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Estimation of Per Capita Consumption of Chicken Egg and Attitude of Tehrani Families towards Factors Influencing Egg Consumption in 2018

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ABSTRACT

Background: Eggs are of the few naturally occurring foods that meet the needs of human body in a balanced manner. The present study was conducted to determine the rate of egg per capita consumption in Tehran city in 2018. **Methods:** The present cross-sectional study was conducted on 4.213 heads of families living in 22 regions of Tehran. Selected randomly using multistage cluster sampling method. The research data were collected through a researcher-made questionnaire completed by interviews. **Results:** Mean egg consumption per person was 2.58 per week and 134 per capita (95%CI; 134-137). Moreover, 39.59% of the participants believed that brown-shelled eggs had a higher nutritional value and 61.99% were unaware about the presence of omega 3-enriched eggs. Concerning the participants' attitudes towards egg consumption effective factors, the 'recommendations of physicians and nutritionists to use eggs' and knowing about harmlessness of cholesterol found in eggs' received the mean highest scores of 3.47 and 3.31, respectively. **Conclusion:** Per capita consumption of eggs among families in Tehran was much lower than the recommended standards. Physicians and nutritionists are recommended to try to raise the community awareness about the nutritional value and correct the misconceptions about egg cholesterol.

Keywords: Egg; Per capita; Cholesterol; Attitude; Tehran

Introduction

Eggs are a high-consumption food product (Yannakopoulos *et al.*, 2005) and play an important role in human nutrition with a high biological value since they are rich in protein, vitamins, and minerals (Constant, 2004, Herron and Fernandez, 2004). Eggs are rich sources of unsaturated fatty acids, essential amino acids, folic acid and vitamins B, D, E, choline (Mayurasakorn *et al.*, 2008), vitamin B12 (Koebnick *et al.*, 2004), and arginine. Consumption of two large eggs provides 10%, 44%, and 25.25% of the recommended values of folic acid, vitamin E, and omega-3 fatty acids in pregnant women (Katz *et al.*, 2005).

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Since egg yolks are rich in docosahexaenoic acid (DHA) and iron, their consumption plays an important role in preventing iron deficiency among infants and children (Makrides *et al.*, 2002). Studies indicated that the eggs may have anti-atherosclerotic effects due to their antioxidant enzymes (Jefarnejad and Kazemi, 2006).

In spite of the benefits of this food product, its fat causes a concern in consumers (Yannakopoulos *et al.*, 2005). In recent years, some misconceptions about the increased risk of coronary artery disease due to egg consumption have raised concerns about use of this product and has led to a negative attitude towards egg consumption.

Cholesterol intake from foods is less likely to increase the risk of heart disease than its reception from saturated fats. Despite the reports showing that egg consumption increases LDL-C, reduces HDL-C, and increases the risk of coronary artery disease (Katz *et al.*, 2005), some studies indicated that egg consumption had no association with blood cholesterol and risk of coronary artery disease (Liu, 2018, Mayurasakorn *et al.*, 2008). According to the results of these studies, egg consumption alone cannot increase the risk of cholesterol. Daily use of an egg does not increase the level of dangerous cholesterol (Alexander *et al.*, 2016, Park *et al.*, 2018, Rong *et al.*, 2013).

Direct and indirect per capita consumption of eggs in Iran is 192 per person, while it is over 300 in China, Mexico, and Japan, 248 in Denmark, 252 in the United States, and more than 220 in Sweden. As shows in **Table 1**, The average egg consumption per capita is 180 globally (International Egg Commission, 2018a).

Despite the high potential of egg production in Iran (production rate of 7887 tons in 2017), the per capita consumption of eggs is low; Iranian people mostly consume eggs in food products (Ebadzade *et al.*, 2017). Only a small number of eggs is consumed directly by the family. Given the high nutritional value of eggs, they can compete with a large number of rich nutrients.

In recent years, enrichment of chicken diet with Omega-3 has led to an increase in national production of omega 3-enriched eggs, which prevents cardiovascular diseases (Mokhtarian *et al.*, 2008).

Among various organizations that oversee the production of poultry products globally, the International Egg Commission (IEC) is the only egg production and processing organization operating in the world. Currently, 42.5% of the IEC members are from the European continent, 25% from the Americas, 20% from the Asian continent, 7.5% from the African continent, and 5% from the oceanic continent. Iran has become a member of the commission since 2001. The second Friday of October was proclaimed as the World Egg Day. The motto of the World Egg Day 2018 was "Health for All, Eggs for All", with the goal of encouraging people to eat more eggs (International Egg Commission, 2018b).

Considering the inevitable necessity, people should change their attitudes regarding the importance of eggs in feeding the family. The communities and experts should change their beliefs about egg cholesterol. To this end, educational and promotional campaigns are required throughout the world, including Iran. Therefore, the current study was conducted to determine the rate of egg consumption per capita and to investigate attitudes of families in Tehran towards the factors affecting egg consumption in 2018.

Materials and Methods

Study design and participants: Target population of the present cross-sectional study included all citizens of Tehran covered by 22 districts. Considering the large sample size of the population and the unknown variance of the studied variable in the population, Morgan table was used to calculate the sample size. The sample size for each region was estimated as 348 people with a total of 8448 people. Considering that the target group included heads of the families and the average family size was two in 4224 families, a total of 4213 participants completed the questionnaires. A randomized sample consisting of 4224 heads of families living in 22

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districts of Tehran in 2018 was selected through multistage cluster sampling. The inclusion criteria were the families living in 22 districts of Tehran in 2018 and the exclusion criteria was unwillingness to participate in the study.

Measurements: Data were collected through a three- part researcher-made questionnaire, including demographic characteristics of the family, number of egg consumption, and attitude questions about the factors influencing egg consumption. The questionnaires were completed through face-to-face interviews. To collect the data, 10 interviewers were trained for interviewing and completing the questionnaires prior to the study. The heads of families who were not willing to participate in the study were excluded and sampling continued from the nearby family. The participants' attitude score was calculated on a five-point Likert scale. The content validity ratio (CVR) and content validity index (CVI) were calculated to assess the validity of the questionnaire using the experts' opinion. The questionnaire's questions were reviewed and verified in terms of subject relevance, clarity, literature simplicity, and necessity. Reliability of the questionnaire was confirmed by calculating the Cronbach's alpha (0.713).

Data analysis: The data were analyzed by Stata12 software using descriptive statistics including central tendency and dispersion indexes and frequency charts.

Ethical consideration: This study was conducted in compliance with the Declaration of Helsinki ethical principles for medical research involving human participants.

Results

In total, out of 4213 families complete the questionnaires, the mean family size was 3.88 ± 0.92 and the highest frequency was a four-member families with 2148 families (50.98%) and three-member families with 1108 families (26.29%). In the families surveyed, the mean number of people with academic education was 1.32 ± 1.11, so that the highest number of people with academic education was 2 with 1402 families (33.27%).

The mean number of egg consumers in Families studied was 3.63 ± 1.06 (**Figure 1**). The mean number of eggs consumed per week was 9.37 ± 6.64 eggs per family. The mean number of eggs consumed per person in a week was 2.58 eggs, which was calculated by dividing 9.37 by the average number of egg consumers (3.63). The mean per capita consumption of eggs per person was estimated to be 134 eggs (95% CI; 134-137) taking 52 weeks in one year. The highest average egg consumption/person per week was in region 1 (4.20 eggs per week), while the lowest rate was in region 10 (1.40 eggs per week; **Figure 2**).

In terms of egg type, 1499 families (35.58%) purchased the eggs in a 30-egg box, 1217 families (28.88%) bought the eggs in bulk, and the rest participants get eggs in packaged containers. Moreover, 2527 families (59.98%) supplied the eggs from a nearby supermarket, 1027 families (24.77%) from chain stores, and the rest from the fruit and vegetable fields and other places. In addition, 3096 (73.48%) heads of families noted that egg consumption did not depend on the season. Concerning consumption of eggs and the risk of cardiovascular diseases, hypertension, obesity, and liver cirrhosis, 2456 (58.29%) of the participants stated that they would not eat eggs in these conditions. In this case, the mean egg consumption per week per person reduced to 1.78 ± 3.8 (93 eggs per year). Furthermore, 3008 (71.39%) heads of families reported that the price of eggs did not affect its purchase power in comparison with other animal proteins. On the other hand, 1668 people (39.59%) believed that brown-shelled eggs had a higher nutritional value and 2612 (61.99%) participants were unaware of the presence of omega 3-enriched eggs.

Concerning the individuals' attitudes towards the factors affecting egg consumption, 'recommendations provided by physicians and nutritionists to use eggs' and 'participants' knowledge about the harmlessness of cholesterol found in eggs' received the highest scores with mean scores of 3.47 and 3.31, respectively. In this

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regard, 'family income' and 'advertisement on egg consumption by individuals, such as artists' showed the lowest mean scores of 2.51 and 2.52, respectively (**Table 2**).

Table 1. Ranking and per capita consumption of eggs *

Rank	Country	Per capita consumption	Rank	Country	Per capita consumption
1	Mexico	357	22	Slovakia	210
2	Japan	330	23	Turkey	200
3	Malaysia	315	24	Finland	198
4	Ukraine	314	25	Peru	198
5	Russia	291	26	Netherlands	195
6	Argentina	266	27	Iran	192
7	Columbia	252	28	Brazil	192
8	America	252	29	Emirates	190
9	Denmark	248	30	England	189
10	China	242	31	Belgium	182
11	Czech Republic	242	32	Swiss	174
12	Austria	234	33	Ireland	169
13	Canada	233	34	Chile	166
14	Germany	233	35	Poland	160
15	Australia	226	36	Cyprus	150
16	New Zealand	225	37	Guatemala	148
17	Spain	225	38	South Africa	143
18	France	221	39	Portugal	142
19	Italy	221	40	Greece	127
20	Sweden	220	41	India	65
21	Hungary	215			

*International Egg Commission- IEC (2016)

Table 2. Frequency distribution and mean score of the participants' attitudes towards the factors affecting egg consumption

Factors	Ineffective	Low	Moderate	High	Very high	Mean score of items out of 5
	N (%)	N (%)	N (%)	N (%)	N (%)	
Prices of eggs	1281(30.41)	720(17.09)	1190(28.25)	654(15.52)	368(8.73)	2.53
Prices of other protein products	1064(25.26)	836(19.84)	1097(20.04)	851(20.20)	365(8.66)	2.66
Family income	1332(31.62)	745(17.68)	1186(28.15)	601(14.27)	349(8.28)	2.51
Availability of eggs	1052(24.97)	969(16.52)	1237(29.36)	857(20.34)	371(8.81)	2.73
Variability in production of eggs	794(18.85)	787(17.68)	1409(33.44)	765(20.53)	358(8.50)	2.79
Public awareness of the nutritional value of eggs	502(11.92)	556(13.20)	4041(24.71)	1304(35.95)	810(19.23)	3.28
Appearance of the egg (color, shell, size, etc.)	981(23.29)	859(20.39)	1042(24.73)	773(18.35)	558(13.24)	2.76
Advice from doctors and nutritionists	344(8.17)	481(11.42)	1095(25.99)	1415(33.59)	878(20.84)	3.47
Advertising on TV and radio	839(19.91)	982(22.31)	987(23.43)	914(21.69)	491(11.65)	2.79
Distribution of educational posters and magazines	987(23.43)	1003(23.81)	1038(24.64)	787(18.68)	398(9.45)	2.68

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Table 2. Frequency distribution and mean score of the participants' attitudes towards the factors affecting egg consumption

Factors	Ineffective	Low	Moderate	High	Very high	Mean score of items out of 5
	N (%)	N (%)	N (%)	N (%)	N (%)	
Training in nutritional value of eggs in schools	572(13.58)	789(17.83)	989(23.47)	1068(25.35)	795(18.87)	3.12
Advertising on egg consumption by popular people such as artists	1190(28.25)	1045(24.80)	959(22.76)	638(15.14)	381(9.04)	2.52
Knowledge of harmlessness of egg cholesterol	434(10.30)	665(15.78)	1052(24.97)	1202(28.53)	890(20.41)	3.31
Variations in the supply of eggs (such as new packaging, etc.)	1059(25.41)	870(20.65)	1170(27.77)	681(16.16)	433(10.98)	2.65

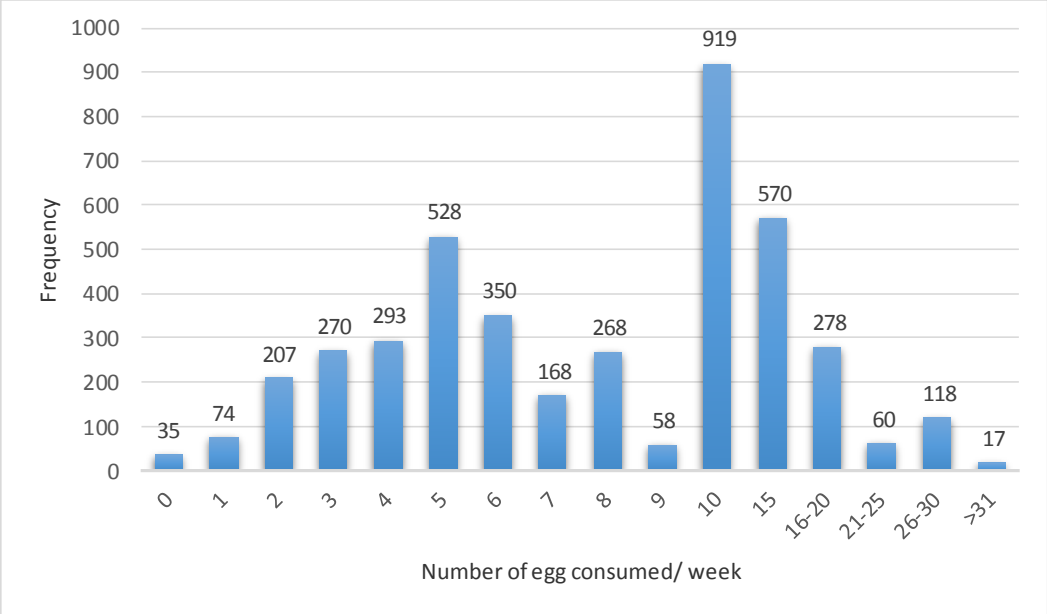

Figure 1. Frequency distribution of egg consumption per week among families of Tehran in 2018

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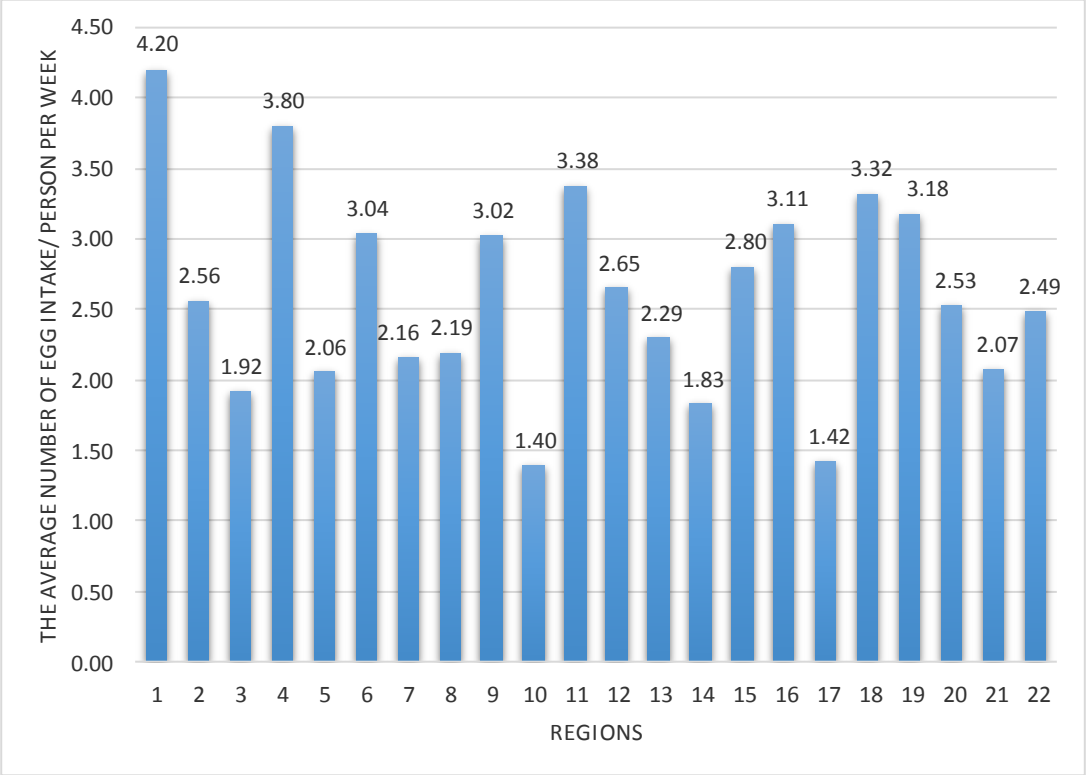

Figure 2. Average egg consumption/person per week in 22 regions of Tehran in 2018

Discussion

The results of this study showed that the mean egg consumption per person was 2.58 eggs per week and the mean per capita consumption of eggs per person was 134 in Tehran (95% CI; 134-137). According to IEC 2016, Iran with 192 eggs per capita is in the 27th place with regard to egg consumption. According to this ranking, Mexico with a per capita consumption of 357 eggs is in the first place and India with 65 eggs per capita is the last place in IEC memberships (International Egg Commission, 2018a, b). The difference between the estimated egg consumption per capita in the current study and the country mean declared on the basis of the IEC can be due to the fact that direct egg consumption was investigated in the administered questionnaire and its indirect consumption in food and sweets was not monitored.

In recent years, various studies reported an increase in serum cholesterol levels after eating eggs. Recent studies have shown that taking an ordinary egg can increase HDL-C and reduce the ratio of triglycerides to HDL-C (Alexander *et al.*, 2016, Jefarnejad and Kazemi, 2006). Other studies did not show any association between the daily consumption of an egg and the risk of coronary heart diseases (Fernandez, 2006, Kritchevsky and Kritchevsky, 2000, Melanson, 2007). No significant difference was found in the risk of heart disease in people who consumed six eggs per week than those who ate 1 egg (Qureshi *et al.*, 2006). The results of a 14-year cohort study on 7002 adults in Korea showed that the risk of type II diabetes was 40% lower in men who consumed 2-4 eggs per week than those who consumed 0-1 egg per week (Lee and Kim, 2018).

Therefore, the motto of "Every healthy person, an egg per day" has been used in recent years by many developed countries, IEC, and Iran to promote health as recommended by Ministry of Health and Medical Education.

According to the findings, one-third of families

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believed that brown-shelled eggs had a higher level of nutritional value than white-shelled eggs, while no difference was observed between white and brown eggs in this regard. Brown-shelled eggs come from chicken with red earlobes and white-shelled eggs come from chickens with white earlobes, but their nutritional nature and value do not differ. However, there may be a different market for them and their market acceptance may be different, which requires education to society.

This study showed that a high percentage of participants were unaware of the presence of omega 3-enriched eggs. Fish, chicken, eggs, canola oil, soy (Gao and Charter, 2000), and almonds (Iwamoto *et al.*, 2002) are the main sources of omega-3 fatty acids. Omega 3-enriched eggs are obtained by changing the diet of laying hens and using a vegetarian diet containing flax, fish, soya, and palm oil. The amounts of omega-3 fatty acids in such eggs are 6 times higher than normal eggs (Ansari *et al.*, 2010, Raes *et al.*, 2002, Yannakopoulos *et al.*, 2005). The omega-3 fatty acids are found in the group of unsaturated fatty acids. Various studies indicated the benefits of these types of fatty acids in reducing the risks of cardiovascular disease (Holub, 2002, Sacks and Campos, 2006, Wang *et al.*, 2006), modulating inflammatory disorders (Farooqui *et al.*, 2007), and preventing the disorders such as breast cancer (Chiu *et al.*, 2004), bipolar disorder (Frangou *et al.*, 2006), Alzheimer's disease (Bourre, 2004), autoimmune disorders (Shahidi and Miraliakbari, 2005), and genetic disorders in the lipid metabolism (Richardson, 2006).

Mokhtarian et al. in Iran investigated the effect of using omega 3-enriched eggs on lipids and hypertension and showed that these eggs could increase HDL-C levels and reduce triglyceride level and hypertension ($P < 0.05$) (Mokhtarian *et al.*, 2008). Therefore, community education is needed to raise awareness about the omega 3-enriched eggs through training sessions, distribution of posters, and educational magazines.

Concerning the participants' attitudes towards egg consumption effective factors, the 'recommendations of physicians and nutritionists to use eggs', knowing about harmlessness of cholesterol found in eggs', and

increased public awareness about nutritional value of eggs had the highest scores about factors affecting egg consumption in the community. Therefore, we need to raise the public's awareness about benefits of eggs as an inexpensive source of protein compared to meat, to correct the beliefs about egg cholesterol, and to provide families with the required information about how well the eggs are bought, stored, and consumed.

On the other hand, the total egg consumption rate should be limited to three eggs per week in people with diabetes, hypertension, cardiovascular disease, obesity, and liver disease. This restriction is limited to the consumption of egg yolks. These patients should avoid eating fatty foods combined with egg and should use the oil-free egg cook method (Mahan and Escott-Stump, 2004).

Regarding the strengths of this study, it can be mentioned that this research was the first study over per capita consumption of eggs in Iranian families. Our findings can be useful for public health nutrition planners.

Given the limitations of this study, we investigated the egg consumption rate in families based on a self-report questionnaire. The items were answered based on the memory of individuals, which could be limited and inaccurate due to forgetfulness. Moreover, the direct consumption of eggs was investigated in this study, which could be affected by overestimation or underestimation

Conclusion

Based on the results of this study, the mean per capita consumption of eggs among families living in 22 districts of Tehran in 2018 was 134 eggs (95% CI; 134-137). According to the heads of families in Tehran, the 'recommendations of physicians and nutritionists to use eggs', knowing about harmlessness of cholesterol found in eggs',

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and 'increased public awareness about nutritional value of eggs' had the highest scores about factors affecting egg consumption in the community. Due to some misconceptions such as increased risk of coronary artery diseases following egg consumption over the past decades, the consumption of this product has been associated with doubt and eggs did not have a good place in the food basket of the community. Therefore, it is proposed to raise the public's awareness by holding educational sessions by physicians and nutritionists at the community level, especially for target groups of mothers and heads of families.

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Authors' Contributions

Rahmanian V, Talakesh SF, and Mashayekhi S drafted and prepared the manuscript. Bahonar A performed the statistical analysis. All authors had equal roles in collecting data as well as designing and conducting the study.

Conflict and interests

There is no conflict of interest in this study.

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