



WORK PACKAGE NO. 6

CONSUMER ACCEPTANCE, PREFERENCES
AND COMMUNICATION

DELIVERABLE 6.9: SUMMARISING
REPORT ON ACCEPTANCE OF DIFFERENT
TECHNOLOGIES AND
RECOMMENDATIONS FOR
COMMUNICATION

Ronja Hüppe

Prof. Dr. Katrin Zander

University of Kassel, Witzenhausen, Germany

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Foreword

The main objective of the project is to develop a “Code of Practice” (CoP). The CoP is addressed to organic food processors and labelling organizations with the aim to provide a set of strategies and tools that can help them making the best choice for careful processing methods and formulations free of additives, while addressing the organic principles, high food quality, low environmental impact and high degree of consumer acceptance. Moreover, for labelling organizations, the CoP provides the necessary assessment criteria and tools to evaluate whether process innovations are in line with the principles of organic food quality. The CoP will be developed so as to be used and implemented easily, applicable in a wide range of situations and conditions and on existing, novel and future processes.

Besides the development of the CoP and the assessment framework, another focus was laid upon consumer acceptance and preferences. Therefore, task 6.5 summarizes the results of WP 6 on consumer acceptance and preferences of different processing technologies and recommendations for communication.

1. Introduction

With a modern and fast changing lifestyle, consumers take increasingly less time for food shopping and preparation, especially in industrialised countries (Ricci *et al.*, 2018). Therefore, convenience food is becoming ever more important (Jackson and Viehoff, 2016). In Germany, sales turnover of ready meals and soups increased constantly throughout the last years from 6.3 million euros in 2012 to 7.3 million euros in 2019, and peaked with 8.6 million euros in 2020, due to the Covid-19 pandemic (Statista, 2021). With this increasing demand of convenience food, food processors have developed new food processing technologies to improve microbiological safety, taste, and shelf life (Biancaniello *et al.*, 2018; Koutchma *et al.*, 2016; Martins *et al.*, 2019; Bevilacqua *et al.*, 2018). However, consumers are sceptical towards processed and convenience food and, supposedly, new technologies as they are often perceived as unhealthy, unsustainable, and unnatural (Martins *et al.*, 2019; Jackson and Viehoff, 2016; Meijer *et al.*, 2020; Román *et al.*, 2017; Knorr and Watzke, 2019).

Societal debates of health risks in foods caused by food scares, additives, and pesticide residues increase the interest in natural and organic food (Azzurra *et al.*, 2019). Organic foods are often perceived to be more natural than their conventional counterparts, and for many consumers, the naturalness of a food product is a key quality attribute, both for primary production and processing (Román *et al.*, 2017). Particularly organic food consumers are more sensitive to and prefer natural, healthy, and environmentally sustainable food products (Meyer-Höfer *et al.*, 2015; Lee *et al.*, 2017; Rana and Paul, 2020; Asioli *et al.*, 2019). Taking both aspects together, there is the desire for convenience on the one hand and for pure and natural foods on the other hand, challenging food processors to develop adequate food processing technologies (Meier *et al.*, 2019; Honorio *et al.*, 2019). This holds true especially for organic consumers, since they tend to prefer traditional and natural processing technologies (Hemmerling *et al.*, 2016), but they also increasingly demand organic convenience food (Willer and Lernoud, 2019).

In organic food processing, there is still a lack of mandatory standards and regulations (Kahl *et al.*, 2014) which is an issue as organic convenience food is on the rise (Willer and Lernoud, 2019; Kilic *et al.*, 2021). As Kilic *et al.* (2021, p. 2) state, “processing technologies with minimal or no changes in foods’ nutritional and sensory properties could offer attractive products with fresh-like taste to (organic) consumers”. Looking at the literature, there is a body of research which deals with consumers’ risk and benefit perceptions (see e.g. Frewer *et al.*, 2011; Siegrist, 2008) as well as with food technology neophobia (see e.g. Martins *et al.*, 2019) and naturalness perception of processed

conventional food (see e.g. Lee *et al.*, 2015; Siegrist and Hartmann, 2020). Yet, to our knowledge, only Popa *et al.* (2017) and Asioli *et al.* (2019) studied consumer preferences regarding organic products.

Therefore, the ProOrg' work package on "consumer acceptance, preferences, and communication" consisted of five main tasks to investigate consumer behaviour related to organic food processing:

- Task 6.1. Qualitative and explorative investigation of consumer knowledge and preferences of selected food processing technologies and trade-offs between different organic food attributes.
- Task 6.2. Assess consumer acceptance and preferences in a quantitative research step.
- Task 6.3. Analysis of the role of cognition and emotions in decision making for careful processed organic food.
- Task 6.4. Understanding of food processing quality by experts of the dairy industry and consumers
- Task 6.5. Summary of results of WP6, including communication recommendations.

The following chapters give a summarizing overview over the results and discussion and some overall conclusions. More detailed results can be derived from the links which are found below each of the five results sections.

2. Results

The results are presented task by task according to their order in the work package.

Task 6.1. Qualitative and explorative investigation of consumer knowledge and preferences of selected food processing technologies and trade-offs between different organic food attributes.

Goal and Method

As a very first step, the associations and expectations of processed organic food and participants' opinions and preferences for different processing technologies were explored. Therefore, nine focus group discussions were carried out in Germany and German speaking Switzerland. In total, 84 participants who bought organic food at least once in two weeks were recruited by a market research agency from an online panel. Processing technologies regarding shelf-life were discussed with the examples of organic milk and orange juice. Particularly, pasteurization, microfiltration, ultra-high temperature treatment (UHT), high-pressure processing (HPP), and concentration.

Results

Processed foods were associated with concepts like additives, artificial flavours, preservatives, E-codes, and chemicals, often negatively connotated. Participants mentioned a general uncertainty concerning processed foods and aspects related to it: origin of ingredients, packaging, or CO₂ footprint. Processing technologies were only mentioned at the side. Advantages were processed products being time saving, convenient, easy to portion, and enable consumption of a non-seasonal variety of goods. These positive aspects also held true for most participants for processed *organic* products. They expected organically produced ingredients, no additives, artificial flavours or preservatives, and as little ingredients and processing steps as possible.

Two groups of consumers emerged from the discussion: the “organic traditionalists” and the “organic pragmatics”. The “organic traditionalists” have strong ecological values and a general scepticism to higher processing levels and technologies. Hence, organic products should be carefully processed in the sense of keeping the natural value and changing the product as little as possible; e.g., pasteurised milk, or direct and fresh juice. They also perceived none of the discussed processing technologies as careful. For these consumers, the entire value chain is important, including the processing stage. Organic processing should actively communicate the benefits of new technologies, such as fewer processing steps, good nutritional values, and lower environmental impacts and energy use, and in doing that, increase transparency for consumers.

The “organic pragmatics” value the organic primary production and convenience more than careful organic processing. The latter is ‘nice-to-have’ but not a decisive purchase criterion. They also accept higher processing levels for organic products because they see benefits in e.g., a longer shelf life (ESL or UHT milk), environmentally friendly transportation (juice from concentrate), or better nutritional values with longer shelf life (HPP-treated orange juice). Health and environmental benefits of new technologies should clearly be communicated to outweigh potential risk perceptions.

Consumers have different preferences and understandings concerning processed organic food and know little about (organic) food processing. They want to know the benefits of a (new) technology but not the details of processing, which makes it difficult to include consumers in developing new (organic) processing technologies. Organic food processors should hence follow a holistic approach to organic

processing, taking consumers' values into account in order to prevent disappointment of consumers' expectations of organic processing. Not only food processors, but also the organic sector in general could benefit from taking a leading position in transparent consumer communication.

Further information: Hüppe, R. and Zander, K. (2021), "Consumer Perspectives on Processing Technologies for Organic Food", *Foods*, MDPI AG, Vol. 10 No. 6, p. 1212. <https://www.mdpi.com/2304-8158/10/6/1212>.

Task 6.2. Assess consumer acceptance and preferences in a quantitative research step

Goal and Method

The main goals of this quantifying study were to investigate organic consumers' acceptance of processing methods for organic food, and to examine if "careful" processing may be a suitable concept to assess the adequacy of processing methods for organic food. "Care" is an essential value in organic food production and used to promote organic products to the consumers. Hence, it is important to understand consumers' associations with the term. Milk was chosen as a sample product in this study. An online survey including a choice experiment was used to investigate organic consumers' acceptance and expectations of processing methods. Homogenization, pasteurization, microfiltration, and high-pressure processing (HPP) resulting in extended shelf-life, were investigated technologies. Participants were recruited in Germany and German speaking Switzerland through an online panel of a market research agency. In total, data was collected from 600 consumers in Germany and 687 consumers in Switzerland.

Results

Processing technologies were not very important purchase criteria for organic consumers. Processing rather played a hidden role, and criteria such as taste, freshness, or shelf-life which are influenced by processing technologies, were very important to consumers. Consumers were sceptical towards new milk processing technologies and preferred the technology they knew, that was pasteurization. Although so far not applied for milk processing in Germany and Switzerland, HPP had a high acceptance among (organic) consumers. The technology's advantage is its ability to preserve the taste and vitamin content. Accordingly, it is a promising technology in organic processing. Yet, the share of respondents who preferred HPP was significantly lower for heavy organic consumers than for occasional and rare organic consumers. Also, consumer preference for microfiltrated milk decreased when consumers purchased organic food more frequently and is thus, less recommended.

Regarding the suitability of "careful processing" for assessing the adequacy of processing methods for organic food, consumers' focus was on the maintenance of taste, vitamins and (micro-) nutrients, naturalness, and low product stress. The acceptance for modifying or impacting a product or accepting a loss through processing was very low. This means that consumer expectations were overly high and can hardly be fulfilled by any processor or processing technology. Still, consumers in both countries considered careful processing as very important and willingness to pay for carefully processed products increased with increasing organic purchase frequency. Looking at specific technologies, HPP, pasteurization, microfiltration, and homogenization were perceived as most careful, whereas UHT was perceived as least careful.

Moving from careful processing to organic processing, results showed that organic food is perceived to be more natural, more carefully processed, healthier, and to have a higher content in valuable

nutrients. Very heavily processed food products were perceived as a contradiction to “organic” and also ready-made meals were perceived as rather unsuitable for “organic”. The technologies perceived as careful were also perceived fitting for organic processing. Maintenance of nutrients, naturalness, and low product stress are closely associated with organic processing. Concerning specific technologies, HPP, pasteurization, microfiltration, and homogenization were named as suitable technologies for organic processing. Generally, participants were somewhat more tolerant when it came to organic than when it came to careful processing.

Summing up, processing indirectly plays an important role in consumers’ milk choice behaviour in that it affects the product attributes taste, freshness, and shelf-life, which are important to consumers. The more consumers buy organic food, the more they pay attention to processing and the less they place emphasis on long shelf-life. Information about the benefits of a new milk processing technologies in terms of shelf-life, taste, and nutritional value can lead to a significant shift in preferences in favour of the new method.

Carefully processed food is perceived as having a higher content in nutrients and as being more natural. Frequent organic consumers have higher expectations towards careful processing and consider it as more important than less frequent organic consumers. The concepts of careful processing and organic processing seem to match very well. For both concepts “the maintenance of nutrients”, “the maintenance of naturalness” and “no/ low product stress” are important components/ aspects. In communication with consumers, the expression “carefully processed” might give rise to overly high expectations. Accordingly, communication should rather focus on tangible benefits for consumers like the preservation of a food’s natural taste and nutritional content.

Further information: Meier, C., Stolz, H., Koch, K. (2021) “Consumer acceptance, preferences and communication - Report on the outcome of the quantitative consumer survey (D6.2)” <https://www.proorgproject.com/copie-de-participation-in-congress->

Task 6.3. Analysis of the role of cognition and emotions in decision making for careful processed organic food.

This task was split into two parts. The first part focussed on associations and consumer perception of different levels of processed organic food. The second part focussed on proposing and evaluating a working definition of “careful processing” by consumers.

Associations and consumer perception of different levels of processed organic food

Goal and Method

The main goal was to identify attributes and claims, that can influence consumers’ perception of processed organic products. Consumers’ associations or meanings related to “careful processing” were identified in order to find best ways to communicate food processing. Moreover, the influence of consumers' emotional state on their views of food processing was investigated by showing them a 2-minute video on environmental issues before answering the questionnaire. As a first step, a conjoint analysis was done to evaluate which product characteristics fit with consumers concept of “organic processing” and purchase intention. Therefore, three products with different processing levels based on the NOVA classification were chosen: vegetable burger (ultra-processed), peas in a glass jar (processed), and a bagged salad (minimally processed). For each product, positive informative messages and neutral messages were selected for four factors: packaging, processing, use of additives, and quality.

Results

The influence of the video lasted only for a short time and respondents experienced a rapid recovery of their emotional state. For all respondents, the most important criteria that processed organic products should entail were no use of chemicals and respect for the environment. However, 70 % of the respondents who saw the video rated “respect for the environment” as most important compared to 53 % of the respondents who did not see the video. For most respondents, information on processing should be communicated via a written information label on the packaging and via a symbol or logo. As a symbol, a hand holding a seedling or a hand indicating the intervention of man was mostly preferred. “Careful processing” of organic products was mostly associated with the terms respectful, eco-friendly, and natural.

The conjoint analysis revealed that peas in glass jar was the processed organic product that best conveyed the idea of “organic product” to consumers. The vegetable burger as an example of an ultra-processed organic product, had a negative influence on consumers association with an organic product. For “packaging” and “processing” the positive synthetic message had a positive impact, compared to a negative impact of a neutral informative message and the absence of a message. A simple and honest descriptive message that informs about the environmentally friendly materials used for packaging or about some process steps having a low impact on the environment (e.g., “processed with low energy consumption to reduce the environmental impact”, “raw materials coming from fields located near the company to reduce the transport environmental impact”) had a more positive impact on the perception of organic.

Summing up, the type of product, information on processing and packaging were the factors which had a major influence on consumers’ concept of “organic food” and consumers’ purchase intention. A label or a symbol or logo are the best ways to communicate food processing. Respectful, eco-friendly, and natural were the terms best associated with a careful processing for organic products.

Further information: Working group: Fiorella Sinesio, Anna Saba, Elisabetta Moneta, Marina Peparaiio, Eleonora Saggia Civitelli, Flavio Paoletti. “Report on the role of cognition and emotions (Deliverable 6.5)”. CREA - Research Centre for Food and Nutrition, Rome.

Proposing a working definition of “careful processing” for organic products

Goal and Method

As seen from the former studies, the understanding and the expectations related to the term “careful processing” were very diverse. Hence, the first goal of this research step was to propose a working definition of “careful processing” and to test its consistency through an experiment, while being used to rate different processing technologies by consumers. The following definition encompasses both, the definitions of careful and minimal processing.

Box 1: Working definition of „careful processing“

“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
- c. limit the impact on the environment by
 - reducing the use of water and energy
 - optimizing waste management
 - promoting recyclable/reusable packaging

The participants were organic consumers who were recruited via Amazon’s Mechanical Turk, potentially representative of the Italian population. In total, 130 consumers (> 18 years) participated in the experiments. 88 % of the sample stated to buy at least between 5 % and 50 % certified organic food, the remaining 12 % stated to buy more than 50 % certified organic food.

The experiment had three steps and two communication schemes were tested. First, participants were presented a working definition of “careful processing”. Second, they got neutral information from a video on eight different processing technologies: pasteurization, HPP, UHT, microwave processing, and pulsed electric fields. As a third step, they were asked to rate the level of carefulness for the different processing technologies from “not at all careful” to “very careful” with help of a multi-colour bar scale or a mono-chromatic bar scale.

Results

Results showed that regardless of which communication scheme was used, the carefulness score for each technology was not significantly different. Comparing the carefulness scores of the different processing technologies and taking pasteurization as a reference technology, microwave processing and pulsed electric fields were perceived significantly less careful than pasteurization. HPP and UHT did not show different statistically significant careful levels compared to pasteurization. These results suggest that the working definition of “careful processing” allows to consistently measure the studied processing technologies. Concluding, Kilic *et al.* (2021, p. 7) state that “... the definition [of “careful processing”] may be useful to further develop an operational, multi-dimensional approach to organic food processing, aiming to: (1) limit the impact of processing on the nutritional and sensory qualities of organic food, while (2) enhancing shelf life and (3) taking care of people and any biotic and abiotic factors both directly and indirectly involved in the processing.”

Further information: Kilic, B., Cubero Dudinskaya, E., Proi, M., Naspetti, S. and Zanolli, R. (2021), “Are They Careful Enough? Testing Consumers’ Perception of Alternative Processing Technologies on the Quality of Organic Food”, *Nutrients*, MDPI AG, Vol. 13 No. 9, p. 2922. <https://www.mdpi.com/2072-6643/13/9/2922>.

Task 6.4. Understanding of food processing quality by experts and consumers

Goal and Method

The last part of the consumer work package investigated whether processors and consumers have the same understanding of processing quality. This does not only provide further insights into consumer understanding of processing quality, but also helps to better understand the communication between processors and consumers and to develop appropriate communication strategies.

For the processor perspective, semi-structured expert interviews with employees of at least partly organic dairy processing companies and organic fruit juice processing companies were administered in Germany, Switzerland and Austria. The interviews were conducted via telephone and covered four major topics: quality of organic milk/juice processing in general, assessment of concrete processing techniques for organic milk/juice processing, product quality of organic milk/juice, and information flow regarding quality and processing between producer and consumer.

For the consumer perspective, five online focus group discussions with German speaking organic consumers were conducted. The participants were recruited by a market research agency and the discussions were audiotaped via zoom. The discussions covered four main topics: general consumer understanding of organic food quality, consumer understanding of processing quality, perception of (juice) standardization, and potential consumer information sources for food processing.

The processors preferred mechanical processing technologies with fewer processing steps. Specific processing techniques for drinking milk and fruit juice were assessed differently; some processors rejected single techniques that were accepted by others. For organic food, this discussion included especially modern processing techniques that preserve the freshness of the raw material as well as technologies that reduce the environmental impact. In these cases, freshness and environmental sustainability appeared in a form of dichotomy. Variances of the raw material and the grade of standardization were topics that arose in the interviews with both processors' groups, so they were included in the focus group discussions to examine the consumers' perceptions.

Preliminary results

The processors discussed the impact of the EU organic regulations on their work and also their perception of organic product and process quality. In general, their understandings of organic processing quality seem to go beyond the EU regulations in terms of sustainability, and included modern technology as well as traditional processing and human contact as important factors for high processing quality. Transferring information about food processing was described as challenging due to the consumers' low food technology literacy and does in some cases limit the techniques in use.

The consumers stated a low food technology literacy and expressed difficulties in assessing processing quality. They were able to discuss the advantages and disadvantages of industrial and artisanal processing. During the discussion about food processing, the participants preferred to talk about agricultural production and food trade but not about processing. They showed high expectations of organic food products and a general mistrust in the food sector. They stressed that they want transparency in the food sector. In general, the participants accepted variances of the raw material and preferred fewer processing steps. The participants showed high interest in food technologies and a willingness to increase their low food technology literacy. As learning material, some preferred videos, others textual information, some spoke in favour of visits at production and processing places.

The consumers are interested in learning more about food processing, and difficulties in consumer communication might be reduced by raising the level of consumers' food technology literacy. Greater

knowledge of food processing could enable consumers to make purchasing decisions which are more in line with their needs. Processors would have the chance to establish a greater variance of differently processed food products on the market. Processors can be engaged in this educational process, for example with guided tours through their facilities.

Task 6.5. Concluding Summary

In this work package, consumer acceptance, preferences, and communication regarding processed organic food and careful processing have been looked at from different perspectives. Consumers have different preferences and understandings concerning processed organic food and know little about (organic) food processing. They demand transparent information and want to know the benefits of a (new) technology but not the details of processing. However, processing indirectly plays an important role in consumers' behaviour in that it affects the product attributes taste, freshness, and shelf-life, which are important to consumers. Information about the benefits of a new (milk) processing technologies in terms of shelf-life, taste, and nutritional value can lead to a significant shift in preferences in favour of the new method. Looking at specific product attributes, the type of product and its processing level, and information on processing influence consumers' perception of "organic food" and also their purchase intention. Products with medium to low processing levels and positive information on processing in a few words or via an understandable logo are stronger associated with organic food than high processing levels, neutral or no written information. Comparing perceptions of processing quality of organic food, both, processors and consumers, prefer technologies with few processing steps, with little impact on the nutritional quality, and natural variances of the raw material as it is more natural. Both groups report a low food technology literacy of the consumers. But the consumers declared to have a high interest in food technology and a demand for transparent information.

Regarding "careful processing", the understanding of consumers is closely related to organic processing and has many meanings. "Careful" or organic processing is associated with respectfulness, eco-friendliness, naturalness, and a higher content in nutrients. In communication with consumers, the expression "carefully processed" often induces high and sometimes unrealistic expectations. Accordingly, communication should rather focus on tangible benefits for consumers like the preservation of a food's natural taste and nutritional content. For processors, defining and complying to "careful processing" can help to develop a more holistic approach to organic processing. This could entail nutritional and sensory qualities, environmental and social aspects as well as consumer values regarding the environment and their expectations of organic processing and processed organic food.

Raising the level of consumer awareness and knowledge of organic processing might be a way to introduce less processed and more variable and natural food products successfully on the food market. As transparency plays an important role for organic consumers, not only food processors but also the organic sector in general should take a leading position in transparent consumer communication and communicate the benefits of processing technologies for consumers as part of a sustainable value chain. This could lead to a further positive differentiation and positioning of organic processed food compared to conventional food and thus, to an increase in demand for organic food in the long run.

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