Specifics of table eggs production in the Republic of Croatia

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ABSTRACT

The self-sufficiency and production of table eggs, as well as the balance of imports and exports in the period from 2013 to 2019 are investigated in this paper. In the aforementioned period, egg production increased by 8.3%, which was insufficient for domestic needs, and the market deficit was compensated by permanent imports. Self-sufficiency decreased to 95 and 90%, respectively. The importance of eggs in human diet, as well as their consumption, is also shown. Official statistical data were used to analyse the situation. Linear and exponential functions were used to describe the phenomena. Research has shown the specifics of egg production and consumption in the Republic of Croatia. Annual egg imports ranged from 2.6 to 15.4%. In order for the Republic of Croatia to be more competitive on the European market, it is necessary to intensify egg production and produce eggs more economically. It is assumed that in the coming period there will be an increase in egg production and consumption in the Republic of Croatia and in EU countries.

Keywords: egg production, market, consumption, self-sufficiency

INTRODUCTION

Poultry is a significant branch in livestock production, and it is characterized by a high degree of industrialization. Modern poultry hybrids are characterized by high genetic potential and, when provided with optimal microclimatic and nutritional conditions, along with health care and zootechnics, they produce quality eggs and meat throughout the year. Eggs are animal products quite important in human diet. They contain highly valuable proteins, essential lipids, vitamins, minerals, and trace elements (Miranda et al. 2015). Nutrients from eggs have a low price compared to other animal products (Carrilo et al. 2012). However, some nutritionists list cholesterol as a controversial ingredient associated with the risk of cardiovascular disease (Li et al., 2013). There is intensive research into technologies that reduce the cholesterol content in eggs. Eliat-Adar et al. (2013) state that the cholesterol introduced into the body by consuming eggs has a limiting effect on the content of cholesterol in the blood and the occurrence of vascular disease. Abeyrathne & Ahn (2013) state that eggs also contain bioactive compounds that have a significant impact in the treatment and prevention of

chronic and infectious diseases. The bioactive compounds in eggs have immunomodulatory, anticarcinogenic and antihypertensive properties. Tran et al. (2014) believe that one egg a day can be consumed as part of a healthy meal. Miranda et al. (2015) state that most eggs per capita are consumed in Mexico (355 pieces), followed by China and Japan (344 and 325 pieces, respectively). Egg consumption in Hungary is high with the amount of 350 pieces per capita, in the European Union 250, and in the Republic of Croatia 170 egg per capita (Bobetić, 2019).

This paper presents the characteristics of egg production and consumption in the Republic of Croatia compared to the countries of the European Union in the period from 2013 to 2019.

MATERIAL AND METHODS

The data obtained from the Croatian Bureau of Statistics, and the Ministry of Agriculture of the Republic of Croatia (annual reports from 2010, 2015 and 2020) are used in this paper. Product consumption balances were calculated in such a way that the quantities for self-sufficiency and import were added to the total egg production, and the values for export were deducted (Bobetić, 2019). Linear and exponential trends were calculated for the total number of poultry, as well as the number of laying hens and broilers as self-sufficiency and egg consumption for the period from 2013 to 2019. The degree of self-sufficiency in egg supply is shown as the ratio of domestic production to consumption (production*100/ consumption). The results of research by authors who have dealt with similar issues when it comes to the conditions of production and consumption of eggs in the countries of the European Union were also used in this paper. Data refer to poultry species, production, import and export, as well as the importance of eggs in human diet.

RESULTS AND DISCUSSION

Poultry population and farming

Table 1 and Figure 1 show the poultry population in the Republic of Croatia in the period from 2013 to 2019. In the analysed period, the total number of poultry increased by 36.96%, and broilers (broiler chickens) by 96.61%, and turkeys 15.12%. The share of hens decreased by 21.79%, ducks by 56.64%, geese by 36.92% and other poultry by 92.21%.

Table 1. Number of poultry by species

Poultry species	2013	2014	2015	2016	2017	2018	2019
Poultry, total	9.306,690	10.317,108	10.189,784	9.856,347	10.399,400	11.412,805	12.746,691
Broilers	4.524,637	5.556,971	5.974,693	5.362,104	5.858,080	7.525,122	8.895,948
Hens	4.125,215	4.201,214	3.583,967	3.857,519	4.002,387	3.556,418	3.226,095
Turkeys	444.116	369.446	495.034	511.844	493.072	442.028	511.289
Geese	26.213	49.011	21.675	21.009	13.284	16.089	16.533
Ducks	120.215	96.024	74.476	91.514	50.848	55.603	52.114
Other poultry	66.294	44.442	39.939	12.357	1.729	17.545	5.162

Source: Croatian Bureau of Statistics, Agricultural production (2019)

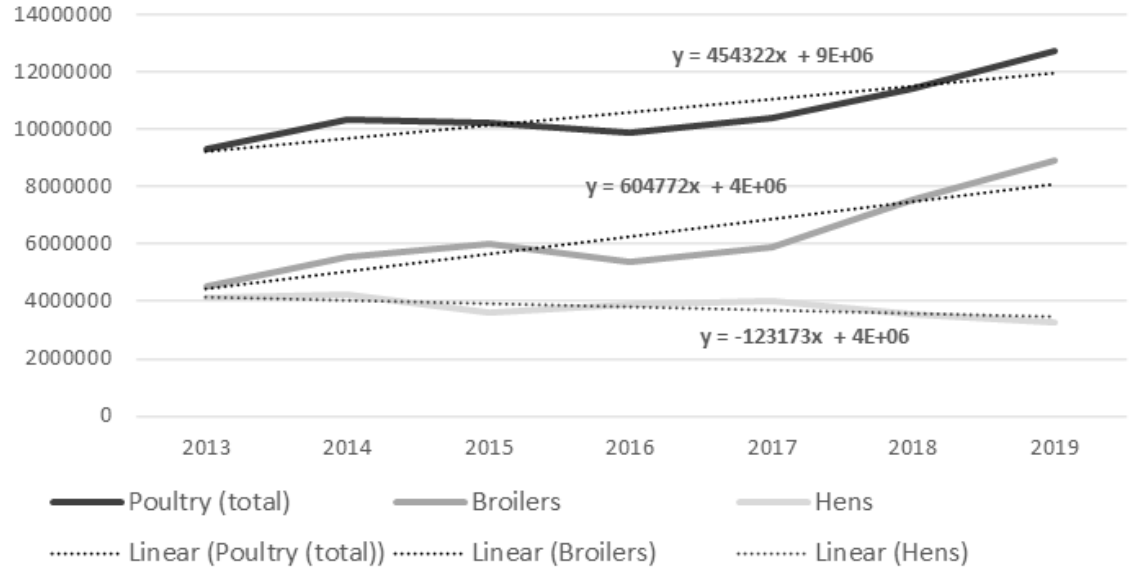

Figure 1. Poultry population in the Republic of Croatia

According to the data on the poultry population, broilers for meat production and laying hens for the production of table eggs are prevalent. Figure 1 shows the trends in the total number of poultry and the number of broilers and hens in the period from 2013 to 2019. The number of poultry moved along a linear curve. Poultry production accounts for 17% of the total livestock production value. It is an industrialized branch of animal husbandry, that uses light and heavy poultry hybrids. It is organized in an intensive way in 70% of farms. On small family farms, poultry is reared in a semi-intensive or even extensive way (Tolušić, 2011).

Table 2 shows the production of table eggs, the balance of imports, and exports and the consumption of eggs in the Republic of Croatia in the period from 2013 to 2019. The data show that the real production of table eggs increased by 30.5%, and the self-supply production decreased to 51.5%. The total production of table eggs increased by 8.2% in the analysed period. Kralik et al. (2017) found that for the period from 2009 to 2014 egg production decreased by 20%. However, authors stated that egg production increased by 7.43% later till 2019. At the same time, the self-sufficiency of egg production has increased (Graph 2).

Table 2. Production, balance of imports and exports of table eggs in the Republic of Croatia

Description	2013	2014	2015	2016	2017	2018	2019*
1. Real production of table eggs	440.553	437.000	444.305	544.000	575.000	570.000	575.000
2. Self- supply	165.000	135.000	120.000	110.000	100.000	80.000	80.800
3. Total production	605.553	572.003	564.305	654.000	675.000	650.000	655.000
4. Import of table eggs	11.840	49.296	99.136	115.000	90.000	88.000	81.000
5. Export of table eggs	8.368	8.656	10.544	23.000	15.000	25.000	39.000
6. Egg consumption	609.025	612.643	622.897	748.000	750.000	713.000	726.00
The 6-3 difference	3.472	40.640	88.512	92.000	75.000	83.000	71.000

Source: Bobetić (2019), *author's assessment

Domestic production of table eggs did not meet the needs of the population, which can be seen from the graph on self-sufficiency of production (Figure 2). The Republic of Croatia does not produce enough eggs to meet its needs. The self-sufficiency of egg production decreased from the index of 95 in 2013 to the index of 88 in 2016, and in 2019 it increased again to the index of 90. Producers' efforts to meet their own needs and quantities for export are significant. The self-sufficiency of egg production in the Republic of Croatia from 2013 to 2019 moves along an exponential curve.

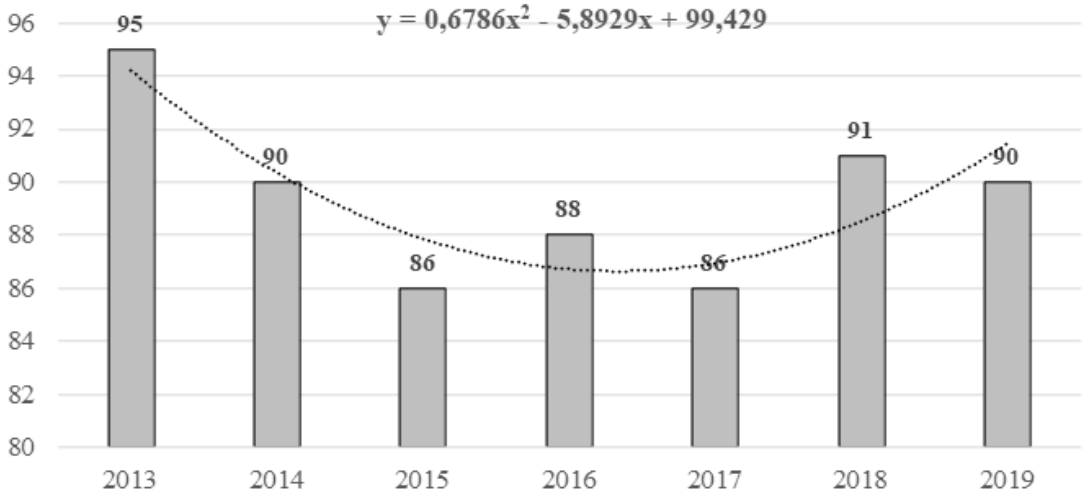

Figure 2. Self-sufficiency of egg production

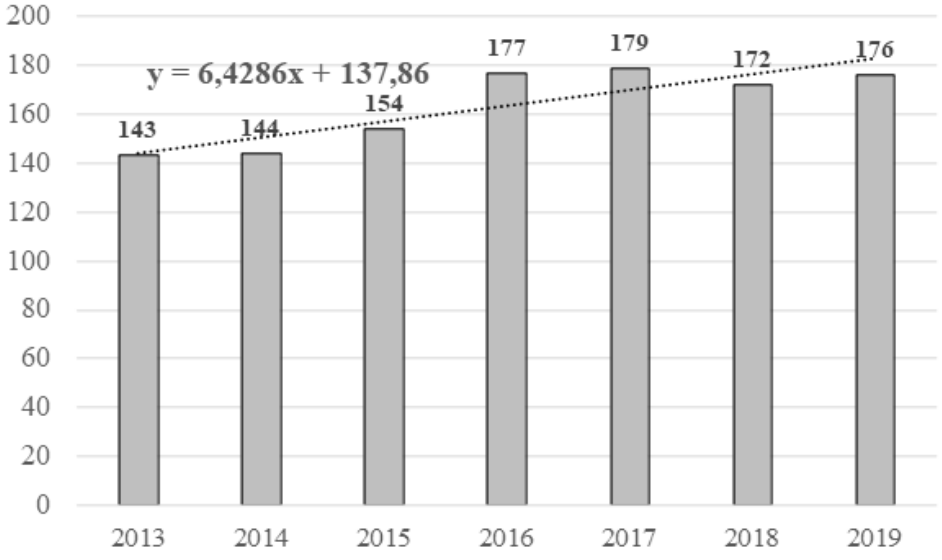

Figure 3. Estimation of egg consumption *per capita*

Consumption of table eggs in the Republic of Croatia is shown in Figure 3. In 2013, egg consumption per capita was 143 pieces (8.6kg), and in 2019 it was 176 pieces (10.56 kg), which is an increase of 23.1%. Data for 2019 show that the consumption of table eggs in the European Union member states was 218 pieces (13.1kg) per capita (Windhost 2017). It is assumed that the consumers will influence the production of quality eggs as healthy and functional products of added nutritional value, as well as their availability in the domestic market, with care for poultry welfare and environmental protection (Bobetić, 2019). The projection of egg production in the EU up to 2025 estimates an increase in egg production by 6.5% and in consumption by 6.0%, which means meeting self-sufficiency requirements and achieving a surplus, i.e. the possibility of export. The largest number of laying hens in the EU are reared in Germany (13.7%), followed by France (12.7%), Spain (11.4%), Poland (11.3%), Great Britain (11.0%) and other countries (European Commission, 2018).

Table egg production systems

The largest number of laying hens is reared in cages 67,3%, 29.9% in floor systems, 2.6% in free-range, and only 0.2% in organic production systems (Ministry of Agriculture, 2020). Organic egg production is organized by only three producers. The reason for this is that for such production a large area (230 laying hens/ hectare of rearing space) should be provided. In EU countries, organic farming of laying hens is on the rise, which is expected in the future for the Republic of Croatia as well. Prior to the implementation of the Council Directive (1999/74/EC) in the Netherlands, cage rearing systems for laying hens were replaced by alternative aviaries, followed by free-range and organic production. A small number of producers keep laying hens in enriched cages. In Switzerland more than 80% of laying hens are reared in aviaries combined with chicken runs, and in Sweden more than 60% of egg production takes place in aviaries or in deep litter systems (Matković et al., 2007; Crnčan et al., 2018). Some EU countries use both free-range and organic farming in the production of table eggs. Eggs must be marked according to their production method. Table 3 provides data on individual laying hen rearing systems in the countries that are the largest egg producers.

Table 3. Laying hen rearing in EU countries

Country	Cage	Floor	Free-range	Organic
France	54.1	11.7	23.0	11.2
Spain	77.6	13.0	8.0	1.4
Italy	42.0	44.5	3.7	4.9
Germany	5.6	60.1	24.2	13.0
The Netherlands	15.2	60.6	17.8	6.4
EU average	48.0	33.0	11.9	6.2

Source: European Commission, Eggs dashboard 2021.

Crnčan et al. (2014) investigated the relationship between the organizational structure of the economy, and the way laying hens are kept. The majority of producers (38.90%) produce eggs on a farm, followed by a form of trade business (35.71%) and a form of company (26.19%). In 70.23% of cases, laying hens are kept in cages. By introducing the new management in egg production, it is possible to achieve economical and profitable production on small family farms placed in rural areas (Kralik, 2020). The author has investigated two genotypes of laying hen on two farms (farm A was used for the production of table eggs, and farm B for the production of hatching eggs). Based on the obtained incomes and outcomes the following economic indicators were calculated. Coefficient of economy A:B was 1.77:1.90, rates of return 43.40% : 47.51% and BEA was 169:105 pieces of egg. The author concluded that both types of farm are suitable for development of poultry production in rural areas. The combination of different production lines can result in a variety of income sources. Similar results were reported by Crnčan et al. (2018).

Farming native breeds

In the Republic of Croatia, Zagorje turkey and Hrvatica hen breeds, whichare suitable for rearing in rural areas, are recognized as native poultry breeds. These breeds are a part of the traditional culture, and serve to provide income to the population in rural areas. These are late-maturing disease-resistant breeds with modest nutritional requirements and good fertility. In addition, they easily adapt to modest rearing conditions. Aid for the farming of native breeds is granted as co-financing of rearing on a family farm for head, that are registered in the Breeding Flocks Central Register. Hrvatica hen is suitable for outdoor rearing, and produces 200-220 eggs, and in rare cases up to 280 eggs per year. The number of hens today exceeds 5,500 head and there are more than 1,300 roosters. Interest in this native breed is increasing.

The importance of eggs in diet

The main role of eggs in nutrition is to ensure the most important nutrients in organism (proteins, fats, vitamins, microelements) in order to satisfy everyday needs of people. Eggs that have a proven positive effect on functions in the organism can be considered as functional food. Functional activity comes from the added ingredients, the so-called nutrients. Eggs of conventional and modified composition are available on the market. Surai and Sparks (2001) state that egg composition can be improved by modifying laying hens' food, especially by adding polyunsaturated fatty acids (n-3 PUFA), vitamin E, selenium, and carotenoids. In enriched eggs, Kralik et al. (2018) increased the levels of n-3 PUFA by 2.4 times, the level of selenium (mg/g) by 3.7 times in the yolk, and by 4.63 times in the egg white, and there were 8.36 times more lutein, and 1.58 times more vitamin E in the yolk of these eggs. The predominant source of polyunsaturated n-3 PUFAs are vegetable and fish oils. Vegetable oils are the main source of α linolenic acid (C18:3 n-3; ALA), and fish oils are the source of eicosapentaenoic acid (C20:5 n-3; EPA) and docosahexaenoic acid (C22:6 n-3; DHA). Linoleic acid (C18:2; LA) is significant in vegetable oils such as sunflower and flaxseed oil. Both precursors are converted to their long-chain metabolites via desaturation and elongation processes. Nutritionists recommend increased consumption of n-3

PUFA because in developing countries the consumption of these fatty acids is 0.15 g/day (Kolanowski et al., 2004). High intake of EPA and DHA was recorded in Japan and Norway, and very low intake in the United States in the diet of vegetarians (Elmadfa and Kornsteiner, 2009).

Ruxton et al. (2004) state that according to the recommendations of EANS (European Academy of Nutritional Sciences) it is necessary to consume a minimum of 0.2 g/day of EPA+DHA. FAO and WHO recommend an intake of 0.2-2g ALA+EPA+DHA. Elmadea & Kornsener (2010) believe that the ratio of n-6/n-3 fatty acids in the diet should be up to 9:1, while the ratio of 4:1 is preferred. Bubel et al. (2011) recommend adding antioxidants, such as selenium and vitamin E, to the diet of laying hens to reduce fat oxidation and the occurrence of unwanted odours. Incorporation of n-3 PUFA in eggs depends on the transfer of usable n-3 PUFA and endogenous PUFA metabolism (Neijat et al., 2016) in the body of laying hens. According to Commission Regulation (EU 116/2010) food is a source of omega-3 fatty acids if it contains at least 0.3 g ALA per 100 g and 100 Kcal of the product, and/or at least 40 mg EPA+DHA per 100 g and 100 Kcal of the product. Food is a high good source of omega-3 fatty acids if it contains at least 0.6 g ALA per 100 g and 100 Kcal of the product and/or at least 80 mg EPA+DHA per 100 g and 100 Kcal of the product. Ruxton et al. (2010) state that the consumption of three eggs per week in women, and four eggs per week in men provides 2% energy, 3% protein, 3% saturated fatty acids and 5% monounsaturated fatty acids.

CONCLUSION

Table eggs are quality animal products. Although the total number of poultry in 2019 increased by 36.96%, the number of hens decreased by 21.79% compared to 2013. The production of table eggs in 2019 in the Republic of Croatia was 655 thousand pieces, and it increased by 8.3% in the analysed period. Egg consumption per capita in the Republic of Croatia was 176 pieces (10.6 kg), and in the EU countries 218 pieces (13.1 kg). In the following period, the production of eggs of improved nutritional and biological value is planned in the Republic of Croatia, as well as the use of native breeds in the development of rural areas. In poultry farming, an increase in egg production is anticipated, as well as the development of a larger number of farmers engaged in intensive production, and the implementation of new technological solutions. This should result in high production standards, production of eggs of improved nutritional value, with care for poultry welfare and environmental protection. It is also advisable to use native breeds of poultry that are adapted to outdoor breeding and organic egg production. It is necessary to intensify the production of table eggs, modernize the technology, develop sustainable production, create new high-value products, and develop new product brands. With the planned use of EU funds through investments we expect the restructure of production on both - small family farms and large poultry farms.

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Specifičnosti proizvodnje konzumnih jaja u Republici Hrvatskoj

SAŽETAK

U radu je analizirana samodostatnost i proizvodnja konzumnih jaja, odnos uvoza i izvoza u razdoblju od 2013. do 2019. godine. U navedenom razdoblju je došlo do povećanja proizvodnje jaja za 8,3% što je nedovoljno za domaće potrebe te je tržišni deficit nadoknađen stalnim uvozom. Samodostatnost se smanjila od 95 % na 90%. Nadalje, prikazana je važnost jaja u ljudskoj prehrani, kao i važnost njihove konzumacije. Za analizu su korišteni službeni podaci dok su za opis stanja korištene linearne i eksponencijalne funkcije. Istraživanje je pokazalo specifičnosti proizvodnje i konzumacije jaja u Republici Hrvatskoj. Godišnji uvoz jaja kretao se od 2,6 do 15,4 %. Kako bi Republika Hrvatska bila konkurentnija na europskom tržištu, potrebno je intenzivirati proizvodnju jaja i ekonomičnije proizvoditi. Pretpostavlja se da će u narednom razdoblju doći do povećanja proizvodnje i potrošnje jaja u Republici Hrvatskoj i u zemljama Europske Unije.

Ključne riječi: proizvodnja jaja, tržište, potrošnja, samodostatnost