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Consumer attitudes toward new technique for preserving organic meat using herbs and berries

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ABSTRACT

This study aims to explore consumers' attitude toward a new preservation technique using herbs and berries in organic meat production, which enables to minimize the amount of chemical additives and to reduce the salt content in meat products. Consumer acceptance of the preservation technique using herbs and berries and intention to purchase products preserved with herbs and berries were investigated through a qualitative approach by means of three focus groups. In general, most participants were positive toward the preservation technique using herbs and berries and there were only few concerns related to the technique. Concerns were related not as much to the technique but more to the products. Four factors seem important in this relation: shelf life, taste, appearance and texture. The intention to purchase products preserved with herbs and berries is generally high, but is dependent on taste and appearance of the products, the price and information level.

1. Introduction

Since ancient times food processing has been a central part of human lives. Operations such as washing, drying, cooling, heating and storing, but also extracting, concentrating, irradiating and microwaving are examples of how processing of food is accomplished and these have over time evolved to become more and more complex to meet the challenges of consumers and society (Floros et al., 2010). A number of objectives are related to food processing for instance securing the safety and quality of the food, but preservation is probably the oldest and most common objective, aiming at increasing the shelf life of food products. Food preservation refers to the processes directed against food spoilage due to microbial action and three different directions can be used: physical methods (food is subjected to a physical treatment like pasteurization or drying), chemical methods (added preservatives) and biological methods (e.g. protective microbial starter cultures) (Lück & Jager, 1997). Some of the first preservation techniques involved drying and salting, were followed by the use of alcohol, smoke, heat treatment, sugar, sulphur dioxide and other organic acids as acetic and lactic acid. In the wake of industrialization, preservation techniques had to meet the need for commercial mass-production, leading to the development of chemical additives.

Organic food is produced according to standards that take into account environmental and animal welfare. An important principle of organic farming is that farmers use a minimum of chemical substances in organic cultivation. The standards for processed organic foods follow the ecological ideas of naturalness, with an emphasis on careful processing using the fewest possible additives. In the EU, 49 out of the 370 authorized additives (E numbers), are permitted in organic products. According to the EU regulations it is allowed to use the preservative nitrite in organic meat production, but the Danish producers have agreed on not to add nitrite in organic meat products. Instead, organic meat producers are using preservation techniques that are as natural as possible, and some of the most commonly used preservation techniques are smoking, curing, fermentation or cooking. However, organic meat producers request new preservation techniques, since for example the use of smoke in meat adds a distinctive taste to the product. Furthermore, due to agreement on not adding nitrite to the meat products and expert advice on reduction in salt intake, new and natural preservation techniques are needed.

During the last decades, scientific studies have shown that plant extracts, herbs and berries can possibly be used as natural preservatives (Burt, 2004; Davidson & Naidu, 2000; Søltoft-Jensen & Hansen, 2005; Viskelis et al., 2009). Using herbs and berries as natural preservatives will enable organic meat producers to employ a new preservation technique, minimizing the use of salt and smoke. In addition, by using different herbs and berries, it becomes possible to develop new organic meat products with new and interesting flavor variants. The preservation technique is not only interesting for the organic industry, but is also highly relevant in conventional production, as a natural preservative will minimize the amount of chemical additives needed or even make them superfluous.

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When developing new food processing technologies, it is important to explore consumer attitudes toward and acceptance of the technology, as this will enhance the likelihood of consumers buying the meat products once they are developed and available on the market. Consumer attitudes are central, as consumer rejection can prevent application of a technology in practice (Olsen, Grunert, & Sonne, 2010). A study on twenty different food-processing technologies has shown that some technologies are easily accepted by consumers, whereas others are rejected (Cardello, 2003). For instance, consumer attitudes toward food irradiation, a preservation method that involves exposing food items to ionizing radiation (gamma rays, X-rays or electrons), tends to be viewed as negative (Rollin, Kennedy, & Wills, 2011), which has restricted widespread application of the technology (Henson, 1995). This emphasizes the importance of understanding consumer attitude formation with regard to new food technologies.

The aim of this study is to investigate consumer attitudes toward a new preservation technique using herbs and berries in organic meat products, and to identify drivers and barriers for accepting the technique and forming intentions to purchase the products resulting from the use of the technique.

2. New preservation technique with herbs and berries

The preservation technique using herbs and berries is about reducing the specific additives nitrite and salt in meat products by replacing these components with suitable herbs and berries. Usually meat products are preserved by heat treatment to 75 °C in the product, hereby eliminating all the live bacteria. However, during the subsequent slicing and packaging, meat products might become re-contaminated by i.e. *listeria monocytogenes* found in the environment. Thus, it is important that the meat products also contain preservative agents to control this specific organism. In most products, a certain amount of salt, nitrite, lactic acid/lactate, vinegar (acetic acid/acetate) or other chemical preservatives, inhibit growth of the bacterium *listeria monocytogenes* to a level where it becomes dangerous for humans consuming the product. If these preservatives are removed from the meat products, complete growth inhibition can no longer be guaranteed and subsequently the shelf life must be shortened to avoid risk of listeriosis. In products that are not heat-treated to 75 °C, the growth inhibition is secured by i.e. low pH obtained by fermentation with lactic acid bacteria ("yogurt-bacteria") in combination with a rather high amount of salt (for instance salami, pepperoni etc.). In organic products, nitrite is unwanted, due to a possible long-term, carcinogenic effect and the general organic principles. Furthermore, an excessive intake of salt has been correlated with an increased risk of coronary heart diseases and an increased mortality, and thus health authorities urge the food industry to reduce the amount of salt in their products. The new idea is to exploit the natural content of antimicrobial compounds that can be found in herbs and berries, and replace the nitrite and a fraction of the salt with herbs and berries. The amount should be at a level that maintains the same growth inhibition as the original meat products in order to have the same shelf life, and at the same time provide the product with a unique new taste and visual appearance.

3. Method

The study sought to give insight into Danish consumers' attitudes toward a new preservation technique using herbs and berries in organic meat products. The study was qualitative, conducted by means of three focus groups. A qualitative method was chosen, because the preservation technique is in the earliest states of being developed and new in a commercial context, thus no consumers have yet any knowledge of the preservation technique. In such a case, focus groups are relevant and useful, because participants throughout the focus group interview will form attitudes toward the preservation technique as they become exposed to information from the moderator and reactions from the other participants. The strength of using focus groups in this study is that it is the interaction in the social context that produces data (Morgan, 1997) i.e., the participants can talk, share and comment on each other's statements and interpretations (Halkier, 2008). The focus groups were carried out in March and April 2011 in Denmark by a professional agency.

3.1. Design of study

An initial framework for understanding consumer attitude formation and acceptance of the new technique for preserving meat products with herbs and berries was developed as a basis for constructing an interview guide (Fig. 1). This framework was inspired by the work of Ronteltap, van Trijp, Renes, and Frewer (2007), who designed a conceptual framework for consumer acceptance of technology-based food innovations, and by the Response Hierarchy Model by Lavidge and Steiner (1961). The consumer acceptance or rejection of the new technique is influenced by the attitude toward it, which in turn is affected by the perception of risks and benefits. The analysis of risks and benefits is related both to applying the technique and to purchasing products that have applied the new technique (Olsen et al., 2010). The risk/benefit analysis is based upon the consumers' knowledge at the time of evaluating the new technique, which in this case includes knowledge of the organic concept, preservation techniques in general, and the specific herbs and berries that might be used as preservatives (see list with herbs and berries in Table 3). Furthermore, as the technique would be new in commercial production, consumer knowledge is primarily based on the information about the new technique given to the participants during the focus groups.

The process of attitude formation is affected by how information on the new technique is communicated to consumers, including the effect of different sources of communication. Further the attitude formation is affected by the characteristic of the consumers, who for instance may be classified related to their consumption patterns (low-, medium- or high users of organic products), but also related to how fast they adopt new innovations (innovators, early adopters, early majority, late majority and laggards) (Rogers, 2003).

Based on the conceptual model, an interview guide was developed. The interview guide consisted of open-ended questions designed to solicit information about (1) consumer knowledge about preservation techniques in organic food production, (2) consumer attitude toward preservation with herbs and berries, (3) consumer attitude toward specific herbs and berries, (4) barriers against acceptance of the

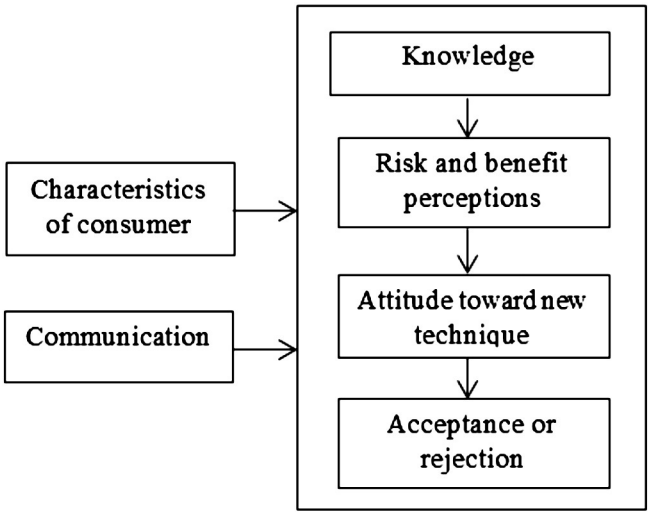

Fig. 1. Conceptual framework for attitude formation toward new technique preserving organic meat using herbs and berries.

techniques preserving with herbs and berries and (5) intention to purchase meat products preserved with herbs and berries. As the preservation technique was new to the participants, it was necessary to introduce not only the technique but also which herbs and berries are usable for preservation. After a general discussion about organic food and preservation techniques, a paper was distributed that briefly explained the new preservation technique using herbs and berries (see Appendix 1). The moderator initially read the explanation aloud for the participants. The participants then had a couple of minutes to elaborate on the information individually and were encouraged to write down their first thoughts about the preservation technique using herbs and berries. Subsequently the group started discussing the new technique, and furthermore their intention to purchase the products where the new technique was employed. In addition, the specific herbs and berries were presented, not only to give participants an opportunity to respond on each herb and berry, but also to give participants the opportunity to relate more concretely to the preservation technique. The Faculty of Agricultural Science, Aarhus University in collaboration with the Danish Meat Research Institute developed a list of 20 different herbs and berries that have shown potential as natural preservatives. This list was presented in writing and participants were asked to mark whether they would find the herb or berry acceptable in meat products or if there were some that were clearly unacceptable (see Appendix 2). Finally, illustrations of meat products with added berries were distributed to the participants, primarily to get insight into how consumers respond to the appearance of meat products with added berries (see Appendix 3). When participants received the illustrations, they were informed that these were meat test products with an appearance that might be similar to future products preserved with herbs and berries. In this case the sausages were added blueberry juice, frozen blueberries and dried cranberries. The reasoning behind the meat test products was to use berries instead of herbs, as these are assumed to be less common in meat production at least in Denmark, and to use different forms of berries, both as juice and as whole (frozen and dried). Furthermore, the blueberry juice was chosen due to the expectation that it would induce an intense shift in the color of the meat products. In Table 1 the ingredient formulation for the different sausages is provided.

3.2. Recruitment

Criteria for recruitment were based on the premise that knowledge production in the focus group depends on the participants' social interaction, which means that there should be a balance between homogeneity and heterogeneity within the focus group (Bloor, Frankland, Thomas, & Robson, 2001). The recruitment criteria were therefore developed such that participants should be different in order to get diverse information, but also should have some similarities to facilitate the conversation among the participants (Halkier, 2008). The agency recruited the participants by phone and the screening of participants was based on six different criteria. The *first* criterion was that participants should be medium users of organic products to ensure that they had a certain level of involvement in organic food and that they might be potential buyers of organic meat products preserved with herbs and berries. Heavy users of organic products were considered less relevant, assuming that they will be either highly interested or not interested at all depending on their attitude toward processed meat. In this context, a *medium user of organic products* was defined as a person buying organic food frequently but not always. In practice, when recruiting a potential participant, the person was asked how often they buy organic products in four different food categories (dairy products; fruit and vegetables; bread, flour and grain; meat and cold cuts) on a five point scale (never, infrequently, sometimes, frequently, always). Potential participants where included if at least two of the answers were sometimes, frequently or always. The *second* criterion the participant should fulfill was that he/she has influence on the purchase of staple food products in the household, thus to secure that they could have an influence on the decision to buy the new products preserved with herbs and berries. The *third* criterion was the age of the participant, which should be between 18 and 60 years. In practice, the focus groups were grouped by age (18–31, 32–45, 46–60 years). The reasoning behind grouping the focus group by age ranges was to secure homogeneity within the groups. The *fourth* criterion was gender, ensuring that every focus group consisted of both men and women. Including both women and men seemed important as earlier studies indicate that women are more skeptical toward accepting new food technology (Hursti, Magnusson, & Algers, 2002). The *fifth* criterion was children in the household, thus to secure that participants with and without children were included in the focus groups. Having both participants with and without children in the household seems relevant as a study among Danish consumers found that the arrival of children (and grandchildren) is a driver for organic consumption (Hjelmar, 2011). The *sixth* criterion was excluding vegetarians due to their lack of relevance in this study. Meat is not a component of a vegetarian diet and vegetarians would therefore not be consumers of the new meat products with herbs and berries. Table 2 gives an overview of the demographics of the participants as well as their frequency of purchasing organic products. Smaller adjustments were necessary in the recruitment process, as there were problems finding enough males that fulfilled the screening criteria, which is the reason why only two of the twenty-one participants are males. On average, the focus groups lasted one and a half hour and out of 30 persons recruited 21 participated. The moderator followed a semi-structured interview guide (see Appendix 4). All focus groups were taped on video camera and recorded on a Dictaphone. The data were transcribed and coded according to pre-specified categories: *Motives for purchasing organic food, Knowledge of preservation techniques, Attitude toward new preservation technique using herbs and berries, Acceptance of products preserved with herbs and berries, and Intention to purchase products preserved with herbs and berries.*

Table 1
Ingredient list for meat test products.

Ingredients (g)	Sausage A per 1000 g	Sausage B per 1000 g	Sausage C per 1000 g	Sausage D per 1000 g	Sausage E per 1000 g	Sausage F per 1000 g
Ham	839	805	771	738	797	797
Water	135	129	124	119	128	128
NaCl	15	14	14	13	14	14
Dextrose	8	8	8	7	8	8
Phosphate	3	3	3	3	3	3
Blueberry, juice	–	40	80	120	20	–
Blueberry, frozen	–	–	–	–	30	20
Cranberry, dried	–	–	–	–	–	30
Nitrite	60 ppm	60 ppm	60 ppm	60 ppm	60 ppm	60 ppm

Meat products produced by Danish Meat Research Institute.

Table 2
Demographics of participants and their purchase of organic products.

Gender	Age	Age of children	Dairy products	Fruit and vegetable	Bread, flour and grain	Meat and cold cut
Focus group 1						
Female	19		Sometimes	Sometimes	Infrequently	Never
Female	23	2	Frequently	Infrequently	Sometimes	Sometimes
Female	26		Always	Sometimes	Sometimes	Infrequently
Male	27		Always	Frequently	Sometimes	Infrequently
Female	28		Frequently	Frequently	Sometimes	Always
Female	31	4, 6	Frequently	Frequently	Always	Sometimes
Focus group 2						
Male	36	1, 4	Sometimes	Frequently	Sometimes	Frequently
Female	37	1, 4, 7	Frequently	Sometimes	Infrequently	Sometimes
Female	37	1, 2	Frequently	Frequently	Frequently	Sometimes
Female	40	8, 12	Frequently	Sometimes	Sometimes	Sometimes
Female	42	12, 19	Always	Sometimes	Frequently	Frequently
Female	43	14, 17	Sometimes	Infrequently	Sometimes	Sometimes
Female	44	6, 9	Frequently	Frequently	Frequently	Sometimes
Female	44	14, 17, 19	Frequently	Frequently	Frequently	Sometimes
Female	44	12, 13	Always	Sometimes	Frequently	Infrequently
Focus group 3						
Female	46	15	Always	Infrequently	Always	Sometimes
Female	53		Infrequently	Sometimes	Sometimes	Never
Female	57		Sometimes	Never	Sometimes	Infrequently
Female	57		Sometimes	Frequently	Frequently	Infrequently
Female	58		Frequently	Always	Sometimes	Frequently
Female	58		Sometimes	Sometimes	Infrequently	Infrequently

3.3. Potential herbs and berries

In this study, the selected 20 species were all within the category of accepted safe foods and selected to broadly represent different food plant organs, i.e. flowers, seeds, fruits — berries, leaves, stems, bulb and display widely different tastes and textures. Whereas some of the included species are well known for their preservation effects (hop, rosemary, lingonberry), other species were included based on knowledge that they contain high concentrations of compounds that in an isolated and concentrated form have shown some antibacterial activity. The aim was to establish a set of complementary natural preservatives with different mode of antibacterial action to achieve additive and possibly synergistic antibacterial action, while still only applying doses of individual natural preservatives that are within consumer acceptance with regard to flavor. The antibacterial mechanism thus could be based on the content of different acids (low pH), phenolic, essential oils or specific compounds as for instance isothiocyanate and allicin, that have been shown to have such effect. It was attempted to select species with an assumed or proven high content of antibacterial agents, however without proof that the plant parts could deliver this effect against the relevant bacteria in meat spoilage. Depending on availability both raw plant parts (i.e. whole berries) and slightly processed foods (i.e. juice) it was chosen to present each species to the focus groups. It is anticipated, that a future use of natural preservative plants is either in the form of dry powder or milled wet solution to ensure homogenous preservation activity in meat products and optionally to include whole berries, cut granules or leaves of the same species to increase consumer recognition and added sensory experience.

4. Results

4.1. Consumer motives to purchase organic food

All participants were medium users of organic food products and therefore purchase organic products often but not always. A key parameter for several of the participants was that the price of organic products is important in the buying situation and, in general, the price of organic products is perceived as high compared to conventional products. This group of organic buyers was quite price-sensitive, as they would buy more organic food products if the price were lowered. To support this a participant said: *I would buy more products that are organic if it was cheaper… and it is so ugh, when the organic minced meat is priced higher and then there is also less in the package (female, 26y)*. Another participant mentioned: *I buy all the organic products that I can afford, milk, eggs, meat, flour and grain, but I cannot afford paying twice as much, for instance for bananas (female, 44y, 2children)*. The price concern was more pronounced for the participants in the young group (age 18–32) and the middle group (age 33–44).

Participants expressed their motivation for being interested in and buying organic food products in several ways. In the young group (age 18–32) one of the participants mentioned that environment and animal welfare play an essential role for buying organic food products, but for others it was not even a parameter that has been considered. For others the reason for buying organic was that it tastes better than conventional products, as for instance milk and fruit and vegetables in general, especially carrots. Some also mentioned that buying organic products gives a certain amount of prestige and status, and is important if or when they have children. This statement is supported by following quotation: *There is also a bit of prestige to have organic products in shelves at home, I think at least. I get very impressed by the homes where there are many organic things and I think Wow… I'm thinking well, how do they afford it?…and they are just super perfect, such a great nuclear family* (female, 31y, two children). Another participant supported this statement saying: *In the modern family, where things are under control, ecology is an incorporated part (female, 28y)*.

When it comes to the middle group (age 33–44), the reasons for buying organic food were more diverse. Some of the motives were that organic products have a better taste, animal welfare, environmental concerns and higher perceived quality. Further, the organic products are purchased for their children, for instance grain/oatmeal for breakfast. One participant said: *It doesn't matter for me [eating organic products] as I have lived for so long, it is much more important for my children (female, 40y, 2 children)*. Several of the participants also mentioned the personal mood/feeling of the day, and which organic products are on sale in the buying situation, as important for the decision to purchase organic products or not. Further, organic products were perceived as more clean and natural, as they contain no or less additives, coloring agents, E-numbers, remains of pesticides and medicine. A participant stated: *organic meat without E-numbers and all the other things that you don't understand is appealing (female, 43y, 2children)*.

The oldest group (age 45–60) had similar motives for buying organic products, as perceived higher quality, environmental concerns, avoiding additives and E-numbers. However, in the buying situation, other factors determine the purchase. Especially the appearance of the product is important, which is emphasized by this quotation: *the product should be good-looking rather than be organic (female, 58y)* and *I purchase with my eyes (female, 46y)*. Further, the shopping place and how the products are displayed are important: *It is of no use if it is messy in a distinguished delicacy shop… it has to look nice with regard to the surroundings, and the displayed products should look delightful (female, 58y)*.

4.2. Knowledge of preservation techniques

In general, participants had little interest in the specific preservation technique applied in meat products. Participants felt that their knowledge about the existing preservation techniques is limited and they felt very uncertain about their own knowledge in that area. On the other hand, when discussing possible preservation techniques, they jointly mentioned the use of chemical additives (e.g. nitrite), smoking (e.g. of sausages), temperature (e.g. pasteurization) and curing. In the light of the limited involvement in and knowledge of the

specific preservation techniques, participants were more interested in what actually has been added to the meat products. This seems to be valid across age groups.

In the young group (age 18–32) a participant stated: *I don't bother about the preservation technique, but I look after what I have had heard is bad… and if there is nothing, I'm happy and satisfied as a consumer (female, 31, 2children)*. Another participant further mentioned this: *I don't care about the preservation technique, but I do care about the content of E-numbers (female, 19y)*.

A participant in the middle group (age 33–44) stated: *If I choose organic meat products, that is because only a limited number of additives have been added, and it must be preserved in one way or another. With regard to organic meat products, often a limited number of additives have been used, so it seems like a more authentic product… so how it has been preserved is not that important to me (female, 44y, 2children)*. A participant said: *It is all about whether we like the idea [organic concept] or not, and not so much about whether it is preserved in one way or another (male, 36y, 2children)*. This indicates that the presence of additives is accepted, but minimizing them seems important, also more important than the specific preservation technique applied.

With regard to checking the ingredient list for additives, some never do and others always do. Several of the participants stated that when buying organic meat products it is not necessary to check the list of additives, because they are convinced that organic products contain a minimum of additives. A participant mentioned: *I get rebuked by my boyfriend, because I walk around checking the ingredient-list, but I want to make sure that I buy the right product (female, 31, 2children)*. Further, a participant said: *When I look for the organic label, I don't check the ingredient list, because I count on that it is in order (female, 44y)*. A rule of thumb is that the fewer the number of chemical additives the better. Two of the participants in the oldest group (age 44–60) furthermore had documentation giving them an overview of possible chemical additives and their (negative) effects on the human body.

4.3. Attitude toward new preservation technique using herbs and berries

Although the participants might not be highly involved in preservation techniques, almost all participants were positive about preservation with herbs and berries, using words like fantastic, exciting, natural and healthy. They thought that the idea is outstanding and many of them stated that they did not understand why industry had not used this preservation technique before. A participant stated: *I wonder why they [the meat producers] haven't started yet, if this is effective (female, 57y)*. They believed that there is consistency between the organic concept and the preservation technique using herbs and berries.

There were some age-related differences in consumer reactions to the new preservation technique. The youngest group (age 18–32) was the most enthusiastic about the concept, emphasizing the fact that this preservation technique can minimize the use of chemical additives. Their enthusiasm mainly related to the health aspects such as giving their children (born as well as unborn) more natural food and further, prevention of allergy. Some associated the preservation technique using herbs and berries to health because as a participant mention: *Herbs and berries are healthy so this preservation technique must be healthy as well (female, 31, 2children)*. This group did not express many concerns about the preservation technique: *It is as natural as possible and I don't have any negative objections (female, 26y)*. The few concerns were more related to the taste of the product and if the length of shelf life is acceptable.

The middle group (age 33–44) was most skeptical toward the preservation technique using herbs and berries. Although the overall attitude was positive, with most emphasis on naturalness: *It sounds great, it is natural and clean products (female, 44y, 2 children)*, there were concerns related to the preservation technique. The concerns related to the manufacturing of meat products including mixing greenery with meat, over dosage of specific substances and removing vitamins from the herbs and berries. A participant argued: *I must admit, that I have a bit of difficulties with it, because in juice and purée there is a growth of bacteria… that is how I think about it… so they have to process the juice or purée in some way, but I don't know how (female, 37y, 3children)*. For a few participants in this group it did not matter if the additives were chemical or natural, because, as they argue, the substance is the same. However, most preferred natural additives in the form of herbs and berries. More of the participants also found themselves exposed to conflicting media messages related to the food area, expressed by "what is healthy today is not healthy tomorrow". A participant mentioned: *I won't like it, because we have heard so much about these herb products and herbal medicine, that they can be toxic for your body, even though they are naturally occurring (female, 43y, 2children)*. This conflicting information via the media breeds skepticism among the participants and this skepticism spreads to the acceptance of the preservation technique using herbs and berries. Another participant supported this: *We get so bombarded with new knowledge, information and fashion phenomena, and what it does to me is, that I become more skeptical, because then it actually shows to be highly unhealthy (male, 36y, 2children)*. Despite this, they generally trusted preservation with herbs and berries and that it is just as safe as using chemical additives. Further concerns raised were related to the product including the taste, odor, texture and appearance.

In general, the oldest group (age 45–60) was positive about the preservation technique using herbs and berries using word like fantastic, positive, appealing and unbelievable. They liked the idea of using herbs and berries as preservatives and did not challenge the preservation technique, because as one of the participants argued: *they did that in the old days where no chemical additives were available (female, 46y)*. In relation to this, they liked the naturalness of herbs and berries and minimizing the amount of chemical additives, which by some were perceived as toxic. Few barriers toward the preservation technique using herb and berries were discussed in this group and their concerns were more related to changes in taste, texture and appearance.

4.4. Acceptance of products preserved with herbs and berries

The participants generally agreed that most of the presented herbs and berries are acceptable as preservatives in organic meat products (see Table 3). This is supported by the statement: *If the product is good, it is doesn't matter which herbs and berries are used (female, 42y, 2children)*. There was a slight tendency that herbs are easier to accept in meat product than berries, primarily because they are used to consume meat products with herbs added and that, the use of berries is newer in relation to meat. Additionally, they did not think that berries (or some of the presented berries) and meat fit well together. Further, the positive attitude was for several of the participants magnified when presenting the specific herbs and berries, as it enhanced the concreteness of a given meat product, so that participants could imagine different variations of herbs and berries. A participant who was a positively surprised when presented for the different herbs and berries, said: *If these are the herbs and berries, that are usable to preserve with, then I would have no barriers to purchase products that are preserved in that way, because they are all some that we are familiar with (female, 44y, 2children)*.

In accepting products preserved with herbs and berries, four factors seem to appear as the most relevant ones. These are taste, appearance, texture and shelf life. In the following, the results are presented for all focus groups, as there were little differences between age groups.

4.4.1. Taste

The most essential factor for accepting new products preserved with herbs and berries is the tastiness of the products. This is

Table 3
Acceptance of specific herbs and berries in meat products and cold cuts.

Herbs and berries	Accepted	Rejected	In doubt
# participants			
Cranberry	21		
Thyme	21		
Garlic	21		
Lingonberry	20		1
Chili	20		1
Rosemary	20	1	
Oregano	19		2
Sage	19		2
Blackberry	18		3
Savory	18		3
Redcurrant	17		4
Blueberry	17	2	2
Horseradish	17	3	1
Aronia	16	1	4
Ramson	16	1	4
Rhubarb	14	2	5
Caraway	13	5	3
Hop	11	3	7
Sea buckthorn	8	3	10
Peppermint	7	7	7

supported by this quotation: *It is fine if it tastes differently, but then it should also be tasty (female, 23y, 2children)*. In this connection, participants found it important how producers combine the herbs and berries in an exciting way, so they seem appealing in the buying situation. Further, the general opinion was that the producers are capable of combining usable herbs and berries in ways that are exciting and tasty.

In all of the groups, they discussed how much changes in taste are acceptable. A participant mentioned: *If the taste doesn't change too much it is a really good idea (female, 58y)*. Whereas another said: *I think it prepares the ground for exciting experiments with flavours (female, 31y, 2children)*. Some of the concerns that were most discussed among the participants related to which degree the new product will taste different from what they are familiar with. Clearly, this question divided the participants. For those preferring a change in taste, one of the positive outcomes would be an extension of what is perceived as a narrow range of organic meat products, adding new exciting flavors. A participant stated: *Sometimes I wander around in the supermarket, because I think everything is so boring (female, 28y)*. In this context, new tastes in the supply of organic meat products were seen as a strength, although it can take some time to get used to them. For others it seemed difficult to accept that the meat product they are familiar with will change taste into something new. In dealing with this issue, they discussed whether brand new meat products should be developed. Given changes in taste, they discussed the extent to which it will change and how much change in taste is acceptable. The general view was that if the change in taste is minor, it is easier and faster to accept and vice versa. Extensive shifts in color of meat products can take generations to accept. Some also had concerns that the taste of herbs and berries will be too pervasive and the taste of meat will be drowned out.

4.4.2. Appearance

Appearance of the meat product was relevant for most of the participants, and one of the most discussed issues in this context was whether the herbs and berries should be visible (added chopped or whole) or not (added in fluid form, e.g., juice or purée). This clearly divided the participants, as some preferred visible herbs and berries, because it is more trustworthy and they found it appealing. This is supported by the statement: *To be trustworthy, you have to see the different herbs and berries; otherwise you can as a consumer be concerned about, if it is only a flavour additive (female, 28y)*. Some expressed that visible herbs are acceptable but not berries, because they are not familiar with it. Others preferred that neither herbs nor berries are visible, because they did not find visible herbs and berries appealing. They also thought that preserving with herbs and berries in a fluid form is more convincing, because it will preserve the entire meat product, whereas concerns were raised using especially whole berries, because they might not be preserving effectively. Few had no preferences related to the appearance of whole/fluid herbs and berries in the product. A participant said: *I don't care, I like both… I have bought the idea (male, 27y)*.

When the illustrations were shown to the participants (see Appendix 3), some concerns were raised in relation to the appearance of the meat test products. The extent to which the color of the meat products would change was a subject that was discussed among participants, which is most relevant for products with herbs and berries added in fluid form (photos 1 and 2). The general opinion was that the colors of the sausages added different levels of blueberry juice were acceptable, although some of the participants expressed concerns related to the sausage with the highest level of blueberry juice, in which the gray tone was associated with spoilage. Some were positive about the minor changes in the colors of the different sausages, as they had expected a more intense shift in colors based on the herbs and berries presented. Some would find it too strange if the meat products changed colors into something as unfamiliar as purple or blue. A participant said: *I won't eat a blue sausage, then I would buy something else, then it could be just as healthy (female, 53y)*. In contrast, the blue color would be acceptable for others if the product is organic, which is supported by the quotation: *Maybe it looks different, but it doesn't matter. It can be grey, blue or red… it would be fine, because it is a natural product without additives (female, 46y)*. The blue color was for some associated with something unhealthy and unnatural for meat products, although the young male participant found the blue color trendy. Some participants would prefer an intense shift in colors rather than just a minor change. When using whole berries (photos 3 and 4), the juice might leak out from the berries and into the surrounding meat, which was not appealing to the participants, because it was associated with a product that was not fresh. Consequently, some found the whole berries appealing only if it would be possible to avoid juice from the berries from leaking out into the meat. A general opinion was that participants would prefer that the meat products should match the color of the herb or berry, for instance would blueberries in a sausage made of beef instead of in a pork sausage be preferred, because blueberries are dark and beef meat is darker than pork meat.

4.4.3. Shelf life

Some concerns were raised about the shelf life of the products preserved with herbs and berries instead of chemical additives. Some expressed skepticism toward the effectiveness of herbs and berries as natural additives, as they considered chemical additives more effective. A participant mentioned: *It sounds like a good idea, but at the same time I'm a bit skeptical about, if it has the same shelf life, because as we know products with E-numbers have a quite long shelf life, so how can it be that it is so good? (male, 27y)*. Further, they did not understand why the industry has not applied it in production earlier, if the new preservation technique is effective. Several of the participants generally trust the effectiveness of the preservation technique using herbs and berries, because as a participant said: *producers will not risk selling a product that is not tested (female, 44y, 2children)*.

4.4.4. Texture and odor

Few of the participants had concerns related to the texture and odor. One participant said: *I think it sounds great, but I'm also thinking, how is it going to look? how about the texture? because I think it depends on colours, odour and texture (female, 42y, 2children)*. Another participant said: *I'm a bit nervous about the texture, should the sausage be poured on the bread? (female, 58y)*. They expect that it will take longer

time to accept the new products if they are different from what they are familiar with. A participant argued: *If it differs a lot in colours and texture, then I think you are right, it will take long time to get it on the market. And if it doesn't with regard to the products that we are familiar with, I think we will easier be attracted to it (female, 37y, 2children)*. A participant also mentions that whole berries are preferred, because of the chewing texture of whole berries.

4.5. Intention to purchase products preserved with herbs and berries

When it comes to the intention to purchase the products, the appearance of the meat products and price level are the main determinants. It furthermore seems important for consumers to get information about the preservation technique using herbs and berries, especially if it is label on the product that herbs and berries are used for preservation. The taste of the products preserved with herbs and berries is the main determinant for repeated purchase.

4.5.1. Price

In the young group (age 18–32), participants generally found organic products much more expensive than conventional products. A participant said: *It would be a pity, if the organic products became more expensive, already they are expensive (female, 19y)*. In this group, the intention to purchase the products preserved with herbs and berries will depend much on the perceived price difference. A participant mentioned: *The success of the products would depend on the price difference compared to conventional meat products (female, 26y)*. For those already buying organic meat products, a price a little higher compared to conventional meat products is acceptable. There is intention to buy organic meat products, but the price plays an important role in the buying situation. This is supported by following quotation: *You would like to make the right decision when you shop, but you also have to be realistic regarding your finances (female, 31y, 2children)*. For the young participants the majority of the discussion is related to financial considerations. However, one participant mentioned: *I have never thought about how unnatural and unhealthy it is with E-numbers, now I can see myself buying the new products (female, 26y)*.

Among the participants in the middle group (age 33–44) there is a consensus that all would try to buy the new products. They are all willing to pay a little extra for the new products preserved with herbs and berries, but then it should be tasty. A participant also mentioned: *I would buy it, but not if the price is twice as much (female, 44y, 2children)*.

In the oldest group (age 45–60) they don't discusses the price that much, but they generally agree that they would pay a little extra. How much extra they want to pay is dependent on the tastiness of the products. A participant said: *I would definite buy it, just to try it (female, 58y)*. Whereas another mention: *I don't think we are the target group, that would buy much of it (female, 57y)*.

4.5.2. Information

It is important for some of the participants that they get information about the preservation technique using herbs and berries. Some of the information should be given on the product, like information on which herbs and berries are used, but for some it is also important to know if the herbs and berries are visible or not. If for instance blackcurrant juice were used as natural additive, it would be positive if this was pointed out specifically on the declaration, because then it would be perceived as a healthier product. Further, some wanted more general information of organic products, especially whether the products are healthier compared to a similar conventional product or not. Others also expressed a need for getting more information about the preservation technique, especially why herbs and berries are usable as preservation. A participant said: *It is important that information will be given about why shelf life is the same, because organic products normally don't have the same shelf life (male, 27y)*.

5. Discussion

The new preservation technique using herbs and berries gives the meat industry opportunities for developing a wider range of new meat products with natural additives. However, new technologies in the food area are not all equally acceptable for consumers. Studies of consumer acceptance of different kinds of meat processing technologies have been carried out, trying to find out what makes a processing technology acceptable or not. Previous research has shown a good deal of skepticism among consumers with regard to new meat processing technologies and have generally shed more light on factors leading to rejection rather than acceptance of new technologies (Frewer et al., 2011). This study might give a different perspective, as the new technique seems to be easily acceptable for consumers. But why seems this technology more acceptable? First, the perceived *naturalness* of the new techniques has a high priority among consumers for accepting new processing technologies in the food area. A study exploring consumer acceptance of beef processing technologies found that, restructuring, applying shock wave technologies and terminal processing were perceived as manipulation and as moving away from what was perceived as natural beef, leading to a rejection of these technologies (de Barcellos et al., 2010). Thus, the high degree of perceived naturalness of preservation with herbs and berries might be a partial explanation of the acceptance of the new technique. Secondly, consumers found the technique relatively *easily comprehendible*. The technique preserving meat with herbs and berries is relatively simple to explain in everyday terms, and herbs and berries are known by all consumers, which might have made it easier for the consumers to comprehend the information about the technique and thereby accepting it. The technique is furthermore easier to comprehend, as some of the consumers are *familiar* with the preserving effects of herbs and berries, due to former generation's use of herbs and berries as preservatives. This corresponds to the results from the risk perception research showing that the familiarity factor is influencing risk acceptability of technology (Slovic, Fischhoff, & Lichtenstein, 1982). A third explanation might be that the technique *solves a recognized problem* among consumers. Besides the perceived naturalness of the technique and the fact that it is easy to understand, the technique also replaces the chemical additives in meat products, which by many consumers are perceived as undesirable ingredients in food products. Fourth, the technology seems to be in line with the food-trend toward *authenticity*. Lewis and Bridger (2000) argue for a new group of consumers, who has a strong desire for authenticity and authentic products. They search for products with value-added extras of intangible assets as for instance authenticity whereas product quality and value for money are perceived as given for new consumers (Dagevos, 2005). In this study we found that authenticity seems to be related both to the organic concept but also to the new technique using herbs and berries, due to the fact that the technique is consistent with preservation techniques used in ancient times of our ancestors. On the other hand one could argue that using herbs and berries in processed organic meat products might be moving away from the authenticity of the products. However, there are no results from this study, which indicates that consumers hold negative attitudes toward the processed part of organic meat products, as there are no statements that organic food should be less processed than conventional food products.

The new technique of preserving meat product with herbs and berries gives the industry opportunities to produce products that meet consumer demands for meat products with less chemical additives and for a broader range of organic products with new and more exciting flavors. This study reveals that different consumer concerns should be kept in mind developing new products using herbs and

berries as preservative. Especially the taste and the visual appearance of the products seem important for consumers purchasing meat products and cold cuts. With regard to the taste of the products, the meat producers should carefully chose and combine different herbs and berries resulting in meat products that are tasty. In addition to this, studies have shown that the use of berries may have unintended consequences and raise wrong expectations on flavor (Saeed, Grunert, & Therkildsen, 2013). Consumers seem to be quite open-minded on which herbs and berries are acceptable, as only a few of the herbs and berries presented were not acceptable. Moreover, they generally trust meat producers' capability of developing new tasty products including combining different herbs and berries in a suitable way. The new technique requires use of herbs and berries, which influence the appearance of the meat products, e.g., changes in color or presence of whole berries. Meat producers should develop appealing meat products, but also carefully consider changes in the appearance away from what is perceived familiar by consumers. Reflecting upon the different age groups, it seems like the young consumers (age 18–32) are more willing to accept changes that are perceived different from what they are familiar with, as they have a more experimenting attitude toward food. Reaching the young consumers, it is important to consider the price of the new products, as the young consumers are more price-sensitive compared to the elder consumers. Besides appealing and tasty products, it is important to have a clear communication for reaching consumers age 33 to 44, as these consumers tend to be most skeptics about preservation with herbs and berries, although in general they are positive toward the technique. For the elder consumers age 45–60, avoiding chemical additives is seen as the most pronounced advantages of the new technique, as this group of consumers have only few concerns related to the technique.

The insight obtained from the focus group discussions are promising and indicate good opportunities for acceptance of preserving meat with herbs and berries. Conducting quantitative studies would be useful to see if the results obtained here generalize. Furthermore, sensory tests could support the product development process of new products that meet the demands of the consumers. In this respect, it could be essential to present different test products, which differ radically from what consumers are familiar with in both taste and appearance parameters, in order to get a better understanding of how products preserved with herbs and berries are perceived by consumers. This seems to be important both for the initial purchase and repeated purchases of the new products, as studies shows that pre-trial expectations raised on behalf of appearance and information are not always fulfilled after actual trial (Saeed et al., 2013).

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Appendix 1. Explanation of preservation technique using herbs and berries

1.1. Preservation with herbs & berries

In conventional meat products and cold cuts chemical preservatives are often used to ensure the safety and self-life of the products, these are some of the E numbers appearing on the product's ingredient list. Instead of using chemical preservatives, researchers are investigating the usability of herbs and berries as preservatives. Some herbs and berries contain high amounts of antimicrobial agents that possibly can prevent bacterial growth.

Before using herbs and berries, they are processed and then added to the meat products in the form of for example, a puree or juice. Compared with using chemical preservatives, the technique is just as safe and offers the same durability to the product. This form of preservation is usable in meat products such as sausages and pâtés.

Please note your first thoughts about preservation with berries and herbs:

Appendix 2. List of potential herbs and berries

Berries:	
__Blackcurrant	__Cranberry
__Aronia	__Redcurrant
__Lingonberry	__Blueberry
__Sea buckthorn	
Herbs:	
__Oregano	__Savory
__Thyme	__Rosemary
__Sage	__Peppermint
Others:	
__Hop	__Rhubarb
__Horseradish	__Chili
__Caraway	__Garlic
__Ramson	

Appendix 3. Illustrations of meat test products

Photo 1. Sausages from left:
Sausage A: standard sausage (no herbs or berries added)
Sausage B: 4% blueberry juice
Sausage C: 8% blueberry juice
Sausage D: 12% blueberry juice
Sausages B, C and D with less salt added than the standard sausage.

Photo 2. Sausages from left:
Sausage A: standard sausage
Sausage D: 12% blueberry juice

Photo 3. Sausages from left:
Sausage a: same recipe as sausage A, but more finely chopped
Sausage F: 2% blueberries, 3% cranberries

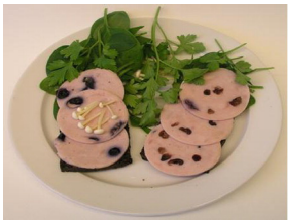

Photo 4. Sausages from left:
Sausage E: 2% blueberry juice, 3% blueberries
Sausage F: 2% blueberries, 3% cranberries
Sausages E and F with less salt added than the standard sausage.

Appendix 4. Interview guide

1. Discussion of organic food
   a. What do you understand by an organic product?
   b. Why do you purchase organic products?
   c. Do you like purchasing new organic products?
   d. How important is the following parameters for you, when you purchase organic products:
      i. How the farmers are producing the product?
      ii. How the manufactures are processing the products?
   e. How processed must an organic product be? (From completely raw and unprocessed to be processed to for instance a salami or pâté)
2. Discussion of organic meat and cold cuts
   a. What types of organic meat and cold cuts do you know of?
   b. What do you think about the supply of organic meat and cold cuts?
   c. Do you buy organic meat and cold cuts? (why/why not?)
      • Discuss; if the participants do not automatically do this:

i. Shelf life (it is an important parameter, expectations)
ii. Additives (it is an important parameter, ok or not)

   d. How important is it to you, that the meat and cold cuts you buy, looks familiar?
      • Discuss; if the participants do not automatically do this:

i. Changes in appearance
ii. Changes in taste

3. Discussion of preservation techniques
   a. What is your knowledge of how to preserve food?
      • Conventional products vs. organic products
   b. How important is the preservation technique compared to other criteria's such as taste, price, quality, brand, appearance, brand and store etc.?
      • Do you check the ingredient list and/or the content of preservatives/E-numbers, when you buy organic products?
4. Discussion of the preservation technique using herbs and berries
   Each participant receives a paper with a short description and explanation of the preservation technique using herbs and berries. The moderator reads the description.
   a. What is your immediate response to preserve with berries and herbs?
   b. Is it a preservation method, you could see used in organic products?
   c. Is it a preservation method that appeals to you?
5. Discussion of willingness to buy products preserved with herbs and berries
   a. Would you be interested in buying meat and cold cuts, in which herbs and berries are used as preservatives?
   b. Would you prefer to buy meat and cold cuts, in which herbs and berries and herbs are used as preservatives?
   c. Would you be willing to pay more for meat and cold cuts, in which herbs and berries are used as preservatives?
6. Discussion of barriers toward purchasing products preserved with herbs and berries
   a. Which kind of problems do you see in relation to the new preservation technique?
   b. What would prevent you from buying organic meat and cold cuts, which are preserved with herbs and berries?
   c. Do you trust that preservation with herbs and berries acts equally as good as chemical produced preservatives? (Why/why not?)
   d. What will it take for you to buy (more) organic meat and cold cuts?
7. Discussion of the selected berries and herbs
   The selected herbs and berries are presented for the participants and each is given a list with the names of the herbs and carriers.
   a. Which of the different herbs and berries do you know of and which do you not know?
   b. Which of the different herbs and berries do you like and which ones do you not like?
   c. Could you imagine that some of these herbs and berries could be added in different kind of meat products and cold cuts, as for instance salami, sausages and pâtés?
   d. Are there any of these herbs and berries that you certainly could not imagine in meat products or cold cuts?
   e. How processed are these herbs and berries allowed to be? Discuss the different forms; whole, chopped, powder, puree, juice or extract.
   Participants note each herbs and berries as acceptable or not acceptable as a preservative in meat products or cold cuts, such as a sausage or pâté.
8. Discussion of illustrations of cold cuts — "prototypes"
   The pictures are distributed to the participants in the following order:
   a. A picture of four different meat sausages added different amounts of blueberry juice. The large sausage is a test sausage without added juice. The sausage next to it is added 4% blueberry juice and the next in turn is added 8% blueberry juice. The last is added 12% blueberry juice. A picture showing the test sausage and the sausage with 12% blueberry juice is distributed at the same time
      • Discuss the colours. Are the colours acceptable and/or appetizing?
      • May the colour change more than at the pictures?
   b. A picture of two meat sausages, one with and one without whole berries
      • Does it look appetizing with whole berries?
      • Do you prefer the one over the other?
      • If the product claims to contain for instance 5% berries, is it then important to you that…

i. You can see the berries?
ii. You can taste the berries?

   c. A picture of rye bread with sliced sausages added whole berries.
      • Used as an example of how a product, in which berries is used as preservative, could look like. How is the response?

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