

# Estimating family shopping behavior: A multi-perspective approach to understanding grocery shopping

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## Abstract

This study examines weekly shopping trips of young families using a multi-perspective approach that considers psychological personality traits, situational influences, and socio-demographic factors to explain food purchases. Over a period of 4 weeks, the data of 60 shoppers and their families as well as 217 purchases were recorded using questionnaires and receipts. Analysis showed that personality traits and socio-demographic data are good predictors of food purchases. The study provides insights into the complexity of shopping behavior, shows the need for multi-perspective approaches, and enables the derivation of strategies to optimize healthy shopping behavior for young families.

## KEYWORDS

big 5, food categories, grocery receipts, shopping behavior, time perspective

## INTRODUCTION

To understand eating behavior, it is crucial to investigate various factors influencing different aspects of eating behavior. Why do we choose a certain food or meal? Why now? Where we eat, with whom we eat, and how much money is available are only three factors that influence food intake and food choice (Neufeld et al., 2022; Story et al., 2002).

Most research regarding the psychology of eating has either looked at emotional aspects, disordered eating, or aspects of the direct food environment (Logue, 2014; Meule & Vögele, 2013). However, what is not available at home cannot be eaten. Therefore, taking the shopping environment to explain food choice behavior into account seems to be another

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important factor in further understanding why people eat what they eat. Supermarket research mostly examines influences on purchasing behavior from a marketing perspective such as shelf space, product placement, the availability of healthy and unhealthy foods, and other influences at the point-of-sale (Shaw et al., 2020; Vogel et al., 2021; Young et al., 2020). A study by Odunitan-Wayas et al. (2020) identified an association between the shelf space ratio of healthy and unhealthy foods and food purchasing decision. Furthermore, supermarket intervention studies investigated food purchasing changes towards healthier food products using nudging strategies such as price incentives or altering product placement (Milliron et al., 2012; Vadiveloo et al., 2020; Young et al., 2020). A recent Dutch study revealed a positive effect on vegetable purchases by implementing a nudging strategy using shopping trolleys with designated space for vegetables and including a social norm message on vegetable purchases (Huitink et al., 2020). One of these messages was “Most customers pick at least seven vegetables” (Huitink et al., 2020, p.3). Other research regarding supermarket shopping focused on shopping patterns, access, frequencies, and locations rather than food choice patterns (Stern et al., 2015; Yoo et al., 2006).

Although it is believed that most of the purchasing decisions are made at the point of sale (POS), we do not know very well whether factors besides existing marketing strategies influence these decisions (see e.g., Chan et al., 2021; Liberato et al., 2014). Does personality matter? Does it matter whether people shop alone or in company? How about age or sex? This study attempts to develop a multi-perspective model that combines several explanatory approaches of purchase behavior from different scientific disciplines. Psychological traits (such as the Big 5: agreeableness, openness, conscientiousness, extraversion, and neuroticism), situational factors (e.g., time spent in shopping), and sociodemographic factors (e.g., age) or body mass index (BMI) are used as explanatory factors for the amounts of different foods purchased in families' weekly purchases. The results may suggest ways to promote healthier diets and lifestyles in families.

## REVIEW OF LITERATURE

### Personality traits

Personality traits are firmly anchored in every person and are relatively stable over time (Zimbardo & Boyd, 1997). The Big Five are understood as fundamental and characteristic traits of individual psychology. Furthermore, they are reflected in many forms of individual action such as the choice of retail purchasing channels (Hermes & Riedl, 2021), in-store or online willingness to purchase (Hermes et al., 2022; Piroth et al., 2020), shopping (Goldsmith, 2016), or food consumption (Nystrand et al., 2021). Following McElroy et al. (2007), we wanted to investigate whether personality (measured as the Big Five Inventory) affects purchase behavior. We were interested in determining the direct effect of the Big Five Personality traits on purchase behavior.

Since the 1980s, several studies have investigated the relationship between time perspective (TP) and physical and mental health (see e.g., Roche & Frankel, 1986). These studies have consistently shown differences between individuals with a present and future orientation. One of the most comprehensive measures of TP is Zimbardo's Time Perspective Inventory (ZTPI; Zimbardo & Boyd, 1997), consisting of items belonging to five different TPs (past-negative, past-positive, present-hedonistic, present-fatalistic, and future). We agree with Zimbardo and Boyd (1997) that TPs “exert a dynamic influence on many judgments, decisions, and actions” (Zimbardo, & Boyd, 1997, p.1272). Thus, it should also be possible to understand time orientation as indicators for food selection or health-related

decisions (van Beek et al., 2017; Zimbardo & Boniwell, 2004). Many studies have already investigated the relationships between time orientation and food purchase or consumption (e.g., Dassen et al., 2015; Daugherty & Brase, 2010; Olsen & Tuu, 2017). We want to use the ZTPI, a common and widely used measurement of TP, to investigate the relationship between time orientation and purchase behavior.

## Situational factors

Situational influences at the POS are very diverse and complex (Bauer et al., 2022) and range from people who interact with the shoppers while shopping to time spent on shopping to the individual's sense of hunger during each shopping trip. Thomas and Garland highlighted the special role of companionship in shopping, noting that “the presence of children makes a substantial contribution to average expenditure” (Thomas & Garland, 1993, p.12). Recent research continuously confirms the influence of accompanying persons during shopping trips on the POS. For example, Chen et al. (2021) showed that parents and partners are the most frequent companions during shopping trips and thereby have the strongest impact on shoppers' unplanned purchase behavior. Hummel et al. (2021) analyzed unplanned purchase behavior using mobile eye tracking technology and demonstrated that the mere presence of accompanying people appears to have an impact on visual attention to the products. Scholz et al. (2021) identified different types of companions in a qualitative study. As a result, they presented redesigned sales strategies, which are adapted to these types of companions.

Besides companionship, factors such as time spent in a shop were described (Nicholls, 1997; Roslow et al., 2000). Since the circulation time on the sales floor has an influence on the potential contacts between shoppers and products, it can be seen as a predictor for the occurrence of unplanned purchases (Santini et al., 2019). Individual's sense of hunger can also affect the amounts of foods bought when shopping. Cheung et al. (2017) showed that hungry participants made less healthy choices than satiated participants. And recently, Carroll et al. (2022) showed in a grocery shopping experiment that more hunger might lead to a higher amount of food purchased in food bundles.

## Sociodemographic factors

Since studies showed that social demographics such as sex, age, and BMI can be understood as individual indicators for difference in food consumption (see e.g., Murakami et al., 2022), we also take them into account in the current study.

This study attempts to examine the quantity of purchased products of several food groups taking different influencing factors into account. The study differs from other studies that use food frequency questionnaires by using collected grocery shopping receipts to examine the amounts of foods purchased. Only a few studies took a closer look at food purchases through grocery receipts so far (see e.g., Cullen et al., 2007; Rankin et al., 1998). Analysis of food purchase receipts is an appropriate way to characterize household food group purchases (Martin et al., 2006; Ransley et al., 2003; Tang et al., 2016; Vepsäläinen et al., 2022).

## METHODOLOGY

The study was designed in accordance with the declaration of Helsinki and approved by the University Ethics Committee. The study presented here is part of a larger project (see Hummel et al., 2021) for which all data were collected from January to May 2017.

### Recruitment and sampling

Participants were recruited in front of a supermarket and in the area around the university. Participants were addressed directly or made aware of the study via posters, social media messages or E-mails. By participating in the study, the participants received a 20 € voucher for a supermarket, retail, or online store of their choice.

To standardize the study population, some inclusion criteria were applied in terms of diet, family composition, and shopping habits. (1) The respondents should be between 20 and 65 years of age. (2) Respondents should live with at least one other person. (3) To exclude special food consumption habits, household members should not follow a vegan diet, have food intolerances, be pregnant, or breastfeed children. (4) Since efficient time planning is central to young couples and parents (Thomas & Garland, 2004), shopping should therefore mainly take the form of a weekly shopping trip to a supermarket (discount or full-range). (5) Subjects should have access to a PC/electronic device with internet connection.

### Procedure

After the participants received basic information about the study and signed written consent forms, they were briefed intensively about the procedure and their tasks. The study lasted for a total of 4 weeks (see Figure 1). During this time, study participants were required to document their weekly shopping trips and participate in online surveys.

The questionnaires were split into two surveys to avoid effort overload for respondents and reduce attrition. Data regarding the psychological scales and social demographics were gathered in these online surveys. The first online survey was scheduled in weeks one and two and the second in weeks three and four. Furthermore, each participant had to document his or her purchases by collecting receipts. Each weekly shopping trip needed to be done by the person who was normally responsible for the week's groceries. The type of products purchased, and the amounts of these products, were documented via the grocery receipts while the circumstances of each shopping trip (situational factors) were documented by the participants on a short questionnaire after each shopping trip. At the end

Recruitment (information, written consent, instructions)	1. Questionnaire (social demographics, Big5)		2. Questionnaire (ZTPI)	
	shopping trip 1 + screening (receipts, ad hoc factors)	shopping trip 2 + screening (receipts, ad hoc factors)	shopping trip 3 + screening (receipts, ad hoc factors)	shopping trip 4 + screening (receipts, ad hoc factors)
week 0	week 1	week 2	week 3	week 4

FIGURE 1 Study procedure.

of the 4 weeks, the participants submitted the collected receipts and purchasing questionnaires to our laboratory.

## Measures

### Questionnaires and other self-reporting scales

#### *Psychological traits*

To capture the time orientation (past-negative, past-positive, present-hedonistic, present-fatalistic, and future), the German version (Reuschenbach et al., 2013) of the ZTPI (Zimbardo & Boyd, 1997) was used. Participants reported their agreement with the corresponding items on a five-point Likert scale (from “very true” to “very untrue”). Data regarding the ZTPI were gathered in the second online questionnaire. Cronbach's Alpha scores for each of the 5 subscales from the ZTPI (Zimbardo & Boyd, 1997, 2015) were calculated. The past negative subscale ( $\alpha=0.85$ ), the present hedonistic subscale, and the future subscale ( $\alpha=0.80$ ) showed good internal consistency scores. The present fatalistic subscale ( $\alpha=0.75$ ) and the past positive subscale ( $\alpha=0.65$ ) showing acceptable internal consistency.

A German version (Satow, 2021) of the Big Five Inventory was used to assess personality traits. This was done by recording agreement with the corresponding items on a four-point Likert scale (from “agree” to “disagree”). Data regarding the Big Five Inventory were gathered in the first online questionnaire. Again, Cronbach's Alpha was calculated for each subscale. The agreeableness subscale ( $\alpha=0.69$ ), the openness subscale ( $\alpha=0.71$ ), the conscientiousness subscale ( $\alpha=0.76$ ) and the extraversion subscale ( $\alpha=0.79$ ) showed acceptable internal consistency; the neuroticism subscale ( $\alpha=0.89$ ) was found to be highly reliable.

#### *Situational factors*

Data regarding situational factors were gathered in self-reporting (paper and pencil) purchasing questionnaires for the four shopping trips by each participant. These included questions about accompaniment for each shopping trip, the length of time spent shopping, and hunger before shopping. Participants counted all accompanying persons for each shopping trip. Hunger was reported by participants on a 10 cm VAS (visual analogue scale) ranging from “not at all hungry” to “very hungry.” The time spent on each shopping trip was reported by the participant and calculated as the time between the beginning of the shopping trip and the end of the shopping trip.

#### *Social demographics and anthropometric measures*

Social demographics (age, sex, graduation, household income, and household size) of the shopper was gathered in the two online questionnaires (see Figure 1). In addition, height and weight were collected by self-report to calculate BMI.

## Receipts

#### *Collecting the grocery receipts*

The participants were instructed to collect and hand in four grocery receipts for the weekly shopping trips at the end of the study. Moreover, receipts for additional purchases (e.g., bakery) were also collected to verify that most of each week's purchases were made during one shopping trip.

*Extending the information from the receipts*

Subsequent online research (on supermarket homepages) identified the packaging amounts (units and g) and energy density (kcal/g) of all products. When kcal/g information was not available on the sites for common foods such as vegetables and fruits, a standardized source (Elmadfa et al., 2017) was used to obtain these values.

*Categorization of food groups and data preparation for the analyses*

Since the data could not be meaningfully analyzed for each product, the data were aggregated based on food categories (see Table 1).

Mean values for a daily consumption per family were formed for each food category. The categorization of the food was carried out (by a nutritionist with a master's degree in nutritional science) according to clear rules and standardized procedures. The categorization of the food was based on previous studies (Haftenberger et al., 2010; Kleiser et al., 2009). Data were aggregated

**TABLE 1** Food groups, categories, and examples of food products.

#	Food group	Categories	Product examples
1	Pasta, rice, potatoes	Pasta, rice, corn	Legumes, Rice, corn, noodles, oatmeal, amaranth, millet, beans, peas, chickpeas, lentils, soybeans, cereal products
		Potatoes	Potatoes, cooked potatoes, potato products
2	Bread, cereals	Bread	Bread, bread rolls, pretzels
		Muesli, cereals	Muesli, cereals, cornflakes
3	Vegetables	Vegetables	Fresh vegetables, deep-frozen vegetables, canned vegetables
4	Fruits	Fruits	Fresh fruits, deep-frozen fruits, canned fruits
5	Meat, sausages	Meat, sausages	Fresh meat, deep-frozen meat, sausages, canned sausages, cold cuts
6	Fish	Fish	Fresh fish, deep-frozen fish, fish products, caviar, sea food
7	Milk, dairy products	Milk	Milk, dairy products, yogurt, cottage cheese, buttermilk, cream
		Cheese	Hard cheese, soft cheese, cream cheese
		Sweets	Chocolate, cookies, candy, fruit gums, honey, nut nougat cream, jam
8	Sweets, fatty snacks, sugar sweetened beverages	Desserts	Ice cream, pudding, dairy desserts, soy desserts, cakes, sweet cakes, pastries
		Snacks	Chips, salt sticks, salted nuts
		SSBs	Cola, lemonade, orange juice
9	Ready meal	Ready meal	Frozen apple strudel, 5-min terrine, canned stew, ready-made lasagna, pre-packaged sandwich
		Ready meal components	Croquettes, French fries, potato wedges, pre-cooked pasta
10	Beverages	Water	Mineral water, table water
		Beverages	Ready-to-drink coffee, tea drinks

for these food categories for each shopping trip and adjusted for household size. The age of the individuals served as an approximation for the assigned factor. In assigning the factor values, for babies, toddlers, and children up to 3 years of age, the factor 0 was assigned; for children from 3 years up to and including 10 years of age, the factor 0.5 was assigned; and for children 11 years of age and older and adults, the factor 1 was assigned (Krug et al., 2018). For example, if a family consists of two adults and one child aged 9 years, the factor is 2.5 (1 + 1 + 0.5). To standardize the family data for the members, the quantities are divided by the factor 2.5.

## Data analysis

The analysis plan consisted of two steps.

1. Description of the participant sample and the quantities purchased, money spent, and energy densities for each food category.
2. We aimed to explain the quantities purchased of key food categories using mixed-effects regressions grouped by participant. To do this, we scaled the household purchase data to weekly personal consumption by dividing total weekly consumption by the number of household members (adjusted for age). We fitted linear mixed models (estimated using ML and nloptwrap optimizer) to predict the purchased amounts of food for each food category. Regressions accounted for fixed effects of social demographics, psychological traits and situational factors and included random intercepts for participants (to take the variability in purchases per participant into account and to realize more precise estimates). The main analysis consisted of a comparison of three regression models for each food category. The aim was to find the best estimation model for the amount of purchased food. Regression model 1 included the socio-demographic variables (age, gender, and BMI). This model was expanded in regression model 2 by the psychological personality traits (ZTPI, B5). Regression model 3 was formed by adding the situational influences (companion, hunger, time spent on a shopping trip). For the interpretation of the results, the model with the highest explanatory power (the highest marginal/conditional  $R^2$ ) was used. We characterized the factors using beta with 95% CI. We used the standard  $p < 0.05$  criteria for determining if the results of any test were significantly different from those expected if the null hypothesis applied. Analysis was conducted using R, version 4.1.3 (R Core Team, 2022) and RStudio, version 2022.2.0.443 (RStudio Team, 2022). The lme4-package, version 1.1.28 (Bates et al., 2015) was used to perform the mixed model regression analysis.

## RESULTS

### Sample characteristics

A total of 61 participants took part in the study. Data from 60 participants (46 female) between the ages of 20 and 58 years, living in the southwest of Germany, were analyzed. Participants' calculated BMI was on average 24.2 kg/m<sup>2</sup> with a minimum at 18.2 kg/m<sup>2</sup> and a maximum at 34.4 kg/m<sup>2</sup>. Education level in the sample was high (76% attended and graduated from high school). Average household size was 3 persons. Almost three fourth of the participants reported a monthly household income between 1000 € and 4000 € (see Table 2).

**TABLE 2** Individual and household characteristics across the sample and separated for sex.

Socio demographics	Men <i>n</i> = 14 (23%)	Women <i>n</i> = 46 (77%)	Total sample <i>n</i> = 60 (100%)
<b>Age</b>			
Min	22	20	20
Max	55	58	58
M (SD)	33.5 (9.96)	36.9 (11.9)	36,1 (11.48)
<b>BMI</b>			
Min	19.3	18.2	18.2
Max	30.5	34.4	34.4
M (SD)	25.6 (3.30)	23.8 (3.90)	24.2 (3.81)
<b>Graduation <i>n</i> (in %)</b>			
Main school	1 (7)	2 (4)	3 (5)
Middle school	1 (7)	10 (22)	11 (19)
High school	12 (86)	33 (73)	45 (76)
<b>Household size</b>			
Min	2	2	2
Max	3	5	5
M (SD)	2.2 (0.43)	2.74 (0.98)	2.6 (0.90)
<b>Household income <i>n</i> (in %)</b>			
Less than 500, €	—	1 (2)	1 (2)
500–1000, €	4 (29)	6 (13)	10 (17)
1001–2000, €	2 (14)	15 (33)	17 (28)
2001–3000, €	4 (29)	11 (24)	15 (25)
3001–4000, €	3 (21)	9 (20)	12 (20)
More than 4000, €	1 (7)	1 (2)	2 (3)
No answer	—	3 (7)	3 (5)

*Note:* Data are based on the number of participants (*n*=60) who are solely or primarily responsible for the purchases in the households.

Abbreviations: M, mean, SD, standard deviation.

## Average weekly shopping

On average, a family spent 57 € on their weekly shopping trip. Thereof, 90% was spent on food and beverages. On average, families spent the most money per week on milk and dairy products, followed by meat and sausages and sweet/fatty snacks. On average, a family bought 7 units of milk and dairy products that had a total weight of 4281 g. Vegetables and fruits were also popular food categories within the sample. On average, a families' shopping trip consisted of 5 units of vegetables with a weight of 2501 g and of 3 units of fruits with a weight of 1857 g. Pasta, rice and potatoes still contributed more than 1000g per category to an average weekly purchase. The food group of breads and cereals and the food group of fish accounted for the smallest amount of the weekly purchases. All unadjusted and adjusted values for the weekly shopping trips are shown in [Table 3](#).

TABLE 3 Characteristics of an average weekly shopping trip.

Food category	Family consumption						Individual consumption										
	Amount (in g)		Counts (in pes)		Price (in €)		Energy (in kcal/g)		Amount (in g)		Counts (in pes)		Price (in €)		Energy (in kcal/g)		
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	
Pasta, rice, potatoes	1123.6	1927.8	1.1	1.4	1.6	3.1	3.9	0.9	415.4	600.2	0.3	0.6	0.6	0.6	0.9	1.9	0.5
Bread, cereals <sup>a</sup>	141.0	399.0	1.4	1.8	1.7	2.3	4.0	0.6	58.5	159.0	0.6	0.7	0.8	1.0	4.0	0.6	0.6
Vegetables	2501.0	2671.7	4.7	3.7	6.4	5.9	0.3	0.1	998.5	932.2	2.0	1.8	2.6	2.4	0.3	0.1	0.1
Fruits	1857.3	1741.3	2.7	2.3	4.8	4.0	0.7	0.3	782.1	712.5	1.2	1.0	2.0	1.8	0.7	0.3	0.3
Meat, sausages	674.1	763.5	2.5	2.4	7.1	7.6	2.4	0.8	276.9	352.3	1.1	1.1	2.9	3.4	2.4	0.8	0.8
Fish	85.8	205.7	0.4	0.7	1.5	3.0	1.6	0.5	34.3	76.5	0.1	0.3	0.5	1.1	1.6	0.5	0.5
Milk, dairy products	4280.8	9129.9	6.8	4.9	9.2	6.6	6.1	24.2	1475.3	1282.5	2.8	1.9	3.7	2.5	2.1	0.4	0.4
Sweets, fatty snacks, SSBs	2538.5	4172.0	4.0	3.4	6.8	7.0	12.5	1.7	965.2	1219.1	1.7	1.5	2.7	2.4	3.2	0.4	0.4
Ready meal	1149.8	1076.9	2.9	2.6	5.4	5.0	4.0	1.1	480.6	464.1	1.3	1.3	2.3	2.2	2.0	0.6	0.6
Beverages	3824.8	8087.9	0.5	0.8	1.3	3.2	0.3	0.2	1610.3	3434.6	0.2	0.3	0.5	1.2	0.1	0.1	0.1

Note: Table represents family consumption (unadjusted data) and individual consumption (adjusted by family consumption that accounts for family members).

<sup>a</sup> Amounts (in g) and energy density (in kcal/g) do represent cereals only since grams were not available for most pastries.

## Influences on the purchase amount of different food groups

A series of multiple regression analyses were performed (see [Figure 2](#)). For each food category the model with the best explanatory power was chosen.

### Amount of pasta, Rice, and potatoes

Model 2 (including sociodemographic factors and psychological traits) explained a significant amount of pasta, rice and potato purchases in the shopping trips (conditional  $R^2=0.11$ , marginal  $R^2=0.11$ ). For an increase of the score in past positive TP, the amount of pasta, rice and potatoes bought on the shopping trips decreased. The same applied for the agreeableness (see [Table 4](#)).

### Amount of vegetables

Model 2 (including sociodemographic factors and psychological traits) was the best model to explain the amount vegetables purchases in the shopping trips (conditional  $R^2=0.48$ , marginal  $R^2=0.28$ ). An increase in the values for age, extraversion, conscientiousness or agreeableness are associated with a decrease in the amount of vegetables bought when shopping. For an increase of the score in present hedonic TP, the amount of vegetables bought on the shopping trips also increased (see [Table 5](#)).

### Amount of fruits

Model 1 (including sociodemographic factors) had a substantial explanatory power with a conditional  $R^2=0.39$  and a marginal  $R^2=0.05$ . Sex contributed significantly to the explanatory power of the dependent variable (see [Table 6](#)).

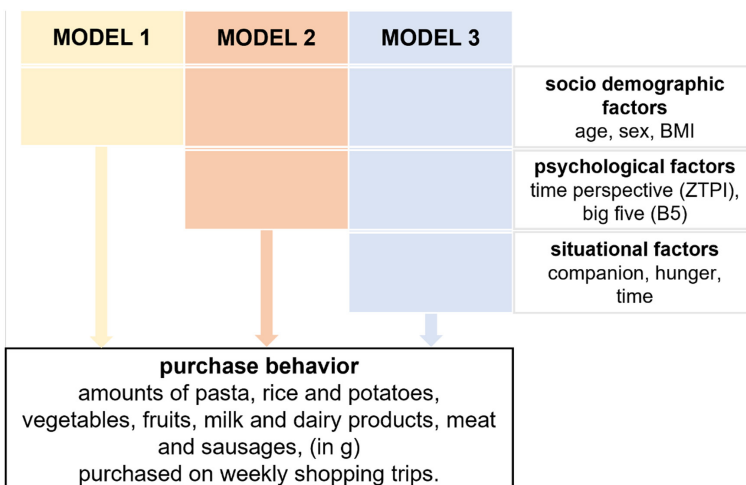


FIGURE 2 Regression models.

TABLE 4 Regression models for pasta, rice, and potatoes.

	Model 1		Model 2		Model 3	
	Estimates	95% CI]	Estimates	95% CI]	Estimates	95% CI]
Intercept	384.66	[-232.54 to 1001.85]	2994.42***	[1257.88 to 4730.96]	2790.81**	[1000.47 to 4581.14]
Social demographics						
Age	-7.83	[-15.95 to 0.28]	-9.01	[-18.54 to 0.52]	<b>-9.81*</b>	<b>[-19.51 to -0.11]</b>
Sex	146.34	[-60.69 to 353.37]	155.37	[-59.52 to 370.26]	142.48	[-75.62 to 360.58]
BMI	8.5	[-15.62 to 32.63]	-1.81	[-25.53 to 21.91]	0.13	[-24.24 to 24.50]
Zimbardo Time Perspective Inventory						
Past negative			-15.89	[-181.84 to 150.05]	-21.16	[-188.38 to 146.06]
Present hedonic			46.91	[-166.94 to 260.76]	49.53	[-166.29 to 265.34]
Future			-88.57	[-309.97 to 132.83]	-76.93	[-303.00 to 149.14]
<b>Past positive</b>			<b>-217.54*</b>	<b>[-412.40 to -22.69]</b>	-195.24	[-396.66 to 6.18]
Big Five						
Present fatalistic			-124.22	[-296.87 to 48.43]	-123.93	[-298.63 to 50.77]
Neuroticism			-24.42	[-203.90 to 155.06]	-18.45	[-201.07 to 164.17]
Openness			162.17	[-66.33 to 390.67]	160.23	[-68.21 to 388.67]
Extraversion			-112.15	[-350.28 to 125.98]	-106.11	[-347.85 to 135.63]
Conscientiousness			24.38	[-264.44 to 313.20]	16.95	[-272.79 to 306.68]
<b>Agreeableness</b>			<b>-331.30*</b>	<b>[-603.09 to -59.52]</b>	<b>-324.26*</b>	<b>[-597.54 to -50.98]</b>
Situational factors						
Companion					-24.97	[-179.00 to 129.07]
Hunger					2.06	[-26.33 to 30.46]
Time					1.11	[-1.39 to 3.60]
$R^2$ (fixed)	0.03		0.11		0.11	
$R^2$ (total)	0.09		0.11		0.11	
AIC	3396.4		3398.8		3403.9	
BIC	3416.7		3452.8		3468.2	
$\chi^2$	—		17.69		3.97	

Note:  $n=60$ , observations = 217. Results in bold are significant influences ( $p < .05$ ) in the regression models. \*\*\* $p < .001$ , \*\* $p < .01$ , \* $p < .05$ .

TABLE 5 Regression models for vegetables.

	Model 1		Model 2		Model 3	
	Estimates	95% CI]	Estimates	95% CI]	Estimates	95% CI]
Intercept	855.86	[-422.46 to 2134.18]	4475.59**	[1270.77 to 7680.42]	4203.61**	[1070.37 to 7336.86]
Social demographics						
Age	<b>-22.68**</b>	<b>[-39.28 to -6.09]</b>	<b>-25.61**</b>	<b>[-43.02 to -8.20]</b>	<b>-26.41**</b>	<b>[-43.31 to -9.52]</b>
Sex	264.18	[-166.78 to 695.13]	319.74	[-81.96 to 721.43]	328.63	[-59.92 to 717.19]
BMI	32.40	[-17.43 to 82.24]	12.48	[-31.67 to 56.63]	10.75	[-32.35 to 53.85]
Zimbardo Time Perspective						
Past negative			58.76	[-253.00 to 370.53]	68.66	[-231.58 to 368.90]
Inventory						
<b>Present hedonic</b>			<b>434.28*</b>	<b>[36.32 to 832.24]</b>	<b>458.94*</b>	<b>[75.22 to 842.65]</b>
Future			317.24	[-92.19 to 726.66]	300.13	[-98.08 to 698.35]
Past positive			-159.33	[-526.10 to 207.43]	-131.38	[-490.01 to 227.25]
<b>Present fatalistic</b>			<b>-309.22</b>	<b>[-629.06 to 10.63]</b>	<b>-316.79*</b>	<b>[-625.73 to -7.84]</b>
Neuroticism			-82.65	[-418.45 to 253.14]	-107.32	[-432.56 to 217.91]
<b>Openness</b>			<b>413.49</b>	<b>[-12.37 to 839.35]</b>	<b>417.95*</b>	<b>[9.48 to 826.41]</b>
<b>Extraversion</b>			<b>-518.89*</b>	<b>[-959.62 to -78.17]</b>	<b>-558.86*</b>	<b>[-986.06 to -131.66]</b>
<b>Conscientiousness</b>			<b>-632.14*</b>	<b>[-1167.40 to -96.88]</b>	<b>-621.16*</b>	<b>[-1136.42 to -105.90]</b>
<b>Agreeableness</b>			<b>-602.70*</b>	<b>[-1107.15 to -98.26]</b>	<b>-569.88*</b>	<b>[-1055.31 to -84.45]</b>
Situational factors						
Companion					126.70	[-87.45 to 340.84]
Hunger					18.40	[-20.28 to 57.07]
Time					2.37	[-0.98 to 5.72]
$R^2$ (fixed)	0.07		0.28		0.29	
$R^2$ (total)	0.48		0.48		0.47	
AIC	3533.7		3526.6		3528.4	
BIC	3554.0		3580.7		3592.6	
$\chi^2$	—		<b>27.12**</b>		4.21	

Note: n = 60, observations = 217. Results in bold are significant influences ( $p < 0.05$ ) in the regression models. \*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ .

## Amount of meat and sausages

Even if the difference in explanatory power no longer increased significantly from model 2 to model 3, model 3 (including sociodemographic factors and psychological traits and situational factors) could explain most of the variance (conditional  $R^2=0.54$ , marginal  $R^2=0.24$ ). While BMI, the past negative score, and shopping duration contributed positively to the explanatory power of the dependent variable, age had a negative influence on the amount of meat and sausage products purchased on shopping trips (see [Table 7](#)).

## Amount of milk and dairy products

For the amount of milk and dairy products and the amount of sweets, no significant regression model was found.

# DISCUSSION, LIMITATIONS, AND CONCLUSION

## Discussion and implications

In this study, we were able to estimate the purchased amounts of different foods in several regression models using psychological traits, situational factors at the POS, and individual characteristics such as socio demographics or BMI as predictor variables.

Except for *milk or dairy products* and *sweets*, we were able to identify regression models to estimate the total amounts purchased in each food group. For the estimation of the amount of purchased *fruits*, sex was the main influencing factor, which was in line with other research (Dinnissen et al., 2021; Stea et al., 2020) and therefore met expectations. The estimations for *pasta, rice, and potatoes* showed low negative associations between the purchased amounts and past positive TP, agreeableness, and age. While rice, pasta, and potatoes can be described as satiating foods, they can also contribute to weight gain when consumed in excessive quantities. Thus, the negative association with agreeableness, a trait associated with sustainable and healthy eating (Conner et al., 2017), seems plausible. Previous studies often showed positive associations for agreeableness (de Buijn et al., 2005) or extraversion (Conner et al., 2017; Esposito et al., 2021; Keller & Siegrist, 2015; Tiainen et al., 2013) and *vegetable* intake. Our results showed negative associations for purchased amounts of vegetables and both social traits. Perhaps the reasons for this were methodological. Considering that overall consumption was limited, increased vegetable consumption that intentionally takes place in social situations (in restaurants, bars, or canteens) might lead to lower consumption in non-social situations (e.g., weekly grocery shopping or meals prepared at home). However, there is a need for future research and studies to clarify this point. The purchased amount of vegetables was positively associated with present hedonic TP which is in line with findings from recently published studies (Ha et al., 2022; Olsen & Tuu, 2017) and shows that the consumption of healthy foods such as vegetables could also be partly hedonic in nature (Jin et al., 2003; Suttikun et al., 2023). Finally, we were able to demonstrate a relationship between age and the amount of vegetables purchased that could be explained by a healthier lifestyle associated with a higher amount of purchased vegetables in younger generations (Koch et al., 2019). The amount of *meat and sausages* bought in the weekly shopping trips was positively associated with the past negative TP and with the BMI of the participants. Ge and colleagues described that “people with a high negative past perspective tend to engage in unhealthy behaviors that have a negative impact on their lives, such as excessive alcohol consumption or internet addiction” (Ge et al., 2020, p.398).

TABLE 6 Regression models for fruits.

	Model 1		Model 2		Model 3	
	Estimates	95% CI]	Estimates	95% CI]	Estimates	95% CI]
Intercept	771.77	[-167.70 to 1711.24]	2130.56	[-487.93 to 4749.05]	2595.84	[-3.69 to 5195.36]
Social demographics						
Age	-3.05	[-15.27 to 9.17]	-4.92	[-19.15 to 9.30]	-2.89	[-16.91 to 11.13]
Sex	<b>335.04*</b>	<b>[18.55 to 651.52]</b>	<b>351.85*</b>	<b>[23.75 to 679.95]</b>	<b>395.35*</b>	<b>[72.91 to 717.78]</b>
BMI	-4.77	[-41.41 to 31.87]	-15.76	[-51.82 to 20.30]	-23.18	[-58.95 to 12.58]
Zimbaro Time Perspective						
Past negative			206.50	[-48.11 to 461.11]	230.59	[-18.59 to 479.76]
Inventory						
Present hedonic			121.02	[-204.06 to 446.10]	135.68	[-182.74 to 454.10]
Future			-256.64	[-591.15 to 77.86]	-309.41	[-639.82 to 21.00]
Past positive			-33.05	[-332.56 to 266.45]	-90.06	[-387.66 to 207.53]
Present fatalistic			-243.05	[-504.35 to 18.25]	-254.48	[-510.83 to 1.88]
Big Five						
Neuroticism			-107.00	[-381.26 to 167.26]	-141.25	[-411.14 to 128.64]
Openness			312.77	[-35.09 to 660.64]	325.31	[-13.66 to 664.29]
Extraversion			-214.95	[-575.02 to 145.12]	-262.22	[-616.69 to 92.25]
Conscientiousness			209.27	[-228.02 to 646.56]	248.84	[-178.74 to 676.41]
Agreeableness			-248.73	[-660.83 to 163.38]	-249.39	[-652.21 to 153.42]
Situational factors						
Companion					172.41	[-4.52 to 349.34]
Hunger					2.52	[-29.42 to 34.46]
Time					-1.81	[-4.57 to 0.96]
$R^2$ (fixed)	0.05		0.15		0.17	
$R^2$ (total)	0.39		0.38		0.39	
AIC	3438.9		3444.2		3445.5	
BIC	3459.1		3498.3		3509.7	
$\chi^2$	—		14.65		4.72	

Note: n = 60, observations = 217. Results in bold are significant influences ( $p < .05$ ) in the regression models. \*\*\* $p < .001$ , \*\* $p < .01$ , \* $p < .05$ .

TABLE 7 Regression models for meat and sausages.

	Model 1		Model 2		Model 3	
	Estimates	95% CI]	Estimates	95% CI]	Estimates	95% CI]
Intercept	-207.01	[-705.44 to 291.42]	-1097.07	[-2493.59 to 299.44]	-1381.58*	[-2751.30 to -11.86]
Social demographics						
Age	-6.16	[-12.37 to 0.05]	-6.24	[-13.69 to 1.22]	<b>-7.28*</b>	<b>[-14.55 to -0.01]</b>
Sex	1.78	[-161.32 to 164.89]	5.23	[-169.40 to 179.86]	-10.61	[-180.73 to 159.51]
BMI	<b>28.99**</b>	<b>[9.67 to 48.31]</b>	<b>29.84**</b>	<b>[9.94 to 49.73]</b>	<b>31.89**</b>	<b>[12.34 to 51.44]</b>
Zimbardo Time Perspective Inventory						
Past negative			<b>168.57*</b>	<b>[33.42 to 303.71]</b>	<b>163.62*</b>	<b>[32.20 to 295.03]</b>
Present hedonic			77.00	[-97.33 to 251.34]	82.16	[-87.26 to 251.59]
Future			34.83	[-147.58 to 217.24]	46.39	[-132.11 to 224.88]
Past positive			102.68	[-57.28 to 262.64]	136.18	[-21.10 to 293.47]
Present fatalistic			-45.05	[-186.05 to 95.95]	-45.89	[-183.33 to 91.54]
Neuroticism			-18.99	[-166.02 to 128.05]	-12.79	[-157.16 to 131.58]
Openness			-88.37	[-273.17 to 96.42]	-94.23	[-272.97 to 84.50]
Extraversion			28.37	[-163.70 to 220.43]	32.70	[-154.69 to 220.09]
Conscientiousness			-27.49	[-263.05 to 208.07]	-39.13	[-268.03 to 189.76]
Agreeableness			30.30	[-192.07 to 252.67]	46.80	[-168.91 to 262.51]
Companion					-17.50	[-103.18 to 68.18]
Hunger					4.69	[-9.89 to 19.26]
<b>Time</b>					<b>1.64**</b>	<b>[0.43 to 2.85]</b>
$R^2$ (fixed)	0.11		0.21		0.24	
$R^2$ (total)	0.54		0.54		0.55	
AIC	2745.1		2754.6		2753.3	
BIC	2764.6		2806.8		2815.3	
$\chi^2$			10.43		7.34	

Note:  $n=60$ , observations=217. Results in bold are significant influences ( $p < 0.05$ ) in the regression models. \*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ .

Besides the psychological scales, BMI is also often interpreted as a marker for unhealthy dietary behavior (Liberali et al., 2021).

There are some implications that can finally be drawn for the shopping behavior of families and their lifestyle:

Research on impulse buying shows that tips such as “reduce your shopping time,” “go shopping alone” (see e.g., Thomas & Garland, 1993) or “don't go shopping hungry” (see e.g., Cheung et al., 2017) can contribute to healthy shopping by reducing unplanned purchases. Our study shows that the situational influences have almost no effect on the amount of food purchased during the weekly shopping trips of young families.

Our findings suggest that psychological traits could influence shopping behavior. Accordingly, we can also ask whether we could change these psychological traits in favor of healthy shopping behavior. For instance, the importance of health-promoting factors such as the present hedonic TP for healthy purchasing behavior such as buying vegetables could be emphasized through nationwide, large-scale health education campaigns. As suggested by Boniwell and Osin (2015), the focus could be on targeted TP coaching that is tailored to the psychological state of the individual. A recent study has shown that digital interventions can be used to change personality traits (Stieger et al., 2021). For example, smartphone apps could provide targeted and tailored support for people with a high level of extraversion, conscientiousness or agreeableness to change these characteristics in favor of healthy food consumption. Additionally, families could be encouraged to develop their own strategies. For example, family members who naturally have more favorable psychological characteristics in relation to healthy purchases could be identified and subsequently be designated to be the main shopper.

## Limitations

The study presented here has some weaknesses that must be outlined. The analyses shown represent only weekly purchases and thus have limited significance for people's overall consumption. We also do not know the proportion of food that was bought but not consumed during the shopping trips. Some of the food purchased may have expired before consumption or been thrown away for other reasons. In addition, the analysis only included people who shop weekly. Accordingly, the scope of the interpretation of the results is limited to people living in families with at least two people and shop weekly. We also cannot completely rule out the possibility that the unnatural study situation influenced the purchasing behavior of the participants.

Our research was clearly focused on the shopper and the explanation of his/her behavior by his/her personality as a gatekeeper. Nevertheless, the stronger inclusion of other family members and their personality inventories would offer further fruitful approaches for future studies.

In implementing this new approach, we focused on the feasibility of the study which resulted in a relatively small sample size ( $n=60$ ). We therefore consider our study to be a pilot study rather than a study representative of the population. Due to the small sample, the results must be interpreted with caution and clear limitations in terms of scope. Even though we have tried to minimize the influence of individual cases, it cannot be ruled out that even small changes in the sample composition can lead to changes in the results for medium-sized samples. This is also reflected in the relatively large confidence intervals.

We have decided on a very simple, clear but also easily reproducible approach to the analyses and there are of course many other ways to analyze the data from the current study. For example, more data-driven analysis techniques could be included in follow-up studies, or the analyses could be supplemented with structural equation modeling to optimize the estimations.

## CONCLUSION

Regarding everyday family life, as explained above, new positive impulses can be derived for the planning and implementation of nutritional interventions or educational strategies for changing/improving consumer behavior and encouraging healthy food consumption.

The results could also have an impact on research. They show the advantages of multi-perspective research and can motivate other researchers to apply multi-perspective approaches. The psychological traits proved to be good predictors. In future studies, the research model used can be extended to other influences, influencing factors, or aspects of food consumption or eating behavior. The shortcomings in this study provide sufficient inspiration for further studies. With regard to other factors, the model could, for example, be extended to other family members and their psychological characteristics and socio-demographic features. The foods included in the study could also be expanded. For example, out-of-home consumption in restaurants, canteens and bars could be included.

## AUTHOR CONTRIBUTIONS

All authors planned and designed the study. CE, PTS, and AN collected and processed the data. GH conducted the data analysis. GH and NSB supervised the realization of the study and wrote the article and contributed to revising the article for publication.

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## CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

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