowledge, no study currently exists that explores the possibility of personalizing price interventions with respect to healthy food choices, despite the increasing application of individualization in other areas of healthy eating promotion, such as personalized nutrition or tailored education programs (Brug et al., 2003).

In practice, the concept of personalized price promotion (PPP) has been put to work thanks to advances in data analytics (Shaffer & Zhang, 2002). Grocery chains are now able to target promotional offers at individual customers based on their purchase histories (Venkatesan & Farris, 2012). Nguyen et al. (2019) synthesize evidence on food-related PPP and find this approach to be more effective than untargeted promotions in inducing more choices of targeted products and improving the economic benefits of food stores or brands. Table 1 summarizes the key elements of studies presented in Nguyen et al. (2019) and indicates the literature gaps relevant to PPP for food products. Overall, the available research is limited to examining how PPP influences the immediate buying decisions of consumers and the performance of brands or stores, thus overlooking the dietary effects of this strategy. Since all studies estimate the effects of PPP at grocery stores, it remains unclear how this approach performs in the FAFH setting. Most previous studies have also investigated factors influencing the effectiveness of PPP. However, they have focused strongly on product and promotion-specific variables such as discount level (Terui & Dahana, 2006), targeting strategy (Baik, 2015), timing strategy (Johnson et al., 2013; Zhang & Krishnamurthi, 2004), and data source (Niraj & Siddarth, 2014). The research by Zhang and Wedel (2009) is the only study that takes consumer-specific characteristics (e.g., promotion sensitivity) into consideration.

The discussion above implies that PPP has the potential to tackle unsolved problems related to healthy eating interventions and emphasizes the need for research into overlooked topics related to this emerging marketing tool. Hence, this study aims to examine whether PPP is more effective than untargeted price reductions in encouraging lower-calorie menu choices at a university canteen. Another objective of this study is to investigate how individual differences in orientations toward food and nutrition affect consumer responses to price promotions. Thus, this study identifies the elements subject to modification and helps fine-tune future personalization strategies to address the heterogeneity of consumers based on their psychological traits (Neslin et al., 1994). For this reason, our study concentrates on the interplay between such psychological factors and promotional responses, as well as subsequent dietary changes among recipients of both personalized and non-personalized discounts.

## 2 | HYPOTHESES

Given its particular strategy of targeting customers individually, food-related PPP has major advantages over the untargeted approaches. Food preferences are relatively well defined and consumers can easily judge whether a promotional offer fits their preferences (Simonson, 2005). Therefore, consumers tend to evaluate a special offer positively if it matches their purchasing patterns. Furthermore, the PPP strategy allows marketers to determine existing customers and reward them with incentives for what they usually buy (Osuna et al., 2016). This strategy enhances customer satisfaction and improves promotion responsiveness (Venkatesan & Farris, 2012). Consumers tend to favor exclusive promotional offers, such as personalized coupons, owing not only to the monetary savings but also the exclusivity of the deals (Drèze & Nunes, 2009; Venkatesan & Farris, 2012). These factors result in a greater likelihood that exclusive offers will be redeemed (Feinberg et al., 2002). Indeed, Nguyen et al. (2019) find that PPP for food products generates a higher rate of coupon redemption and purchase incidence compared to non-personalized promotions. This research evidence leads to our first hypothesis.

**Hypothesis 1** *Personalized coupons for lower-calorie foods lead to higher redemption rates than non-personalized coupons.*

Previous research indicates a larger effect of food-related PPP than its untargeted counterparts in inducing consumers to switch to and buy more of a promoted product (Khan et al., 2009; Venkatesan & Farris, 2012; Zhang & Breugelmans, 2012). According to Nguyen et al. (2019), such adjustments result in changes in food consumption patterns. Purchase acceleration and repeated purchase increase the inventories of discounted items and stimulate consumption of such stockpiled products (Chandon & Wansink, 2002). Meanwhile, switching between food alternatives with different dietary values creates changes in the nutrient intake of consumers (Hawkes, 2009). From this standpoint, we speculate that the greater likelihood of behavioral change after PPP brings about more dietary differences than when untargeted strategies are in place. As a result, the following hypothesis is tested in this study.

**Hypothesis 2** *Personalized coupons for lower-calorie foods lead to more changes in menu and calorie selection than their non-personalized counterparts.*

Given the trend of FAFH, convenience is becoming a vital driver in food choice (Conner, 1993). Several studies find convenience orientation to correlate strongly with energy-dense diets, thus exhibiting a negative relationship with healthy eating patterns (Delley & Brunner, 2019; Ulijaszek, 2007). Since convenience orientation constitutes the tendency to prefer comfort in consumption, this trait predicts the use of heuristics to reduce the cognitive efforts in decision making (DelVecchio, 2005; Mandrik, 1996). Shoppers are more responsive to external cues in their surroundings when they are not under cognitive

TABLE 1 Overview of literature on food-related PPP

Examined variables		Determinants of PPP effectiveness			
Author (Year)	Setting	Purchase behavior	Economic performance	Food consumption	Consumer-specific
Zhang and Krishnamurthi (2004)	Grocery store	Purchase incidence and acceleration	Brand sales and profit	Promotion timing	
Terui and Dahana (2006)	Grocery store		Brand sales and profit	Discount level	
Khan et al. (2009)	Grocery store	Purchase incidence and acceleration	Store sales and profit	Promotion type and regularity	
Zhang and Wedel (2009)	Grocery store		Store profit	Promotion strategy	Promotion sensitivity
Venkatesan and Farris (2012)	Grocery store	Coupon redemption, purchase acceleration, etc.	Store sales	Promotion regularity	
Zhang and Breugelmans (2012)	Grocery store	Store visit, purchase acceleration	Store sales, customer retention, and acquisition		
Johnson et al. (2013)	Grocery store		Brand profit	Promotion timing, brand characteristics	
Niraj and Siddarth (2014)	Grocery store		Brand and store profit	Within-chain versus cross-chain data source	
Baik (2015)	Grocery store	Coupon redemption, store visit	Store sales and profit	Promotion strategy	
Osuna et al. (2016)	Grocery store	Coupon redemption	Brand sales	Promotion strategy, category, and brand characteristics	
Present study	University canteen	Coupon redemption	Menu and calorie selection		Nutritional perceptions

load, and discounts are likely to be more effective under such circumstances (Carroll et al., 2018). In consequence, we expect that discount coupons for lower-calorie menus play a substantial role in mediating the negative effects of convenience orientation on changes toward making a lower-calorie choice. In other words, we hypothesize that:

**Hypothesis 3a** *Convenience orientation correlates positively with coupon redemption after the intervention.*

**Hypothesis 3b** *Convenience orientation positively affects post-intervention dietary changes through the mediating role of coupon redemption.*

Since this study focuses on lower-calorie foods, it is crucial to take the calorie concern and knowledge of participants into account. Prior evidence shows that consumer knowledge about calories strongly influences decisions related to FAFH (Carrillo et al., 2012; Sun et al., 2010). Upon exposure to calorie information, consumers tend to select items or menus containing less energy (Larson et al., 2018; Roberto et al., 2010). Findings by Oakes and Slotterback (2002) and Wardle et al. (2000) further reveal that weight and calorie-conscious consumers are more likely to reduce their energy consumption and increase their intake of fruit and vegetables. Consumers with such patterns also exhibit greater responsiveness to price reductions on healthy foods (Muller et al., 2017). This leads to the following hypotheses on the interplay between calorie concern, coupon redemption, and dietary changes.

**Hypothesis 4a** *Calorie concern correlates positively with coupon redemption after the intervention.*

**Hypothesis 4b** *Calorie concern positively affects post-intervention dietary changes through the mediating role of coupon redemption.*

Food choice is strongly influenced by consumer perception of quality traits (Conner, 1993; Rozin et al., 2004). According to the Total Food Quality model of Grunert et al. (1996), food quality is characterized by not only sensory traits (e.g., taste) but also health, convenience, and process-oriented dimensions (e.g., local or organic production). While taste and convenience act more as barriers when it comes to healthy eating (Deshpande et al., 2009), perceptions of food healthfulness encourage healthy choices of FAFH (Filimonau et al., 2018). From the perspective of consumers, organic and local foods are perceived as healthier, fresher, and less energy-dense than conventional alternatives (Schifferstein & Oude Ophuis, 1998). Buyers of such products have lower Body Mass Index (BMI) and exhibit healthier consumption patterns both at home and away from home (Cavaliere et al., 2014; Lu & Gursoy, 2017; Schifferstein & Oude Ophuis, 1998). In the present study, quality preference constitutes the propensity for considering health and process-oriented attributes in food selection and is expected to induce consumers to make favorable dietary changes. Nevertheless, inference about food quality are negatively related to promotion responsiveness (Cohen & Babey, 2012). Consumers who tend to assume that a higher price is associated with higher quality usually undermine the value of

discounted products and show greater reluctance in responding to price promotions (Palazon & Delgado-Ballester, 2009). It is plausible to assume that a quality-oriented consumer is not likely to redeem a coupon even though it targets healthier foods. Hence, our hypotheses regarding the interaction involving quality concerns, coupon redemption, and subsequent dietary changes are as follows:

**Hypothesis 5a** *Quality preference correlates negatively with coupon redemption after the intervention.*

**Hypothesis 5b** *Quality preference negatively affects post-intervention dietary changes through the mediating role of coupon redemption.*

Asp (1999) postulates that barriers to healthy eating are vital factors influencing food decisions of individual consumers. Such barriers result from the resistance to change existing habits and lack of motivation to adopt a new dietary behavior. Lack of motivation stems primarily from negative beliefs such as the “healthy is expensive” intuition, which infers that the costs of healthy choices outweigh their benefits (Haws et al., 2017). Unmotivated consumers also exhibit low-value beliefs (e.g., the importance of a healthy diet is not sufficient enough to make it worth pursuing) and a lack of effort beliefs (e.g., it requires a lot of effort to eat healthily) (Hardcastle et al., 2015). Meanwhile, food selection and consumption are habitual activities that take a long time to form and are difficult to change (Orbell & Verplanken, 2010). This results in a substantial level of resistance among consumers. Nearly 60% of European consumers were unwilling to compromise on taste to aim for the healthfulness of food (Brug, 2008). In Germany, 16% of respondents stated no intention to change or try a healthier diet while 22% considered the cost of giving up on favorite foods as a major barrier to healthy eating (Kearney & McElhone, 1999). Derived from previous research, our assumptions about the relationship between coupon redemption, dietary changes, and the mentioned cognitive barriers are the following:

**Hypothesis 6a** *Negative beliefs about healthy eating correlate negatively with coupon redemption after the intervention.*

**Hypothesis 6b** *Negative beliefs about healthy eating negatively affect post-intervention dietary changes through the mediating role of coupon redemption.*

**Hypothesis 7a** *Resistance to change eating habits correlates negatively with coupon redemption after the intervention.*

**Hypothesis 7b** *Resistance to change eating habits negatively affects post-intervention dietary changes through the mediating role of coupon redemption.*

## 3 | METHODS

### 3.1 | Experimental design

Using personalized and non-personalized discount coupons, we carried out a quasi-natural experiment to promote menu choices

containing fewer calories than the original alternatives. This study took place at a university canteen in southern Germany in 2017. An ethical approval for this study was issued by the university's Ethics Commission in November 2017. The study participants were conveniently recruited from canteen patrons, most of whom were students and employees at the campus.

The experiment was conducted using server-based software to enable ordering with mobile devices. First, all subjects filled out a questionnaire about their gender, job-related and free-time activities, and their tendency to buy products that are on sale. They next chose a menu from items listed at the canteen. All menus consisted of a main dish, side dish, dessert, and drink. Once they had selected their menus, we offered participants various discount coupons targeting menu alternatives with lower calorie content. Participants had the option of redeeming the coupons they had been given, or staying with their initial choices, and they paid the cashier for their items. All subjects had to complete another questionnaire about their sociodemographic and psychological characteristics after the meal. After handing in this questionnaire, each person earned €8 and a discount equal to the value of the coupon they had redeemed.

In this experiment, the canteen's technical infrastructure did not allow us to determine participants' deal proneness based on their ordering histories, as suggested by Kukar-Kinney and Xia (2017). Therefore, we measured deal proneness based on Likert-type scale items presented in Lichtenstein et al. (1993). Factors related to food and nutrition were constructed out of psychological items from different scales (see Appendix B). To determine consumers' convenience orientation, we used statements about preferences for convenience (Scholderer et al., 2004), time and energy saving when eating or preparing meals (Candel, 2001). Calorie concern was estimated using dieting behaviors and nutritional knowledge constructs from Lundholm and Wolins (1987) and Gracey et al. (1996), respectively. Aspects of quality preference were defined based on the Total Food Quality Model (Grunert et al., 1996) and corresponding attitudinal items from Scholderer et al. (2004). Negative beliefs about healthy eating consisted of nutrition-related beliefs items developed by Gracey et al. (1996) and O'Connell et al. (1981). The resistance to change eating habits was measured with one item ("I dislike everything that might change my eating habits"). All items were assessed on six-point Likert-type scales ranging from 1 (very untrue for me) to 6 (very true for me). This scale was used since it is more reliable and exhibits a higher trend for discrimination than a five-point scale (Leung, 2011; Rungson, 2010).

### 3.2 | Menu design and calorie estimation

Appendix A presents the list of menu items on the day of the experiment. Participants had a total of 176 menu options based on two main dishes, four side dishes, two desserts, and 11 drinks. Based on recipes provided by the canteen, we estimated the calorie content of main dishes, side dishes, and desserts using the PRODI<sup>®</sup> application.

The nutritional values of foods in this application were derived from Germany's Federal Food Code database (Kluthe, 2012; Poschwatta-Rupp, 2016). The calorie content of drinks was based on their labeled nutritional facts. The dishes with the lowest calorie content in each category were considered healthy or low-calorie items (e.g., vegetable curry as a main dish, mixed salad as a side dish, fruit salad as a dessert, and mineral water as a drink).

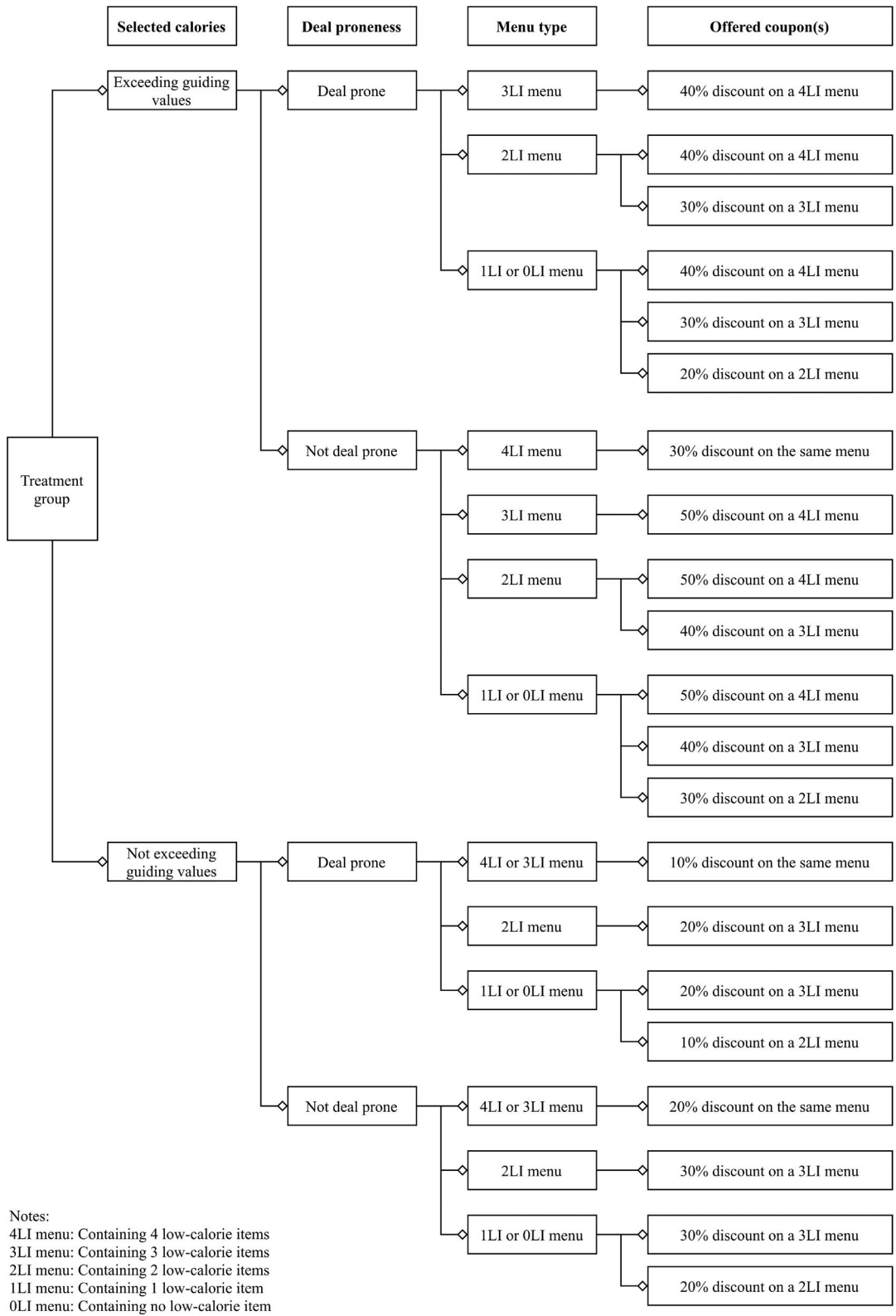
Following the menu selection, the experiment software automatically generated the total calories selected by each subject and compared these with guidelines for energy intake issued by the German Nutrition Society (2015). First, we used information on free-time and job-related activities gathered in the questionnaire to identify the subject's Physical Activity Level (PAL). Second, we determined the recommended calorie intake per meal for each individual based on their gender and PAL value (German Nutrition Society, 2015). Since recommendations by the German Nutrition Society (2015) were given on a daily level, we assumed that lunch accounted for 30% of the daily energy intake (Huseinovic et al., 2016; Schwedhelm et al., 2019) and estimated the individual guide values accordingly.

### 3.3 | Intervention

Study participants ( $n = 165$ ) were randomly assigned to a treatment or control group. Subjects in the control group ( $n = 96$ ) obtained identical coupons for a 50% discount on a menu consisting of four low-calorie items. Participants in the treatment group ( $n = 69$ ) had a selection of up to three personalized coupons, depending on their original menu selection. As shown in Figure 1, the aim of coupon personalization is to encourage participants to switch to a menu with more healthy items and fewer calories than their initial choices. For instance, we provided an individual choosing a menu with two low-calorie items with different coupons: one for the four-low-calorie-item menu and one for a random menu with three low-calorie items.

The personalized coupons differed in terms of not only the targeted menus but also the discounts, which ranged from 10% to 50%. Menus with more low-calorie items were discounted at a higher level. We also determined the amount of discount for each coupon based on an individual's deal proneness and calorie selection. Participants who chose more calories than their recommended energy intake received higher discounts than those who selected an appropriate amount of calories. This intervention was in line with suggestions from Nordström and Thunström (2015) on giving larger compensations to consumers with poor dietary intake. Likewise, subjects less prone to redeem the coupons were provided with higher discounts since they needed more attractive incentives to respond to promotions than deal-prone consumers did (DeVecchio, 2005).

Apart from cross-selling coupons to motivate the selection of lower-calorie alternatives, we provided participants with reward coupons based on their selections. Reward coupons were offered when a subject's original choice contained three or more low-calorie items and whose calorie content met the recommendations for energy intake.



Notes:  
 4LI menu: Containing 4 low-calorie items  
 3LI menu: Containing 3 low-calorie items  
 2LI menu: Containing 2 low-calorie items  
 1LI menu: Containing 1 low-calorie item  
 0LI menu: Containing no low-calorie item

FIGURE 1 Coupon personalization based on calorie need, deal proneness, and menu choices

### 3.4 | Statistical analysis

We examined the effects of personalized and non-personalized coupons in terms of coupon redemption decisions, as well as changes

in menu and calorie selection. The Pearson's Chi-square test was applied to categorical variables and the Mann-Whitney U test to continuous variables. In accordance with Cohen (1988), we quantified the between-group differences to measure the magnitude

of treatment effects. For dichotomous variables, we computed Cramer's *V* statistics while rank biserial *r* was used for continuous variables. To interpret the effect-size measures, we followed additional guidelines from Fritz et al. (2012).

We performed a Structural Equation Modeling (SEM) procedure to investigate the effects of psychological characteristics on the treatment effectiveness using the lavaan package in R (Rosseel, 2012). We used the DWLS (Diagonally Weighted Least Squares) estimator for factor extraction, since this method makes no assumption of multivariate normality and performs better than Maximum Likelihood (ML) for ordinal data (Li, 2016; Mîndrilă, 2010). Prior to the extraction, we examined the data suitability for factor analysis using the Bartlett's test of sphericity and the Kaiser–Meyer–Olkin (KMO) measure. To examine the validity of latent constructs, we computed the average variance extracted (AVE) and composite reliability (CR) measures. According to Fornell and Larcker (1981), the acceptable values for CR and AVE are 0.7 and 0.5, respectively. The final model's goodness-of-fit was assessed based on the Chi-square fit statistic and indices such as Comparative Fit Index (CFI), Tucker–Lewis–Index (TLI), Standardized Root Mean Square Residual (SRMR), and Root Mean Square Error of Approximation (RMSEA) (Tabachnick & Fidell, 2013).

To ensure the measurements are equivalent between the control and treatment groups, we constrained model parameters and tested the establishment of measurement invariance at various levels (Millsap, 2011). First, we held all factor loadings constant between the two groups for metric invariance testing. The second model was nested under the first model and additionally required intercepts to be equal across groups to establish scalar invariance. Third, we included constraints on residual variances to examine strict invariance. These constrained models were compared with a configural model using Chi-square difference tests. Parameters of the configural model were estimated freely across groups. An insignificant difference between the configural model and a constrained model indicates the establishment of invariance at the corresponding level (Vandenberg & Lance, 2000). If the measurements are invariant across groups, a single-group model is sufficient. Otherwise, a multi-group model is used to demonstrate the between-group distinctions (Hensher & Stopher, 1979).

Afterward, we extended the model to specify the pattern of relationships between coupon redemption, dietary changes, and psychological characteristics. To take the influence of coupon type into consideration, we included an exogenous variable indicating whether the redeemed coupon was personalized or not. Dietary changes were measured by differences in the number of selected calories and healthy items between a subject's initial and final menu choices. The calorie-related indicator was divided by 1,000 to ensure scale consistency between two variables. The causal relationship between psychological traits and coupon redemption was examined to test hypotheses  $H_{3a-7a}$ . We additionally measured the effects of these psychological predictors (causal variables) on dietary changes (outcome variable) through the mediating role of coupon redemption ( $H_{3b-7b}$ ). The indirect effect of a specific

psychological variable was estimated by multiplying the point estimate of the causal path between this variable and the mediator with the impact of the mediator on the outcome variable (Shrout & Bolger, 2002).

We assessed the nature of mediation based on the typology presented in Zhao et al. (2010). If an indirect effect exists and there is no direct effect, the path from a causal variable to the outcome is completely mediated by the mediator (indirect-only mediation). Complementary mediation occurs when the direct and indirect not only exist but also point to the same direction. Another case is competitive mediation, in which the direct effect has the opposite sign to the indirect effect, which is the product of paths from the predictor to the mediator and from the mediator to the outcome. When there is no indirect effect, the pattern is categorized as either no-effect non-mediation or direct-only non-mediation, depending on the presence of the direct effect. To test the significance of indirect paths, we bootstrapped the results by repeatedly sampling from the data set with replacement and computing the indirect effect in each resampled set (Preacher & Hayes, 2008). The confidence interval (CI) at the 95% level was obtained for each causal variable based on 5,000 iterations of resampling (see Table 6). An interval without the null value indicates the corresponding indirect effect is significantly different from zero (Preacher & Hayes, 2008).

## 4 | RESULTS

### 4.1 | Participants and interventions

Table 2 demonstrates the sociodemographic and lifestyle-related characteristics of the study participants. The final sample consisted of 165 adults (43.64% were female). The average age of this sample was 30.58 ( $SD = 11.61$ ) and the average household size was 1.93 ( $SD = 1.17$ ). Around one-third of participants earned less than €900 per month, and the majority (63.64%) had an academic degree. The sample's average BMI was 23.74 ( $SD = 3.29$ ), with more than half of the participants leading a moderately active physical lifestyle (PAL 1.6) and 27.88% being overweight or obese. Among the participants, a small proportion was vegetarian or vegan (7.88%) or followed a special diet at the time of the experiment (4.85%). According to Chi-square and Mann–Whitney U tests, there was no statistically significant distinction between members of the control and treatment groups ( $p > .05$ ).

Table 3 presents the significant differences between the two intervention types. In alignment with the intervention strategy, each subject in the control group received an identical coupon, whereas a total of 154 coupons were distributed to the treatment group. This resulted in an average of 2.23 coupons ( $SD = 0.83$ ) delivered to each treatment group member. Unlike the control intervention, most personalized coupons (64.94%) encouraged participants to choose a menu with two or three low-calorie items. Coupons with discounts between 20% and 40% accounted for approximately 80% of the personalized deals. A small proportion was offered at the highest



TABLE 2 Participant characteristics and tests of group differences

	Overall <i>n</i> = 165	Control <i>n</i> = 96	Personalized <i>n</i> = 69	<i>p</i> -value
Female, %	43.64	40.62	47.83	.447
Age ± <i>SD</i>	30.58 ± 11.61	31.53 ± 11.96	29.25 ± 11.05	.213
Household size ± <i>SD</i>	1.93 ± 1.17	1.92 ± 1.19	1.96 ± 1.14	.830
Education level, %				.693
Secondary school with apprenticeship	1.82	1.04	2.90	
High school or equivalent	4.24	4.17	4.35	
High school with university entrance qualification	30.3	28.12	33.33	
Academic degree (Bachelor's, Master's)	63.64	66.67	59.42	
Net monthly income, %				.853
Under 900 Euro	32.12	32.29	31.88	
900 to under 1,500 Euro	12.12	11.46	13.04	
1,500 to under 2,600 Euro	21.82	21.87	21.74	
2,600 to under 3,600 Euro	13.94	12.50	15.94	
3,600 to under 5,000 Euro	14.55	16.67	11.60	
More than 5,000 Euro	5.45	5.21	5.80	
BMI ± <i>SD</i>	23.74 ± 3.29	24.10 ± 3.46	23.24 ± 3.00	.097
Overweight, including obese, %	27.88	32.29	21.74	.188
Physical activity level (PAL), %				.533
PAL 1.4	22.42	21.88	23.19	
PAL 1.6	54.55	52.08	57.97	
PAL 1.8	19.39	22.92	14.49	
PAL 2.0	3.03	2.08	4.35	
PAL 2.2	0.61	1.04	0.00	
Following a diet, %	4.85	4.17	5.8	.910
Being vegan or vegetarian, %	7.88	11.46	2.9	.085

discount level of 50% (12.34%). The percentage of subjects getting a reward coupon for the low-calorie menus they initially selected was higher in the treatment (15.94%) than in the control group (3.12%).

## 4.2 | Treatment effects

Table 4 illustrates intervention effects on coupon redemption, food choice, and calorie selection across interventions. Personalized coupons had a much higher redemption rate (76.81%) than the non-personalized counterparts (26.04%). This difference was statistically significant ( $p < .001$ ) and consistent with our first hypothesis. The Cramer's *V* statistic of 0.5 indicated a large effect size. Contrary to the control intervention, personalized coupons were redeemed at various discount levels, with 30% discount coupons having the highest redemption rate (20.29%).

Prior to the intervention, the number of low-calorie items in the menus initially selected was comparable over two treatments ( $p > .05$ ), and both groups exhibited increases in post-intervention measures. However, the change among subjects obtaining personalized coupons was larger. This resulted in the significantly higher number of low-calorie items selected per menu after the personalized

intervention (2.70,  $SD = 1.08$ ), compared to the control group (2.11,  $SD = 1.49$ ,  $p < .01$ ). Although both interventions led to a significant rise in the percentage of four-low-calorie-item menus, there was a prominent distinction in the proportion of other menu types. Whereas non-personalized coupons hardly affected the choice of menus with one or no low-calorie item, the percentage of such menus dropped tremendously from 50.72% to 13.04% after the personalized treatment. In addition, it was clear that more choices with three low-calorie items were made in the treatment group, whereas this number declined slightly in the control group. Such changes resulted in a significant discrepancy in the post-intervention breakdown of different menu types between the two groups ( $p < .001$ ,  $V = 0.4$ ), given that there was no significant difference before the intervention ( $p > .05$ ).

Concerning menu item selection, the interventions had no differential effect on drink choices ( $p > .05$ ). Nevertheless, personalized coupons induced a considerably higher number of subjects to switch to a healthier main dish ( $p < .01$ ), side dish, and dessert ( $p < .05$ ), compared to non-personalized counterparts. Since these items contributed greatly to the total number of menu calories, such alterations resulted in a tremendous distinction in the final selected calories between the control (892.55,  $SD = 509.75$ ) and treatment

**TABLE 3** Characteristics of the coupons offered and tests of group differences

	Overall n = 250	Control n = 96	Personalized n = 154	p-value
Discounted menu types, %				.000
Two low-calorie items	14.00	0.00	22.73	
Three low-calorie items	26.00	0.00	42.21	
Four low-calorie items	60.00	100.00	35.06	
Discount levels of offered coupons, %				
10% discount	4.40	0.00	7.14	.000
20% discount	9.60	0.00	15.58	
30% discount	19.60	0.00	31.82	
40% discount	20.40	0.00	33.12	
50% discount	46.00	100.00	12.34	
Reward coupon, %	8.48	3.12	15.94	.009

group (669.67, SD = 354.46,  $p < .01$ ). Although both interventions led to decreases in the selected calories, the absolute and percentage change in calorie selection in the personalized group were significantly larger than in the control group ( $p < .01$ ). Furthermore, the rank biserial  $r$  of 0.3 indicated a moderate treatment effect on calorie reduction. This outcome supports our second hypothesis that personalized coupons lead to more favorable dietary changes than non-personalized coupons.

### 4.3 | Effects of psychological factors

Appendix B demonstrates the results of the pre-extraction analysis for SEM. The average KMO measure of 0.66 implied sample adequacy and Bartlett's test of sphericity revealed that the correlation matrix between observed variables differed significantly from an identity matrix ( $p < .001$ ). The AVE and CR values of all extracted constructs met the thresholds of 0.5 and 0.7, respectively. Table 5 presents the results of the invariance tests in which equality constraints were introduced to the model parameters. Differences in TLI and SRMR indices were marginal across models. The insignificance of all Chi-square tests confirmed the invariance establishment in the metric, scalar, and strict levels ( $p > .05$ ). Hence, no multi-group solution was required. The final model additionally revealed a good fit to the data with  $\chi^2 = 118.03$  ( $p > .05$ ), CFI = 0.98, TLI = 0.98, SRMR = 0.07, and RMSEA = 0.03.

Figure 2 also illustrates the causal relationships between independent variables and coupon redemption decisions, as well as subsequent dietary changes. The likelihood of coupon redemption was associated positively with dietary changes ( $b = 1.13$ ,  $p < .001$ ). Coupon redemption also correlated positively with personalized

coupon ( $a_1 = 0.56$ ,  $p < .001$ ), convenience orientation ( $a_2 = 0.29$ ,  $p < .01$ ) and calorie concern ( $a_3 = 0.23$ ,  $p < .01$ ) while being negatively affected by resistance to change ( $a_6 = -0.38$ ,  $p < .001$ ). These findings were in line with our assumptions in  $H_{3a}$ ,  $H_{4a}$ , and  $H_{7a}$ . Hypotheses  $H_{5a}$  and  $H_{6a}$  were not supported since the model revealed no significant impact of quality preference and negative beliefs on coupon redemption ( $p > .05$ ). While none of the psychological variables exhibited a significant direct effect on dietary changes ( $p > .05$ ), personalized coupon had a negative impact on this outcome variable ( $c_1 = -0.36$ ,  $p < .05$ ). In other words, personalized coupons led to a lower level of dietary changes than non-personalized coupons when the effect of coupon redemption was held constant.

Table 6 demonstrates the bootstrap results of the mediated effects and summarizes the mediation type related to each independent variable. The indirect effects of personalized coupon were statistically significant ( $a_1b = 0.63$ , 95% CI [0.40, 0.86]) and pointed to the opposite direction with its direct effect, implying a competitive mediation pattern. The indirect effects of convenience orientation, calorie concern and resistance to change were also significant, with none of the corresponding bootstrap 95% CIs including zero. This indicated the case of indirect-only mediation. Through the mediation of coupon redemption, convenience orientation and calorie concern affected dietary changes positively ( $a_2b = 0.33$ ,  $a_3b = 0.26$ ) as proposed by hypotheses  $H_{3b}$  and  $H_{4b}$ . The negative indirect effects of resistance to change on the outcome variable were also consistent with our assumptions in  $H_{7b}$  ( $a_6b = -0.43$ ). In terms of quality preference and negative beliefs about healthy eating, no mediation effect was found. Hence, hypotheses  $H_{5b}$  and  $H_{6b}$  were not supported by the model's output.

## 5 | DISCUSSION

### 5.1 | Consideration of findings

This quasi-natural experiment delivers initial empirical insights into the effectiveness of personalized coupons in promoting lower-calorie food choices and reducing energy intake in relation to the non-personalized strategy. The findings reveal both interventions to motivate redeeming offered coupons, switching to menus with more low-calorie items and decreasing selected calories. This outcome is consistent with previous research on the effectiveness of price reductions at restaurants, school cafeterias, vending machines, and other FAFH settings (An et al., 2013; French, 2003; French et al., 2001; Nordström & Thunström, 2015).

Given positive changes in both intervention groups, the personalized treatment exhibits a considerably larger effect on coupon and menu choices. This result is supported by findings by Khan et al. (2009), Venkatesan and Farris (2012), and Zhang and Breugelmans (2012). These studies show that PPP performs better than non-personalized approaches in inducing coupon redemption and the subsequent behavior of product switching. To some extent, the higher redemption rate of PPP is explained by the greater

**TABLE 4** Treatment effects on coupon redemption, food choice, and calorie reduction

	Control <i>n</i> = 96	Personalized <i>n</i> = 69	<i>p</i> -value	Effect size
Coupon redemption rate, %	26.04	76.81	.000	0.5 <sup>a</sup>
Redemption rate by coupon type, %				
10% discount	0.00	15.94	.000	
20% discount	0.00	14.49	.000	
30% discount	0.00	20.29	.000	
40% discount	0.00	14.49	.000	
50% discount	26.04	11.60	.037	
Number of low-calorie items in selected menus ± <i>SD</i>				
Before intervention	1.49 ± 1.05	1.55 ± 1.05	.712	
After intervention	2.11 ± 1.49	2.70 ± 1.08	.006	0.2 <sup>b</sup>
Types of initial menu choices, %			.609	
No low-calorie item	15.62	15.94		
One low-calorie item	42.71	34.78		
Two low-calorie items	21.88	31.89		
Three low-calorie items	16.67	13.04		
Four low-calorie items	3.12	4.35		
Type of final menu choices, %			.000	0.4 <sup>a</sup>
No low-calorie item	14.58	2.90		
One low-calorie item	31.25	10.14		
Two low-calorie items	11.46	28.99		
Three low-calorie items	13.54	30.43		
Four low-calorie items	29.17	27.54		
Switching among main dishes, %			.001	0.3 <sup>a</sup>
To vegetable curry	8.33	28.99		
No change	91.67	71.01		
Switching among side dishes, %			.019	0.2 <sup>a</sup>
To side salad	17.71	34.78		
From side salad	0.00	1.45		
No change	82.29	63.77		
Switching among desserts, %			.021	0.2 <sup>a</sup>
To fruit salad	16.67	33.33		
No change	83.33	66.67		
Switching among drinks, %			.998	0.0 <sup>a</sup>
To mineral water	19.79	18.84		
No change	80.21	81.16		
Initial calorie selection ± <i>SD</i> , kcal	1,043.00 ± 421.01	1,020.06 ± 415.02	.729	
Final calorie selection ± <i>SD</i> , kcal	892.55 ± 509.75	669.67 ± 354.46	.002	
Absolute calorie change ± <i>SD</i> , kcal	150.45 ± 297.94	350.39 ± 436.49	.001	0.3 <sup>b</sup>
Percentage calorie change ± <i>SD</i> , %	15.56 ± 27.13	27.95 ± 30.02	.006	0.3 <sup>b</sup>

<sup>a</sup>Cramer's *V*.<sup>b</sup>Rank biserial *r*.

percentage of reward coupons in the treatment group (15.94%) than the control group (3.12%). Nevertheless, this significant distinction in coupon redemption rate is mainly attributed to the different nature

of the inducement across groups. Since the control intervention is identical for all subjects and targets only the four-low-calorie-item menu, participants whose initial choices contain no low-calorie item

TABLE 5 Tests of measurement and structural invariance

Invariance test	Constrained parameters	Comparison with configural model				
		$\Delta\chi^2$	$\Delta df$	$\Delta TLI$	$\Delta SRMR$	p-value
Metric invariance	Factor loadings	9.68	8	0.012	0.004	.288
Scalar invariance	Factor loadings, intercepts	13.65	16	0.003	0.002	.625
Strict invariance	Factor loadings, intercepts, residuals	22.18	28	0.002	0.005	.773

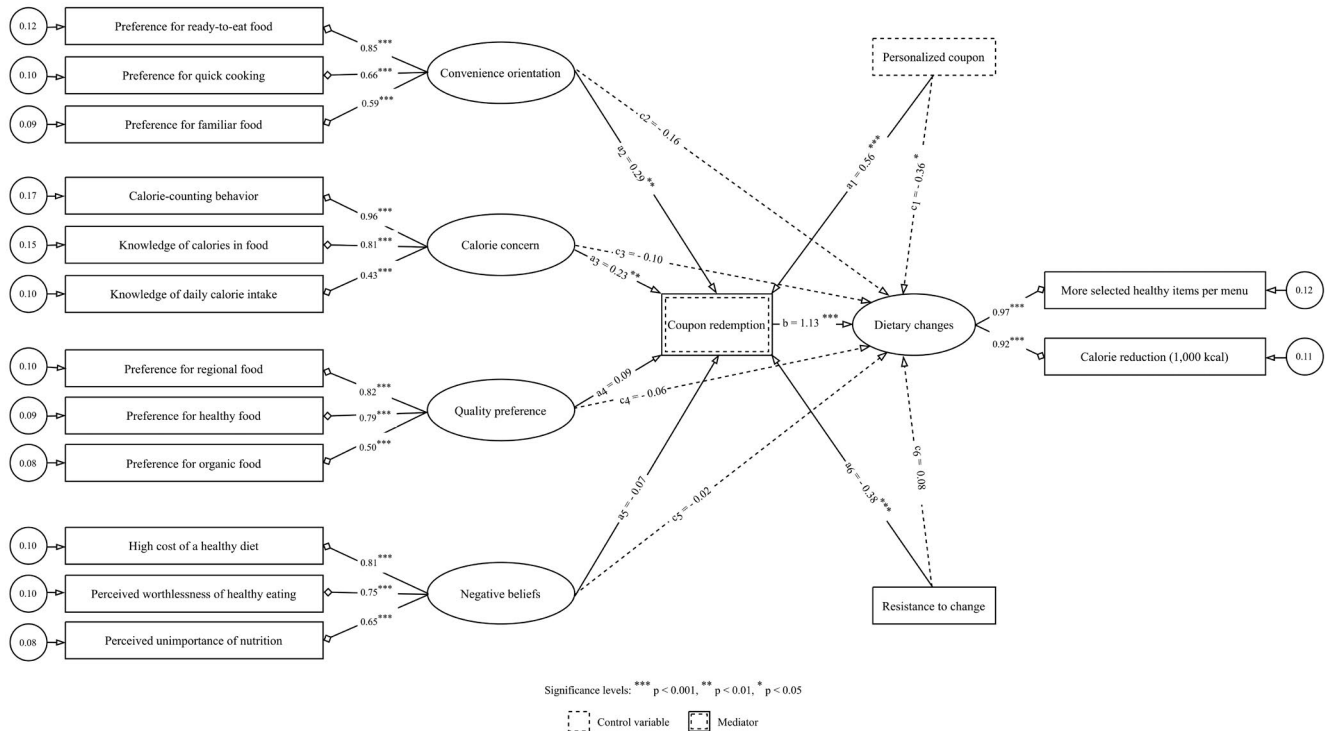


FIGURE 2 Effects of psychological factors on coupon redemption and dietary changes

TABLE 6 Direct effects on dietary changes and mediated effects through coupon redemption

	Mediated effect				Outcome	Direct effect	Mediation type
	Coef.	SE	p-value	Bootstrap 95% CI			
Personalized coupon	0.63	0.12	.000	[0.40, 0.86]	+	-	Complementary
Convenience orientation	0.33	0.13	.011	[0.08, 0.58]	+	Not exist	Indirect only
Calorie concern	0.26	0.13	.047	[0.01, 0.52]	+	Not exist	Indirect only
Quality preference	0.11	0.15	.483	[-0.19, 0.40]	Not exist	Not exist	No effect
Negative beliefs	-0.08	0.15	.581	[-0.37, 0.21]	Not exist	Not exist	No effect
Resistance to change	-0.43	0.11	.000	[-0.64, -0.22]	-	Not exist	Indirect only

Note: 5,000 bootstrap samples.

have to change the whole composition of their menus to take advantage of the offer. This drastic change tends to be met with greater reluctance in promotional responses among this group. On the contrary, a large proportion of participants in the treatment group had the option of changing only some elements of their original menus, since most personalized coupons target alternatives with two or

three low-calorie items. As a result, these participants are more willing to compromise on their choices and take advantage of the deals.

The preceding argument is supported by the breakdown of menu types after the intervention. Although the percentage of subjects selecting a final menu with four low-calorie items in the treatment group (27.54%) is lower than the control group (29.17%), altogether

the personalized treatment leads to a significantly higher number of low-calorie items per post-intervention choice. The different effects of the two coupon types are further explained by the outcomes of the mediation analysis. Since a smaller proportion of personalized coupons target menus with all four low-calorie items than non-personalized coupons, the personalized approach is found to induce fewer adjustments in the number of selected low-calorie items and subsequent menu calories. However, personalized coupons are overall more effective in bringing about favorable dietary changes than their untargeted counterparts if the mediating effect of their significantly higher coupon redemption rate is taken into account.

Our findings demonstrate the switching behavior among menu items. Except for drinks, receivers of personalized coupons are more likely than control group members to switch to a healthier main dish, side dish, or dessert, with the greatest changes happening among side dishes and desserts. In this experiment, coupons are offered in the form of bundles, which consist of multiple products and are promoted at a special price (Janiszewski & Cunha, 2004). According to Hur and Jang (2015), the main dish in a menu bundle is an anchor item with the greatest importance, whereas side dishes or desserts are tie-in elements, which are perceived as less important (Sarin et al., 2003). In other words, consumers use the main dish to evaluate the overall menu and subsequently adjust their perception based on their evaluations of the remaining items (Yadav, 1994). As a result, consumers are less responsive to a promotional cue that requires them to change the anchor element and more willing to alter their choices on tie-in items. Our study further points to a low rate of switching to mineral water in both treatment groups. This pattern is attributed to the health-halo bias based on the consumer assumption that the prominent items in their choices are healthy, and subsequent underestimation of the overall number of menu calories. For instance, consumers tend to select beverages containing more calories when the main dish or other anchoring items are positioned as healthy (Chandon & Wansink, 2007). As a result of changes in menu item selection, the amount of calorie reduction subsequent to the personalized intervention is significantly higher than the control intervention. This outcome further supports the discussion from Nguyen et al. (2019) regarding the effects of PPP for healthier foods on dietary changes.

Our study finds a strong correlation between coupon redemption and psychological characteristics such as convenience orientation and calorie concern. This emphasizes the significance of consumer perception in their responses to promotion and provides more insights to understand this cognitive process. According to Chandon et al. (2000), promotional responses are not only determined by the economic benefits (e.g., monetary savings) of this action. Price promotions also offer consumers an opportunity to improve the shopping convenience by reducing the search and decision costs, or upgrade to a product of higher quality which would cost more without promotion. Supported by this theory, we find that coupons are perceived as an inducement to opt for a healthier and lower-calorie alternative among convenience-oriented and calorie-conscious consumers. Coupon redemption plays a substantial role in mediating

the association between dietary outcomes and such psychological predictors. Our evidence highlights the effectiveness of using discount coupons to encourage lower-calorie foods, particularly among calorie-conscious buyers with budget constraints, or consumers seeking more convenient choices by relying on promotional cues (Carroll et al., 2018; Chandon et al., 2000).

Meanwhile, participants who dislike changing their eating habits are more reluctant to redeem the coupons. Favorable changes in dietary outcomes are also less likely to happen among those consumers. Such negative effects could result from the unfavorable perception consumers with a strong aversion to changes have about promotions targeting options different from their regular choices (i.e., cross-selling coupons). In the FAFH setting, food consumption is frequently repeated and consumers develop behaviors that are strongly influenced by past habits (Orbell & Verplanken, 2010). The resistance to change is more likely to be intensified in such habitual contexts. Hence, food choice is not subject to change unless interventions occur to alter consumer experience and perception over the long term (Lassen et al., 2016).

The mediation analysis reveals no effect of negative beliefs about healthy eating on coupon redemption and subsequent dietary outcomes. Such findings are not consistent with theoretical and empirical evidence from Hardcastle et al. (2015) and Deshpande et al. (2009). Nutritional beliefs are more likely to affect behaviors concerning much deliberation such as adopting a healthy diet as in Deshpande et al. (2009) than an action that requires a swift response as it is the case in our study. Likewise, the direct and indirect effects of quality preference are not found in our model. This could result from the construction of this latent variable, which includes both health and process-oriented dimensions of food quality. Although organic and local foods are frequently perceived as healthy and light on calories (Prada et al., 2017), empirical studies find no direct association between such process-related considerations and the choice of or preference for low-calorie foods (Filimonau et al., 2018; Schifferstein & Oude Ophuis, 1998).

Although a large body of literature demonstrates the effectiveness of price interventions, this study is the first to examine the dietary effects of personalizing price reductions in a real-life setting of FAFH. Our study has another advantage of segmenting consumers based not only on behavioral and dietary criteria but also on promotion responsiveness. This strategy takes consumer segmentation closer to the individual level, thus enhancing the accuracy of coupon personalization (DeVecchio, 2005). In addition, the mediation analysis output provides valuable evidence on how consumers' psychological traits influence their responses to price interventions for low-calorie foods. Such responses include not only immediate changes in purchase decisions following price interventions but also dietary adjustments resulted from these behavioral changes (Hawkes, 2009). Therefore, it is meaningful to examine coupon redemption as a mediator to elaborate the interplay between psychological predictors and dietary outcomes. Including this variable as a mediator and coupon type as a control variable in the SEM provides further explanations on the differential effects of personalized and

non-personalized coupons. Despite its advantages, this study has some methodological limitations. The study participants are generally more active and have a higher education level than the overall population structure in Germany. In addition, the setting of a university canteen does not allow us to explore actual consumption patterns based on purchase histories. When interpreting the treatment effectiveness in this study, it is advisable to take the higher rate of obesity and overweight among recipients of non-personalized coupons into account, despite the statistical insignificance of the between-group difference ( $p = .188$ ).

## 5.2 | Directions for future research

Further research is desirable to validate conclusions drawn from our study on PPP at FAFH establishments and extend our findings to other application areas, such as grocery or online shopping. Moreover, the targeting strategy based on individual calorie needs and deal proneness could be validated in other settings to provide evidence-based recommendations for improving the quality of consumer segmentation and personalization. Interesting research questions and designs for future studies can be derived from the shortcomings of our work. Future work conducted with a more representative sample in a natural shopping environment is recommended. This setting not only enables the accumulation of consumer purchase histories used for segmentation and personalization (Amue et al., 2012) but also facilitates the evaluation of long-term dietary changes. Given the links between culture, food choice, and coupon use (Kim & Yi, 2016; Nestle et al., 1998), it is also important to assess the cross-cultural validity of the present study's outcomes in countries other than Germany.

The better performance of PPP over the non-personalized approach highlights the advantage of adapting this cutting-edge promotional tool to nutritional intervention programs. This strategy is likely to address the limitations of current price reductions such as issues in delivering irrelevant incentives to the wrong target group, overlooking the population at risk, or favoring health-conscious and higher-income consumers (Dallongeville et al., 2011; Muller et al., 2017). Given the increasing digitalization of food-related transactions, it is now feasible for researchers and policymakers to understand consumers individually and modify intervention strategies to fit their personal preferences (Nguyen et al., 2019). This ability to target the right consumers and offer them exactly what they need is the key to preventing the phenomenon of psychological reactance proposed by Brehm (1980) and increasing consumer acceptance of price interventions for healthier foods.

The SEM output underlines the necessity of taking further psychological traits of consumers into account in developing nutritional interventions. A segmentation based on consumer's nutritional perceptions and food motives such as Gong et al. (2020)'s approach could help address consumer heterogeneity and enhance the targeting ability of pricing strategies for healthy food. The promotional cues should be attractive enough to not only attract

convenience-oriented and calorie-conscious consumers but also override consumers' resistance to change and induce them to break their existing habits. Future studies should also consider using mixed interventions to generate the best outcome (Rothschild, 1999). For instance, intervention strategies could adopt theories in menu psychology to shift consumers' attention from energy-dense foods while making nutritious alternatives enjoyable and convenient (Stewart et al., 2005; Wansink & Love, 2014). Visually attractive information cues, such as traffic light labels, can be used together with monetary incentives to provide consumers with sufficient dietary knowledge (Drescher et al., 2014). Calorie labeling is particularly beneficial for individuals with low-calorie consciousness in identifying a lower-calorie menu and redeeming coupons that target this option (Ellison et al., 2013). Nutrition information programs are also imperative for reshaping nutritional perception and moderating the negative effects of resistance to change. There are many reasons for people to resist change, including not only external barriers but also internal factors such as the positive evaluation of their current diets and health status (Kearney & McElhone, 1999; Lea & Worsley, 2003). Therefore, a closer investigation into consumer perception is necessary to understand such underlying factors and design information programs accordingly. Furthermore, the effects of quality preference and negative beliefs about healthy eating should be examined more thoroughly.

The COVID-19 pandemic is another important issue to consider in future research on this topic. Empirical evidence shows that the lockdown affects consumers' eating habits negatively, with an upward trend in snack and unhealthy food consumption (Pellegrini et al., 2020; Robinson et al., 2020), or decreasing willingness to pay for fresh products (Laguna et al., 2020; Wang et al., 2020). Declines in income and mental health contribute further to poorer food choices, given that the negative impacts are disproportionately greater for low-income households or obese people than other population groups (Laborde et al., 2020; Pellegrini et al., 2020; Robinson et al., 2020). As a result, it is even more necessary now than before the pandemic for future research to focus on price interventions to promote healthier food choices and tackle the obesity issue. The social distancing regulations and temporary closure of FAFH establishments create a sudden shift towards food delivery and online grocery shopping, with many consumers using such services for the first time (Baker et al., 2020; Grashuis et al., 2020). Despite possible decreases in demand after the pandemic, a large proportion of these new adopters are likely to continue utilizing them, which facilitates the digitalization of food-related transactions to a greater extent than would have been the case without this pandemic (Hobbs, 2020). This presents more opportunities to examine consumer purchase histories and customize marketing offers or intervention strategies to individual needs (Richards & Rickard, 2020). However, this trend requires a deeper understanding of consumers' online shopping behavior, which is characterized by a different degree of impulsiveness and information processing than point-of-sale decisions (Jeffrey & Hodge, 2007; Verhagen & van Dolen, 2011). Hence, the design of PPP approaches should be adjusted accordingly.

## 6 | CONCLUSIONS

In short, our research casts a new light on the effects of PPP on food products, and underlines the potential for utilizing this personalized promotional tool to motivate healthy eating. This study not only contributes to the understanding of consumer response to promotion but also provides valuable input for implementing and evaluating food-related PPP. More importantly, the study outcomes form the first steps toward developing an emerging instrument to address the drawbacks of existing price promotions for healthier foods with the assistance of information technology. Implications from our research are therefore of great importance to not only food marketers and consumer researchers, but also policy makers.

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### CONFLICT OF INTEREST

The corresponding author and co-authors have no conflict of interest to disclose.

### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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## APPENDIX A

## List of menu items by category and calorie content

Menu items	kcal
Main dish	
Vienna-style pork schnitzel	848
Indian curry with vegetables	227
Side dish	
French fries	422
Potato salad	94
Organic rice	207
Mixed salad	15
Dessert	
Blackberry yogurt	249
Fruit salad	87
Drink	
Coke	210
Orange-flavored soft drink	190
Lime-flavored soft drink	185
Mixed soft drink	215
Apple spritzer	210
Apple- and peach-flavored drink	250
Red currant flavored drink	290
Apple- and lemon-grass flavored drink	50
Blood orange- and coriander-flavored drink	50
Strawberry-, black-current- and mint-flavored drink	50
Mineral water	0

## APPENDIX B

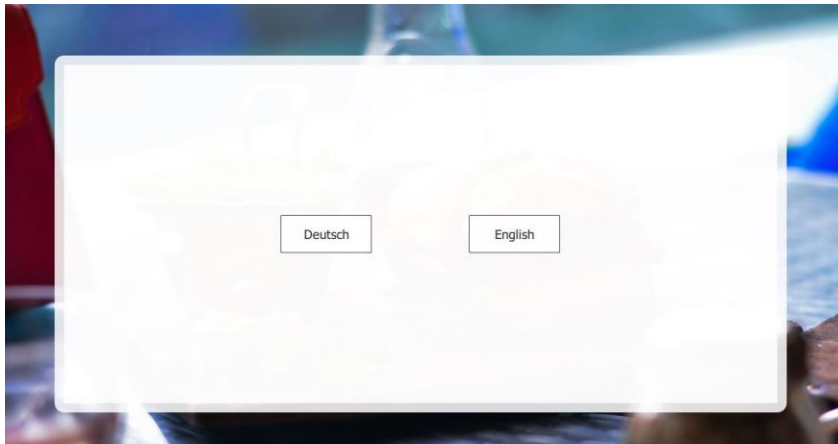
## Psychological statements and indicators of data suitability for SEM

Variables	Statements (1 = very untrue of me, 6 = very true of me)	Sources	KMO	CR	AVE
Convenience orientation				0.76	0.51
Preference for ready-made food	I often use ready-to-eat foods and instant mixes in my cooking	Scholderer et al. (2004)	0.67		
Preference for quick cooking	At home, I prefer to cook meals that can be prepared quickly	Candel (2001)	0.55		
Preference for familiar food	I only eat foods that are familiar to me	Scholderer et al. (2004)	0.65		
Calorie concern				0.80	0.54
Calorie-counting behavior	I count calories in order to keep my weight under control	Lundholm and Wolins (1987)	0.56		
Knowledge of calories in food	I know the calorie content of the food and beverages I consume	Lundholm and Wolins (1987)	0.54		
Knowledge of daily calorie intake	I have trouble knowing how many calories I should consume in a day (reversed)	Gracey et al. (1996)	0.68		
Quality preference				0.78	0.50
Preference for regional food	I do not mind paying more money for regional products	Scholderer et al. (2004)	0.80		
Preference for healthy food	I am willing to pay more for healthy food	Scholderer et al. (2004)	0.68		
Preference for organic food	I always select organic food if I have the opportunity	Scholderer et al. (2004)	0.60		
Negative beliefs on healthy eating				0.83	0.55
High cost of a healthy diet	I find that a healthy diet is too expensive	Gracey et al. (1996)	0.70		
Perceived worthlessness of healthy eating	It is not worth putting much effort into maintaining a healthy diet	Gracey et al. (1996)	0.76		
Perceived unimportance of a healthy diet	A healthy diet is an important determinant for a healthy life (reversed)	O'Connell et al. (1981)	0.73		
<b>Indicators of data suitability for SEM</b>					
Overall Kaiser–Meyer–Olkin (KMO)					0.66
Bartlett's test of sphericity					$\chi^2(66) = , p < .001$

# Supplementary Materials

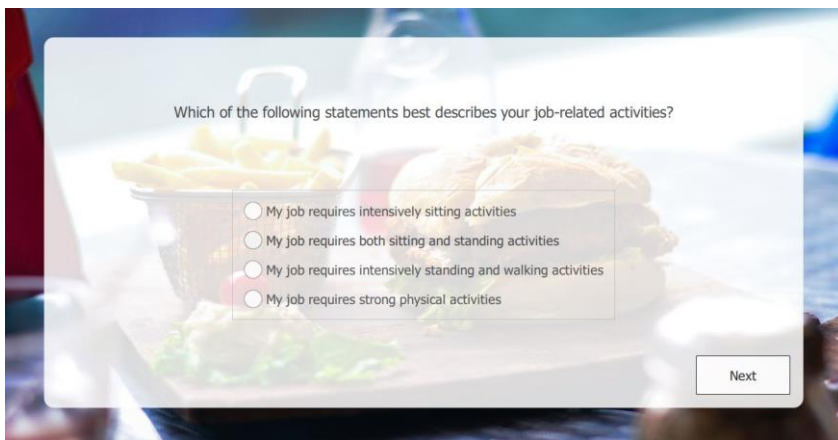
## Software screenshots from the lab experiment

### 1. Language selection

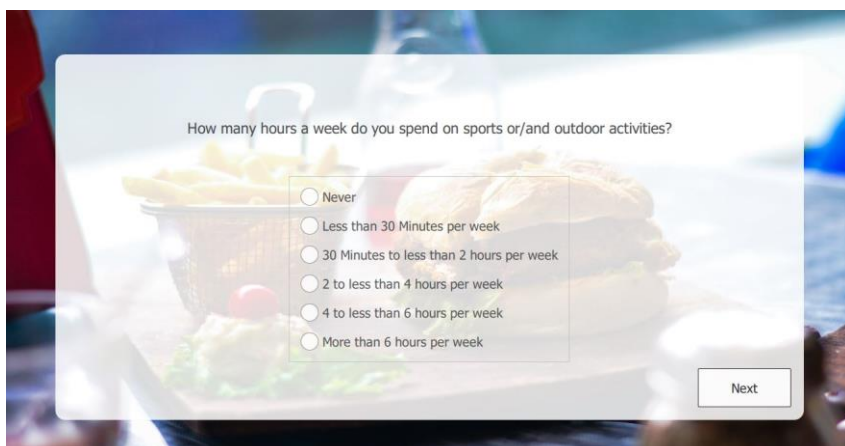


### 2. Questions used to compute guiding values for energy intake

#### 2.1. Occupational physical activities



#### 2.2. Sports and outdoor activities



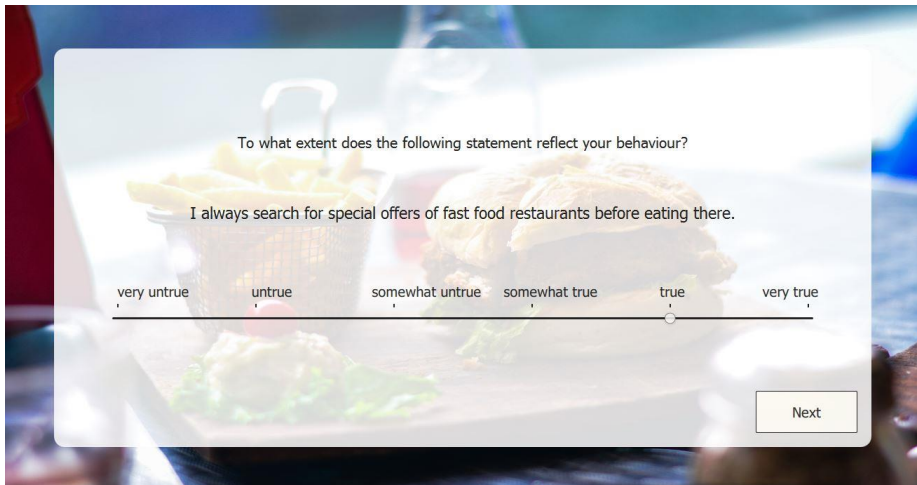
### 3. Questions used to compute deal proneness

To what extent does the following statement reflect your behaviour?

I always search for special offers of fast food restaurants before eating there.

very untrue    untrue    somewhat untrue    somewhat true    true    very true

Next

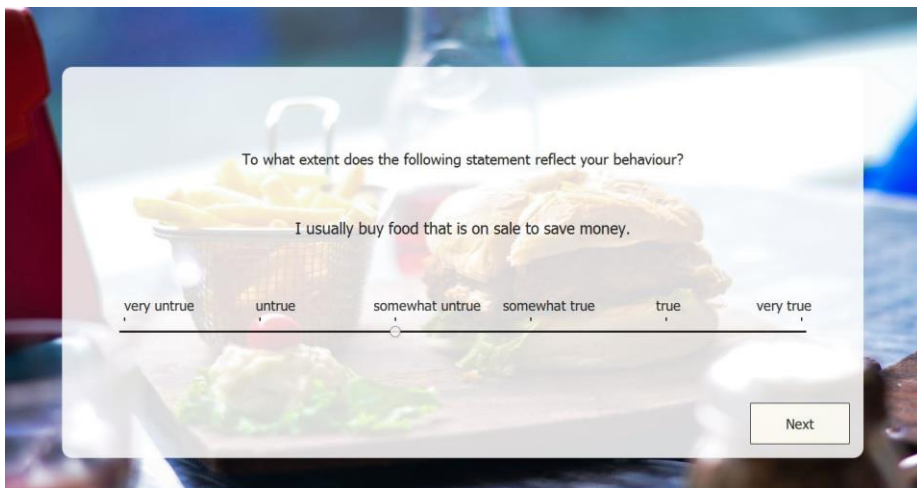
A screenshot of a survey question. The background is a blurred image of a fast-food meal with a burger, fries, and a drink. A white semi-transparent box contains the text. The question asks about the extent to which the statement "I always search for special offers of fast food restaurants before eating there." reflects the respondent's behavior. A horizontal scale with six points is shown, with a slider positioned at the "true" mark. A "Next" button is in the bottom right.

To what extent does the following statement reflect your behaviour?

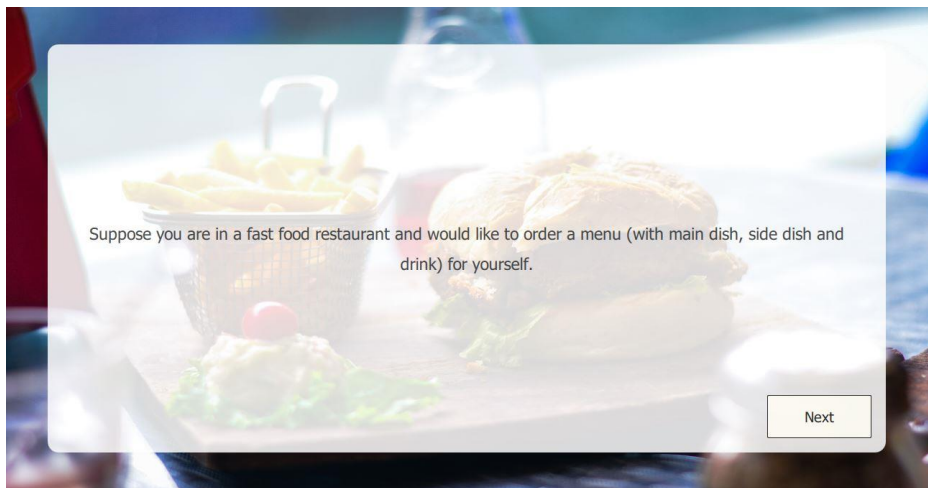
I usually buy food that is on sale to save money.

very untrue    untrue    somewhat untrue    somewhat true    true    very true

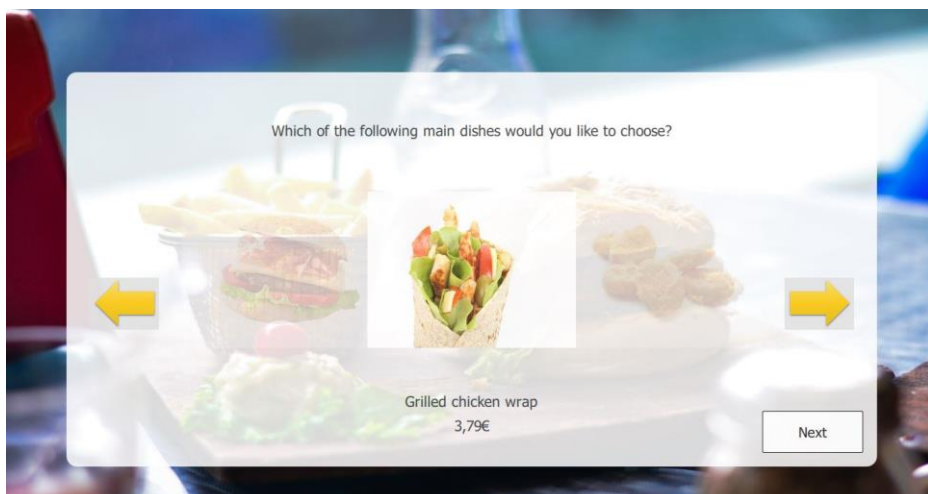
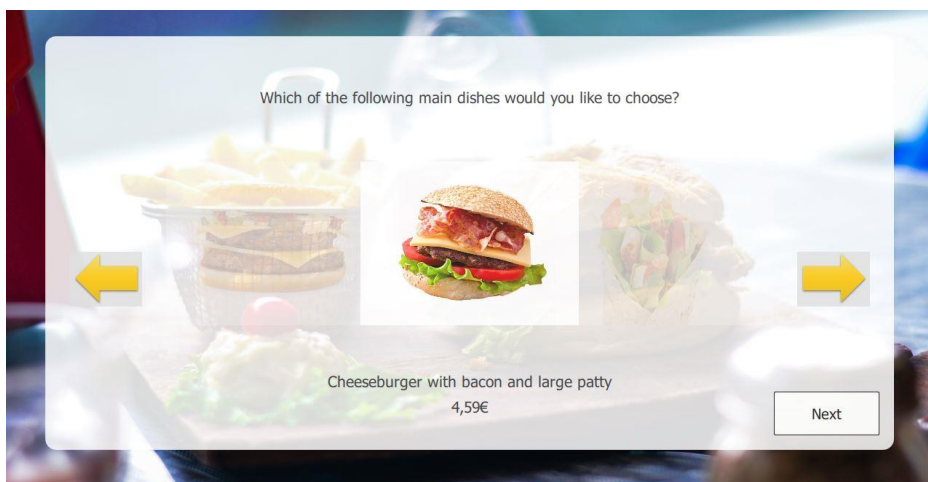
Next

A screenshot of a survey question. The background is a blurred image of a fast-food meal with a burger, fries, and a drink. A white semi-transparent box contains the text. The question asks about the extent to which the statement "I usually buy food that is on sale to save money." reflects the respondent's behavior. A horizontal scale with six points is shown, with a slider positioned at the "somewhat untrue" mark. A "Next" button is in the bottom right.

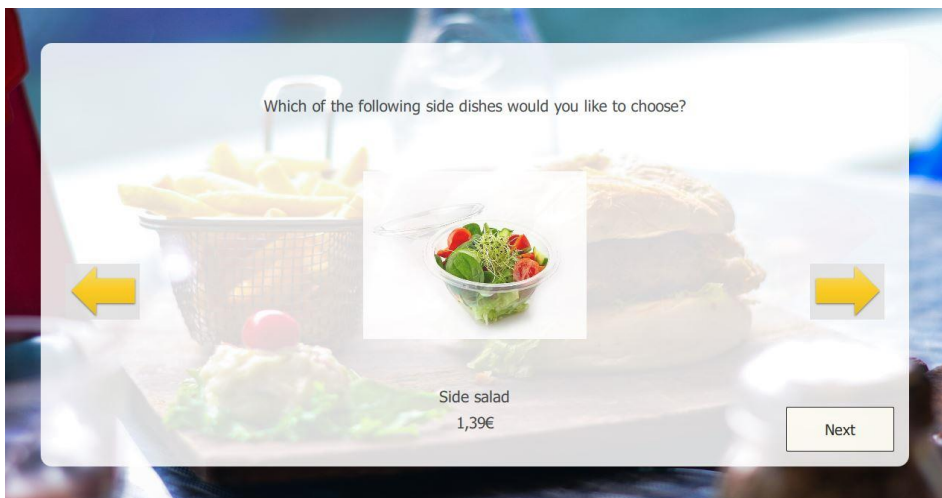
## 4. Menu choice



### 4.1 Main dish

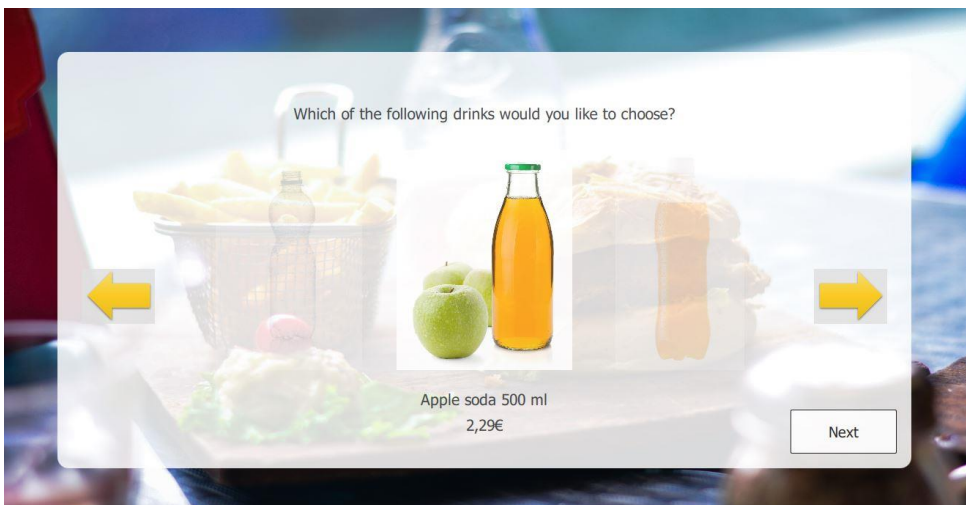
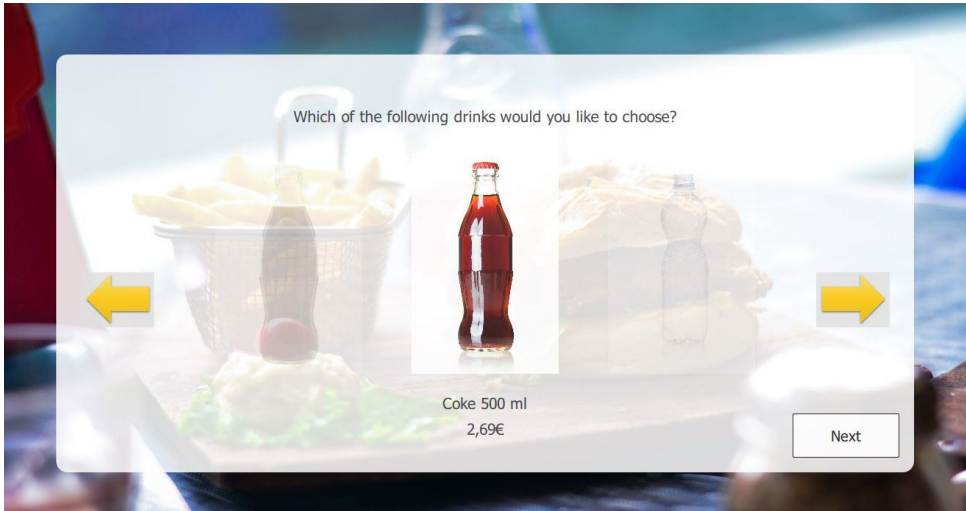


## 4.2 Side dish

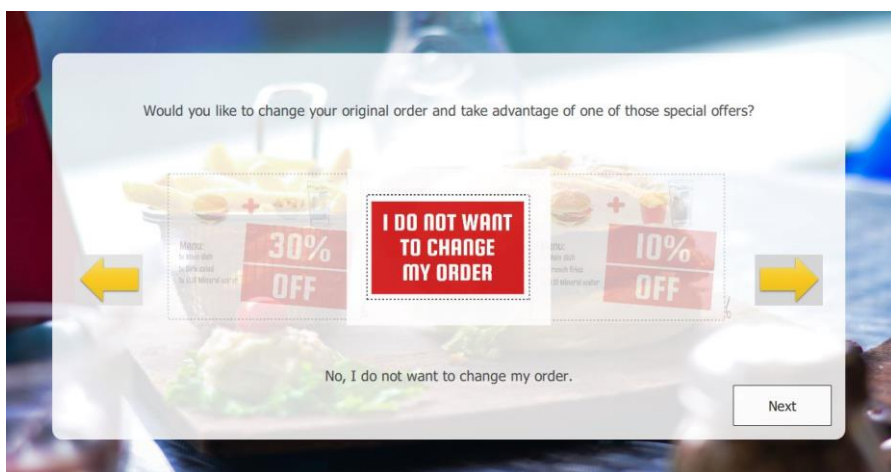
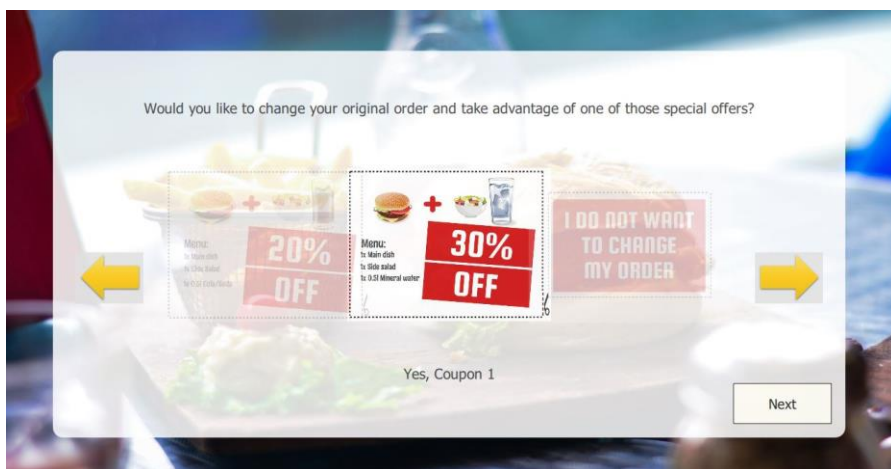




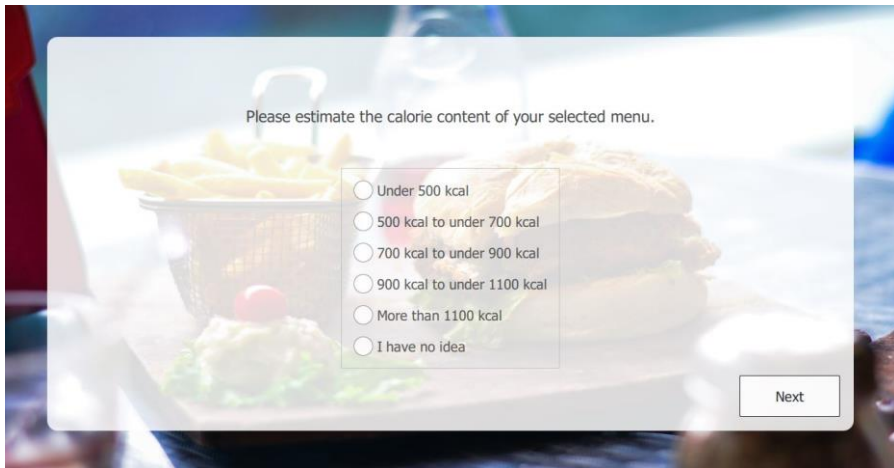
### 4.3 Drink



## 5. Coupon selection



## 6. Estimation of selected calories

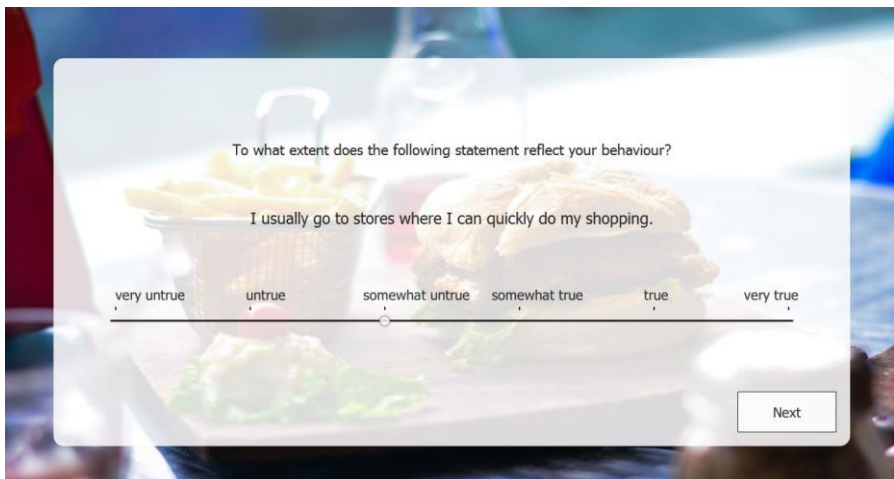


Please estimate the calorie content of your selected menu.

- Under 500 kcal
- 500 kcal to under 700 kcal
- 700 kcal to under 900 kcal
- 900 kcal to under 1100 kcal
- More than 1100 kcal
- I have no idea

Next

## 7. Post-intervention questions about food and nutrition

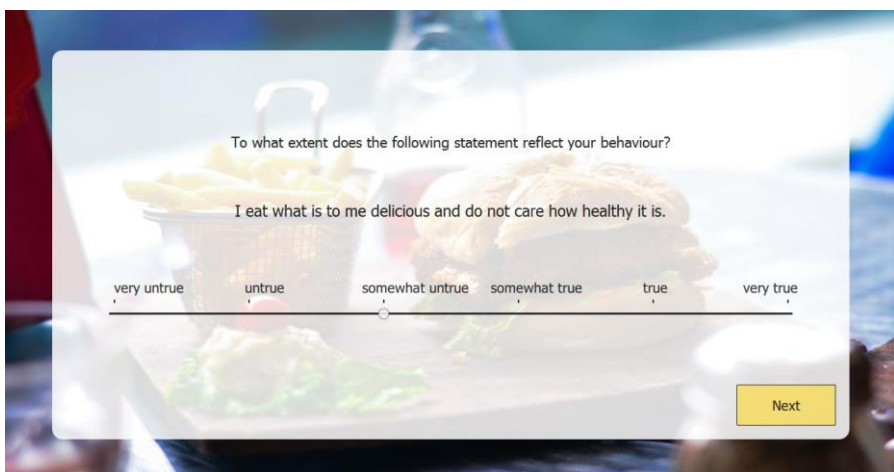


To what extent does the following statement reflect your behaviour?

I usually go to stores where I can quickly do my shopping.

very untrue   untrue   somewhat untrue   somewhat true   true   very true

Next



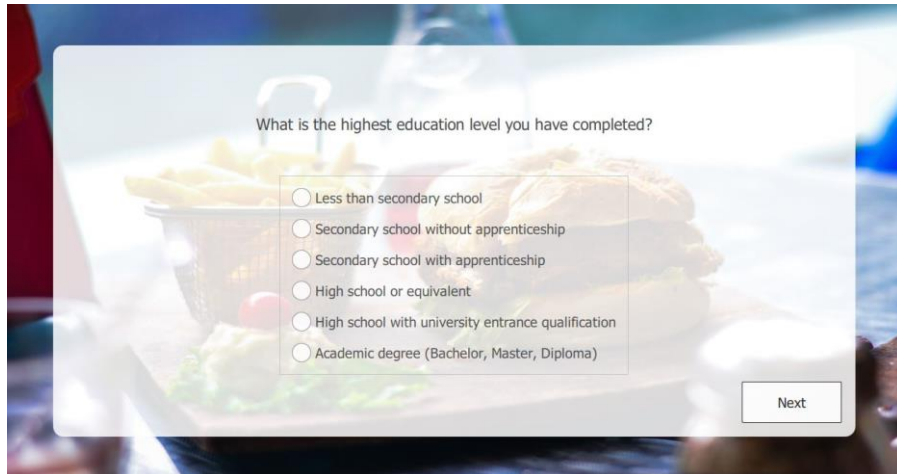
To what extent does the following statement reflect your behaviour?

I eat what is to me delicious and do not care how healthy it is.

very untrue   untrue   somewhat untrue   somewhat true   true   very true

Next

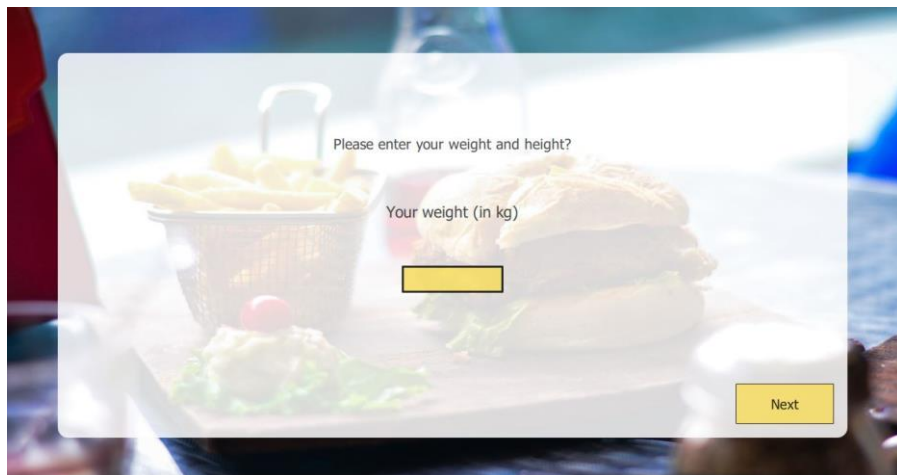
## 8. Post-intervention questions sociodemographic and biological characteristics



What is the highest education level you have completed?

- Less than secondary school
- Secondary school without apprenticeship
- Secondary school with apprenticeship
- High school or equivalent
- High school with university entrance qualification
- Academic degree (Bachelor, Master, Diploma)

Next



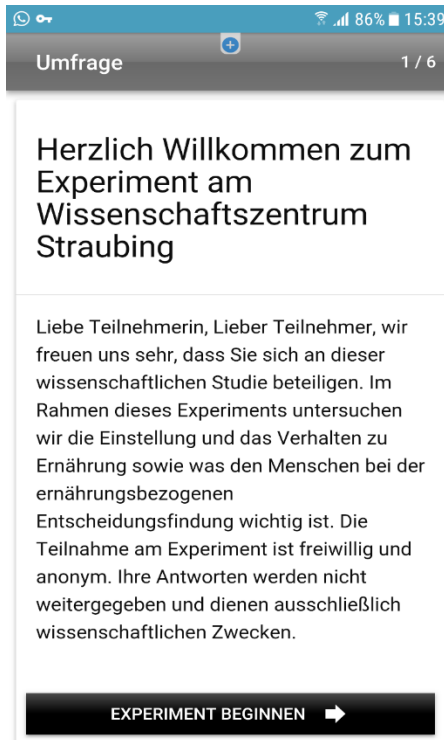
Please enter your weight and height?

Your weight (in kg)

Next

## Software screenshots from the field experiment

### 1. Welcome page and consent form



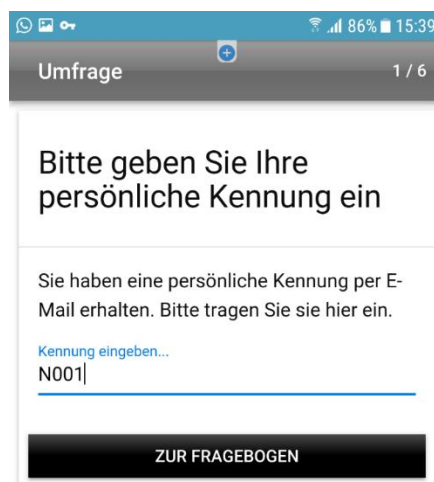
Umfrage 1 / 6

Herzlich Willkommen zum Experiment am Wissenschaftszentrum Straubing

Liebe Teilnehmerin, Lieber Teilnehmer, wir freuen uns sehr, dass Sie sich an dieser wissenschaftlichen Studie beteiligen. Im Rahmen dieses Experiments untersuchen wir die Einstellung und das Verhalten zu Ernährung sowie was den Menschen bei der ernährungsbezogenen Entscheidungsfindung wichtig ist. Die Teilnahme am Experiment ist freiwillig und anonym. Ihre Antworten werden nicht weitergegeben und dienen ausschließlich wissenschaftlichen Zwecken.

EXPERIMENT BEGINNEN →

### 2. Input of participant ID



Umfrage 1 / 6

Bitte geben Sie Ihre persönliche Kennung ein

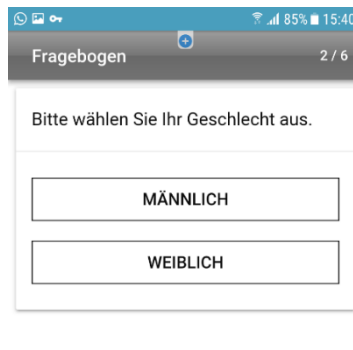
Sie haben eine persönliche Kennung per E-Mail erhalten. Bitte tragen Sie sie hier ein.

Kennung eingeben...  
N001|

ZUR FRAGEBOGEN

### 3. Questions used to compute individual recommended values for energy intake

#### 3.1. Gender



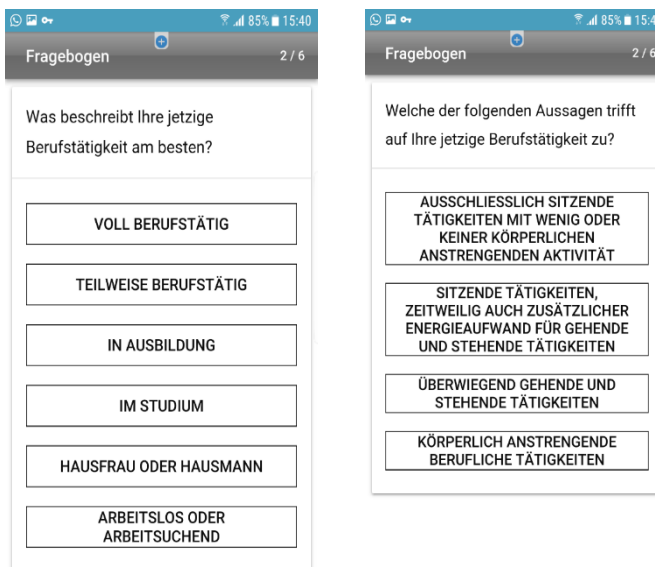
Fragebogen 2 / 6

Bitte wählen Sie Ihr Geschlecht aus.

MÄNNLICH

WEIBLICH

#### 3.2. Occupational activities



Fragebogen 2 / 6

Was beschreibt Ihre jetzige Berufstätigkeit am besten?

VOLL BERUFSTÄTIG

TEILWEISE BERUFSTÄTIG

IN AUSBILDUNG

IM STUDIUM

HAUSFRAU ODER HAUSMANN

ARBEITSLOS ODER ARBEITSUCHEND

Fragebogen 2 / 6

Welche der folgenden Aussagen trifft auf Ihre jetzige Berufstätigkeit zu?

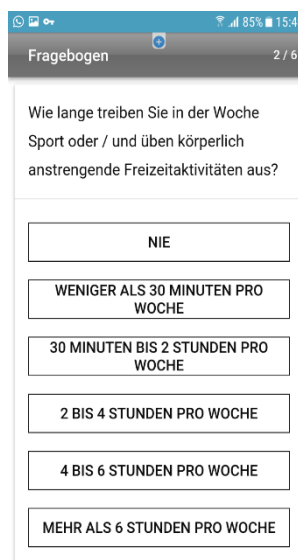
AUSSCHLIESSLICH SITZENDE TÄTIGKEITEN MIT WENIG ODER KEINER KÖRPERLICHEN ANSTRENGENDEN AKTIVITÄT

SITZENDE TÄTIGKEITEN, ZEITWEILIG AUCH ZUSÄTZLICHER ENERGIEAUFWAND FÜR GEHENDE UND STEHENDE TÄTIGKEITEN

ÜBERWIEGEND GEHENDE UND STEHENDE TÄTIGKEITEN

KÖRPERLICH ANSTRENGENDE BERUFLICHE TÄTIGKEITEN

#### 3.3. Sport and free time activities



Fragebogen 2 / 6

Wie lange treiben Sie in der Woche Sport oder / und üben körperlich anstrengende Freizeitaktivitäten aus?

NIE

WENIGER ALS 30 MINUTEN PRO WOCHE

30 MINUTEN BIS 2 STUNDEN PRO WOCHE

2 BIS 4 STUNDEN PRO WOCHE

4 BIS 6 STUNDEN PRO WOCHE

MEHR ALS 6 STUNDEN PRO WOCHE

#### 4. Questions used to estimate deal proneness

192.168.2.100:8082/#/ques 18

Fragebogen 2 / 6

Ich achte beim Essen immer auf den Preis.

trifft nicht zu  trifft völlig zu

192.168.2.100:8082/#/ques 18

Fragebogen 2 / 6

Ich bin immer auf der Suche nach Sonderangeboten bevor ich einkaufe.

trifft nicht zu  trifft völlig zu

192.168.2.100:8082/#/ques 18

Fragebogen 2 / 6

Ich schaue nach Sonderangeboten in der Zeitung oder im Internet, um diese beim Einkaufen zu nutzen.

trifft nicht zu  trifft völlig zu

192.168.2.100:8082/#/ques 18

Fragebogen 2 / 6

Ich kaufe gewöhnlich preisreduzierte Lebensmittel um Geld zu sparen.

trifft nicht zu  trifft völlig zu

## 4. Menu choice

Fragebogen 3 / 6


### i Information


1. Auf dem nächsten Bildschirm sehen Sie die für Sie verfügbaren *Gutscheine* in einer Dropdown Liste.
2. Der erste Gutschein beinhaltet die Menüzusammenstellung, die Sie gerade eben ausgewählt haben.
3. Bitte überlegen Sie gut.

**WEITER ZUM GUTSCHEINAUSWAHL**

## Beilagen

### Pommes Frites

 { "student": 0.9, "employer": 1.1, "guest": 1.6 }  
EUR



Gericht Ausgewählt

**AUSWÄHLEN**

Bitte wählen Sie je ein Gericht aus folgenden Kategorien: Hauptgericht, Beilage, Getränk, Nachspeise.

## Hauptgerichte

### Schnitzel Wiener Art

! [ "A", "C", "AA" ]


 { "student": 3, "employer": 3.8, "guest": 4.5 }  
EUR




Gericht Ausgewählt

## Getränke

### Coca Cola 0,5l

 { "student": 1.1, "employer": 1.1, "guest": 1.1 }  
EUR




Gericht Ausgewählt

**AUSWÄHLEN**

## Nachspeisen

### Brombeerjoghurt

! [ "G" ]

 { "student": 0.7, "employer": 0.9, "guest": 1.3 }  
EUR



Gericht Ausgewählt

**AUSWÄHLEN**



## 5. Coupon offers

4 / 6

### Information

1. Hier sehen Sie die für Sie verfügbaren Gutscheine. Der **erste Gutschein** ist für Ihre ursprüngliche Menüauswahl und beinhaltet keinen Rabatt.
2. Alle anderen Gutscheine beinhalten Ermäßigung für ein vorgegebenes Menü.
3. Bitte wählen Sie jetzt einen von den Gutscheinen:

Gutschein Nr. 1: 0% Rabatt auf ▼


Gutschein Nr. 2: 20% Rabatt auf ▼

Gutschein Nr. 3: 30% Rabatt auf ▼


Gutschein Nr. 4: 40% Rabatt auf ▼

Coupon 1


Gutschein Nr. 1: 0% Rabatt auf




Indisches Gemüsecurry



Pommes Frites



Labertaler Apfel-Kirsch-Prickler 1,0l




Obstsalat


GUTSCHEIN AUSWÄHLEN

Coupon 2


Gutschein Nr. 2: 20% Rabatt auf




Indisches Gemüsecurry



Salatmix mit Dressing oder Paprika Salatmix mit Dressing



Labertaler Prickler Johannisbeere 1,0l




Obstsalat


GUTSCHEIN AUSWÄHLEN

Coupon 3


Gutschein Nr. 3: 30% Rabatt auf




Indisches Gemüsecurry



Salatmix mit Dressing oder Paprika Salatmix mit Dressing



Labertaler Apfel-Kirsch-Prickler 1,0l




Obstsalat


GUTSCHEIN AUSWÄHLEN

Coupon 4


Gutschein Nr. 4: 40% Rabatt auf




Indisches Gemüsecurry



Salatmix mit Dressing oder Paprika Salatmix mit Dressing



Labertaler Balance Apfel-Lemongrass 1,0l



Brombeereoghurt

GUTSCHEIN AUSWÄHLEN

## 6. Coupon selection and next steps

### 6.1 Information on selected coupon

**i** Herzlichen Glückwunsch!  
Sie haben folgenden Gutschein erhalten:

Ihre Kennung: N001

Gutschein Nr.: 3

Mit dem Gutschein erhalten Sie **30% Rabatt** auf das folgende Menü:

- Indisches Gemüsecurry - 2.70 EUR
- Salatmix mit Dressing oder Paprika  
Salatmix mit Dressing - 1.10 EUR
- Labertaler Apfel-Kirsch-Prickler 1,0l - 1.35 EUR
- Obstsalat - 1.30 EUR

Insgesamt: **6.45 EUR**

Rabatt 30%: **1.94 EUR**

**Aufwandsentschädigung**  
8.00 EUR + 1.94 = **9.94 EUR**

### 6.2 Instructions for the steps following coupon redemption

Gutschein 4 / 6

**i** Hier  
Ihnen  
Hinw  
offer

1. Persönliche Kennung eingeben
2. Umfrage ausfüllen
3. Menü auswählen
4. Gutschein auswählen
5. Essen abholen
6. Aufwandsentschädigung abholen

Ihre

Gutschein Nr.: 3

Mit dem Gutschein erhalten Sie **30% Rabatt** auf das folgende Menü:

- Indisches Gemüsecurry - 2.70 EUR
- Salatmix mit Dressing oder Paprika  
Salatmix mit Dressing - 1.10 EUR
- Labertaler Apfel-Kirsch-Prickler 1,0l - 1.35 EUR
- Obstsalat - 1.30 EUR