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A central place for meat, but what about pulses? Studying French consumers' representations of main dish structure, using an indirect approach

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Abstract: Over time, meat has acquired a central place in French gastronomy. The role played by plant-based proteins, such as pulses, is less clear. In order to better understand it, this study seeks to identify how French non-vegetarian consumers structure their main dish, using an indirect approach. A total of 120 participants had to compose dishes, following six different scenarios, by selecting three images of food items out of the twenty proposed. Results provided information about: (1) the first food product chosen, and (2) how foods from different food-groups were associated. Our results indicated that (1) French non-vegetarian consumers generally constructed their main dishes using animal-based food products first. Some differences were nevertheless identified, in relation to the scenario presented, and the profile of the participants. Results also showed that (2) the food-groups most often associated within a dish were Meat, Starch, and Vegetable. The Pulse group, when used, was in general associated with the Meat and Vegetable food-groups. These findings provide new evidence of the structure of the French main dish. They also highlight possible levers that could be used to promote pulses to French consumers.

Keywords: indirect measures; food choice intentions; food associations; first food choice; main-dish composition; evoked context; plant-based food

1. Introduction

The shift toward a more sustainable diet appears to be a lengthy and difficult process. Since the mid-twentieth century, consumers have regularly been submitted to injunctions to change their diet, in order to improve their nutritional intake, but these direct interventions have often led only to moderate or null short-term effects on health (Mozaffarian, Angell, Lang, & Rivera, 2018). One of the major difficulties for consumers may be that, in adapting their diet to include healthier and more sustainable foods, their focus should be on the quality, and not only on the quantity, of the food products consumed (Schösler & de Boer, 2018). The way meals are structured also needs to be addressed. The cultural definition of an appropriate meal is a major determinant of meal size and composition (Pliner & Rozin, 2000). Among other characteristics, the traditional meal in French gastronomy, as listed by the UNESCO as part of the Intangible Cultural Heritage of Humanity, should respect a given structure (UNESCO, 2010). In France, meals are usually composed of three main parts: a starter, a main dish, and then cheese or dessert. In everyday life, consumers often choose to eat either a starter with a main dish, or a main dish with a dessert. The organization of the main dish, in France, may vary according to the gender, age, and level of education of the consumer (Poulain, 2002). French women tend to eat more white meats

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(i.e. chicken) and vegetables, while French men tend to eat more beef (CREDOC, 2007). French consumers follow culinary scripts (i.e. implicit rules) to construct their meals, taking into account the type of food, and the context: place, time, and company (Marshall, 2000). In addition, a close relationship has been found between eating occasion (e.g. lunch, dinner, snacking, etc.) eating location (e.g. at home, at work, on a camping trip, on a train, etc.), and the foods chosen when constructing a meal (Marshall & Bell, 2003).

Whatever the type of meal, however, meat products tend to play a central role in the composition of the main dish in France. A recent survey has underlined that, for 85 % of French consumers, whatever their age, protein intake comes from four food-groups, in the following proportions: meat, fish, and eggs (41%), dairy products (15%), cereals (15%), and a heterogeneous group, including sandwiches, pizza, pastries, and savory biscuits (7.6%) (ANSES, 2017b). The central place allocated to meat in France seems to be inherited from historical events. Since Antiquity, cultural prestige has been associated with meat (Quellier, 2013). During the eighteenth and nineteenth centuries, major social inequalities impacted people's access to food products, especially foods of animal origin. In the twentieth century, there was an "animalization" of the French diet, resulting from the historical prestige value attached to meat, and from the democratization of access to animal-based food products (Boutaud & Stengel, 2016). Along with historical and societal reasons, nutritional aspects can also explain French consumers' attachment to meat. Meat is known to contain protein. Even those consumers who do not really know what a protein is know that protein is essential for health (Terrien, 2018). The taste of meat and the pleasure of eating meat are also important for consumers, and are thus clearly a barrier to any decrease in meat consumption (Poquet, Chambaron-Ginhac, Issanchou, & Monnery-Patris, 2017).

The amount of meat in the weekly French food basket has decreased since the 1980s. In 2016, the mean consumption of meat products in France - except for poultry - was about 12 to 16 kg per year/person (ANSES, 2017a; INTERBEV, 2017; Tavoularis & Sauvage, 2018). According to Boutaud & Stengel (2016), this decrease may be due to the growing interest in sustainability, animal wellbeing, and other environmental issues, since the Grenelle Environment Forum in 2007. Another possible reason is that, as meat has become more easily accessible, its social value has declined, so that consumers of higher socio-economic status now tend to eat meat less often (Tavoularis & Sauvage, 2018). Meat products may no longer completely satisfy the expectations of new generations, because of the greater variety of plant-based products now available. Sanitary crises have also caused increasing suspicion of the sanitary and nutritional characteristics of meat, particularly red meat (Boutaud & Stengel, 2016).

Even though all these problems have affected the image of animal-based food products, meat is still a central element of food in France, and other Western countries (Schösler & de Boer, 2018). Much still needs to be done to shift society's perception of red meat as "the essential product" for a healthy and wealthy diet (Sabaté, Sranacharoenpong, Harwatt, Wien, & Soret, 2015), and to encourage consumption of plant-based food, such as pulses. Protein-rich plant foods, especially pulses, present clear environmental and nutritional benefits. Plant protein intake has been shown to be an indicator of nutrient adequacy in the French diet, (Camilleri et al., 2013). Increasing the proportion of plant proteins in the human diet should also improve food security, and make more food available for the world's ever-growing population (Day, 2013). A low-meat diet is also beneficial for the environment, through the reduction of greenhouse emissions (Hedenus, Wirsenius, & Johansson, 2014), and reduced use of land, water, fuel, fertilizers, and pesticides (Smil, 2002).

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Yet the consumption of pulses has declined in France over the past few decades, falling from 7.2 kg/person per year in 1920 to 1.7 kg/person per year in 2016. The current average consumption of pulses is insufficient, and should be considerably increased to at least twice a week, as possible substitutes for meat and poultry (ANSES 2017a, HCSP 2017). In 2016, a national food consumption study concluded that French nutritional recommendations should separate pulses from the Starch food-group, due to their higher content in protein and fiber (ANSES, 2016). All these statements show that it remains challenging to promote pulses in France as a plant-based protein source.

To promote the consumption of pulses, a study of the respective importance of the different food-groups in a meal will be necessary, in order to understand the determinants of consumer food choices. Consumer strategies for choosing foods tend to be repeated, thus forming part of their routine (Furst, Connors, Bisogni, Sobal, & Falk, 1996). Firmly established food habits may become a barrier to the integration of other foods.

To access information about consumer food choices, most studies use direct methods, including surveys and consumption questionnaires (Cerri, Thøgersen, & Testa, 2019). Such direct methods can present drawbacks. There can be dissociation between what participants think or say about their behavior and what they actually do (Köster, 2003). Direct methods are also prone to social desirability bias, where participants tend to give the best image of themselves through their answers (Latkin, Edwards, Davey-Rothwell, & Tobin, 2017). Consequently, indirect methods need to be developed to avoid such potential biases. One example of indirect methods is to formulate questions in terms of other people (e.g., friends or family) or imaginary situations (Belk, 2006). Short descriptions of a person or a social situation have long been used in social research, to improve the reliability of measures obtained by surveys or questionnaires (Alexander & Becker, 1978). In consumer studies, scenarios have been shown to be useful and efficient tools to evoke consumption contexts in the laboratory setting (Jaeger & Porcherot, 2017). The use of a written scenario leads respondents to imagine an occasion when they would consume foods, and requires them to think of that occasion while responding to the question or performing the required task. The details of the evoked situation are provided by the researcher and are therefore standardized across respondents. Scenarios have mainly been used in sensory tests, where they resulted in hedonic ratings influenced by the type of consumption context evoked (Hein, Hamid, Jaeger, & Delahunty, 2010). In a recent study, an indirect approach was proposed to study the choices made by French participants in different contexts. This method consisted in asking participants to select three food images to compose a main dish, taking into account six different contexts evoked by simple scenarios (Melendrez Ruiz et al., under revision). Each participant also completed a questionnaire about the properties of the foods used in the dish-composition task. The accuracy of the dish-composition task was assessed by several indicators. First, the dish-composition task with the control scenario (everyday, at-home) was shown to genuinely reflect participants' declared consumption habits. Secondly, the dish-composition task proved to be repeatable when using the same scenario, while producing different but consistent results for different scenarios. The frequent choice of products declared not to be good for health or for the environment showed that this task was not affected by social desirability bias. The comparison between the foods chosen for different scenarios and the properties attached to these foods allowed us to better understand participants' representations of foods frequently consumed in France.

In the present study, the same dish-composition task was used to explore the choices made by non-vegetarian consumers in France, and to identify the typical structure of the main dish, by studying the first product that participants chose to compose a dish, and the food-group associations that they made. Sequence of choice has rarely been studied in

relation to meals. The first food chosen to compose a meal at a buffet was shown to influence subsequent choices (Wansink & Hanks, 2013). When preparing a food or a beverage composed of two ingredients, changing the pouring sequence influences the global quantity and ratio of the two ingredients (Bschaden et al., 2019). The first product chosen when composing a dish could well affect overall dish-composition and the resulting food intake.

In the present study, we hypothesized that the structure of French main dishes, and particularly the central position of animal-based food products, would vary depending on the context of the meal and the characteristics of the consumers. Consumer profiles (gender and age) and context-related differences in main-dish composition could then be used to encourage healthier and more eco-friendly food choices.

2. Materials and Methods

2.1 Participants

To qualify for the study, participants (n=120) had to be over 18 in age, without specific or restrictive diets (e.g., vegetarian, gluten-free, etc.), and with no food allergies or severe dislike of certain foods. Another condition for participation in the study was to cook several times a week, for themselves and/or their household. Table 1 gives an overview of participant characteristics. The median (35) and the mean age (39) were the same for male and female. Participants were informed about the conditions of the study, and were asked for written informed consent before beginning the study, and were remunerated at the end.

The 120 participants were placed in simulated real-life situations, with six different scenarios, and were asked to compose a main dish using photographs of food products.

2.2 Construction of a set of images

In order to give identical information to all the participants throughout the study, the food products were presented in the form of photographs. A dataset of food products was constructed, taking several criteria into consideration. First, all the food products belonged to the traditional French culinary repertoire. They were chosen to represent the four main categories of food recently recommended by the *French National Health and Nutrition Program* (PNNS) to compose a main dish: Meat group, Starch group, Vegetable group, and Pulse group. The Meat group included meat, poultry, fish, and eggs. The Pulse group included dried beans, lentils, and peas. The Starch group included cereals and potatoes. The Vegetable group included products commonly considered as vegetables in France, regardless of their botanic classification. All the food products were presented raw, as they would be before preparing a meal.

Rigorous methodological precautions were taken. Products, purchased in supermarkets, were all photographed in the same conditions. Equivalent volumes of the raw products were presented in the center of a white porcelain plate, on a blue background. Blue was chosen to create contrast between the white plate and the background (Charbonnier, van Meer, van der Laan, Viergever, & Smeets, 2016). Photos were taken on the same day, in the same lighting conditions. During the entire photo shoot, all conditions were maintained constant: the shooting angle, the distance between the lens and the center of the plate, the position of the plate on the table, and the table itself.

After being standardized via Photoshop ® (luminosity, intensity of color, etc.), the twenty images were printed (9 cm x 13 cm) and plasticized. A pre-test was carried out on a

small sample of people ($n=30$), who were not included in the main study. This pre-test showed that all the food items were recognized, and that the amount of food per image was judged equivalent by all the participants. The photographic quality of the images was consistent, with a mean quality score of 3.7 out of 5 (SD: 1.137); all the products were in the same group for image quality, except for salmon and tomato, which were judged more qualitative, because of the greater contrast between their color (shades of red) and the white plate (Friedman test and multiple pairwise comparison by two-tailed Nemenyi test).

2.3 Creation of scenarios for the dish-composition task

Six scenarios were created (Table 2). They were meant to evoke real-life situations in which people make food choices. The use of these scenarios also established comparable conditions for all participants during the dish-composition task. The Everyday scenario was used as a control for our study. For each scenario, a general instruction was given to participants: "In this situation, compose a main dish, using three photographs."

2.4 Organization of the sessions

All sessions were individual, took place in the laboratory, and lasted about 45 minutes. All 20 images were placed on a table in front of the participant, in the form of a 5 X 4 rectangle (Figure 1), in a random way, to avoid any effect of order or position. The experimenter asked the participant to identify all the foods. Then the first scenario was presented, and the participant was asked to compose a main dish according to the scenario given, using only three foods. Participants were asked to choose only three food images, but four food-groups were represented. This choice was meant to reflect the number of food products used to compose a main dish in France (usually two or three), and to avoid participants choosing one image from each food-group.

Then the participant put the cards back on the table and was asked to compose another dish in the same conditions, without using the same food triplet. For each scenario, the participant composed five dishes. Once the five dishes had been composed, a new scenario was presented, with the same instructions. The order of the scenarios was randomized between participants so as not to bias the results by an order effect.

2.5 Statistical analysis

The XLSTAT software program for Windows (Addinsoft, version 2018-1) was used for all statistical analyses. The confidence interval was set at 95%.

2.5.1 First food product chosen in the dish-composition task (first-choice)

The first food product chosen by the participant was recorded as the first-choice for each of the five trials in the six scenarios.

Global frequency for the first food chosen

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For each food product, the global frequency of this first-choice for all six scenarios together was calculated for each participant. Food-product frequencies were then ranked, and a Friedman test was performed on the sum of the ranks to determine if the differences between food products were significant. A multiple pairwise comparison (two-tailed Nemenyi test) identified similar first-choice frequencies among food products.

Frequency of first-choice for each food-group in each scenario

The first-choice frequencies for the five products belonging to the same food-group were summed per scenario, for each participant. These frequencies were ranked, and a Friedman test was performed on the sum of the ranks to determine if the differences between scenarios were significant for a given food-group. A multiple pairwise comparison (two-tailed Nemenyi test) identified similar first-choice frequencies among scenarios for each food-group.

Frequency of first-choice for each food-group in relation to participant characteristics

The first-choice frequencies for the five products belonging to the same food-group were summed for each participant, for all six scenarios together. Four contingency tables were built, one for food-group and participant age (<40 and >40), one for food-group and participant gender (male or female), one for food-group and participant household composition (single, couple, or family), and one for food-group and participant level of education (low, medium, or high). A Chi-square cell-per-cell test showed for each cell of the contingency table whether the observed values were significantly higher or lower than the theoretical values, or equal to them (Symoneaux, Galmarini, & Mehinagic, 2012).

2.5.2 Food-group associations

Each main dish composed by a participant was taken to be an association of three food products, identified by food-group. The frequencies of all possible food-group combinations were calculated, considering all scenarios together, and then each scenario separately. The order in which food products were chosen was not taken into account when listing food-group associations. In total, eleven associations were observed.

After ranking food-group association frequencies, a Friedman test was used to determine if the differences between scenarios were significant for a given food-group. These frequencies were ranked and two different Friedman tests were run, one to see if there were significant differences between associations, considering all scenarios together. A second test allowed us to compare the frequencies of the association of the Pulse and Starch food-groups, with or without meat, for each scenario. For each Friedman test, a multiple pairwise comparison using the Nemenyi / Two-tailed test was performed.

3. Results

In order to better understand how French consumers structure their main dish, we recorded the first food product chosen in each trial (first-choice), sorted by food-group. We then examined the relationship between participant characteristics and first food-group choice. Finally, we assessed first food-group choice in relation to each scenario.

3.1. First food product chosen in the dish-composition task

3.1.1. Global frequency for the first food product chosen

The first-choice frequency for each food product is presented in Figure 2. The Meat group (45%) was chosen more frequently in first position, followed by the Starch (28%), Vegetable (14%), and Pulse (13%) groups. Among food products, the three most frequent first-choices were salmon, chicken, and beef (each representing more than 10% of the first-choice). Products from different food-groups were the next most frequent choices: eggs, sausages, all the starches, and brown lentils (from 7% to 4% of the first-choice). The food products least frequently chosen in first position were all the vegetables, and all the pulses except brown lentils (from 3% to 1% of the first-choice).

3.1.2. Frequency of first food-group choice, in relation to participant characteristics

The results of the Chi-square cell-per-cell analyses showed that participant characteristics contributed significantly to the frequency of the first food-group choice. First, we compared the results for male and female participants for each food-group (Table 3). Male participants more frequently chose products from the Meat group in first position, whereas female participants more frequently chose products from the Vegetable and Pulse groups in first position. There was no significant difference in first food-group choice for the Starch group. Table 3 illustrates the results obtained for each food-group in relation to the age of participants. Younger participants (aged <40) more frequently chose products from the Pulse and Starch groups in first position, whereas older participants (aged >40) more frequently chose products from the Meat group in first position. There was no significant difference in first food-group choice for the Vegetable group.

Level of education contributed significantly to first food-group choice (Table 3). Participants with a high level of education chose products from the Pulse group more frequently in first position, and chose products from the Meat group less frequently in first position, in comparison with participants with lower levels of education. By contrast, participants with a low education level chose products from the Meat and Vegetable groups more frequently in first position, and chose products from the Starch group less frequently in first position. In comparison with other participants, those with a medium education level chose products from the Vegetable group less frequently in first position.

3.1.3. First-choice frequency for each food-group, for each scenario

After assessing overall first-choice frequency for each food product and food-group, the next step was to investigate if the first-choice remained constant for each scenario. A Friedman test showed that the first food-group choice was significantly different in relation to scenario for the Meat, Pulse, and Starch groups (p -value <0.0001), but no difference was observed for the Vegetable group (p -value 0.400). Products from the Meat group were chosen in first position much less frequently in the Budget (29%) and Vegetarian (13%)

scenarios, compared to the Everyday scenario (52%), considered as control. Products from the Pulse group were chosen in first position more often in the Vegetarian scenario (23%), compared to the Everyday scenario (9%). Products from the Starch group were chosen in first position more frequently in the Budget (47%) and Vegetarian (42%) scenarios, compared to the Everyday scenario (24%). The Vegetable group was the only food-group where the first-choice remained constant for each scenario, with a mean of 14% (Figure 3).

As significant differences were observed between scenarios for the first food-group chosen by participants, we investigated whether first-choice frequency was the same for each of the five products in a food-group, across all six scenarios. With the Vegetarian scenario, the first-choice for the Meat group was either eggs (70%) or salmon (30%), while for the Pulse group, the first-choice was similar for all food products, except white beans (7%). For the Budget scenario, participants rarely chose salmon (< 3%) or beef (< 3%). In the Restaurant scenario, the most frequent first-choice for the Pulse group was red lentils (36%). In all scenarios, except the Restaurant scenario (9%), brown lentils were the most frequent first-choice for the Pulse group. However, the frequency for brown lentils was much lower for the Vegetarian scenario (27%) than for the Everyday (control) scenario (54%).

A correspondence analysis (CA) was performed on the frequency of first-choice for products across the six scenarios (Figure 4). Axis 1 represents 70% and axis 2 represents 23% of the global variance. Axis 1 distinguishes the Vegetarian and Budget scenarios, versus all the other scenarios. Participants more frequently chose all products from the Pulse, Starch and Vegetable groups, plus egg for the Vegetarian and Budget scenarios. In contrast, salmon, beef, and chicken were most often chosen in first place in the Restaurant, Guest, Self-service and Everyday scenarios. Axis 2 shows that participants selected any of the pulses (except lentils), and any vegetable more often as first-choice for the Vegetarian scenario, while for the Budget scenario, participants tended to select egg, starches, and lentils. In the Restaurant scenario, salmon and beef were chosen in first place more frequently than in Everyday, Self-service and Guest scenarios, where chicken was used more often as a first choice.

3.2. Food-group associations

The second part of the analysis focused on the way participants combined the four different food-groups (Meat, Pulse, Starch, and Vegetable) to create a main dish.

3.2.1. Global frequency for food-group associations

Participants had to compose a main dish using only three food images, but four different food-groups were represented: Meat (M), Pulse (P), Starch (S), and Vegetable (V). Among all combinations produced by participants, there were 11 different associations (Table 4). We summed all the associations produced for each scenario; a Friedman test

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showed that participants used different types of food associations to compose a main dish (p-value <0.0001).

Results show that participants composed a main dish from three food-groups (68% of all associations), in the following order: MSV (45%), MPV (12%), PSV (6%), and MPS (5%). A further 30% of associations used only two food-groups: more frequently MV (12%) and SV (10%), and least frequently PS (0.4%). Few associations used only one food-group: V (2%).

3.2.2. Frequency of With Meat vs Without Meat associations, in each scenario

In order to better understand the role of meat and how other food-groups were associated with or without meat, we considered associations containing at least one meat product (MP, MS, MV, MPS, MPV, and MSV) separately from those without meat (V, PS, PV, SV, and PSV). The results from a Friedman test showed that food associations With Meat and Without Meat were significantly different across all scenarios (p-values <0.0001).

Table 4 shows the food-group associations produced by participants. As expected, the With Meat association was lowest in the Vegetarian scenario (24.3%). For the Budget scenario, the Without Meat association increased to 29.5%.

3.2.3. Frequency of Pulse-Starch (PS) associations, With Meat vs Without Meat, in each scenario

In order to understand how consumers associated plant-based protein products, we focused on the association between Pulse and Starch groups across all six scenarios (Figure 5). Association frequencies were identified as With Meat (MPS), or Without Meat (PS and PSV). A Friedman test showed that all PS associations varied in relation to the scenario presented (p-values <0.0001).

Results showed that Without Meat associations were not frequent except for the Vegetarian scenario (23%). In the Restaurant and Self-service scenarios, With Meat associations were more frequent than those Without Meat. By contrast, in the Vegetarian and Budget scenarios, Without Meat associations were more frequent. In the Guest and Everyday scenarios, no difference was observed between PS associations With Meat and Without Meat.

4. Discussion

One of the main objectives of this paper was to identify how French non-vegetarian consumers composed a main dish, using an indirect approach, based on a dish-composition task with six different scenarios. Three main results will be discussed below: the central role of meat in main dishes in France, the relationship between participant characteristics and first food-product choice, and the influence of context on first-choices (food-group and food product) and food-group associations.

4.1. The central role of meat in main-dish composition

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For all scenarios, almost 80% of the main dishes composed by participants contained a food product from the Meat group. As one of the six scenarios evoked a Vegetarian context, this frequency of 80% for Meat is particularly high, confirming the pre-eminent place of meat in French food habits. The most frequent first food-product choice belonged to the Meat group (45%), even though only five of the twenty photographs presented showed Meat group products. A Chinese study found that consumers generally choose in first place the food they consume most often (Ma, 2015). The first-choice can thus be considered as the most spontaneous, reflecting consumers' food habits. In our study, more than half the dishes containing a product from the Meat group were constructed around that food product. The other food-groups – Pulse, Starch, and Vegetable – were chosen to complement this first-choice (referred to here as secondary choices). Our results are in accordance with previous declarative studies suggesting that meat is perceived by French consumers to be a central element in a meal, and therefore a significant part of the French food diet (Poquet et al., 2017). This prominent position may result from the nutritional recommendation widely popularized by the National Plan for Nutrition and Health (PNNS) over the last 15 years: “Construct your main dishes around a serving of meat, fish, ham, or eggs, accompanied with vegetables and starches (potatoes, pasta, rice, wheat precooks, semolina, corn, pulses, etc.)” (PNNS, 2015). The associations produced by participants in our study show that they often followed these recommendations to construct their main dishes: the most frequent association (45% of the dishes composed) used the food-group association Meat - Starch – Vegetable (MSV). According to sociologists, the most usual French main dish can be described as being composed of “mainly a hot cooked meat, vegetable and/or starches” (Grignon, 2009). The next most frequent associations in our study (both at 12%) combined products from two or three food-groups: Meat, Pulse, and Vegetable (MPV), or only Meat and Vegetable. The MSV association was used three times more often than MPV, which seems to reflect the PNNS recommendation (PNNS, 2015), where pulses were long placed within the Starch group, thus generating potential confusion for consumers about the properties of these two food-groups (Pulse and Starch). To clarify this point and to encourage the consumption of pulses, recommendations have recently been changed in France (in 2017), and now recommendations differentiate between the Pulse and Starch food-groups. This change is probably too recent to have had any perceptible effect on how consumers compose their main dishes.

Similar main-dish compositions can be found in other countries around the world: the weekday main meal in Britain is usually composed of “one meat and two vegetables” (Marshall, 2000); the main meal in Scandinavian countries consists of boiled potatoes with meat or fish (Prättälä, 2000); in Brazil, the main meal includes rice, beans, meat, and vegetables (Mattos & Martins, 2000). Even though these meal compositions do not seem very different from the French main dish, Grignon (2009) suggested that the mechanisms leading the composition of a main dish for a French consumer could be influenced by other characteristics than the food itself. The construction of a main dish for French people could be an “easy” way to maintain social and cultural practices, as part of their food heritage. In this sense, the food product is not the key element in itself, but rather for what it symbolizes: history, family traditions, and cultural heritage, which also guide the composition of a main dish in France (Grignon, 2009). A very strong effect of cultural heritage could be a barrier to a change in food habits. In order to better assess the strength of this cultural influence, we investigated the effect of different contexts and consumer characteristics on the composition of a main dish.

4.2. Effect of consumer characteristics on first-choices

Participant characteristics (gender, age, and level of education) significantly affected the first food-product choice. Men chose Meat products first more frequently than women did. This result is consistent with a previous study, which showed a relationship between gender, culture, and meat consumption. A higher meat consumption can be explained both by “traditional masculinity”, and by a Western-type diet, where meat is readily available and not too expensive (Schösler, de Boer, Boersema, & Aiking, 2015). Decreasing the amount of meat in the diet is thought to be difficult for such consumers (Schösler et al., 2015). In our study, women chose Pulse and Vegetable products first more frequently than men did. In 2007, a French study found that women consumed more vegetables than men did, but French men consumed pulses more than women did (CREDOC, 2007). This result needs to be put in perspective, as the survey may have been prone to declarative and social desirability bias. Our study suggests that men may state that they eat more pulses, but may not use them as the central part of their meal, while women may eat pulses less often than men, but may use them more often as the principal ingredient of their main dish.

We also found an effect of participant age on dish-composition. Participants aged over 40 chose Meat products first more frequently than younger participants. This result is in accordance with a study from Finland by Vainio et al. (2016), which showed an increase in meat consumption with age. The Pulse and Starch food-groups were chosen first more frequently by participants aged under 40. This result seems to indicate that, for young participants, a more central position for products from the Pulse and Starch groups compensates for using products from the Meat group less frequently as the central part of the main dish. In a survey carried out one week after the dish-composition task (Melendrez Ruiz et al., under revision), the same 120 participants perceived Starch and Pulse food products as being cheaper and more environmentally friendly than Meat products. Younger people are more sensitive to the notion of a sustainable diet, and to the necessity of reducing animal-product consumption in favor of plant-based protein products (Lacour et al., 2018). Thus, younger consumers seem more likely to adapt their main-dish composition toward a less meat-centered diet.

Our study also revealed an effect of level of education on the first food-product choice. Previous studies carried out in France and Northern Europe identified higher Meat product consumption among people with a low level of education (ANSES, 2017b; Vainio et al., 2016). Our results go further and show that, similarly to young people, those with a higher level of education are adapting the composition of their main dish, centering their choice more frequently on Pulse products and less frequently on Meat products. One explanation is that such consumers are more health aware (Shepherd, 2005).

4.3. Influence of tested scenario (evocated eating context) on main-dish composition

Both first-product choice and food-product associations showed similar trends regarding Meat products, which were chosen first, with the same frequency, in the context of the Self-service, Restaurant, Guest, and Everyday scenarios. Although the result was not significant, first-choice frequency remained higher for Meat products in the Restaurant and Guest scenarios. The frequency of With and Without Meat associations was similar in the Self-service, Restaurant, and Guest scenarios, where With Meat associations were slightly more numerous than in the Everyday scenario. The Restaurant and Guest scenarios were used to evoke a prestigious social context. The Self-service scenario also evokes a meal taken with people who are not close relatives. The results suggest that the central role of

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Meat products for French consumers is even higher when social interaction is involved. In France, Meat products have a more festive connotation than other food-groups, and are more frequently consumed at family meals, with an aperitif, and also during the weekend(ANSES, 2017b).

The tendency was different for the Budget and Vegetarian scenarios, where both first-product choice and food-product associations involving Meat products were less frequently observed. For the Budget scenario, the decrease in frequency for Meat products could result from the high price of meat products, as perceived by participants (Melendrez Ruiz et al., under revision). A recent study in New Zealand found that the high cost of meat was one of the main and strongest motivations to reduce meat consumption (Lentz, Connelly, Miroso, & Jowett, 2018). This result seems to be confirmed in our study by the more frequent choice of Starch products in first place in the Budget scenario. Participants in our study declared a cheaper price for the Starch group than for other products (Melendrez Ruiz et al., under revision).

Lower frequency for Meat products was an expected result for the Vegetarian scenario, as we assumed participants would understand this scenario to evoke an eating pattern where animal products, eggs, and dairy products should be excluded from the diet (Position of the American Dietetic Association, 2009). We deliberately did not provide any explanation about the meaning of the Vegetarian scenario, because we wanted to know how people understood this diet. Several eating patterns may be judged representative of a vegetarian diet. Vegans refuse all animal products, while lacto-ovo-vegetarians include dairy products and eggs, and pesco-vegetarians will eat fish, eggs, and dairy products (Tonstad, Butler, Yan, & Fraser, 2009). In France, few adults (1.8%) declare that they follow a vegetarian diet excluding meat, and even fewer (0.1%) declare that they exclude all animal products (ANSES, 2017a). We expected that most participants would choose photographs from the Pulse, Starch, and Vegetable groups. However, many participants in our study used eggs or salmon as the first-choice for the construction of main dishes with the Vegetarian scenario. This result could indicate either that their interpretation of a vegetarian diet corresponds to the pesco-vegetarian diet, or that it was impossible for these participants not to use a Meat product as the first-choice to compose a main dish. They excluded beef, chicken, and sausage but could not avoid replacing them by another product from the Meat group, again highlighting the central role of Meat products in French main-dish composition. Another strategy to replace Meat (chicken, beef, sausage) in the Vegetarian scenario seems to have been an increased use of Pulse and Starch products in first position. By contrast, the first-choice frequency of Vegetable products was constant across all six scenarios, and the global use of Vegetable products was the same for the Vegetarian and Everyday scenarios. This consistent use of Vegetable products could be explained as an effect of nutritional recommendations in France. The PNNS states that it is important “to consume at least five portions of vegetables and/or fruits per day”(PNNS, 2011). Thus, as the use of Vegetable products is very high in main dishes, even in the Everyday context, it cannot really be increased, and so consumers may focus dietary changes on the Pulse and Starch groups rather than on Vegetable products. Still, there may be some association, in the mind of the consumer, between the Vegetarian context and Pulse and Starch products. This strong relationship between a vegetarian diet and Pulse product consumption has been identified in Canadian consumer representations (IPSOS, 2010).

4.4. Perspectives: how to encourage healthier and more eco-friendly food choices

In this study, participants generally chose products from the Meat group in first place to compose main dishes. Constructing main dishes around Meat products may be a barrier

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to the shift toward a more sustainable diet (Schösler & de Boer, 2018). The literature shows that a more carnivorous diet may evoke power and strength (Quellier, 2013), and that consumers strongly attached to such a diet are less motivated to reduce their consumption of Meat products and to opt for a more plant-based diet (Graça, Calheiros, & Oliveira, 2015). One of the difficulties for consumers when decreasing their consumption of animal-based products is that of reaching an adequate level of protein intake. If no source of animal-based protein is consumed, a balanced amino-acid intake can only be reached by associating complementary plant-based food-groups (GEM-RCN, 2015), such as cereals (rich in methionine, but deficient in lysine) and pulses (rich in lysine, but poor in methionine) (Chardigny & Walrand, 2016). We therefore focused part of our analysis on the Pulse-Starch association. Instead of replacing meat by Pulse and Starch food products, participants tended to use one of these two groups to complement their first-choice of Meat food products. Yet participants in our study also knew that the Pulse products contain proteins (Melendrez Ruiz et al., under revision). These results suggest that food-product association is determined more by usage than by nutritional knowledge. This is in line with the literature showing that consumers tend to use 'taken-for-granted frames' in their daily culinary practices (de Boer & Aiking, 2017).

Few participants associated Pulse and Starch food products. In the Everyday, Guest, Self-service, and Restaurant scenarios, the With-Meat association was more frequent than the Without-Meat association, indicating that the Pulse-Starch association was not chosen for reasons of nutritional complementarity, in such contexts. This may be due to the strong impregnation of French culinary tradition, where a Pulse product is usually associated with a Meat product, such as sausage or pork (e.g. "cassoulet" or "petit-salé") (Rio, 2017). The Pulse and Starch groups are thus considered to be usual associations with Meat products. By contrast, in the Budget and Vegetarian scenarios, both Pulse and Starch food products were more often found in Without-Meat than in With-Meat associations. Nevertheless, the Starch group is more often associated with the Vegetable group than with the Pulse group, even though the Starch-Vegetable association cannot provide a satisfactory protein intake. The Pulse group was more often used as a replacement for Starch than for Meat. Taken together, these results indicate that the Pulse group does not hold a central place in main-dish composition. This can be a barrier to the use of Pulses as the main protein intake. For consumers, the Pulse group seems to take second place in relation to Meat products.

Considering this attachment to meat in France, with the secondary position of plant-based proteins, how can main-dish composition be modified to include healthier and more eco-friendly products, such as those of the Pulse group? Recent changes to nutritional recommendations in France may help to attain this objective. The removal of Pulse products from the Starch group should lead consumers to be more aware of their high protein and fiber content, instead of focusing only on their richness in carbohydrates. The notion of a vegetarian protein dish was recently defined as a dish without meat or fish, containing other plant- or animal-based protein sources (e.g. eggs, dairy products, and cheese). Examples of possible associations of several plant-based protein products have been proposed: red beans and corn, bulgur wheat and chickpeas, lentils and rice (GEM-RCN, 2015). These recent changes in communication should improve consumer knowledge of the Pulse group. This improvement is necessary, as we observed in our study that pulses were more frequently used in main-dish composition as a replacement for Starch than in association with Starch products.

Our study suggests that other levers could be used in the short term to increase Pulse food-product consumption, together with the recent changes in communication strategies.

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For example, in our study, the Budget scenario context showed that participants were generally aware of the low price of Pulse and Starch food products, but seemed less aware of the nutritional interest of their association. Better communication about the nutritional interest of the Pulse-Starch association should be combined with a focus on the advantageous price of these food products. Concrete examples of plant-based main dishes should be proposed, taking into consideration the nutritional needs and budget of different consumer profiles.

Our results also highlighted the potentially negative image of the Pulse group as “products for vegetarians only”. Participants chose Pulse food products more frequently in the Vegetarian scenario, but limited their use in other scenarios. It will be necessary to find to new ways to promote the Pulse group beyond the vegetarian context.

Another strategy to promote a better-balanced, and more sustainable diet is suggested by our results. The majority of Pulse-Starch associations also involved a product from the Meat group, especially in the Restaurant and Self-service contexts. This result confirms the importance of strategies focused on “social” meals. Eating often creates barriers between human groups within the same culture (Poulain, 2002). Foods frequently consumed by higher social categories acquire a positive image. With time, these foods tend to be more and more integrated into the diets of middle and lower social groups, as a symbol of increasing social status. In our study, participants with a high level of education more frequently chose products from the Pulse group in first position. This could be the sign of an ongoing increase in the social status of pulses, which could have a positive long-term effect on less educated communities. Strategies to encourage dietary modifications should also focus on other consumer characteristics, such as age or gender, as our study revealed that men and participants aged >40 composed their main dish around Meat products more often than was the case for women and younger participants, who more frequently built their main dish around the Pulse and Starch groups.

4.5. Strengths and limitations

One of the principal limits of our study is that consumer behavior was not measured in real-life conditions. We cannot be certain that the food products chosen for a given scenario would effectively be chosen in a real-life situation of main-dish composition. In particular, participants were forced to choose neither more nor less than three food products, which may not correspond to their daily food habits. Nevertheless, one of the strengths of our study is that the indirect approach – a dish-composition task with six different scenarios - limited many of the biases observed with direct approaches, in particular the social desirability bias (Melendrez Ruiz et al., under revision). We therefore expected to obtain more spontaneous results with this indirect protocol than with direct tolls (e.g. questionnaires).

The task we proposed could be developed further, by including different food products (e.g. dairy products), with new scenarios, and by giving more specific instructions (constructing a main dish for dinner or lunch). Although we studied the Pulse and Starch associations in a main dish, we did not study an entire meal. Recommended daily levels of protein intake may also be balanced within an entire meal (starter, dessert, dairy products, etc.), or through all foods consumed during the day.

5. Conclusions

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To our knowledge, this study was the first to use an indirect approach to explore main-dish composition in France, with six different scenarios used to evoke real-life situations. Our findings provide evidence of the central role of meat in main-dish construction for French consumers, in most of the contexts evoked. The traditional focus on meat in French cuisine could be a barrier to promoting healthier and more sustainable diets, with a decrease in the use of Meat products, in favor of more plant-based products. One potential lever could be to adapt the strategy to the profile of the consumer (i.e. gender, level of education, and age).

In particular, we showed that, when pulses are used, their nutritional interest is not fully taken into account. Pulse products are more often associated with Meat than with Starch products. This could be a result of traditional French cuisine, which often associates pulses with meat, but also to a misunderstanding of the consumer advice provided by French authorities. In such messages, for many years, pulses and starches were presented as a single group (Starch group). Recently this advice was modified to highlight the nutritional value of pulses, but it may still be too early to observe any resulting adaptation in consumer food habits. Nutritional communication may not be enough to change food habits, and so consumers should also be provided with concrete examples of how to compose main dishes that better integrate pulses, while providing adequate nutritional intake, and reducing the central place of meat in the French diet.

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Table 1. Main demographic characteristics of the participants.

Characteristics	Categories	Number of participants	%
Sex	Male	60	50
	Female	60	50
Age	<40	66	55
	>40	54	45
Education*	High	41	34
	Medium	40	33
	Low	39	32
Household composition	Family	33	28
	Couple	47	39
	Living alone	40	33

* Level of education expressed in number of years of formal schooling: Low < 12; Medium ≥12<15; High ≥ 15

Table 2. Scenarios used in the dish-composition task.

Title of the scenario*	Script*	Why this scenario?
Everyday	In an everyday meal at your home, you have to prepare the meal.	As a control
Self-service	You decide to eat at the self-service canteen. On the menu, all the foods represented in the photographs are available.	In a no-cooking context
Restaurant	You won dinner at a four-star restaurant during a competition. With this restaurant's concept, you are invited to create a dish from a list of ingredients, in order to test the chef's talents.	In a no-cooking context, with a tasty dish and prestige
Budget	At the end of the month and after paying most of your bills, you do not have a lot of money and you have to prepare an economical meal	Budgetary constraints
Vegetarian	You have invited a friend to eat and you have to prepare the meal. You have to remember that she/he is a vegetarian.	Specific population
Guest	You and your partner decided to invite the couple who just moved in next door to dinner at your place.	Social context

* Participants were given scenario scripts with no titles; titles are only used to refer to the scenarios in this paper.

Table 3. Total first-choice frequency for each food-group by gender (Male and Female participants), by age (<40 years old and >40 years old) and by level of education, expressed in number of years of formal schooling: Low < 12; Medium ≥12<15; High ≥15.

Food-group	Gender		Age		Level of education		
	Female	Male	<40	>40	High	Medium	Low
Meat	735 (-)*	899 (+)*	754	880 (+)*	517 (-)*	556	561 (+)*
Starch	517	479	646 (+)*	350 (-)*	359	352 (-)*	285
Pulse	267 (+)*	193	287 (+)*	173 (-)*	178 (+)*	145	137
Vegetable	281 (+)*	229 (-)*	293	217	176	147 (-)*	187 (+)*

*Indicates significant difference higher (+) or lower (-) than the theoretical values (Chi-square cell per-cell analysis; p-value <0.05).

Table 4. Percentage for food-group associations per scenario. Percentage for food-group associations With Meat and Without Meat per scenario.

N° of food-groups used	Associations	Everyday	Self service	Restaurant	Guest	Budget	Vegetarian	(% To all the scenarios)
Three	MSV	57.3	55.2	39.7	57.2	46.2	14.7	45.0
Three	MPV	10.0	17.0	22.7	12.2	7.5	3.3	12.1

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Three	MPS	3.8	6.7	7.5	4.5	5.0	1.5	5.6
Three	PSV	2.3	1.2	1.5	1.8	7.7	19.0	4.8
Two	MV	12.2	9.8	13.3	14.3	6.2	3.7	11.8
Two	SV	8.0	3.8	3.0	2.7	16.8	36.2	9.9
Two	PV	2.3	1.8	2.7	1.0	2.5	13.3	3.9
Two	MS	1.8	2.2	4.2	3.5	4.0	0.7	2.7
Two	MP	1.2	1.3	3.8	1.7	1.3	0.5	1.6
Two	PS	0.0	0.3	0.3	0.0	0.3	1.7	0.4
One	Veggi	1.0	0.7	1.0	0.8	2.2	5.3	1.8
With meat		86.3	92.2	91.2	93.3	70.2	24.3	78.8
Without meat		13.7	7.8	8.5	6.3	29.5	75.5	21.0

Food-group associations occurring fewer than 5 times were not included in the analysis.
Food-groups: M=Meat, S= Starch, P= Pulse, and V= Vegetable.

Figure 1. Set of photographs created for the main-dish composition task.

Figure 2. Frequency of first choice for each food product, considering all scenarios together. Products with the same letter (A-J) were chosen with comparable frequency (two-tailed Nemenyi test; $p < 0.05$).

Figure 3. First-choice frequency for each food group in each scenarios. Letters indicate comparable frequency for first food-group choice across all six scenarios (two-tailed Nemenyi test; $p < 0.05$).

Figure 4. Correspondence Analysis (CA) for products chosen first by participants in all the scenarios

Figure 5. Frequency of Pulse-Starch associations, grouped as With Meat and Without Meat, per scenario. Letters indicate comparable frequency for PS associations across all six scenarios (two-tailed Nemenyi test; $p < 0.05$).

Highlights

- When asked to compose a main dish, respondents took into account the evoked context
- They mostly structured their main dish around proteins from animal sources
- Food-groups associations varied according to the evoked context
- The most frequent food association included meat, starches and vegetables
- Pulses were barely used and often associated with proteins from animal sources

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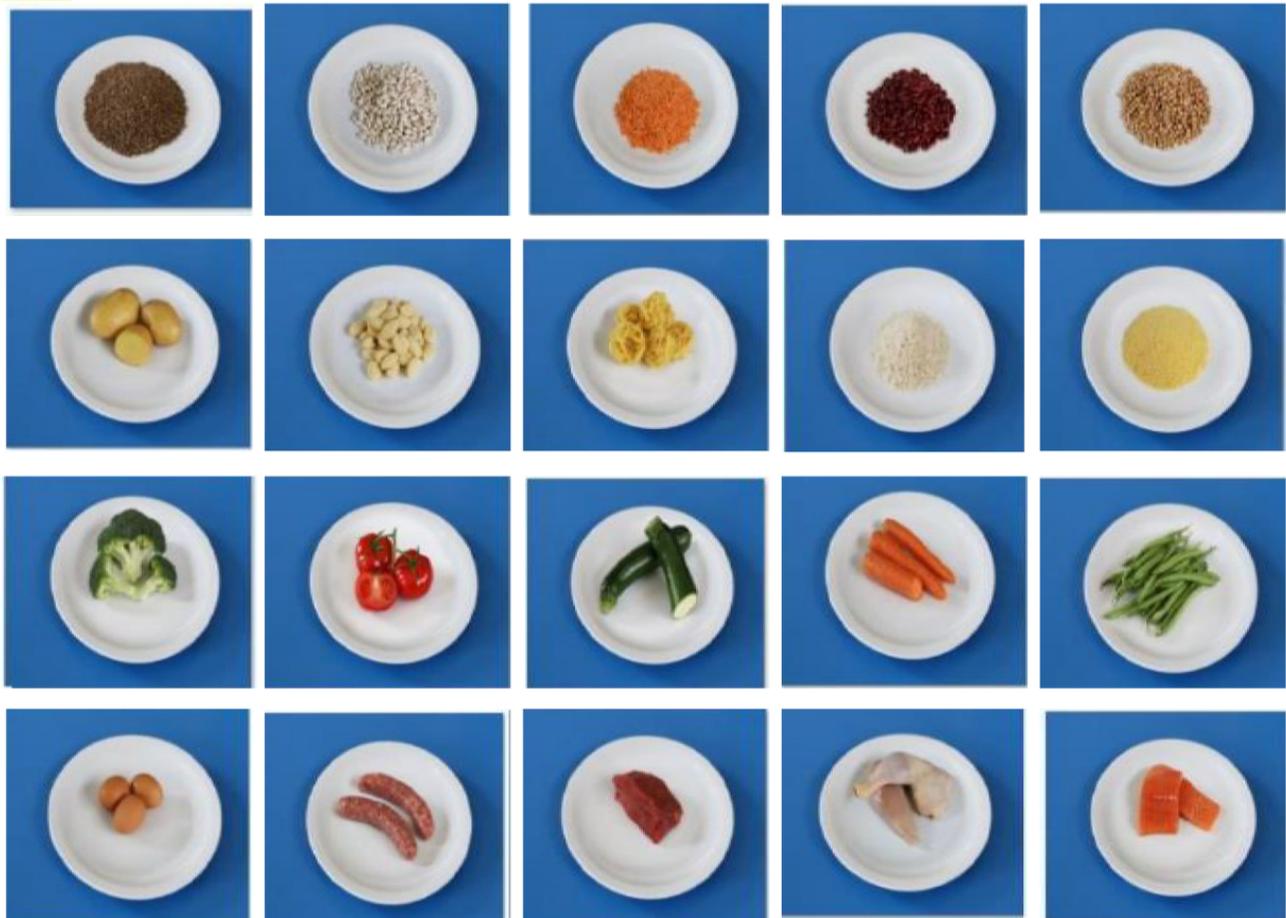


Figure 1

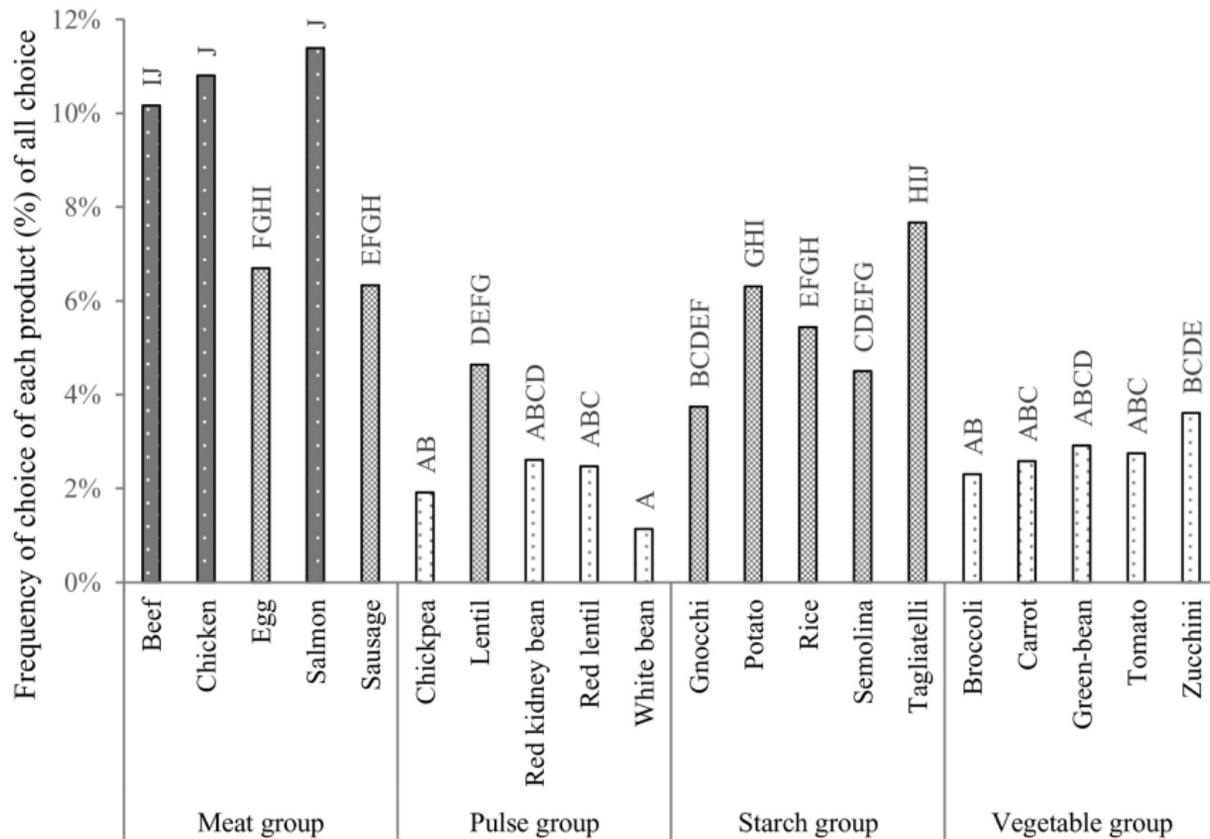
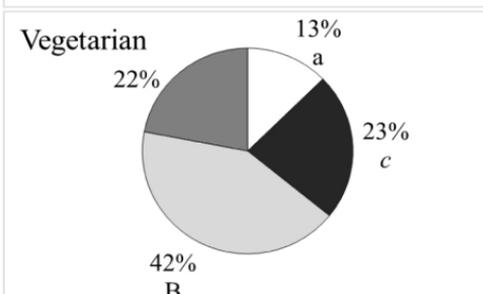
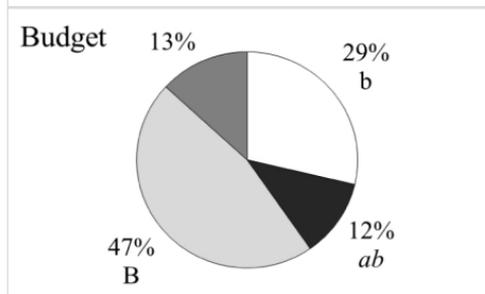
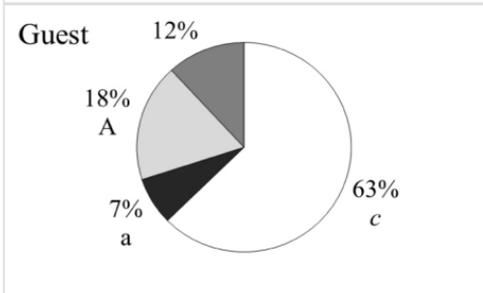
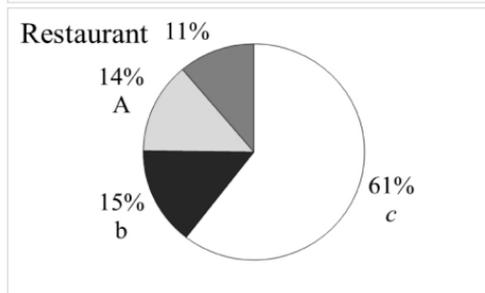
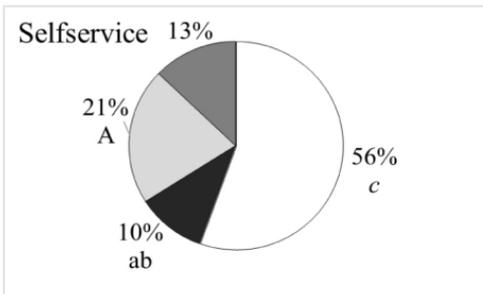
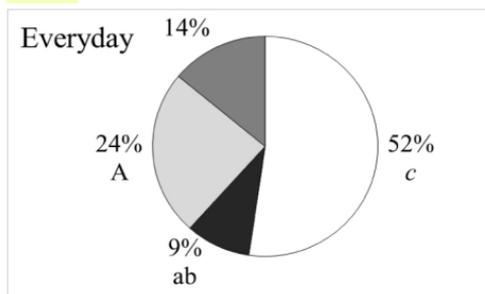


Figure 2



Meat group (A)
 Pulse Group (A)
 Starch group (A)
 Vegetable group (A)

Figure 3

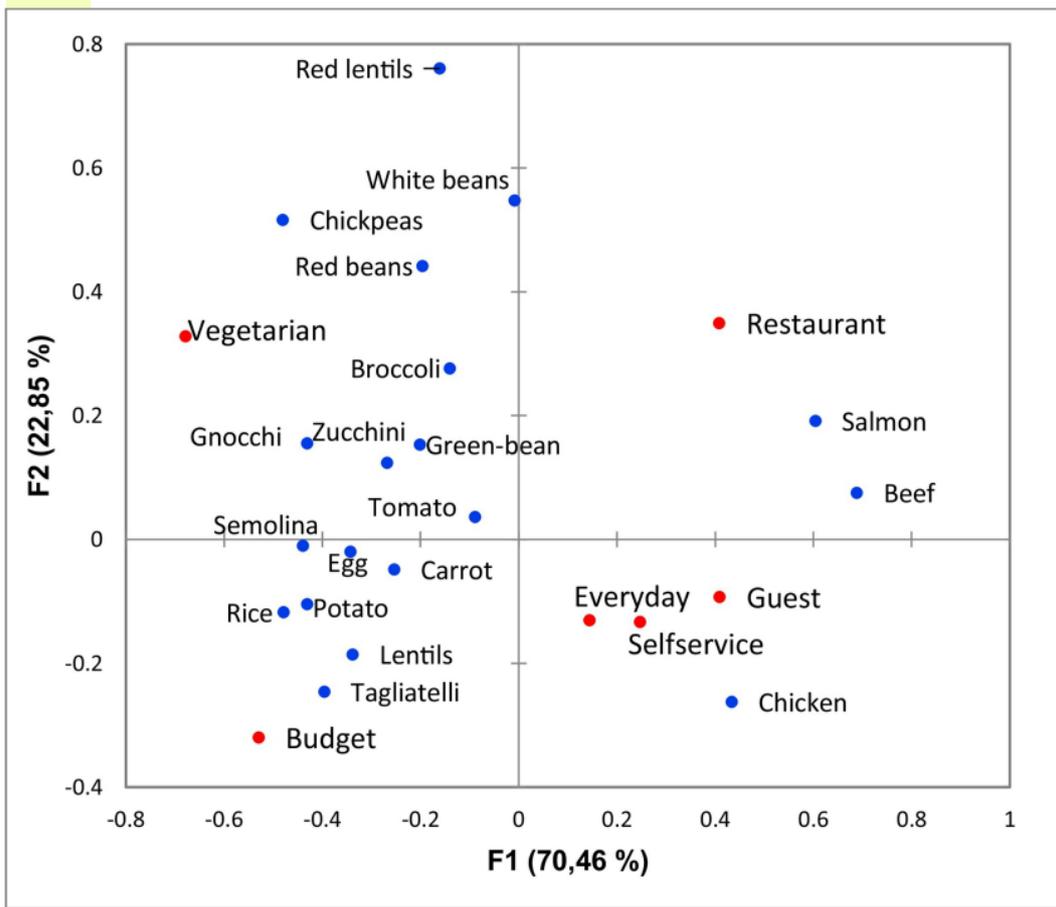


Figure 4

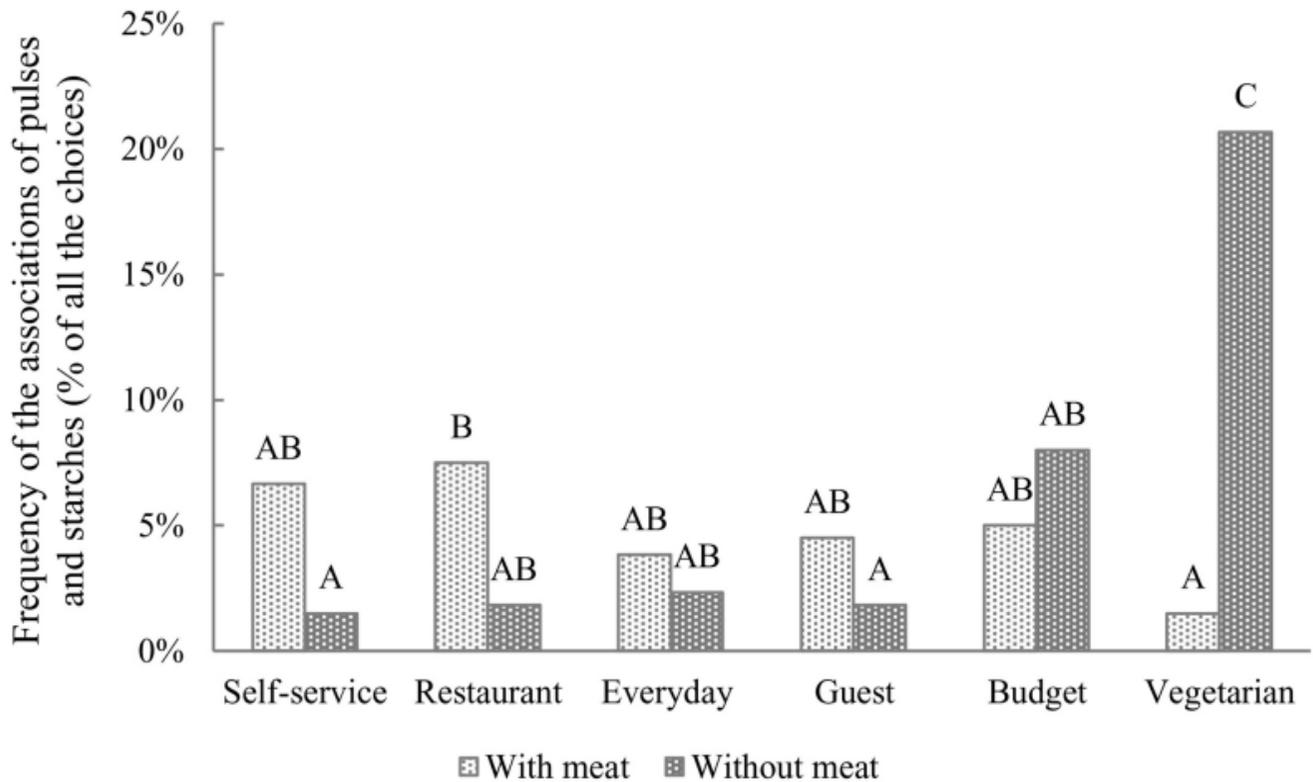


Figure 5