



DIPARTIMENTO DI SCIENZE AGRARIE ALIMENTARI E AMBIENTALI

CORSO DI LAUREA IN: FOOD AND BEVERAGE INNOVATION AND MANAGEMENT

**CONSUMER PERCEPTIONS OF
ALTERNATIVE FOOD PROCESSING
METHODS FOR ORGANIC PRODUCTS:
THE ROLE OF EMOTIONS**

TYPE OF THESIS: Experimental

Student:

BUSRA KILIC

Supervisor:

PROF. RAFFAELE ZANOLI

Cosupervisor:

DOTT. EMILIA CUBERO

DUDINSKAYA

ANNO ACCADEMICO 2019-2020

ABSTRACT

Understanding consumers' expectations about the process-related quality of organic products as well as communicating with consumers about food processing technologies are important subjects for the food sector, given the increasing public interest in how ingredients are processed. The uncertainty about processing technologies in consumers' minds can lead them to misinterpret the labels, given shopping time is limited. A definition of careful processing may help, if correctly communicated, to further distinguish organic food products from conventional ones. Moreover, it will address the development of new production methods suitable for the processing of organic foods. However, organic consumers' acceptance is essential for the successful implementation of these technologies. The transparency about processing methods may increase consumers' confidence in organic processed foods and the organic sector as a whole. This may be obtained by proper communication of the level of "carefulness" of processing methods. Since emotions play an important role in consumers' preferences, it is important to understand how emotions can influence organic consumers' behavior when choosing among different processing methods.

In this study, a working definition of "organic careful processing" was introduced and tested. Besides, a 2-minutes video of a shopping experience with anxiety-inducing features and audio (screaming baby) was specifically prepared for this study, as well as a neutral-tone cartoon illustrating different processing methods. To answer the various research questions formulated for the present study, four different experiments were carried out.

Study 0 tested the ability of the video to induce a state of anxiety in respondents.

Study 1 tested the consistency of ranking different processing methods using the working definition of organic careful processing and different ranking schemes (monochromatic or multi-color-based).

Study 2 tested the role of induced anxiety in influencing consumer preferences for different processing methods;

Study 3 tested the role of induced anxiety in influencing consumer preferences for differently communicated more or less careful processing methods;

Findings show that:

- 1) when the definition of organic careful processing was communicated, the definition allows to consistently rank the different technologies:
- 2) induced anxiety does not significantly influence the choice of processing methods;
- 3) induced anxiety does not appear to significantly influence the way consumers choose among food products with different levels of “carefulness” in processing methods communicated by colour or monochromatic scales.

These preliminary findings will help to fill the gap in the perception of organic consumers regarding alternative food processing technologies.

To my mother and my father who support every decision of mine in my life.

TABLE OF CONTENTS

LIST OF TABLES.....	6
LIST OF FIGURES	7
ACRONYMS AND ABBREVIATIONS	9
INTRODUCTION.....	10
CHAPTER 1 : LITERATURE REVIEW.....	13
1.1 Organic Production	13
CHAPTER 2 METHODOLOGY:.....	19
2.1 Study 0: Test of anxiety generating video/audio.....	20
2.2 Study 1: Communication of Careful Processing.....	24
2.3 Study 2: Role of emotions in consumer preference of processing options.....	29
2.4 Study 3: Role of emotions in intentions to purchase organic processed products	36
CHAPTER 3 RESULTS AND DISCUSSION:.....	41
3.1 Results of Study 0	41
3.1.1 Comparing 3 Different Treatments	42
3.2 Results of Study 1	43
3.2.1 Comparison of Influence of Two Communication Schemes on Carefulness Perception.....	43
3.2.2 Comparison of Consumer Perception Food Processing Technologies	43
3.3 Results of Study 2	44
3.3.1 Comparison of Consumers Choices Regarding Processing Technologies.....	45
3.4 Result of Study 3.....	47
DISCUSSION.....	52
CONCLUSION	54
BIBLIOGRAPHY	55

LIST OF TABLES

Table 2-1: Objective of studies carried out in present study	19
Table 2-2: Cronbach's Alpha test for 3 constructs: anxiety, relaxation, and fear	21
Table 2-3: Treatments that are carried out in study 0	22
Table 2-4: Treatment that is carried out at study 2	30
Table 2-5: Attributes and levels.....	38
Table 3-1: Participants allocation to treatments in study 0	41
Table 3-2: Participants allocation to different communication schemes in study 1.....	43
Table 3-3: Participant allocation for each product in study 2.....	44
Table 3-4: Participants allocation for each treatment.....	47
Table 3-5: Distribution of consumer choices for milk product according to the two different treatment.....	47
Table 3-6: Distribution of consumer choices for orange product according to the two different treatment.....	48

LIST OF FIGURES

Figure 0-1: Order of 4 sub-studies	12
Figure 1-1: Organic production system.....	13
Figure 1-2*: Stages of production according to the European Commission (EC) Regulation 834/2007.....	14
Figure 1-3: Food processing classification according to EPIC.....	15
Figure 1-4: Food processing classification according to the NOVA system.....	16
Figure 2-1: Experimental design of study 0	20
Figure 2-2: The discrete emotions questionnaire for checking participants emotional state before treatment.....	20
Figure 2-3: The discrete emotions questionnaire for measuring participants' emotional state after treatment.....	23
Figure 2-4: Experimental design of study 1	24
Figure 2-5: Participant (consumer) profile	24
Figure 2-6: Monochromatic colour bar based scale used for communicating with consumers.....	25
Figure 2-7: Multi-color bar based scale used for communicating with consumers.	25
Figure 2-8: Example of questions asked in study 1	27
Figure 2-9: Randomisation of processing methods to 2 different communication schemes	28
Figure 2-10: Experimental design of study 2	29
Figure 2-11: Organic consumer profile for participants of study 2.....	30
Figure 2-12: Options were introduced to participants.....	31
Figure 2-13: Food products visuals that are presented to participants in study 2-Organic orange juice	32
Figure 2-14: Food products visuals that are presented to participants in study 2-Organic apple juice	33
Figure 2-15: Food products visuals that are presented to participants in study 2-Organic milk	33

Figure 2-16: Food products visuals that are presented to participants in study 2-Organic soy drink	34
Figure 2-17: Processing choice allocation to products.....	35
Figure 2-18: Example of question that was presented to participants.....	35
Figure 2-19: Choices were presented within milk products that are processed with different technologies.....	36
Figure 2-20: Experimental design of study 3	37
Figure 2-21: Participants' organic food purchase frequency.....	37
Figure 2-22: Colour based care-score developed for use in study 3	38
Figure 2-23: Care-score labels used to communicate the level of carefulness of processing technologies applied.....	39
Figure 2-24: The European organic logo was used in study 3.....	39
Figure 2-25: Non-organic multi-color based care-score used for orange juice product....	40
Figure 2-26: Organic monochromatic color-based care score used for milk product.....	40
Figure 3-1: Emotional states of participants before the treatment	41
Figure 3-2: Evoked emotional states of participants after treatment.....	42
Figure 3-3: Descriptive analysis for participants who were communicated with multi-based and monochromatic colour bar based schemes.....	44
Figure 3-4: Frequency of risky and safety options preferences for organic orange juice .	45
Figure 3-5: Frequency of risky and safety options preferences for organic apple juice....	45
Figure 3-6: Frequency of risky and safety options preferences for organic soy drink.....	46
Figure 3-7: Frequency of risky and safety options preferences for organic soy drink.....	46
Figure 3-8: Choice set 8 for orange juice product*.....	49
Figure 3-9: Choice set 8 for milk product*	49
Figure 3-10: Choice set 3 for orange juice product*.....	50
Figure 3-11: Choice set 3 for milk product*	50
Figure 3-12: Choice set 5 for orange juice product*.....	51
Figure 3-13: Choice set 5 for milk product*	51

ACRONYMS AND ABBREVIATIONS

FAO	The Food and Agriculture Organization of the United Nations
EU	European Union
EC	European Commission
IFOAM	International Federation of Organic Agriculture Movements
EPIC	European Prospective Investigation into Cancer and Nutrition
SD	Standard Deviation

INTRODUCTION

The global organic food and drink market was worth EUR 92 billion in 2017. While 47 % of the global market was accounted for by the US, the EU followed with 37% reaching EUR 34.3 billion (European Commission, 2019). Thus, the organic sector has important market potential, arising from the need for coherent standards and principles in the processing of organic food and beverage products to guarantee consumers high-quality food products.

While the European Union (EU) organic market continued growing at a significant pace in the last decade, there is still a lack of mandatory standards and indications for organic food processing (Kahl *et al.*, 2014). There is a need for an exact definition and indications to be applied in organic food and beverage production. Organic producers need guidance to make the best choice for careful processing and how to inform consumers. Especially that potential organic consumers are interested in tasty and easy-to-use organic processed products, with ‘fresh-like’ characteristics while still being safe of food-borne diseases and having a long shelf-life (Zanoli and Naspetti, 2002). A set of strategies for making decisions can help organic food processors to take the best choice for careful processing methods that address the organic principles, high food quality, low environmental impact, and high degree of consumer acceptance (Core Organic Cofund, 2019).

Previous researches showed that consumers’ perception, quality expectations, and their credence about organic food and organic production are strongly related to the quality of the product (Kahl *et al.*, 2012; Naspetti & Zanoli, 2009). However, Naspetti and Zanoli (2009) demonstrated that consumers seem unaware of production and processing methods and ask for more information. Organic consumers want to be informed about how organic products are produced, and they desire to distinguish organic products from the conventional one in terms of processing methods applied. Better communication seems fundamental to organic consumers’ awareness.

Early perception and learning at a cognitive level are factors that affect the basic and long-lasting preferences on food consumer choices. Both sectors, organic and conventional, require the acceptance of innovation by the consumer (Lado and Yousef, 2002). Consumers’ acceptance and perception are crucial for the purchasing of novel products (Siegrist, 2008).

However, not all novel technologies are accepted by consumers in an equal manner. Information arises as one of the important elements for consumer acceptance. Individuals tend to have negative attitudes toward new technology. That can be simply resolved by providing more information and communicating with them to fulfill their lack of knowledge (Teisl, Fein and Levy, 2009).

The relation between perceived benefits and more positive attitudes suggests that as more information about the different technologies is provided to consumers, their attitudes may become affected towards these technologies since uncertainty will disappear (Siegrist, 2008).

Besides, a previous study shows that learning, motivation, social behaviors, and emotions may influence consumers' preferences (Köster & Mojet, 2007). A better understanding of emotions in consumer preference is essential. Both positive and negative emotions influence consumer's preferences. According to previous studies, emotions like fear/anxiety (negative emotion), may decrease willingness to take risks, while hope (positive emotion) may decrease unhealthy and unsafe food-related behaviors (Wyer et al., 2019). Linked to this, the acceptance of innovative and alternative technologies can be affected by emotions since the perceived benefits and perceived risks are found as an important factor for the acceptance of novel technologies. Consumers may tend to perceive new food processing methods as riskier than conventional food processing methods (Siegrist, 2008).

The main objective of this study¹ is to examine consumer perceptions of alternative food processing methods for organic products and to demonstrate the role of emotions. To reach this objective, the following research questions are formulated:

Question 1: How can careful processing be best communicated?

Question 2: Do emotions interfere with how careful processing can be perceived?

Question 3: How emotions (anxiety/fear) influence organic consumers' and preference (intention to purchase) of organic processed products when careful processing is communicated?

¹ Code of Practice for organic food processing (ProOrg). It has been funded in the scope of the 2017 CORE Organic Cofond call. CORE Organic is the acronym for "Coordination of European Transnational Research in Organic Food and Farming. The CORE Organic Cofund consortium consists of 25 partners from 19 countries. 11

This study respectively consists of a literature review, methodology, results, discussion and conclusion chapters. To achieve the objective of this work, 4 sub-studies were carried out as is shown in the figure below.

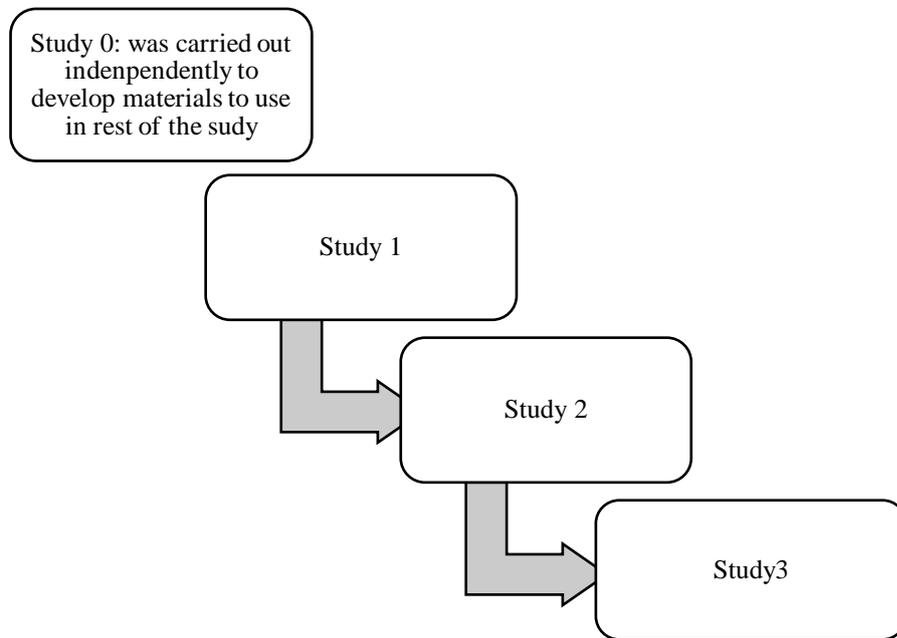


Figure 0-1: Order of 4 sub-studies

CHAPTER 1: LITERATURE REVIEW

1.1 Organic Production

Organic production is an overall system that aims sustainable agriculture, high-quality products, and the use of processes that have less impact on the environment, humans, plants (Katsarova, 2015). Figure 1-1 shows the main components of organic products which start from farm management.

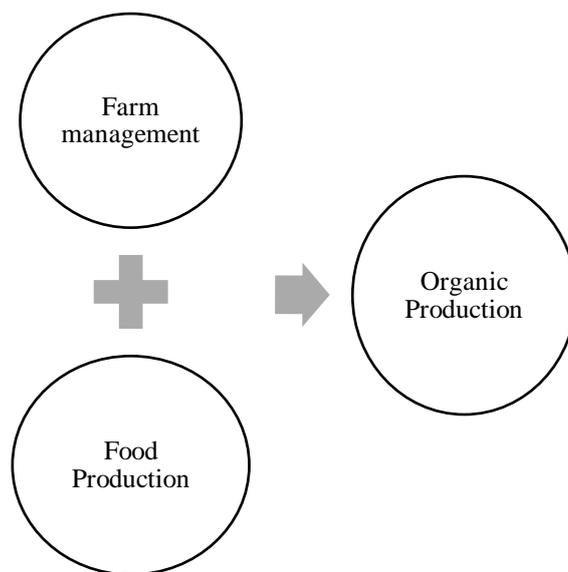


Figure 1-1: Organic production system

Different authorities provide the standards and guidelines related to organic production at diverse levels. For example, the European Commission provides guidance at the European level (EU, 2018), the International Federation of Organic Agriculture Movements at the global level (IFOAM, 2014), and local or private associations at the national level (Kahl *et al.*, 2010).

At the European level, organic production is defined according to the European Commission (EC) Regulation (EU), 2018/848² on organic production and labeling of organic products. Figure 1-2 shows all stages of organic production from farm to fork.

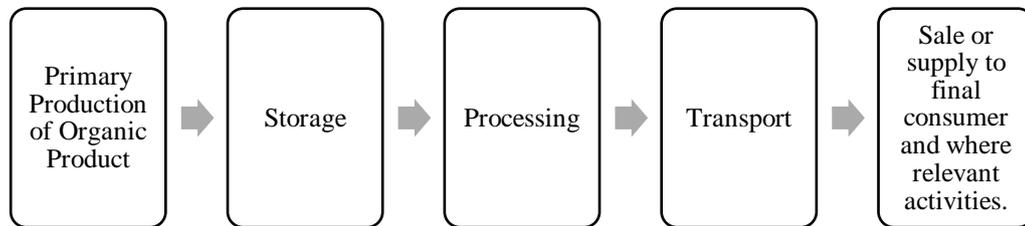


Figure 1-2*: Stages of production according to the European Commission (EC) Regulation 834/2007.

*Relevant activities include labelling, advertising, import, export, and subcontracting activities.

The general principles of organic production include (a) respect for nature's systems and cycles and the sustainment of the natural sources; (b) the preservation of natural heritage sites; (c) the responsible use of energy and natural resources during production; (d) the production of high-quality food, agricultural and aquaculture products that satisfy consumers' needs and preferences (European Parliament and European Council, 2018).

1.2 Food Processing in The Context of Organic Production

According to European Commission regulation 852/2004 on the hygiene of foodstuffs, processing refers to any action that substantially alters the initial product, including heating, smoking, curing, maturing, drying, marinating, extraction, extrusion, or a combination of those processes (EC, 2004). Food systems have changed during the last decade in all the world. This change has occurred due to the increase in the population of the world, changes in the lifestyle of people, and rising expectations of consumers on the quality of food products. Due to this fact, the food industry has evolved in recent years according to the needs of consumers. Nowadays almost every food product is processed in some way (Moubarac *et al.*, 2014).

Food processing and packaging technologies have provided some advantages for both consumers or producers, such as extending the shelf life of unprocessed foods, enabling their storage for longer use, or to make them edible, and, often, to make their preparation more convenient. However, up to date, questions about the health-impact of processing have created

² Current consolidated version: 14/06/2018: <http://data.europa.eu/eli/reg/2018/848/2018-06-14>

a need for some classifications in terms of food processing applied to processed foods (Knorr and Watzke, 2019). As a consequence of the increased interest of consumers and researchers, particular and more comprehensive assessments of the impact of food processing are studied (Monteiro *et al.*, 2018). In 2015 the FAO (2015) published a guidance report and described examples of food classifications based on food processing. One of them is developed as part of the European Prospective Investigation into Cancer and Nutrition (EPIC) at the European level (Figure 1-3). According to the EPIC classification, food processing is classified as non-processed foods; modestly or moderately processed food, and processed food. However, this classification has one drawback, there is not a clear distinction between cooking and industrial processing (Moubarac *et al.*, 2014).

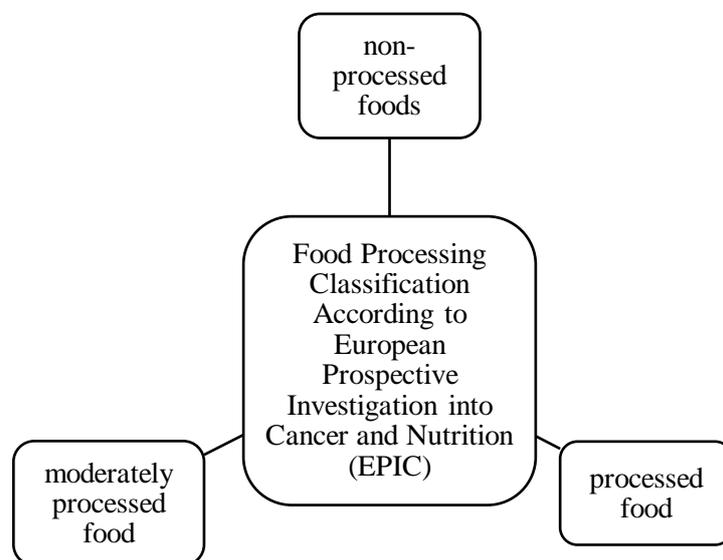


Figure 1-3: Food processing classification according to EPIC.

On the other hand, Moubarac *et al.*, (2014) evaluated the NOVA classification system (Figure 1-4) which is accepted as more specific, comprehensive, and coherent compared to other food processing classification systems. The NOVA system classifies foods according to the nature and purpose of food processing. It includes four groups which are: unprocessed or minimally processed foods, processed culinary ingredients, processed foods, and ultra-processed food and drink products (Monteiro *et al.*, 2018). However, Knorr and Watzka (2019) stated the NOVA classification as confusing, due to the fact that the applied categorization is not based on the extent or purpose of processing.

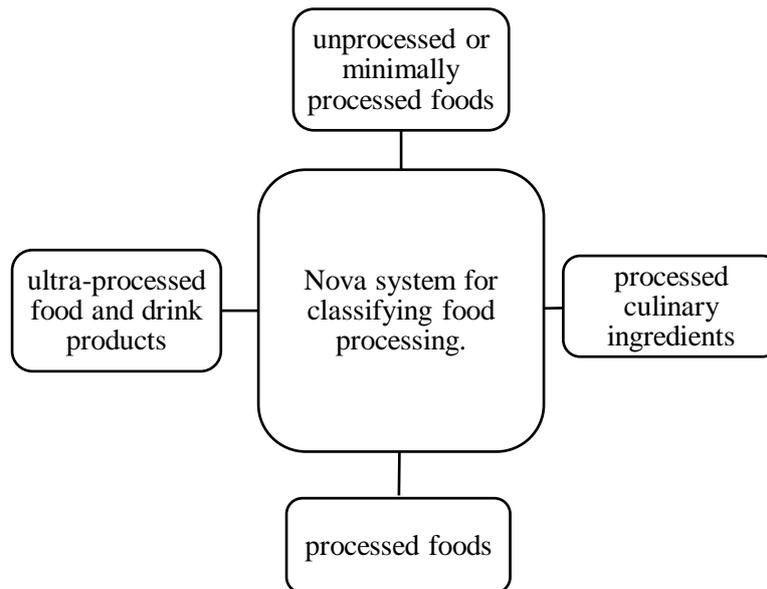


Figure 1-4: Food processing classification according to the NOVA system.

Therefore, there is still disagreement on the classification of food processing. On the other hand, specific principles for organic production have already been stated in Article 7 of Regulation (EU) 2018/848. These specific principles are obligatory for the processing of organic foods and include that (a) organic foods are produced from organic agricultural ingredients, (b) the use of food additives, non-organic ingredients, micronutrients, and processing aids are restricted, (c) substances and processing methods that will not comply with true nature of the product are excluded, (d) organic foods should have been processed with care, preferably through the use of biological, mechanical and physical methods and (e) the food containing, or consisting of, engineered nanomaterials are excluded (European Parliament and European Council, 2018).

Notwithstanding, previous researches showed people are not so aware of processing methods and organic consumers mostly associate organic food with food products that are either unprocessed or at least have a low level of processing. Naspetti and Zanolli (2009) demonstrated that European consumers perceive organic food as a food product that is being processed naturally and without chemicals, providing the possibility to eat products with a minimum amount of additives.

1.3 Consumer Perception of Innovative Food Technologies

The European Commission (EC) stated in Regulation 2018/848 that organic foods should have been processed with care. Processes that maintain the protection of all known nutrients of the food, protect as much as possible the integrity of the product, and avoid nutritional losses became interested in organic food processing (Kahl *et al.*, 2014). Even though several methods are applied to process food not all of them have the same effect on different dimensions of food quality (Barbosa-Cánovas *et al.*, 2004). The food industry is applying heat treatments for many years to pasteurize or sterilize food. The perceived benefits of thermal treatments by the industry are higher due to their efficacy and safe end-product. High-temperature short-time (HTST) pasteurization and ultra-high temperature (UHT) sterilization are used to produce many food products in many different countries. However recently, the food industry faces novel technologies that may involve different mechanisms and may be useful in characterizing a new technology system (Barbosa-Cánovas *et al.*, 2004). New and alternative processing technologies empower innovations in the food industry (Siegrist, 2008). For better competitiveness of the European food and beverage industry, the development and adoption of emerging food processing technologies such as high-pressure processing, pulsed electric field, microwave heating, ohmic heating, infrared heating, became essential recently (Jermann *et al.*, 2015; Probst *et al.*, 2015).

Furthermore, consumer's acceptance and their credibility are fundamental for the success of both novel food products and the application of innovative processes in the food industry. Most consumers have little knowledge of food technologies, especially in terms of alternative food processing. However, food processed with an emerging technology may generate some concerns for consumers. When general questions are asked to consumers about novel technologies, they express their concern regarding possible harmful by-products. Moreover, they are suspected of unknown health risks from consuming food products that are processed through different methods. Related studies showed consumers may have difficulties assessing the possible benefits of processing technologies. According to the study of Olsen (2010), some technologies such as genetic modification and irradiation are not accepted by consumers whereas high-pressure processing, use of pulsed- electric fields, and the application of pulsed light are accepted as the more promising ones. Even though public discussions about genetically modified foods have a longer history relatively, consumers have similar perceptions related to new food technologies (Siegrist, 2008). Perceived risks are increased in the public's mind when there are not definite benefits that are detected. It is essential to make the benefits of novel technologies clear enough for the greatest likelihood of consumer

acceptance (Bruhn, 2007). Considering this, risk communication related to alternative processing technologies is crucial.

1.3.1 Emotions Role in Preferences of Food Consumer

Emotions are defined as short-term responses to particular stimuli. And they can be categorized according to their valence (positivity/negativity), arousal (high/low), and motivational direction (approach/avoid). In this classification, anxiety is a negative and high arousal emotion (Harmon-Jones, Bastian and Harmon-Jones, 2016). Recent studies showed there is a relationship between specific emotions such as anxiety and information processing. Therefore, emotion has a considerable effect on the cognitive processes in humans, including, perception (Köster and Mojet, 2015; Tyng et al., 2017). Besides, the emotions elicited in one situation can influence understanding and behavior in an unrelated situation (Wyer *et al.*, 2019). Recent studies show that emotions have effects on risk perception and human choices (Zadra and Clore, 2011; Lu, Xie and Zhang, 2013). Kusev et al. (2017) demonstrated that anxiety as an emotional state can lead to more risk-avoiding preferences.

CHAPTER 2

METHODOLOGY:

This chapter explains the methodology of four different studies respectively study 0, study 1, study 2, and study 3. Table 2-1 summarises the aims of studies carried out.

Table 2-1: Objective of studies carried out in the present study

Aims	
<i>Study 0</i>	To create and test materials that induce anxiety (as an emotional state) in people in the context of shopping.
<i>Study 1</i>	To test whether the type of communication scheme influences the classification of the processing technology using careful processing definition.
<i>Study 2</i>	to explore if a consumer's emotional state influences how consumers perceive the information about organic processed products
<i>Study 3</i>	to analyze the role of emotions in preferences to purchase organic processed products.

2.1 Study 0: Test of anxiety generating video/audio

Design. A between-subjects completely randomized pre-post comparative experimental design that is shown in Figure 2-1 was carried out using the Qualtrics platform³. Each participant was assigned randomly to each of the treatments.

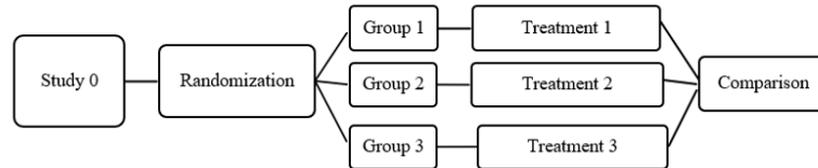


Figure 2-1: Experimental design of study 0

Participants. Participants were 195 individuals, older than 18 years old, who completed the study online using Amazon's Mechanical Turk⁴. Participants who were joined with mobile devices were not allowed to participate in the study.

Only fluent English speakers were taken into account. Participants initially were naïve about the purpose of the study but were informed that they will be requested to evaluate some images/videos/audio and all the related risks to this task.

Participants who stated their emotional state as “quite a bit”, “very much” and “an extreme amount” for anxiety and fear items (see Figure 2-2) were excluded from the study.

	1 not at all	2 slightly	3 somewhat	4 moderately	5 quite a bit	6 very much	7 an extreme amount
Anxiety	<input type="radio"/>						
Relaxation	<input type="radio"/>						
Fear	<input type="radio"/>						

Figure 2-2: The discrete emotions questionnaire for checking participants emotional state before treatment

³ Qualtrics is an online survey tool that provides creating online experiments. When respondents' complete surveys the data is collected and assembled by the software.

⁴ Amazon Mechanical Turk is a crowdsourcing web service that is an online labour market where employees are recruited by employers for the execution of different kind of tasks researches.

Measures. For measuring state self-reported emotion level, the discrete emotions questionnaire (DEQ) was used. The discrete emotion questionnaire has been developed by Harmon-Jones (2016) to measure eight distinct state emotions which are anger, disgust, fear, anxiety, sadness, happiness, relaxation, and desire. Participants' emotional state before treatment was measured by one item question on their current level of anxiety, relaxation, and fear. Then, participants' emotional state after the treatment was measured through three constructs based on the DEQ: anxiety, relaxation, and fear, comprising twelve items (four for each construct). The reliability of all constructs was independently tested (see Table 2-2).

Table 2-2: Cronbach's Alpha test for 3 constructs: anxiety, relaxation, and fear

Source	Construct	Cronbach's α	4 Items	New Items	New Cronbach's α
The discrete emotions questionnaire. Harmon-Jones (2016)	Anxiety	0,86	Anxiety	Anxiety	0,87
			Nervous	Nervous	
			Dread	Worry	
			Worry		
	Relaxation	0,94	Easy-going	Easy-going	
			Calm	Calm	
			Relaxation	Relaxation	
			Chilled-out	Chilled-out	
	Fear	0,94	Terror	Terror	
			Panic	Panic	
			Scared	Scared	
			Fear	Fear	0,94

According to the results of the reliability test, the dread item was extracted from the anxiety construct, increasing the Cronbach's alpha from 0,86 to 0,87. The relaxation scale was measured with four items that are easy-going, calm, relax, chill. The fear scale was measured with 4 stems which are terror, panic, scared, and fear. Both constructs, fear, and relaxation, maintained the same number of items as the Cronbach's alpha could not be increased by removing any item.

Materials. In previous literature, there are various ways used to elicit anxiety. Previous studies showed that movies can generate emotions in people (Gross and Levenson, 1995; Rottenberg,

Ray and Gross, 2007) . For example, Bradley (2009) found that using anxiety-provoking film clips could effectively evoke anxiety. Additionally, the study of Zhu (2017) on an experiment related to food commercials provides some insight into provoking emotions. The authors show that the participants who have been shown a video lost their attention, especially after 90 seconds. Materials used in study 0 were prepared considering these findings from the literature.

For the present study, a baseline video⁵ was developed about a usual trip around the supermarket. Later, the audio of the video was modified by adding undesirable noises that could generate anxiety according to the study of Westman (1981). All materials were designed and modified in the context of a shopping (grocery) theme. The mute video with no sound was used for treatment 3, while only the audio content was used for treatment 2 and the baseline video (sound and video) was used for treatment 1 as is shown in Table 2-3.

Table 2-3: Treatments that are carried out in study 0

	Application
<i>Treatment 1</i> (Video+ Audio)	Non-anxious applicants are requested to watch and listen to the emotion eliciting video.
<i>Treatment 2</i> (Audio)	Non-anxious applicants are requested to listen only to audio.
<i>Treatment 3</i> (Mute Video)	Non-anxious applicants are requested to watch the video which doesn't have the audio.

All materials were designed homogeneously, with the same length which is 2:00 minutes. It is important to emphasize that the use of the anxiety word in the treatments was avoided.

Procedure. Participants were asked to read carefully the privacy consent form and sign it. Only participants who signed the consent as “yes” became part of the study. At the beginning of the experiment, participants were asked to evaluate their emotional state on a simplified 7-point Likert scale. Eligible participants were randomly divided into three different groups and each group attended one of the three different treatments (video with audio /mute video/audio).

⁵ Link for mute emotion eliciting video which is created for study 0: <https://youtu.be/QHu7zHDkQYc>

Before initiating the treatments, participants were asked to watch/listen carefully to the materials that were presented. In each treatment, the respondents were shown the corresponding media content (video with sound, mute-video, or only audio). To ensure that all participants completed their tasks fairly and to ensure the true implementation of the treatments by the respondents, special features of Qualtrics software were used such as blocking the “next” button skip and blocking the “mute” alternative while the video/audio was on. With this purpose, a JavaScript code was used, and respondents were not enabled to mute the sound of the material presented to them. After they had completed their task, they were asked to assess their emotional state with a self-reported emotion scale (Harmon-Jones, Bastian and Harmon-Jones, 2016). The 7-likert point scale was used in study 0 is shown in Figure 2-3.

	1 not at all	2 slightly	3 somewhat	4 moderately	5 quite a bit	6 very much	7 an extreme amount
Anxiety	<input type="radio"/>						
Nervous	<input type="radio"/>						
Dread	<input type="radio"/>						
Worry	<input type="radio"/>						
Easy-going	<input type="radio"/>						
Calm	<input type="radio"/>						
Relaxation	<input type="radio"/>						
Chilled out	<input type="radio"/>						
Terror	<input type="radio"/>						
Panic	<input type="radio"/>						
Scared	<input type="radio"/>						
Fear	<input type="radio"/>						

Figure 2-3: The discrete emotions questionnaire for measuring participants’ emotional state after treatment.

The results of this study were evaluated using PSPP⁶ software. Descriptive analysis was used for seeing the distribution of the collected data from the experiment. Then, one-way analysis of variance (ANOVA) was conducted to compare the means of the three different treatments and to identify if one of the treatments was generating significantly more anxiety

⁶ PSPP is a software application for analysis of sampled data, intended as a free alternative for some other common software.

than the others. The general linear model (GLM) was conducted to identify if there were statistically significant differences between participants' emotional states before and after treatments.

2.2 Study 1: Communication of Careful Processing

Design. A between-subjects post-test only randomized experiment was conducted using the Qualtrics platform. Each group was presented with one of the communication schemes as details are shown in Figure 2-4.

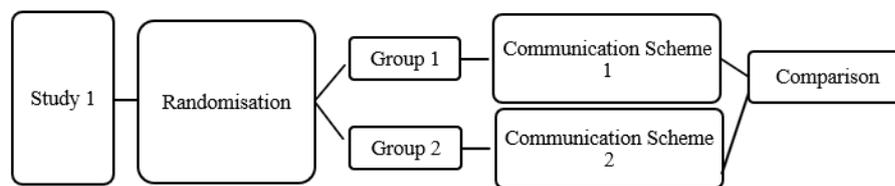


Figure 2-4: Experimental design of study 1

Participants. 130 organic consumers, older than 18 years old, who consume more than 5% of their food as certified organic products were recruited from Amazon's Mechanical Turk. Figure 2-5 shows the organic consumers' profile that participated in this study. Participants were also informed that the information which they will provide will considerably contribute to new scientific knowledge on organic food processing methods and may benefit them as an organic consumer. Only fluent English speakers were taken into account.

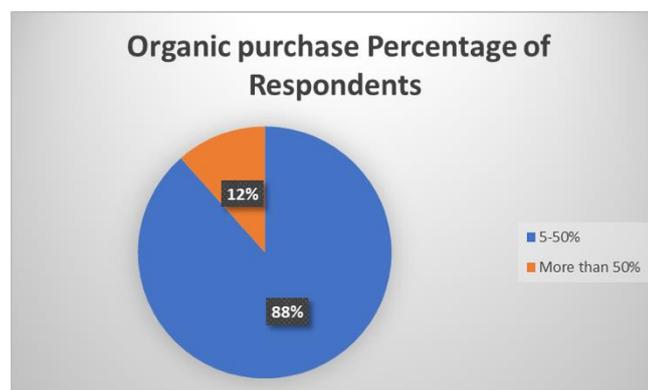


Figure 2-5: Participant (consumer) profile

Participants with a red-green color deficiency were excluded from the experiment. To achieve this aim, the simplified 6 plates (plate numbers; 1, 2, 4, 8, 10, 14) version of the Ishihara color test⁷ (Handaya, Tokyo, Hongo Harukicho, 1917) was used.

Measures. In the experiment, the subjects had to rate the carefulness of different food processing technologies. In literature, front-of-pack labelling is stated as a helpful tool to communicate with consumers on making healthier choices. Between front-of-pack labels, the multiple traffic light (green, red, and amber) label is an effective way to communicate with the consumer (van Herpen and Trijp, 2011; Hawley *et al.*, 2013). Hence, in this study to measure carefulness level from 0 to 100, 2 scales based on the monochromatic color bar scale (see in Figure 2-6) (dark blue = not at all careful, blue = not so careful, whitish pale blue = very careful) and multi-color bar scale (Figure 2-7) (red = not at all careful, yellow = not so careful, green = very careful.) were presented to participants



Figure 2-6: Monochromatic colour bar based scale used for communicating with consumers in study 1



Figure 2-7: Multi-color bar based scale used for communicating with consumers in study 1

⁷ Ishihara is well known and one of the most used color deficiency tests. The extended version of the Ishihara color test consists of 38 Ishihara plates with a set of colored dotted plates.

Materials. The Regulation (EU) 2018/248 on organic production points out that the processing of organic foods should be carried out with care. Hence, there is a need for a comprehensive definition of careful processing for use in the production of organic processed food products. According to European legislation on organic production (EU, 2018) and previous studies (Kahl, *et al.*, 2014), a careful processing definition to use in this study was developed as:

'Careful processing' refers to methods that aim to:

a) preserve the nutritional and sensory quality of raw materials from organic farming by limiting the use of additives,

b) minimize the risks for consumer and worker health while promoting fair supply-chains, and

c) limit the impact on the environment by:

-reducing the use of water and energy,

- optimizing waste management, and

- promoting recyclable/reusable packaging.”

Eight processing methods were classified as thermal processing: pasteurization (control), ultra-high temperature (UHT), microwave processing, non-thermal processing, pulsed electric fields, high-pressure processing, modified atmosphere packaging (MAP), edible coating, active packaging (Probst *et al.*, 2015). Processing methods were chosen mostly according to the current application of the food industry. And innovative food processing technologies were included to demonstrate consumers' perceptions related to them. A 3:11 minute length informative video⁸ that includes definitions of the eight processing methods was created. The video was designed with short but clear definitions, to avoid generating bias on participants, either any advantages or disadvantages of processing technologies that have not been mentioned in the video.

⁸ Link for informative video which is created for study 1: https://youtu.be/Veks_qH_OcM

Procedure. Participants were asked to read carefully the privacy consent form and sign it. Only participants who signed the consent as “yes” became part of the study. Eligible participants were randomized to 2 different groups. Both groups primarily are requested to read the careful processing definition and then to watch the informative video. Following this, the first group rated the carefulness level of each processing method, according to the definition presented to them, on a monochromatic colour bar-based scale, while the second group rated carefulness in a multi-color bar-based scale. Figure 2-8 shows the way of presenting the question to participants.

Thinking of "Careful processing" definition, please rate how carefully processed is high-pressure processing.

If you need to refresh the meaning of high-pressure processing, [click here](#).

If you need to refresh the meaning of careful processing, [click here](#).

Figure 2-8: Example of questions asked in study 1

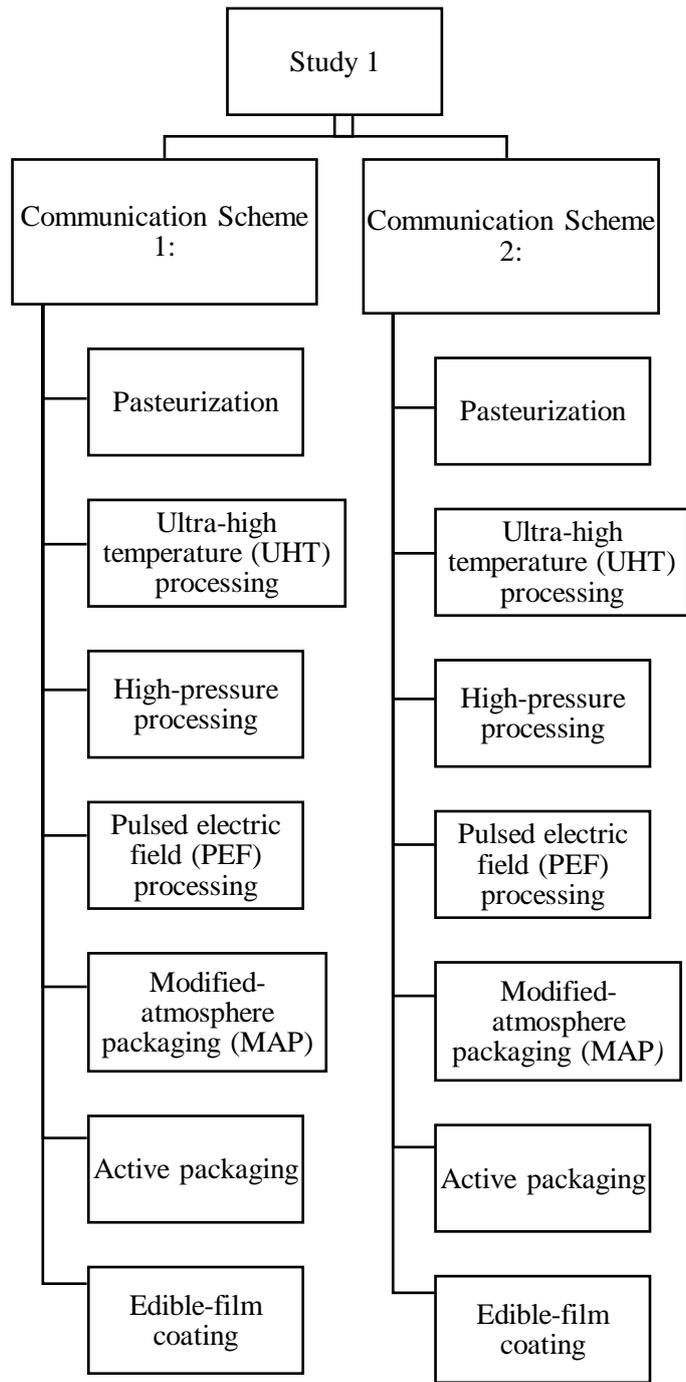


Figure 2-9: Randomisation of processing methods to 2 different communication schemes in study 1

Figure 2-9 shows processing methods used in this study and how they were allocated for both communication schemes.

To analyze the result of this study statistically, results are evaluated in PSPP software. Descriptive analysis was used for seeing the details of the data and for conducting further statistical analyses. The independent samples t-test was used for comparing the means of two groups that have been randomized for 2 different communication schemes to determine whether there is statistical evidence that the associated population means are significantly different. A one-sample t-test was used for comparing means of the pasteurization process and other processes are used.

2.3 Study 2: Role of emotions in consumer preference of processing options

Design. As it is shown in Figure 2-10, a between-subject, the post-test only randomized experiment was carried out using the Qualtrics platform. Respondents were assigned to one of two groups to compare and determine whether any influence of emotion to make a different preference on food consumers.

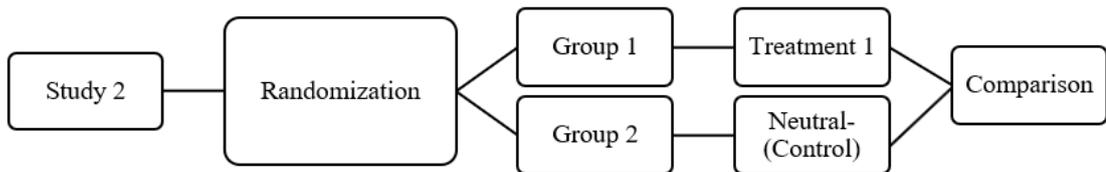


Figure 2-10: Experimental design of study 2

To the first group, treatment was administrated (a video to generate anxiety), while the second group was the control group. Table 2-4 explains the different procedures applied to two different groups. Then obtained data from the two groups was analyzed and compared statistically.

Table 2-4: Treatment that is carried out at study 2

	Application
<i>Treatment 1</i> (<i>Emotion manipulation</i>)	Non-anxious applicants are requested to watch and listen to 2-minute anxiety eliciting video then, they are asked to watch an informative video about food processing technologies.
<i>Treatment 2</i> (<i>Control group</i>)	. Non-anxious applicants are requested to only watch the informative video

Participants. 192 organic food consumers, older than 18 years old. Participants who have more than 5% percentage of home consumption frequency for certified organic products and at least purchase 3 of the following organic products which are milk, soy drink, orange, and apple juice, were recruited from Amazon Mechanical Turk (Figure 2-11). They were informed that the information which they will provide will considerably contribute to new scientific knowledge on organic food processing methods and may benefit them as an organic consumer. Only fluent English speakers were taken into account.

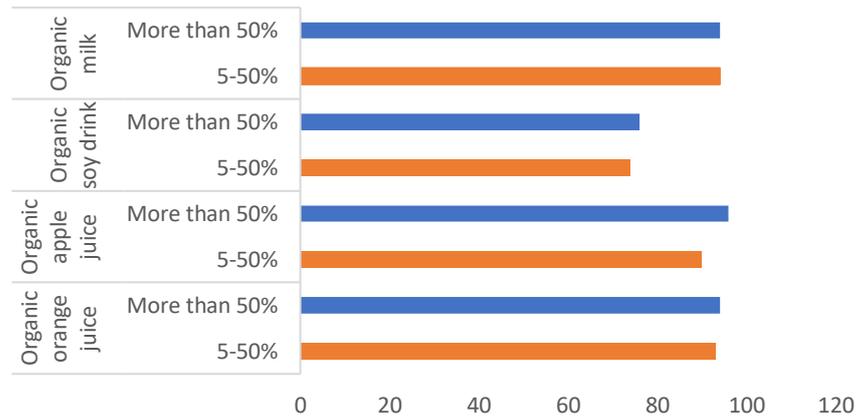


Figure 2-11: Organic consumer profile for participants of study 2

Participants who have evaluated their emotional state as “quite a bit”, “very much”, and “an extreme amount” for anxiety and fear items were excluded from this study.

Measures. Studies show that many factors have influenced consumers' preferences. Emotions are one of these factors that might affect the preferences of consumers to make risky or less risky preferences (Köster and Mojet, 2007).

The treatment was subject to measure the effect of emotion on the preferences of the organic consumer. Participants were asked to choose the most preferred one between four options (see Figure 2-12). Even in study 1, findings did not show a statistically significant difference in terms of carefulness between pasteurization and high-pressure processing. According to the previous research of Siegrist (2008), alternative technologies have been perceived as risky by consumers. Considering this, high-pressure and pulsed electric field processed organic products were assumed as a risky option.

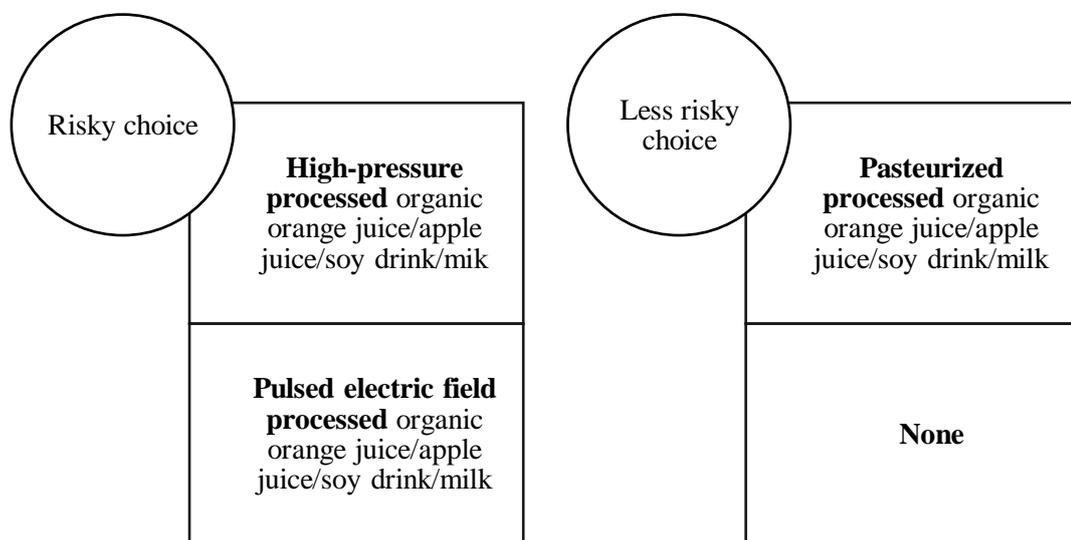


Figure 2-12: Options were introduced to participants in study 2

Material. An informative 1:28 minute length video⁹ was created. The video included a thermal process neutral definition which is pasteurization (control) and 2 non-thermal processes neutral definitions which are pulsed electric fields, high-pressure processing. The same definitions of the three processing technologies were used for study 2 that has been used in study 1.

To manipulate the emotion, the video that was created and tested in study 0 was used. Organic processed food products were visualized for making consumer choices easier during the experiment. To indicate all the processing technology used in the production of organic

⁹Link for informative video which is created for study 2: <https://youtu.be/IUPM8P5IPbY>

processed food is not obligatory according to European legislation. For this reason, pictures of packages obtained from an online wholesome grocery website were used and designed according to the aim of the experiment. Packages were presented only with the name of the product, the way they were processed, and with the organic logo of the EU as they are shown in the figures below (Figure 2-13, Figure 2-14, Figure 2-15, Figure 2-16).

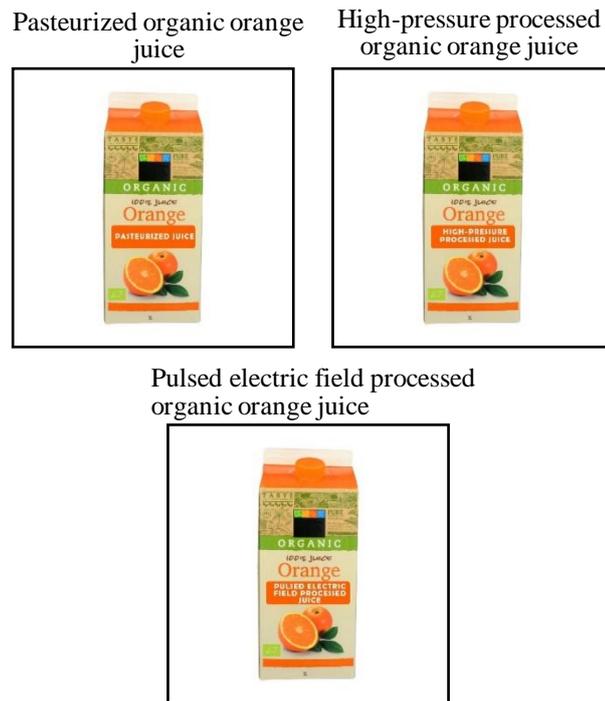


Figure 2-13: Food products visuals that are presented to participants in study 2 - Organic orange juice

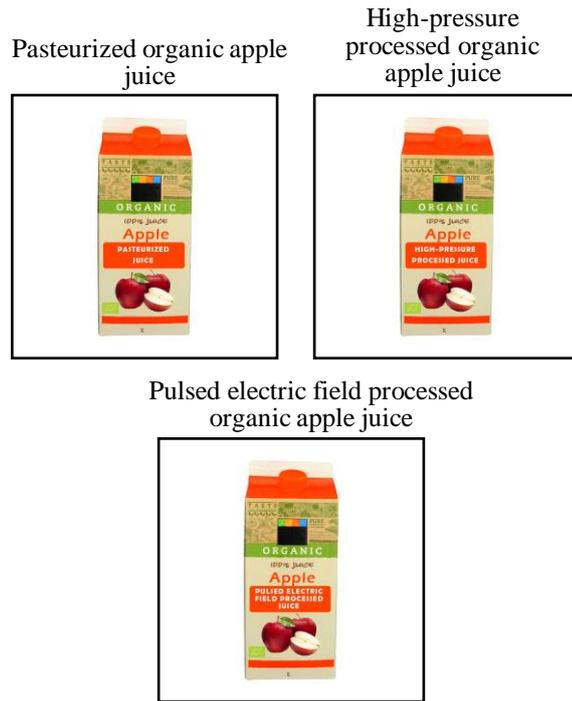


Figure 2-14: Food products visuals that are presented to participants in study 2-Organic apple juice

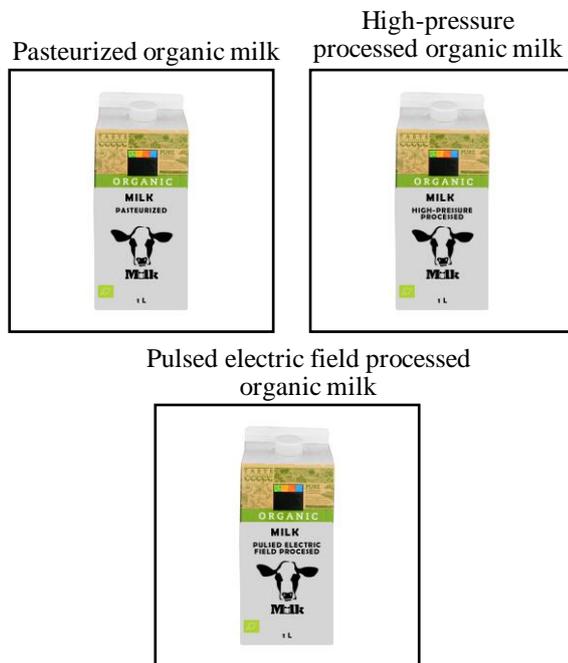
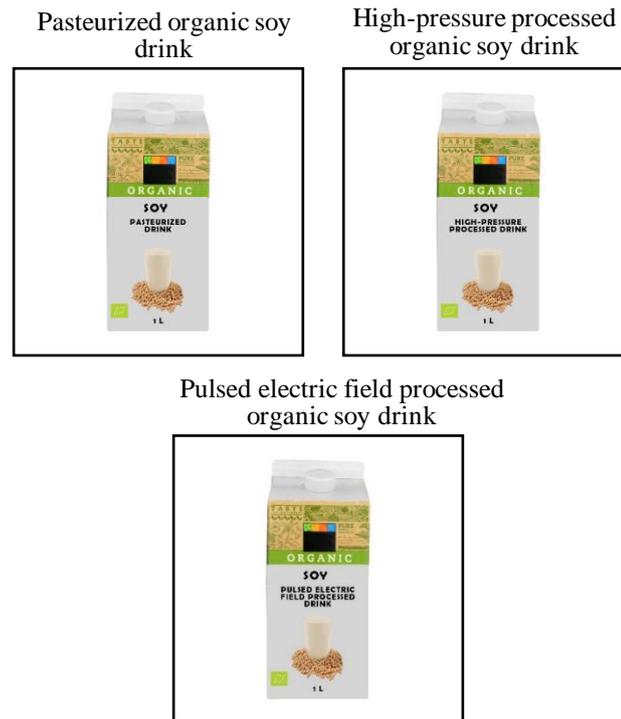


Figure 2-15: Food products visuals that are presented to participants in study 2-Organic milk



**Figure 2-16: Food products visuals that are presented to participants in study 2-
Organic soy drink**

Procedure. Participants were asked to read carefully the privacy consent form and sign it. Only participants who signed the consent as “yes” became part of the study. Then organic consumers were asked to evaluate their emotional level before proceeding with the treatments. Non-anxious organic consumers were randomized for 2 different treatments. The first group was primarily showed an emotion eliciting video, following that they were shown the informative video that includes basic definitions. Unlike the first group, the second group only was showed an informative video. Then, both groups followed the same procedure, and they were asked to choose among four options of the same organic product (orange juice, apple juice, soy drink, milk) that were processed with different processing technologies. The None option was presented to participants who do not have any preferences from these technologies as a fourth option. The figure below (Figure 2-17) shows each option were represented to respondents.

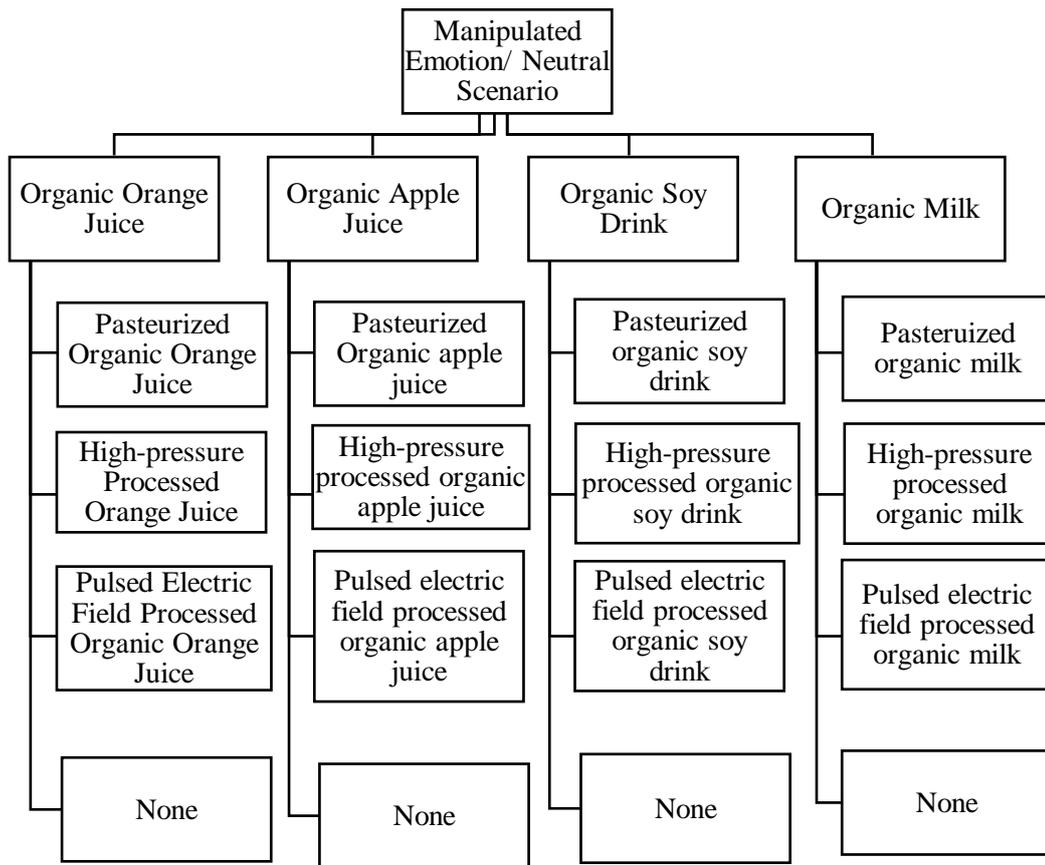


Figure 2-17: Processing choice allocation to products

Two figures are shown above (Figure 2-18 and Figure 2-19) represent the way questions were introduced in study 2.

From the following options, each of them corresponds to a 1 liter of organic milk which has been processed by different methods that were presented in the previous video:

Thermal Processes(pasteurization) and Non-thermal Processes(high-pressure processing and pulsed electric field processing).

If you need to refresh the meaning of pasteurization, [click here](#).

If you need to refresh the meaning of high-pressure processing, [click here](#).

If you need to refresh the meaning of pulsed electric field processing, [click here](#).

Figure 2-18: Example of question that was presented to participants.

Now, please select the product which you would prefer.



Figure 2-19: Choices were presented within milk products that are processed with different technologies.

Results were evaluated in PSPP software. Descriptive analysis was used for seeing details of the data and for conducting further statistical analyses. The independent samples t-test and paired samples test were carried out comparing the means of the anxiety arising level whether statistically significantly different from the beginning for the participants in emotion manipulated scenario. Pearson's chi-squared test was used to evaluate how likely are observed differences between the choices of consumers according to their treatments.

2.4 Study 3: Role of emotions in intentions to purchase organic processed products

Design. As it is shown in Figure 2-20, a between-subject, post-test only randomized experiment, was carried out using Qualtrics. Participants were primarily randomized to two different treatments and after they were randomized to one of the choice tasks either for either orange juice or milk.

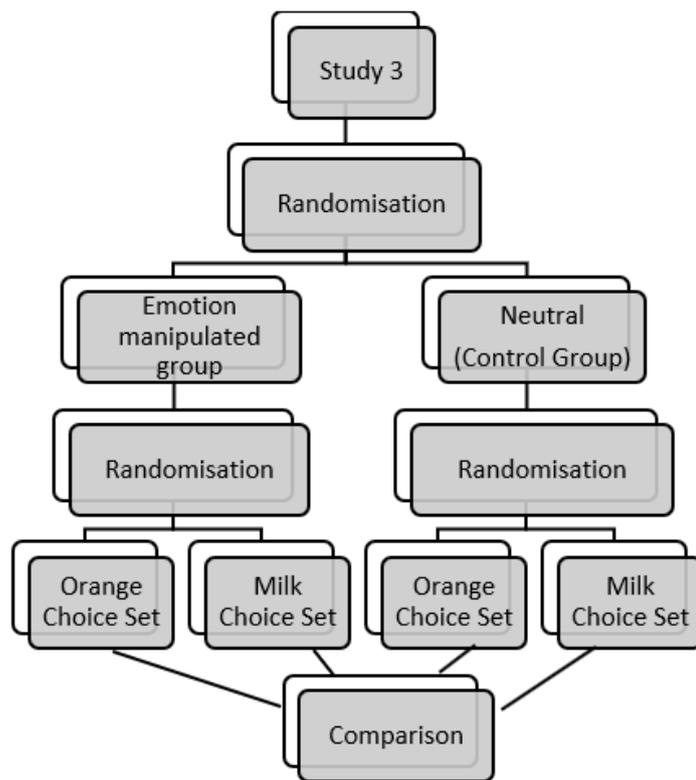


Figure 2-20: Experimental design of study 3

Participants. 128 organic food consumers, older than 18 years old, who both purchase certified organic products and at least purchase organic milk or orange juice, were recruited from Amazon Mechanical Turk. As it is shown in Figure 2-21, the percentage of food that participants or their household members purchase for home consumption, was mostly between 5-50%.

Organic Food Consumption

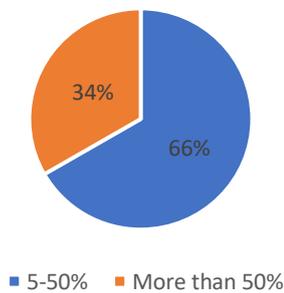


Figure 2-21: Participants’ organic food purchase frequency

Participants with a red-green color deficiency were excluded from the experiment using the simplified 6 plates version of the Ishihara color test (Handaya, Tokyo, Hongo Harukicho, 1917). Only fluent English speakers were involved in study 3. All participants were informed that the information which they will provide will considerably contribute to new scientific knowledge and may also benefit them as an organic consumer.

Measures. A choice task to investigate the effect of emotional state on consumers' preferences on milk and orange was designed. As it is shown in Table 2-5: Attributes and levels three attributes (carefulness, color, organic) with two-level were selected according to the aim of the study. The design was created using a D-efficient approach in the Ngen software (D-error = 0.989699, A-error = 1.336436). All attributes were dummy variables.

Table 2-5: Attributes and levels

	Attributes		
	Carefulness	Colour	Organic
Level	Careful	Monochromatic colour bar	Organic
	Less careful	Multi-color bar	Non-organic

Material. One label which is based on a blue monochromatic colour bar scale and a multi-color bar scale were prepared to communicate the carefulness of the processing technology to the consumer. The label was named as care-score (Figure 2-22)

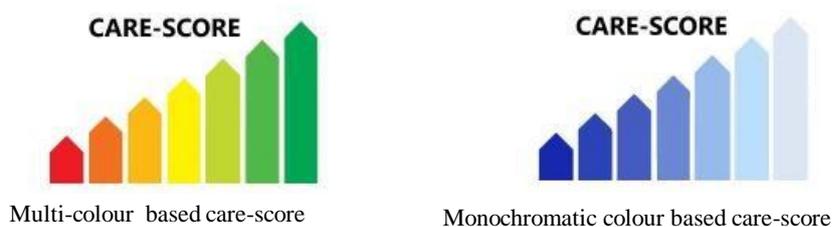


Figure 2-22: Colour based care-score developed for use in study 3

Care-score had 7 lines that start from green and goes to red for the multi-color based care-score and from pale blue to dark blue for blue monochromatic color based care-score. To communicate with the consumer in terms of carefulness level of processing technology: for

the less careful option, smaller lines, which are red for multi-color based care-score, and dark blue for monochromatic color-based care-score were marked within black lines. While to communicate the careful option, longer lines, which are green for multi-color based score, and pale blue for monochromatic color-based care-score, were marked within black lines as they are shown in the figure

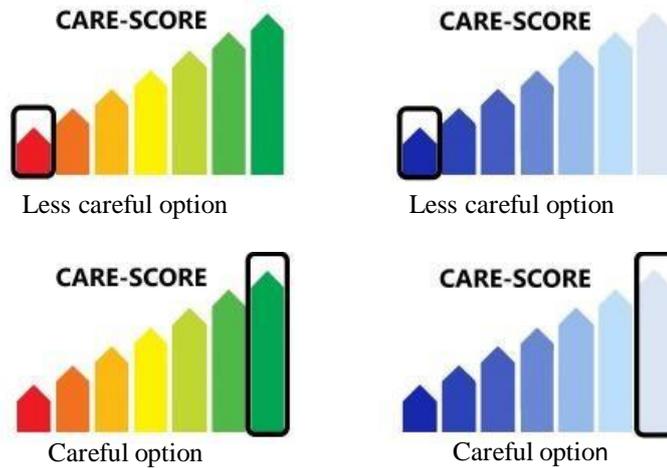


Figure 2-23: Care-score labels used to communicate the level of carefulness of processing technologies applied

To represent organic production to the consumer the European organic logo (The European Commission, 2018) was used (see Figure 2-24).



Figure 2-24: The European organic logo was used in study 3.

Afterward, two products were designed with related labels according to the attributes and their levels. The products that were the focus of this study are a carton box (1L) of orange juice and a carton box (1L) of milk. Pictures of packages were found from an online wholesome grocery shopping website. All adjustments needed for study 3 were applied

according to choose the design. Two examples of products used in study 3 are shown in the figures below.



Figure 2-25: Non-organic multi-color based care-score used for orange juice product



Figure 2-26: Organic monochromatic color-based care score used for milk product

Procedure. Participants were asked to read carefully the privacy consent form and sign it on the Qualtrics platform. Only participants who signed the consent as “yes” became part of the study. Respondents were assigned to one of two groups. The treatment was administrated (a video to generate anxiety) for the first group, while the second group was the control group. Following that, each group was randomized for 8 choice sets of one of the products (either milk or orange). In each set, consumers were presented with two packages of products with different attributes and levels. Participants selected their most preferred option, or they chose none of the alternatives which were presented to them.

To analyze the results PSPP software was used. Pearson’s chi-squared test was used to evaluate how likely are observed differences between the preferences of two groups.

CHAPTER 3 RESULTS AND DISCUSSION:

In this section, the data analyses and results will be discussed.

3.1 Results of Study 0

Respondents number that were assigned for three different treatments are shown in Table 3-1.

Table 3-1: Participants allocation to treatments in study 0

<i>Treatment</i>	Respondents
<i>Video treatment</i>	60
<i>Audio treatment</i>	66
<i>Mute video treatment</i>	69

Figure 3-1 demonstrates that all respondents started from similar emotional states before they had been randomized to three different treatments

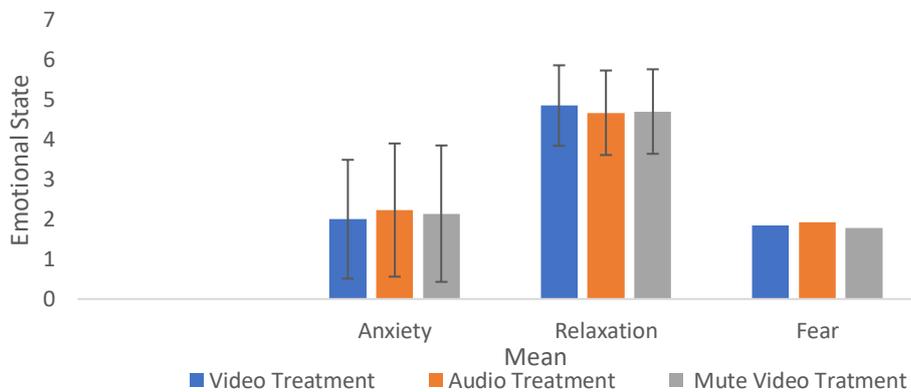


Figure 3-1: Emotional states of participants before the treatment

3.1.1 Comparing 3 Different Treatments

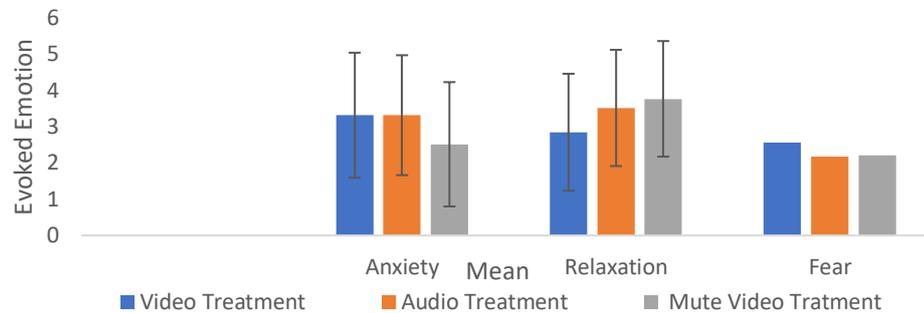


Figure 3-2: Evoked emotional states of participants after treatment

As it is shown in the figure above, participants' emotional state changed after their assignment to three different treatments. An ANOVA was calculated on participants' ratings of anxiety items. The analysis was significant, $F(37,35) = 7,46, p = ,00$.

Furthermore, the Bonferroni post hoc test indicated significant differences between the audio and the mute video, and between the baseline video and the mute-video; no significant differences were found between the audio and the baseline video treatments. This result indicates either audio or the baseline video treatment influenced consumers' emotional state.

3.2 Results of Study 1

The table below (Table 3-2) shows the participants' allocation for each communication scheme.

Table 3-2: Participants allocation to different communication schemes in study 1

<i>Scales</i>	Participants
<i>Monochromatic Color-based Communication Scheme</i>	60
<i>Multi-color based-Communication Scheme</i>	60

3.2.1 Comparison of Influence of Two Communication Schemes on Carefulness Perception

An independent-samples t-test was conducted to compare the rating of carefulness between two communication schemes for each processing method. Any significant differences did not found. Results suggest that the communication scheme does not significantly influence how the technologies are ranked. Moreover, the careful processing definition allows to consistently rank the different technologies.

3.2.2 Comparison of Consumer Perception Food Processing Technologies

The figure below (Figure 3-3) compares the carefulness ranking of each processing technology. Furthermore, the one-sample t-Test was conducted for all samples, to demonstrate whether the ranking for the carefulness of pasteurization is statistically different from the ranking for the carefulness of ultra-high temperature processing, high-pressure processing, pulsed electric field processing, and microwave processing.

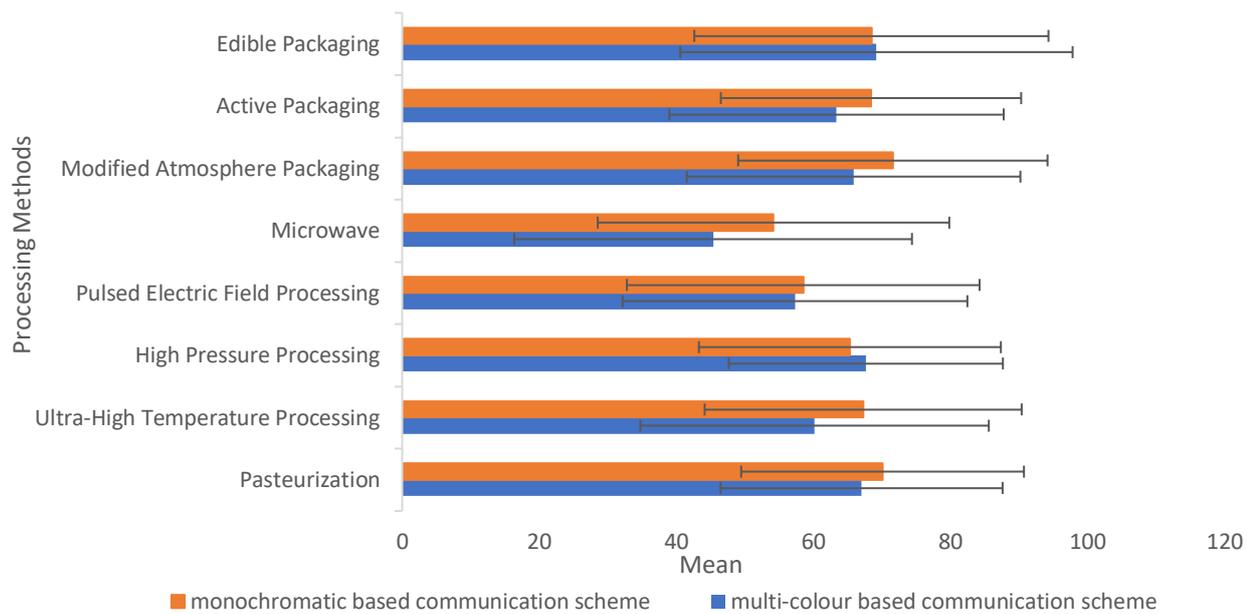


Figure 3-3: Descriptive analysis for participants who were communicated with multi-based and monochromatic colour bar based schemes

Results showed ranking for the carefulness of pasteurization are statistically significantly different from ultra-high temperature processing ($p=,026$), pulsed-electric field processing ($p=,262$), and microwave processing ($p=,000$) while there were no significant differences for high-pressure processing. The same test indicated ranking for the carefulness of modified atmosphere statistically was not significantly different from active packaging and edible-film coating.

3.3 Results of Study 2

Table 3-3 shows the number of respondents who were assigned to make choices for each product.

Table 3-3: Participant allocation for each product in study 2

Variable	N
Organic orange juice	187
Organic apple juice	186
Organic soy drink	150
Organic milk	188

3.3.1 Comparison of Consumers Choices Regarding Processing Technologies

To explore relationships between the emotional state of participants and their preference cross-tabulation (crosstabs) was conducted for each choice set separately.

Figure 3-4 shows the descriptive analysis of results, for organic orange juice. A chi-square test showed that there was no significant association between participant's emotional state and their risky preference for orange juice product, $X^2 (1, N = 187) = 1,15, p = 0,283$. Nevertheless, anxious participants tend to choose the safety option for orange juice product.

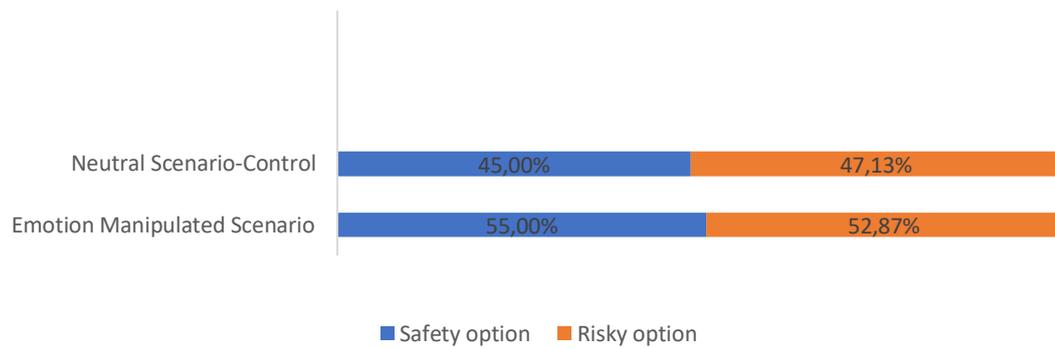


Figure 3-4: Frequency of risky and safety options preferences for organic orange juice

Figure 3-5 shows the descriptive analysis of results for, organic apple juice. A chi-square test showed that there was no significant association between participant's emotional state and their risky preference for organic apple juice product, $X^2 (1, N = 186) = 1,85, p = 0,173$. Participants' preferences were similar for orange juice product.

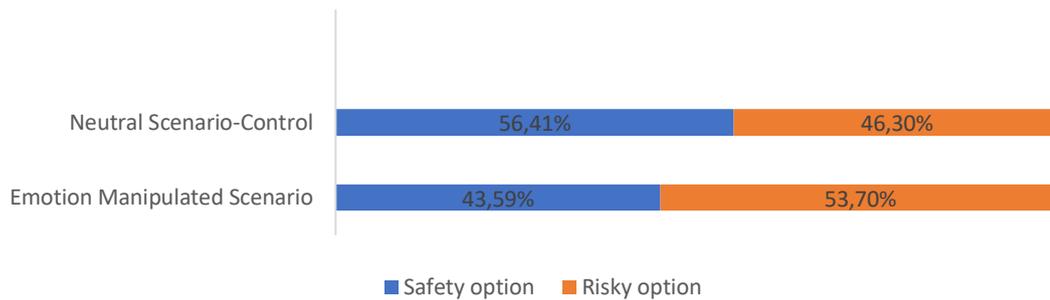


Figure 3-5: Frequency of risky and safety options preferences for organic apple juice

Figure 3-6 shows the descriptive analysis of results, for organic soy drink. A chi-square test showed that there was no significant association between participant's emotional state and their risky preference for organic soy drink product, $X^2 (1, N = 150) = .00, p = .979$. Anxious participants' preference was similar for both options.

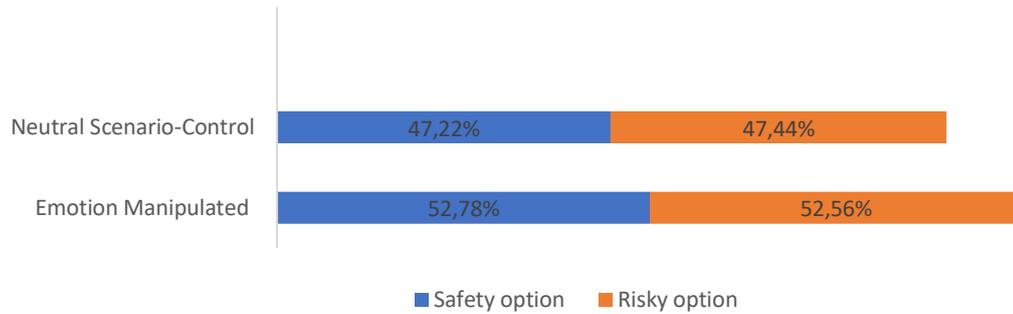


Figure 3-6: Frequency of risky and safety options preferences for organic soy drink

Figure 3-7 shows the descriptive analysis of results, for organic milk. A chi-square test showed that there was no significant association between participant's emotional state and their risky preference for organic milk product, $X^2 (1, N = 188) = .51, p = .474$. Nevertheless, Anxious participants tend to choose safety option.

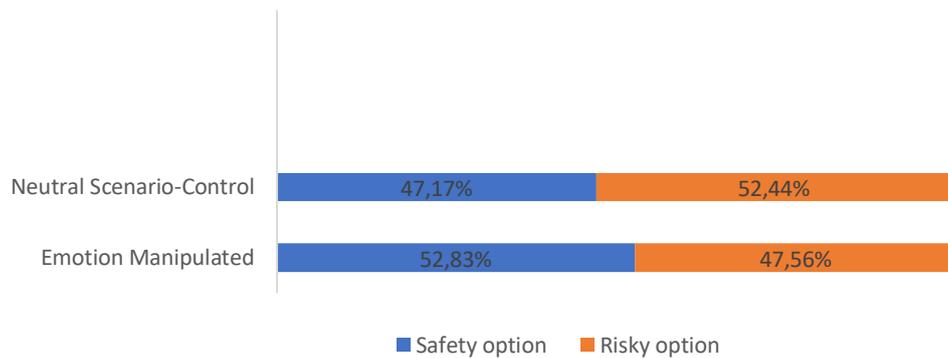


Figure 3-7: Frequency of risky and safety options preferences for organic milk

3.4 Result of Study 3

The table below shows the participants' numbers randomized into two different treatments.

Table 3-4: Participants allocation for each treatment

	Number of Participants
<i>Emotion Manipulated Scenario</i>	64
<i>Neutral scenario (control)</i>	64

Cross-tabulation (crosstabs) was used to see the relationships between the emotional state of participants and their preference. Eight choice sets of each product separately were analyzed in PSPP software.

Table 3-5: Distribution of consumer choices for milk product according to the two different treatment

<i>Choice Set for Milk</i>	Emotion Manipulated Scenario			Neutral Group (Control)			Chi-square p-value
	Alternative 1	Alternative 2	None	Alternative 1	Alternative 2	None	
1	58,82%	40,00%	71,43%	41,18%	60,00%	28,57%	,187
2	46,34%	53,85%	50,00%	53,66%	46,15%	50,00%	,890
3	43,75%	48,78%	57,14%	56,25%	51,22%	42,86%	,837
4	41,03%	57,89%	66,67%	58,97%	42,11%	33,33%	,311
5	56,52%	50,00%	40,74%	43,48%	50,00%	59,26%	,534
6	45,00%	57,89%	40,00%	55,00%	42,11%	60,00%	,603
7	42,86%	55,00%	47,83%	57,14%	45,00%	52,17%	,737
8	50,00%	43,24%	71,43%	50,00%	56,76%	28,57%	,387

Table 3-6: Distribution of consumer choices for orange product according to the two different treatment

<i>Choice Set</i> <i>For</i> <i>Orange</i> <i>Juice</i>	Emotion Manipulated			Neutreal Group			Chi-square p value
	(Control)						
	Alternative 1	Alternative 2	None	Alternative 1	Alternative 2	None	
<i>1</i>	47,06%	52,63%	44,44%	52,94%	47,37%	55,56%	,871
<i>2</i>	47,22%	57,89%	44,44%	52,78%	42,11%	55,56%	,706
<i>3</i>	60,00%	50,00%	40,00%	40,00%	50,00%	60,00%	,670
<i>4</i>	41,94%	60,87%	50,00%	58,06%	39,13%	50,00%	,388
<i>5</i>	66,67%	50,00%	39,29%	33,33%	50,00%	60,71%	,193
<i>6</i>	45,00%	55,56%	66,67%	55,00%	44,44%	33,33%	,525
<i>7</i>	47,83%	70,59%	37,50%	52,17%	29,41%	62,50%	,109
<i>8</i>	73,91%	33,33%	45,45%	26,09%	66,67%	54,55%	,013

A chi-square test was conducted on each choice set for each product. Results showed that there was no significant association between the participant's emotional state and their preference for different orange juice alternatives and milk alternatives with diverse attributes, except for choice set eight orange juice products.

Chi-square test for choice set eight showed that there was a significant association between the participant's emotional state and their preference for different orange juice alternatives ($p=,011$). While there was no significant association for milk alternatives ($p=,387$) in the same choice task. Anxious participants mostly preferred organic labeled, monochromatic-color risky alternatives (alternative 1, see Figure 3-8 and Figure 3-9) for both orange juice product (73,91%) and milk product (50%).



Figure 3-8:Choice set 8 for orange juice product*

*Alternative 1, alternative 2, and none option are shown in the figure respectively.



Figure 3-9:Choice set 8 for milk product*

*Alternative 1, alternative 2, and none option are shown in the figure respectively.

In choice set 3 when both alternatives were non-organic and carefully processed. The preference of participants about color-based labels were different for the two products. Anxious consumers preferred mostly (60%) monochromatic color label product for orange juice (alternative 1, see Figure 3-10) while multi-color label (alternative2, see Figure 3-11) for milk (48,78%).



Figure 3-10: Choice set 3 for orange juice product*

*Alternative 1, alternative 2, and none option are shown in the figure respectively.



Figure 3-11: Choice set 3 for milk product*

*Alternative 1, alternative 2, and none option are shown in the figure respectively.

However, in the choice set 5, similarly to choice task 3, when both alternatives were non-organic but non-carefully processed. The anxious participants preferred mostly preferred multi-color-based care-score labeled product (alternative 1, see in Figure 3-12 and Figure 3-12) for both orange juice product (66,67%) and milk product (56,52%).



Figure 3-12: Choice set 5 for orange juice product*

*Alternative 1, alternative 2 and none option are shown in figure respectively.



Figure 3-13: Choice set 5 for milk product*

*Alternative 1, alternative 2, and none option are shown in figure respectively.

DISCUSSION

Organic food quality is a complex concept that includes both product and process-related aspects (Kahl *et al.*, 2012). Organic consumers still have limited knowledge regarding processing technologies; while, on the other hand, processors, and other stakeholders have difficulties understanding consumers' requirements with regard to organic food quality (Naspetti and Zanolini, 2009). Today there is a lack of indications for organic food processing within the EU. In study 1, a careful processing definition was proposed to use in the conversion of organic foods. Careful processing definition was communicated with consumers through monochromatic colour bar based scale and multi-color bar based scale. The proposed careful processing definition allows to consistently rank the different technologies. Participants ranked the pasteurization process as most careful according to the careful processing definition was introduced to them. Between pasteurization and high-pressure processing, a statistically significant difference was not found while there were statistically significant differences between pasteurization; pulsed electric field processing, microwave processing, and ultra-high temperature processes. This finding is consistent with the previous study of Olsen *et al.* (2010) about consumer acceptance of high-pressure processing and pulsed electric field.

Food technologies without observable benefits are perceived as more dreadful than food technologies with some evident benefits (e.g. convenience food) (Siegrist, Keller, and Kiers 2006). Uncertainty related to a novel processing technology may affect the perception of consumers and as a result their perceived risk about these technologies. In study 2, the effect of consumers' emotional state¹⁰ on their risky preferences, related to organic processed products is investigated. According to the findings of study 2, the generated anxiety emotional state on participants did not lead them to make less risky choices (pasteurization processed products and no preference option). However, results showed some differences between the four different products. Even, a statistically significant effect of emotions was not found for

¹⁰ To investigate emotions role on organic food consumers' choice, three treatments were tested in study 0. Both video and audio treatment were effective to generate anxiety emotional states. That result was robust with the study of Gross (1995) that examine physiological responses to emotion-inducing films. However, it is important to emphasize that this material aimed to use specifically in this study to evoked anxiety in shopping-related situations.

any product, anxious participants mostly tend to make less risky choices for organic orange juice and organic milk products. Characteristics of processed food might have an impact on the perception of the organic claim by consumers (Prada, Garrido and Rodrigues, 2017). One interpretation of these findings is that could be both orange juice and milk are perceived to be a product where freshness is more relevant. Scozzafava et al. (2020) state that milk is a product in consumers' imagination as a wholesome food independently of the production method adopted. Considering previous literature, in study 2, organic consumers might not consider the processed-related quality of organic soy drink and organic apple juice, due to the characteristics of these products. Thus, they do not perceive any risk, related to high-pressure processing and pulsed electric field. While on the other hand, they were perceiving alternative processing technologies as a risk for organic orange juice and organic milk products.

Results of study 3 showed that the respondents were not influenced by induced anxiety in choosing among products were different level of carefulness were communicated. This result is not product dependent. However, the analyses were conducted for this study were preliminary and further, more sophisticated analysis tools, are needed to draw final conclusions.

To examine features of processed food products that can modulate the perception related to processing technologies of organic consumers, could be interesting to a better understanding of the perception of organic consumers about food processing technologies for further studies.

Lastly, experiments may be conducted in a more equal sample in emotion scenarios, for further studies. A previous study shows older adults can be more selective in their use of cognitive and their responses to risk information (Finucane, 2008). Considering this finding, to further reduce confounding factors, individuals who have a similar perception of risk should be selected to further investigate how emotions influence organic consumers' preferences in future research.

CONCLUSION

The present research aimed to demonstrate organic consumers' perception regarding alternative food processing technologies and the role of emotion in their preferences. Better taste and improved nutritional value are perceived as potential benefits when consumers purchase food products. However, consumers are not often aware of the processing technologies applied to products when they are evaluating the benefits related to products. Consumer acceptance for an alternative technology could be an issue when consumers do not perceive the additional value of these technologies (Bruhn, 2007; Siegrist, 2008).

In the present study, (organic) careful processing was defined and communicated with color-based or monochromatic communication schemes. Different communication schemes did not affect the ranking of carefulness, which therefore was consistently ranked showing the validity of the working definition provided in this study.

The influence of emotions (i.e., induced anxiety) on organic consumers was not found to significantly influence consumers' preferences on different processing technologies/methods nor the level of carefulness of these methods. This may indicate that induced anxiety does not interfere with the cognitive processes related to choosing organic food, whatever processed. This finding contributes to the knowledge on the role of emotion in consumption, and appear to contradict the previous finding on the role of anxiety on risk-averse behaviours.

Besides, but these findings still need to be confirmed, it appears to show that organic food is perceived as less risky by consumers, no matter the level of carefulness of the processing method applied.

The working definition of organic 'careful processing' and the color-based care-score label that was developed in this study may be useful starting points for better communication of processing methods in organic food.

BIBLIOGRAPHY

- Barbosa-Cánovas, G. V. et al. (2004) Novel food processing technologies, *Novel Food Processing Technologies*. doi: 10.1111/j.1365-2621.2005.01109.x.
- Bradley, B. F. et al. (2009) 'Effects of orally administered lavender essential oil on responses to anxiety-provoking film clips', *Human Psychopharmacology*. doi: 10.1002/hup.1016.
- Bruhn, C. M. (2007) 'Enhancing consumer acceptance of new processing technologies', *Innovative Food Science and Emerging Technologies*, 8(4), pp. 555–558. doi: 10.1016/j.ifset.2007.04.006.
- Core Organic Cofund (no date) Organic Product Processing | ProOrg. Available at: <https://www.proorgproject.com/> (Accessed: 1 December 2020).
- EC (2004) 'Commission Regulation (EC) No 852/2004 of 29 April 2004 on the hygiene of foodstuffs', *Official Journal of the European Union*, L 269(September 2000), pp. 1–15.
- EU (2018) 'Regulation 2018 848 EU on Organic Production and Labelling of Organic products', 2007(834), pp. 1–121. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02018R0848-20180614>.
- European Commission (2019) 'Organic farming in the EU. A fast growing sector.', *EU Agricultural Markets Briefs*, (13), p. 12. Available at: http://ec.europa.eu/agriculture/markets-and-prices/market-briefs/index_en.htm.
- European Parliament and European Council (2018) 'REGULATION (EU) 2018/848 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018 on organic production and labelling of organic products and repealing Council Regulation (EC) No 834/2007', *Official Journal of the European Union*, 2018(1151), p. 150. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R0848&from=EN>.
- Fao (no date) Guidelines on the collection of information on food processing through food consumption surveys. Available at: www.fao.org/publications (Accessed: 4 November 2020).

- FAO (2015) Guidelines on the collection of information on food processing through food consumption surveys, Food and Agriculture Organization of the United Nations, Rome. Available at: <http://www.fao.org/publications/card/en/c/a7e19774-1170-4891-b4ae-b7477514ab4e>.
- Finucane, M. L. (2008) 'Emotion, affect, and risk communication with older adults: Challenges and opportunities', *Journal of Risk Research*. NIH Public Access, 11(8), pp. 983–997. doi: 10.1080/13669870802261595.
- Gross, J. J. and Levenson, R. W. (1995) *Emotion Elicitation Using Films, COGNITION AND EMOTION*.
- Harmon-Jones, C., Bastian, B. and Harmon-Jones, E. (2016) 'The discrete emotions questionnaire: A new tool for measuring state self-reported emotions', *PLoS ONE*, 11(8), pp. 1–25. doi: 10.1371/journal.pone.0159915.
- Hawley, K. L. *et al.* (2013) 'The science on front-of-package food labels', *Public Health Nutrition*, 16(3), pp. 430–439. doi: 10.1017/S1368980012000754.
- van Herpen, E. and Trijp, H. C. M. va. (2011) 'Front-of-pack nutrition labels. Their effect on attention and choices when consumers have varying goals and time constraints', *Appetite*. Academic Press, 57(1), pp. 148–160. doi: 10.1016/j.appet.2011.04.011.
- Jermann, C. *et al.* (2015) 'Mapping trends in novel and emerging food processing technologies around the world', *Innovative Food Science and Emerging Technologies*. Elsevier Ltd, 31, pp. 14–27. doi: 10.1016/j.ifset.2015.06.007.
- Kahl, J. *et al.* (2010) 'Organic food claims in Europe', *Food Technology*, pp. 38–46.
- Kahl, J. *et al.* (2012) 'Organic food quality: a framework for concept, definition and evaluation from the European perspective', *Journal of the Science of Food and Agriculture*. John Wiley & Sons, Ltd, 92(14), pp. 2760–2765. doi: 10.1002/jsfa.5640.
- Kahl, J. *et al.* (2014) 'Organic food processing: A framework for concept, starting definitions and evaluation', *Journal of the Science of Food and Agriculture*, 94(13), pp. 2582–2594. doi: 10.1002/jsfa.6542.
- Katsarova, I. (2015) *Briefing European Parliamentary Research Service*.
- Knorr, D. and Watzke, H. (2019) 'Food processing at a crossroad', *Frontiers in Nutrition*, 6(June), pp. 1–8. doi: 10.3389/fnut.2019.00085.
- Köster, E. P. and Mojet, J. (2007) 'Theories of food choice development', *Understanding Consumers of Food Products*, pp. 93–124. doi: 10.1533/9781845692506.1.93.
- Kusev, P. *et al.* (2017) 'Understanding risky behavior: The influence of cognitive, emotional and hormonal factors on decision-making under risk', *Frontiers in Psychology*.

Frontiers Research Foundation, p. 102. doi: 10.3389/fpsyg.2017.00102.

Lado, B. H. and Yousef, A. E. (2002) 'Alternative food-preservation technologies: Efficacy and mechanisms', *Microbes and Infection*. Elsevier Masson, pp. 433–440. doi: 10.1016/S1286-4579(02)01557-5.

Lu, J., Xie, X. and Zhang, R. (2013) 'Focusing on appraisals: How and why anger and fear influence driving risk perception', *Journal of Safety Research*. J Safety Res, 45, pp. 65–73. doi: 10.1016/j.jsr.2013.01.009.

Monteiro, C. A. *et al.* (2018) 'The un Decade of Nutrition, the NOVA food classification and the trouble with ultra-processing', *Public Health Nutrition*. Cambridge University Press, pp. 5–17. doi: 10.1017/S1368980017000234.

Moubarac, J.-C. *et al.* (2014) 'Food Classification Systems Based on Food Processing: Significance and Implications for Policies and Actions: A Systematic Literature Review and Assessment', *Current Obesity Reports*. Springer Science and Business Media LLC, 3(2), pp. 256–272. doi: 10.1007/s13679-014-0092-0.

Naspetti, S. and Zanolli, R. (2009) 'Organic food quality and safety perception throughout europe', *Journal of Food Products Marketing*, 15(3), pp. 249–266. doi: 10.1080/10454440902908019.

Olsen, N. V., Grunert, K. G. and Sonne, A. M. (2010) 'Consumer acceptance of high-pressure processing and pulsed-electric field: A review', *Trends in Food Science and Technology*. Elsevier Ltd, 21(9), pp. 464–472. doi: 10.1016/j.tifs.2010.07.002.

Prada, M., Garrido, M. V. and Rodrigues, D. (2017) 'Lost in processing? Perceived healthfulness, taste and caloric content of whole and processed organic food', *Appetite*, 114, pp. 175–186. doi: 10.1016/j.appet.2017.03.031.

Probst, L. *et al.* (2015) 'Sustainable, Safe and Nutritious Food'.

Rottenberg, J., Ray, R. and Gross, J. (2007) 'Emotion Elicitation Using Films', *The Handbook of Emotion Elicitation and Assessment*. Available at: https://scholarcommons.usf.edu/psy_facpub/1811 (Accessed: 15 September 2020).

Scozzafava, G. *et al.* (2020) 'Organic milk preference: is it a matter of information?', *Appetite*. Academic Press, 144, p. 104477. doi: 10.1016/j.appet.2019.104477.

Siegrist, M. (2008) 'Factors influencing public acceptance of innovative food technologies and products', *Trends in Food Science and Technology*. Elsevier Ltd, 19(11), pp. 603–608. doi: 10.1016/j.tifs.2008.01.017.

Siegrist, M., Keller, C. and Kiers, H. A. L. (2006) 'Lay people's perception of food hazards: Comparing aggregated data and individual data', *Appetite*. Appetite, 47(3), pp. 324–332. doi:

10.1016/j.appet.2006.05.012.

Teisl, M. F., Fein, S. B. and Levy, A. S. (2009) 'Information effects on consumer attitudes toward three food technologies: Organic production, biotechnology, and irradiation', *Food Quality and Preference*. Elsevier, 20(8), pp. 586–596. doi: 10.1016/j.foodqual.2009.07.001.

The European Commission (2018) *The organic logo | European Commission*. Available at: https://ec.europa.eu/info/food-farming-fisheries/farming/organic-farming/organic-logo_en (Accessed: 28 November 2020).

Wyer, R. S. *et al.* (2019) 'The Effect of Incidental Emotions on Judgments and Behavior in Unrelated Situations: A Review', *Journal of the Association for Consumer Research*, 4(2), pp. 198–207. doi: 10.1086/701889.

Zadra, J. R. and Clore, G. L. (2011) 'Emotion and perception: The role of affective information', *Wiley Interdisciplinary Reviews: Cognitive Science*. NIH Public Access, 2(6), pp. 676–685. doi: 10.1002/wcs.147.

Zanoli, R. and Naspetti, S. (2002) 'Consumer motivations in the purchase of organic food: A means-end approach', *British Food Journal*, 104(8), pp. 643–653. doi: 10.1108/00070700210425930.

Zhu, X. *et al.* (2017) 'How commercial food videos affect female customers measuring female bio-response towards commercial food videos', *PhyCS 2017 - Proceedings of the 4th International Conference on Physiological Computing Systems*, (PhyCS), pp. 35–44. doi: 10.5220/0006394300350044.