Sensory attributes of organic poultry meat and consumer perception

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Abstract: The effect of organic production (OP) system on the sensory characteristics and on the consumer perception of poultry meat is discussed. Physical activity, pasture intake and age at slaughter animals are key factors in determining the quality of organically produced meat and their effects vary with genetic strain (fast and slow-growing strains). In conventional farming, fast-growing chicks are generally used. These animals are found to be inadequate for OP, going through several health and welfare problems the most recurrent of which are leg disorders and lameness. Contrarily, the use of slow-growing strains in OP is found to have positive repercussions either on animal welfare and on product qualitative characteristics (eating quality and appearance) perceived by consumer.
In conclusion, the organic poultry production could be an interesting production method especially if suitable changes in Reg 1804/99 are done.

Keywords: Organic production; Chicken; Meat quality.

Running Head. Organic poultry meat

The primary objective of organic agriculture is achievement of an ecological production to enhance biodiversity, environmental sustainability and food safety. Organic production (OP) is established according to the organic standards and the European regulations (Regulation 2092/91 and 1809/99) outlining specific productive protocols for agriculture and animal husbandry. In this Regulation there are two types of rules: compulsory rules disciplining feeding protocols (no chemical feed additives and no GMO feed ingredients), prophylaxis, and therapy as well as rearing system (origin of animals, older age at slaughtering, external area) and recommendations (use of slow-growing strain, pasture availability). As regards the recommendations for poultry organic production and especially those related to the use of slow-growing breeds in OP system (§1), these seem to concern more animal welfare and quality product than the compulsory rules do.
Even if product quality is not the main goal of organic farming, expectation of consumers (§ 2) and scientific evidence (Gordon et al., 2002) pointed out the necessity to control not only the process but the “real” animal welfare and the characteristics of product as well.
Given the discrepancies between the stringency of compulsory rules (e.g. no synthetic vitamins) of low or no impact on animal welfare and on product quality and the flexibility of recommendations which consider these parameters to a great extent, revision of organic regulation is highly recommended.

1 Effect of OP on qualitative characteristics (chemical) of poultry meat

Since consumers appreciate mainly the appearance and the eating quality of a product, the effect of OP on some physiological mechanisms implicated in these traits will be discussed. Compared to the standard broiler, eating quality of organic chicken meat varies greatly. This is because producers are using a wide range of breed-types and of feed ingredients.
Outdoor access has been shown to improve meat quality, making meat firmer, than the indoor production (Farmer et al., 1997), and such effect is affected by the strain used (Owens et al., 2006). In OP, although a wide range of strains are used, only the slow-growing strains can fully benefit of organic rearing system (pasture availability, older age), whereas the fast-growing strains are characterized by a very low degree of adaptation (Reiter and Bessei, 1996).

Nevertheless, many producers still use these latter strains because chicks of a local breed or slow-growing genotypes are difficult to find and because the growing performance of these animals is poor (Network for Animal Health and Welfare in Organic Agriculture, 2002).
Genetic selection of animals for a better growth rate has progressively modified their behavior (Schütz and Jensen, 2001) reducing kinetic activity in particular, while increased energetic costs. These birds tend to stay indoor rather than forage in the pasture (Weeks et al., 1994). Moreover, the weight of organic fast-growing birds is excessive determining welfare problems, like leg weakness, high culling and high mortality rates. On the contrary, slow-growing strains have an intensive foraging behavior (Bokkers and Koene, 2003; Lewis et al., 1997; Minh and Ogle, 2005) and spend a lot of time outdoor (65-78% of budget time *vs.* 35-40 % for fast-growing strains; Gordon et al., 2002 and Castellini et al., 2003). Consequently, they ingest higher amounts of grass (Castellini et al., 2003) responsible for the higher amounts of α-tocopherol and carotenoids found in their meat (Table 1) and thus, for their greater *in vivo* antioxidant capacity (Castellini et al., 2004).
Compared to the commercial broiler, organically produced poultry meat is leaner but with a shorter shelf-life (Lewis et al., 1997; Castellini et al., 2002a,b) (Castellini et al., 2006). The organic meat is characterized by a higher TBARS level (Fig. 1), which could be ascribed to a higher content of Fe ions that catalyze peroxidation, and to a greater degree of unsaturation of intramuscular lipids (O' Keefe et al., 1995, Castellini et al., 2002ab, Chartrin et al., 2005). High TBARS levels not only limit the self-life of the organic product but have a negative repercussion on sensory evaluation (§ 4), too.
The trend of meat oxidative stability during storage depends on the initial meat oxidative status and on the animal genotype. A higher kinetic activity induces a higher lipid peroxidation and this is particularly evident in meat of fast-growing strains. The better oxidative status of slow-growing genotypes meat could be due to a lower lipid level, adaptation of muscular fibers to the physical activity and due to a higher intake of compounds with antioxidant activity.
Considering the peculiar oxidative status of organic birds, different strategies should be adopted, like avoid unnecessary carcass processing, reduce storage time and provide high levels of antioxidants. If synthetic vitamins continue to be banned by organic regulation, the intake of compounds with an antioxidant activity (like tocopherols, carotenoids and polyphenols) through pasture ingestion by organic chicks shall be considered crucial for increasing animal antioxidant defence (Lopez-Bote et al., 1998).

2 Consumer expectation and attitude to consumption

The different studies on consumer perception of organic meat agree on the major reasons for a consumer to prefer organic products, namely health and environmental concerns (Bjerke, 1992). Other reasons have been revealed by more recent surveys (Grunert et al., 2004). Consumers seem to make several positive inferences from the organic product which refer also to animal welfare and taste. However, positive inferences do not necessarily lead to a purchase if a consumer does not retain that the balance between give and get components is favourable (e.g. budgetary restrain, Fig. 2).
According to Mceachern and Schröder (2002) there are at least two types of organic consumers: with a high- or low-involvement. Low-involvement consumers do not pay attention on intangible attributes (safety, health, animal welfare, biodiversity, attention to environment), while are very interested in tangible attributes (price, visual characteristic, etc). On the contrary, high-involvement consumers, who regularly purchase organic products, require more intangible quality attributes. Consumer involvement is influenced by knowledge: many respondents identify organically produced meat as the best for satisfying their livestock production concerns.
The high-involvement consumers are a solid basis for the organic market. A further growth of this market could be achieved by increasing the number of low-involved consumers and by paying more attention to the tangible attributes.

The fact that consumers associate OP not only with a good health status, animal welfare and environment concern, but also with a good taste is very positive. However, such expectations shall be confirmed after the purchase. Consumers expect that taste of organic products is better and a disconfirmation of this expectation may raise the barrier to organic demand.
This inconvenient has been observed in Europe since the last years: organic poultry production was stable, whereas the growth rate of the whole OP was 4-5% per year (Fig. 3). Other reasons explaining this negative trend are high cost of production and low concern of poultry chains, avian flue, etc. Lack of consumers ability to distinguish a conventional product from an organic one shall also be considered.

3 Appearance, eating quality and consumer perception of organic poultry meat

Due to the high variability in OP, comparison with conventionally produced food is difficult. In addition, there is a limited number of published data (Kouba, 2002) and there is no clear trend in terms of sensory quality differences between organic and conventional foods.
Capability of a sensory panel to discriminate meat of different origin is largely debated and many authors have reported not univocal results (Farmer et al., 1997). The sensory perception is affected by many factors the most important of which is assessor training. Owens et al. (2006), showed that a trained sensory panel is able to detect some texture and flavour differences among poultry products, whereas an untrained consumer panel is unable to indicate any difference in liking, appearance, texture, and flavour between organic and conventional meat. Preferences are related to what customers are familiar with and a long-term exposure to conventional broiler meat flavour may cause resistance to other flavours perception. Assessors have to understand this clearly. In addition, eating qualities are consistently being optimized (Gordon et al., 2002).
Consumer perception, “real” or “conditioned”, is relevant in the immediate and future decision of a purchase. In an experiment conducted to assess differences between expectation and quality experienced after consuming an organic pork meat (Fig. 4), quality perceived fell short of expectations including taste and tenderness (as cited by Grunert et al., 2004). The study showed clearly that organic products may be wrongly classified if certain qualitative characteristics, which currently are little familiar to consumers, are taken into account.
Appearance and eating quality (texture, flavor, and juiciness) are the main product traits assessed by consumers (Jahan et al., 2005). Texture, and tenderness in particular, are crucial consumer attributes. Organic chicken meat is generally firmer and strongly flavoured than broiler meat (Jahan et al., 2005, Grashorn and Serini, 2006). When poultry meat is purchased from a supermarket (with no indication of strain, of age and of feed), selection is based on meat appearance and texture, while only a sub-group of assessors is able to distinguish between different products on the basis of their aroma and flavour (Jahan et al., 2005).
Genetic strain seems to affect the texture, too. Slow-growing birds are expected to be less tender than the fast-growing birds because of the different age. In older birds, a great part of collagen is cross-linked reducing meat tenderness. Several authors showed that the age-related changes in meat tenderness are related to strain (Horsted et al., 2005). Commercial strains meat tend to be tougher and less tender with age, whereas the opposite has been observed for the meat deriving from slower growing breeds (+4.1%; Castellini et al. 2006; +8.1% Grashorn, 2006 and +26.3% Owens et al., 2006). The higher degree of maturity of fast-growing birds and their larger muscle mass, both leading to a reduced protein catabolism, may be the main reasons for this trend (Dransfield and Sosnicki, 1993). Given the reduced proteolytic potential, a less post-mortem proteolysis, and therefore, a reduced tenderization of the meat is expected.
TBARS values are found to be negatively correlated with the sensory evaluation results: panellists seem to prefer the organic meat stored for a maximum of 2-3 days. After 4 days of storage, meat liking of fast-growing strains is greatly reduced (Fig. 5).

4 How organic poultry meat can fulfil these expectations

For appropriate organic poultry production it would be wise not to adopt productive protocols tailored for intensive systems (diets, environments and genetic strains).
As demonstrated, use of slow-growing strains in OP can remarkably affect eating quality of poultry meat. Unfortunately, organic farmers are not obligated to adopt this strategy in their production as there is no official restriction. Hence, changes in Regulation 1804/99 should be done to improve product qualitative aspects and animal welfare. Such changes are also required by consumers, who is getting more and more interested not only to the production process (environment) but also to the organic product characteristics (eating quality).
The importance of the use of slow-growing breeds in OP could be better understand considering that it is possible to produce meat with unique qualitative characteristics by using feed not necessary of high quality.

Table 1 Meat antioxidant composition and in vivo antioxidant capacity and serum alpha-tocopherol level of organically reared slow- and fast-growing strains (from Castellini et al., 2003, mod.).

Strain		Slow-growing	Fast-growing	Significance
carotenoids	mg kg^{-1}	21.2	19.1	*
α-tocopherol	mg kg^{-1}	38.5	36.2	*
Antioxidant capacity	μmol HClO mL^{-1}	715	522	*
serum α-tocopherol	mg L^{-1}	19.0	17.2	*

*: P ≤ 0.05 ; n.s. not significant

Figure 1. Changes in TBARS level (expressed as mg of malondialdehyde, MDA, per kg of muscle) in chicken breast muscles during display (from Castellini et al., 2002b, 2006 mod.).

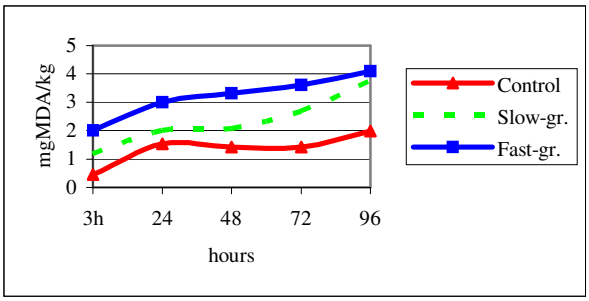


Fig. 2. Hierarchical value for perception of organic/conventional pork by consumers (mod. Grunert et al. 2002).

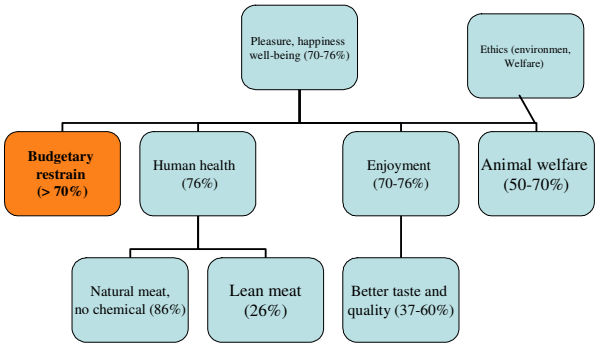


Figure 3 - Trend of organic poultry meat production (estimated from Eurostat)

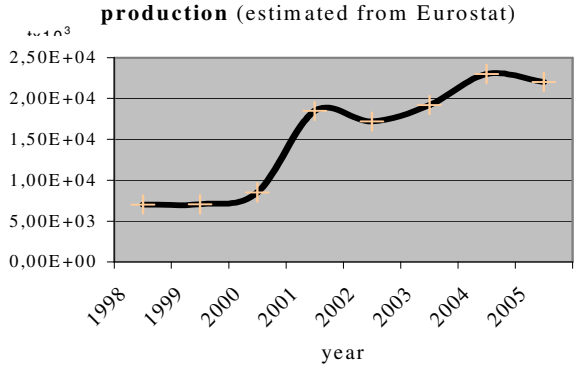


Fig. 4 - Differences between expected and experienced quality (from Grunert & Anderson, 2000 mod.)

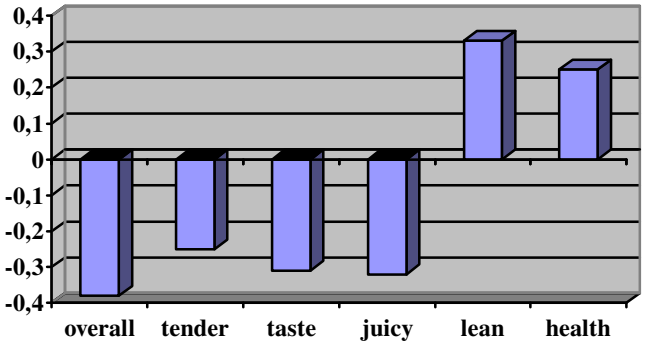
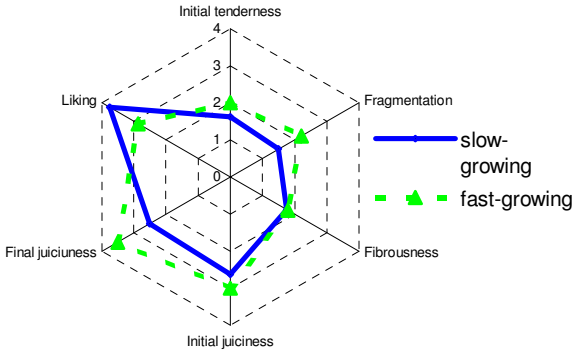
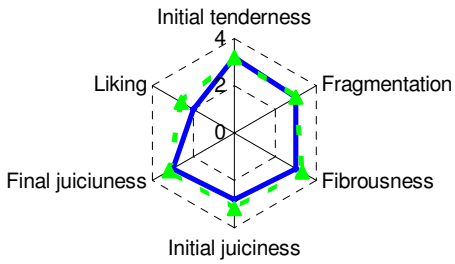


Figure 5. Overall liking and TBARS value of conventional or organic breast muscle after 0h or 96h storage at 4 °C (from Castellini et al., 2006 mod.).





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