

CONSUMER CRITERIA FOR PURCHASING EGGS AND THE QUALITY OF EGGS IN THE MARKETS OF THE CITY OF BELGRADE

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Abstract: In order to examine the consumers' attitude towards eggs, 239 respondents in the area of the City of Belgrade were surveyed, and the assessment of the quality of eggs on the Belgrade market was done by examining the quality of eggs in super/hypermarkets. In the survey, consumers expressed their views about the place of purchase of eggs, the criteria for purchasing and the significance of certain quality traits/properties. In the egg quality test eggs of class A were used, and it was done on egg samples from 5 super/hypermarkets, from a total of 10 egg manufacturers. Based on the results of the study, it was found that most egg consumers buy in super/hypermarkets (39.62%), that the brand/manufacturer was not important for 30.37% of the respondents, that they preferred to buy larger eggs (SS, S and A classes). The quality of eggs is very important for 73.28% of subjects, and the colour of the yolk preferred by the respondents was extremely yellow (62.76%). The supply of table eggs on the market was different (from 1 to 5 manufacturers) per retail store. The quality of eggs, observed for all super/hypermarkets and all manufacturers, expressed in Haugh units, decreased with the shelf life of eggs. The quality of eggs from category 1 to 10 days, in all super/hypermarkets, observed for all manufacturers, was within the studied class A, with egg weight ranging from 60.9 to 64.1g, egg shell colour from 3.6 to 4.2, egg cleanliness 4.4 to 5.0, the colour of the yolk (Roche) from 10.9 to 13.2, and the number of Haugh units from 73.2 to 91.7. The results of the research indicate that consumers in the City of Belgrade are placing importance on the quality of table eggs, that there are differences in the supply and freshness of the eggs between the markets, and that there are differences in the quality within the same market, regardless of the manufacturer.

Key words: eggs, consumers, poll/survey, market, quality of eggs, Belgrade

Introduction

The habits and attitudes of consumers in different areas have been gaining importance over the last decades, whereby the consumer can no longer be considered a passive observer, but someone with an important role in creating an environment in terms of the production, market, environment, etc. Consumer attitudes are of importance from several aspects, and while the knowledge of attitudes is recognized by some authors as the basis for successful marketing (*Jovović and Femić, 2006*), on the other hand, some authors point to a strong relationship between consumer perception, quality and food safety (*Savović et al. al., 2012*).

In the last two decades, poultry production has faced a variety of challenges in terms of changes in legislation and numerous requirements in the field of food safety, ecology, production technology - production systems, animal welfare, production sustainability, as well as socio-economic changes, which has opened many issues relating to consumer attitudes. Also, it can be observed that with the tendency to appreciate consumer attitudes, the number of research in this field, mainly polls or surveys, is focused on consumer preferences of table eggs (*Fearne and Lavelle, 1996; Mizrak et al., 2012.; Huang, 2013; Kralik et al., 2014; Tolimir et al., 2016; Zelić et al., 2016*).

When it comes to the quality of the eggs, while the manufacturers primarily give attention to the egg weight and quality of the egg shell, as a prerequisite for good price and marketing, consumers also show interest in quality, but with special attention to the egg weight, the colour of the egg shell and of the yolk, the quality of the egg white and the absence of meat and bloody stains (*Tolimir et al., 2008*). *Škrbić et al. (2006)* indicate an increase in consumer interest in the safety and quality of eggs, and according to research by *Hernandez et al. (2005)*, consumer safety and egg freshness are the most important factors for them, and in relation to the sensory qualities of the quality of the eggs, the strength of the egg shell, the consistency of the egg white and the colour of the yolk are properties specially valued by consumers in a number of European countries (France, Germany, Italy, Great Britain, Spain, Poland and Greece).

Since the initial quality of the eggs is at its highest in the moment of laying, and from that moment on the internal egg quality begins to decline, egg handling and management in terms of storage conditions and storage are very important (*Jin et al., 2011*). In this sense, from the aspect of the quality, later procedures and handling of eggs within the sales points, i.e. the conditions in the facility, as well as the time from the moment of supply of eggs to the retail facility to the sale of eggs, are very important. The study of the quality of eggs in retail facilities is subject of research by many authors, mainly in order to determine the quality of eggs (shelf life of eggs, egg weight, albumen height, Haugh units, colour of yolk, number of broken eggs) which come from different manufacturers and different production

systems - conventional or alternative or eggs from functional food programs (*Bell et al., 2001; Burley and Johnson, 2013; Patterson et al., 2001*).

The aim of this study is to determine the habits of consumers in the City of Belgrade when purchasing eggs and their attitudes, that is, the criteria for purchasing eggs and their preferences. At the same time, the aim of the study is to enable the examination of the supply of eggs on the Belgrade market in super/hypermarkets, through the representation of various manufacturers within the market, and to contribute to the assessment of the quality of eggs in this market segment, observed through the shelf life of eggs sold to consumers, and the manufacturers that are present within a single retail facility and at the level of all retail facilities.

Material and Methods

Survey was conducted in 2016, on the territory of the city of Belgrade. A total of 239 consumers of table eggs took part in the survey, randomly selected, and taking into account that they represented different categories (sex, age, education). Respondents filled out surveys without the presence of interviewers, for the purpose of data objectivity. The structured survey questionnaire consisted of: 1) data on the respondent obtained by circling the offered responses related to the sex (male, female); 2) the questions of a closed type, according to the principle of the nine-step Likert scale - where **1** was: "It does not matter at all", to **9** "Very important to me" - applied to the question of how important the brand/manufacturer is when purchasing eggs and how much important freshness of eggs is; 3) the question „Where do You purchase eggs most frequently“ - offered answers: in the market, in the mini market, in the super/hyper market and other (do not buy eggs/you have your own production, you are buying directly from the manufacturer); 4) the question „Which size or class of eggs you prefer to buy“ - offered answers: SS (70g and above), S (65-70g), A (60-65g), B (55-60g), C (50-55g), D (45-50g), E (less than 45g), and „I don't care about the class of eggs“, and 5) the question „Which colour of the egg youlk You prefer“ – offered answers: light yellow, medium yellow, very yellow (yellow-orange) and „The yolk colour does not matter to me“. Only fully filled questionnaires were processed statistically.

The quality of eggs was tested in October 2017, referring to eggs exclusively of A class, and it was performed on egg samples from 5 super/hypermarkets in the City of Belgrade (A, B, C, D, E) for a total of 10 egg manufacturers that were present in these retail facilities (indicated by numbers 1 to 10). Sampling of eggs for egg quality analysis was performed always on the same day, in three repetitions in all retail facilities. In each of the markets, the supply of eggs was recorded - the number of suppliers, i.e. the manufacturers, and the best before date (date

indicating the deadline for sale), based on which the egg shelf life was determined on the day of sampling. For each egg manufacturer, the sample consisted of 10 eggs (one pack), each of which was tested individually for the properties of external and internal egg quality. Analysis of the quality of all eggs was done in one day, the first day after purchase, whereby eggs from the moment of purchase in the markets until the next day, when they were analyzed, were stored in the cooling cabinets, i.e. in the same conditions as in the retail store. In order to determine the impact of egg shelf life on egg quality at the level of all retail facilities, the egg samples of all manufacturers were classified into three categories - from 1 to 10, 11 to 20, and 21 to 30 days shelf life. For each egg group, the following quality properties were determined: egg weight, albumen height and HU. In the category of eggs from 1 to 10 days, for eggs obtained from all retail facilities and all manufacturers, the following egg quality properties were determined: egg weight (measured on a technical scale of 0.01g), egg shell colour (visually estimated from 1 to 5), cleanliness of the egg shell visually estimated from 1 – the lowest to 5 – the highest score), colour of the egg yolk (visually estimated with Roche Yolk Color), the albumen height (measured by tripod micrometer) and Hough units (determined by American Yolk Color calculator) and egg shell thickness (determined by using the micrometer).

Respondents' responses were processed using the standard method of analysis in the Microsoft Excel program. Statistical processing of the obtained data for the egg quality was done in the Statistics 8 program, by the variance analysis StatSoft. Inc. (www.statsoft.com).

Results and Discussion

Table 1 gives an overview of the results related to the consumers' habits in the purchase of eggs, i.e. answers to the questions: "Where do you most often purchase the eggs from?", "How important to you is the brand/manufacturer when purchasing eggs?" and "You prefer the eggs of which size/class, when purchasing eggs?".

Based on the results of the study (Table 1), it can be concluded that most of the surveyed egg consumers buy in the super/hypermarket (39.62%), that for the majority of consumers the brand/manufacturer of eggs is not important in terms of egg choice are (30.37%) and that consumers in the area of Belgrade prefer large eggs, of SS, S and A categories (a total of 69.82%), with the highest number of respondents choosing the class A (28.38%).

Regarding the purchase of eggs, the results of this study may be associated with the research of *Kralik et al. (2014)*, who also have found by survey research that 38.78% of respondents choose a supermarket as a place of purchasing of eggs. The results obtained in the present study, that consumers prefer large eggs as a selection criterion when buying are in line with the research by *Zelić et al. (2016)*.

However, when compared with the results of the same authors, the data on the importance of a particular brand of eggs are different, as in the research conducted in the Tuzla region it was established that 56.16% of the respondents have chosen a particular brand.

Table 1. Habits of Belgrade consumers in the purchase of eggs

Categories of respondents		Answers to the question: "Where do you most often purchase the eggs from?"									
Answers											
	%	Green market	Mini-market	Super/hypermarket	Other						
Sex											
Male	27.78	26.79	10.71	44.64	17.85						
Female	72.22	22.44	10.90	37.82	25.85						
Collectively	100	23.58	10.85	39.62	26.85						
Answers to the question: "How important to you is the brand/manufacturer when purchasing eggs?"											
Score range											
	%	1	2	3	4	5	6	7	8	9	
Sex											
Male	27.78	32.20	8.47	10.17	8.47	10.17	8.47	5.08	3.39	13.56	
Female	72.22	29.68	10.32	9.68	7.10	9.68	3.87	9.68	5.16	14.84	
Collectively	100	30.37	9.81	9.81	7.48	9.81	5.14	8.41	4.67	14.49	
Answers to the question: "You prefer the eggs of which size/class, when purchasing eggs?"											
	%	SS	S	A	B	C	D	E	Not important		
Sex											
Male	27.78	21.67	26.67	26.67	6.67	0.00	0.00	0.00	18.33		
Female	72.22	11.11	27.78	29.01	11.73	0.62	1.23	0.00	18.52		
Collectively	100	13.96	27.48	28.38	10.36	0.45	0.90	0.00	18.47		

* 1 – It is not at all important to me; 9 - It's very important to me

Table 2 gives an overview of the results related to the consumers' attitude towards the quality of the eggs, i.e. the answers to the following questions: "How important is the freshness of eggs?" and "Which colour of egg yolk do you prefer?"

Table 2. Importance of the egg quality for consumers

Categories of respondents		Answers to the question: "How important is the freshness of eggs?"*								
Score range										
	%	1	2	3	4	5	6	7	8	9
Sex										
Male	27.78	4.76	1.59	0.00	1.59	1.59	3.17	3.17	12.70	71.43
Female	72.22	5.92	1.78	1.18	1.18	2.37	2.96	1.78	8.88	73.96
Collective y	100	5.60	1.72	0.86	1.29	2.16	3.02	2.16	9.91	73.28
Answers to the question: "Which colour of egg yolk do you prefer?"**										
Score range										
	%	1		2		3		4		
Sex										
Male	27.78	3.08		23.08		61.54		12.31		
Female	72.22	1.15		29.31		63.22		6.32		
Collective y	100	1.67		27.62		62.76		7.95		

* 1 – It is not at all important to me; 9 - It's very important to me

** 1 - light yellow; 2 - medium yellow; 3 - extremely yellow (yellow orange); 4 - I do not care about the colour of the yolk

The results of the study of the importance of egg freshness (Table 2), from the angle of the consumer, indicate that Belgrade consumers pay great attention to egg freshness, since 83.19% of respondents voted for the highest score (8 and 9). The result of this research is in agreement with the general tendency of increasing consumers' criteria for food quality and safety (*Savović et al., 2012*), as well as the results of *Hernandez (2006)* according to which the freshness of eggs is rated as the most important parameter by consumers in Spain. One of the essential characteristics of the egg quality is the colour of the yolk (Table 2), which consumers pay great attention to, and in most EU countries, the more intense (darker) yellow colour is appreciated (*Parrott et al., 2013; Hernandez et al., 2005*). The obtained results of this research, according to which the majority of consumers (62.76%) prefer the extremely yellow colour of the yolk, are in agreement with the research of the mentioned authors.

Part of the study concerned the market research in terms of supply in Belgrade super/hyper markets, for which, based on the results of the survey, it can be concluded, are the places where Belgrade consumers are most often purchasing eggs, regardless of whether they are female (37.82%) or male (44.64%). In terms of supply, it was noticed that the number of manufacturers present in the retail facilities was different and that it was at least 1 (in the C, D, E retail facilities), while in the retail facility B it was 2, and in the A there were 5 manufacturers.

The results of the monitoring of egg weight in retail facilities and quality expressed by Haugh units (Figures 1 and 2) related to all the eggs that were offered

in the markets, with the analysis including all manufacturers (10) and eggs of all shelf lives (classified in three groups - from 1 to 10, from 11 to 20, and from 21 to 30 days). The weight of eggs ranged from 60.00 g to 63.05 g, which for manufacturers and all shelf life groups, was in accordance with the class in which the eggs were categorized. Class A eggs were subject to analysis, given the survey found that the majority of consumers in the choice of egg class preferred this class, which was 29.01% for females and 26.67% for males.

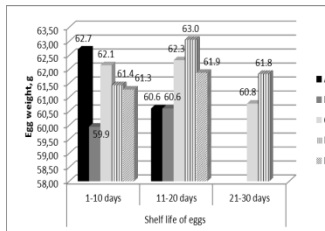


Figure 1

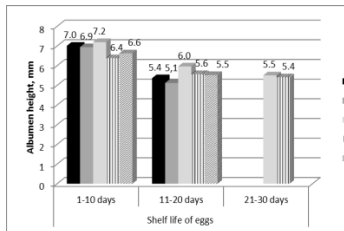


Figure 2

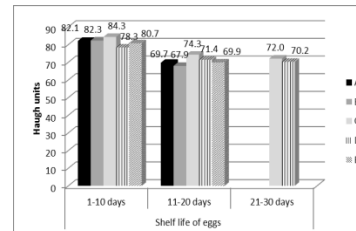


Figure 3

Figure 1. Egg weight in super/hypermarkets

Figure 2. Albumen height depending on shelf life of eggs and hypermarket

Figure 3. Haugh units depending on shelf life of eggs and hypermarket

The analysis of data for Haugh units showed that with the increase in shelf life of eggs, the number of Haugh units decreased, i.e. the quality of eggs declined, indicating that three markets that offered only eggs from the first two groups (up to 20 days) had better offer for consumers compared to two markets where the shelf life of eggs ranged from 1 to 30 days. The number of Haugh units decreases with egg shelf life is also confirmed in the study by *Jin et al., (2011)*, which can be linked to research results suggesting that the egg has the best quality immediately after laying and that it is further reduced in dependence from further manipulation (*Pavlovski et al., 1996*).

The results of egg quality analysis in Belgrade hypermarkets are given in Table 3.

Table 3. Quality of eggs in Belgrade hypermarkets depending on the manufacturer

Market											
	A					B			C	D	E
Manufacturer											
Trait		1	2	3	4	5	6	7	8	9	10
Egg weight, g	\bar{X}	60.9 ^c	63.9 ^{ab}	62.4 ^{abc}	64.1 ^a	62.1 ^{abc}	61.7 ^{bc}	61.8 ^{bc}	61.3 ^c	62.1 ^{abc}	62.0 ^{abc}
	SD	1.7	1.8	0.8	1.9	1.2	1.4	1.4	1.7	1.8	1.6
Egg shell colour, points	\bar{X}	4.0	3.6	3.9	4.2	4.1	4.2	4.1	4.0	3.9	4.0
	SD	0.5	0.7	0.3	0.4	0.6	0.4	0.6	0.5	0.6	0.00
Egg shell cleanliness, point	\bar{X}	5.0	5.0	5.0	5.0	4.9	5.00	4.4	5.0	5.0	5.0
	SD	0.0	0.0	0.0	0.0	0.3	0.0	0.9	0.0	0.0	0.0
Egg yolk colour, (Roche)	\bar{X}	12.9 ^a	12.9 ^a	12.5 ^{abc}	10.9 ^e	12.7 ^{ab}	12.0 ^{bcd}	11.6 ^{de}	13.2 ^a	12.8 ^{cd}	12.8 ^{ab}
	SD	0.3	0.3	0.5	1.0	0.5	0.5	0.7	0.9	0.4	0.6
Albumen height, mm	\bar{X}	6.5 ^{bcd}	8.0 ^{ab}	7.4 ^{ab}	5.9 ^{cd}	7.2 ^{abc}	8.5 ^a	5.7 ^d	6.6 ^{bcd}	7.2 ^{abc}	6.8 ^{bcd}
	SD	1.1	0.8	0.8	0.7	1.0	0.9	1.1	1.3	1.2	0.8
Haugh Unit (HU)	\bar{X}	79.5 ^{bcd}	88.0 ^{ab}	85.0 ^{ab}	74.1 ^{cd}	83.8 ^{abc}	91.7 ^a	73.2 ^d	80.7 ^{bcd}	83.0 ^{abc}	81.6 ^{bcd}
	SD	8.4	4.3	4.2	5.5	6.4	4.9	9.4	7.0	8.5	5.4
Shell thickness, 0.01mm	\bar{X}	40.5	41.5	40.3	38.7	41.2	39.6	41.8	40.2	38.4	41.9
	SD	2.1	2.1	2.3	4.2	2.3	2.1	3.0	2.6	2.0	2.5

* a-d average values in each row without common superscript are significantly different at $p < 0.01$

Based on the fact that consumers appreciate the freshness of eggs, and that it is important to both female (73.96%) and male (71.43%) consumers in this study, the study of the quality of eggs was carried out only in the group of eggs of shelf life 1 to 10 days. The established values of the parameters, in all markets (5), and for all manufacturers (10), for egg weight ranged from 60.9 to 64.1g, shell colour from 3.6 to 4.2, egg cleanliness from 4.4 to 5, yellow colour (Roche) of 10.9 to 13.2 and the number of Haugh units from 73.2 to 91.7. The results of the study indicate that the quality of the eggs differed significantly, observed within single retail facility/market and at the level of all retail facilities/markets, for the properties of egg weight, colour of yolk, albumen height and Haugh units. The statistically significant differences between the manufacturers can be associated with the research of Škrbić *et al.* (2006) indicating the variability of individual quality characteristics of table eggs depending on the manufacturer. Given that the quality of the eggs is influenced by a large number of different factors prior to laying - genetics, production system, nutrition, chicken health, chicken age, and after the laying of eggs - conditions for storage, packaging, transport and sales points, as well as the shelf life of eggs (Pavlovski *et al.*, 2007; Tolimir *et al.*, 2008; Jin *et al.*, 2011), the quality of eggs in the retail facilities could be viewed as a result of the collective impact of all of these factors.

Pavlovski et al. (2007) state that for consumers an optimal egg weight is between 53g and 73g, while eggs of good freshness are those with 75 or more Haugh units, which could classify eggs obtained from 8 of the total of 10 analyzed manufacturers be considered as eggs of good quality. Observed according to the number of Haugh units, the quality of eggs of all manufacturers was satisfactory, i.e. the eggs showed values ranging from 73,2 to 91,7 Haugh units). The obtained values for the cleanliness of the shell indicate that the cleanliness of eggs in Belgrade retail facilities was satisfactory, as well as the strength of the shell, which should be about 0.375 mm (*Pavlovski and Vitorović, 1996*). The established colour of the yolk, irrespective of the variation between the manufacturers, indicated that the eggs in the markets, were in line with the preferences of consumers in our area, considering that according to the survey, 27.62% preferred the medium yellow and 62.76% extremely yellow color of the yolk. Consumers preference to the more intense colour of the yolk, is also established in the study of *Pavlovski and Mašić (1994)*, according to whom the majority of consumers (56.5%) prefer the yellow colour of the yolk (up to 9 points on Roche scale), and 27% of consumers over 40 years of age prefer a dark yellow color (over 9 points on Roche scale).

Also, by analyzing the data (Table 3), it can be concluded that the number of brands within a single super/hypermarket ranged from 1, which was established in three retail facilities/markets (C, D, E), to 5 brands/manufacturers in one market (A), which indicates a different supply in this segment of the Belgrade market. Considering that according to the obtained results, the quality of the eggs of different producers, within and between the markets, varies considerably, and the survey survey indicates that a significant number of consumers in the City of Belgrade are not important producers (30.37%), while only 14.49% of manufacturers consider it very important when buying eggs, future trials should focus on additional parameters that are important for choice (price, packaging, etc.).

Considering that according to the obtained results, the quality of the eggs of different manufacturers, within single retail facility and between the retail facilities, varied considerably, and that the survey showed that for considerable number of consumers in the City of Belgrade the brand/manufacture (30.37%) was not important, while only 14.49% considered the manufacturer as very important criterion when buying eggs, future studies should focus on additional parameters that are important for choice (price, packaging, etc.).

Conclusion

The first part of the study presents the results of the survey of the habits of egg consumers in the City of Belgrade (239 respondents - 27.78% female and 72.22% male) in terms of place of purchase, the criteria they have for choosing

when purchasing eggs - the importance of the brand/manufacture and class of eggs, as well as what qualities of quality consumers prefer - the colour of yolk and freshness eggs. In the second part of the study, results are given regarding the supply of eggs on the Belgrade market, in super/hypermarkets and the quality of eggs of different manufacturers observed within single retail facility and between the retail facilities.

According to the survey, the majority of consumers in the City of Belgrade are purchasing eggs in super/hypermarkets (39.62%), and when purchasing eggs, the manufacturer is not important at all for 30.37% of respondents. At the same time, the freshness of eggs is very important for consumers (73.28%), they prefer to buy larger eggs (class SS, S and A are preferred by 69.82%) and prefer eggs of extremely yellow colour (62.76%).

In regard to the egg supply, differences were registered between the super/hypermarkets (the number of brands/manufacturers within the single retail facility/market varied from 1 to 5), as well as the differences in the freshness of eggs within a single market, or between individual markets. The results of egg quality in super/hypermarkets indicate that the quality of eggs, expressed in Haugh units, declines with the shelf life of eggs. The quality of eggs within the single retail facility/market differed statistically significantly, depending on the manufacturer, and significant differences were determined by comparing the manufacturers at the level of all retail facilities/markets for the properties of egg weight, colour of the yolk and Haugh units. The analysis of eggs displayed in retail facilities from 1 to 10 days, in all markets (5) and for all manufacturers (10), and the established values of egg quality parameters indicated that the quality of eggs in the Belgrade markets was satisfactory.

Kriterijumi potrošača pri kupovini konzumnih jaja i kvalitet jaja u marketima na području grada Beograda

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Rezime

U cilju ispitivanja stavova potrošača jaja anketirano je 239 ispitanika na području Grada Beograda, a ocena kvaliteta jaja na beogradskom tržištu obavljena je ispitivanjem kvaliteta jaja u super/hipermarketima. Kroz anketno ispitivanje potrošači su se izjasnili o mestu kupovine jaja, o kriterijumima pri kupovini i o značaju pojedinih osobina kvaliteta. Ispitivanje kvaliteta jaja odnosilo se na jaja

klase A, a obavljeno je na uzorcima jaja iz 5 super/hipermarketa, za ukupno 10 proizvođača jaja. Na osnovu rezultata ispitivanja konstatovano je da većina potrošača jaja kupuje u super/hipermarketima (39,62%), da pri kupovini nije bitna robna marka/proizvođača za 30,37% ispitanika, da najradije kupuju jaja veće mase (SS, S i A klase). Kvalitet jaja veoma je važan za 73,28% ispitanika, a boja žumanca koju preferiraju je iz kategorije izrazito žuta (62,76%). Ponuda konzumnih jaja bila je različita (od 1 do 5 proizvođača) po marketu. Kvalitet jaja, posmatrano za sve super/hipermarkete i sve proizvođače iskazan kroz Hogove jedinice opadao je sa starošću jaja. Kvalitet jaja iz kategorije 1 do 10 dana, u svim super/hipermarketima, posmatrano za sve proizvođače, bio je u okviru ispitivane klase A, pri čemu se masa jaja kretala od 60,9 do 64,1g, boja ljuske od 3,6 do 4,2; čistoća jaja od 4,4 do 5,0; boja žumanca (Roche) od 10,9 do 13,2, a broj Hogovih jedinica od 73,2 do 91,7. Rezultati istraživanja upućuju na zaključak da potrošači u Gradu Beogradu poklanjaju pažnju značaju kvaliteta konzumnih jaja, da između marketa postoje razlike u pogledu ponude i svežine jaja, kao i da unutar jednog marketa i posmatrano na nivou svih marketa postoje razlike u kvalitetu, u zavisnosti od proizvođača.

Ključne reči: jaja, potrošač, anketa, market, kvalitet jaja, Beograd

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