Journal Pre-proofs

Review

More than words! A Narrative review of the use of the projective technique of Word Association in the studies of food consumer behavior: methodological and theoretical implications

Edgar Rojas-Rivas, Angélica Espinoza-Ortega, Humberto Thomé-Ortiz, Facundo Cuffia

PII: S0963-9969(22)00181-8
DOI: https://doi.org/10.1016/j.foodres.2022.111124
Reference: FRIN 111124

To appear in: *Food Research International*

Received Date: 19 December 2021
Revised Date: 8 March 2022
Accepted Date: 9 March 2022

Please cite this article as: Rojas-Rivas, E., Espinoza-Ortega, A., Thomé-Ortiz, H., Cuffia, F., More than words! A Narrative review of the use of the projective technique of Word Association in the studies of food consumer behavior: methodological and theoretical implications, *Food Research International* (2022), doi: https://doi.org/10.1016/j.foodres.2022.111124

More than words! A Narrative review of the use of the projective technique of Word Association in the studies of food consumer behavior: methodological and theoretical implications

Edgar Rojas-Rivas[1], Angélica Espinoza-Ortega[1], Humberto Thomé-Ortiz[1] & Facundo Cuffia[2]

[1] Instituto de Ciencias Agropecuarias y Rurales (ICAR), Universidad Autónoma del Estado de México, México

[2] Facultad de Ingeniería Química, Universidad Nacional del Litoral, Argentina

Corresponding author: E. Rojas-Rivas. Email: erojasr003@profesor.uaemex.mx, edgar.altermann@gmail.com

Abstract

Word association (WA) is a projective and powerful technique that consists of the spontaneous generation of words from specific stimuli. This technique is used in sociology and psychology studies; however, in the Consumer and Food Science area has gained importance since it allows to explore beliefs, expectations, or attitudes in the context of food consumption behavior. The aim of this work is to present a current status on the use of this technique in the studies of food consumption behavior. A narrative review of the literature was carried out with articles published in four databases: ScienceDirect, Wiley Online Library, Emerald Insight, and Taylor & Francis. Seventy-four articles that show the use of the WA technique in different cultures were selected. WA technique has been applied in different countries, however, it has been primarily used in Latin America. WA has been applied mainly to decipher consumers' perceptions towards different aspects of food, although some works show that WA serves to understand beliefs, expectations, impressions, attitudes, and even to conceptualize different categories of food from the language of consumers. Some theoretical and methodological implications are discussed regarding the use and application of this projective technique.

Keywords: projective techniques, Word Association, food consumer behavior, narrative review.

1. Introduction

1.1 Methods for the study of consumer behavior

The techniques to understand consumer behavior and their food selection have evolved from quantitative to qualitative techniques. Qualitative techniques allow to obtain more detailed information without restriction or conditioning (Rodrigues et al., 2015). An example of quantitative methods is Quantitative Descriptive Analysis (QDA®), a method that allows to identify a series of attributes associated with food products. However, it is restricted to the language of subjects (trained or semi trained assessors) analyzing the product (Stone and Sidel, 2004). Consumers' food choices are not only influenced by sensory aspects of food, but other non-sensory aspects such as packaging, labeling or price also play an important role (Ares and Deliza, 2010a). In terms of sensory methods, qualitative techniques have gained importance as complementary methods to obtain descriptions of foods through the language of consumers (Varela and Ares, 2012). In this context, these descriptions are very useful in terms of product development or marketing since, together to the consumer hedonic and attitudinal responses, are fundamental to the acceptance of a product (Varela and Ares, 2012).

On the other hand, it is known that data collection through surveys or self-administered scales, where consumers must answer a structured questionnaire produces limited results since the subjects are not investigated in depth (Doherty and Nelson, 2010). That is why qualitative techniques acquire great relevance to understand the perception and behavior of consumers (Roininen et al., 2006). These techniques allow projecting the consumer behavior through flexible questions guided

by an interviewer. Among the qualitative techniques used to understand consumer behavior in a food context are focus groups, interviews (structured or semi-structured) or the repertory grid, among others. However, some limitations of these techniques are when larger samples are studied, or, sometimes, when it is necessary to have trained moderators (focus groups), which implies higher costs and loss of time (Varela and Ares, 2012).

In this context, novel qualitative methodologies to understand consumer behavior in the selection of their food have emerged in recent years. An example are the projective techniques, ethnography applied to consumer science and the use of information founded on social networks (Twitter, Facebook or Instagram) to understand consumer's perception and attitudes (Ares and Varela, 2018; Danner and Menapace, 2020; Laguna et al., 2020; Zocchi et al., 2020). Projective techniques are tools that allow to investigate consumer behavior since they provide an in-depth understanding of how people think or feel about a product or a consumer good (Gámbaro, 2018). These techniques are based on the assumption that, by presenting an unstructured and ambiguous stimulus, it is possible to access people's most intimate feelings, beliefs, or attitudes towards various aspects; including the selection of food products (Donoghue, 2000; Vidal et al., 2013). In addition, the great advantage that these techniques present include low cost, little or no training by the participants, and provide a wealth of information on human behavior.

1.2 Projective techniques: brief history and overview

The origin of projective techniques dates to the beginning of the 20th century. Among the first applications of projective techniques were to study personality disorders. One of the first tests was through the Word Association (WA) technique developed

by Carl Jung, with which patients were asked to mention the first words to a list of specific terms (such as foods, ingredients, body parts, moods, among others). Later, in the 1920s, the Rorschach test was developed, which consisted of presenting ink spots to the study subjects so that they could indicate the figures or shapes that they observed when looking at the spots (Mesias and Escribano, 2018). However, over the years, its use extended to the understanding of consumer behavior and market research. One of the pioneering works regarding the use of projective techniques in understanding the consumer and its perception of foods was through Mason Haire's Shopping List in 1950, which aimed to evaluate consumers' perception of instant coffee (Gámbaro, 2018; Upshaw et al., 2018).

According to Donoghue (2000) and Doherty and Nelson (2010), there are five types of projective techniques: Association, Construction, Completion, Order of Choice, and Expressive. Regarding association techniques, their procedure asks participants to mention the first words that come to mind when they are presented with a stimulus, such as a word, phrase or photo (Eldesouky et al., 2015). In construction techniques, participants must build an image or story on a specific topic. The third projective technique is Completion, in which participants are presented with an incomplete stimulus, such as sentences or cartoons with sentences in bubbles. The Order of Choice technique consists of the participants choosing some stimulus from a list to put it in order. Finally, expressive techniques incorporate stimuli in new productive aspects, such as role-playing games (Doherty and Nelson, 2010). Mesias and Escribano (2018) made a detailed conceptual description of the previously described projective methods to study consumer behavior (Haire, 1950; Donoghue

2000, Dohery and Nelson, 2010; Elsedouky et al., 2015; Gámbaro, 2018; Mesías and Escribano, 2018).

At the beginning of the 21th century, the use of projective techniques to understand consumer behavior began to spread, specifically in a food context. For example, Roninen et al. (2006) used associative techniques to identify the perception of consumers towards local foods. Ares and Deliza (2010a) used the WA technique to analyze the influence of color and shape of milk desserts on consumer expectations. Vidal et al. (2013) combined three projective techniques (WA, completion task and Hair's Shopping List) to study the perception and consumption motives towards a ready-to-eat salad.

Although associative techniques have been the most widely used to study food consumer behavior, in recent years other projective methods have been employed to study consumer perceptions, attitudes and preferences towards different food products (Viana et al., 2016; Sales et al., 2020; Sass et al., 2021, Penna et al., 2021; Alcaire et al., 2021; da Silva et al., 2021; Goldner et al., 2021; Alencar et al., 2021). For example, Viana et al. (2016) applied the projective technique of completion task in an online survey to study the attributes of frozen hamburgers in consumers' preferences, identifying that this tool provides valuable information on consumer behavior. Sales et al. (2020) also employed the completion technique to study consumer preferences towards different presentations of coffee; Alencar et al. (2021) used it to find out the opinions and expectations of celiac consumers towards gluten-free products; and Alcaire et al. (2021) identified the motivators and barriers of consumption of healthy snacks in a school context among children and mothers in Uruguay.

Another example of the great potential of the projective methods is the completing a story technique, in which consumers have to complete a story presented with images, phrases or text. da Silva et al. (2021) identified the factors that could influence and limit consumption decisions towards different types of cheeses with this method. Finally, Sass et al. (2022) combined two projective techniques (Shopping List and Product Personality Profile) to study consumer perceptions towards eggs. Besides, these authors (Sass et al., 2022) introduced the product personality profiling technique in a food context; a tool that allows to understand in depth the characteristics of a product, since consumers are asked to describe it in terms of sociodemographic characteristics such as gender, age, occupation, among other aspects (Gámbaro et al., 2019).

Furthermore, in the context of food matrices, projective techniques have been used to study the perception of consumers towards fruits and vegetables (Krumreich et al., 2019); cereals (Son et al., 2014; Dahiya et al., 2014; Bernardo et al., 2019; Rojas-Rivas et al., 2019), meat products (Viana et al., 2014; Graça et al., 2015; de Andrade et al., 2016; Ruby et al., 2016; da Rosa et al., 2019) and dairy products (Ares and Deliza, 2010a; Ares et al., 2010b; Oliveira et al., 2016; Soares et al., 2017; Pinto et al., 2018; Judacewski et al. 2019; da Silva et al., 2021).

1.3 Pros, cons and challenges of projective methods

One of the great advantages of projective methods is the wealth of information generated through this type or research. However, this aspect could indicate a greater challenge in the interpretation of the results obtained from these methods, which means that researchers or academics with knowledge or skills in the analysis of information of this nature are required (Donoghue, 2000). Between of the

significant challenges of using projective techniques we found the validity, reliability, and interpretation of the information (Doherty and Nelson, 2010). According to Gambaro (2018), more research is needed regarding the reliability and validity of the results obtained with projective techniques. That is, the associations generated by consumers towards a food product have stability over time despite the sociodemographic differences or consumer lifestyles, and results in research of this nature can be replicated with different samples in other cultural contexts. This aspect is a major challenge in cross-cultural studies due to the cultural differences of the populations, since it is necessary to standardize the results identifying the meaning of the ideas, beliefs or values projected by consumers. In this sense, it is also important to highlight the job of "experts" in word grouping exercises, who through their interpretation perform the grouping of words in categories of higher hierarchy or rank. Therefore, this aspect is of great relevance to guarantee the validity and stability of the associations between different cultures or consumers groups.

Another advantage (and at the same time a weakness) in the use of projective methods, is the rapid generation of results, implying low costs without the need to have trained subjects to use its. However, given that the results are of a qualitative nature, which implies a wide subjectivity of the responses, it is necessary that there be at least three experts involved in the analysis of the information with experience in the treatment of words, phrases or ideas generated from these methods. Therefore, it is necessary that the "experts" contrast their main findings to reach a consensus on the results of an investigation (categories or dimensions generated), involving more time in the analysis of the information. Furthermore, the disparity in the criteria applied by studies to group words into categories/dimensions should be

considered in future studies since the factors described above contribute significantly to the stability and validity in the studies using projective methods.

It is noteworthy that due to the increase in online platforms in which projective methods can be applied, it is also essential to explore the validity and stability of the results obtained from these methods. For example, in the case of the comparison of the results obtained from the application of ballots in contrast to online platforms, where the researcher has a less control over the people on the other side of the screen. In addition, the application of several projective methods in combination can also contribute to the validity and stability of the information obtained through projective methods (Donoghue, 2000; Gámbaro, 2018).

To our knowledge, no article has been identified that performs a systematic or narrative review of the literature on how these techniques have been used to study consumer behavior and their relationship with food selection, specifically with the projective technique of WA. Furthermore, this review aims to contribute to the knowledge on the validity and stability of the information generated from the projective methods in the field of food science.

1.4 Projective technique of WA: some theoretical and methodological aspects

WA is a powerful technique to understand people's attitudes and behaviors (Roininen et al., 2006). Schmitt (1998) establishes that this technique was instrumental in the 1960s and 1970s, specifically in psychology, where different tests were carried out with this technique to evaluate cognitive development and social attitudes. One of the reasons that make this technique attractive is its speed and versatility in obtaining results, since through a simple procedure in which people are

asked to mention the words associated to a specific stimulus, highly complex results are obtained that reflect their inner thoughts. Figure 1 details the steps in the procedure used to obtain consumer responses with the WA technique.

At methodological level, the associations generated by consumers are grouped into categories or dimensions according to their meaning or synonymy, which implies that identified categories are expressed in frequencies or percentages. Some studies use statistical methods such as the Chi Square test or Correspondence Analysis. For the Chi Square, the associations/categories obtained from a WA task are represented in a contingency table. Therefore, this test is used to determine the association/independence between rows and columns of the table while the Correspondence Analysis is employed to obtain a two-dimensional graphical representation of the contingency table and complement the interpretation of the table. However, the possibilities and diversity of statistical methods for the treatment of information from the WA technique have not been addressed.

Insert Figure 1 around here

At theoretical level, the WA technique is based on the expectancy-value model (Ajzen and Fishbein, 1980), where the first associations or beliefs towards some object are the best predictors to understand human behavior (Roininen et al., 2006; Gámbaro, 2018). This model is based on the fact that human behavior is measured through the intention to perform it and is directly related to people's attitudes towards the object in study, having a positive or negative orientation, since they reflect a predisposition to carry out an action or behavior. Besides, attitudes are governed by the belief system that subjects have and that reflect their inherent thoughts. For

example, if the beliefs or thoughts of a subject towards fast food have a negative representation or meaning (if a consumer mentions words like: gaining weight, overweight, tasteless), possibly their attitudes are in the same direction and leading to a behavior of rejection towards it.

In addition, other theoretical approaches, such as the Theory of Social Representations (Moscovici, 1988), have been applied with the WA technique to understand the eating behaviors (Lo Monaco and Bonetto, 2019). This theoretical approach establishes that the associations mentioned by consumers towards an object of representation (stimulus) are structured in three main fields: Information, Field of Representation and Attitude. The first refers to the sum of knowledge that people have towards some object of representation. The second establishes how the information is structured or what aspects have greater or lesser importance, that is, the hierarchical value that an individual or social group assigns to the object of representation. Finally, the third field is the positive or negative connotation that consumers have towards the representation, which significantly influence their behaviors.

Within the framework of social representations is the structural approach, which was introduced by Rodrigues et al. (2015) to study the associations of winemakers and consumers towards the concept of minerality in France. These authors organized the social representations of both groups in four main areas: central core, first periphery, zone of contrasting elements, and second periphery. Each of the zones has its importance and gives meaning to the object of representation.

1.5 Aim and research questions

In this context, several studies have employed WA to study consumer perception, attitudes, or behavior and their relationship to food selection in sensory and consumer science. However, to our knowledge, no information reviews the state of knowledge or studies on how the WA technique has been used in consumers in a food-related context. Furthermore, the methodological tools and procedures used to study the associations generated with this projective technique have not been addressed. Finally, this work attempts to identify information into the factors associated with the stability and validity of associations in different geographical and cultural contexts of the studies that employ this technique.

The aim of this work was to present a current status on the use of the WA technique in the studies of food consumption behavior. Therefore, the following research questions were formulated and addressed:

RQ1: What are the primary uses of the WA technique in studies of consumer behavior in a food context?

RQ2: What are the methodological tools used in the studies of food consumer behavior that employ the WA technique?

RQ3: What are the main factors that influence the validity and stability of the associations generated from the WA technique in the food consumer behavior studies?

2. Material and methods

A narrative review of the literature was carried out according to the methodological guidelines proposed by Green et al. (2001). Narrative reviews allow to present a perspective on a specific topic and its process is based on searching for documents in information sources such as specific databases. This process is carried out

through an initial search to identify the articles that address the topic, subsequently the inclusion and exclusion criteria of articles to be retained in the review are established. The topics to be addressed in the identified manuscripts are established and the information is synthesized in figures or tables (Green et al., 2001; Sato et al., 2016). Furthermore, many studies in the area of Food Science have carried out similar reviews [for example, to study sociological concepts and to understand consumer behavior towards food selection (Sato, 2016) or different types of nutritional labeling of foods (Temple, 2020)].

The review and selection of the documents were carried out during November 2020. Four databases were selected to search for papers that have used the WA technique in a context related to food and consumer behavior. The databases were ScienceDirect (SD), Wiley Online Library (WOL), Emerald Insight (EI), and Taylor and Francis (TF). Figure 2 details the search process for articles in the four databases.

Insert Figure 2 around here

The search for papers was carried out by entering the keywords "projective techniques", "word association", "food", "perception", "attitudes", and "consumer behavior" in each of the databases. The years of selection of the papers were from 2000 to 2020. In WOL, EI, and TF, the search filter for papers in the area of knowledge of "Food Science" was applied. The criteria for selecting the papers were:

A. Each manuscript should be related to the consumer and the study of their perception, attitudes, or behavior in food selection.

B. WA technique would be used in a main or complementary way at a methodological level.

C. Papers were published in English and had a peer review process in the identified journals.

All papers were fully read and those that did not meet the criteria described above were excluded from the study. Once the papers were read, the methodological tools used in each one and the way to obtain the information through the WA to study consumer behavior were considered.

A table was constructed to capture the most important information of each paper considered in this narrative review: i) place of study/cross-cultural; ii) aim of the research; iii) size and composition sample in terms of the gender of the participants; iv) methodological collection procedure; v) categorization and statistical treatment of words; and vi) food or food category of the study.

In the first section, with the characteristics of the papers identified, a linear regression model was performed to ascertain the relationship and the trend in the publication of papers with this methodological tool over the years. In the second section, the articles were divided according to their sample size and quartiles were calculated. Subsequently, a multiple correspondence analysis (MCA) was carried out between the groups identified according to sample size, regions and countries where the research was carried out applying the WA technique. MCA is a multivariate statistic tool used to obtain a representation map that allows visualizing the relationship between more than two categorical variables (Greenacre and Blasius, 2006). Finally, we present an example of the use of the Chi Square test and Correspondence Analysis, highlighting some theoretical aspects of its uses together with the WA

technique. All statistical analyzes presented in the manuscript were carried out with the software XLSTAT 2014.

3. Results and discussion

3.1 Characteristics of the papers identified in the four databases

Seventy-four articles that used the WA technique researched consumer behavior in a food context in a principal or complementary way. In Figure 3, the number of articles identified per year is shown, and it is observed that in recent years the use of this technique has increased in the study of consumer behavior in the selection, perception, and attitudes towards different types of food products. A linear regression model was performed to identify the growth trend in the publication of articles. It is expected that the number of publications in subsequent years that use the WA technique in studies of food consumer behavior will continue to grow since the linear regression model satisfactorily met the goodness of fit indices ($R^2 = 0.594$, $b_0 = 1.212$, $b_1 = 0.7622$, $P<0.05$). In recent publications that use of the WA technique and other projective methods, show the growth of these methods in order to study the food consumer behavior. For example, the WA technique has been used to study the perception of consumers towards traditional foods and its relationship with food neophobia and with different cultural regions in a single country (Bernal-Gil et al., 2020; Sánchez-Vega et al., 2020), other foods such as pulses (Melendrez-Ruíz et al., 2021), beers in three European countries (Rivaroli et al., 2021), desserts among older people (Riquelme et al., 2022), red meats (Popoola et al., 2021), novel foods such as hamburgers with added mushrooms (Patinho et al., 2021), food–related concepts such as nostalgia in different sociological generations of consumers (X, baby boomers or millennials) (Espinoza-Ortega, 2021), places of consumption such

as traditional markets, supermarkets or alternative food networks (Escobar-Lopez et al., 2022); including on the fear associated with food choices in times of COVID-19 (Gómez-Corona et al., 2021).

In the context of completion task, Sales et al. (2020) identified the perception of consumers towards coffee in three different presentations (capsules, grains and powder), establishing that this methodology provides similar results in relation to hard laddering. Alcaire et al. (2021) employed this technique in order to understand children's healthy food choices in a school environment using five incomplete dialogues. These authors identified barriers to food choices, such as the sale of unhealthy foods at school, or lack of time to prepare food at home. da Silva et al. (2021) used it to determine the perception of risk towards cheeses in different regions of Brazil, establishing that some consumers do not buy this type of product due to the lack of some certification or when the origin of the product is not known. Alencar et al. (2021) used completion task in combination with other projective methods to identify consumers' perception towards gluten free products. The authors identified the characteristics that consumers consider lacking, specifically the sensory ones such as flavor and texture. Finally, a novel projective method is the Product Personality Profile task, which can serve to guide marketing campaigns towards consumers, for example towards eggs (Sass et al., 2021) or kefir products (Penna et al., 2021).

Insert Figure 3 around here

The papers identified in the four databases were as follows: SD = 49 (68.05%), WOL = 16 (22.22%), EI = 7 (9.72%) and TF = 2 (2.77%). The database with the largest number of the articles was SD, specifically in the journals of "Food Quality and

Preference", "Food Research International", and "Appetite". In WOL, the journal in which more articles were identified was "Journal of Sensory Studies". One of the reason could be that this journal considers papers on word grouping and semantic differentiation techniques applied to sensory science and consumer research (Journal of Sensory Studies, 2020).

Studies conducted in more than one country or region were named "cross-cultural studies". Almost half of the studies that have used the WA technique have been carried out in Latin America (n = 39), specifically in Brazil (n = 23) and Uruguay (n = 7). In the European region, 19 papers were identified using this technique that included several countries such as Spain, France, Sweden, Portugal, the United Kingdom, among others. It is noteworthy that "cross-cultural studies" have increased in recent years since 11 papers were identified in this narrative review. For example, the first cross-cultural study identified using the WA technique was carried out by Guerrero et al. (2010), who studied consumer associations towards the traditional concept within the framework of traditional foods. In addition, most cross-cultural studies focus on studying the perception or representations of consumers towards food concepts such as "feeling good" in a food context (Sulmont-Rossé et al., 2019), creaminess (Antmann et al., 2011), well-being (Ares et al., 2015) or gastronomy (Rojas-Rivas et al., 2021). In North America, three studies were registered, and finally, in the Asian continent this qualitative technique has been used the least (2.77%). Table 1 summarizes each of the characteristics of the articles: aim, place of study, food product and methodological tools used.

Insert Table 1 around here

In the majority of the studies identified, the samples of consumers used are composed mostly for female consumers (n = 52). Only 10 studies used a sample with a higher proportion of men, particularly studies focused on wine (Rodrigues et al., 2015) and beer (Gómez-Corona et al., 2016). Some studies (n = 8) used balanced samples in terms of gender (50/50). Notably, four studies did not report the composition of their sample in relation to this variable (Table 1). Female consumers are the ones who have more contact with of knowledge of food and its preparation; possibly this is one of the reasons why studies that have used the WA technique have been focused on this sector of the population. However, future research should explore associations related to men's attitudes and behaviors in food selection with this technique.

In most of the manuscripts analyzed, it was observed that the participants were over 18 years of age. However, given the versatility and ease of use of this technique, its use has been limited to understand the perceptions and behaviors in children or underage participants since only five manuscripts that use it were identified (Goldner et al., 2013; Olsen et al., 2015; Latorres et al., 2016; Martjin et al., 2015; Daltoé et al., 2017). In this context, it is recommended to extend the use of this qualitative tool to many sectors of the population, including children, to better understand their eating behaviors as opposed to answering more structured questionnaires. For example, Goldner et al. (2021) have proposed free drawing as a qualitative tool to understand food consumption among children since supervision or assistance is not necessary to conduct the experiment. Likewise, in a cross-cultural study, Ragelienė (2021) has extended its use as a projective technique to understand food preferences among children aged 8 to 13 years.

3.2 Uses of the WA technique in the studies of food consumer behavior

The versatility and ease of use of the WA technique allow obtaining information on consumer behavior towards different food categories or specific products quickly and with solid results. In this narrative review, the main food topics with which this projective technique has been employed were identified (**RQ1**). Table 2 summarizes the information of the identified papers along with the main study product.

Insert Table 2 around here

Traditional foods: one of the most studied categories is traditional foods, which have been investigated in different geographical and cultural contexts, including several European countries (Guerrerro et al., 2010; Renko et al., 2014) and China (Wang et al., 2016). In Latin America, specifically in Mexico, the factors associated with the consumption of these products were identified, such as gender, and the categories obtained through the word association ("way of elaboration, habit, basic, and origin") influence the consumption of traditional foods (Serrano-Cruz et al., 2018). Other studies have focused on foods and beverages that are representative of some ethnic groups (Bernal-Gil et al., 2020) and foods that present a traditional/functional duality (de Albuquerque et al., 2019; Rojas-Rivas et al., 2019). García-Berrón et al. (2021) showed that the WA has been one of the main methods to understand the perception and consumption motives of traditional foods.

Meat and seafood products: these products have also been one of the topics of interest to learn about consumer behavior, specifically about their perception and attitudes towards different products such as lamb meat, capybara, even meat made in vitro from animal cells (Viana et al., 2014; Graca et al., 2015; de Andrade et al., 2015; da Rosa et al., 2019; Bryant and Barnett, 2019). de Andrade et al. (2016)

studied the perception of Brazilian consumers towards lamb meat, highlighting that sensory characteristics and hedonic attitudes influence consumer behaviors. These results agree with those reported by da Rosa et al. (2019) with the case of capybara meat. In addition, de Andrade et al. (2016) extended the use of Global Chi Square and Chi Square per Cell tests applied with the WA technique (Symoneaux et al., 2013). In seafood, the WA technique has also been used to study the perception and consumption intention of these products, such as anchovies (Latorres et al., 2016), fish-based products (Mitterer-Daltoe et al., 2013) or gray mullet (Tiyo de Godoy et al., 2019).

Alcoholic and non-alcoholic beverages: in the field of alcoholic and non-alcoholic beverages, word associations are relevant for understanding attitudes, representations, and willingness to consume them (Esmerino et al., 2017; Pheco et al., 2018; Pinto et al., 2018; Rodrigues et al., 2017). For example, Sester et al. (2013) studied consumers' perception of 14 types of beers; Gómez-Corona et al. (2016) analyzed the social representations of consumers in Mexico and France towards craft beers, identifying the patterns that consumers have towards these products. Pinto et al. (2018) studied the perception of consumers towards bottled mineral water, establishing that there are noticeable differences in perception according to gender, concluding that the promotional campaigns of this product could be oriented according to this variable.

Conceptualization: another use of this technique is that it allows the generation of concepts that lack clarity, that are not well defined, or whose conceptualization has not been approached from the common language or people's knowledge (Rodrigues et al., 2015). Some authors use this projective technique to define concepts related

to food (Ruby et al., 2016; Sulmont-Rossé et al., 2018; Ares et al., 2020; Schnettler et al., 2020), such as traditional foods (Guerrero et al., 2010), or well-being in a food context (Ares et al., 2014; Ares et al., 2015), the minerality of wine (Rodrigues et al., 2015), sustainability (Barone et al., 2020), gastronomy (Rojas-Rivas et al., 2020), or sensory characteristics of food, as in the case of "creaminess" (Antmann et al., 2011). For example, Barone et al. (2020) suggested that young consumers with a high educational level have greater clarity about the concept of sustainability. Furthermore, some papers not only rely on the language of consumers to define food concepts, but also use the language of experts such as winemakers, chefs or health professionals (Rodrigues et al., 2015; Rojas-Rivas et al., 2020; Ares et al., 2020).

Packaging and labeling: this technique has been helpful to evaluate consumers' perceptions towards different types of food packaging or label information to identify if consumers perceive what the messages wants to convey (Ares and Deliza, 2010a,b; Ares et al., 2011; Piqueras-Fiszman et al., 2011; Piqueras-Fiszman et al., 2013; Eldesouky et al., 2015; Miklavec et al., 2015; Oliveira et al., 2016; Celhay and Ramaud, 2018; Rebollar et al., 2019; Alcantara et al., 2020). Ares and Deliza (2010a) studied the influence of the color and package shape of milk desserts on consumer expectations. Ares et al. (2011) designed five types of labels for yogurt, identifying whether each label conveys a different message to consumers. Some works combine this projective technique with neuroscience tools to perform eye tracking and obtain more precise results on consumers' ocular fixation on food products (Piqueras-Fiszman et al., 2013; Oliveira et al., 2016). Oliveira et al. (2016) studied the perception of consumers towards functional food labels, highlighting the

importance of label design in the associations towards products and the messages that functional food labels convey.

Other food categories: different food categories have also been studied to understand the perception of consumers, for example, towards local foods (Roininen et al., 2006), fast food (Danes et al., 2010), genetically modified organisms (Connor and Siegriest, 2011), organic foods (Hilverda et al., 2016) and functional foods (Rojas-Rivas et al., 2018). The power of this associative technique is exemplified by the results of Connor and Siegrist (2011), who established that consumers relate specific crops with genetically modified products. Other different food products have been explored to study the expectations and impressions of consumers, including dairy desserts such as milk desserts (Ares and Deliza, 2010b), dairy functional foods (Ares et al., 2010) and cheeses (Soares et al., 2017; Judacewski et al., 2019).

Unfamiliar foods: concerning products that consumers are unfamiliar with or unusual in their diets, the WA technique is helpful to understand their perceptions or behaviors. For example, de Albuquerque et al. (2019) used it to find out the perception of Brazilian consumers towards nopal (edible fruit of the plant with the same name, green color and covered with thorns), a product of Mexican origin. Martins et al. (2019) studied consumers' associations towards fruit juices made with new food technologies in conjunction with the Food Technology Neophobia Scale (Evans et al., 2010). Rodrigues et al. (2017) analyzed consumer attitudes towards edible flowers using the structural approach of social representations. Finally, Bisconsin-Junior et al. (2020) used it to understand consumers' representations of edible insects in several regions of Brazil.

These results agree with Gámbaro (2018), who established that projective methods allows to understand the consumer behavior towards different food categories, since the associations given by consumers provide essential information about their perception and attitudes, which can be relevant in terms of marketing, product development and consumer education.

3.3 Methodological procedures in the use of the WA technique in the studies of food consumer behavior

RQ2 aims to provide insights on the methodological procedures used in food consumer behavior studies that employ the WA technique. One of the fundamental objectives of using the WA is to obtain information and the generalization of the results about consumer behavior, i.e. categories or words that emerge from an associative task have stability between different population sectors or in repetitive studies with different samples of consumers (Gambaro, 2018). Furthermore, the validity and stability of the associations depends on the sample size and word categorization, which allows extrapolation of the results to other population and geographical contexts. This section describes the sample size used in the studies identified, as well as the information collection strategy and methods used to analyze the associations generated by consumers.

3.3.1 Sample size and data collection procedures

The articles were divided into quartiles (Q1 – Q3) according to the sample size they used. Four groups of studies were identified: those using a small sample size, less than 110 participants (n = 18, Median = 63.5); medium size, between 111 and 198 participants (n = 19, Median = 150); large size, from 199 to 482 consumers (n = 19, Median = 329); and very large size, over 483 participants (n = 18, Median = 767.5).

Insert Figure 4 around here.

Figure 4 shows the MCA carried out with the four identified study groups according to their sample size, the regions and countries. The first factor explained 61.74% of the variance, while the second 31.40%. The results show that this variable differentiates the studies. In some European and Latin America countries, studies have employed small samples. However, the most extensive studies are those that study consumer perceptions at cross-cultural level (with some exceptions such as Swiss or Slovenia) (Connor and Siegrist, 2011; Mikllavec et al., 2016).

On the other hand, studies using small samples are mainly focused on the sensory analysis of products, as the conditions for recruiting participants are mostly carried out in sensory analysis laboratories, while some studies collect information through questionnaires or face-to-face interviews. Moreover, as this type of study is carried out with small samples, it is possible to combine it with other sensory tools such as eye-tracking to better determine consumers' perceptions or expectations of the products evaluated (Piqueras-Fiszman et al., 2013; Oliveira et al., 2016).

Studies that use a medium sample size (between 111 and 198 participants), the methodology of data collection is mainly through online surveys and with questionnaires or face-to-face interviews. Only one study combined the online survey with face-to-face questionnaires. Studies with larger sample sizes, information gathering was conducted mainly through online surveys. This pattern is replicated in most extensive studies (> 483 participants) as it is desired to reach a more significant number of consumers through cross-cultural studies or in countries where their territory is comparable to that of a continent and, therefore, there is a more significant number of participants in order to represent the population. For

example, in Brazil, four studies were registered through online surveys with samples ranging from 607 to 1232 participants (Alcantara et al., 2020; da Rosa et al., 2019; Krumreich et al., 2019; Miklavec et al., 2016).

The results establish that the sample size used in the studies employing the WA technique is related to the process or way of obtaining the information, either through interviews or face-to-face questionnaires or with larger samples through online surveys. This information can be useful for future works using this methodological tool and, based on it, collect the data according to the sample size and the target population to be reached.

3.3.2 Stimuli used with the WA technique and methods of categorizing words

Almost 72.97% (n = 54) of the studies using the WA technique to extract information from inducing phrases or words, used one or more stimuli (example: well-being, organic foods, functional foods, sustainability) to generate words that spontaneously come to mind of study participants. For example, Ares et al. (2014) found that foods that consumers associated with the concept of well-being were fruits, vegetables, water or meat. Rojas-Rivas et al. (2018) identified that consumers related functional foods with products such as fruits, cereals, salads, yogurt, and milk, among others. The other way of using the WA technique has been through images (22.97%, n = 17), in which participants were asked to observe the products and then spontaneously generate the words. Only three studies using physical products to apply the WA were observed. Sester et al. (2013) asked to the participants to first taste the beers and then to indicate the first words that came to mind. Latorres et al. (2016) used this process with fish meat balls among children of 6 to 14 years old.

Ares et al. (2010) asked to the consumers to first perform the WA task and then try the antioxidant-enriched milk desserts.

These results were in agreement with that of Mesias and Escribano (2018) on the main stimuli (verbal such as word or phrases and nonverbal such as images or photographs) used to extract consumer responses from associative techniques. It is important to note that future studies could use physical products together with WA; or could also explore consumer associations towards contexts of consumption. Furthermore, future studies could investigate the optimal stimuli in order to generate spontaneously associations, taking into account consumers fatigue and the stability and validity of the associations.

Once the word association task is carried out, the following methodological process is the generation of the information database to group the words and generate categories or dimensions of higher rank. This procedure is fundamental in word analysis since the main findings and inferences to be made will depend on it. This word grouping process has been described by Bécue-Beratut et al. (2008) and it is carried out as follows:

- Verification of misspellings.
- Lemmatization (elimination of connectors, supplemental terms and adverbs and standardization of words).
- Grouping of words according to their meaning and synonymy.
- Analysis of words with difficulty to group them in some category (words or terms whose meaning is difficult to place in a category).
- Word translation.

Furthermore, this process is carried out by at least three experts who have experience in word grouping exercises, since initially, each expert groups the words individually and later compare their results with the other two experts and arrive at a consensus on each of the categories/dimensions generated, as well as the final name of each one. Mesias and Escribano (2018) established that the construction of categories based on personal interpretation of the experts involved in the word grouping process must be carried out carefully to avoid interpretation mistakes; so, a careful and exhaustive analysis in the grouping of words is necessary to avoid that the results lack validity and stability.

However, through the review, it has been observed that the studies that use the word grouping process present disparity in the grouping criteria. Table 1 summarize the criteria used by the studies to categorize the words. Most studies (n = 34, 45.94%) use a 5% frequency of words that present similarity in their meaning to be considered a category of analysis. Nine papers used 10% and three 15% as minimum criteria for grouping the words. Seventeen papers (22.97%) categorized words using criteria ranging from 1% to 9% frequency of mention. It is noteworthy that eleven papers (14.86%) did not specify the minimum percentage in the frequency of mention of words to be considered as categories of analysis.

The results described above may be useful at a methodological level for future research when performing the word grouping processes with the WA technique. For example, based on the evidence presented, it is suggested that future works, could use 5% as a minimum criterion in the frequency of mentioning words for their subsequent grouping into categories/dimensions of analysis, thereby avoiding the

loss of valuable information using a more significant number of words generated from this projective exercise.

3.3.3 Main and complementary methods for the analysis of information from the WA technique

Three main methods of analysis of the words, categories, and dimensions generated from a WA exercise were identified. The first is based on the qualitative descriptive analysis of the information by grouping words into categories. The second and third methods use multivariate statistical tools focused on the comparison of frequencies and the extraction of information from the contingency table for its graphical representation. It is noteworthy that there is a diversity of statistical and cognitive tools used to analyze information from a WA task (Figure 5). Furthermore, Figure 6 details the main, secondary as well as other methodological tools used in combination with the WA technique.

Insert Figure 5 around here

Insert Figure 6 around here

3.3.3.1. Qualitative analysis

Nine studies (12.32%) used only content or triangulation analysis of the words following the methodological processes of Bécue-Bertaut et al. (2008) for later grouping into categories or dimensions. This analysis makes it possible to identify the essential elements according to their frequency of mention. Two studies present word clouds to make a graphic description of its results (Danes et al., 2010; Schlinkert et al., 2020). Another work analyzes foods instead of words based on the WA, grouping them into food categories (Saldaña et al., 2020).

The advantages of this type of analysis are that it allows to quickly observe which are the categories of greatest importance. For example, Eldesouky et al. (2015) reported only the categories identified from two projective techniques (word association and completion tasks). In addition, when other qualitative tools are used in conjunction with the WA technique, such as the free listing or open-ended questions, it is convenient to use this type of analysis since a large amount of information is obtained and could require more time to group the words or comments mentioned. Ares et al. (2014) performed only qualitative descriptive analysis using the tools described above.

The disadvantages of this type of analysis is that it does not allow to delve into the perception or attitudes of consumers according to consumption patterns, sociodemographic characteristics or differences in lifestyle since the associations/categories obtained are analyzed globally among the study samples.

3.3.3.2. Chi-Square and frequency comparison statistics

56.75% (n = 42) of the studies identified, in addition to performing descriptive analysis of the categories/dimensions, used the Chi-Square test to compare the frequency of mention of the words or categories generated from the WA technique, either to ascertain the association/independence in the frequency of mention between rows and columns (McHugh, 2013) of the categories represented in the contingency table or to identify the source of variation in the same table with the Global Chi-Square and Chi-Square per Cell tests (Symoneaux et al., 2012). Symoneaux et al. (2012) introduced this statistical tool in sensory and consumer science in a food context to analyze responses from open-ended questions for the sensory characterization of apples.

The review shows that its use has been extended for the analysis of the information generated from the WA technique (Ares et al., 2015; de Andrade et al., 2015; Judacewski et al., 2019; Krumreich et al., 2019; Bernal-Gil et al., 2020; Rocha et al., 2020), specifically for the study of the sensory characteristics of products (Ares and Deliza, 2010b; Krumreich et al., 2019), or according to the frequency of consumption that people present towards different foods (de Andrade et al., 2016; Judacewski et al., 2019), including the identification of types of consumer groups according to their perception and eating behaviors (Viana et al., 2014; Rojas-Rivas et al., 2019; Bernal-Gil et al., 2020). Moreover, in cross-cultural studies, these statistical tests are par excellence the tools to make comparisons in the frequency of mention of the categories/dimensions (Ares et al., 2015; Sulmont-Roseé et al., 2019) and identify the most relevant elements in each population or culture.

Some studies use other statistical tests for the comparison of the frequencies of words or categories in conjunction with the Chi-Square test, for example, Bonferroni correction (Sester et al., 2013; Son et al., 2014), Fisher's exact test (Gómez-Corona et al., 2016; Rodrigues et al., 2017) or Marascuilo Multiple Comparison (Schnettler et al., 2020). Some other works use the Z test to compare the proportions of the categories (Fiszman et al., 2014) or with the Cochran Q test (Roascio-Albistur et al., 2019).

Some of the advantages of the use of the Chi Square test is that it allows observing the most important elements in the frequency of the categories according to the consumer groups, food products or between different cultures. Antmann et al. (2011) observed the differences between the associations made for Spanish and Uruguayan consumers towards the concept of creaminess, however they only

indicated the globally differences with this test. For their part, the Chi Square Per Cell test allows identifying the source of variation in the frequency of categories/dimensions in the contingency table, including not only different cultural contexts, but also sociodemographic characteristics of consumers such as gender, age or educational level (Rojas-Rivas et al., 2020).

The negative aspect using this type of analysis is that only the differences in the frequencies of words or categories are reported in the contingency table, not being able to observe them through a graphical representation. In addition, the Global Chi Square test can be calculated with basic statistical software (e.g., Excel), but for the Chi Square Per Cell test it is necessary to have specialized software such as XLSTAT that can identify the differences between the cells of the table.

3.3.3.3. Correspondence Analysis (CA) and Multiple Correspondence Analysis (MCA)

CA is a multivariate statistical test that also serves to verify the independence between the rows and columns of a contingency table, that is, between two qualitative variables that have a measure of correspondence. It is considered an extension of Principal Component Analysis (PCA) applied to nominal variables. CA allows obtaining a graphical representation of the independence between the rows and columns since it extracts the most significant amount of information in two factors or components (Abdi and Williams, 2010). Notably, 41.89% (n = 31) of the studies analyzed use this statistical tool to graphically explain the categories/dimensions identified on the products, consumer groups or food concepts.

CA is useful to identify the elements of greater relevance about a food product or concept at a cultural level. For example, this methodology was observed in five cross-cultural studies such as Son et al. (2014), who used CA to study consumer representations of three countries in Asia and one in Europe towards rice; Guerrero et al. (2010), who studied traditional food concepts in six regions of Europe; or Ares et al. (2015), who explored the well-being among consumers in Europe and Latin America.

Almost 28% of the identified studies combine the Chi-Square test with the CA. In addition, some studies use MCA (Ares et al., 2011; Goldner et al., 2012; Graca et al., 2015) to compare two or more qualitative variables in the contingency table, including the categories or dimensions identified from the WA technique. The advantage of using the CA or MCA is that allows to have a graphical representation between the categories generated from the word association with consumer typologies (de Andrade et al., 2016; Bernal-Gil et al., 2020); about sociodemographic characteristics of consumers (Barone et al., 2020; de Albuquerque et al., 2019; Rojas-Rivas et al., 2020) or in cross-cultural studies (Guerrero et al, 2010; Ares et al., 2015; Sulmont-Rossé et al., 2019). Some limitations are when only two groups or cultures are investigated, since in this instance it is not possible to obtain a bi-dimensional map.

3.3.3.4 Some theoretical and methodological implications of the use of the Chi Square test and CA with the WA technique

The Chi-Square (χ^2) is a non-parametric statistical test that is frequently used to test hypotheses when the measurement level of the variables is nominal and is generally

performed in a contingency table of 2 x 2. As a non-parametric test, at least one of the following aspects must be met:

a) The level of measurement of the variables must be nominal or ordinal.

b) The size of the study groups may be the equal or different

c) The raw data that has been measured on an interval scale, violates any of the following aspects: ***i)*** the data does not follow a normal distribution; ***ii)*** there is no equality of variances and ***iii)*** data are no longer measured in interval or proportion, and are expressed in categories.

Furthermore, the Chi Square test must fit some statistical assumptions when used: ***i)*** the data in the cells must be frequencies or counts; ***ii)*** the variables in the table are exclusive; ***iii)*** each subject can contribute only to one cell of the contingency table; ***iv)*** the groups within the table are independent; ***v)*** there are at least two variables that have been measured as categories; and ***vi)*** the value of the expected or theoretical cells must be 5 or more in at least 80% of the cells in the table (McHugh, 2013). The Chi Square formula is as follows:

$$\sum \chi 2 = \frac{(\mathrm{O} - \mathrm{E})2}{\mathrm{E}}$$

Where:

χ2 = Chi Square for each cell

∑χ2 = Sum of Chi Square for all cells on the contingency table (Global Chi Square)

O = Observed frequencies

E = Expected or theoretical frequencies

However, this test indicates globally the independence or association between rows and columns of the contingency table, not allowing identifying the source of variation in the cells. To obtain more detail on the source of variation, the Chi Square Per Cell test can be used to identify whether the observed frequencies are higher or lower than the theoretical frequencies at different levels of significance (P<0.05*, <0.01**, <0.001***) (Symoneaux et al., 2012).

3.3.3.5 Example of the CA and Global Chi Square and Chi Square per Cell tests

In the case of the WA technique, these tests are useful to know the independence/association in the contingency table between the categories/dimensions (rows) generated towards food products, consumer groups or between cultures (columns). We present an example that could be useful for the readers of Food Research International in the use of Global Chi Square, Chi Square per Cell test and Correspondence Analysis using the software XLSTAT 2014.

Example: A group of 30 consumers performed a WA task with four commercial beers (A - D). The exercise consisted of asking consumers for the first three words that came to mind when looking at the images of beer bottles. After grouping the words, the experts identified five categories of analysis for the four products, obtaining different frequencies of citation in the categories (rows) for each product (columns). Only the categories mentioned by more than 5% of the participants were considered for the analysis and frequency of mention of the categories was considered only if a participant mentioned a category once. The information was represented in a contingency table of 5 x 4 = 20 cells (Figure 7).

Insert Figure 7 around here

The Global Chi Square reported in the contingency table was 26.151 while the theoretical was 21.026 with 12 degrees of freedom. Thus, the test was statistically significant (P<0.05) and it was decided to explore the source of variation in the contingency table. It was observed that the frequency of mention in the first category of beer "A" was significantly lower than the theoretical frequencies (9.62), suggesting that this category was associated significantly less with this beer than the other three ones. Regarding the third category, it was identified that frequencies observed in product “D” were significantly higher than expected (7.11), while for product “C” were significantly lower (9.27). These results suggest that this category was associated significantly more towards product D and significantly less with beer C. Finally, the frequencies of the fifth category for beer "D" were lower than the expected (2.58).

According to the assumptions that must be considered for the Chi Square test, they were satisfactorily fulfilled, since the information on the cells are frequencies or counts and each subject contributed only once to each of the cells. However, theoretical frequencies less than 5 were detected in four cells of the contingency table (category five of all beers). Nevertheless at least 80% of the cells (20 x 0.80 = 16) have expected frequencies greater than 5 (Figure 7).

In the above-mentioned sample, CA was also used to obtain a graphical representation in order to confirm the association of categories (rows) and products (columns) mentioned by consumers in the above example. Some theoretical aspects of the use of CA are that, when it is concluded that there is an association between the categorical variables of the contingency table from the Chi Square test, CA allows to determine the relationship between the variables and complement the interpretation of the contingency table. Besides, CA shows a map where the

information is represented in two components or factors that explain the inertia of the data within the contingency table (Beh and Lombardo, 2014).

The inertia of the contingency table from the CA is proportional to the Chi-Square test, so the factorial loads of the inertia decompose the $\chi 2$ into orthogonal components, which are called factors, or components as in the PCA. The total inertia is equal to the sum of the eigenvalues of the components. In addition, the rows and columns of the contingency table in the CA have the same role, so there are contributions from both parts (Abdi and Williams, 2010; Beh and Lombardo, 2014).

In Figure 7 the map obtained through the CA is showed. The first two components extracted 96.29% of the inertia of the contingency table. While the first factor contributed with 57.81% (eigenvalue of 0.098), the second extracted 38.45% (eigenvalue of 0.065). With respect to the contributions of rows in the contingency table, the first component separated categories 3, 2 and 5. For the second component, the categories that contributed the most were 1, 4 and 2.

The graphical representation of the CA allows to visualize the association between rows and columns of the contingency table and to complement the analysis obtained from the Chi Square test. Therefore, the four beers studied were differentiated by the categories generated from the WA technique. Beer "B" was closer to categories 2 and 5; category 3 is part of the representation or perception of products "A" and "D"; and finally, "C" beer was related to a greater extent with categories 1 and 4.

3.3.3.6. Other analysis tools

On the other hand, several statistical tools and indexes used in the psychology area to analyze the information from the WA technique were identified. Some studies use Multiple Factor Analysis (MFA) when several stimuli are applied (Ares et al., 2011;

Pontual et al., 2017) or in combination with other assessment tools or scales, such as the hedonic scale (Ares and Deliza, 2010a). MFA is a multivariate factorial method in which quantitative and qualitative variables can be included, such as the contingency table generated from a WA task, that is expressed in frequencies of the categories. For example, Ares and Deliza (2010a) applied MFA to evaluate consumer expectations according to product color and package shape of milk desserts, along with perceived taste and willingness to purchase using a 9-point hedonic scale. These authors identified that perceived taste and willingness to buy them were related to flavor and color characteristics. Another example of using this multivariate method is reported by Pontual et al. (2017) who used MFA to evaluate the expectations of celiac and non-celiac consumers towards different types of pizza. Hierarchical Cluster Analysis is also used to establish consumer patterns of perception and attitudes regarding the food products evaluated (Ares and Deliza, 2010b; Gómez-Corona et al., 2016). For example, Ares and Deliza (2010b) used cluster analysis based on the free listing methodology applied to the WA technique (Hough and Ferraris, 2010), in which a database was designed with the positions of the words/categories for each participant. Results allowed to obtain typologies of consumers and identified particular characteristics that were related to the respective clusters or groups. Some studies transform the categories into binary variables (0/1) to perform Binary Logistic Regression combined with other scales such as FCQ (Serrano-Cruz et al., 2018).

Finally, several studies that use the theoretical approach of social representations (Moscovici, 1988) use cognitive indices to identify the categories of most significant importance or weight among consumers. For example, the Diversity and Rarity Index

(Rodrigues et al., 2015), Centrality Index (Rodrigues et al., 2015), the Polarity Index (Rodrigues et al., 2015; Rodrigues et al., 2017; Gómez-Corona et al., 2016; Bisconsin-Junior et al., 2020) or the Cognitive Salience Index (CSI) (Rojas-Rivas et al., 2021). Rodrigues et al. (2015) used the structural approach of social representations with the WA technique among winemakers and consumers. These authors introduced the Diversity and Rarity Index to identify the diversity of words before being categorized, as well as the words that are cited only once (Rarity). In addition, they used the Centrality Index to establish the most important representations and those that have a positive and negative connotation with the Polarity Index. Rojas-Rivas et al. (2021) applied the CSI from the free listing method to the WA technique, indicating that this index is very useful to know the social representations of greater cognitive importance among consumers.

3.3.4 Methodological tools used in combination with the WA technique

Forty-six manuscripts that use other qualitative and quantitative methodological tools in combination with the WA technique were identified. This section provides a brief description of the methods used in conjunction with WA to analyze consumer behavior in a food context (Table 3).

Insert table 3 around here.

3.3.4.1. Qualitative methods

Some studies combine the WA technique with other projective techniques such as the Haire's Shopping List or Completion task to better understand the perception, expectations, or attitudes of consumers towards various food products (Vidal et al., 2013; Eldesouky et al., 2015). Some use focus groups or hard laddering interviews. For example, Roininen et al. (2006) combined laddering interviews with the WA

technique, establishing that the second one (WA) generates more significant results. In addition, it requires less time to extract information from consumers since their internal cognitive structures can be accessed without any restriction or conditioning, unlike the application of instruments with a more meaningful structure such as questionnaires.

Other qualitative techniques that have been combined with the WA are free listing (Hough and Ferraris, 2010) or open-ended questions (ten Kleij and Musters, 2003; Symoneaux et al., 2012). Unlike the WA, the free listing technique or the open-ended questions do not restrict the number of words or comments mentioned about some stimulus or cultural domain. Therefore, they are fundamental to deepen the object of study at a qualitative level. For example, Ares et al. (2014) presented a global perspective of the concept of well-being in a food context using the WA technique, free listing, and open-ended questions. When these methods were used together, they allow to obtain a holistic perspective of the perceptions and attitudes of consumers towards a concept or food and to establish categories that can be useful for the development of quantitative instruments. For example, based on the categories identified for Ares et al. (2014), it was possible to develop a questionnaire to measure well-being in a food context through a cross-cultural study (Ares et al., 2016).

3.3.4.2. Quantitative methods

The WA technique has been used with other quantitative tools in which sensory analysis methods predominate, such as Conjoint Analysis, Projective Mapping, or preference tests. Ares and Deliza (2010a) used Conjoint Analysis to understand the perceived taste and purchase intention towards different milk desserts, identifying

how the package shape and color of the products influence consumer expectations. Some studies use the WA technique in combination with the hedonic scale towards products evaluated by children (Goldner et al., 2012; Lattorres et al., 2016) or nopal cookies among consumers in Brazil (de Albuquerque et al., 2019). As has been established in previous sections, some studies combine neuroscience tools to perform eye tracking and better understand consumers' perception or expectations towards food products (Piqueras-Fiszman et al., 2013; Oliveira et al., 2016).

It is noteworthy that many studies combine the WA technique with questionnaires or scales that have been validated in previous studies. For example, to study the fear of rejection of consumers to try new or unfamiliar foods to their diet with the Food Neophobia Scale developed by Pliner and Hobden (1992) or the Food Technology Neophobia Scale (Evans et al. al., 2010). Bernal-Gil et al. (2020) identified different patterns of food neophobia among consumers, establishing that the associations generated through the WA technique towards an ethnic beverage are related to the levels of neophobia among the identified groups.

The Food Choice Questionnaire (FCQ) (Steptoe et al., 1995) is a tool widely used and validated by several studies that systematically measures the motives for food consumption among consumers. FCQ combined with the WA, provides essential information on food preferences and behaviors. Mitterer-Daltoé et al. (2013) observed that the WA technique allows understanding consumers' perception of seafood products, corroborating which are the elements that most influence the consumption of this type of products with the FCQ. Serrano-Cruz et al. (2018) designed a binary linear regression model, in conjunction with the FCQ and the categories obtained from the WA, establishing the factors associated with the

consumption of traditional foods. Several consumer attitude and behavior questionnaires have been used in conjunction with Cluster Analysis to identify behavioral patterns among the population, corroborating the associations regarding consumer food attitudes (Viana et al., 2014; Rojas-Rivas et al., 2019). For example, Viana et al. (2014) used an attitudinal questionnaire together with the WA technique to relate consumer attitudes and their perception towards frozen hamburgers with different attributes. In the same direction, Rojas-Rivas et al. (2019) related the perception and attitudes of consumers towards amaranth using the WA technique and an attitudinal questionnaire.

The advantages of using questionnaires, scales or other quantitative methods in conjunction with the WA technique is that they help to deepen the knowledge of consumer behavior, have a holistic perspective on the factors that influence their perception, preferences or attitudes and show the main determinants in the selection of food.

3.4. Validity and stability of the associations in cross-cultural studies

One of the significant challenges when using the WA technique is the stability and validity of the information generated and the extrapolation of the results in different geographical and cultural contexts, even with different consumer samples. Eleven cross-cultural studies were identified that provide information to corroborate that the associations generated by consumers have validity and stability in different geographical and cultural contexts (**RQ3**). Most cross-cultural studies focus on studying the perception or representation of consumers towards concepts in a food context.

3.4.1 The role of culture in the stability of associations

Culture is a fundamental factor in the stability and differences in the associations generated by consumers, which is reflected in the perception and consumption patterns of populations. For example, Antmannn et al. (2011) established that the concept of "creaminess" is associated with dairy products among Uruguayan and Spanish consumers. In addition, these authors identified the same categories/dimensions in both population groups; however, the differences are given in the sensory characteristics perceived towards the concept and the hedonic attitudes of the consumers. Another example is established by Son et al. (2014) towards the perception of rice among consumers in three countries in Asia and one in Europe. For Asian consumers, this product is associated with the agricultural sector, the territory and being essential in food and nutrition. On the other hand, for Europeans, their sensory characteristics are of greater relevance, precisely their appearance (Son et al., 2014).

In the case of gastronomy, Rojas-Rivas et al. (2021) established that there is consensus in the representation of this concept among consumers in two Latin American territories, however, culture is a marker that differentiates the social representations of consumers towards gastronomy. Argentine consumers enjoy gastronomy in restaurants and bars, while Mexican consumers find it in fixed or semi-fixed markets (also known as *tianguis*, they are places that are established one day of the week in a specific area of central Mexico), even on the streets. In addition, for Mexican consumers, gastronomy is part of the culture and the identity, that is represented in a wide range of foods and beverages (Rojas-Rivas and Cuffia, 2022). Even at the regional level in a country, culture differentiates the perception of

consumers towards food (Soares et al., 2017; Bisconsín-Junior et al., 2020; Sánchez-Vega et al., 2020).

On the other hand, Sulmont-Rossé et al. (2019) conducted the largest cross-cultural study, using a sample of more than 8000 participants in 14 countries across all continents. In addition, these authors used balanced samples in terms of gender and age of the participants to avoid a bias in the associations generated towards the concept of "feeling good in a food context". The results show that culture is an element that influences the associations generated by consumers. In highly globalized economies such as the USA, fast food was associated significantly more with this concept and significantly less among European consumers. Furthermore, in European countries, the associations are ambivalent as it is a territory where the Mediterranean diet is associated with good nutrition. Because of this, the concept was associated with the consumption of fruits and vegetables and, in general with good nutrition. However, in some countries of this region, it was also associated with the consumption of "alcohol" and alcoholic beverages, possibly due to its wine culture.

Finally, we present an example that can give indications of the stability of the associations generated with the WA technique over time with cross-cultural studies, as well as those carried out in a country or single region on the concept of traditional foods (Guerrero et al., 2010; Renko et al., 2014; Wang et al., 2016; Serrano-Cruz et al., 2018) (Table 4).

Insert Table 4 around here.

The above-mentioned four studies were carried out at different times and with culturally different populations. The first of them is that of Guerrero et al. (2010), who

identified ten main dimensions associated with the concept of traditional foods. These dimensions are represented in Table 4. Despite being a study within the European continent, the stability of associations is differentiated by culture. For example, in Italy, consumers considered the dimensions "Variety" and "Special consumption occasions" to a lesser extent than in the other five countries. Nevertheless, in all six regions, consumers recognize that these products have a strong connection to the production processes and importance in the heritage of each region.

Renko et al. (2014) used the WA technique to determine the Austrian and Croatian consumer associations towards this food category. Despite using a limited sample of participants and only performing qualitative descriptive analysis of the information, the authors identified some dimensions concerning the previous study. However, in both countries, the "Marketing", "Variety", and "Habit" dimensions were not identified; that is, they are not part of the consumer representations. This result is according to Guerrero et al. (2010) in which the first two dimensions were mentioned to a lesser extent in the six countries.

Wang et al. (2016) studied the consumer associations of two cities in China towards the concepts of "European food" and "traditional food." In this case, only the dimensions obtained towards the second study concept are reported in Table 4. Chinese consumers associated traditional foods mainly with their sensory characteristics, their heritage, their origin, and the importance they have for health due to their consumption. These dimensions agree with the results of Guerrero et al. (2010). "Elaboration," "Habit," and "Basic / simple" were mentioned to a lesser extent by Asian consumers. Furthermore, the dimensions “Symbolic meaning", "Safety”

and "Mood" were only identified among the representations of Chinese consumers towards traditional foods (Wang et al., 2016).

Sulmont-Rossé et al. (2019) established that the sensory characteristics of food are the most critical dimension towards the concept of "feeling good in a food context" among Chinese consumers. These results suggest that the associations generated by consumers are stable even with different food concepts, as people's eating behaviors (for example, traditional foods or feeling good in a food context) are strongly rooted and challenging to modify. That is why the WA technique allows to understand people's eating behaviors, identifying variations according to socio-economic and cultural contexts.

Finally, Serrano-Cruz et al. (2018) also studied the associations of Mexican consumers towards traditional foods. These authors only reported the categories obtained from the word grouping process (qualitative descriptive analysis), agreeing with previous studies on the importance of the categories/dimensions "Heritage", "Origin" and "Health" in the perception of traditional foods. The categories "Habit" and "Sensory characteristics" were also associated to a greater extent by Mexican consumers. The category "Special occasions" was mentioned to a lesser extent, suggesting that these products are a daily part of the diet among this population.

Furthermore, the example presented above also allows to observe that the work of content analysis or triangulation carried out by experts in the word grouping process is fundamental in the stability and validity of the associations/categories between different cultures. Despite the cultural differences that may exist between consumers, it is essential that the experts involved in the analysis of words have experience in these type of exercises in order to avoid misinterpretation which would

lead to a loss of reproducibility of the associations and categories (Mesias and Escribano, 2018).

3.4.2 Stability in the associations according to the type of sampling, data collection and job of experts

Another aspect to highlight in cross-cultural studies is the way in which information is collected. Most studies of this nature are carried out using convenience sampling. This type of sampling allows quick recruitment of participants, establishing inclusion and exclusion criteria for consumers to be part of the study. For example, Son et al. (2014) included only female participants to find out their associations towards rice. On the contrary, Gómez-Corona et al. (2016) did it with male participants to learn about social representations towards craft beer. This information suggests that future cross-cultural research could use random sampling to have a greater representation of the associations generated by consumers in order to obtain stability in the associations over time and the characteristics of the consumers.

Some studies use quota sampling to have defined distributions in some sociodemographic variables such as gender and age (Ares et al., 2015; Sulmont-Roseé et al., 2019). For example, Sulmont-Roseé et al. (2019) established exclusion criteria for the subjects who participated in the experiment: people who should not be related to the food or beverage industry, cosmetics, market research, among others. Furthermore, these authors defined the distribution of the samples in each country in terms of gender and age.

On the other hand, it was observed in cross-cultural studies that information collection is carried out through online platforms, which suggests that the questionnaire is filled out through devices such as cell phones or computers.

Through this method of collecting information it is not possible had a great deal or control during the experiment as consumers could search for information about the presented stimulus on their devices. Even the order of presentation of the questions could bias the results if several stimulus or projective methods are used. Sulmont-Rossé et al. (2019) used five qualitative techniques to find out how consumers define the concept of “feeling good” in a food context, establishing that each question was shown separately to each participant in the online platform used in the experiment, which could reduce bias in consumer responses and contribute to future research in the design of experiments using the WA technique in conjunction with other qualitative tools through online platforms, guaranteeing reliable responses to the product or concept of study.

According to Viana et al. (2015) the application of projective techniques in online platforms provides valuable information on the perception of consumers towards some food product, highlighting its application for future research in order to compare the results obtained from online surveys versus face-to-face/paper ballots exercises using projective methods. In addition, we have observed that in the majority of cross-cultural studies (72%) the work of at least three experts with knowledge of word grouping processes is essential for the stability and validity of associations, regardless of the cultural differences of each territory (which are reflected in the frequencies of each category/dimension) where these studies have been carried out. Only one study uses two researchers to group the words into categories (Gómez-Corona et al., 2016), while in one investigation they do not use experts to group the words, since only the citation frequency of the most mentioned words was calculated and reported. (Ruby et al., 2016). Finally, despite the fact that Renko et al. (2014)

groups the words into categories on the concept of traditional foods, they do not report the use of at least two experts for the grouping of words. Possibly, this is one the reasons why their study do not identify most of the categories of representation of the concept of "traditional foods".

4. Conclusions

This work aimed to present the current state of using the WA technique in food consumer behavior studies. For this, seventy-four papers were identified that use WA in a main or complementary way, focused on understanding consumers' perceptions, attitudes, and behaviors towards different food products. It is observed that the ease of application of this technique allows the study of a diversity of foods or food categories, such as traditional, functional, organic, genetically modified products, among others. Furthermore, it is worth highlighting that its application is very important in the conceptualization of food terms or concepts that lack clarity or that, in its conception, has not been approached from the consumer language.

More than 100 years have passed since this projective technique was developed in the field of psychology and, until now, it continues to be widely used for the study of human behavior since the results obtained are very strong. In sensory and consumer science it is not an exception since it allows obtaining information on consumer’s perception, preferences and attitudes regarding the selection of food products. It is expected that its use will continue to increase in subsequent years because it is a versatile tool that is easy to use and that yields great information on consumer behavior. Furthermore, in cross-cultural studies we have also observed a growing trend in the use of this tool to understand the behavior of the food consumers,

including to explore the perceptions of the fears associated with food choices during the COVID-19 pandemic.

The methods of obtaining consumer associations range from face-to-face interviews and questionnaires to online surveys that allow reaching a larger population. This word elicitation methodology has been used in studies with large sample sizes or cross-cultural studies. However, there is a disparity in word categorization processes in categories/dimensions in several identified studies. Therefore, based on the evidence presented, we suggest that future studies use the 5% frequency of mention as a criterion for grouping words and not losing valuable information.

Three main methods of analysis of word associations were identified, showing the importance that have Chi-Square test (Global Chi-Square and Chi-Square per Cell) and Correspondence Analysis as a fundamental statistical tools for their analysis. Furthermore, a variety of qualitative and quantitative tools have been used in conjunction with the WA technique, specifically in the area of sensory analysis, as well as validated questionnaires and scales such as the Food Choice Questionnaire, Food Neophobia Scale or attitudinal questionnaires.

Cross-cultural studies provide valuable information on the stability and validity of associations by consumers from different geographic and cultural regions. However, more research is needed on this aspect concerning applying the WA technique in food consumer behavior studies. In addition, it is important that the content analysis or triangulation of the words is carried out among experts on the subject to have stability and validity in the results with different samples of consumers.

Summarizing, this narrative review presents information on how the WA technique has been used in the studies of consumer behavior in a food context.

5. Study limitations

The results presented have some limitations that should be considered. First, the selected articles were identified only in four databases (SD, WOL, EI and TF), leaving aside other databases that can provide more information on this technique. Another limitation is that only articles published in English were considered, excluding the existing literature in other languages. Future studies using this technique could focus on investigating cross-cultural associations on a specific concept or food to have more information on the validity and stability of consumer-generated associations.

In addition, this review only showed some of the advantages and disadvantages of the main analysis methods identified for the words generated from the WA technique, such as descriptive qualitative analysis, the Chi Square test and CA. Therefore, future studies could use the information identified in this article to make a systematic comparison between the diversity of methods used for the analysis in order to obtain new results related to projective methods (such as WA technique), and to generate additional information on the consumer behavior.

Finally, another limitation that was not addressed in this article and that could contribute to the validity and stability of the associations is from the studies that have used multiple projective methods to study the perceptions and attitudes of consumers, since the using multiple projective methods could help understand the stability of consumer responses over time.

6. Conflicts of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

7. CRediT author statement

Edgar Rojas-Rivas: Conceptualization, Methodology, Formal analysis, Writing, Review and Editing. **Angélica Espinoza-Ortega:** Formal analysis, Writing, Review and Editing. **Humberto Thomé-Ortiz:** Formal analysis, Writing, Review and Editing. **Facundo Cuffia**: Methodology, Formal analysis, Writing, Review and Editing.

8. Acknowledgements

To the Mexican National Council of Science and Technology (Consejo Nacional de Ciencia y Tecnología - CONACYT) for the scholarship granted to author E. Rojas-Rivas through the program of **Estancias Posdoctorales por México 2021**.

The authors are deeply grateful for the comments made by the three reviewers, which contributed significantly to the improvement of the final version of the article.

9. References

Abdi, H., & Williams, L.J. (2010). *Principal Component Analysis*. Wiley Interdisciplinary Reviews: Computational Statistics. https://doi.org/10.1002/wics.101

Ajzen, I. & Fishbein, M. (1980). *Understanding Attitudes and Predicting Social Behavior*. Prentice-Hall.

Alcaire, F., Antúnez, L., Vidal, L., Velázquez, A. L., Giménez, A., Curutchet, M. R., ... & Ares, G. (2021). Healthy snacking in the school environment: Exploring children and mothers' perspective using projective techniques. *Food Quality and Preference*, 90, 104173. https://doi.org/10.1016/j.foodqual.2020.104173

Alencar, N. M. M., de Araújo, V. A., Faggian, L., da Silveira Araújo, M. B., & Capriles, V. D. (2021). What about gluten-free products? An insight on celiac consumers' opinions and expectations. *Journal of Sensory Studies*, e12664. https://doi.org/10.1111/joss.12664

Antmann, G., Ares, G., Salvador, A., Varela, P., & Fiszman, S. (2011). Exploring and explaning creaminess perception: consumers' underlying concepts. *Journal of Sensory Studies*, 26 (1), 40-47. https://doi.org/10.1111/j.1745-459X.2010.00319.x

Ares, G., & Deliza, R. (2010a). Studying package shape and color influence on consumer expectations of milk desserts using word association and conjoint analysis. *Food Quality and Preference*, 21(8), 930-937.

Ares, G., & Deliza, R. (2010b). Identifying important package features of milk desserts using free listing and word association. *Food Quality and Preference*, 21(6), 621-628. https://doi.org/10.1016/j.foodqual.2010.03.010

Ares, G., & Varela, P. (2018). *Methods in Consumer Research Volume 1*. 1st Edition. Woodhead Publishing. Elsevier.

Ares, G., Barreirio, C., Deliza, R., Giménez, A., & Gambaro, A. (2010). Consumer expectations and perception of chocolate milk desserts enriched with antioxidants. *Journal of Sensory Studies*, 25, 243-260. https://doi.org/10.1111/j.1745-459X.2010.00293.x

Ares, G., De Saldamando, L., Giménez, A., & Deliza, R. (2014). Food and well-being. Towards a consumer-based approach. *Appetite*, 74, 61-69. https://doi.org/10.1016/j.appet.2013.11.017

Ares, G., de Saldamando, L., Giménez, A., Claret, A., Cunha, L. M., Guerrero, L., de Moura, A.P., Oliveira, D.C.R., Symoneaux, R., & Deliza, R. (2015). Consumers' associations with well-being in a food-related context: A cross-cultural study. *Food Quality and Preference*, *40*, 304-315. https://doi.org/10.1016/j.foodqual.2014.06.001

Ares, G., Deliza, R., Barreiro, C., Giménez, A., & Gámbaro, A. (2010). Comparison of two sensory profiling techniques based on consumer perception. *Food Quality and Preference*, 21(4), 417-426. https://doi.org/10.1016/j.foodqual.2009.10.006

Ares, G., Giménez, A., Vidal, L., Zhou, Y., Krystallis, A., Tsalis, G., Symoneaux, R., Cunha, L.M., Pinto, A., Claret, A., Guerrero, L., Cardello, A.V., Wright, A., Jefferies, L., Lloyd, M., Oliveira, D., & Deliza, R. (2016). Do we all perceive food-related wellbeing in the same way? Results from an exploratory cross-cultural study. *Food Quality and Preference*, 52, 62-73. https://doi.org/10.1016/j.foodqual.2016.03.014

Ares, G., Girona, A., Rodríguez, R., Vidal, L., Iragola, V., Machín, L., de León, C., & Bove, I. (2020). Social representations of breastfeeding and infant formula: An exploratory study with mothers and health professionals to inform policy making. *Appetite*, 151. 104683. https://doi.org/10.1016/j.appet.2020.104683

Ares, G., Piqueras-Fiszman, B., Varela, P., Marco, R. M., López, A. M., & Fiszman, S. (2011). Food labels: Do consumers perceive what semiotics want to convey?. *Food Quality and Preference*, 22(7), 689-698. https://doi.org/10.1016/j.foodqual.2011.05.006

Barone, B., Rodrigues, H., Nogueira, R.M., Silva, K.R.L. and Herman, J. (2020). What about sustainability? Understanding consumers' conceptual representations through free word association. *International Journal of Consumer Studies*, 44 (1), 44-52. https://doi.org/10.1111/ijcs.12543

Beh, E. J., & Lombardo, R. (2014). C*orrespondence analysis: Theory, practice and new strategies*. John Wiley & Sons.

Bernal-Gil, N.Y., Favila-Cisneros, H., Zaragoza-Alonso, J., Cuffia, F. & Rojas-Rivas, E. (2020). Using projective techniques and Food Neophobia Scale to explore the

perception of traditional ethnic foods in Central Mexico: A preliminary study on the beverage Sende. *Journal of Sensory Studies*, e12606. https://doi.org/10.1111/joss.12606

Bernardo, C. O., Ascheri, J. L. R., Carvalho, C. W. P., Chávez, D. W. H., Martins, I. B. A., Deliza, R., Freitas, D.G.C., Aparecida, V., & Queiroz, V. A. V. (2019). Impact of extruded sorghum genotypes on the rehydration and sensory properties of soluble beverages and the Brazilian consumers' perception of sorghum and cereal beverage using word association. *Journal of Cereal Science*, *89*, 102793. https://doi.org/10.1016/j.jcs.2019.102793

Bisconsin-Júnior, A., Rodrigues, H., Behrens, J. H., Lima, V. S., da Silva, M. A. A., de Oliveira, M. S., Januário, L.A., Deliza, R., Netto, F.M., & Mariutti, L. R. B. (2020). Examining the role of regional culture and geographical distances on the representation of unfamiliar foods in a continental-size country. *Food Quality and Preference*, 79, 103779. https://doi.org/10.1016/j.foodqual.2019.103779

Bryant, C. J., & Barnett, J. C. (2019). What's in a name? Consumer perceptions of in vitro meat under different names. *Appetite*, 137, 104-113. https://doi.org/10.1016/j.appet.2019.02.021

Celhay, F., & Remaud, H. (2018). What does your wine label mean to consumers? A semiotic investigation of Bordeaux wine visual codes. *Food Quality and Preferenc*e, 65, 129-145. https://doi.org/10.1016/j.foodqual.2017.10.020

Connor, M., and Siegrist, M. (2011). The power of association: Its impact on willingness to buy GM food. *Human and Ecological Risk Assessment: An International Journal*, 17(5), 1142-1155. https://doi.org/10.1080/10807039.2011.605725

da Rosa, P. P., Ávila, B. P., Costa, P. T., Fluck, A. C., Scheibler, R. B., Ferreira, O. G. L., & Gularte, M. A. (2019). Analysis of the perception and behavior of consumers regarding capybara meat by means of exploratory methods. *Meat Science*, 152, 81-87. https://doi.org/10.1016/j.meatsci.2019.02.011

da Silva, V. M., Minim, V. P. R., Ferreira, M. A. M., de Paula Souza, P. H., da Silva Moraes, L. E., & Minim, L. A. (2014). Study of the perception of consumers in relation to different ice cream concepts. *Food Quality and Preference*, *36*, 161-168. https://doi.org/10.1016/j.foodqual.2014.04.008

da Silva, W. P., Pimentel, T. C., da Silva, C. B., Pagani, M. M., da Cruz, A. G., Freitas, M. Q., & Esmerino, E. A. (2021). Story Completion technique: A useful methodology to evaluate the risk perception of consumers from different regions of Brazil about cheeses sold at open markets. *Journal of Sensory Studies*, e12702. https://doi.org/10.1111/joss.12702

Dahiya, P. K., Linnemann, A. R., Nout, M. J., Van Boekel, M. A., Khetarpaul, N. K., & Grewal, R. B. (2014). Consumption habits and innovation potential of mung bean foods in Hisar District of Haryana State, India. *Ecology of Food and Nutrition*, 53(2), 171-192. https://doi.org/10.1080/03670244.2013.807809

Daltoé, M. L. M., Breda, L. S., Belusso, A. C., Nogueira, B. A., Rodrigues, D. P., Fiszman, S., & Varela, P. (2017). Projective mapping with food stickers: A good tool for better understanding perception of fish in children of different ages. *Food Quality and Preference*, 57, 87-96. https://doi.org/10.1016/j.foodqual.2016.12.003

Danes, J. E., Hess, J. S., Story, J. W., & York, J. L. (2010). Brand image associations for large virtual groups. *Qualitative Market Research: An International Journal*, (13), 309-323. https://doi.org/10.1108/13522751011053653

Danner, H., & Menapace, L. (2020). Using online comments to explore consumer beliefs regarding organic food in German-speaking countries and the United States. *Food Quality and Preference*, 83, 103912. https://doi.org/10.1016/j.foodqual.2020.103912

de Albuquerque, J., de Souza, J., de Albuquerque, J., Silva, T., Escalona-Buendia, H., Bosquez-Molina, E. y Morerira, P. (2019). Consumer perception and use of nopal (Opuntia ficus-indica): A cross-cultural study between Mexico and Brazil. *Food Research International*. https://doi.org/10.1016/j.foodres.2018.08.036

de Alcantara, M., Ares, G., de Castro, I.P.L., & Deliza, R. (2020). Gain vs. loss-framing for reducing sugar consumption: Insights from a choice experiment with six product categories. *Food Research International*, 136, 109458. https://doi.org/10.1016/j.foodres.2020.109458

de Andrade, J. C., de Aguiar Sobral, L., Ares, G., & Deliza, R. (2016). Understanding consumers' perception of lamb meat using free word association. *Meat Science*, 117, 68-74. https://doi.org/10.1016/j.meatsci.2016.02.039

Doherty, S., and Nelson, R. (2010). Using projective techniques to tap into consumers' feelings, perceptions and attitudes... getting an honest opinion. *International Journal of Consumer Studies*, 34, 400-404. https://doi.org/10.1111/j.1470-6431.2010.00880.x

Donoghue, S. (2000). Projective techniques in consumer research. *Journal of Family Ecology and Consumer Sciences*, 28, 47–53. https://doi.org/10.4314/jfecs.v28i1.52784

Duarte Alonso, A., Bressan, A. and Sakellarios, N. (2016). A resource-based approach in the context of the emerging craft brewing industry. *European Business Review*, 28 (5), 560-582. https://doi.org/10.1108/EBR-12-2015-0176

Eldesouky, A., Pulido, A.F., & Mesias, F.J. (2015). The Role of Packaging and Presentation Format in Consumers' Preferences for Food: An Application of Projective Techniques, *Journal of Sensory Studies*, 30 (5), 360-369. https://doi.org/10.1111/joss.12162

Escobar-López, S. Y., Espinoza-Ortega, A., Moctezuma-Pérez, S., Chávez-Mejía, C., & Martínez-García, C. G. (2022). Consumers' perception of different types of food markets in Mexico. *International Journal of Consumer Studies*, 46 (1), 147-160. https://doi.org/10.1111/ijcs.12650

Esmerino, E. A., Ferraz, J. P., Tavares Filho, E. R., Pinto, L. P., Freitas, M. Q., Cruz, A. G., & Bolini, H. M. (2017). Consumers' perceptions toward 3 different fermented dairy products: Insights from focus groups, word association, and projective mapping. *Journal of Dairy Science*, 100(11), 8849-8860. https://doi.org/10.3168/jds.2016-12533

Espinoza-Ortega, A. (2021). Nostalgia in food consumption: Exploratory study among generations in Mexico. *International Journal of Gastronomy and Food Science*, 25, 100399. https://doi.org/10.1016/j.ijgfs.2021.100399

Evans, G., Kermarrec, C., Sable, T., & Cox, D.N. (2010). Reliability and predictive validity of the Food Technology Neophobia Scale. *Appetite*, 54 (2), 390-393. https://doi.org/10.1016/j.appet.2009.11.014

Fiszman, S., Carrillo, E., & Varela, P. (2015). Consumer perception of carriers of a satiating compound. Influence of front-of-package images and weight loss-related

information. *Food Research International*, 78, 88-95. https://doi.org/10.1016/j.foodres.2015.11.003

Fiszman, S., Varela, P., Díaz, P., Linares, M.B., & Garrido, M.D. (2014). What is satiating? Consumer perceptions of satiating foods and expected satiety of protein-based meals. *Food Research International*, 62, 551-560. https://doi.org/10.1016/j.foodres.2014.03.065

Gambaro, A. (2018). Projective techniques to study consumer perception of food. *Current Opinion in Food Science*, 21, 46-50. https://doi.org/10.1016/j.cofs.2018.05.004

Gámbaro, A., Roascio, A., Boinbaser, L., Pérez, S., & Parente, E. (2019). Application of two projective techniques in the study of consumer perception of antiperspirant/deodorants. *Journal of Sensory Studies*, 34(1), e12478. https://doi.org/10.1111/joss.12478

García-Barron, S.E., Leyva-Trinidad, D.A., Carmona-Escutia, R.P., Romero-Medina, A., & Villanueva-Rodríguez, S.J. (2021). Evaluation of traditional foods from a consumer's perspective: a review of methods and highlights. British Food Journal, 123, 4451-4465. https://doi.org/10.1108/BFJ-12-2020-1090

Goldner, M. C., Lescano, G., & Armada, M. (2013). Food menus evaluation for most liked products in children from Puna, region of Argentina. *Appetite,* 61, 66-76. https://doi.org/10.1016/j.appet.2012.10.022

Goldner, M.C., Sosa, M., & Garitta, L. (2021). Is it possible to obtain food consumption information through children's drawings? Comparison with the Free Listing. *Appetite*, 160, 105086. https://doi.org/10.1016/j.appet.2020.105086

Gómez-Corona, C., Lelievre-Desmas, M., Escalona-Buendía, H.B., Chollet, S., & Valentin, D. (2016). Craft beer representation amongst men in two different cultures. *Food Quality and Preference*, 53, 19-28. https://doi.org/10.1016/j.foodqual.2016.05.010

Gómez-Corona, C., Rakotosamimanana, V. R., Sáenz-Navajas, M. P., Rodrigues, H., Franco-Luesma, E., Saldaña, E., & Valentin, D. (2021). To fear the unknown: Covid-19 confinement, fear, and food choice. *Food Quality and Preference*, 92, 104251. https://doi.org/10.1016/j.foodqual.2021.104251

Graça, J., Oliveira, A., & Calheiros, M. M. (2015). Meat, beyond the plate. Data-driven hypotheses for understanding consumer willingness to adopt a more plant-based diet. *Appetite*, 90(90), 80–90. https://doi.org/10.1016/j.appet.2015.02.037

Green, B. N., Johnson, C. D. and Adams, A. (2001). Writing narrative literature reviews for peer-reviewed journals: secrets of the trade. *Journal of Sports Chiropractic and Rehabilitation*, 15, 5-19. http://dx.doi.org/10.1016/S0899-3467(07)60142-6

Greenacre, M., & Blasius, J. (2006) Correspondence analysis and related methods in practice, Boca Raton, Chapman & Hall/CRC.

Guerrero, L., Claret, A., Verbeke, W., Enderli, G., Zakowska-Biemans, S., Vanhonacker, F., Issanchou, S., Sajdakowska, M., Granli, B.S., Scalvedi, L., Contel, M., & Hersleth, M. (2010). Perception of traditional food products in six European regions using free word association. *Food Quality and Preference*, 21(2), 225–233. https://doi.org/10.1016/j.foodqual.2009.06.003

Hilverda, F., Jurgens, M., & Kuttschreuter, M. (2016). Word associations with "organic": what do consumers think of?. *British Food Journal*, 118(12), 2931-2948. https://doi.org/10.1108/BFJ-05-2016-0229

Hough, G., & Ferraris, D. (2010). Free listing: A method to gain initial insight of a food category. *Food Quality and Preference*, 21, 295–301. https://doi.org/10.1016/j.foodqual.2009.04.001

Judacewski, P., Los, P. R., Lima, L. S., Alberti, A., Zielinski, A. A. F., & Nogueira, A. (2019). Perceptions of Brazilian consumers regarding white mould surface-ripened cheese using free word association. *International Journal of Dairy Technology*, 72(4), 585-590. https://doi.org/10.1111/1471-0307.12649

Krumreich, F. D., Seifert, M., Santos, R. B., & Gularte, M. A. (2019). Consumers' Impression of Minimally Processed Gala Apples Using Word Association. *Journal of Food Science*, 84(10), 2955-2960. https://doi.org/10.1111/1750-3841.14779

Laguna, L., Fiszman, S., Puerta, P., Chaya, C., & Tárrega, A. (2020). The impact of COVID-19 lockdown on food priorities. Results from a preliminary study using social media and an online survey with Spanish consumers. *Food Quality and Preference*, 86, 104028. https://doi.org/10.1016/j.foodqual.2020.104028

Latorres, J. M., Mitterer-Daltoé, M. L., & Queiroz, M. I. (2016). Hedonic and word association techniques confirm a successful way of introducing fish into public school meals. *Journal of Sensory Studies*, 31(3), 206-212. https://doi.org/10.1111/joss.12204

Lo Monaco, G., & Bonetto, E. (2019). Social representations and culture in food studies. *Food Research International*, 115, 474–479. https://doi.org/10.1016/j.foodres.2018.10.029

Luckett, C. R., & Seo, H. S. (2015). Consumer attitudes toward texture and other food attributes. *Journal of Texture Studies*, *46*(1), 46-57. https://doi.org/10.1111/jtxs.12110

Martins, I. B. A., Oliveira, D., Rosenthal, A., Ares, G., & Deliza, R. (2019). Brazilian consumer's perception of food processing technologies: A case study with fruit juice. *Food Research International*, 125, 108555. https://doi.org/10.1016/j.foodres.2019.108555

Martjin, C., Pasch, S., & Roefts, A. (2016). Sweet Christmas: Do overweight and obese children associate special events more frequently with food than normal weight children?*, *Appetite*, 96, 426-431. https://doi.org/10.1016/j.appet.2015.10.010

McHugh, M. L. (2013). The chi-square test of independence. *Biochemia Medica*, 23, 143–149. https://doi.org/10.11613/BM.2013.018

Melendrez-Ruiz, J., Claret, A., Chambaron, S., Arvisenet, G., & Guerrero, L. (2021). Enhancing assessment of social representations by comparing groups with different cultural and demographic characteristics: A case study on pulses. *Food Quality and Preference*, 92, 104188. https://doi.org/10.1016/j.foodqual.2021.104188

Mesías, F., & Escribano, F. (2018). Projective Techniques. In Ares, G., & Varela, P. (Eds.). *Methods in Consumer Research Volume 1* (pp. 79-102). 1st Edition. Woodhead Publishing. Elsevier. https://doi.org/10.1016/B978-0-08-102089-0.00004-2

Miklavec, K., Pravst, I., Raats, M. M., & Pohar, J. (2016). Front of package symbols as a tool to promote healthier food choices in Slovenia: Accompanying explanatory

claim can considerably influence the consumer's preferences. *Food Research International*, 90, 235–243. https://doi.org/10.1016/j.foodres.2016.10.052

Mitterer-Daltoé, M.L., Carrillo, E., Queiroz, M.I., Fiszman, S., & Varela, P. (2013). Structural equation modelling and word association as tools for a better understanding of low fish consumption. *Food Research International*, 52 (1), 56-63. https://doi.org/10.1016/j.foodres.2013.02.048

Moscovici, S. (1988). Notes towards a description of Social Representations. *European Journal of Social Psychology*, 18, 211–250. https://doi.org/10.1002/ejsp.2420180303

Oliveira, D., Machín, L., Deliza, R., Rosenthal, A., Walter, E.H., Giménez, A., & Ares, G., (2016). Consumers' attention to functional food labels: Insights from eye-tracking and change detection in a case study with probiotic milk. *LWT – Food Science and Technology*, 68, 160-167. https://doi.org/10.1016/j.lwt.2015.11.066

Olsen, N. V., Altintzoglou, T., Almli, V. L., Hersleth, M., Skuland, A., & Honkanen, P. (2015). Dish composition: children's mental representation and expected liking. *British Food Journal*, 117(9), 2361-2371. https://doi.org/10.1108/BFJ-11-2014-0373

Pacheco, M. H., Kuriya, S. P., Capobiango, C. S., Pimentel, T. C., Cruz, A. G., Esmerino, E. A., & Freitas, M. Q. (2018). Exploration of gender differences in bottled mineral water consumption: A projective study of consumer's perception in Brazil. *Journal of Sensory Studies*, 33(4), e12434. https://doi.org/10.1111/joss.12434

Patinho, I., Saldaña, E., Selani, M. M., Teixeira, A. C. B., Menegali, B. S., Merlo, T. C., Rios-Mera, J.D., Dargelio, M.D.B., Rodrigues, H., & Contreras-Castillo, C. J. (2021). Original burger (traditional) or burger with mushroom addition? A social

representation approach to novel foods. *Food Research International*, 147, 110551. https://doi.org/10.1016/j.foodres.2021.110551

Penna, A. C. G., Portel, C. S., Pagani, M. M., Márcico, E. T., Silva, A. C., & Esmerino, E. A. (2021). Impact of food choice and consumption profile on the perception of food coloring on kefir labels: Insights of the projective technique of Product Personality Profiling. *Food Research International*, 110802. https://doi.org/10.1016/j.foodres.2021.110802

Pinto, L. D. P. F., Silva, H. L., Kuriya, S. P., Maçaira, P. M., Cyrino Oliveira, F. L., Cruz, A. G., & Freitas, M. Q. (2018). Understanding perceptions and beliefs about different types of fermented milks through the application of projective techniques: A case study using Haire's shopping list and free word association. *Journal of Sensory Studies*, 33(3), e12326. https://doi.org/10.1111/joss.12326

Piqueras-Fiszman, B., Ares, G., & Varela, P. (2011). Semiotics and perception: Do labels convey the same massages to older and younger consumers? *Journal of Sensory Studies*, 26 (3), 197-208. https://doi.org/10.1111/j.1745-459X.2011.00336.x

Piqueras-Fiszman, B., Velasco, C., Salgado-Montejo, A., & Spence, C. (2013). Using combined eye tracking and word association in order to assess novel packaging solutions: A case study involving jam jars. *Food Quality and Preference*, 28(1), 328-338. https://doi.org/10.1016/j.foodqual.2012.10.006

Pliner, P., & Hobden, K. (1992). Development of a scale to measure the trait of food neophobia in humans. *Appetite*, 19, 105–120. https://doi.org/10.1016/0195-6663(92)90014-W

Polizer, Y.J., Lapa-Guimaraes, J., Noronha, R.L., & Trindade, M.A. (2018). Evaluation of consumers' perception regarding frankfurter sausages with different healthiness attributes, *Journal of Sensory Studies*, 33 (6), e12468. https://doi.org/10.1111/joss.12468

Pontual, I., Amaral, G. V., Esmerino, E. A., Pimentel, T. C., Freitas, M. Q., Fukuda, R. K., Sant'Ana, I.L., Silva, L.G., & Cruz, A. G. (2017). Assessing consumer expectations about pizza: A study on celiac and non-celiac individuals using the word association technique. *Food Research International*, 94, 1-5. https://doi.org/10.1016/j.foodres.2017.01.018

Popoola, I. O., Anders, S., Feuereisen, M. M., Savarese, M., & Wismer, W. V. (2021). Free word association perceptions of red meats; beef is 'yummy', bison is 'lean game meat', horse is 'off limits'. *Food Research International*, 148, 110608. https://doi.org/10.1016/j.foodres.2021.110608

Ragelienė, T. (2021). Do children favor snacks and dislike vegetables? Exploring children's food preferences using drawing as a projective technique. A cross-cultural study. *Appetite*, 165, 105276. https://doi.org/10.1016/j.appet.2021.105276

Rebollar, R., Lidón, I., Gil-Pérez, I., & Martín, J. (2019). How should I tell you this? The effects of the image used to convey that a natural yogurt is sweetened on consumer expectations and willingness to buy. *Food Research International*, *126*, 108721. https://doi.org/10.1016/j.foodres.2019.108721

Renko, S., Cerjak, M., Haas, R., Brunner, F., & Tomić, M. (2014). What motivates consumers to buy traditional food products? Evidence from Croatia and Austria using word association and laddering interviews. *British Food Journal*, 116, 1726-1747. https://doi.org/10.1108/BFJ-02-2014-0090

Riquelme, N., Robert, P., & Arancibia, C. (2022). Understanding older people perceptions about desserts using word association and sorting task methodologies. *Food Quality and Preference*, 96, 104423. https://doi.org/10.1016/j.foodqual.2021.104423

Rivaroli, S., Lindenmeier, J., Hingley, M., & Spadoni, R. (2021). Social representations of craft food products in three European countries. *Food Quality and Preference*, 93, 104253. https://doi.org/10.1016/j.foodqual.2021.104253

Roascio-Albistur, A., Gámbaro, A., & Ivankovish, C. (2019). Consumers' perception of olive oil-based dressings evaluated by complementary techniques: Focus group and word association. *International Journal of Gastronomy and Food Science*, 18, 100176. https://doi.org/10.1016/j.ijgfs.2019.100176

Rocha, C., Moura, A.P., & Cunha, L.M. (2020). Consumers' associations with herbal infusions and home preparation practices. *Food Quality and Preference*, 86, 104006. https://doi.org/10.1016/j.foodqual.2020.104006

Rodrigues, H., Ballester, J., Saenz-Navajaz, M.P. and Valentin, D. (2015). Structural approach of social representation: Application to the concept of wine minerality in experts and consumers. *Food Quality and Preference*, 46, 166-172. https://doi.org/10.1016/j.foodqual.2015.07.019

Rodrigues, H., Cielo, D. P., Gómez-Corona, C., Silveira, A. A. S., Marchesan, T. A., Galmarini, M.V., & Richards, N. S. P. S. (2017). Eating flowers? Exploring attitudes and consumers' representation of edible flowers. *Food Research International*, 100, 227-234. https://doi.org/10.1016/j.foodres.2017.08.018

Roininen, K., Arvola, A. & Lahteenmaki, L. (2006). Exploring consumers' perceptions of local food with two different qualitative techniques: Laddering and word

association. *Food Quality and Preference*, 17(1-2), 20-30. https://doi.org/10.1016/j.foodqual.2005.04.012

Rojas-Rivas, E., Espinoza-Ortega, A., Martínez-García, C. G., Moctezuma-Pérez, S., & Thomé-Ortiz, H. (2018). Exploring the perception of Mexican urban consumers toward functional foods using the Free Word Association technique. *Journal of Sensory Studies*, 33(5), e12439. https://doi.org/10.1111/joss.12439

Rojas-Rivas, E., Espinoza-Ortega, A., Thomé-Ortiz, H., & Moctezuma-Pérez, S. (2019). Consumers' perception of amaranth in Mexico: A traditional food with characteristics of functional foods. *British Food Journal*, 121, 1190-1202. https://doi.org/10.1108/BFJ-05-2018-0334

Rojas-Rivas, E., Rendón-Domínguez, A., Felipe-Salinas, J. A., & Cuffia, F. (2020). What Is Gastronomy? An Exploratory Study of Social Representation of Gastronomy and Mexican Cuisine among Experts and Consumers using a Qualitative Approach. *Food Quality and Preference*, 103930. https://doi.org/10.1016/j.foodqual.2020.103930

Rojas-Rivas, E., Urbine, A., Zaragoza-Alonso, J., & Cuffia, F. (2021). Cross-cultural representations of gastronomy among consumers in two Latin American countries. *Food Research International,* 109881. https://doi.org/10.1016/j.foodres.2020.109881

Rojas-Rivas, E., & Cuffia, F. (2022). Gastronomy: a novel social representation of foods through consumers' language. In: Bhat, R. (Ed.) *Future Foods: Global Trends, Opportunities and Sustainability Challenges* (pp. 411 - 424). Academic Press. Elsevier. https://doi.org/10.1016/B978-0-323-91001-9.00030-X

Ruby, M.B., Alvarenga, M.S., Rozin, P., Kirby, T.A., Richer, E. & Rutsztein, G. (2016). Attitudes toward beef and vegetarians in Argentina, Brazil, France, and the USA. *Appetite*, 96, 546-554. https://doi.org/10.1016/j.appet.2015.10.018

Saldaña, E., Martins, M. M., Behrens, J. H., Valentin, D., Selani, M. M., & Contreras-Castillo, C. J. (2020). Looking at non-sensory factors underlying consumers' perception of smoked bacon. *Meat Science*, 163, 108072. https://doi.org/10.1016/j.meatsci.2020.108072

Sales, Y. J. D., Corrêa, F. J. B., Tavares-Filho, E. R., Soares, P. T. S., Durço, B. B., Pagani, M. M., ... & Esmerino, E. A. (2020). Insights of Brazilian consumers' behavior for different coffee presentations: An exploratory study comparing hard laddering and completion task. *Journal of Sensory Studies*, 35(6), e12611. https://doi.org/10.1111/joss.12611

Sánchez-Vega, L. P., Espinoza-Ortega, A., Thomé-Ortiz, H., & Moctezuma-Pérez, S. (2021). Perception of traditional foods in societies in transition: The maize tortilla in Mexico. *Journal of Sensory Studies*, 36(2), e12635. https://doi.org/10.1111/joss.12635

Santosa, M., Clow, E. J., Sturzenberger, N. D., & Guinard, J. X. (2013). Knowledge, beliefs, habits and attitudes of California consumers regarding extra virgin olive oil. *Food Research International*, 54(2), 2104-2111. https://doi.org/10.1016/j.foodres.2013.07.051

Sass, C. A., Pimentel, T. C., Guimarães, J. T., Silva, R., Pagani, M. M., Silva, M. C., Queiroz, M.F., Cruz, A.G., & Esmerino, E. A. (2021). How buyer-focused projective techniques can help to gain insights into consumer perceptions about different types

of eggs. *Food Research International*, 144, 110320. https://doi.org/10.1016/j.foodres.2021.110320

Sato, P., Gittelsohn, J., Fernandez, R., Roble, O.J., & Baeza, F. (2016). The use of Pierre Bourdieu's distinction concepts in scientific articles studying food and eating: A narrative review. *Appetite*, 96, 174-186. http://dx.doi.org/10.1016/j.appet.2015.09.010

Schlinkert, C., Gillebaart, M., Benjamins, J., Poelman, M., & de Ridder, D. (2020). The snack that has it all: People's associations with ideal snacks. *Appetite*, 152, 104722. https://doi.org/10.1016/j.appet.2020.104722

Schmitt, N. (1998). Quantifying word association responses: what is native-like? *System*, 26 (3), 389-401. https://doi.org/10.1016/S0346-251X(98)00019-0

Schnettler, B., Hueche, C., Andrades, J., Ares, G., Miranda, H., Orellana, L., & Grunert, K.G. (2020). How is satisfaction with food-related life conceptualized? A comparison between parents and their adolescent children in dual-headed households. *Food Quality and Preference*, 86, 104021. https://doi.org/10.1016/j.foodqual.2020.104021

Serrano-Cruz, M. R., Espinoza-Ortega, A., Sepúlveda, W. S., Vizcarra-Bordi, I., & Thomé-Ortiz, H. (2018). Factors associated with the consumption of traditional foods in central Mexico. *British Food Journal*, 120, 2695-2709. https://doi.org/10.1108/BFJ-11-2017-0663

Sester, C., Dacremont, C., Deroy, O., & Valentin, D. (2013). Investigating consumers' representations of beers through a free association task: Comparing packaging and blind conditions. *Food Quality and Preference*, 28(2), 475-483. https://doi.org/10.1016/j.foodqual.2012.11.005

Soares, E., Esmerino, E., Ferrreira, M.V., da Silva, M.A., Freitas, M., & Cruz, A. (2017). What are the cultural effects on consumers' perceptions? A case study covering coalho cheese in the Brazilian northeast and southeast area using word association. *Food Research International*, 102, 553-558. https://doi.org/10.1016/j.foodres.2017.08.053

Son, J. S., Do, V. B., Kim, K. O., Cho, M. S., Suwonsichon, T., & Valentin, D. (2014). Understanding the effect of culture on food representations using word associations: The case of “rice” and “good rice”. *Food Quality and Preference*, *31*, 38-48. https://doi.org/10.1016/j.foodqual.2013.07.001

Steptoe, A., Pollard, T., & Wardle, J. (1995). Development of a measure of the motives underlying of the selection of food: the food choice questionnaire, *Appetite*, 25 (3), 267-284. https://doi.org/10.1006/appe.1995.0061

Stone, H., & Sidel, J.L. (2004). *Sensory Evaluation Practices*, 3rd Edition. Orlando, FL. Academic Press.

Sulmont-Rossé, C., Drabek, R., Almli, V. L., van Zyl, H., Silva, A. P., Kern, M., McEwan, J.A., & Ares, G. (2019). A cross-cultural perspective on feeling good in the context of foods and beverages. *Food Research International*, 115, 292-301. https://doi.org/10.1016/j.foodres.2018.12.012

Symoneaux, R., Galmarini, M. V., & Mehinagic, E. (2012). Comment analysis of consumer’s likes and dislikes as an alternative tool to preference mapping. A case study on apples. *Food Quality and Preference*, 24, 59–66. https://doi.org/10.1016/j.foodqual.2011.08.013

Temple, N. (2020). Front-of-package food labels: A narrative review. *Appetite*, 144, 104485. https://doi.org/10.1016/j.appet.2019.104485

ten Kleij, F., & Musters, P. A. D. (2003). Text analysis of open-ended survey responses: A complementary method of preference mapping. *Food Quality and Preference*, 43, 43–52. https://doi.org/10.1016/S0950-3293(02)00011-3

Tiyo de Godoy, N., Veneziano, A. L., da Cunha Rodrigues, L., Schoffen Enke, D. B., & Lapa-Guimarães, J. (2019). QIM, CATA, and Word Association methods for quality assessment of flathead gray mullet (Mugil cephalus): Going beyond the trained panel. *Journal of Sensory Studies*, 34 (2), e12482. https://doi.org/10.1111/joss.12482

Upshaw, D.C., Hardy, M. & Habig, P. (2018). Projective research: using the past to teach in the present. *Marketing Education Review*, 28 (2), 115-119. https://doi.org/10.1080/10528008.2018.1448284

Varela, P., & Ares, G. (2012). Sensory profiling, the blurred line between sensory and consumer science. A review of novel methods for product characterization. *Food Research International*, 48, 893-908. https://doi.org/10.1016/j.foodres.2012.06.037

Varela, P., & Fiszman, S. M. (2013). Exploring consumers' knowledge and perceptions of hydrocolloids used as food additives and ingredients. *Food Hydrocolloids*, 30(1), 477-484. https://doi.org/10.1016/j.foodhyd.2012.07.001

Viana, M.M., dos Santos, V., & Trindade, M.A. (2014). Consumers' perception of beef burgers with different healthy attributes. *LWT – Food Science and Technology*, 59, 1227-1232. https://doi.org/10.1016/j.lwt.2014.05.009

Viana, M.M., Silva, V., Deliza, R., & Trindade, M.A. (2016). The use of an online completion test to reveal important attributes in consumer choice: An empirical study on frozen burgers. *Food Quality and Preference*, 52, 255-261. https://doi.org/10.1016/j.foodqual.2015.11.016

Vidal, L., Ares, G., & Giménez, A. (2013). Projective techniques to uncover consumer perception: Application of three methodologies to ready-to-eat salads. *Food Quality and Preference*, 28, 1-7. https://doi.org/10.1016/j.foodqual.2012.08.005

Wang, O., Gellynck, X., & Verbeke, W. (2016). Perceptions of Chinese traditional food and European food among Chinese consumers. *British Food Journal*, 118, 2855-2872. https://doi.org/10.1108/BFJ-05-2016-0180

Zocchi, D. M., Piochi, M., Cabrino, G., Fontefrancesco, M. F., & Torri, L. (2020). Linking producers' and consumers' perceptions in the valorisation of non-timber forest products: An analysis of Ogiek forest honey. *Food Research International*, 137, 109417. https://doi.org/10.1016/j.foodres.2020.109417

Figure 1. Flowchart of procedure of an exercise with the Word Association technique.

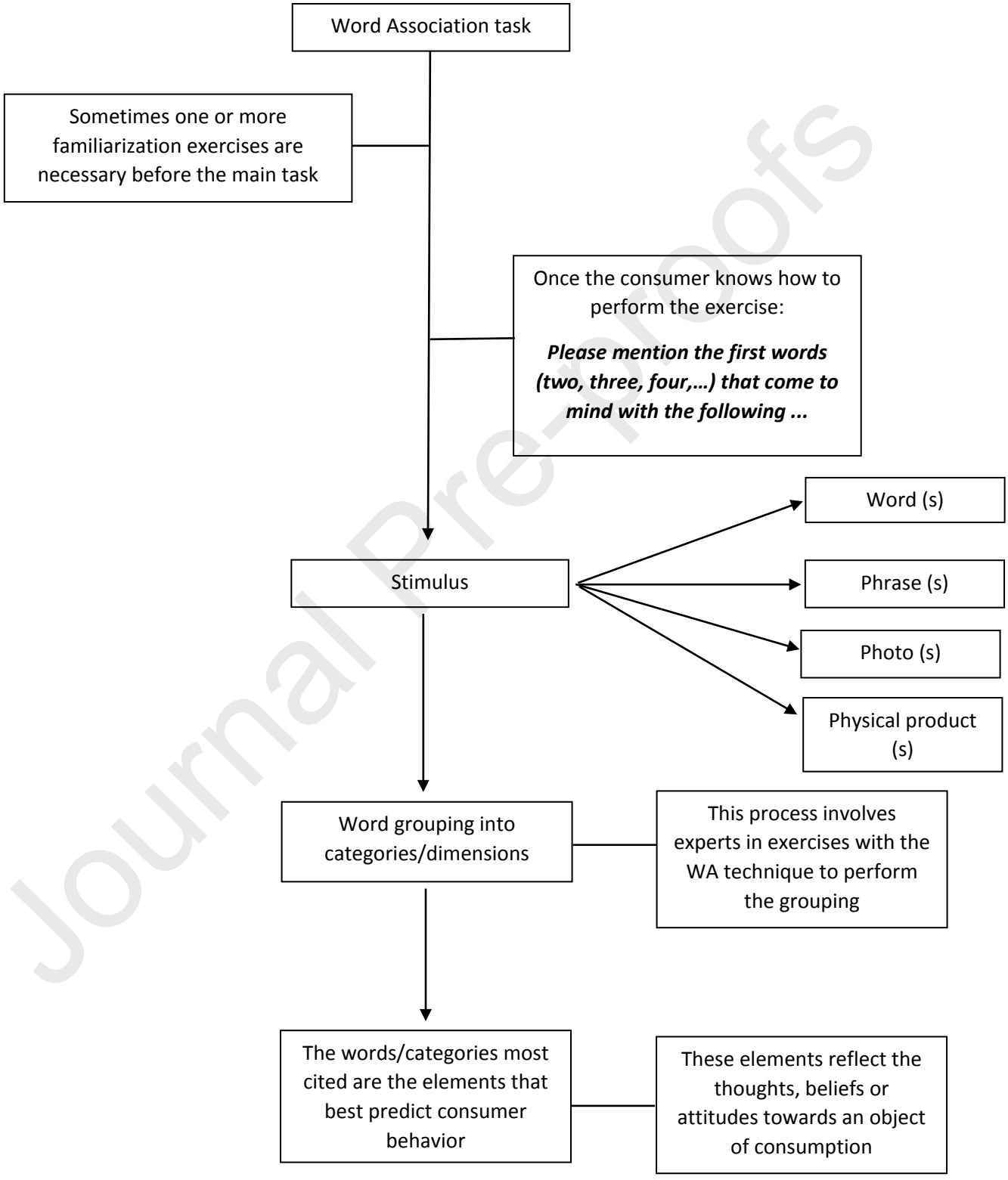


Figure 2. Process of search and selection of articles in the four databases.

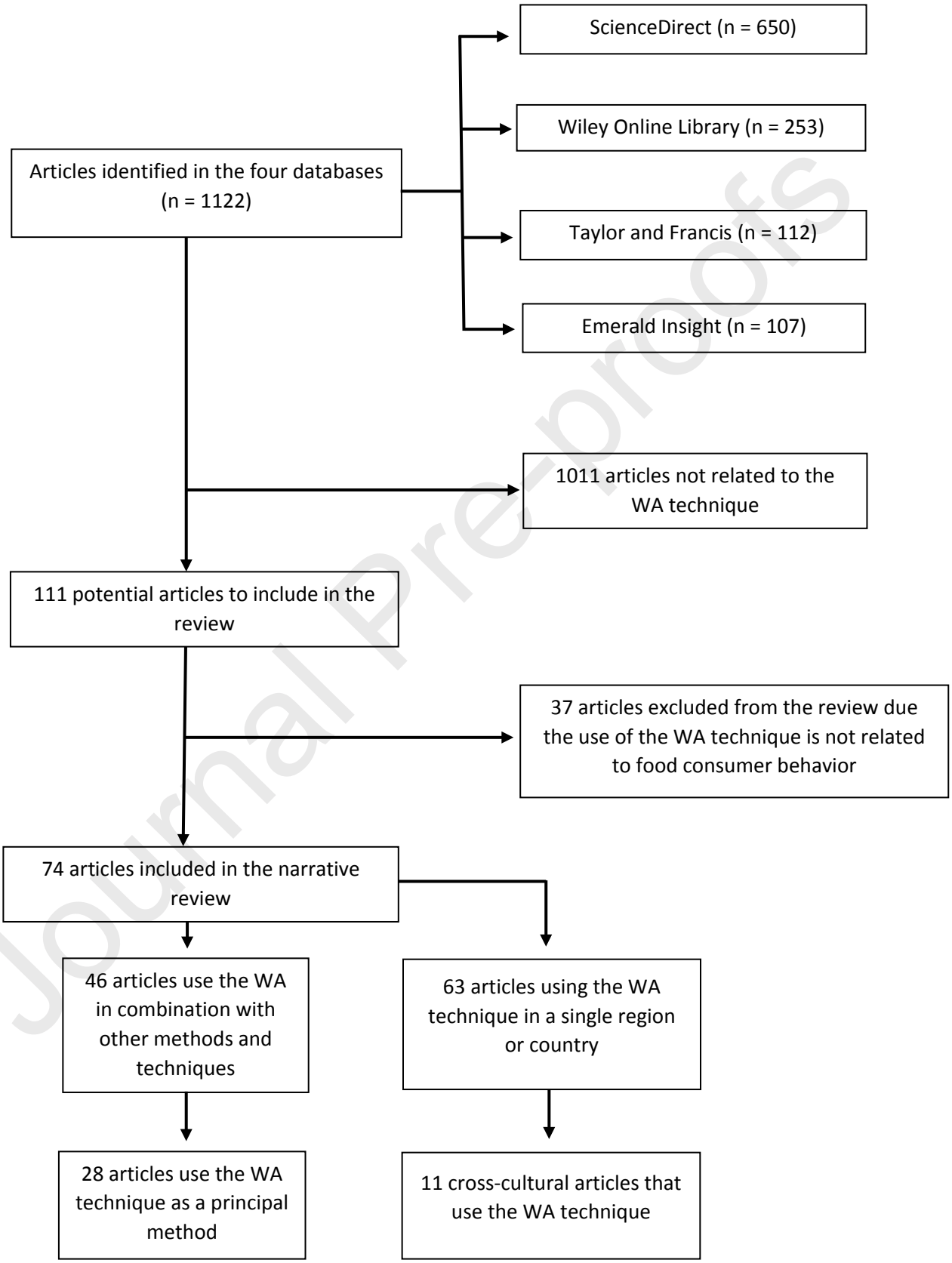


Figure 3. Articles identified in the four databases per year.

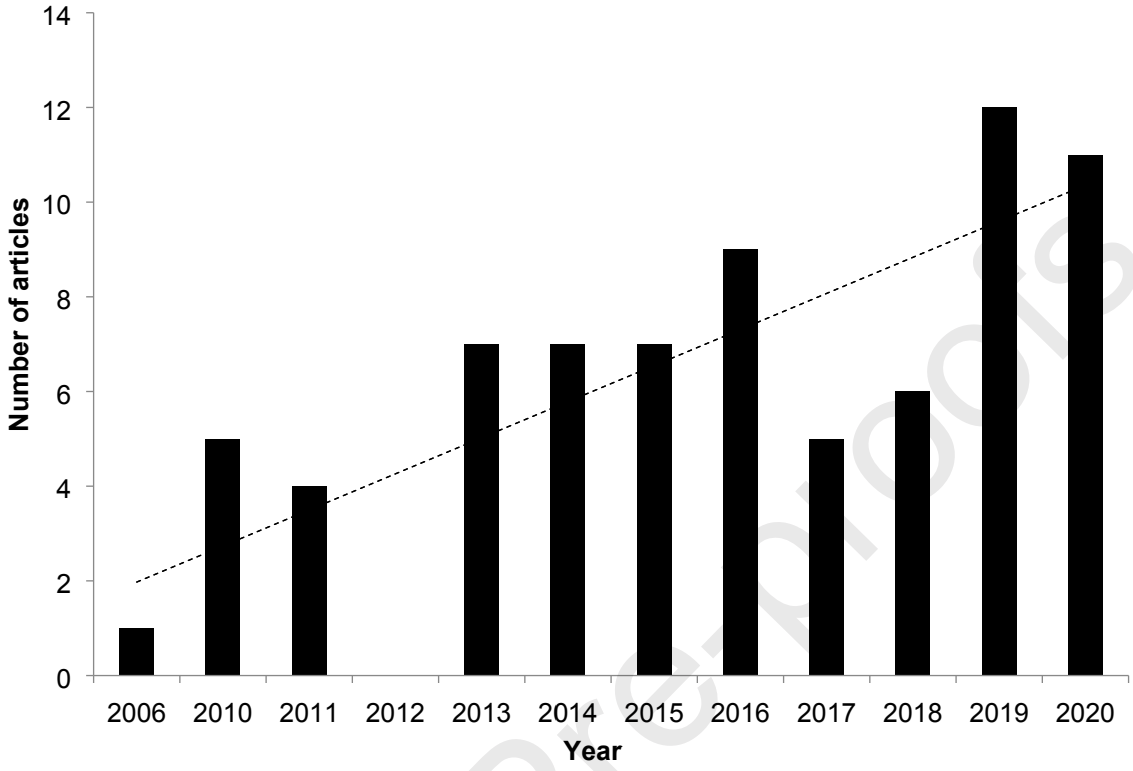
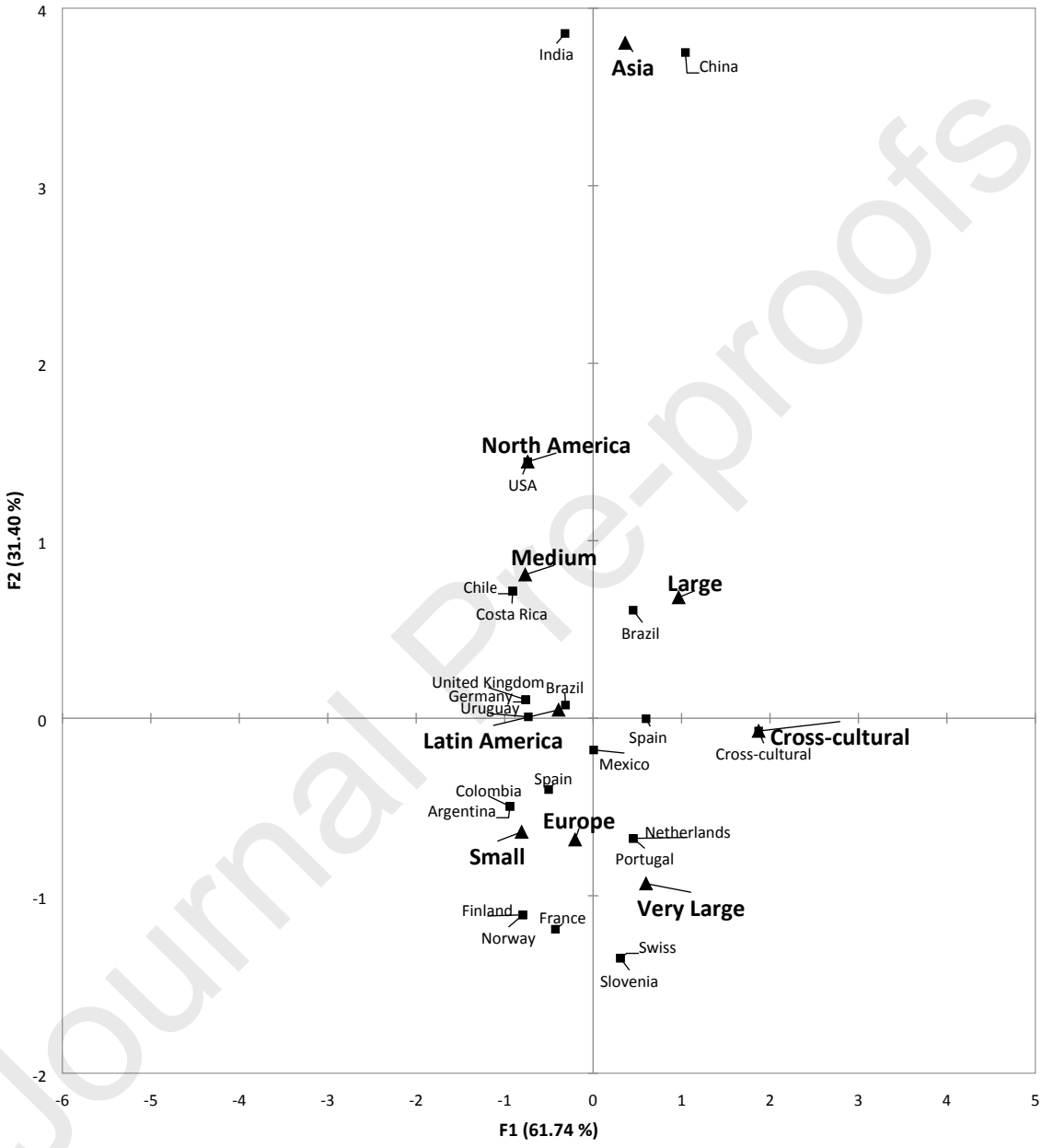


Figure 4. Multiple Correspondence Analysis (MCA) of the articles identified according to the sample size and the study country/region.



Note: the variable with the categories *Small, Medium, Large* and *Very large* indicates the studies that were categorized according to the sample size used. The regions indicate where each study was conducted.

Figure 5. Primary and complementary methods for the analysis of information from the WA technique.

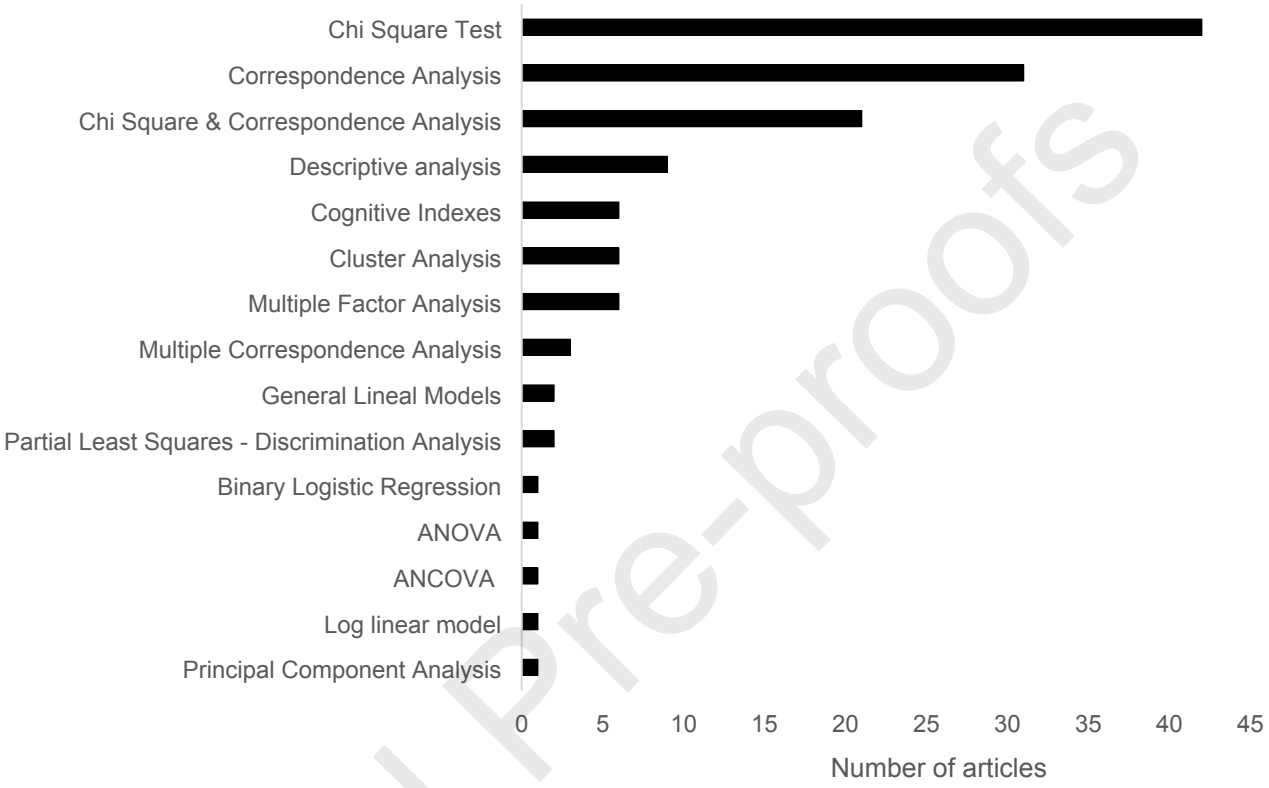


Figure 6. Methods for the analysis of information from the WA technique.

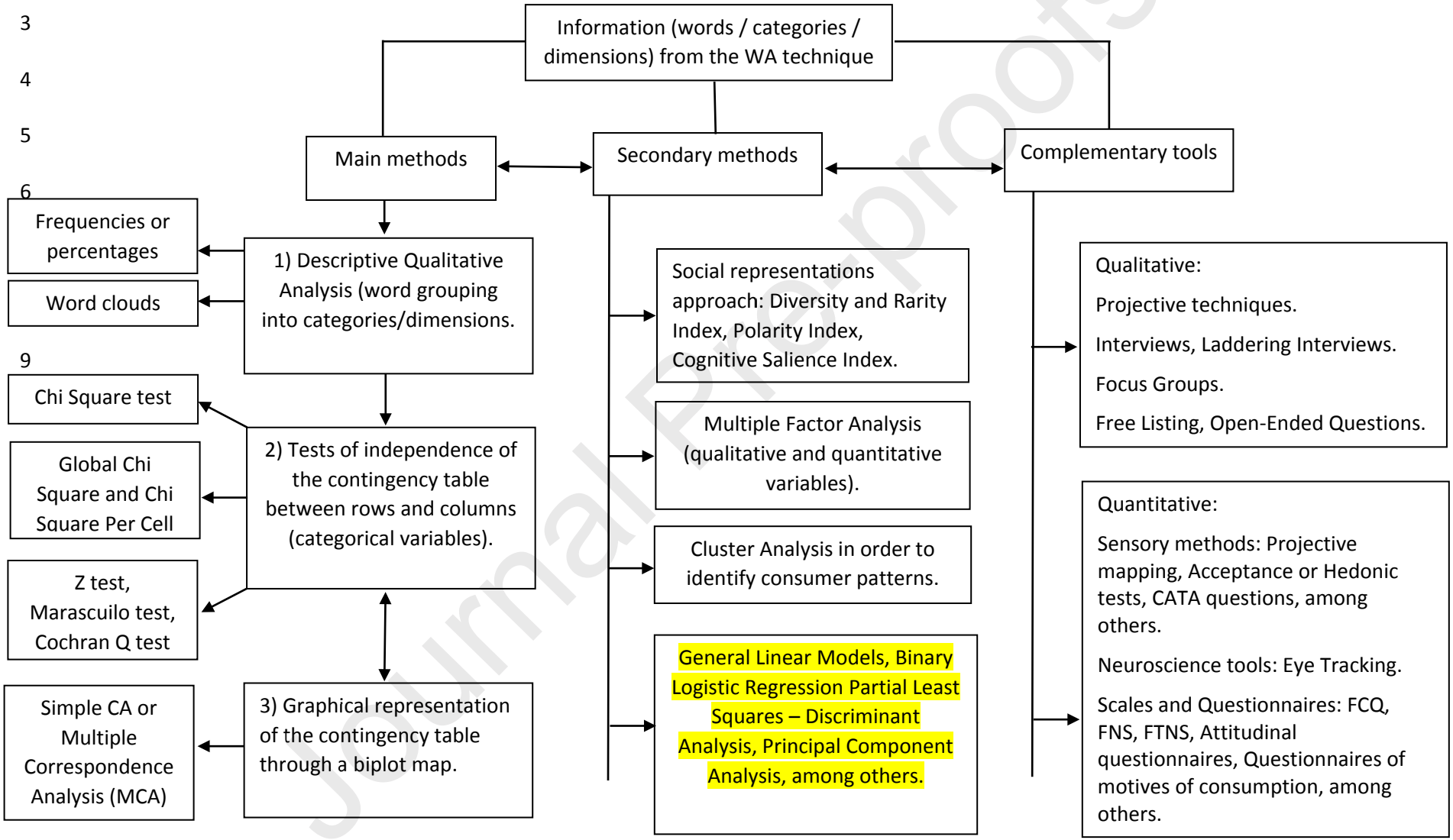


Figure 7. Example of the use of Chi-Square test and Correspondence Analysis in the contingency table of categories generated through a WA task.

7.1. Observed and expected frequencies

Category/product	A	B	C	D
1	5 (9.62)	15 (13.52)	18 (12.92)	8 (9.92)
2	10 (6.69)	11 (9.41)	7 (8.99)	4 (6.90)
3	9 (6.90)	6 (9.70)	5 (9.27)	13 (7.11)
4	5 (6.27)	6 (8.82)	11 (8.43)	8 (6.47)
5	3 (2.50)	7 (3.52)	2 (3.37)	0 (2.58)

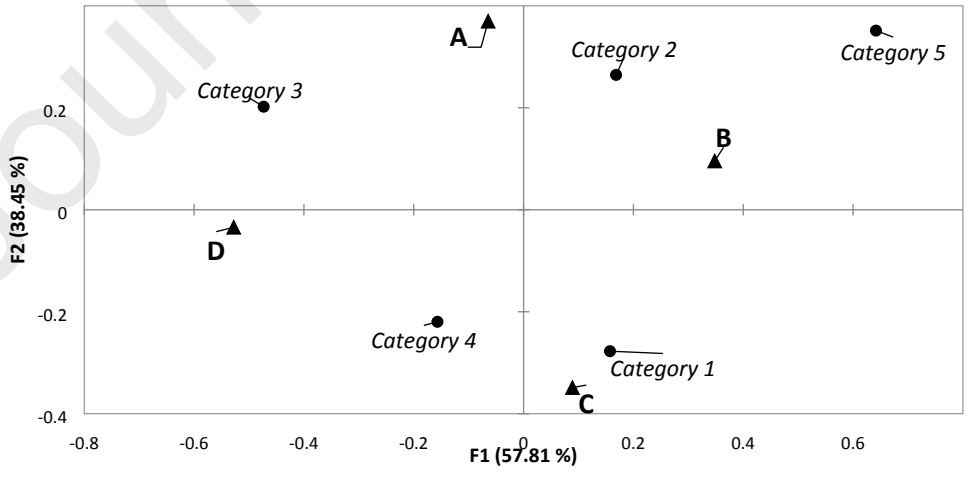
Expected frequencies are in brackets

7.2. Global Chi Square and Chi Square per Cell tests

Category/product	A	B	C	D
1	5 (-)*	15	18	8
2	10	11	7	4
3	9	6	5(-)*	13(+)*
4	5	6	11	8
5	3	7	2	0(-)**

Global Chi Square observed = 26.151, Theoretical Global Chi Square = 21.026. DF = 12, *P* value = 0.010.
Signs (+) or (-) indicate if the observed frequencies were higher or lower than the theoretical frequencies according to the Chi Square per Cell test.
Statistically significant differences = * $P<0.05$, ** $P<0.01$

7.3. Correspondence Analysis



Graphical representation of the contingency table between the categories identified through the WA technique and the products evaluated. The CA identified two factors that explained 96.29% of the inertia of the table.

33 **Table 1. Matrix of the studies included in the narrative review.**

Regional or Cross-cultural study	Number of subjects	Objective	Application of WA task	χ2	CA	Categories (%)	Food or food category of study	Reference
Finland	25 (+)	Establish the personal values, meanings, and specific benefits of consumers towards local foods	Personal interviews	No	No	8%	Local foods (local, organic, intensive, and conventional)	Roininen et al. (2006)
USA	196	Understand the perception and attitude towards brands using associations of virtual groups	Online survey	No	No	Not specified	Brands of fast food	Danes et al. (2010)
Uruguay	105 (+)	Application of WA to identify consumers' expectations towards milk desserts and the influence of package shape and color	Laboratory of sensory analysis	No	No	10%	Milk dessert package	Ares & Deliza (2010a)
Uruguay	100 (+)	Identify consumers' perception of the packaging of milk desserts using WA and free listing to compare both methodologies later	Convenience sampling in universities and public places	Yes	No	10%	Milk desserts	Ares & Deliza (2010b)
Cross-cultural	721 (+)	Identify consumers' associations to the concept "traditional" in a food-related context in six regions of Europe	Convenience sampling with quotas in each region	Yes	Yes	5%	Traditional foods (six regions in Europe)	Guerrero et al. (2010)
Uruguay	75 (=)	Investigate consumers' expectations towards chocolate milk desserts enriched with antioxidants	Central Location Test	Yes	No	10%	Milk desserts enriched with antioxidants (functional foods)	Ares et al. (2010)
Cross-cultural	227 (+)	Understand how consumers in Spain and Uruguay define the concept of creaminess and what products are classified as creamy	Convenience sampling with quotas	Yes	No	5%	Creaminess concept	Antmann et al. (2011)
Cross-cultural	200 (+)	Investigate whether the labels successfully convey the intended message using natural yogurt as a case study among consumers in Spain and Uruguay	Online survey	No	Yes	5%	Messages on yogurt labels	Ares et al. (2011)
Swiss	654 (-)	Investigate the free associations evoked by the term biotechnology and how it influences consumer behavior	Face to face interviews	No	Yes	1.9%	Genetically modified foods (chocolate)	Connor & Siegriest (2011)

Spain	101 (+)	Study different symbols of food labels among consumers of different age groups	Face to face questionnaire	Yes	No	5%	Semiotics and labeling symbols of natural yogurt	Piqueras-Fizman et al. (2011)
Argentina	20 (+)	Investigate the acceptability and preference among various menus for children between 11-14 years old	Laboratory of sensory analysis	No	Yes	Not specified	20 types of menu (14 main dishes and six desserts)	Goldner et al. (2013)
Uruguay	169 (+)	Study consumers, perception, and motivations to buy a ready-to-eat salad using three projective techniques (WA, completion, and Haire's shopping list)	Online survey	No	No	5%	Salad ready-to-eat	Vidal et al. (2013)
France	67 (+)	To evaluate the mental representations of consumers towards different types of beer, investigating extrinsic and intrinsic attributes with the word association technique	Laboratory of sensory analysis	Yes	Yes	5%	14 commercial beers	Sester et al. (2013)
Colombia	50 (-)	Study the perception of consumers about different food packaging using the strawberry jam as a case study	Laboratory of sensory analysis	No	No	10%	16 images of jam jars	Piqueras-Fiszman et al. (2013)
Spain	140	Identify consumer associations towards hydrocolloids used as thickeners in foods	Online survey	No	No	Not specified	Hydrocolloids used as food additives	Varela & Fiszman (2013)
USA	35 (+)	Understand relevant factors that affect the purchase of extra virgin olive oil among American consumers	Focus groups	No	No	Not specified	Extra virgin olive oil	Santosa et al. (2013)
Brazil	200 (+)	Develop a model to understand consumer behavior in the selection of fish products, identifying their perception through the word association technique	Face to face questionnaires	No	No	5%	Fish products (*Engraulis Anchoita*)	Mitterer-Daltoé et al. (2013)
Brazil	56 (+)	Study the perception of consumers towards frozen meat burgers with different healthy attributes	Laboratory of sensory analysis	No	No	5%	Frozen burgers with healthy attributes	Viana et al. (2014)
Cross-cultural	59 (+)	Explore the differences between the perception and motives of consumers regarding the purchase of traditional foods in Austria and Croatia	Face to face interviews	No	No	3%	Traditional foods (Austria and Croatia)	Renko et al. (2014)
Uruguay	120 (=)	Study how consumers understand the concept of well-being in a food context	Face to face questionnaires	No	No	5%	Concept of well-being in a food-related context	Ares et al. (2014)
Spain	200	Evaluate the perceptions of the word "satiating" among experts in the area of food science and technology and non-experts	Laboratory of sensory analysis	Yes	No	10%	Eight dishes with four types of protein	Fiszman et al. (2014)

Cross-cultural	195 (+)*	Study the perception of consumers towards "rice" and "good rice" in two different cultures	Face to face interviews	Yes	Yes	15%	Rice	Son et al. (2014)
Brazil	224 (+)	Evaluate the perception of consumers towards seven food concepts using the WA technique	Convenience sampling in public places	Yes	Yes	10%	Seven concepts of ice-creams	da Silva et al. (2014)
India	152 (=)	Assessing mung bean consumption habits with the WA technique	Interviews with structured questionnaires	Yes	Yes	Not specified	14 mung bean food products	Dahiya et al. (2014)
Spain	203 (+)	Evaluate two projective techniques – WA and completion techniques – to study consumers' expectations about food packaging	Online survey	No	No	5%	Food packaging	Eldesouky et al. (2015)
USA	337 (+)	Examine current attitudes of North American consumers towards food texture and other attributes	Online survey	Yes	Yes	4-5%	32 different foods	Luckett & Seo (2015)
Norway	89 (=)	Investigate how plant components (carrot and broccoli) influence children's associations and the expected taste of two typical Norwegian dishes (meatballs and salmon)	Central Location Test	No	Yes	5%	Experimental design of four dishes	Olsen et al. (2015)
Portugal	410 (+)	Study the mental representations of consumers towards meat	Online survey	No	No	9%	Meat	Graça et al. (2015)
Cross-cultural	755 (+)	Explore cross-cultural consumer associations in five countries with the concept of well-being in a food-related	Face-to-face questionnaires/ Online survey	Yes	Yes	5%	Concept of well-being in a food-related context	Ares et al. (2015)
Spain	42 (+)	Gain insight into consumer perception of Glucomannan, a functional ingredient that is recognized for helping to lose weight	Face to face questionnaires	Yes	No	5%	Dietary supplements (case of konjac glucomannan)	Fiszman et al. (2015)
France	87 (-)	Understand the meaning of the concept of the "minerality" of wine in different social groups through the Theory of Social Representations	Face to face interviews	No	No	Not specified	Concept of the minerality of red wine	Rodrigues et al. (2015)
Brazil	132 (+)	Evaluate the acceptance of fish meatballs introduced at lunch to children between 6 and 14 years of a public school	Face to face questionnaires	No	Yes	5%	Fish meatballs	Latorres et al. (2016)
China	302 (+)	Obtain the perceptions associated with traditional Chinese and European foods from Chinese consumers	Online survey	Yes	Yes	3%	Traditional Chinese food and European food	Wang et al. (2016)

Netherlands	206 (+)	Examine the word associations consumers have towards organic foods	Online survey	Yes	No	4%	Organic foods	Hilverda et al. (2016)
Slovenia	1050 (-)	Examine the familiarity and perception of the "protective food symbol" in Slovenia, consumer associations with the symbol, and how these associations influence their consumption decisions	Online survey Consumer panel	Yes	No	Not specified	Three front packaging symbols on healthy food	Miklavec et al. (2016)
Brazil	1025 (+)	Study the perception that Brazilian consumers have about lamb meat	Online survey	Yes	No	5%	Lamb meat	de Andrade et al. (2016)
Germany	111 (+)	Study the spontaneous associations of children towards special events with food.	Face to face interview	No	No	Not specified	Food associations at special events	Martjin et al. (2016)
Cross-cultural	1695 (+)	Investigate consumer attitudes towards meat and vegetarianism through WA	Online survey	No	No	Not specified	Meat and vegetarianism concept	Ruby et al. (2016)
Uruguay	60 (+)	Study the attention to the labeling of functional foods using probiotic milk as a case study	Laboratory of sensory analysis	Yes	No	15%	Functional food labeling: a case of probiotic milk	Oliveira et al. (2016)
Cross-cultural	300 (-)	Study the social representations of craft beers among male consumers in Mexico and France	Central Location Test	Yes	Yes	1.7%	Craft beers	Gómez-Corona et al. (2016)
Brazil	549 (=)	Investigate the dimensions of social representations using as cases food made with edible flowers and yogurt with edible flowers using the WA technique	Central Location Test	Yes	No	1%	Food with edible flowers/ Yogurt with edible flowers	Rodrigues et al. (2017)
Brazil	149 (-)	Understand the perception towards fish products among school children of three different age groups	Face to face interviews	Yes	Yes	5%	Fish food	Daltoé et al. (2017)
Brazil	150	Investigate the perception of two groups of consumers: celiac and non-celiac, towards different pizza flours	Online survey/Face to face questionnaires	Yes	Yes	10%	Pizza dough for celiac and non-celiac consumers	Pontual et al. (2017)
Brazil	50 (+)	Identify consumers' perception towards three fermented products using three methodologies: WA, projective mapping, and focus groups	Laboratory of sensory analysis	Yes	Yes	5%	Three fermented beverages	Esmerino et al. (2017)
Brazil	400(+)	Study the influence of regional culture on consumers perceptions of coalho cheese	Online survey	Yes	No	5%	Coalho cheese	Soares et al. (2017)

Brazil	100 (+)	Identify differences in the perception of consumers towards bottled water according to gender	Laboratory of sensory analysis	Yes	No	5%	Bottled mineral water	Pacheco et al. (2018)
Brazil	120 (+)	Evaluate the perception of consumers towards frankfurter sausages with different healthiness attributes	Laboratory of sensory analysis	Yes	No	10%	Frankfurter sausages with different healthy attributes	Polizer et al. (2018)
Brazil	100 (+)	Evaluate the perception and elucidate the profile of buyers of different types of fermented milk through WA and Haire's Shopping List	Online survey	Yes	No	5%	Fermented milk	Pinto et al. (2018)
Mexico	610 (=)	Explore the perception of Mexican consumers towards functional foods using the WA technique	Face to face questionnaire	Yes	Yes	5%	Functional foods	Rojas-Rivas et al. (2018)
Mexico	512 (+)	Identify the factors associated with the consumption of traditional foods among the Mexican population	Face to face questionnaire	No	No	2%	Mexican traditional foods	Serrano-Cruz et al. (2018)
France	932 (-)	Identify the meanings of the visual codes of Bordeaux wine	Online survey	No	Yes	1%	Meanings of wine labels	Celhay & Ramaud (2018)
Cross-cultural	8325 (=)	Explore the conceptualization of the term "feeling good" from the language of consumers in a cross-cultural context	Online survey	Yes	No	15%	Concept of "feeling good" in a food-related context	Sulmont-Rossé et al. (2019)
Brazil	408 (+)	Understand the perceptions and choices of Brazilian consumers regarding mature cheeses with a white mold surface using the WA method	Online survey	Yes	No	5%	White mould surface-ripened cheeses	Judacewski et al. (2019)
Brazil	607 (+)	Identify the perception and preferences of consumers towards minimally processed Gala apples	Online survey	Yes	Yes	1%	Gala apples	Krumreich et al. (2019)
Brazil	112 (+)	Verify how untrained assessors perform quality assessment of gray mullet	Laboratory of sensory analysis	Yes	Yes	10%	Flathead gray mullet with different degrees of freshness	Tiyo de Godoy et al. (2019)
Mexico	610 (=)	Identify consumers' perception of amaranth and its relationship with the motives for consumption	Face to face questionnaires	Yes	Yes	5%	Amaranth: traditional Mexican food with functional properties (functional foods)	Rojas-Rivas et al. (2019)

Brazil	1200 (+)	Study consumer perception and behavior regarding the consumption of capybara meat	Online survey through social networks	No	No	5%	Capybara meat	da Rosa et al. (2019)
Brazil	423 (+)	Explore the spontaneous associations of consumers towards fruit juices made with new food technologies and how the level of neophobia influences these associations	Online survey	Yes	Yes	5%	Fruit juice made with novel food technologies	Martins et al. (2019)
Brazil	477 (+)	Evaluation of the potential of sorghum for the preparation of beverages	Online survey	Yes	No	5%	Use of sorghum for the elaboration of beverages	Bernardo et al. (2019)
Cross-cultural	400 (+)	Study the perception of consumers in Mexico and Brazil towards nopal (*Opuntia ficus-indica*)	Online survey	Yes	Yes	5%	Nopal Cookies made with nopal	de Albuquerque et al. (2019)
United Kingdom	185 (-)	Study the perception of consumers towards in vitro meat under different names	Online survey	No	No	1.6%	In vitro meat grown from animal cells	Bryant & Barnett (2019)
Spain	112 (+)	Assess how packaging imagery used to convey that a natural yogurt is sweetened influences consumer expectations and willingness to buy	Online survey	No	No	4%	Labels of yogurts	Rebollar et al. (2019)
Costa Rica	124 (+)*	Compare the methodologies of focus groups with word association to understand consumers' perception towards dressings with olive oil	Online survey	No	Yes	5%	Dressings with olive oil	Roascio-Albistur et al. (2019)
Brazil	150 (+)	Explore the conceptualization of the term "sustainability" among Brazilian urban consumers using the WA technique	Face to face interviews	No	Yes	5%	Concept of sustainability	Barone et al. (2020)
Brazil	150 (+)	Study the influence of non-sensory factors on consumer behavior towards smoked bacon	Online survey	No	No	2%	Smoked bacon	Saldaña et al. (2020)
Mexico	329 (-)	Study how chefs and consumers define the concept of gastronomy and the cultural domain of Mexican cuisine	Face to face questionnaire	Yes	Yes	5%	Concept of gastronomy	Rojas-Rivas et al. (2020)
Brazil	780 (-)	Explore the role of regional culture in consumer representations of edible insects	Face to face questionnaire	Yes	Yes	5%	Edible insects	Bisconsin-Junior et al. (2020)
Mexico	160 (+)	Study the perception of consumers towards traditional ethnic foods and how food neophobia influences their perception	Face to face questionnaire	Yes	Yes	5%	Traditional ethnic foods	Bernal-Gil et al. (2020)

Uruguay	330 (+)*	Explore the social representations of mothers and health professionals about breastfeeding and infant formula	Face to face interviews	No	No	1%	Social representations of the concepts of breastfeeding and infant formula	Ares et al. (2020)
Cross-cultural	479 (+)	Social representations towards gastronomy concepts among Mexican and Argentinian consumers	Face to face questionnaire	Yes	No	5%	Cross-cultural representations of gastronomy concept	Rojas-Rivas et al. (2020)
Portugal	489 (+)	Consumers' perception of herbal infusions and practices of preparation	Online survey	Yes	Yes	5%	Herbal infusions	Rocha et al. (2020)
Chile	164 families (+)	Explore the conceptualization between parents and adolescents on the concept "satisfaction with food-related life"	Face to face interview	Yes	No	Not specified	Concept of "satisfaction with food-related life."	Schnettler et al. (2020)
Netherlands	1087 (+)**	Study the concept of the ideal snack from the perception of consumers and identifying the concepts of healthy and unhealthy snack	Face to face questionnaire and online survey	No	Yes	Not specified	Healthy, unhealthy, and ideal snacks	Schlinkert et al. (2020)
Brazil	1232(+)	Study the impact of two types of front labeling on consumer associations towards sugar	Online survey	No	No	1%	Front labeling of food and sugar	de Alcantara et al. (2020)

(+) (-) (=) These signs indicate whether there was a more significant, lesser, or equal proportion of female participants concerning the male gender in the study.

* Only women participated in the study.

** In these studies, some participants decided not to declare their gender.

40 **Table 2. Main themes identified through the use of the WA technique.**

Theme	Food/concept	Reference
Traditional foods	In six regions of Europe	Guerrero et al. (2010)
	Between Austria and Croatia	Renko et al. (2014)
	Traditional and European foods in China	Wang et al. (2016)
	Traditional foods in Mexico	Serrano-Cruz et al. (2018); Bernal-Gil et al. (2020)
	Traditional/functional foods	Rojas-Rivas et al. (2019); de Albuquerque et al. (2019)
Meat and seafood products	Frozen burgers	Viana et al. (2014)
	Lamb meat	de Andrade et al. (2016)
	Capybara meat	da Rosa et al. (2019)
	Representations of meat	Graça et al. (2015)
	Meat made in vitro	Bryant & Barnett (2019)
	Anchovies	Latorres et al. (2016)
	Fish-based products	Mitterer-Daltoe et al. (2013)
	Gray Mullet	Tiyo de Godoy et al. (2019)
Conceptualization	Minerality of wine	Rodrigues et al. (2015)
	Sustainability	Barone et al. (2020)
	Traditional foods	Guerrero et al. (2010)
	Satisfaction with food-related life (SWFRL)	Schnettler et al. (2020)
	Gastronomy	Rojas-Rivas et al. (2020)
	Breastfeeding/Infant formula	Ares et al. (2020)
	Well-being	Ares et al. (2014)
	Creaminess	Antmann et al. (2011)
Alcoholic and non-alcoholic beverages	Fermented beverages	Esmerino et al. (2017)
	Mineral water	Pacheco et al. (2018)
	Herbal infusions	Rocha et al. (2020)
	Fermented milks	Pinto et al. (2018)
	Yogurt with flowers	Rodrigues et al. (2017)
	Beers	Sester et al. (2013); Gómez-Corona et al. (2016)
	Wines	Celhay & Remaud (2018)
Labelling	Shape and color of milk desserts	Ares & Deliza (2010a)
	Package features of milk desserts	Ares & Deliza (2010b)
	Food labels (semiotics)	Ares et al. (2011)
	Semiotics of food labels	Piqueras-Fiszman et al. (2011)
	Eye tracking of labels	Piqueras-Fiszman et al. (2011)
	Packaging of cheeses	Eldesouky et al. (2015)
	Front of package symbols	Miklavec et al. (2016)
	Means of wine labels (semiotics)	Celhay & Remaud (2018)

	Eye tracking and functional food labels	Oliveira et al. (2016)
Other food categories	Local foods	Roininen et al. (2006)
	Fast food	Danes et al. (2010
	Genetic Modified Organisms	Connor & Siegriest (2011)
	Organic foods	Hilverda et al. (2016)
	Functional foods	Rojas-Rivas et al. (2018)
	Dairy products	Ares & Deliza (2010); Ares et al. (2010); Soares et al. (2017); Judacewski et al. (2019)
Unfamiliar foods	Nopal among Brazilian consumers	de Albuquerque et al. (2019)
	Edible flowers	Rodrigues et al. (2017)
	Fruit juices elaborated with novel technologies	Martins et al. (2019)
	Edible insects	Bisconsín-Junior et al. (2020)

59 **Table 3. Methods used in combination with the WA technique.**

60

Methods	Techniques/tools	Authors
Projective techniques	Haire's Shopping List	Vidal et al. (2013); Pinto et al. (2018); Vidal et al. (2013)
	Completion task	Eldesouky et al. (2015); Schnettler et al. (2020)
	Choice task	de Alcantara et al. (2020)
Interviews and Focus groups	Hard laddering	Roininen et al., 2006
	Focus groups	Santosa et al. (2013); Dahiya et al. (2014); Esmerino et al. (2017); Roascio-Albistur et al. (2019)
	Laddering interviews	Renko et al. (2014)
Other qualitative techniques	Free listing	Ares & Deliza (2010); Ares et al. (2014); Fiszman et al. (2014); Sulmont-Rossé et al. (2019); Rojas-Rivas et al. (2020)
	Open-ended questions	Ares et al. (2014); Graca et al. (2015); Rojas-Rivas et al. (2020)
Sensory methods	Conjoint Analysis	Ares & Deliza, 2010; Fiszman et al. (2015); Miklavec et al. (2016); Saldaña et al. (2020)
	Overall liking, willingness to purchase o buy	Ares et al. (2010); Esmerino et al. (2017); Pinto et al. (2018); Rebollar et al. (2019)
	Hedonic scale	Goldner et al. (2013); Fiszman et al. (2014)
	Projective Mapping	Fiszman et al. (2015); Daltoé et al. (2017); Esmerino et al. (2017); Saldaña et al. (2020)
	Acceptance test	Latorres et al. (2016); Polizer et al. (2018); Bernardo et al. (2019); de Albuquerque et al. (2019)
	Preference test	Krumreich et al. (2019)
	EsSense Profile	Polizer et al. (2018)
	Quantitative Index Methods	Tiyo de Godoy et al. (2019)
	CATA questions	Tiyo de Godoy et al. (2019); Bernardo et al. (2019); de Albuquerque et al. (2019)
Neuroscience	Eye tracking	Piqueras-Fiszman et al. (2013); Oliveira et al. (2016)
Questionnaires and Scales	Questionnaire of knowledge	Varela & Fiszman (2013)
	Attitudinal questionnaire	Viana et al. (2014); Pacheco et al. (2018); Polizer et al. (2018)
	Nutritional Knowledge Questionnaire	Fiszman et al. (2014)
	Health Consciousness Scale	Da Silva et al. (2014)

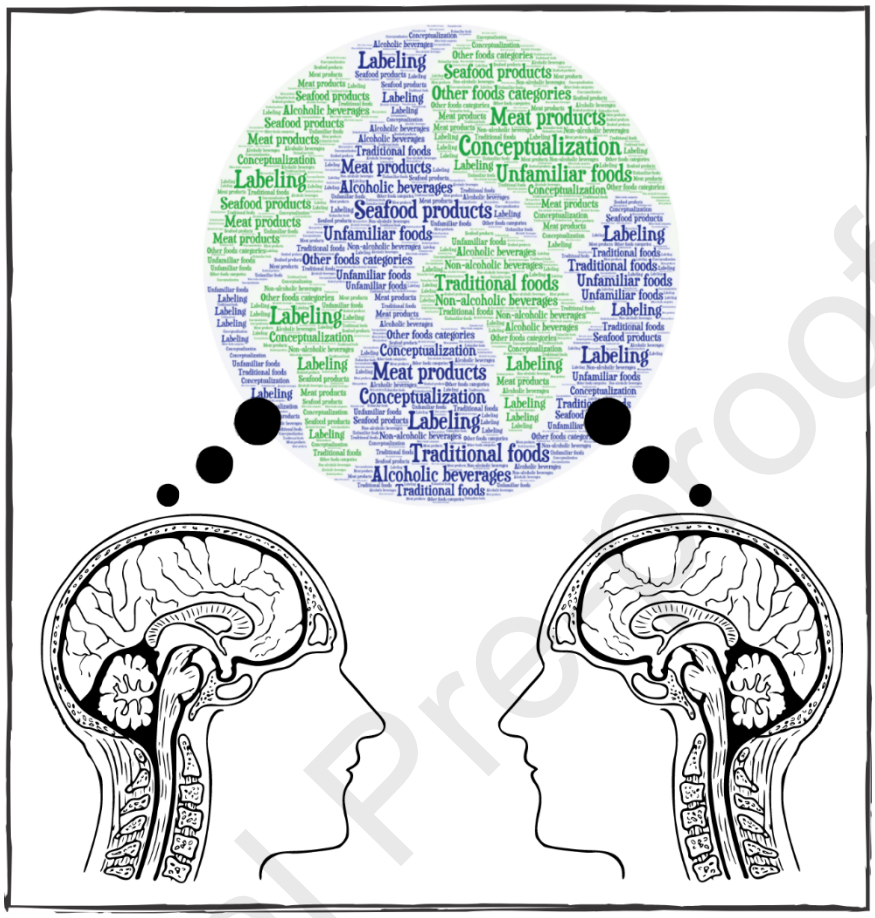
	Questionnaire of eating habits or consumption	Graca et al. (2015); Judacewski et al. (2019); Rojas-Rivas et al. (2019); da Rosa et al. (2019); Rocha et al. (2020)
	Questionnaire of psychological values	Hilverda et al. (2016)
	Consumption attitudes towards vegetarianism	Ruby et al. (2016)
	Food Choice Questionnaire	Serrano-Cruz et al. (2018); Mitterer-Daltoé et al. (2013)
	Food Technology Neophobia Scale	Martins et al. (2019)
	Attitudinal and behavioural questionnaire	Bryant & Barnett (2019)
	Food Neophobia Scale	Bernal-Gil et al. (2020)

Table 4. Example of the stability of the categories/dimensions generated through the WA technique between different studies on the perception of consumers towards traditional foods.

Dimensions/ categories	Guerrero et al. (2010) n = 721	Renko et al. (2014) n = 59	Wang et al. (2016) n = 302	Serrano-Cruz et al. (2018) n = 512
Elaboration	X (+)	X	X (-)	-
Heritage	X (+)	X	X (+)	X (+)
Origin	X (+)	X	X (+)	X (+)
Health	X (+)	X	X (+)	X (+)
Special occasions	X	X	X	X (-)
Habit	X	-	X (-)	X (+)
Sensory aspects	X	X	X (+)	X (+)
Marketing	X (-)	-	X	-
Basic/simple	X (-)	-	X (-)	X
Variety	X (-)	X	X	X
Symbolic meaning*	-	-	X	-
Safety*	-	-	X	-
Mood*	-	-	X (-)	-

* Categories/dimensions only founded by Wang et al. (2016).
The values (+) or (-) mean the categories/dimensions mentioned to a greater or lesser extent by each study.
The x or - signs mean if a category/dimension was identified in each study.

Graphical abstract



Note: Formation of the word clouds that appear in the graphical abstract were done with the free online version of the WordArt program: Word Art Cloud Creator. For more information visit: https://wordart.com/create

Highlights

- A narrative review was carried out with 74 articles using the WA technique
- Use of WA technique is a growing trend in food science field
- Several methods for the analysis of the words were reviewed and discussed
- Cross-cultural studies are important to validity and stability of associations

CONFLICTS OF INTEREST

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.