

# Chapter 5: The quality of local and regional food

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**Summary:** It is no simple task to define food quality and depending on whether you ask a scientist or a consumer you could end up with two very different definitions. In the following chapter we will provide a definition and explanation of food quality in the context of local and regional food. The quality concept is divided in production quality, the way the food has been produced, and product quality, the quality of the produce itself. Most effort will be put on the latter, based on an illustration of four important product quality traits. Last, a short account for how consumers perceive the quality of local and regional food and their very varying reasons for purchasing it or not.

## How to define food quality?

Food quality is, as noted by many researchers before us, a complex concept. In its simplest form quality can be understood as a product's ability to meet the expectations of the user. However, as quality also can be understood as "properties" or "inherent value", different food quality parameters may be of importance depending on where in the food chain you operate. Also for the end user, the consumer, the perception of food quality vary widely due to factors like culture, age, economic resources and knowledge. It is further difficult to draw system boundaries of what should be included in the concept, should for example the way the seeds were treated and package material recycled be part of the quality of a tomato?

Few food products are identical and the quality of food stuffs is seldom determined by a single property but by a combination of several properties. To make sense of the concept it is important to try to make a combined evaluation of the different properties and express the result as reductionist as possible Beck-Friis et al. (2013). It is however often impossible to combine all data into a "total quality concept" (Beck-Friis et al., 2013).

It is common to discriminate between *objective* and *subjective quality*. *Objective quality* concerns those properties that can be measured or analyzed in for example a laboratory while the *subjective quality* is about such traits that are experienced by the end user, the consumer. The subjective quality is associated with expectations and may be about how the food has been produced, how it is presented, in which context it is consumed and ethical and cultural considerations.

One way of entangling the quality concept may be to divide further it into 1) *production quality* and 2) *product quality*. The *production quality* encompasses the way the food has been produced. It deals with sustainable production methods, food security issues and cultural and ethical considerations like animal welfare. The way the food has been transported and processed and how packaging materials and nutrients can be recirculated are also included in production quality. Some production quality properties are objective and can be evaluated. As an example, life-cycle assessment (LCA) is a technique for systematically analyzing a product from cradle-to-grave,

that is, from resource extraction through manufacture and use to disposal resulting in a value whereby the environmental impact of the specific product can be assessed. Through LCA different production and distribution methods can be compared objectively. Other production quality traits are more subjective. For many consumers the production conditions associated with animal food production is concerning. Many care for how the animals that provide us with meat, milk and eggs have been reared and treated during transportation and slaughter. The assessment of animal welfare can either be based on objective research on the physical and mental needs of the production animals but also on more subjective, ethical positions regarding how we believe animals should be treated, positions that may vary in-between different cultures or even in-between individuals.

From a consumer, producer and retail perspective, local or regional production is often a positively value loaded concept. However, it can be discussed whether the production quality is generally different for this type of food. The relationship between locally produced foods and social benefits are complicated (Wretling Clarin, 2010). It is far from self-evident that locally produced foods support collective desirables like a reduced climate-impact or increased employment any more than would food produced in more distant places or by other techniques. Small local producers may also deal with financial circumstances that do not permit focus on sustainability and ethical considerations like animal welfare.

The *product quality* concerns the quality of the produce itself. Also here different properties has to be taken into account. Figure 1 can serve as an illustration of four important quality traits and how they can be perceived by the consumer. In the following we will try to account for if and how local or regional production of food may impact on these traits. The presentation is not complete and we do not claim to cover all aspects, instead it can be seen as “food for thought” regarding these issues.

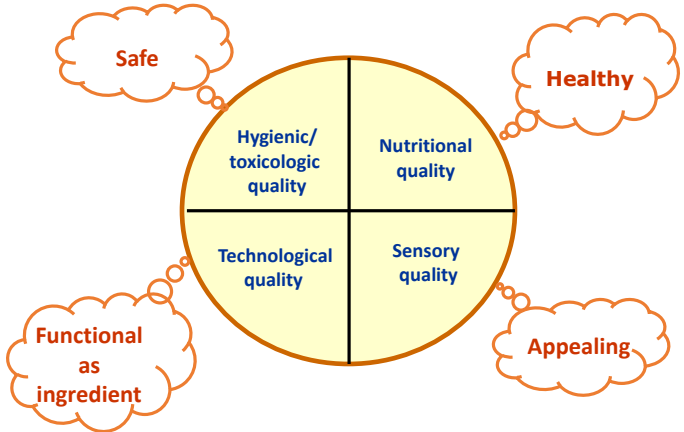


Figure 1. An illustration of four important product quality traits and how they can be perceived by the consumer.

## Hygienic and toxicological quality

Safe foods are a basic requirement and it is almost taken for granted that the foods that we buy does not carry pathogenic microorganisms or is poisonous. In Scandinavia we are “spoilt” with high hygienic and toxicological quality but unfortunately it is impossible to completely avoid harmful substances in food, because many of them are produced naturally in the food or can be found in the environment. The Nordic climate in combination with thorough official control programs has given Denmark and, perhaps even more so, Sweden, some production advantages in relation to hygienic and toxicological quality. The need to treat plants and animals with antibiotics and pesticides is relatively small here in comparison with other countries. This reduces the risk of antibiotic resistant bacteria as well as residues of medicines and pesticides in the food.

However, various food scandals, from the discovery of Bovine Spongiform Encephalopathy (BSE or “mad cow disease”) to more recent outbreaks of Salmonella, E. coli and Listeria have affected food producers and consumers in Europe.

During the 1990s there was an increase in the number of food-borne diseases in Denmark. Especially outbreaks of Salmonella increased during the period due to increase in the poultry, and later partly due to pork and eggs. A third increase in 1997 was mainly due to eggs. The development was turned as a result of a focused effort from authorities and the food industry, but salmonella outbreaks are still present today. It was until 2014 recommended by the authorities that eggs were not consumed raw, and some risk groups are still advised to follow the recommendation. While the disease of Salmonella rarely causes death, it is unfortunately the case with the disease of Listeria. The mortality rate is approximately 25%. In Denmark, there are usually about 50 disease cases per year. But in 2014 the incidence was remarkable high, with over 90 cases (SSI, 2015). The cases attracted attention in the public media. This type of cases affects the consumers and it may lead some consumers in the direction of the local and regional producers.

There have been various surveys of consumer attitudes towards food safety. In a Danish survey, conducted in 2002, the Danish consumers seems to be relatively skeptical about food safety, compared to consumers from other European countries, particularly with regard to eggs and meat, but also to some extent to fresh fruit and vegetables. Skepticism regarding eggs and fresh meat must certainly be seen in context with the salmonella problems, and the BSE scandal in the late 1990s, while consumer skepticism regarding fruits and vegetables probably is related to the fear of pesticide residues in the products (Jensen, 2002).

The food scandals have led many national food regulatory agencies to tighten food safety and inspection legislation. These developments may be seen, in a world of growing food trade, as a way to protect national food markets and critique is raised against them regarding unclear effects on public health (Miewald et al., 2015). Policies around food safety are one arena in which large-scale policies can produce consequences for small-scale production (Carter-Whitney, 2008) and some assert

that food safety and inspection legislation threaten the economic viability of small-scale producers and processors.

One of the tools to achieve the goal of safe food is traceability (National Food Agency, 2012). Traceability is about tracing and following all foodstuffs, food producing animals and other substances intended for use as foods, through all stages of the food chain. The demand for traceability is regulated by food legislation but may be supported by for example other authorities, customers, food retail or as part of certification schemes. For local and regional food production and consumption traceability should be natural. A defined sender is often a key element in marketing this type of food and as discussed earlier, consumers often perceive product quality as associated with, and even dependent of, the specific production region and its physical, biological and cultural prerequisites, its terroir (Nygård and Wramner, 2013).

Some years ago the horsemeat scandal flattened the food industry in all of Europe. The lack of traceability in the pre-prepared frozen meals and meats served at restaurants, resulted in thousands of Europeans consuming horsemeat instead of beef meat, without knowing it. The main issue was the sub suppliers that sold horsemeat as if it was beef meat, to large food enterprises like the Swedish Findus, a leading international frozen food enterprise, and other food enterprises in Europe. The scandal received great attention in the media and the food ministers from the countries involved were hastily called for a meeting with the European Consumer Commissioner, despite the fact that no hygienic or toxicological hazards were present in this case. The scandal had huge economic consequences for the food enterprises involved, but the consumers' food safety was never at risk. A scandal like the horsemeat scandal can be an advantage for the local and regional food producers, because the consumers' demand for traceability is increased and the trademark for many local and regional food producers is to write origin- and traceability descriptions directly on the package. The same kind of traceability is difficult in large scale production because of varying suppliers depending on season and price (Erin-Madsen, 2013).

However, local and regional food production can also be associated with hygienic and toxicological hazards. Larger food producers typically have more resources to ensure and maintain effective routines while local and regional food production is often characterized by small scale enterprises where a lack of competence and resources may constitute a risk factor.

The local and regional production prerequisite as such is another area of caution. Cadmium (Cd) is a metal that is harmful to the environment and to health. The main source of exposure to cadmium for non-smoking humans is via foodstuffs, and in Sweden 70% of this intake is in the form of cereals, potatoes and vegetables. Plant properties, pollution inputs and soil factors all influence Cd concentrations in agricultural crops. The conditions that prevail in Skåne, situated close to the continent, with an intense agriculture high levels of cadmium in the bedrock and densely populated constitutes a special problem for this region (Backe et al., 2003). In a joint report from several Swedish authorities, among them the Swedish Environmental

Protection Agency and the National Food Agency, an action plan to reduce cadmium exposure is suggested (Swedish Environmental Protection Agency, 2013). This plan might affect local and regional food producers in that it suggests;

1. To decrease the production of cereal-, potato- and vegetable varieties that have a naturally high uptake of cadmium in areas where the soil exhibits high cadmium content. Another, adjacent action is to shift to the use of varieties that are not as prone to take up cadmium.
2. To use the right produce to the appropriate type of food. This implies ways to, via information, steer producers to try to use produce and raw materials with the lowest possible cadmium content in the production process. This may be applicable for foods that is consumed in large quantities or by risk groups like infants (e.g. baby formulas).
3. (Swedish Environmental Protection Agency, 2013)

The possibilities for the different regions of the South Baltic area to, on a national level, affect the cadmium levels in food are limited as a lot of the food that is consumed is imported and originates from other regions or countries. Further, cadmium is deposited to our arable land also from external sources via fertilizers and through pollution.

Another harmful substance, acrylamide, which is classified as carcinogenic, is a chemical that can be found in coffee as well as starchy foods, such as potato and cereal products, which have been deep-fried, roasted or baked at high temperatures. The levels of acrylamide can vary considerably between products and can also vary for the same product that has been cooked or processed at different times. Levels of acrylamide in cooked potato products are primarily influenced by the levels of reducing sugars in the product and this in turn is influenced by where and how the potato is grown, storage time, temperature and variety of potato used.

In investigations of the acrylamide content of Swedish foods, the National Food Agency has found that, for most foods the number of products that exceed the indicative value set by EU is decreasing (Hellenäs et al., 2013). However, the exception is potato chips where too high levels in relation to the indicative value are found in chips from most Swedish producers. One of the explanations to these increased levels may lie in that potatoes grown in Sweden, for unknown reasons, result in higher levels of acrylamide than what does potatoes grown in many other parts of Europe (Hellenäs et al., 2013). More research is therefore needed concerning the effect of regional growing conditions and choice of potato variety on the formation of acrylamide in potato products.

## **Nutritional quality**

Several factors determine the nutritional quality of fruits and vegetables: the specific variety chosen, the growing methods used, ripeness when harvested, post-harvest handling, storage, extent and type of processing, and distance transported. The vitamin and mineral content of fruits and vegetables depends on decisions and practices all along the food system – from seed to table – whether or not that sys-

tem is local or global (Firth, 2007). There are however, some factors that indicate that the nutritional value of a regionally or locally produced fruit or vegetable may be as high as or even higher than the equivalent food item originating from more distant places. Foods grown far away has been transported and handled more and therefore there is a risk of nutrients loses before reaching the consumer. Further it regionally or locally produced fruit and vegetable can be harvested and sold at their peak of ripeness, often meaning that the nutritional quality is optimized. Farmers growing for a local market can, to a greater extent, favor taste, nutrition and diversity over transportability when choosing varieties. Greater crop diversity from the farmer means greater nutritional diversity for the eater (Firth, 2007).

However, with modern processing methods nutrient retention is less of a problem and as an example studies have shown that frozen vegetables like broccoli, beans, spinach and carrots have a more uniform nutrient content than does the fresh equivalents and that the retention of, especially vitamin C is better when the vegetables are frozen than when they are sold fresh.

In Denmark there is an area of North West Zealand called *Lammefjorden* (the area is highlighted in Figure 1 in chapter 2) where the soil conditions provides the farmers with incredible good agricultural land. The soil is rich in nutrients, particular chalk. The good conditions were created when the inlet was dammed in 1875. The nutrients were created by dead plants and animals that for thousands of years fell down on the seabed and became mud. In some places of the inlet the mud is more than 20 meters deep, which is quite unique. Deposit of sand, and especially also clay, is present in the mud, and in large parts stones are replaced with mussel- and oyster shells given the soil naturally high calcium content. The carrots that are grown here are very rich in vitamins and taste, and is one of six products in Denmark that holds the label for Protected Geographical Indication (PGI) (Ministry of Environment and Food, 2015). The characterization of carrots from *Lammefjorden* is an extra high content of natural carotene and sugar. Carotene is the precursor to the formation of vitamin A and sugars affect the sweet taste of the carrots. The nutritional quality is a huge part of this regional producer's trademark.

Regional variations in nutritional content may be more evident in minor crops in which the genetic material has been conserved. As an example, horseradish, which has its origin in Southeast Europe, was brought to the Nordic countries by monks during the thirteenth century. Here, horseradish was used both as a bitter spice and as a medicinal plant to treat headaches, digestive disorders, high blood pressure and gout. A recent study of Nordic horseradish populations revealed considerable genetic and phenotypic diversity between accessions clustered in accordance with the country of origin (Wedelsbäck Bladh, 2014). Consequently, the horseradish originating from different parts of the Nordic countries exhibited variations in regard to their nutritional content. There was a high variation in glucosinolate levels among the investigated accessions and the vitamin C content also varied between accessions - from 57 to 182 mg /100g FW (Wedelsbäck Bladh, 2014). The most likely explanation to the high diversity in horseradish could be the introduction to Nordic

cloisters and subsequent distribution to different parts of the countries at many different occasions (Wedelsbäck Bladh, 2014). Another crop that exhibits variations in its nutritional value depending on where it has been grown is black currant, where fruits grown in the south of Sweden had higher contents of most phenolic compounds, ascorbic acid and soluble solids than those grown in northern Sweden (Rajeev Vagiri, 2014) .

## **Technological quality**

Technology is part of the industrial food production today and it provides many opportunities for the industry as well as for the consumer. But some of these opportunities are subjects for public debate namely because of the interference with what some consumers find natural for a food product. While the debate previously was about food additives, the present debate is about whether or not we as consumers will “allow” genetic modification (GMO) of our crops and foods (Justesen et al., 2010).

When referring to technological product quality, we mean properties that mainly influence the further processing of the product, be it in the food industry or in the kitchen. It may be the water-holding capacity of meat or the amount and type of protein in wheat. The technological quality is, as is the case for all product quality traits, a result of many production factors from genetics to cultivation and rearing measures. Analogously, local or regional production may affect the technological quality to some extent, even if is not all that evident. The production of Durum Wheat on the island of Ven, in-between Denmark and Sweden, may however serve as an example. The climatic conditions on the island makes it possible to grow Durum wheat further north than what is usually the case, The durum wheat is “hard”, which means that protein and starch in the wheat kernel is more tightly bound than in other types of wheat cultivated in Sweden. This “hardness” is a technological property that makes the durum flour ideal for making pasta. It makes the pasta smooth and glossy. Hence, local conditions may permit for different technological quality attributes.

## **Sensory quality**

A sensory property can be defined as the human physiological-psychological perception of a number of physical and other properties of food and their interactions (Rahman et al., 1999). We examine the food using all our senses (touch, sight, taste, smell and hearing) and signals are sent to the brain which interprets the signals and comes to a decision about the food's sensory quality. Food sensory quality has been suggested to comprise:

- Tactile properties, from touching and handling the food using for example cutlery as well as in the mouth, experiencing cooling, pungent or astringent sensations
- Textural properties, perceived mainly by biting and mastication, i.e. by the mouth
- Color and appearance, i.e. the visual perception

- Odor, the volatiles entering through the orthonasal passage
- Flavor, i.e. the five basic tastes (sweet, salty, sour, bitter and umami) perceived by the taste buds in the mouth and the aromatics, i.e. the volatiles released from the food via the retronasal passage
- The sound of the food, like the sound when braking or chewing hard bread

(Rahman et al., 1999, Meilgaard et al., 2007)

Sensory properties are measured by trained or untrained sensory panels or individuals, *i.e.* the consumers. The sensory quality of food is of uttermost importance when consumers choose food. Taste can seldom be assessed in beforehand in the supermarket, like it can in for example a manual cheese shop, but once experienced, an appealing taste is very important for buying the product again. Many value taste as more important than for example the nutritional quality of the food. Labeling products with different brands is an effective way for companies to inform the consumer about the taste of a certain product (Lundin, 2011).

Picture the taste of a ripe and sun warm strawberry that you put in your mouth directly after it has been picked and compare with those that were perhaps picked yesterday, and that are served cool after having been stored in the fridge overnight. When fruits and vegetables are picked at the optimal stage of ripening and eaten as soon as possible or after a short and careful storage, they taste more. And, opposite, when they are selected and treated for storage and transportation the full taste may be compromised. Reasons for this “lack of taste” have been widely discussed, and the main accepted explanation is that the industry has been focusing on yields, pest resistance, product homogeneity, durability and low price, while taste parameters have been a lower priority within plant breeding, production and distribution (Fernqvist, 2014). Further, there is the notion that the sensory quality of a product depends on where it has been produced. As noted earlier, consumers often perceive product quality as associated with a products terroir (Nygård and Wramner, 2013) Countries like France recognized the importance of special sensory attributes of a region as a unique quality marker more than a century ago when laws were imposed to protect the wine sector from falsification (Rytkönen et al., 2013). As described by Rytkönen et al. (2013) the association with the origin and place of production is communicated clearly by that the product carries the name of the place, like Champagne or Roquefort. Food quality in relation to the French model can be described as:

*“The quality of a food product is intimately associated with an interplay between a given, demarcated geographical area – a local- with some nature-given prerequisites and production methods which have been shaped during a long period of the history, conforming to the conditions of the territory.”* (Jonsson, 2011)



Thus fresh, seasonal produce from the near region is likely to have a special and attractive sensory quality. Further, special varieties may stand a better chance of surviving in local/regional systems contributing to a more varied product flora and richer sensory experiences. However, in Scandinavia we often claim that the long summer days and special light conditions, in combination with cool summer nights result in fruit, berries and vegetables with a highly developed aroma but the scientific evidence for this is not evident.

### **The role of product quality in the purchase situation**

When consumers buy food they balance price and quality. Some consumers value quality before price while others appreciate a low piece more (Lundin, 2011). Generally it is not complicated for the consumer in a buying situation to find out the price of a certain product. It can be considerably more difficult to assess the product quality before consumption. Some properties, like the color and shape of a potato or the state of ripening of the strawberries are more evident and can be valued before purchase while others can be detected first after consumption, others still, like the origin and production and processing methods are impossible to assess without oral or written information through labeling. There are different types of labeling. Firstly, the ingredients are declared through the ingredient list. Many products are further sold under a specific brand and this branding can also be a way of signaling quality. Strong brands are associated with high quality (Lundin, 2011). Mandatory or voluntary labeling is another way of informing consumers about different quality properties like production and processing methods. Knowledge about the meaning of different types of labeling helps the consumers to make well informed buying decisions and quality competition in-between companies is favored by credible information about the quality of a product (Lundin, 2011). The possibility to label a food product in a credible way may lead to a more varied product assortment. Products with certain qualities, which may be the case for example in locally or regionally produced food, generally have a higher production cost than does those of other (lower) qualities. It is thus of importance to be able to communicate certain information to the consumers so that they may identify for example locally produced vegetables and for them to be willing to pay for them.

In this context it may be appropriate to discuss the producers, the senders, role and importance for the locally produced food. In lacking a formal definition of local and regional food, it will be the distinguishable sender who will act guarantor for the locally and regionally produced food. Just by being distinguishable a small-scale producer can create confidence among consumers (Wretling Clarin, 2010). A sender using a geographic origin and proper contact details gives a credible impression (Wretling Clarin, 2010).

### **Does the consumer think that local and regional production of food affect food quality?**

It is known that consumers have different reasons for choosing locally or regionally produced foods, it may be the close proximity of the production as such, favoring

of small-scale production, climate-concerns, quality, taste a distinguishable sender or other things (Wretling Clarin, 2010). Generally properties associated with production quality are more important reasons for choosing locally produced food than does properties associated with product quality.

Through mapping where the consumers buy their local food and through discussing their consumption patterns as well as their content in their fridges Jooisse (2014) draws the conclusion that “local food” includes various understandings, postulations and procedures. Even if consumers tend to discuss local foods in a similar manner, the consumption pattern regarding this type of food differ fundamentally in-between persons. It can comprise anything from growing your own vegetables, subscribing to locally produced “grocery bags”, take part of collective purchase groups or taking pride in enjoying fancy dinners with friends, entirely based on local produce.

A Swedish thesis by Fernqvist (2014) report that including ‘origin’ as a credence cue, result in a strong country-of-origin and regional effect on consumer liking, favoring domestic and regional food over imports. Further, the more regional or local the product is believed to be, the higher the evaluation scores. This effect is moderated by origin or belonging to the specific area, which tends to increase liking for products from the same region. This would explain why, in the studies by Fernqvist, a label signaling ‘Swedish’ affects Swedish consumers.

Urban consumers, although somewhat “disconnected” are among the most concerned about food issues and this group is often interested in local foods. However, this does not necessarily translate into purchase behavior. Convenience of the “one-stop” supermarkets along with availability, price and labeling were found to be barriers to the purchase of local food (Penney and Prior, 2014). The drivers for buying local food on the other hand were freshness, health benefits and improved quality (Penney and Prior, 2014).

The fact that we, as consumers, put different values in the concept of locally and regionally produced food, makes the concept somewhat diffuse. The concept does, however, canalize a very positive and growing trend in that consumers are interested in the production as well as product quality of what they eat. Hopefully all parts of the food-chain, including food scientists and educators can seize this interest. Shewfelt wrote already in 1999:

*“most postharvest researchers, producers and handlers are product-oriented, while consumers, marketers and economists are more likely to be consumer-oriented in that quality is described by consumer wants and needs”, (Shewfelt, 1999)*

Thus, more than 15 years ago he pointed at the problem that not much research does both parts of the chain i.e. production and marketing issues. Hopefully, the strive for high production and product quality will be a future beacon in food production and consumption in the south Baltic region, thereby reconnecting different parts of the food-chain.

## Summarizing the chapter

- **Food quality** is a complex concept. A common way to define food quality is to discriminate between objective (properties that are measured and analyzed) and subjective quality (traits experienced by the consumer). In this article the concept is further described by dividing it into production quality and product quality.
- **Production quality** encompasses the way the food has been produced, e.g. cultivation and rearing measures, processing and transportation.
- **Product quality** is illustrated in figure 1. The figure shows four important product quality traits and how they can be perceived by the consumer.
- **Hygienic and toxicological quality, i.e. food safety** is of great concern for the consumers. The number of food scandals in the food industry may contribute to directing consumers toward local and regional foods with high **traceability**, but these small scale producers also face challenges regarding **hygienic and toxicological hazards**.
- Some literature suggests that local and regional food producers have some advantages when it comes to the **nutritional quality** of the products, especially fruits and vegetables.
- **Technological quality** includes properties that influence the further processing. It is a result of many production factors from genetics to cultivation and rearing measures and local or regional production may affect the technological quality to some extent.
- The **sensory quality** of a product is important when consumers choose foods, but it can rarely be assessed before purchase. When buying products from local producers the consumer has the opportunity to taste and talk about the product before purchase.
- **Consumers** have **different reasons for choosing** locally or regionally produced foods and **perceive quality differently**. However, the phenomena canalize a positive and growing trend in that consumers are interested in the production as well as product quality of foods.

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