Animal Health Prod and Hyg (2023) 12 (1) : 52 - 58

Animal Health, Production and Hygiene

www.dergipark.or.tr/tr/pub/aduveterinary

Review

Investigation of Organic Chicken Breeding and Meat Quality

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A B S T R A C T

In recent years, with the increase in income in our country, it has been seen that most consumers are awareness of healthy eating and are interested in organic food. The emergence of various diseases, such as cancer and obesity, play a significant role in this preference. In addition, with the prolongation of life expectancy, the desire to increase the quality of life is very important. Due to the harm caused by the foods obtained by conventional methods to human health and the environment, consumers' demand for healthy and quality food has led to a market segment consisting of organic products. The availability of many conventional foods with unsafe additives, preservatives, sweeteners, and colorants can be seen as another factor in the increasing importance of natural, safe, and healthy foods. This review study it is aimed to correct some existing misperceptions by giving detailed information about organic chicken breeding and meat quality.

Keywords*: Organic chicken, conventional chicken, chicken meat quality, fatty acid composition.*

Organik Tavuk Yetiştiriciliği ve Et Kalitesinin İncelenmesi

Ö Z E T

Ülkemizde son yıllarda gelir artışı ile birlikte tüketicilerin çoğunun sağlıklı beslenme bilincine sahip olduğu ve organik gıdaya ilgi duyduğu görülmektedir. Bu tercihte kanser ve obezite gibi çeşitli hastalıkların ortaya çıkması büyük rol oynamaktadır. Ayrıca yaşam süresinin uzamasıyla birlikte yaşam kalitesini artırma isteği de büyük önem taşımaktadır. Konvansiyonel yöntemlerle elde edilen gıdaların insan sağlığına ve çevreye verdiği zararlar nedeniyle tüketicilerin sağlıklı ve kaliteli gıdaya olan talebi organik ürünlerden oluşan bir pazar segmentinin ortaya çıkmasına neden olmuştur. Güvenli olmayan katkı maddeleri, koruyucular, tatlandırıcılar ve renklendiriciler ile piyasada pek çok geleneksel gıdanın bulunması, doğal, güvenli ve sağlıklı gıdalara verilen önemin artmasında bir başka faktör olarak görülebilir. Bu derleme çalışmasında, organik tavuk yetiştiriciliği ve et kalitesi hakkında detaylı bilgi verilerek, var olan bazı yanlış algıların düzeltilmesi amaçlanmaktadır.

Anahtar kelimeler: *Organik tavuk, konvansiyonel tavuk, tavuk eti kalitesi, yağ asidi kompozisyonu.*

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Received Date: 10.03.2023 – Accepted Date: 27.04.2023
DOI: 10.53913/aduveterinary.1263469

Introduction

Organic poultry is defined as a production model in which animals are allowed to exhibit their natural behavior. It has been determined that organic agriculture and food product markets are concentrated in big cities such as Istanbul, Ankara, and Izmir. In contrast, purchasing organic agriculture and food products is not common because consumers throughout Turkey do not have enough information about organic production and find the price expensive (Eryılmaz et al., 2015).

It has been determined that the studies on this subject need to be revised. This review study it is aimed to eliminate the misinformation about organic chicken by giving information about organic chicken breeding and meat quality.

Conventional Livestock

Conventional livestock farming is known as a production method in which a large number of animals are compressed into a small number of large enterprises. Studies show that conventional production has harmed many environmental, biological and socio-economic structures, especially human and animal health, leading to the extinction of small-scale agriculture and animal husbandry (Hanoğlu, 2013).

Today, conventional animal husbandry is a production method aiming for the highest yield with more animals and inputs (Çukur and Saner, 2005). Intensive breeding methods and tight housing systems applied to animals cause important health problems by weakening the immune systems of animals (Öztürk and Türkoğlu, 2012). One of the main drawbacks of industrial animal husbandry is using genetically modified (GMO) corn and soybean products as feed because they are cheaper. Studies in the literature reveal GMO DNA fragments in the meat of animals fed with GMO feeds. In a study, GMO DNA was detected in the tissues of animals fed GMO corn (Hanoğlu, 2013).

Especially in European countries, the increase in diseases caused by animal feeding causes consumers to turn to alternative products (Hanoğlu, 2013). Today, the European Union countries are starting to abolish chicken farming in traditional cage systems, taking into account animal rights, technological developments, and the improvement of the economic structure have also caused a change in consumption habits (Türker et al., 2017).

Organic Livestock

Agricultural enterprises have a complementary relationship between plant and animal production. Fertilizer for livestock, crop production; vegetative production also provides fodder for livestock with both the production of fodder crops and by-products and residues. However, later on, this relationship was brought to a breaking point (Hanoğlu, 2013).

Organic livestock can be defined as a production system where the number of animals is low, at appropriate feeding and shelter conditions, with the appropriate production and marketing methods to obtain high quality products and reach a high price. In the Regulation on the Principles and Implementation of Organic Agriculture, organic animal production: “Producing animals using breeding animals or semen, producing human food and animal and plant nutrition products from animal products, supplying organic raw materials to industries and scientific studies that obtain their raw materials from agriculture, every stage of which is authorized according to this Regulation. It is defined as “production activities controlled and certified by the organization” (Çukur and Saner, 2005; Anonymous, 2010).

The main differences distinguishing organic livestock from conventional livestock; are animal welfare, a natural environment, healthy products, and sustainable resources (Çukur and Saner, 2005). Considering these differences, organic livestock farming has come to occupy an important place as an alternative livestock production model, especially in the United States and the European Union (Çiçek and Tandoğan, 2009).

The countries with a say in organic animal production are listed as the USA, Canada, Austria, Denmark, Germany, England, France, and Argentina. Among them, the most important countries in organic livestock farming are the USA and Canada. In these countries, the trend towards organic meat was realized after some hormones in meat were examined under laboratory conditions and it was determined that these hormones increased the risk of some types of cancer. Thus, organic meat, milk, yoghurt, cheese, and eggs began to take their place in the market (Yunus, 2003; Çiçek and Tandoğan, 2009; Öztürk and Türkoğlu, 2012; Hanoğlu, 2013; Yenilmez and Uruk, 2014).

There is a general perception that chicken meat obtained through organic production methods is more delicious. This perception is also confirmed by the results of many studies. The studies stated that the meat obtained with organic production is superior in terms of crispness, texture, and juiciness while being darker in color and having a low cooking loss. The difference in chicken meat flavor is mainly due to genotype, age, feeding, and rearing style (Ceylan, 2014).

Basic Rules for Organic Poultry

According to the Regulation on the Principles and Implementation of Organic Agriculture (2010).

There are some rules regarding organic animal production. These rules cover the following basic elements such as genotype, nutrition, reproduction and shelter (Anonymous, 2010):

•In organic livestock breeding for breeding or production, breeds with high adaptability to environmental conditions and resistance to diseases are selected. For this reason, priority is given to native breeds and hybrids adapted to that region.

• Animals brought from organic farms and fed completely organic feeds, whose genetic structure has not changed.

• Natural methods are used in reproduction in organic

animal breeding.

• Animals must have access to pastures, outdoor promenades, or open spaces. The number of animals per unit area in pastures and open areas should be limited to provide sufficient animal manure for the crop production in the production unit.

Conventionally bred animals may be found in the same holding, provided that the barns and land on which they are reared are clearly separate from the organically bred units and that separate species are present.

• If organic animal products cannot be distinguished from conventional products, these products cannot be considered organic.

• The transition period in animal production is 10 weeks for meat production poultry, provided that they are not older than 3 days. Some breeders or breeds used in intensive production, which do not have special diseases or health problems, are used as breeders.

• If the number of organically raised animals insufficient in a flock created for the first time, conventionally raised broiler chickens can be used in organic livestock farming, provided that they are not older than 3 days of age when they leave the farm they came from.

• Organic animal breeding and animal production enterprises keep regular records regarding the entry and exit of animals and all treatment practices.

Animal Health and Veterinary Intervention in Organic Animal Breeding

According to the Regulation on the Principles and Implementation of Organic Agriculture (2010), it is important to take preventive measures rather than treatment in organic animal breeding. The necessary measures for the protection of animals against diseases are as follows:

• Disease-resistant, suitable breeding breeds are selected.

• Walking for regular exercise that boosts the natural immunity of animals access to fields or pastures and the use of quality feed are provided.

• To prevent health problems in animals due to overcrowding Appropriate placement frequency is provided.

The most appropriate vaccines or drugs should be used to minimize or prevent the risk of transmission of pathogens to animals (Ak, 2002).

Feed Supply and Animal Nutrition in Organic Animal Production

Vegetable-based feeds for animal nutrition should preferably be produced in the enterprise. Chemical pesticides and fertilizers should not be thrown on pastures. Animal fat and animal by-products cannot be added to the rations. Regulation rules should be followed in the use of vitamins and minerals (Ak, 2002).

Shelter

Another important point of organic animal husbandry is to provide good shelter conditions. All hygienic measures should be taken to establish and maintain shelters in ecological livestock farming. The shelter should receive adequate fresh air and daylight and should give freedom of movement to all species and races (Ak, 2002).

According to the Regulation on Implementation (2010), necessary shelter areas for poultry are given.

Table 1. Necessary shelter area for poultry

Shelter type	Internal area (Net area reserved for animals) Number of animals/m^2	Promenade (Rotatable area m^2/head)
Fattened poultry house animals (in fixed shelters)	10 up to 21 kg live weight/m^2	4
Fattened poultry (in portable barns)	16[(1)] up to 30 kg live weight/m^2 mobile poultry houses	2.5

[(1)]Only in the case of portable shelters not exceeding 150 m^2 of floor area

Transport

According to the Regulation on the Principles and Implementation of Organic Agriculture (2010), there are rules that must be followed especially for animal welfare in organic animal transportation. These rules:

• Animals are transported stress-free

• Loading and unloading operations are carried out carefully and without the use of an electrical stimulant device to force the animals. It is forbidden to use sedatives before and during transportation.

• In land transportation, a break is made every 8 hours for feeding, watering, and resting.

Slaughter

Appropriate measures should be taken so as not to create stress during slaughter. Slaughter should be done separately from the slaughterhouse of conventional animals, separate slaughterhouses should be used and synthetic additives cannot be used to protect products after slaughter (Ak, 2002).

Table 2. Organic broiler breeding and meat production in Türkiye (Ministry of Agriculture and Forestry, 2021)

Years	Total number of farmers	Number of chickens (pieces)	Meat production (tonnes)
2007	2	1.400	-
2008	1	500	1
2009	1	69.150	34.5
2010	2	273.910	550
2011	5	325.436	713.06
2012	5	102.082	210.31
2013	18	716.024	1030.06
2014	17	834.167	1823
2015	23	589.804	2130
2016	26	608.862	1485.9
2017	12	604.900	1266
2018	26	606.790	134.128
2019	6	94.583	45
2020	20	469.345	49.78

Organic chicken farming in Türkiye

Organic chicken farming showed an increasing trend. According to the 2021 data from the Ministry of Agriculture and Forestery (2021), there are 20 organic chicken breeding farmers in Turkey. Table 2 shows the number of farmers, the number of organic chickens, and the amount of organic chicken meat obtained between 2007 and 2020.

Türkiye also has an important place in organic chicken production. Organic poultry has developed in some of our provinces. Accordingly, a significant increase has been achieved in the production of organic chicken and chicken products. This shows that the demand for organic chicken products is also increasing (Aykutoğlu and Cakir, 2021).

According to 2020 data from the Ministry of Food, Agriculture and Livestock, organic chicken production was carried out by 20 producers in Turkey, and a total of 469.345 organic chickens and 49.78 tons of organic chicken meat were produced.

Table 3 shows the number of farmers in various provinces in 2021, the number of organic chickens grown and the amount of organic chicken meat. According to this table, a producer is in first place in Izmir, producing 171.559 organic chickens. This is followed by a producer in Sakarya with 132.500 organic chickens. A producer in Istanbul, which is the last place, raised 350 chickens in 2021 (Ministry of Agriculture and Forestry, 2021).

As a result of the study conducted by Husak (2007), it was determined that organic chicken meat is superior to conventional chicken meat in terms of protein amount, omega-3 and omega-6 fatty acids, mineral substance content and crispness, and also has a lower fat level. As a result of the sensory evaluations, it was stated that the chewiness of organic chicken meat was higher.

Średnicka-Tober et al. (2016) examined the fatty acid profile of organic and conventional chicken meats. It has been reported that saturated fatty acids and monounsaturated fatty acids are lower and omega-3 fatty acids and polyunsaturated fatty acids are higher in organic chicken meat.

Meluzzi et al. (2009) investigated the effects of different genotypes (slow, medium, and fast-growing) and feeding methods on the chemical composition of organic chicken meat. As a result of this study, the highest levels of polyunsaturated fatty acids, omega-3, and omega-6 fatty acids were detected in slow-growing organic chicken meat. Monounsaturated fatty acids were found to be lowest in slow-growing organic chicken meat. In addition, it has been determined that the amount of fat in slow-growing chicken meat is lower than in medium and fast-growing chicken meat.

Castellini (2005) and Castellini et al. (2002) investigated the effects of organic production systems on chicken meat. As a result of the studies, it has been stated that the water-holding capacity, pH, and fat content of organic chicken meat are lower than conventional chicken meat. At the same time, cooking loss and omega-3 fatty acids are higher. It has also been observed that organic breast meat's sensory quality is better than conventional breast meat's.

As a result of the study conducted by Grashorn and Serini (2006), it was reported that organic chicken meat and skin are more yellow in color than conventional chicken meat, cooking losses are lower, and texture values are higher. It has been concluded that the dry matter content, ash and protein amounts, omega-3 fatty acids of organic chicken meat are higher than conventional chicken meat. As a result of the sensory evaluation, it was stated that the panelists found organic chicken meat to be tougher and tastier than conventional chicken meat.

Table 3. Organic poultry breeding (Ministry of Agriculture and Forestry, 2021).

Provinces	Number of farmers	Number of poultry (pieces)
ADANA	1	13.300
BALIKESİR	1	12.000
BOLU	3	42.000
BURDUR	1	1.800
BURSA	1	2.617
ELAZIĞ	4	55.284
İSTANBUL	1	350
İZMİR	8	171.559
KIRKLARELİ	6	49.790
KOCAELİ	2	4.652
MANİSA	4	55.472
MERSİN	1	4.000
ORDU	35	109.000
SAKARYA	4	132.500
SAMSUN	1	83.838
TRABZON	2	1.500
UŞAK	9	48.590

Castromán et al. (2013) in a study conducted in Uruguay, observed that higher levels of polyunsaturated fatty acids were detected in conventional chicken meat. In addition, it was stated that the omega-3 and omega-6 fatty acids of conventional chicken meat had statistically higher values. Contrary to other studies, they reported that monounsaturated fatty acids were higher in organic chicken meat. Researchers emphasized that these differences are not due to the carcass region taken from the chicken, but to the production method.

Saleh et al. (2015) investigated the quality of organic chicken meat. As a result of the study, they reported that the amount of fat in organic chicken meat is lower and the cooking loss is higher compared to conventional chicken meat.

Sirri et al. (2010) investigated the effects of different genotypes (slow, medium, and fast- growing) on the fatty acid profile of organic chicken meat. As a result of the study, it was reported that slow and medium-growing chickens had lower fat contents than fast-growing chickens. It was observed that the breast meat of slow-growing chickens contained a statistically higher amount of protein than medium and fast-growing chickens. The highest amounts of arachidonic acid, eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA) or docosapentaenoic acid (DPA) were detected in the meat of slow-growing chickens. On the other hand, a-linolenic acid was found in the lowest amount in the meat of slow-growing chickens. The total amount of polyunsaturated fatty acids is statistically different in each, with the highest in slow- growing chickens (413 g/kg fat), followed by medium fast-growing chickens (358 g/kg fat), and the lowest in fast- growing chickens (324 g/kg fat).

Total omega-3 fatty acid values are highest in slow-growing chickens (77.1 g/kg fat), followed by medium fast-growing chicken (54.6 g/kg fat) and lowest in fast-growing chicken (43.5 g/kg fat) was detected. Total omega-6 fatty acid values were highest in slow- growing chicken (336 g/kg fat), followed by medium fast-growing chicken (301 g/kg fat) and lowest in fast- growing chicken meat.

Napolitano et al. (2013), the sensory properties of fast-growing conventional chicken meats (CC), fast-growing organic chicken meats (OFG), and slow-growing organic chicken meats (OSG) were investigated. In the study, the chicken breast meat was used for sensory evaluation. As a result of sensory evaluation, CC was more brittle than OFG, and OSG was more fibrous than both OFG and OSG, OFG and OSG had a stronger aftertaste. In contrast, OSG was rated less watery than OFG and CC before swallowing and less fibrous than OFG.

Fanatico et al. (2007) investigated how fast and slow-growing chickens affect meat quality with and without open space access. It has been reported that the flesh and skin colors are more yellow when slow-growing chickens have open field access, but the same effect is not seen when fast-growing chickens have open field access. It was stated that breast meat obtained from slow-growing chickens contained more protein and a-tocopherol and half the amount of fat detected in fast-growing chicken meat. In addition, it was reported that chickens with open field access had more protein in

their meat. It has been concluded that the meat of slow-growing chickens has a lower water holding capacity and is more crispy than fast-growing chicken meat.

Capan and Bagdatli (2021) investigated the physicochemical, microbiological, and sensorial properties of organic and conventional retail chicken meat. The organic chicken breasts had a higher fat content than conventional chicken breasts. The protein content of organic thighs was higher than that of conventional thighs. Organic chicken meat contains more mineral substances than conventional chicken meat and has a higher pH value, cooking loss, and water holding capacity. Alpha-linoleic and docosahexaenoic acids were found to be higher in organic chicken meat. *Salmonella* spp. was detected in all conventional chicken and 66.66% of organic chicken.

Conclusion

As a result, omega-3 and omega-6 fatty acids are found in higher amounts in organic chicken meat compared to conventional chicken meat. Eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which are omega-3 fatty acids, are known to have positive effects on health. These fatty acids lead to important biochemical and physiological changes in the body. Omega-3 fatty acids are recommended for their beneficial effects in preventing and treating diseases such as heart disease, cancer, diabetes, and high blood pressure that affect human health. As a result of research other than fatty acids, it has been determined that organic chicken meat contains higher protein and lower fat than conventional chicken meat. As a result of the studies, it is seen that organic chicken meat is superior to conventional chicken meat not only in terms of fatty acid composition and protein content but also in many quality characteristics. Today, it is seen that consumers are turning to foods rich in low-fat, high-protein, and unsaturated fatty acids in their diets. For this reason, it is thought that the demand for organic chicken meat is increasing day by day.

Acknowledgements

The authors thank the reviewers for their valuable comments and suggestions, which increased the clarity and scope of the article.

Conflict of Interest

The authors declare that they have no conflict of interest in this study.

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