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Abstract

Poultry meat and eggs are a significant source of nutrients in the human diet. Poultry products are widely consumed because they are nutritionally valuable, there are no religious restrictions on consumption, it is relatively easy to prepare diverse meals based on poultry, and the price of such products is relatively low. The aim of this research was to investigate the development of poultry production in the Republic of Croatia in the period 2010-2014, comprising the period of two years after Croatia joined the EU. The paper also compares data of poultry production in Croatia and in the EU. Over the period in question, total meat production in Croatia was reduced by 23%, meat import was increased by 45%, poultry meat export was increased by 46%, and production of eggs decreased by 20%. At the same time, in the EU countries poultry production was increased by 8.8% on average, export was increased by 10%, and import was reduced by 3.7%, while the egg production stagnated. In 2014, consumption of poultry meat in Croatia was 18.3 kg per capita, and in the EU 26.8 kg per capita. Self-sufficiency in the poultry production over the analyzed period was not satisfactory, therefore in the coming years, Croatia will have to develop quickly this important branch of livestock breeding. In addition to conventional production, faster development refers to production of organic and functional poultry products.

Keywords: Poultry meat production, egg production, consumption, Croatia, EU

1. Introduction

In Croatia, as well as in the European Union, poultry breeding is constantly gaining in importance. Poultry meat is consumed throughout the world because of its high nutritional value, suitability for quick preparation and relatively low prices. Referring to poultry meat consumption, chicken is mostly consumed, followed by turkey. Chemical composition and nutritive value depend on the carcass part. Parts with the highest quality are breasts and drumsticks with thighs. In broil-

ers, fat is found under the skin, so the nutritional quality of meat is different if analyzed with skin or without it. A 100g of chicken with skin contains 243Kcal, while the same amount of turkey contains 145Kcal. Cholesterol content ranges from 43.4 to 95.3mg/100g of chicken meat (Janječić, 2005). Chicken breasts without skin contain 24.15% protein, 0.62% fat, 74.01% water and 1.22% ash. In 100g of white meat, there are 359.22mg of potassium, 61.95mg of sodium, 1.09mg of zinc, 0.08mg of manganese and 1.79mg of iron (Kralik et al., 2001). Lipids in poultry meat, compared to lipids in other farm animals' meat, are richer in essential fat acids (linoleic, α-linolenic and arachidonic), and they make up 22% of the total fat. However, in cattle meat these fat acids make up 2-4% and in the pork up to 9%. Because of the desirable nutritional composition and reasonable price, eggs are used almost daily in the human diet. Biological value of egg protein is 100 and because of that it is fully digested and absorbed by an organism (Mandić, 2007). In 100g of the edible part of fresh eggs there is 76.15g of water, 12.56g of protein, 9.51g of fat, 149Kcal and 372mg of cholesterol (USDA 2014)[1]. All of the stated facts influence yearly increase in the consumption of poultry meat and eggs in Croatia.

The aim of this study was to investigate the development of poultry production in Croatia during the period 2010-2014 (from the moment when Croatia joined the EU) and to compare it with the poultry production in the EU.

2. Material and methods

The data presented in this paper are obtained by the Statistical Yearbook of the Republic of Croatia, 2013, 2015 as well as by BPEX (2015)[2] and AVEC (2015)[3]. The balance of consumption and processing of products in the Republic of Croatia was calculated so that in the total production of poultry meat and eggs were counted quantities of import and deducted quantities of export (Bobetić, 2014)[4]. The paper presents linear trends of poultry slaughter and growth ($Y_{t=}\alpha+\beta x_t+e_t$), exponential trend in poultry number ($Y_{t=}\alpha+\beta_1 x_t+\beta_2 x_t^2+e_t$) and the trend of logarithmic trajectory in net weight ($Y_{t=}\alpha\beta_2^{xt2}x_t e_t$). The degree of self-sufficiency is presented as a ratio between domestic production and domestic consumption. Related research results of other authors are also included in this research. Figures shown in this research refer to production, import, export, balance and consumption of poultry and eggs.

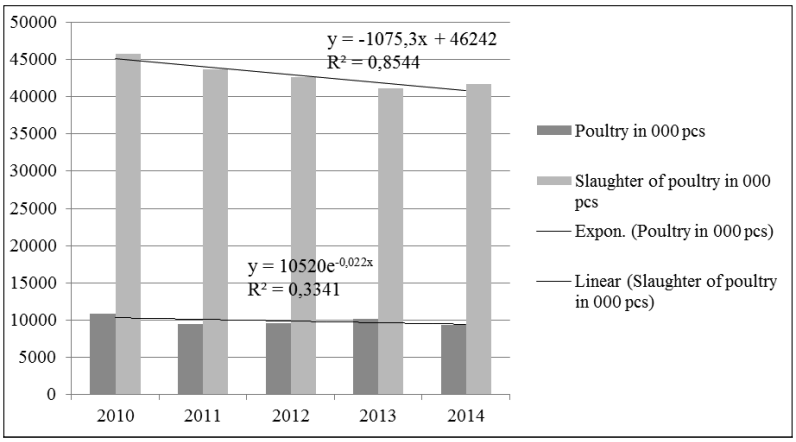
3. Research results and discussion

3.1 Poultry production in the Republic of Croatia

Poultry production in Croatia and in the EU is marked by industrial production. There are in-line hybrids used in intensive production because of their significant genetic potential. Comparative advantage of poultry breeding, in comparison to other types of domestic animals, is seen in the short production cycle and rapid capital turnover. Contemporary nutritional guidelines recommend lower intake of fat and therefore poultry meat is promoted as healthy type of food. The price of poultry meat depends on poultry type, on the production methods and processing. Domestic production of poultry meat (Table 1) does not meet the domestic demand i.e. consumption, and the estimated self-sufficiency was calculated by the method of production and consumption balance (Bobetić, 2015). The structure of poultry population in 2014 was the following: broilers 53.9%, chickens 40.7%, turkeys 3.5%, geese 0.5%, ducks 0.9% and other sorts of poultry 0.5%.

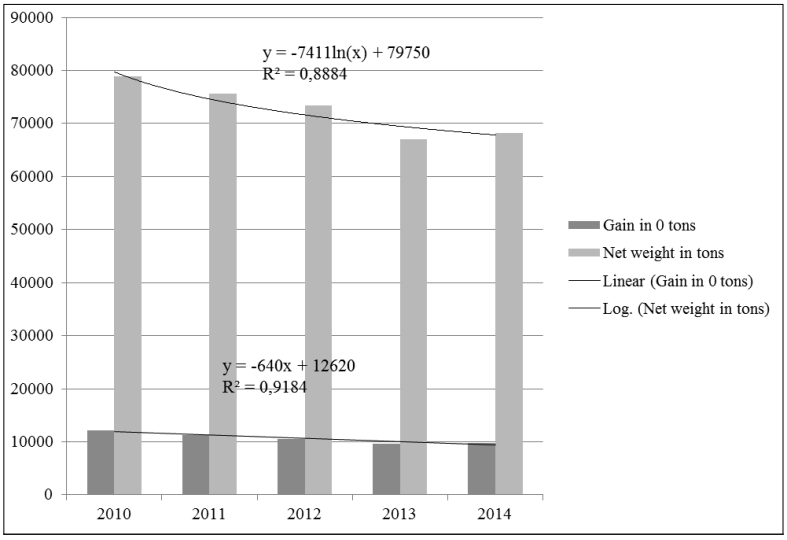
The number of poultry in the period 2010-2014 ranged from 9.47 million to 10.32 million, being on average 9.75 million. In the same period, the slaughter of poultry was on average 43.62 million and the net weight of slaughtered poultry was on average 79.98 thousand. At the same time, live weight gain was on average 103.3 thousand (Figures 1 and 2). These data show that the number of poultry was slightly increased in the analyzed period, but the number of slaughtered poultry, poultry growth, as well as the weight of slaughtered poultry decreased. Croatian membership in the EU, although still comprising a short period of time, did not have positive effect on the development and increase in poultry production, which resulted in significant import of poultry meat.

Figure 1 Total number of poultry and slaughter of poultry



Source: Statistical Yearbook of the Republic of Croatia (2013, 2015)[5]

Figure 2 Gain and net weight of slaughtered poultry



Source: Statistical Yearbook of the Republic of Croatia (2013, 2015)[6]

Number and productivity of poultry production indicate a trend of decrease over the analyzed period. Statistics refers to production of chicken and turkey meat in slaughterhouses (Table 1). Total production of chicken and turkey meat decreased from 2010 till 2014 (index of 2014/2010 was on average 0.77, for chicken meat 0.84, and for turkey meat 0.69). The balance of consumption and processing was also decreased (index 2014/2010 was 0.85). The import, but also the export of poultry meat was significantly increased (index 1.45 and 1.46, respectively). Consumption and processing of meat per capita in 2014 was 18.3kg, of which 15 kg refers to chicken meat and 3.3kg to turkey meat. Assessment of self-sufficiency of the poultry meat in 2014 was only 73%.

Table 1 Total production of poultry meat, import, export and balance of consumption and processing

Year	Production of chicken and turkey meat in slaughterhouses (t)	Total production of poultry meat (t)	Import of poultry meat (t)	Export of poultry meat (t)	Balance of consumption and processing
2010	61,780	78,936	15,163	3,754	90,345
2011	61,521	75,603	13,609	4,705	84,507
2012	61,337	73,460	16,359	5,121	84,698
2013	58,500	67,000	17,571	4,286	80,285
2014	59,214	61,065	22,029	5,482	77,612
Index 14/10	0.95	0.77	1.45	1.46	0.85
Self-sufficiency in 2014					73%
Consumption and processing of poultry meat per capita/kg in 2014					18.3

Source: Bobetić (2014)

Grgić et al. (2015) calculated the self-sufficiency of poultry meat for the period 2010-2012 to be over 90%. Based on the data for 2000-2012, the authors projected somewhat lower self-sufficiency for 2016 (81.17%). In the past four years, there is continuous growth of import and export of chicken and turkey meat. Since Croatia has lower consumption of poultry meat per capita than the EU-27, it is expected that production of all types of meat, including poultry meat, will increase in future. Bobetić (2014) predicted that poultry meat production in the EU should increase by 20-30% until 2020.

During the analyzed period 2012-2014 (Table 2, the period from which Croatia has been the EU member), the maximum capacity of hens decreased by about 30%, which was probably caused by incompatibility of Croatian laws with the EU regulations that refer to requirements for amending of laying hens' keeping conditions (increased keeping area/head), lack of investments and others. Export of live poultry for slaughter, as well as import of table eggs was significantly increased. Furthermore, import of one-day-old chickens and export of the egg products were increased.

Table 2 Indicators of poultry production in the Republic of Croatia

Indicator	2012	2014	Index 14/12
Production of one-day-old poultry (000 pcs.)	49,342	51,007	1.04
Import of one-day-old chickens (000 pcs.)	1,485	3,192	2.15
Export of one-day-old chickens (000 pcs.)	4,922	6,200	1.25
Export of live poultry for slaughter (t)	506	3,537	6.99
Import of meat products (t)	5,869	8,880	1.51
Export of meat products (t)	4,922	6,200	1.25
Import of table eggs (t)	846	2,830	3.34
Export of table eggs (t)	649	510	0.78
Import of egg products (t)	285	270	0.95
Export of egg products (t)	84	106	1.26
Maximum capacity of laying hens (000 pcs.)	2,566	1,698	0.66

Source: Bobetić (2015)

Production of hatching and table eggs is overviewed in Table 3. In the period 2010-2014, production of hatching eggs was decreased by 27.6%, import of hatching eggs of heavy lines was increased by 63.8%, and the export of hatching eggs was reduced by 76.2%. The balance in the stated period was on average 62.01 thousand pieces of eggs. When referring to the period 2013-2014, i.e. the time when Croatia joined the EU, it is visible that production and export of hatching eggs was lowered, however, the imports of hatching eggs increased. The production of table eggs over the period 2010-2014 decreased by 133.786 thousand pieces or by 19%. Upon entering the EU, this situation in Croatia slightly improved (Bobetić, 2015), influencing significant import of products (Table 2) in 2014.

Table 3 Production, import and export of hatching and table eggs in 2010-2014

Year	Production of hatching eggs (000 pcs.)	Import of hatching eggs HL* (pcs.)	Export of hatching eggs (pcs.)	Balance of hatching eggs (pcs.)	Production of table eggs (000 pcs.)
2010	56,640	13.500,000	7.506,000	62.634,000	704,119
2011	45,600	17.572,000	3.724,569	59.447,431	691,791
2012	45,780	23.000,000	781,200	64.000,000	584,982
2013	43,000	22.371,186	980,280	63.000,000	590,000
2014	41,000	22.109,901	1.785,563	61.000,000	570,333
Index 14/10	0.72	1.63	0.23	0.97	0.80

H* heavy lines

Source: Bobetić (2015)

3.2 Poultry production in the EU

Countries in the European Union have set certain standards in poultry breeding. However, there are technologies and consumer preferences that affect the consumption of poultry meat in each country. National market structure points out mainly conventional breeding of poultry (more than 90% of the market), with the exception of France, where about 25% of the market refers to poultry produced outdoors. According to EU Regulation No. 1169/2011, since 1 January 2015, it is necessary to inform consumers about the origin of food (Labelling of food). It is anticipated that in the next decade, consumption of poultry meat will increase rapidly, because of its image of healthy food and its reasonable price. It is estimated that there will be 2% of annual increase in consumption of poultry meat (1.6% increase in consumption of all types of meat). It is expected that by 2024 consumers will prefer poultry meat more than pork or beef. The projection indicates that in the next 10 years poultry meat will take up 32% of the EU meat market (AVEC, 2015). According to the same source, production of poultry meat in Croatia in 2010 was 30 thousand tons (carcass weight), and in 2014 it increased to 35 thousand tons. In 2014, the largest producer of poultry meat in the EU was Poland (2560 thousand tons), followed by France (1835 thousand tons), Germany (1785 thousand tons) and other countries. In the period 2010-2014, all EU countries except Portugal increased production of poultry meat.

When analyzing indicators in the Table 4, the EU countries increased poultry meat production (8.8%), as well as export (10%), but they decreased import (3.7%) and increased the consumption (for 1.5 kg/capita). At the same time, self-sufficiency of poultry meat was stagnant or increased (for 0.9%). Germany is the largest importing country of poultry meat in the EU, with 566t of carcasses. It is followed by the Netherlands with 413t of carcasses, and the lowest import was reported by Malta, 5 tons of carcasses. AVEC (2015) was not calculated for Croatia. The largest country that exports poultry meat in the EU is the Netherlands, with 1129t of carcasses, followed by Poland with 709t of carcasses. In the total production of poultry meat at the EU level in 2014, 30% refers to broiler meat. Over the period 2010-2014, production of turkey meat was increased by 1.75%, and the production of broiler meat was increased by 10.9%. Consumption of turkey meat increased from 3.6 to 3.9kg per capita.

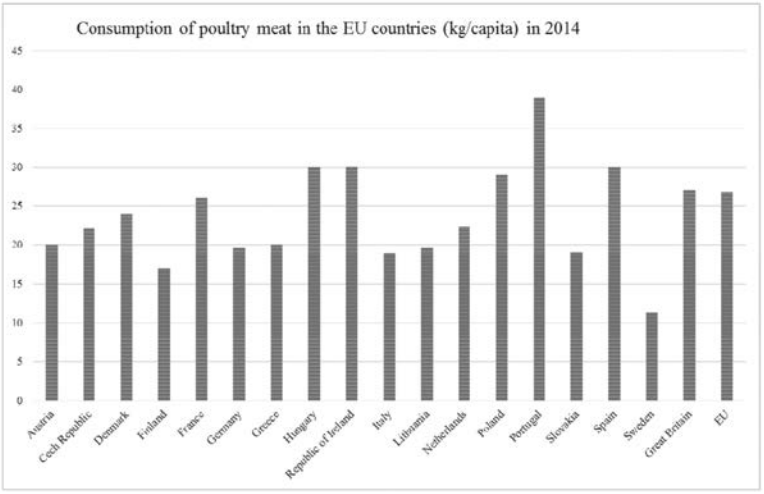
Table 4 Balance of production, import and export and consumption of poultry meat in the EU (000 t of carcass)

Indicator	2010	2011	2012	2013	2014*
Production	12,953	13,215	13,484	13,731	14,001
Export	1,149	1,204	1,234	1,223	1,265
Import	782	796	795	750	753
Consumption	12,578	12,797	13,034	13,245	13,566
Consumption per capita, kg	25.3	25.7	26.1	26.3	26.8
Self-sufficiency, %	103.0	103.3	103.4	103.7	103.9

** estimate*
Source: EU Commission, BPEX, AHDB, Poultry Pocketbook (2015)

The Figure 3 presents consumption of poultry meat per capita in 2014 in the EU. The highest self-sufficiency of poultry meat in 2014 was recorded by the Netherlands (230), then in Poland and Hungary (145), and the lowest in Austria (70). In 2014, the most poultry meat was consumed in Portugal (39 kg/capita), then in Spain (31 kg/capita), and in Greece and Ireland (30.5 and 30.4 kg/capita, respectively). The lowest amount of poultry meat was consumed in Sweden and in Finland (11.3 and 18.1 kg/capita, respectively).

Figure 3 Consumption of poultry meat in the EU countries (kg/capita) in 2014



Source: EU Commission, AVEC (2015)

Magdelaine et al. (2008) pointed out the differences in consumption of broiler meat between some countries. In the Great Britain, processed products are mostly sold (58%), followed by cut parts (31%) and whole carcasses (11%). In Germany, broiler meat is mostly sold in processed form (36%), then in parts (50%) and as carcasses only 5%. In Spain, processed products of poultry are the least sold (only 5%), and the best sold are whole carcasses (60%). In some countries, fresh poultry meat is most preferred, while in some other countries, poultry meat is best sold in frozen form.

In the EU in 2013, the largest producer of table eggs was France (836 thousand tons), followed by Germany (832 thousand tons) and Italy (765 thousand tons). As for the production of table eggs, Croatia takes up the 22nd place (35 thousand tons).

When considering the indicators in the Table 5, production of eggs in the EU stagnated during the

2010-2013 period (around 7.3 thousand tons), the import decreased by 36%, the export was increased by 26%, and the self-sufficiency was maintained at 103. Consumption of eggs in the same period, as shown in thousand tons, indicated an increase. Considering the number of inhabitants, consumption of eggs in the EU was 200 pcs. per capita. Figure 4 shows the consumption of eggs per capita in the EU countries.

Table 5 Balance of egg production, import, export and self-sufficiency in the EU

Indicator	2010	2011	2012	2013	2014*
Production of eggs, 000 t	7297	7303	7265	7333	7434
Import, 000 t	33	20	37	21	13
Export, 000 t	182	217	186	215	229
Hatching eggs, 000 t	880	874	987	812	870
Consumption, 000 t	6268	6231	6129	6327	6348
Self-sufficiency (%)	102	103	102	103	103

** Estimated*
Source: EU Commission, BPEX (2015): Poultry Pocketbook

There are researches performed (Kralik et al., 2015) to determine reasons that influence the purchase or its absence of functional products in different countries. The majority of consumers stated that the purchase of functional food is motivated by their health concerns, good taste, acceptable price and extended expiry date (Tables 6 and 7).

Table 6 Consumers' reasons that influence the purchase of functional food in some European countries

Country	Reasons	Reference
Croatia	Better quality of functional products, such food has positive effect on health, preference towards purchase of organic food, its good taste.	Markovina et al. (2011)
Denmark	Convenient dietary intake of nutritive ingredients that have a positive effect on health, perception of the organic food.	Poulsen (1999)
Finland	Positive effect on health, enthusiasm about new technologies in the food production.	Urala and Lähteenmäki (2007) Simojoki et al. (2005)
Italy	Positive effect on health, enjoy eating that type of food.	Annunziata and Vecchio (2011) Annunziata and Pascale (2019)
Greece	Positive effect on health, good taste, practical packaging, prices equal to those of other similar products, recognition of brands	Krystallis et al. (2008)
Montenegro	Positive effect on health, wish to provide quality food for children.	Stojanović et al. (2013)

Source: Kralik et al. (2015)

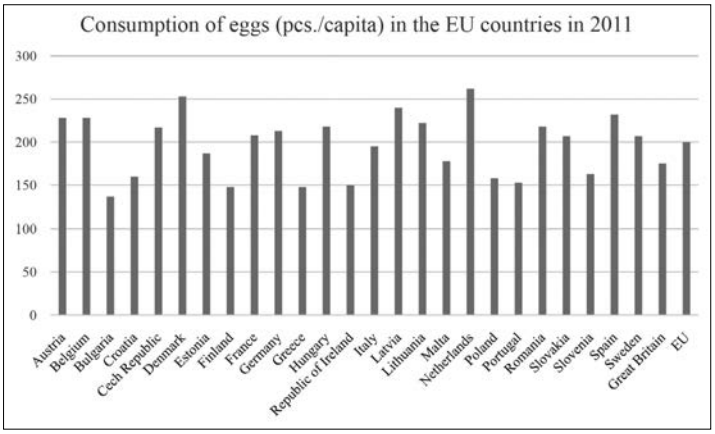
The researches of Childs and Poryzees (1997) confirmed that older people showed less interest in purchase of functional products if compared to younger consumers. Stojanović et al. (2013) stated that the level of education, household standard, availability and awareness of health benefits for different functional products affected the consumers in their choice and purchase of functional products. The lack of purchase of functional food products (Table 7, Kralik et al., 2015) is often explained by two reasons: price is too high if compared to conventional products, and there is suspicion about positive effects on human health.

Table 7 Reasons that affect consumers not to buy functional food in some European countries

Country	Reasons	Reference
Croatia	These products are a big fraud, they do not have positive effects on health, it is only a fashion to eat this type of food that does not have particular effects, the prices are too high, and consumers are not well informed.	Markovina et al. (2011) Kralik et al. (2014)
Denmark	Unacceptable price, poor marketing of products, poor awareness about the advantages of this type of food.	Poulsen (1999)
Finland	Supplements that have positive effect on health are not part of some savoury food, consumption of functional food is not necessary, these products are a big fraud, increase in number of these products is a bad trend for the future.	Simojoki et al. (2005)
Italy	Consumers are not always willing to give up their favourite food in order to improve their health, healthy people do not require special food, the concern that this type of food contains some unnatural substances, consumers do not believe in positive effects of that food, price is too high, number of those products in stores is limited, lack of information about the advantages of that type of food.	Annunziata and Vecchio (2011) Annunziata and Pascale (2019)
Greece	Lack of information about the advantages of functional food, price is too high, doubts about the declaration.	Krystallis et al. (2008)
Montenegro	Weak promotion and insufficient information about advantages of functional products, high price, availability.	Stojanović et al. (2013)

Source: Kralik et al. (2005)

Figure 4 Consumption of eggs (pcs./capita) in the EU countries in 2011



Source: Global Poultry Trends (2014)[7]

According to the projection of IEC (International Egg Commission), in France, there were 122 eggs consumed per capita in 2011, of which 35 pieces were consumed in shell, and 87 pieces (39%) were consumed in egg products. In Italy, there were 206-210 eggs consumed per capita, of which 35% was consumed as products. In the Netherlands, consumption of eggs was 185-188 pieces per capita, of which 23% was consumed in products. In Spain, the consumption of eggs was 155 pieces per capita, of which 45% was consumed in products. In the Republic of Croatia, yearly consumption of eggs is 160 pcs. per capita.

3.3 New demands on the market of meat and eggs

Convenient preparation and acceptable taste makes chicken meat a very desirable food for consumers.

Consumers prefer tasty, healthy and convenient products. If a product does not have a satisfactory taste, consumers will not accept it although it may have reasonable price and high nutritional value. In the last decade, researchers raised awareness on the importance of animal wellbeing, so the producers of poultry meat are faced with new requirements that concern animal keeping. Furthermore, consumers are aware of the negative effects of various food additives and decide to buy organically produced poultry products. Dark poultry meat is becoming increasingly demanded. Demand for this type of meat will increase in proportion to the increase of the world's population. Lower price of dark meat and its satisfactory nutritional value, as well as acceptable content of fat, high concentration of iron and zinc, influence the generally positive perception of dark meat among consumers. Organic food market is increasingly developing in the most EU countries, and also in Croatia. Consumers buy such products, especially those that have the "eco" label, because they consider them tastier and healthier than conventional products. Food can be labelled as organic if 95% of its content is produced organically (Brčić-Stipčević, 2013).

Leading organic food producers sell their products on diverse markets, such as Austria (5%), Germany, Denmark and Luxembourg (3.7 to 2.8%). Studies show different results when it comes to consumers of organic food. Zakowska-Biemans (2011) and Dimitri and Dettmann (2012) stated that socio-demographic factors were less important compared to the education. If we take Greece, Croatia and France into consideration highly educated consumers prefer organic food (Tsakiridou et al., 2008; Brčić-Stipčević et al., 2011; Ngobo, 2011). According to these authors, financial situation (income) was important in deciding to purchase organic food. In Croatia and Greece, consumers stated that organic products were too expensive (Radman, 2005; Tsakiridou et al., 2008). In March 2014, the European Commission[8] adopted the Regulation on Organic Production and Labelling of Organic Products.

Markovina et al. (2011) performed a study among young consumers, aged 14-30 years (n = 1035) to determine to what extent they were familiar with the term "functional food". About 40% of examinees were familiar with the concept of "functional food", and 27% of them often bought such products. The most important attributes of functional products are taste and price, and their correlation. There are three factors that explain the attitude of young consumers towards such food: awareness on health, lack of confidence in the functional properties of food and quality of functional products. More than a half of examinees (51.8%) were willing to buy functional products in the future. Consumers with higher incomes were ready to consume significantly more functional products in the future. Based on the survey on 557 examinees, Kralik et al. (2014) determined that in Croatia there were only 30.7% of consumers aware of the concept of functional food. Significant percentage of examinees paid greater attention to the origin of eggs (33.39%). Stojanović et al. (2013), as well as Čalić et al. (2011) reported that producers of functional food were obliged to permanently inform consumers on advantages of functional ingredients over conventional products. Functional products are a new category of food that needs to develop its marketing by emphasizing its health benefits. Diplock et al. (1999) stated that food could be marked as functional after corroborating its beneficiary effects on one or more target functions in an organism. Urala and Lähteenmäki (2007) pointed out the need for permanent monitoring of consumers' demands for functional food. The authors determined that functional food as part of daily meals had good prospects on the European market.

4. Conclusion

The analysis of data on development and state of poultry production in Croatia from 2010-2014 confirmed the decrease in production of poultry meat by 5% and in the production of eggs by 20%. However, import of poultry meat was increased by 40% and of table eggs by 234%. At the same time, the EU countries had increased production of poultry meat by 10% and of eggs by 1.9%. Self-sufficiency of poultry products during the analyzed period was not satisfactory, so in the future Croatia will have to focus on increasing its own production or import. Production of organic food, of food with "eco" label, as well as of the functional food, can have particular importance for domestic and European market. In order to increase production of poultry meat and eggs in Croatia, it is necessary to take into account several factors, such as: development of sustainable poultry production, creation of new high-quality and market-friendly competitive products, restructuring of production in both sectors (small family farms and large farms), development of new brands, better linking of poultry production to scientific and expert opinions and structured use of EU funds through investments in future developments.

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PROIZVODNJA MESA PERADI I JAJA U REPUBLICI HRVATSKOJ I ZEMLJAMA EUROPSKE UNIJE

Sažetak

Meso peradi i jaja značajni su izvori hranjivih tvari u ljudskoj prehrani. Peradarski proizvodi konzumiraju se radi visoke hranidbene vrijednosti, nedostatka vjerskih ograničenja, brze pripreme jela, kao i relativno niskih cijena. Cilj je rada bio istražiti razvoj peradarske proizvodnje u Republici Hrvatskoj u razdoblju 2010. - 2014., dvije godine nakon ulaska Republike Hrvatske u EU i usporediti podatke sa stanjem peradarske proizvodnje u zemljama EU-a. Ukupna proizvodnja mesa u tom razdoblju u RH smanjena je za 23%, uvoz mesa povećan je za 45%, izvoz mesa peradi povećan je za 46%, proizvodnja jaja smanjena je za 20%. U zemljama EU-a istovremeno je rasla proizvodnja peradi u prosjeku za 8,8%, rastao je izvoz za 10%, smanjio se uvoz za 3,7%, a proizvodnja jaja je stagnirala. Konzumacija mesa peradi u RH bila je 18,3 kg po stanovniku, a u zemljama EU-a 26,8 kg po stanovniku u 2014. godini. Samodostatnost proizvoda od peradi u analiziranom razdoblju nije bila dovoljna te će RH u budućem razdoblju morati brže razvijati ovu značajnu granu stočarstva. Brži razvoj uključuje, osim konvencionalnih, proizvodnju organskih i funkcionalnih peradarskih proizvoda.

Ključne riječi: proizvodnja mesa peradi, proizvodnja jaja, konzumacija, Hrvatska, EU