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RESEARCH

Using a conceptual model to describe organic food process quality: the perspective of consumers

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Abstract The food chain actors hold different perspectives on organic food quality. For processors, it is important to align their quality design with consumer expectations. Based on the organic food quality model by Vasileva et al. (Org Agr 9:1-12, 2019) this study investigates the consumer perspective on organic food processing, focusing on natural variations and modern technology with fruit juice as the main example product. In September 2021, we conducted four online focus groups with 29 organic shoppers from Germany (15 female, 14 male; between 18 and 70 years old) and performed a qualitative text analysis. The participants expect environmental and social sustainability in organic food production. For them, organic quality means a lower processing degree and less standardization. They are sceptic about blending and the production of juice made from concentrate. They prefer directly bottled juice and accept more variations of juice characteristics. They are open to modern technologies if these are environmentally friendly and socially acceptable. They are interested in raising their food literacy and show trust in information offered by processors. To bridge information asymmetry, they use several indicators. Comparing the results with the literature, the quality perceptions of processors and consumers are close. The model used has proven to be suitable for presenting the process quality from different perspectives and for showing relevant connections between the actors.

Keywords Organic food processing · Consumer perspective · Food quality model · ProOrg · Fruit juice

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Introduction

Food quality includes the measurable characteristics of the final product (product quality) and also the way it is processed (process quality). The process quality includes the production technologies as well as environmental and social impacts of production (Kahl et al. 2012; Zikeli et al. 2014). For organic food, the process quality is especially important (Kahl et al. 2010). Production of organic

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food should be careful to the product, the people, and the environment (Nielsen 2004). These aspects can hardly be verified by consumers (information asymmetry), what makes them credence attributes (Daniloska 2014). Organic food is not only available on the market as raw goods, but also as processed products (Kumar et al. 2023). Food processing is an important interface between producers and consumers (Keding et al. 2013). It is important to meet consumer expectations in order to be successful on the market. At the same time, the various legal requirements for the processing of organic food must be met. Only then producers are allowed to use organic labels which are important to bridge the information asymmetry (Vasileva et al. 2019). In the European Union, the regulation (EEC) No. 2018/848 is mandatory for organic food production, but producers can also produce according to the guidelines of the different organic farming associations. Within these guidelines, we find different regulations for specific processing technologies: For example, the regulation (EEC) No. 2018/848 allows to produce juice from juice concentrate, while most organic farming associations prohibit this technology (Gäa e.V. 2014: 38; Biokreis e.V. 2015: 3; 5; Biopark e.V. 2016: 29; Bioland e.V. 2022: 5; Bio Suisse 2023: 236–237; Naturland e.V. 2023: 33; Demeter e.V. 2024: 107–108). A higher processing degree removes the product further from its natural state (Adnan et al. 2017), but lower processing limits the ability to compensate for natural fluctuations (Bates et al. 2001; Anonymous 2016). Technologies must be chosen carefully. The technology assessment should include effects on the product and also effects on people and the environment (Luttikholt 2007). We can see this balancing of different aspects in practice in the Naturland guidelines for juice processing: the production of juice made from concentrate is restricted in general. But exceptions are possible after approval if it makes sense due to the life cycle assessment (Naturland e.V. 2023: 33). Process quality is therefore assessed differently, depending on which aspects are considered to be more important. As the actors in the food value chain have their own individual understanding of quality, this must be taken into account when considering organic processing (Kahl et al. 2010).

Theoretical background

Perspectives on process quality of organic food

The production of food is often recognised as a multi-stage process (Hamatschek 2021). Important components are production and consumption. The key players include producers and consumers, which each have their own perspectives on quality (Riegel and Hoffmann 2012). As producers produce for consumers, they are not isolated from each other. This connection becomes visible in the conceptual model by Vasileva et al. (2019), that they developed to evaluate organic quality. The model follows an integral approach which means that the quality of food includes all desirable characteristics. For organic, this means more than just measurable product characteristics, but also social and ecological aspects of production. Figure 1 shows the model with focus on consumer aspects (in bold).

The Designed Quality includes both the legal requirements and the processors' individual quality standards. The Perceived Quality includes the consumer perceptions and expectations regarding the whole production chain of the food. The model further includes the Achieved Quality which is expressed via the physical product on the market and is determined by e.g., sensory, physico-chemical and microbiological characteristics. In addition to product quality, process quality is also important for organic food. This does not always have an effect on the physical properties of the product, but is made measurable by the labels of the certifying organisations (Kahl et al. 2012; Dalmoro 2022). Kahl et al. (2012) therefore describe labelling as a product and not a process-related attribute. Organic quality is nevertheless cited as a classic example of credence attributes, as consumers only have limited opportunities to check the quality of the products themselves (Daniloska 2014; Vasileva et al. 2019). This leads to the bridges between the qualities described in the model: Designed and Achieved Quality are connected by *sustainable management*. It achieves the congruence of both Qualities via quality management and control. This bridge lies in the responsibility of the representatives of the supply side of the market. Achieved Quality and Perceived Quality are connected by *information asymmetry*. Consumers assess

Fig. 1 Conceptual Model for Organic Food Quality by Vasileva et al. (2019) with focus on consumer aspects

which products meet their quality expectations best based on perceived process and product-specific characteristics. However, consumers do not have complete information about the production process and therefore must trust the information they get from the supply side. Information asymmetry can lead to products appearing to be of better quality than they actually are (Giannaka and Yiannaka 2023). Also, aspects of processing are not always transparent for the consumers: Consumers have difficulties in evaluating food processing due to low food literacy (Zheng et al. 2019). If consumers do not understand how processing occurs, they may reject processing methods (Coppola et al. 2014). Vasileva et al. (2019) propose e.g. certification systems and labels to overcome information asymmetry.

It must be noted that consumers use that information on the product that make sense from their subjective point of view. The choice of quality cues depends on the consumer's knowledge and experience, and may differ from expert opinion (Grunert 2007). Consumers can be empowered to make informed decisions through a *learning process* which is the bridge between Designed and Perceived Quality (Vasileva et al. 2019). But this learning process also includes the processors: They are encouraged to include the consumer expectations into their Designed Quality to satisfy consumer needs.

Overall, the model offers the opportunity to adopt different perspectives on quality. At the same time, it also shows ways in which the gaps between different perspectives can be overcome. This is especially important for the organic sector, where cooperation between the various stakeholders is important for the further development (Arbenz et al. 2017). In the following, we apply the model components of Designed and Perceived Quality to organic processing.

Designed quality of organic food processing

Following the model, the Designed Quality includes the relevant legal restrictions for organic food processing. In the European Union, this is the regulation (EEC) No. 2018/848. Processors can also decide to process according to standards from organic farming associations and develop individual quality standards (Seidel and Kretzschmar 2008). Compared to other actors of the food system, there are only a few studies

including the processors' perspective (Kamrath et al. 2019). Ilbery and Kneafsey (2000) conducted a study with small producers of regional specialty food products. They found that processors use the specification, which is the detailed and documented description of the food and its processing (Riddick et al. 2016), as the base for the Designed Quality. The Designed Quality of the participants includes the ingredients, the recipe, the production process, hygiene and cleanliness, the raw material and knowledge as well as handmade production. For the organic baby food processors surveyed by Seidel and Kretzschmar (2008) food safety and raw materials are most important quality aspects. They also expect different processing technologies for organic than for non-organic food yet within the study, no differences are found. They describe variations in the raw material as a challenge. The participants in the study by Borghoff et al. (2023a), who were employees from organic juice processing companies, describe the same challenge. They report that they need to standardize natural variations of the raw material, but this means a more intense processing. As examples, they describe production of juice made from concentrate or blending of juice, which requires a double pasteurization. In a further study with employees from organic dairies, processors describe similar problems for the case of non-homogenised milk (Borghoff et al. 2023b). The milk processors also indicate that consumers and retailers demand fresh milk with longer shelf life. But this needs an additional microfiltration. The processors from both studies describe the low consumer food literacy as challenging: Consumers would misinterpret natural variations as food fraud. This fear is not new. As we can in read Stanziani (2008), consumers accused bakers of flour quality manipulation already in pre-industrial. The bakers on the other hand explained differences with natural variations. The processors also describe the type of processing as relevant. While the experts in the study by Ilbery and Kneafsey (2000) base their quality understanding on handmade production, the experts in the study by Borghoff et al. (2023a) and Borghoff et al. (2023b) also include modern automated production methods in their Designed Quality. This is similar to the findings of Castellini et al. (2023) who found technical indicators as an important part of the quality perception of farmers and processors. In contrast, the consumers in their study, report a simple quality perception. This difference is challenging, as the participants in the studies by Borghoff et al. (2023a) and Borghoff et al. (2023b) report: Consumers would feel put off by modern production. They would only consider old-fashioned processing methods to be of high quality, even if these led to higher product damage. The processors stress the effects of processing on the product itself, but also the effect on people and the environment. They thus include important aspects of organic food quality in their own quality concept (Kahl et al. 2012).

Perceived quality of organic food processing

Although there are more studies on the consumer perspective on food quality, they do not cover all the topics that are relevant for processors. For consumers, the core principle of organic food is naturalness. This is particularly characterized by the absence of man-made influences (Rozin et al. 2012; Meyer-Höfer et al. 2015; Castellini et al. 2023). Processing is especially important for the perceived naturalness of a food product: The stronger the processing, the stronger the reduction of the assumed naturalness (Evans et al. 2010). Therefore, natural variations as a result of less processing should be in line with consumer expectations of organic food. Less industrialised processing, human contact, and traditional or minimal processing can all increase the perceived naturalness (Stanziani 2008; Abouab and Gomez 2015; Román et al. 2017; Schirmacher et al. 2023). Consequently consumers expect organic food to have a lower processing degree and associate organic processing with more human contact (small-scale production, artisanal production etc.) (Verhoog et al. 2007; Hüppe and Zander 2021; Fartsi et al. 2023). This fits the presentation of processing in advertising, which predominantly depicts manual processing methods (Schippmann-Schwarze et al. 2023). Interestingly, the participants in a study by Vasileva et al. (2014) expect organic food to be processed traditionally but with modern technology. They prefer modern technology for food safety reasons. They see industrial processing not in line with organic. But they associate industrial processing not with technology, but with the *scale* of production. For the case of organic fruit products, consumers expect a different way of processing than for non-organic fruit products (Espinosa-Brisset et al. 2023). Hüppe and Zander (2021) conducted a focus group study with

organic juice as an example product. They found that consumers expect organic food processing to be less intense and environmentally friendly. For the case of juice, consumers are sceptical about juice made from concentrate, but see advantages in more efficient transportation.

Consumer expectations of organic food processing appear to be complex and differentiated. This is a challenge for processors who want to manufacture products in such a way that they comply with Perceived Quality.

Objectives of this study

This study investigates the Perceived Quality of organic food, with focus on natural variations and modern or traditional processing methods. The study also explores what methods consumers consider appropriate for bridging Designed and Perceived Quality, and what consumers use as bridges to the Achieved Quality, see Fig. 2.

We decided for a qualitative study design. Consumers understand "organic" to mean more than the legally regulated aspects. They associate aspects with organic food that are not part of the organic principles per se, such as a lower caloric content (Schuldt and Schwarz 2010; Meyer-Höfer et al. 2013). The qualitative study design gave us the freedom for follow-up questions and to discover the research topic in more detail (Bitsch 2005; Stewart et al. 2009).

Methodological approach

We decided for focus groups for data collection, because they are well suited for surveys that focus on consumer demands on products and services (Henseling et al. 2006: 3–4). Focus groups are discussions with several participants that are guided by a moderator using key questions. They are used for topics about which there is limited knowledge. Through the discussion with several participants, new topics that were previously unknown can emerge (Stewart et al. 2009).The number of focus groups is mostly between 3 and 5. Less structured discussion guidelines need more focus groups than higher structured guidelines (Lamnek 1998:108–110).

We planned to conduct in-person focus groups, but had to adapt our method to online focus groups using the software Zoom due to the COVID19-pandemic. Web conference technology allows to conduct synchronous focus groups that include audio and video data. Therefore, tone of speaking and body language are still perceivable (Falter et al. 2022).

We developed the focus group guideline in a team with partners from an international research project and conducted a pre-test for evaluation. The

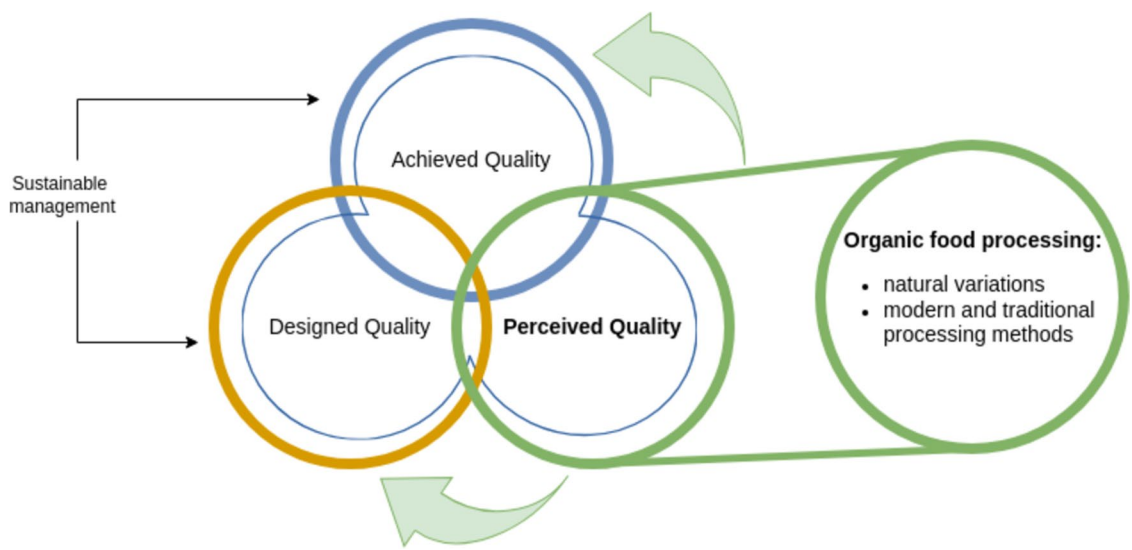

Fig. 2 Adapted model

Table 1 Focus group guideline (translated from German by the authors)

Topic or input	Narrative request and questions or content of input
Introduction	Every participant says their first name, their place of living (voluntary information), and which food products they shop for in organic quality
Food quality in general	Questions: o When you buy food, what do you look for in products in general? o What is important to you when it comes to organic products?
First input	Presentation of the food value chain with the stages of agricultural production, food processing, trade, and private consumption
Process quality	Question: o What do you think of when you think of quality in organic food processing? o What do you think about processing techniques (manually, automated)? (ask only if not mentioned by the participants themselves)
Homogeneity and variance I	Question: o How important is homogeneity of juice to you?
Second input	Three ways of apple juice processing are described: 1. direct bottling with one pasteurization step 2. filling in bulks, blending, and bottling with two necessary pasteurization steps 3. production of juice made from concentrate
Homogeneity and variance II	Questions: o How do you assess these technologies? o How do you assess the importance of a standardized taste and low processing degree?
Information about processing	Questions: o Where would you like to find out about processing? o Who should provide the information? o How should the information be presented? (text, comic, video, etc.)
Closing	Question: o Are there still points that are important but that we have not talked about so far?

participants of the pre-test followed the same characteristics as those of the participants of the final focus groups and have been recruited in the same way. The final guideline for the focus groups is shown in Table 1. We start with an open introduction in which the participants describe their expectations of the production of organic food in general, before we discuss the topic of natural variations using the example of fruit juice.

From 09 to 21 September 2021, we conducted four online focus groups of 90 min with 6–8 participants (29 participants in total). The participants were recruited by a market research institute and received an expense allowance for their participation. The in-person focus groups by Hüppe and Zander (2021) had a similar research topic. Therefore, we decided for similar participants characteristics regarding organic shopping frequency, age, gender and working activity: We included participants that shop for organic food products at least every fortnight. Half of the participants in every focus group were between 18 and 45 years old and the other half between 46 and 70 years. In contrast to Hüppe and Zander (2021) we have lowered the maximum age to 70 years, as this is suitable for online focus groups according to the experience of the market research institute. We also reduced the number of participants per focus group, because this is suggested for the online setting (Tuttas 2015). The highly structured guide allowed us to work with a reduced number of focus groups. Overall, every focus group included at least 33% and a maximum of 66% of participants that consider themselves female. At least 33% of all focus group participants were working full or part-time, the other participants were students, pensioners, or people without regular work.

During the focus groups, we followed the questioning route technique, in which the questions follow a fixed sequence. This gives the opportunity to compare the answers across the focus groups (Benighaus and Benighaus 2012: 124).

Online focus groups must be well prepared to avert or quickly resolve technical difficulties (Tuttas 2015). Therefore, every focus group was accompanied by a technical assistant from the market research institute for technical support. The moderator, who is also the first author, was supported by at least one co-moderator during the pre-test and half of the online focus groups.

The transcription of the focus groups is based on the audio recording by a professional transcription service according to the simplified transcription rules by Dresing et al. (2015). We conducted a qualitative text analysis using a set of concept-driven and data-driven codes (Kuckartz 2019). Our top-level codes were derived from the discussion guideline, while we developed most sub-level codes based on the material (Kuckartz and Rädiker 2019: 96–97). This allows us to understand how participants responded to the key questions and the inputs (Rädiker and Kuckartz 2019: 233). With this procedure, some sub-level codes appear under different top-level codes. This needs a clear designation (Kuckartz and Rädiker 2019: 106).

We coded in a team of two researchers with experience in qualitative text analysis. We assigned text passages to the top-level codes using the discussion guideline. We assigned text passages to the sub-level codes at first individually on half of the material. In the next step, we compared and discussed deviations. With these discussions, we further developed the categories and sharpened the category descriptions. This enabled the unambiguous assignment of previously ambiguous text passages. This procedure is particularly suitable for qualitative text analyses (Kuckartz 2018: 210–217). The development of the categorisation system was documented in detail in order to make the development process comprehensible (Becker et al. 2019). The translated code system is part of the Supplementary Material (translation from German to English by the authors). The analysis was carried out thematically via the code summaries (Kuckartz 2019). The analysis was performed with MaxQDA 2022.

Results

Table 2 gives a summary of the findings. A more detailed and thematically structured description of the focus group results is provided in the following sections.

Product quality of organic food

The participants describe the product quality via the sensory impression (appearance, odour, taste) and the ingredients of the product.

Sensory impression

The participants expect a pleasant taste and a natural look. They describe that the food should look imperfect (with imperfection as defined in Hooge 2021) and non-standardised (e.g., curved carrots or varying colour of egg yolk). Participants describe different quality expectations regarding organic and non-organic food: For example, some participants say that for non-organic food, the flavour is the most important quality criterion. But for organic food, other aspect are also relevant to them.

Ingredients

The participants expect that organic food processing preserves nutrients and works with fewer, familiar ingredients. They expect organic products to be free from genetic engineering and harmful substances. They see additives, sugar and palm oil as critical substances. They assess sugar as harmful to health and describe a conflict between high sugar content and organic quality. Average products, e.g., cream cheese, with a high number of ingredients, additives, and sugar lead them in a conflict. One participant formulates this as "It's just industry" (FG2, B3, male, 25, paragraph 65). In response, some participants say they prefer to make products themselves. They do not mention salt as a critical ingredient, but as a natural preservation method (salting). The participants reject palm oil because they assess it as harmful to the environment. In one focus group, the discussion even led to the proposal of shocking images of cleared forests on products containing palm oil. The participants describe difficulties in the traceability of ingredients. Some want to avoid ingredients from certain countries, but this is challenging with processed products. The participants are also not sure how many organic ingredients are needed to get the organic label.

Process quality

The participants already address food processing during the discussion on organic quality in general.

Table 2 Short summary of the discussions with illustrative quotes

Topic	Summary of discussion	Quote example
Introduction	Participants shop a diverse set of foods in standard food market and in alternative food networks as defined by Richards et al. (2011)	"[…] my husband and I, buy many different types of food in organic quality. But above all vegetables. We have them delivered. It's a kind of campaign of rescued organic vegetables that are somehow too big and too small and too crooked and too overgrown, that would otherwise not be used or ploughed under. […] Otherwise, we also buy a mixture of organic and conventional produce in the supermarket. […] (FG1, B3, female, 43, paragraph 20)
Overall Quality of Organic Food: Quality indicators	Imperfect, non-standardized food	"For me, good quality means above all that you can see that the food is not so, yes, optically cultivated for the consumer, but that you can see that it comes from nature. And that it may not be as straight and beautiful as any other. But that in case of doubt it is simply genuine. That you can still recognize the naturalness in it a little bit." (FG2, B3, male, 25, paragraph 21)
	A short shelf-life	"And the less durable. So the shorter the shelf life. So when I see food that then lasts three weeks or four weeks or three months. That's not for me. […]" (FG3, B4, female, 44, paragraph 57)
	Shopping Channel	"[Organic minced meat from] Supermarkets may have quite good quality […]. But it has nothing to do with the quality that you get, let's say, in private butcher's shops. […]" (FG2, B1, female, 58, paragraph 29)
Process Quality	Low processing degree	"[…] the less processed, the better" (FG2, B5, male, 62, paragraph 82)
	Gentle processing	"I would also really describe it in such a way that the natural state of the products is somehow preserved as well as possible. I would somehow connect that with gentle." (FG4, B4, female, 52, paragraph 204) "So gentle is a term that fits perfectly. You want to protect your own health as well as the environment from negative influences and the word describes that perfectly." (FG4, B8, male, 62, paragraph 194)
	Acceptance of modern machinery	"I believe that this gentle production can also be achieved in an industrial plant, where there is a high degree of mechanical processing." (FG4, B3, male, 28, paragraph 130)
	Different valuation of the individual stages of the food value chain	"[…] I think that all the components that are added/ maybe packaging and other materials should also be of organic quality, because otherwise the quality of the end product is reduced again". (FG1, B4, female, 34, paragraph 243) "If I put organic in before processing, then organic comes out in the end. […] it is still organic, because there are no pesticides or because the animals had a better life than conventionally kept animals. So I would say that the organic content remains the same, no matter how much I process it. […]" (FG1, B6, female, 49, paragraph 237)
	High demand for transparency	"Well, I wouldn't shy away from modern processing methods or say that I reject them. But of course, you have to inform yourself and I would like to be honestly informed about what happens to the food." (FG3, B1, male, 50, paragraph 152)

Table 2 (continued)

Topic	Summary of discussion	Quote example
Homogeneity and Variance	Associations: Homogeneity = non-organic food Natural variances = organic food	"For me, it's also a sign of quality if I don't always have the same taste. […]" (FG3, B2, male, 59, paragraph 192)
Fruit Juice Production	Low processing is preferred	"[…] That there are as few processes as possible in between, from the fruit to the finished juice. […]" (FG2, B3, male, 61, paragraph 142)
	Higher processing might fit with organic if it is more eco-friendly	"I also agree that it is really important from a climate point of view, because it is simply much less weight that you have to transport. […]" (FG4, B6, female, 30, paragraph 244)
Information on Processing	Processors as a source of information because they know best Fear of misuse of information on advertisement	"I would prefer to get information from the producer. Because the manufacturer knows best what he does with his food. Of course, you have to be able to make sure that the information is correct and that it is not, in case of doubt, embellished information or anything else." (FG2, B3, male, 25, paragraph 162)

Overall, the participants assess the importance of the stages of the food value chain differently: For some participants, organic means that every stage of the value chain is important for organic quality. This includes not only the intensity of processing, but also aspects of environmental and social sustainability. Other participants consider the stage of agricultural production as more important:

> *"But it still ends up being organic because I don't use pesticides […] the organic content remains the same, no matter how much I process it." (FG1, B6, female, 49, paragraph 237)*

The stage of distribution, especially the shopping channel, is highly important for the participants as a quality indicator.

Shopping channel

Although the shopping channel was not part of the focus group guideline, the participants raised this topic at several stages of the focus groups. They use the shopping channel to describe food quality:

> *"Then we […] got minced meat from the supermarket, also in organic quality […]. When we wanted to fry it, half of it was watery." (FG2, B1 female, 58 paragraph 29)*

Participants say that food that they buy directly from the producer (butcher, farmer, farmer's market) is of superior quality, compared to food from retail. Food from discounters in particular has a bad image. Some participants report mistrust in the organic quality of food from discounters:

> *"[…] And how often have I read about some discounters recalling organic products? […] You don't even dare to buy something like that in the supermarket anymore […]. You can't rely on the organic product." (FG2, B2, male, 61, paragraph 98)*

Participants repeatedly report that food, which they buy directly from the farmer, would also be organic, even if it did not have a label.

Environmental sustainability

The participants expect organic food to be environmentally friendly and report that sometimes organic products do not meet their expectations. They describe mistrust regarding organic food with long transportation distances, from foreign countries with different organic regulations and organic food that is out of season. They describe their inner conflict in shopping situations where they must weigh organic food and local food. This is also the case for plastic packed organic food and plastic free non-organic food. Another problem they describe is that organic food is not always available in suitable amounts (e.g., only bigger bundles). This would easily lead to food waste in their households.

The participants speak out about including the ecological footprint of the whole production chain in the assessment of organic food quality. They discuss if high energy requirements in production are in line with organic quality. They also discuss the presence of non-standardised food on the market. They think that too high aesthetical standards could lead to food waste.

Animal welfare and social sustainability

The participants describe animal welfare as an important aspect of organic food processing. The well-being of employees is mentioned seldom during the discussion about organic food processing in general, but is an important topic during the discussion about modern and traditional technology (see 4.2.5).

Processing degree

The participants describe that ingredients are more important for them as the processing degree. They discuss the appropriate number of processing steps for organic food. A higher number of processing steps causes discomfort for some. Others reflect that organic processing could also mean more processing steps, if these were slower and less mechanised. They are aware that many everyday products, such as noodles, undergo a complex processing procedure.

The participants associate low processing with less thermal stress, slow processing, and a better taste. Low processed foods would give the freedom for more creativity when cooking. With high processing, the participants associate more food additives. They think these might be necessary to restore the flavour that is lost through intense procedures. The participants use a shorter product shelf life as an indicator for low processing. As examples of low processed products, the participants mention non-homogenised milk and less ground flour (whole grain). Some participants use the term "gentle processing" to describe how organic food processing should take place. Upon further probing, they explained that gentleness means preserving the nutritional value and environmentally friendly processing. They associate the term with slow processing, less machinery, less grinding, less thermal stress, and saving energy. Other participants reject the term as a marketing phrase.

Processing technology

The participants broadly accept the use of modern machinery for organic food processing. They describe modern, mechanised food processing as sustainable as long it is environmentally friendly and socially acceptable. In the context of social sustainability they discuss job losses in food production due to modern technology. The participants state that they need to understand modern processing technologies to accept them. As a positive example, they cite organic processors with glass production facilities. Here they can see how processing takes place. Seeing how food is produced and how people are involved is also repeatedly cited by participants as a confidence-building measure about primary agricultural production. They value handmade production, but state that it would be not possible to feed the world's population with handmade organic food.

> *"When I hear organic bread, I still think it was kneaded by hand. When I think about it for a moment, I think, no, that can't be. […] They all sell the [product name] bread that I love to eat, they can't all be hand kneaded. But I think it would be cool if they said how it was made." (FG1, B6, female, 49, paragraph 261)*

Handmade food is something special while machine-made food is for every day:

> *"If you want to have that for everyday life, then I would rather go to automation […]. But if I'm on holiday […], then I would prefer a small cidery because it just gives me a nice feeling […]" (FG4, B6, female, 30, paragraph 131)*

While modern machinery is broadly accepted, the image of organic products as a mass market causes discomfort in some:

> *"For me, that somehow describes a small conflict. […] Organic has long since become a mass market. And I think that many people who are active in the organic sector don't think so. The basic idea is to make a mass market out of it. The problem is, of course, that if you don't do it, you reach far fewer people with these products. […]" (FG4, B8, male, 62, paragraph 115)*

In this context, the participants also discuss the risk of contamination with pollutants: some see higher

risks in large-scale production, while others consider small production lines to be more vulnerable.

Homogeneity and Variations of Juice

The participants report on their quality criteria when buying juice. For some naturalness is crucial. For others freshness, the production region or taste are of higher importance. Even before the moderator's explanations on juice production (second input, cf. Table 1 in the Appendix), the participants assess natural variations of juice as an indicator of low and natural processing. They find natural variations suitable for organic food. They associate standardisation with the non-organic food market ("uniform vegetable or uniform fruit", FG4, B7, female, 60, paragraph 274). They propose processors to be proactive about natural variations and use them as a positive marketing claim. One participant (FG2, B1, female, 58) rejects clearing as an unnecessary processing step for organic juice even before the processing technologies of fruit juice production were presented.

After the explanation on juice production, the participants repeat that they see natural variations as an indicator of low and natural processing. They doubt if they would notice variations, but they also discuss if children would accept non-standardised juice. In this context, they discuss what is more important: a low processing degree or a delicious taste? While flavour is important to some, others do not want to accept a higher degree of processing. They also share ways of dealing with excessive natural variations at home (diluting, re-sugaring).

Processing technologies for juice

The participants accept non-blended direct juice as most appropriate for organic processing. Many do not feel comfortable with blending. They associate it with adulterated wine. They also consider the multiple heating steps in the blending process unsustainable and therefore not in line with organic quality. However, some participants accept blending for organic juice. They consider using this technique to reduce food waste. Juice made from concentrate is also rejected for organic food by the participants because it is considered as over-processed.

> *"[…], it is a natural product, and it is allowed to taste different. […] So, I find this kind of blending and levelling quite creepy. I can imagine that there are consumers who expect exactly that. […] But on the other hand, […] I find it all the more pleasing and a sign of high quality when something is allowed to taste the way nature produced it that year. […]" (FG1, B3, female, 43, paragraph 279)*

The participants fear too much dilution and the addition of sugar. But some participants discuss if juice made from concentrate is more resource-saving. Then it would be acceptable for organic food. Some participants are willing to accept more intense processing for environmental benefits, but not for a better taste. In this context, one participant uses the image of the "spoiled consumer" (FG3, B1, male, 50, paragraph 167) who is to blame for higher energy demand during processing.

Information on processing

The participants complain about their lack of knowledge on processing. They demand transparency about the production process of organic food, especially to understand the economics behind it. They discuss whether the extra cost of organic production justifies the premium price. They describe how they assess organic food regarding the premium price and strategies of compensation, e.g., organic meat in smaller amounts. However, not all participants show high interest in food processing, and this caused a heated discussion in the first focus group (see *5.4 Limitations*).

The participants discussed the package, information on websites, TV, visitations and tastings as possible ways of consumer information and learning:

They see the packaging as practical because the information is available directly at the point of sale. Yet they fear that packages are too small for detailed information. They mention that websites offer enough space, but participants without a smartphone or mobile internet access cannot use them while shopping. Several participants report that they like to watch documentaries about food production and processing on TV. They propose to show them in prominent slots, maybe even on

children's television for early education. Visitations and tastings are welcomed but cumbersome information channels:

> *"It would be even better in schools, […], that the pupils […] go to the baker and are shown how the bread rolls are made, […]." (FG4, B1, male, 66, paragraph 289)*

The participants assess videos as easier to consume than texts but fear their misuse for advertisement. They speak out for live-action videos instead of cartoons.

> *B3:"[…] the consumer is not willing to read a huge text for every single product about how the food is processed. And to be shown this briefly and succinctly in a video, and perhaps actually SEE it again, is, I think, much more memorable. And yes, it just makes you more aware."*
> *B5: "Well, I would be more interested in a certificate, because I don't want to watch a commercial." (FG2, B3, male, 25, and B5, male, 62, paragraphs 174–175)*

Some of the participants state that they use organic labels as an indicator for organic quality. Yet they describe that they also include products without such a label in their understanding of organic quality in cases they know the production conditions, e.g., buying food directly from the farmer. For widely used labels, they express the fear that the mass of products could lead to inadequate quality controls. Some participants propose more differences in the organic logo to reflect the different organic standards, e.g., with a traffic light rating system like the Nutri-Score.

> *"[…] a good organic label or a good certificate would create trust. But as it is at the moment, there is still a huge difference between the EU organic label and the Demeter or Biokreis organic label." (FG2, B5, male, 62, paragraph 165)*
> *" […] And that could perhaps be done with a traffic light, by comparing all these organic labels and then classifying them: Okay, this is at the upper end, and this is at the lower end." (FG2, B7, male, 26, paragraph 110)*

The participants also discuss who should offer the information. Several participants state they would prefer the processors as a source of information because they know best about the processing. On the other hand, the participants fear misuse of information for advertisement. Further mentioned sources of information are Wikipedia; organizations such as Slow Food, Greenpeace and the independent product testing body Stiftung Warentest. They also mention the organic farming association Demeter and consumer protection agencies.

Participants repeatedly express a lack of time that prevents them from being more engaged with their purchases.

Discussion

The participants' Perceived Quality for organic products includes the product characteristics and also the way of processing, even in cases when processing aspects do not lead to differences in the final product (e.g., energy efficiency). They expect environmental and social sustainability as well as animal welfare, a lower processing degree and less standardisation for organic food. They are open to modern technologies as long as these are environmentally friendly and socially acceptable. Following the model of Vasileva et al. (2019) they are open to bridging the gap to the Designed Quality by means of consumer learning. They perceive the information asymmetry between Achieved and Designed Quality in shopping situations and describe their ways to bridge this gap. The findings are discussed in detail in the following sections.

Perceived quality and expectations of organic food in general

The participants in our study report similar reasons for buying organic to other German consumers (cf. BMEL 2022). Environmentally friendly production is especially important for them, which is in line with previous studies (Meyer-Höfer et al. 2015; Jäger and Weber 2020; Brümmer and Zander 2022; Rizzo et al. 2023). For some of the participants in our study, the stage of agricultural production of the raw material is more relevant for organic quality. Others assess the whole food chain as important. Hüppe and Zander (2021) found similar approaches in their focus

groups. They classified them as organic pragmatics (stage of agricultural production is more important, higher processing levels are accepted) and organic traditionalists (whole food chain important, preference for low processing). This consumer typology seems a sensible strategy for defining the target group for organic products.

Perceived quality and expectations of organic food processing

For the participants in our study, it is not only the sheer number but rather the nature of the processing steps that is important for organic food processing. The participants report a positive image of low processing degrees. They associate high processing with a negative effect on health. This is in line with findings from the European Food Information Council (2016). The association of low processed food and healthiness can lead to a preference for nutritionally valuable products, such as flour from whole grains (an example mentioned by the participants in our study). But this health halo can also lead to harmful outcomes, for example when the caloric content of foods is underestimated (Schuldt and Schwarz 2010; Besson et al. 2019). Consumer learning strategies should include this risk. The participants in our study show a realistic picture of food processing. They associate organic with manual processing, but are aware that an organic mass market might need further production methods. They describe the advantages of industrial processing above all in the economic dimension (economies of scale) and to a lesser extent in the ecological dimension. These findings are similar to those from Hüppe and Zander (2021). The participants of their focus group also accept the industrial processing of organic food, but state that they would prefer small-scale production. In our discussions, two independent images of processing quality crystallize: On the one hand, small-scale, manual processing, whose added value lies primarily in its traditional nature. On the other hand, modern, machine-based processing, which is characterized by environmental protection. In this point, the participants in our study agree with the processors of the interview study by Borghoff et al. (2023a) and Borghoff et al. (2023b). The participants in our study trust modern processing especially when they see how the processing is done, e.g., by visiting the processing facility. The human element is important to them, but not a criterion for excluding modern technology. In our focus groups we did not show pictures of modern food processing, so we cannot conclude how participants would react to pictures of modern production. In a study by Tempesta et al. (2010), participants were rather put off by images of modern production of wine. Therefore, we cannot yet recommend that processors use images of modern production for advertisement. Future research on how consumers react to images of different processing methods (high or low degree of automation, small or large scale etc.) seems helpful. This research could include a variety of organic products to evaluate if the type of product also influences how consumers react to these pictures, e.g., plant-based and animal-based products.

Processing of organic juice

We found that the desire for fewer processing steps is not only relevant for juice concentrate, but also for the blending of juice. This caused discomfort for the participants in our study and they proposed to market juice like wine. Here, harvest-related variations are considered as a positive quality criterion (Verdú Jover et al. 2004). A similar concept could be developed for juice. Although this strategy fulfils the desire for less processing, in the case of exotic fruits it may conflict with the goal of environmentally friendly production. Technological innovations in this area, such as options for resource-saving transport or greater product protection during juice concentrate production, could combine care for the product and the environment.

Homogeneity and variations

Like the participants in the study by Loebnitz et al. (2015), the participants in our study are positive about natural variations. In contrast to the study participants of Suher et al. (2021), they prefer crooked fruits and vegetables, which they see as a sign of close-to-nature cultivation. The Perceived Quality of the participants thus corresponds to the Designed Quality of the processors by Borghoff et al. (2023a). Leaving a product in a state with natural variation is one way to signal naturalness. Another way would be to develop a label for the degree of naturalness, as Sandin (2017) proposed.

Concerning the taste of juice, it is not clear whether the participants in our study are aware of the variations that can occur with non-standardisation. One participant (FG1, B6, female, 49) assumes that she would probably not notice variations. Another participant (FG2, B6, female, 46) is aware about the extent of possible variations, because she already produced juice on their own. Further research seems worthwhile to investigate the acceptance of flavour variations. The reduction of standardisation should be accompanied by consumer learning, as most consumers are used to standardised products through the market (Loebnitz et al. 2015). A practical example in this area is provided by the experience of the Japanese initiative Daichi-o-Mamoru-Kai: this seller of agrichemical-free fruit and vegetables was able to increase the acceptance of previously rejected non-standardised food through consumer education and farm visits. The lack of uniformity of the products was used as a positive feature of the marketing campaign (McGill 2009).

Bridge between perceived and achieved quality: information asymmetry

The participants in our study describe several indicators that they use to bridge the gap and find products that are in line with their quality expectations:

Indicator Ingredients

The participants in our study seem to follow the "natural is better"-heuristic to bridge the information asymmetry. They associate "natural" mostly with fewer ingredients (Chalamon and Nabec 2016; Hüppe and Zander 2021). Their scepticism about unfamiliar ingredients is in line with findings from Aschemann-Witzel et al. 2019 and Song and Schwarz 2009. Actually, “free from” and organic are two different categories (Asioli et al. 2017) but our results and other studies (e.g. Dickson-Spillmann et al. (2011)) suggest that a combination of both could be a fruitful strategy for organic food processing. The quantity of approved additives is clearly reduced for organic food in the European Union (Commission of the European Communities 2018: 9). But consumers have only limited knowledge of food additive regulations (Bearth et al. 2014). This information asymmetry can be addressed with consumer learning.

In addition to additives, participants express negative views about sugar and palm oil as ingredients. They associate both with highly processed products. The cultivation of palm oil can have negative environmental consequences (Khamarudin et al. 2021). A high sugar consumption is associated with a negative health impact (Ma et al. 2022; Huang et al. 2023). The reduction of the sugar and salt content in convenience foods is part of the national reduction strategy in Germany (BMEL 2018). Although negative effects of high salt consumption are documented (see e.g. Di Liu et al. (2023)), the participants in our study do not mention salt as a critical ingredient. On the contrary they mention salting as a natural form of processing. They do not seem to associate salt with high processing and might not be aware of the risks of high salt consumption. The reduction of the salt content influences product characteristics (Rysová and Šmídová 2021), but it is still possible to produce delicious products with lower salt content using modern technology (cf. e.g., Barnett et al. (2020)).

Indicator Short shelf life

In general, consumers value products with a longer shelf life (Scozzafava et al.). Even some organic consumers accept higher processing as long as this enhance the shelf life (Hüppe and Zander 2021). The processors from the study by Borghoff et al. (2023b) assume that consumers would expect a long shelf life. In contrast, the participants of our focus groups report that they would appreciate a short shelf life as a positive quality indicator. It is not clear whether consumers outside our sample share this view. It could also be that consumers are positive about a shorter shelf life, but do not act accordingly (cf. Amilien et al. 2022). A gap between intention and behaviour is prominent in the case of sustainable diets and sustainable consumption in general (ElHaffar et al. 2020; Fink et al. 2021). Further generalizable surveys and studies are required before recommendations for organic processors can be derived. Also, future research should not only focus on examining the gap, but also on solution strategies (ElHaffar et al. 2020).

Indicator Labels

Some participants report that they use labels as indicators. Labels are a proven means of bridging

information asymmetries (Golan et al. 2001). European consumers' trust in organic labels is generally high (Nagy et al. 2022; BMEL 2022). However, many consumers do not know the exact content of organic labels, especially regarding different organic standards (Janssen and Hamm 2011; BMEL 2022)—except for Demeter. Consumers associate the Demeter label with anthroposophy and strict organic regulations (Janssen and Hamm 2011). The participants of our study showed trust in Demeter, just like the participants in the study by Di Guida and Christoph-Schulz 2023. Both studies worked with German-speaking consumers. The success of Demeter in the German-speaking area could be examined in a further study. The results could be used to revise the business and communication strategy for the whole organic sector. Raising knowledge on organic labels can be a further strategy e.g., with online courses. Mansilla et al. 2021 used this strategy successfully for nutritional labels.

Some of the participants in our study are in favour of a differentiated organic label. In general, consumers prefer simplified information (Grunert and Wills 2007). However, studies have shown that consumers can cope with multiple labels and that nuanced information about organic quality does not reduce the willingness to buy (Neuhofer et al. 2023; Sonntag et al. 2023).

It is noteworthy that some participants tend to distrust widespread labels, just as an organic mass market arouses unease. The participants themselves describe that on the one hand, they are critical of the entry of organic food into the mainstream. On the other hand, they welcome the simplified access to organic food. The participants describe a conflict, that is also discussed in the organic sector (Wit and Verhoog 2007; Gottwald 2016; Desquilbet et al. 2018; Dalmoro 2022). This clearly shows the importance of the preservation of the organic principles for the further development of the organic sector. One possible approach to this is to show the specific benefit of production, e.g., more animal welfare or better protection of the environment (the "Organic Plus", see Rizzo et al. (2023)).

Indicator Shopping channel

The participants in our study shop for organic food in conventional retail stores and alternative food networks (AFN) (Richards et al. 2011). AFN become more relevant for German organic consumers in general, but supermarkets are still the main source of organic foods (BMEL 2022). The participants in our study use the shopping channel as an indicator of organic quality. They report a high level of trust in farmers' markets, farm stores, specialty retailers, and organic-only stores, or processors that offer glass production facilities. The focus group guideline did not contain any questions on the shopping channel, so the fact that the participants of all focus groups took up this aspect highlights its importance as a quality indicator. Some of the focus group participants report mistrust of organic food from conventional supermarkets, which is in line with other studies (Nagy et al. 2022; Di Guida and Christoph-Schulz 2023). Long value chains and the anonymous relationship between trader and consumer impede trust building (Richards et al. 2011). AFN with shorter supply chains become more attractive (Richards et al. 2011; Wobker et al. 2015). The participants in our study prefer direct sales and farmers' markets for organic food, similar to the participants in the study by Di Guida and Christoph-Schulz (2023). For the participants in our study, this is an even stronger indicator of organic quality than labels. Nevertheless, organic foods in conventional supermarkets can be an "ice breaker" for organic food consumption (Gottschalk and Leistner 2013). Therefore, this shopping channel remains an important purchase option.

In summary, consumers use different indicators to overcome information asymmetry. Whether they use appropriate information depends on their level of education and food literacy (Socoliuc et al. 2022). Consumer learning is therefore an important aspect in bridging the gap between Perceived and Achieved Quality. The model by Vasileva et al. (2019) places consumer learning between Perceived and Designed Quality. This will be the subject of the next section.

Bridge between Perceived and Designed Quality: Consumer learning

The participants show a high demand for transparency and interest in learning about food processing. This is positive, because a greater willingness to learn leads to higher customer satisfaction (Sun et al. 2022). Proactive information about organic food is also necessary to explain premium prices

for organic food (Rödiger et al. 2016; Scozzafava et al. 2020; Stampa et al. 2020). Processors, who are a preferred source of information for the participants in our study, can engage in consumer education. This would give them the opportunity to learn more about the Perceived Quality at the same time. Hanninen and Sandberg (2006) developed a consumer learning roadmap that processors can use to plan and implement consumer learning. However, this map has not been tested with food products so far. The roadmap starts with triggering the existing knowledge, e.g., by introducing a new product. This is followed by monitoring of the consumer knowledge, e.g., by collecting online discussions from consumers about the product. These individual stories are a valuable addition to aligning the Designed Quality with the Perceived Quality (Gorry and Westbrook 2011). The final step is guidance of consumer learning, e.g., through educational newsletters. Since the participants in our study mentioned tastings and company visits positively, we suggest these as educational measures. Certainly, not every processing plant can offer factory tours, and not all consumers want to visit a factory. However, processors could, for example, provide insight into production via their website. Videos are effective tools for consumer information and learning. But they must be tailored to consumer groups (Cao et al. 2021). The participants in our study fear the misuse of information videos for advertisement, so they should be neutral and informative (Korn and Hamm 2014).

The organic retail trade could be a further important actor in consumer learning. Organic retailers can contribute to consumer education with campaigns such as tastings. This underlines the great importance that the organic trade has for the organic food industry (Kaufmann 2023).

The participants repeatedly report having not enough time to deal with organic food quality. This is a well-known factor regarding the intention behaviour gap (Fink et al. 2018, 2021). Therefore, consumer learning strategies should be designed to be as time efficient as possible.

Limitations

This study investigates the topic of process quality of organic food from the consumers' perspective with an explorative, qualitative research design. Further qualitative and quantitative research is needed to verify the results and provide further insights into the topic. Focus group discussions also have certain limitations. One is the danger of bias due to social desirability (Littig and Wallace 1997). Food is a morally charged topic (Askegaard et al. 2014) and there is always a risk of social desirability with surveys in this area (Schwingshackl et al. 2021). Barlösius (2016) describes the currently prevailing eating morals with the patterns "Everything was better in the past", "Organic is better", "Distrust of the food industry must be voiced" and "Commitment to conscious nutrition". A breach of these patterns is perceived as a provocation (Barlösius 2016). We observed this in our first focus group: At the end of the session, participant B2, male, 63 states that he is not interested in processing of organic food at all. Taking this as a closing statement causes vehement objection from participant B6:

> *"[…] I think it's a bit of a pity that when someone says, "I'm not interested in that" if that were the conclusion/ the conclusion of the evening/ […]." (FG1, B6, female, 49, paragraph 356)*

When evaluating our results, the danger of distortions due to social desirability must always be considered. We advocate further research on our questions to make the results more precise, e.g., with online surveys. These have the advantage that the pressure for social desirability is reduced by the absence of the person conducting the survey (Grimm 2011). To obtain representative results, quantitative surveys should also be carried out. Here, the survey instrument should be constructed in such a way that social desirability is reduced and recognized in the analysis (Cerri et al. 2019; Larson 2019), e.g., by eliminating dishonest responses from the data with an algorithm, see Thøgersen (2017).

The online setting also led to limitations, e.g., regarding the input that is limited to material that can be shown on screen. An in-person focus group offers more flexibility in the type of input. In our case, we could not present a physical food product but only show pictures. Perceiving a product with all the senses could lead to different reactions in the participants. On the other hand, this greater distance to the product could also lead to a more abstract discussion, as the participants have to deal with organic food on a different level. The advantage of the online setting was that

it was not necessary to travel to the focus group, which meant that a broad group of consumers could participate (cf. Niederberger and Zwick (2023).

Conclusion

We applied the quality model by Vasileva et al. 2019 to organic food processing with focus on the consumer perspective. This includes the Perceived Quality as well as the bridges to the Achieved Quality (information asymmetry) and the Designed Quality (learning process). Our results give a detailed description of consumer expectations regarding organic food processing with focus on the product of fruit juice. We found which indicators consumers use to bridge the information asymmetry between Perceived and Achieved Quality. We also found out about the consumer requirements regarding the learning process to bridge Perceived and Designed Quality.

The model proved to be useful for examining the process aspect of quality, considering the different perspectives of processors and consumers. Our exploratory research design also enabled us to find approaches for further research in the field of food processing, consumer information and education, and in the intention-behaviour gap.

What is particularly relevant for practitioners in the organic sector is that we have not only found similarities between Designed and Perceived Quality, but consumers also want to find out more about processing with the help of processors. Our insights into which indicators consumers use to overcome information asymmetry and how they seek to learn about processing can be used by both processors and consumer education actors.

The consumer demands we found for organic processing, especially organic juice, can provide impetus for the choice of technology and for further discussion about which technologies are seen in line with the organic principles.

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Data availability The lead author has full access to the data reported in the manuscript. The data are not publicly available due to privacy reasons. For more information please contact the corresponding author (rahier@fh-muenster.de).

Declarations

The project was submitted to the Ethics Committee of the University of Kassel and classified as unproblematic in terms of research ethics. The transaction number is zEK-19.

Consent to participate Informed consent was obtained from all individual participants included in the study.

Consent to publish The participants have consented to the submission.

Conflict of interest The authors declare no competing interests.

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