

Factors affecting egg consumption in young consumers

Igor Kralik¹, Ana Zelić², Jelena Kristić¹, Sanja Jelić Milković^{1*}, Ana Crnčan¹

*1 Josip Juraj Strossmayer University of Osijek, Faculty of Agrobiotechnical Sciences Osijek,
Department of Bio-economics and Rural Development, Croatia*

2 AGRO-KOVAČEVIĆ, Croatia



Licensed under a Creative Commons Attribution 4.0 International License



The research was carried out on consumers aged 20 to 30 years. The survey was conducted among the young population, on a sample of 200 respondents; male (M, n = 100) and female (F, n = 100). Respondents were asked to answer three sets of questions: a) egg quality indicators; b) which are the benefits of consuming eggs compared to other animal products; and c) which are the disadvantages of consuming eggs. A Likert scale (min = 1, max = 5) was used to evaluate the responses on the factors that influence egg consumption. The respondents (M 4.50 : F 4.11; P < 0.01) gave the highest score to the factor of health safety (shell cleanliness and product safety). Female respondents prefer longer shelf life of eggs (M 3.18 : F 3.59; P < 0.01) and their versatile use (M 4.07 : F 4.29; P < 0.01) compared to male respondents. As one of the disadvantages of egg use, the respondents mention the possibility of damage in transport (M 2.97 : F 3.31; P < 0.01). Female respondents favour the health safety of eggs (M 4.11 : F 4.50; P < 0.01). The disadvantages of egg consumption such as the possibility of infection (M 3.60 : F 3.42), fat and cholesterol intake (M 2.86 : F 2.93) and dislike for eggs (M 2.22 : F 2.12) were not considered to be limiting factors by the respondents and sex differences were not statistically significant (P > 0.05). Interval estimation of the mean values μ in male and female populations was made. The research indicates the attributes that consumers value when choosing and buying products, which can serve as a future guide for egg producers.

Keywords: consumption, egg quality, nutritional value, freshness

1 Introduction

The challenge of understanding nutrition and health as well as reducing the risk of developing disease requires consumers to increase their awareness of the right choice of healthy and quality foods. Eggs are an animal product that is consumed daily whether fresh or in processed foods. Thus the question arises: which egg is a good quality egg? The definition contains a set of specific characteristics such as: clean shell, size and weight, sensory properties, nutritional properties, safety - absence of pathogens etc., Haugh units >75 (HU), air chamber <2 mm (Bertechini and Mazzuco, 2013). Eggs are an example of a "complete food" because they satisfy the need for essential nutrients during human growth and life. They contain nine essential amino acids: histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine (Lunven et al., 1973). They also contain fat-soluble vitamins (A, D, E, K) as well as water-soluble B vitamins (Garza et al., 2000). An egg contains 200 to 300 mg of cholesterol, but this is no longer considered harmful to health as it was in the past. In fact, the consumption of one egg/day does not increase neither serum cholesterol nor increase the risk of cardiovascular disease in healthy males and females (Zaheer, 2015). Furthermore, its role in the formation of steroids, such as vitamin D, as a precursor in the formation of bile, which is important in fat digestion, is prominent. Daily consumption of one egg does not increase serum cholesterol nor the risk of cardiovascular disease in healthy males and females (Zaheer, 2015).

* **Corresponding Author:** Sanja Jelić Milković. Faculty of Agrobiotechnical Sciences Osijek, Department of Bio-economics and Rural Development, Vladimira Preloga 1, 31000 Osijek, Croatia. E-mail: sajelic@fazos.hr. ORCID: <http://orcid.org/0000-0003-0505-6970>

Consumer's attitude towards egg quality can be based on external quality indicators (shell cleanliness and strength, shape index) as well as internal quality indicators (pH values, egg white and egg yolk consistency, and nutrient content). Eggs are a cost-effective source of nutrients, especially important for the growth and development of children and young adults. The average consumption of eggs in EU countries is 12.0 kg per capita/year and in the Republic of Croatia 10.3 kg per capita/year (Bobetić, 2019). Consumers buy eggs according to their knowledge, which changes over time depending on their preferences, market offering, financial circumstances and knowledge on nutrition. The aim of the research was to determine young consumers' views on the advantages and disadvantages of egg consumption, based on a questionnaire.

2 Material and methods

The survey was conducted on a young population of the University of J. J. Strossmayer's students between the ages of 20 and 30 years. The people included were male (M, n = 100) and female (F, n = 100). The survey was conducted using three groups of questions.

Egg quality indicators: quality (appearance and size), stability (shelf life and storage possibilities), health safety (shell cleanliness and product safety) and nutritional value (nutrient and calorie content).

Advantages of consuming eggs over other animal products are the following: they are more affordable, have a longer shelf life, they are easy to prepare and have a wide variety of uses.

Disadvantages of production and consumption of table eggs are: a possible presence of pathogens, excessive intake of cholesterol and fat, the possibility of damage during transport and the aversion to the consumption of eggs.

A Likert scale (min 1 max 5) was used in the survey. For each attribute, consumers had to score on a Likert scale (min 1 max 5) the relative importance in determining product choice. The research results were processed using TIBC Statistica TM version 13.4.0.14. (Soft Inc.,© 1984-2018). Testing the significance of differences between the means of egg quality and consumption indicators in males and females was performed using the z-test method ($n > 100$ for value of $P < 0.05$ and $P < 0.01$). Estimation of the mean values of populations by sex was performed using static indicators of samples for males and females (Kralik et al., 2012) as follows:

$$z = \frac{(\bar{x}_1 - \bar{x}_2) / \sqrt{(\frac{s_{x1}^2}{n_1} + \frac{s_{x2}^2}{n_2})}}{\mu}, \text{ where}$$

\bar{x}_1 and \bar{x}_2 - mean values of characteristics

$s_{(x_1)}$ and $s_{(x_2)}$ - standard errors of the mean

μ - the population mean

$$\mu = \bar{x} \pm 1,96 \times s_{\bar{x}} ; P < 0.05$$

3 Results and discussion

The results of the egg quality assessment (Table 1 and Figure 1) show that the respondents of both sexes pay the greatest attention to the cleanliness of the shell and the safety of the product, which is called health safety in the questionnaire. The scores for the aforementioned properties were: M 4.11; F 4.50 and the difference in gender scores was highly significant ($P < 0.01$). Respondents rated very highly the egg stability feature, meaning the shelf life and the possibility of storing eggs (M 4.21; F 4.31; $P > 0.05$). The appearance and size of the eggs were evaluated by male respondents with a score of 4.08 and by female respondents 4.01 ($P > 0.05$). In 2015, Zelić et al. found that 50.0% of the respondents purchased eggs of greater weight (L class 63-73 g), and as an advantage of eggs over other animal produce, 32.2% of the respondents cited easy and quick preparation of meals, and 30.1% the respondents emphasized the nutritional value of eggs. The respondents consider high cholesterol, shorter shelf life and the possibility of damage in transport to be the disadvantages of egg consumption. Missmer et al. (2002) reported that eggs contained 425 mg/100 g of cholesterol, while the acceptable daily intake for adults is 200 mg and for children 100 mg. Increased LDL cholesterol levels may influence the development of atherosclerosis, which is also stated by Shin et al. (2013). However, Bao et al. (2012) and Zhang et al. (2013) emphasize the importance of eggs in the diet because of their nutritional value, neglecting cholesterol content. Kralik et al., (2014) state that consumers choose to buy eggs depending on their weight: mostly M grades (44.7%), followed by L (38.96%), XL (12.57%) and S (3.70%) grades. From the aforementioned it follows that the price, which

depends on the weight class, is important to the respondents. The respondents rated the nutritional value of eggs with lower scores (M 3.95; F 3.93; $P > 0.05$). Such scores for the nutritional value of eggs may mean that the respondents of both sexes do not have sufficient knowledge of the aforementioned trait. Patil et al. (2005) also state in their research that consumers lack knowledge of eggs being a source of nutrients. It is the biological value of egg protein (Guter and Low, 2008; Sparks, 2006) that is higher than in other foodstuffs (cakes, biscuits, muffins, etc.) and which young people are happy to consume as part of their daily diet.

Table 1 Results of the analysis according to sex

Indicators	$\bar{x} \pm s$	$\bar{x} \pm s$	z
	Male	Female	
Egg quality			
Egg appearance and size	4.08±0.07	4.01±0.07	0.71
Stability (shelf life and the possibility to store eggs)	4.21±0.05	4.31±0.06	1.15
Health safety (shell cleanliness and product safety)	4.11±0.05	4.50±0.08	4.15**
Nutritional value (nutrients and calories)	3.95±0.08	3.93±0.07	0.28
Advantages of consuming eggs			
Affordable price	3.70±0.08	3.58±0.06	1.20
Longer freshness	3.18±0.07	±3.590.06	4.95**
Easy meal preparation	4.11±0.08	4.20±0.06	0.90
Variety of uses	4.07 ±0.07	4.29±0.06	2.20*
Disadvantages of consuming eggs			
Possibility of infection (presence of pathogens etc.)	3.60±0.08	3.42±0.09	1.50
Fat and cholesterol intake	2.86±0.08	2.93±0.07	0.06
Shell damage in transport	2.97±0.09	3.31±0.09	2.90**
Aversion to egg consumption	2.22±0.08	2.12±0.08	0.90

Note: $\bar{x} \pm s$ average, * $P < 0.05$; ** $P < 0.01$

Bejaei et al. (2011) point out that some consumers consider free-range eggs to have higher nutritional value than conventional eggs or that brown-shell eggs are more nutritious than white-shell eggs. The latter has not been scientifically proven. Kralik and Rebekić (2018) also concluded that the younger generation of the respondents lacked knowledge and education about the importance of eggs in the diet, especially eggs enriched with n-3 PUFA fatty acids. Information relating to human health must be verified, accurate and comprehensible to every consumer in order to attract their attention and influence their product choice (Čalić et al., 2011). The advantage of consuming eggs over other food products is seen by the respondents to be in the ease of preparing meals, as is evident from the scores (M 4.11; F 4.20; $P > 0.05$). The affordable price (M 3.70; F 3.58; $P > 0.05$) factor and longer egg freshness period (M 3.18; F 3.59; $P < 0.01$) follow. Kozelova et al. (2018) reported that among numerous factors, the most important factor for the respondents was the price of eggs (34.0%), and the frequency of egg consumption was 90.0% for the respondents. According to the Ordinance on Egg Quality (Official Gazette, 2006), the minimum shelf life with proper storage should not exceed 28 days. During egg storage, hydrolytic processes of nutrient degradation take place, which is affected by storage conditions (Bertechini and Mazzuco, 2013). Consumers' attitudes regarding drawbacks that may occur with egg consumption include the possibility of infection (presence of pathogens) and they differ between the sexes (M 3.60; F 3.42; $P > 0.05$).

Highly significant differences were found in the respondents' ratings of the problem of egg damage in transport (M 2.97; F 3.31; $P < 0.01$). The scores for aversion to eggs in both sexes were minimal and the differences are not statistically significant (M 2.22; F 2.12; $P > 0.05$). There were slight differences in the scores according to sex regarding fat and cholesterol intake through egg consumption (M 2.86; F 2.93; $P > 0.05$). Some consumers link egg consumption to an increase in plasma cholesterol content (Bertechini and Mazzuco, 2013), although some studies have demonstrated a positive effect on human health (Ruxton et al., 2010). According to the EBN (Egg Board Nutrition, 2012), an egg contains 213 mg of cholesterol, while through liver metabolism an adult produces 300 mg of

cholesterol daily. Some respondents' attitudes link egg consumption to coronary heart disease (CHD) risk. The results of research by Fernandez (2006) and Barraj et al. (2009) rebut these views, which is confirmed by the research of Shin et al. (2013). Mutungi et al. (2008) found no negative effect on human endothelial functions when consuming two eggs/day. Table 2 shows the estimated μ values, based on sample parameters, for male and female populations.

Table 2 Estimation of the mean value interval μ for factors influencing egg consumption by sex ($P < 0.05$)

Indicators	Confidence interval	
	Male	Female
Egg quality		
Egg appearance and size	3.94-4.22	3.87-4.15
Stability (shelf life and the possibility to store eggs)	4.11-4.30	4.19-4.43
Health safety (shell cleanliness and product safety)	4.01-4.21	4.35-4.65
Nutritional value (nutrients and calories)	3.80-4.10	3.73-4.08
Advantages of consuming eggs		
Affordable price	3.55-3.85	3.46-3.70
Longer freshness	3.04-3.32	3.44-3.94
Easy meal preparation	3.96-4.26	4.08-4.43
Variety of uses	3.93-4.21	4.17-4.41
Disadvantages of consuming eggs		
Possibility of infection (presence of pathogens etc.)	3.45-3.75	3.24-3.60
Fat and cholesterol intake	2.71-3.01	2.79-3.07
Shell damage in transport	2.79-3.15	3.13-3.49
Aversion to egg consumption	2.07-2.37	1.97-2.27

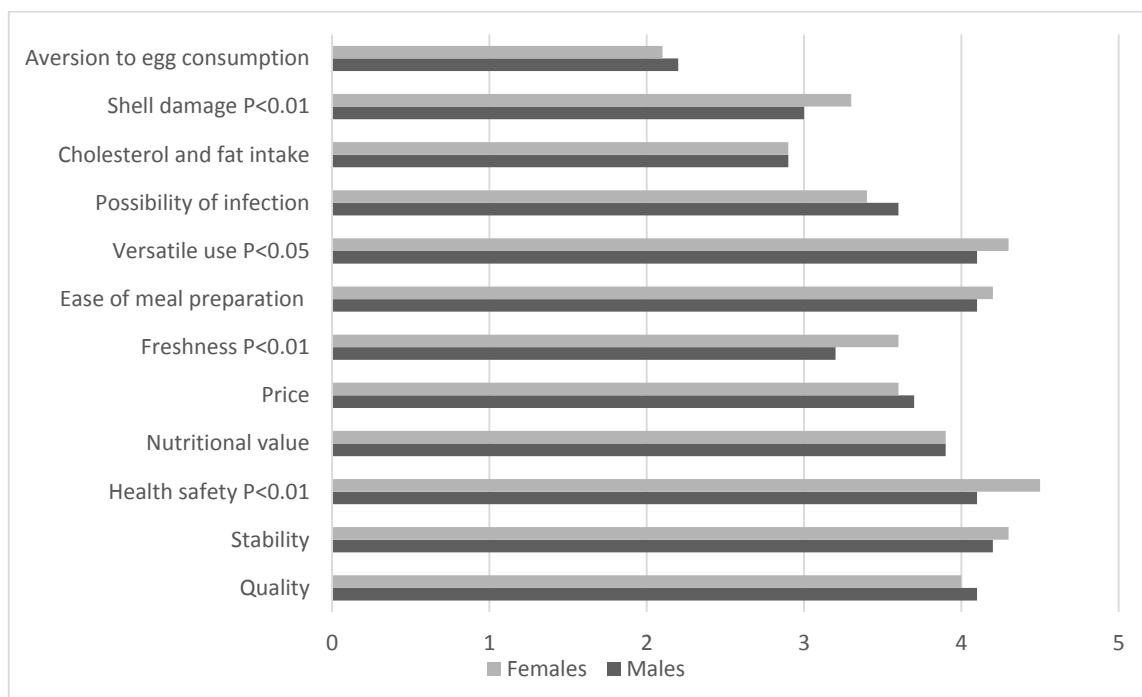


Figure 1 Scores of factors affecting egg consumption by sex

If the results of previous research (Kralik et al., 2017), which was conducted on the respondents in the statistical set up to 30 years (38.1% F and 52.2% M), 31-50 years (41.3 F and 36.3 M), and older than 51 years (F 20.6% and M 11.5%), are compared with the results of this study involving exclusively young respondents of both sexes (F 50.0% and M 50.0%), then it is evident that in both studies the respondents emphasized as especially significant the product safety (shell cleanliness; $P < 0.01$), as well as longer freshness of eggs ($P < 0.01$). Young respondents also highly rated the versatile use of eggs (M 4.07 : F 4.29) and the significance between the sexes was high ($P < 0.05$). No significant differences were found between sexes in the previous study in assessing egg consumption drawbacks. Diet is just one of the factors of an acceptable lifestyle which includes maintaining optimal weight, exercising, not smoking, reducing stress and other factors that contribute to define a healthy lifestyle (Hasler, 2002).

4 Conclusions

Based on the results of the study, it can be stated that the attitudes regarding egg quality indicators differ between males and females. Female respondents favour the stability feature (shelf-life and the possibility of storing eggs) more than male respondents do. For practical reasons, it is important for them to easily prepare their meals and to be able to use eggs in a variety of ways. Attitudes on the negative effects of eggs in human diet such as higher intake of cholesterol and fat in the human body and the possibility of damaging the eggshell were rated higher by female than male respondents. Shell cleanliness and product safety as well as an affordable price are more important to female respondents compared to male respondents. There is a low level of aversion to the consumption of eggs in both sexes. In terms of nutritional value of eggs, the scores by sex of the respondents did not differ significantly. Based on the statistical parameters of the samples, an estimation of μ in male and female populations was made.

References

- Bao, P.P., Shu, X.O., Zheng, Y., Cai, N., Ruan, Z.X., Kai, G., Yinghao, S., Yu-Tang, G., Wei, Z., Wei, L. (2012). Fruit, vegetable and animal intake and breast cancer risk by hormone receptor status. *Nutrition Cancer*, 64(6), 806-819.
- Barraj, L., Tran, N., Mink, P. (2009). A Comparison of Egg Consumption with Other Modifiable Coronary Heart Disease Lifestyle Risk Factors: A Relative Risk Apportionment Study. *Risk Analysis*, 29(3), 401-415.
- Bejaei, M., Wiseman, K., Cheng, K.M. (2011). Influences of demographic characteristics, attitudes, and preferences of consumers on table egg consumption in British Columbia, Canada. *Poultry Science*, 90(5), 1088-1095.
- Bertechini, A.G., Mazzucco, H. (2013). The table egg: A review. *Ciência e Agrotecnologia*, 37(2), 115-122.
- Bobetić, B. (2019). The Challenges and Expectations of the EU and Poultry Production in Croatia in the Medium-Term to 2030. *Proceedings of 13th Symposium "Poultry Days 2019" with International Participation*, May 8 – 11, 2019, (pp. 18-23). In Croatia.
- Čalić, S., Friganovic, E., Maleš, V., Mustapić, A. (2011). Functional food and consumers. *Practical Management*, 2(2), 51-57.
- EBN - Egg Board Nutrition (2019). *Egg composition*. Retrieved December 22, 2019 from <https://www.eggnutritioncenter.org/topics/nutrients-in-eggs/>, accessed
- Fernandez, M.L. (2006). Dietary cholesterol provided by eggs and plasma lipoproteins in healthy populations. *Current Opinion in Clinical Nutritional and Metabolic Care*, 9(1), 8-12.
- Garza, C., Rasmussen, K.M. (2000). Pregnancy and Lactation. In: Garrow, G.S., James, W.P.T., Ralph, A. (eds.) *Human Nutrition and Dietetics* (10th Ed.). Churchill Livingstone, London (pp. 437-448).
- Guter, M.M., Low, E.M. (2008). The British egg marketing board 1957-71-A reassessment. *Journal of Agricultural Economics*, 22(3), 247-265.
- Hasler, C.M. (2002). Functional foods: benefits, concerns and challenges - a position paper from the American Council on Science and Health. *Journal of Nutrition*, 132(12), 3772-3781.
- Kralik G., Škrtić Z., Kralik Z. (2012). *Biometrika u zootehnici*. Sveučilište J. J. Strossmayera u Osijeku (pp. 76-81, 91-93).
- Kralik, I., Kralik Z., Zelić, S. (2014). *Consumer preferences of table eggs*. *Proceedings of 49th Croatian and 9th International Agronomy Symposium*. 16-21 February 2014, Faculty of Agriculture University of Josip Juraj Strossmayer in Osijek (pp. 56-160). In Croatia.

Kralik, I., Zelić, A., Kralik, G. (2017). Influence of socio-demographic characteristics of examinees on egg quality awareness and consumption. *Interdisciplinary management research*. 19-21 May 2017, Josip Juraj Strossmayer University of Osijek, Faculty of Economics in Osijek (pp. 1193-1205). In Croatia.

Kralik, Z., Rebekic, A. (2018). Consumers preferences on the usefulness In and consumption of enriched products. *Krmiva*, 60(1), 17-24.

Lunven, P., Le Clement de St Marcq, C., Carnovale, E., Fratoni, A. (1973). Amino acid composition of hen`s egg. *British Journal of Nutrition*, 30(2), 189-194.

Missmer, S.A., Smith-Warner, S.A., Spiegelman, D., Yaun, S.S., Adami, H.O., Beeson, W.L. Van den Brandt, P.A., Fraser, G.E., Freudenheim, J.L., Goldbohm, R.A., Graham, S., Kushi, L.H., Miller, A.B., Potter, J.D., Rohan, T.E., Speizer, F.E., Toniolo, P., Willett, W.C., Wolk, A., Zeleniuch-Jacquotte, A., Hunter, D.J. (2002). Meat and diary food consumption in breast cancer: a pooled analysis of cohort studies. *International Journal of Epidemiology*, 31(1), 78-85.

Mutungu, G., Ratliff, J., Puglisi, M., Torres-Gonzalez, M., Vaishnav, U., Leite, J. O., Quann, E., Volek, J. S., Fernandez, M. L. (2008). Dietary cholesterol from eggs increases plasma HDL cholesterol in overweight men consuming a carbohydrate-restricted diet. *Journal of Nutrition*, 138(2), 272-276.

Patil, S.R., Cates, S., Morales, R. (2005). Consumer food safety knowledge, practices and demographic differences: Findings from a meta-analysis. *Journal of Food Protection*, 68(9), 1884-1894.

Official Gazette 115/2006, Ministry of Agriculture, Forestry and Water Management (2006). *Rulebook on egg quality*. Retrived December 22, 2019 from <https://www.poslovni-savjetnik.com/propisi/pravilnik-o-kakvoci-jaja-urednicki-procisceni-tekst-nn-br-1152006-692007-i-762008>

Ruxton, C.H.S., Derbyshire, E., Gibson, S. (2010). Nutritional properties and health benefits of eggs. *Nutrition and Food Science*, 40(3), 263-279.

Shin, J.Y., Xun, P., Nakamura, Y., He, K. (2013). Egg consumption in relation to cardiovascular disease risk and diabetes: Systematic review and meta-analysis. *American Journal of Clinical Nutrition*, 98(1), 146-159.

Sparks, N.H.C. (2006). The hen`s egg- is its role in human nutrition changing? *World`s Poultry Science Journal* 62(2), 308-315.

Zaheer, K. (2015). An Updated Review on Chicken Eggs: Production, Consumption, Management Aspects and Nutritional Benefits to Human Health. *Food and Nutrition Sciences* 6(13), 1208-1220.

Zelić, A., Kralik, Z., Kralik, I., Mahmutović, H. (2015). Consumer Preferences When Purchasing Table Eggs In The Area Of Tuzla City In Bosnia And Herzegovina. *Krmiva*, 57(2), 75-79.

Zhang, B., X., Pan, M., X., Wang, L., Mo, X.F., Chen, Y.N., Lin, F.Y., Ho, S.C. (2013). Choline and betaine intake is inversely associated with breast cancer risk: a two-stage case-control study in China. *Cancer Science*, 104(2), 250-258.