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Assessment of Consumer Preferences and Perceptions on Egg Consumption via Correspondence Analysis

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A B S T R A C T

Egg is one of the most important nutritive foods in human diets. Most nutritionists recommend the consumption of at least one egg per day during the age of development. The aim of this study was to determine consumer preferences on egg consumption according to demographic and health conditions in Turkey. For this reason, a questionnaire with 12 questions was applied to voluntary 814 participants. Relationship between demographic data and questions were evaluated using Correspondence Analysis. Results indicated that consumers' age was very effective on egg consumption frequency and consumed egg types. Similar results were observed for consumers' income level. On the other hand, education level of consumers was only effective on consumed egg types, as expected. It was found that disorders restricted egg consumption frequency and affected consumed egg types. In conclusion, it was determined that sources from which the participants look for information about eggs differed according to their educational background. The present study provides information about relation between egg consumption and demographic data. Results of the study are valuable for the local and industrial egg producers for understanding consumer-purchasing decision on egg consumption.

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Yumurta Tüketimine İlişkin Tüketici Tercihlerinin ve Algılarının Correspondence Analiz ile Değerlendirilmesi

M A K A L E B İ L G İ S İ

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Ö Z

Yumurta, insan diyetlerindeki en önemli besleyici gıdalardan biridir. Çoğu beslenme uzmanı, gelişim çağında günde en az bir yumurta tüketimini önermektedir. Bu çalışmanın amacı, Türkiye'deki demografik ve sağlık koşullarına göre yumurta tüketimine ilişkin tüketici tercihlerini belirlemektir. Bu amaçla gönüllü 814 katılımcıya 12 sorudan oluşan bir anket uygulanmıştır. Demografik veriler ve sorular arasındaki ilişki Correspondence Analizi kullanılarak değerlendirilmiştir. Sonuçlar tüketicilerin yaşının yumurta tüketim sıklığı ve tüketilen yumurta türleri üzerinde oldukça etkili olduğunu göstermiştir. Benzer sonuçlar tüketicilerin gelir düzeyi için de gözlenmiştir. Öte yandan, tüketicilerin eğitim düzeyi beklendiği gibi sadece tüketilen yumurta türleri üzerinde etkili olmuştur. Hastalıkların yumurta tüketim sıklığını kısıtladığı ve tüketilen yumurta türlerini etkilediği bulunmuştur. Sonuç olarak, katılımcıların yumurtalar hakkında bilgi aradıkları kaynakların eğitim geçmişlerine göre farklılık gösterdiği belirlenmiştir. Bu çalışma, yumurta tüketimi ile demografik veriler arasındaki ilişki hakkında bilgi vermektedir. Çalışmanın sonuçları, yerel ve endüstriyel yumurta üreticileri için, yumurta tüketimine ilişkin tüketicilerin algı ve kararlarını anlamak açısından değerlidir.

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Introduction

Egg is not only one of the most valuable food in human diet but also it is used in many food formulations due to its nutritional and functional effects. The total world egg production were 800.885.59 tonnes, this value in European Union were 7.144.416 least developed countries – 1.888.211 and low-income food deficit countries – 8.301.831 tonnes (FAOSTAT, 2019). The world export and import values of eggs were 2.179.205 tonnes (3.532.450.000 US$) and 2.137.229 (3.587.048.000 US$) according to the (FAOSTAT, 2019) data, respectively. In Turkey, the total egg production 1.205. 075 tonnes while import and export values were 1.714 tonnes (2.2547.000 US$) and 348.208 (375.790.000 US$), respectively (FAOSTAT, 2019). According to 2018 data, egg consumption was 224 egg/person and egg production was 295 egg/person in Turkey (EPA, 2018). The stats given above was showed that egg was consumed in not only developed but also underdeveloped countries due to easy find, cheap and nutritious.

Egg consists of approximately 75% water, 12% proteins, 12% lipids and small amount of carbohydrates and minerals (Yamamoto et al., 1997). Additionally, egg protein is called "exemplary protein source" due to its high digestibility. Besides, egg protein contains all of the essential amino acids and non-essential amino acids with balanced rate. Egg is also regarded as a good source of bioactive compounds such as linoleic acid, phosvitin, vitamin A, vitamin D3, riboflavin, vitamin B12, vitamin E, thiamine, folic acid, phosphorus, magnesium, calcium, copper, zinc, iodine and iron (Lesnierowski and Stangierski, 2018; Sunwoo and Gujral, 2015). The amount of cholesterol in 58 g hens egg is approximately 213 mg hence; eggs are regarded as major source of dietary cholesterol (Ronzio, 2003).

Despite the rich nutrient content mentioned above, some of the factors are limits egg consumption or affects consumer preferences, such as age, lifestyle, income level, education level, knowledge level, animal welfare, price, health concerns, etc. In literature, reported that price is the most important attribute for Spanish consumers followed by the hens' feed and their rearing conditions (Mesías et al., 2011). In Turkey, reported that 51.6% of families purchased eggs from supermarkets and 48.7% of respondent paid attention on production date when purchasing eggs. In the same study was reported that 86% of respondents could pay higher prices for organic eggs (Demircan et al., 2018). In another study reported that the most effective purchasing factors on consumers was egg packaging and egg colour at a rate of 67.46% and 81.20%, respectively (Mızrak et al., 2012).

Another important factor affecting egg consumption is high cholesterol content of egg hence; most people avoid consuming eggs or restrict egg consumption (William et al., 2017). Recently, researches proved that relation between disorders and human diets showed high correlation. From these disorders gastrointestinal disorders, obesity, diabetes and cardiovascular disorders are the leading ones (Ballesteros et al., 2015; Eckel et al., 2014; Geiker et al., 2018; Soliman, 2018).

The goal of this study is to measure the preferences, trend and level of knowledge of the Turkish consumers on egg consumption.

Materials and Methods

Questionnaire

Questionnaire containing 12 questions was prepared. The questionnaire was composed regarding demographic data (Q1-Q5), sports/activities (Q6), preferences and consumption of egg (Q8-Q10), disorders (Q11) and information resources (Q12) of consumers. Respondents can check multiple boxes between the Q7 and Q11. 814 volunteer egg consumers at living in different parts of Turkey responded in the survey during May to September 2019. The questionnaire and information about the participants are given in Table 1. This study was approved by Çanakkale Onsekiz Mart University Clinical Research Ethics Committee (App. No: 2019-11). After approval, the questionnaire was applied face to face and using with online Google Forms® and link was announced by social media accounts and sent by email lists.

Data Analysis

The data obtained from the survey was evaluated by using SPSS v.23.0 (IBM Corp.) statistical software. Correspondence Analysis (CA) was performed to explain relation among demographic data, egg consumption and factors affecting consumption. Correspondence analysis is one of the statistical technique that provides graphical presentation of cross tabulations. Correspondence analysis is appropriate statistical technique applied for the categorical data and explain relationship between categories in a concise way. Results were displayed in detail with plot in a multidimensional space, where related or similar categories are shown closer to each other (Aday and Yener, 2014; Greenacre and Blasius, 2006).

Result and Discussion

The age, gender, marital status, education level, monthly income levels, number of children and sports frequency of the participants are given in Table 1. As seen from Table 1, 20.5% of the participants ranged between 18-25, 24.6% - 26-35, 21.1% - 36-45, 19.7% - 45-55 and 14.1% were 55+ age. 50.5% of the participants were male and 49.5% participants were female. 61.5% of the participants were married, while 38.5% were single. Considering the educational level of the participants, 54% of the participants had at least a university diploma (university, master and PhD.) and 46% graduated from high school and primary school. 60% of the participants had at least one child, while 40% of the participants had no child. Additionally, the income of 52% of the participants was 2.500₺ and above, while 48% of participants earned below 2.500₺. The number of the participants without children were 327 (40.2%), participant with one children - 143 (17.6%), two children - 261 (32.1%), three children- 65 (8%) and 4+ children - 18 (2.2%). It was determined that 8.6% of participants were doing sport or activities every day, 23.3% - several times per week, 19.8% - once a week while 48% participants were never doing sports or activities.

Table 1. Demographic Data of Respondents and Consumption Practices of Eggs.

Questions	Practice	Frequency	
		n	%
Q1- Age?	☐18-25	167	20.5
	☐26-35	200	24.6
	☐36-45	172	21.1
	☐46-55	160	19.7
	☐55+	115	14.1
Q2- Gender?	☐Female	411	50.5
	☐Male	403	49.5
Q3- Education level?	☐Primary	170	20.9
	☐Senior	201	24.7
	☐University	370	45.5
	☐Master	56	6.9
	☐Ph.D.	17	2.1
Q4- Marital status?	☐Married	501	61.5
	☐Single	313	38.5
Q5- How many children do you have?	☐0	327	40.2
	☐1	143	17.6
	☐2	261	32.1
	☐3	65	8.0
	☐4+	18	2.2
Q6- Monthly income level? **	☐0-1500	212	26.0
	☐1501-2500	178	21.9
	☐2501-3500	135	16.6
	☐3501-5000	148	18.2
	☐5000+	141	17.3
Q7- What is your frequency of doing sports / activities?	☐Everyday	70	8.6
	☐Several times per week	190	23.3
	☐Once a week	161	19.8
	☐Never	391	48.0
Q8- What is the frequency of egg consumption?	☐Once a day	260	31.9
	☐Several times per day	118	14.5
	☐Once a week	121	14.9
	☐Several times per week	288	35.4
	☐Never	27	3.3
Q9- What kind of eggs do you prefer? *	☐Free-Range	166	20.5
	☐Organic	187	23.1
	☐Industrial	108	13.3
	☐Village	285	35.2
	☐Enriched	14	1.7
Q10- What attributes do you pay attention to when purchasing eggs? *	☐Price	245	30.3
	☐Mark	194	20.4
	☐Dimension	129	15.9
	☐Colour	96	11.9
	☐Shape	49	6.1
Q11- Do you have any known disorders? *	☐Cholesterol	35	4.3
	☐Cardio-vascular	41	5.0
	☐Diabetes	35	4.3
	☐Obesity	8	1.0
	☐None	603	74.1
	☐Other	61	7.5
Q12- Which resources do you get information about relationship between food and health? *	☐Television	142	17.5
	☐Internet	540	66.4
	☐Newspaper	40	4.9
	☐Journal	10	1.2
	☐Book	19	2.3

*The values shows only consumers marking a single option, **Turkish Lira

The effects of gender and marital status on egg consumption, purchasing factors and the type of eggs consumed are given in Figure 1. Gender was significantly effective on egg consumption frequency (P<0.05). The egg consumption frequency of male and female participants were commonly "once a day" and "several times a week" (Figure 1a). There was no statistically significant relationship among gender with egg types and egg purchasing factors (P>0.05). For the female respondents purchasing factors were "price", "dimension" and "colour". In addition, female respondent preferred "enhanced" type of eggs while male respondents preferred "organic" (Figure 1b). Nevertheless, the purchasing factors of male respondents were mostly "shape" and "trademark" (Figure 1c). Marital status was significantly influenced on egg consumption frequency, preferred egg types and egg purchasing factors (P<0.05). Similar to gender results the egg consumption frequency of married and single participants were mostly "once a day" and "several times a week" (Figure 1d). Results showed that married people mostly preferred "village" type of eggs while single people preferred "organic" eggs (Figure 1e). In literature data, reported more than 80% of Turkish consumers can pay much more for organic eggs (Mizrak et al., 2012).

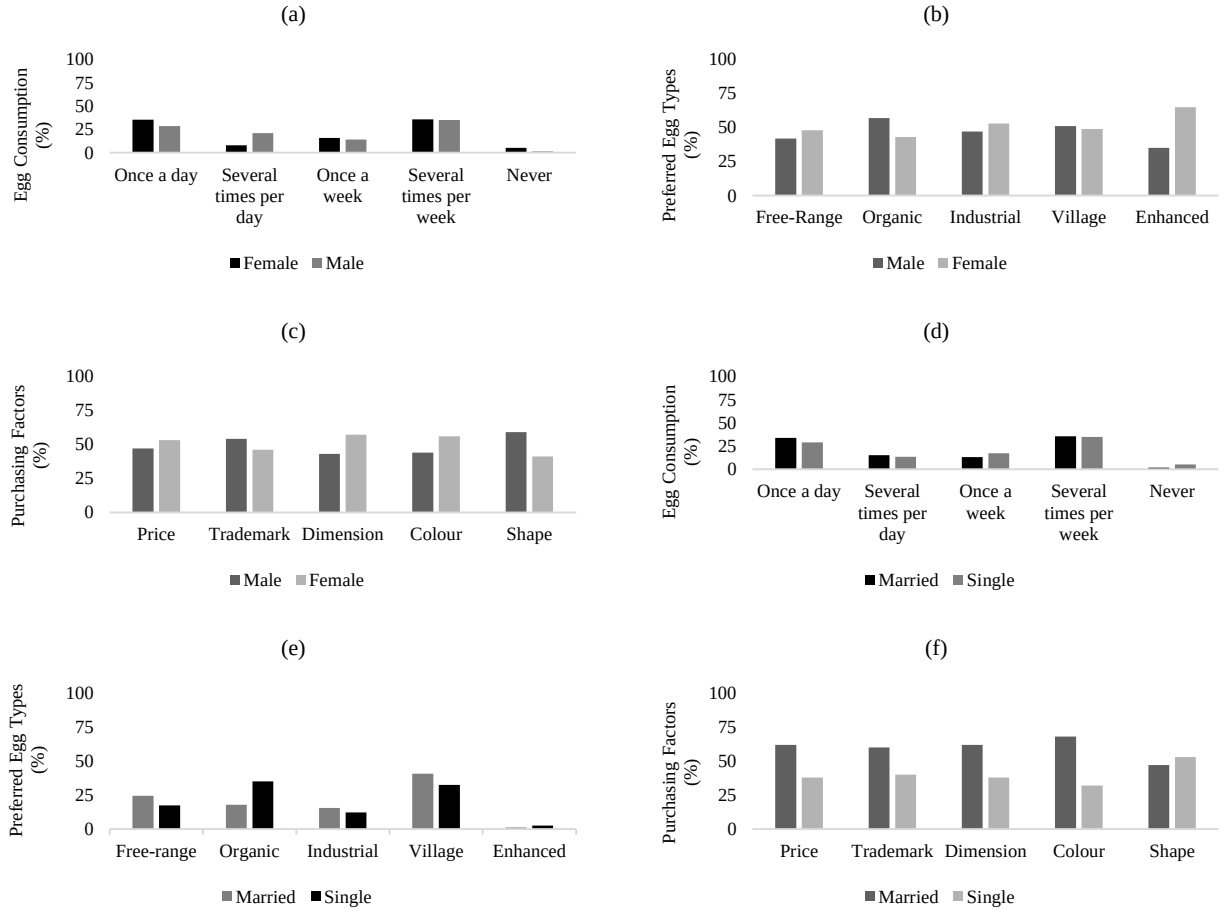

Figure 1. Egg Consumption Frequency (a), Preferred Egg Types (b), Purchasing Factors (c) of Respondents According to Gender and Relationship Among The Egg Consumption Frequency (d), Preferred Egg Types (e), Purchasing Factors (f) and Marital Status.

The purchasing factors for married respondents were colour>price>dimension>trademark>shape of eggs while male respondents were shape > trademark > dimension > price > colour (Figure 1f).

Figure 2a shows relation between age (Q1) and egg consumption frequency (Q8). The egg consumption frequency of respondents at 18-25 age were "once a week", 26-35 age - "once a day" and 46-55 age - "several times a week". Additionally, a remarkable result was that egg consumption frequency of 55+ age people was "several times per day". Only 27 participants out of 814 stated that they never consumed eggs.

In Figure 2b, the preferences of consumers on egg types in regard to age were displayed. Generally, 18-25 aged respondents preferred "organic" eggs, 26-35 ages consumed mostly "industrial" eggs but also "free range" and "enhanced" egg types. Consumers older than 55 preferred "village" eggs, obtained from hens fed in villages. Moreover, "trademark" and "dimension (size)" were the most important attributes for consumers of 18-25 and 26-35 age. For consumers of 36-45 and 46-55 age, the most important egg attribute was "price" (Figure 2c). On the other hand, egg "shape" and "colour" attributes were the most important for the consumers older than 55 years of age. As a result, consumer age was a very

effective factor on egg consumption, preferred egg types and egg purchasing factors of consumers (P<0.05). One of the previous research reported only 26 out of 448 participants never consumed eggs. Differ from our results, the older participants consumed less frequently eggs in Accra metropolitan area (Ayim-Akonor and Akonor, 2014). These differences can be explained with different eating habits, life style and socio-economic factors.

In the same study reported that similar to our findings, the age was more effective on egg consumption than other demographic data and 47.6% of the respondents liked eggs from locally-bred chicken (Ayim-Akonor and Akonor, 2014). In a recent study it was reported that the egg consumption frequency of age of under 21 was everyday (3.10%), 3-5 times (22.90%), 1-2 times (64.60%) and never (9.40%) (Giannetto et al., 2016). In the same study, the researchers reported the egg consumption frequency for consumers of age of 25 was everyday (2.40%), 3-5 times (18.30%), 1-2 times (68.30%) and never (11.00%) (Giannetto et al., 2016).

Another factor affecting the frequency of egg consumption and preferred egg types was number of children (P<0.05). Families with 1, 2 and 3 children and without children consumed eggs more than families with more than four children (Figure 3a). Particularly, families with 1, 2 and 4+ children preferred "village" type of eggs and families without children preferred "organic" eggs (Figure 3b). Older consumers and consumers with families mostly preferred cheaper eggs such as commercial rural eggs (Boxall et al., 2007).

Literature finding are close to our findings. There were no statistically significant relationships between number of children and egg purchasing factors (P>0.05, data not shown).

Contrary to the consumer age, the education level of consumers was not effective on frequency of egg consumption (P>0.05, data not shown), though it was effective on purchased type and purchasing factors of egg (P<0.05).

Primary school and high school graduates mostly preferred "village" type eggs, while master and university graduates preferred "free range" and "organic" eggs (Figure 4a). Previous research reported that consumption of free-range, organic and enhanced eggs increased with increasing education level (Bejaei et al., 2011). Moreover, attributes considered by the consumer when buying eggs differed according to their education level. Generally, the egg choice of primary school graduates was determined by "colour", while high school graduates decision was done according to "price". It was found that for university graduate consumers, the most important attribute are both egg "shape" and "dimension". "Trademark" is the most effective attributes on the master degree consumers. However, these attributes (price, shape, colour, dimension and trademark) were not effective on PhD graduate consumers preferences. (Figure 4b).

Mizrak et al., (2012) indicated that for the Turkish consumer factors of purchasing were brand (13.29%), colour (4.33%), size (10.74%), date of production (62.40%), price (4.96%) and other (4.28%).

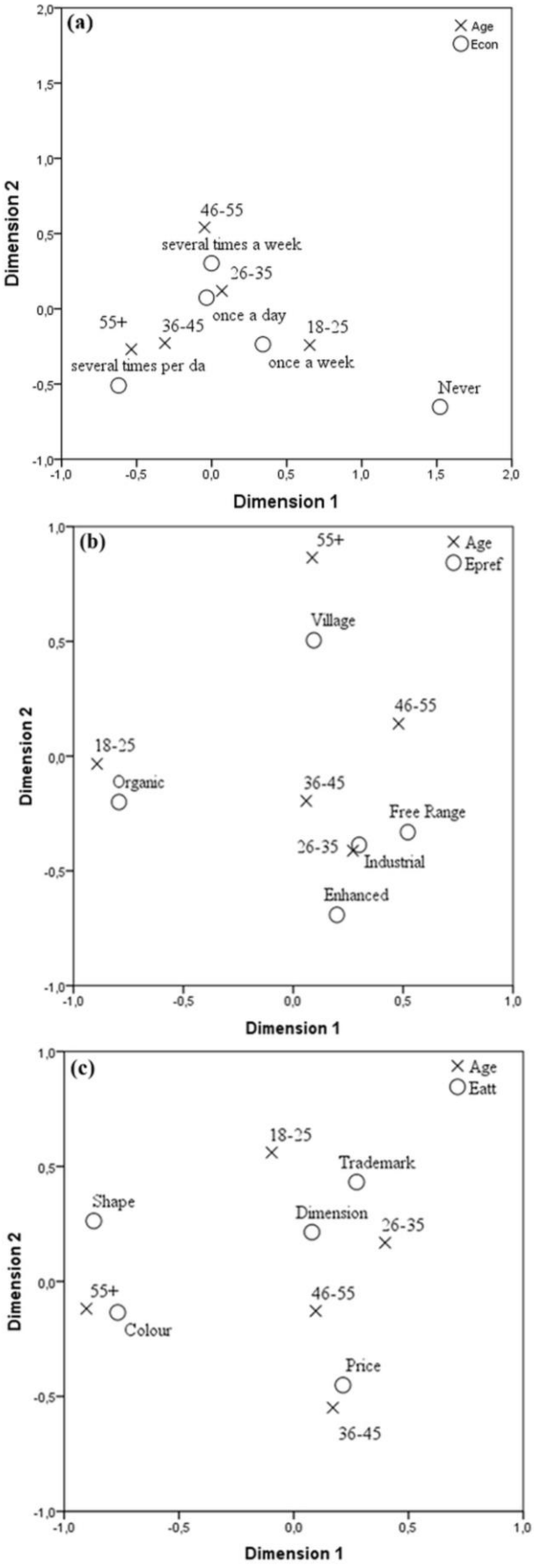

Figure 2. Relationship Among Egg Consumption Frequency (a), Preferred Egg Types (b), Purchasing Factors (c) and Age of Respondents.

Econ: egg consumption, Epref; preferred egg types, Eatt; egg purchasing factors.

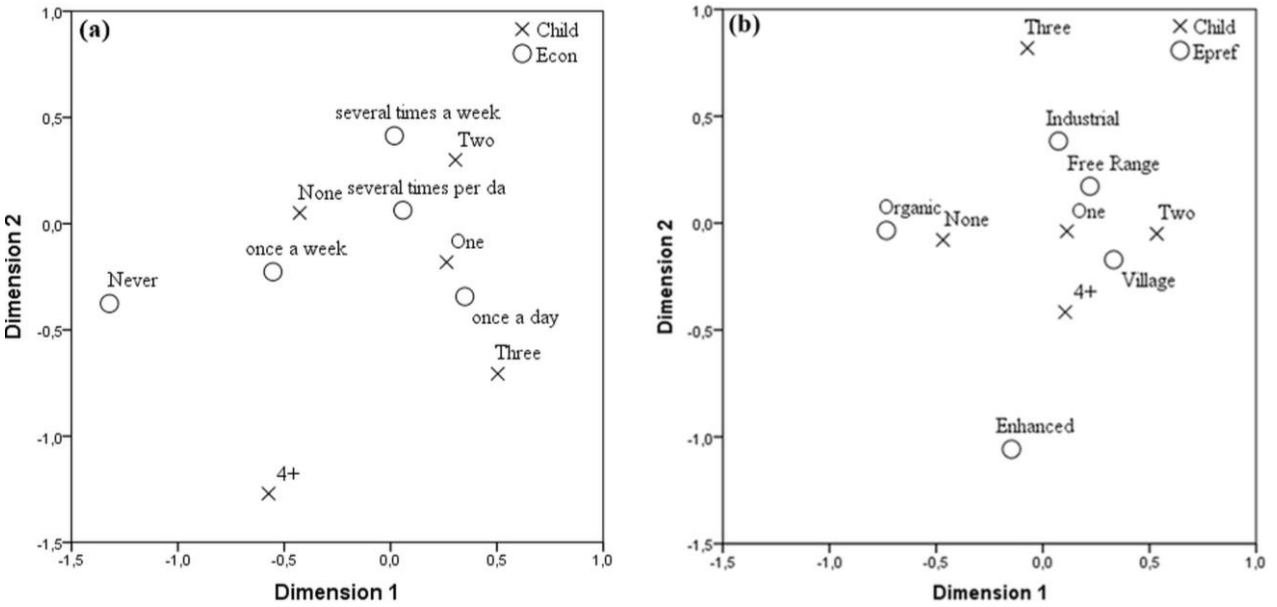

Figure 3. Relationship Among Egg Consumption Frequency (a), Preferred Egg Types (b), and Number of Children Child; Number of children, Econ: egg consumption, Epref; preferred egg types.

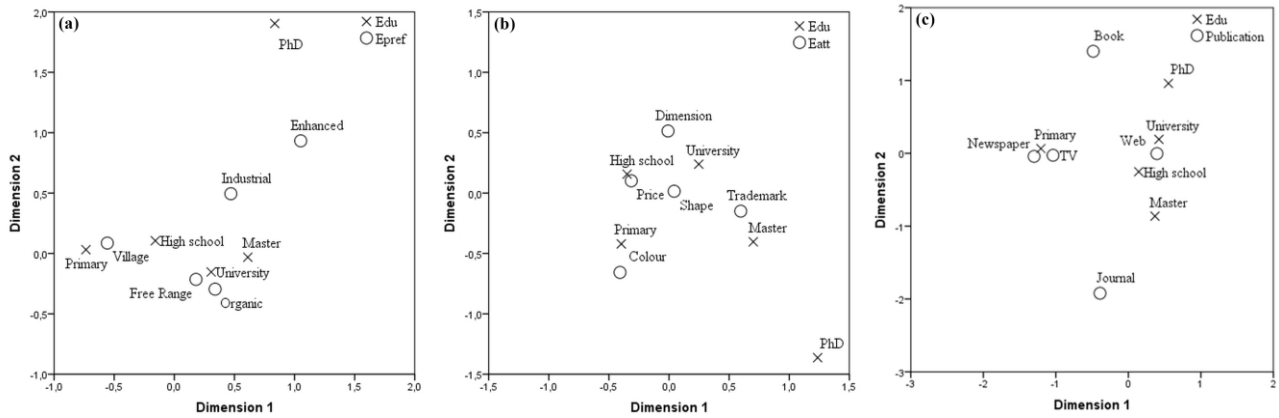

Figure 4. Relationship Among Preferred Egg Types (a), Purchasing Factors (b), Information Resources (c) and Education Level of Participants.

Edu; Education level, Epref; preferred egg types, Eatt; egg purchasing factors

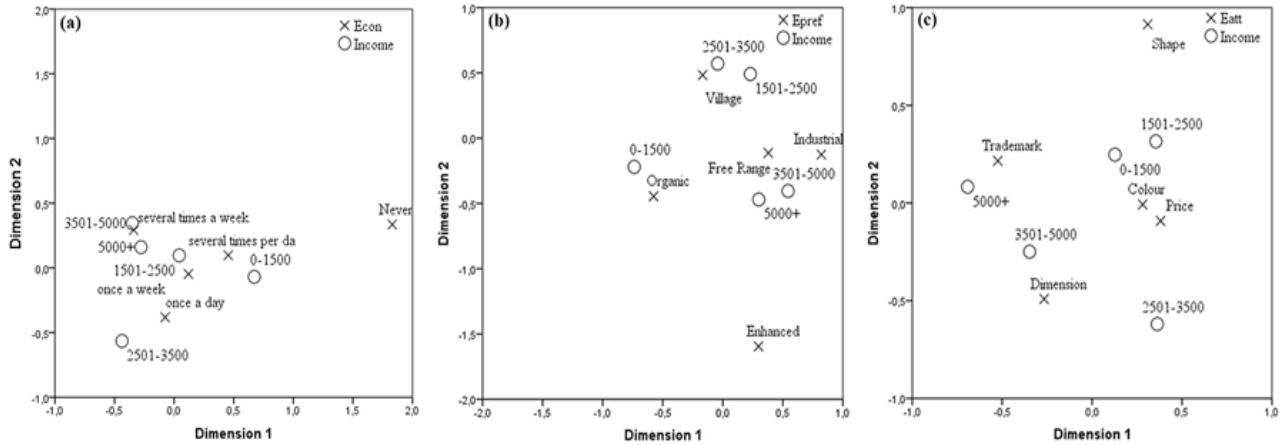

Figure 5. Relationship Among Egg Consumption Frequency (a), Preferred Type of Eggs (b), Purchasing Factors (c) and Monthly Income Levels of Participants

Income; Monthly income level (Turkish Lira), Econ: egg consumption, Epref; preferred egg types, Eatt; egg purchasing factors.

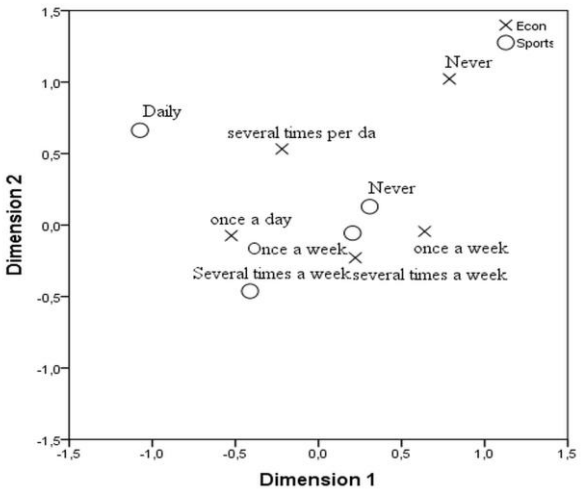

Figure 6. Relationship between Sports and Egg Consumption Frequency
Econ: egg consumption.

In another study, 61% of university students indicated that price was the most effective factor on egg purchases, while 27% of students did not agree (Giannetto et al., 2016). Figure 4c showed the resources that the respondents used to obtain information about egg. According to the results, primary school graduates preferred television, master and high school graduates -- journal, PhD graduates -- newspapers and books, while university graduates used internet resources. The education level of participants was found to be effective on the information retrieval resources (P<0.05).

Income levels of consumers were found to be effective on egg types, egg consumption frequency and egg purchasing factors (P<0.05). The egg consumption frequency of respondents with 0-1500₺ was "several times per day", 1501-2500₺ was "once a week", 2501-3500₺ was "once a day", 3501-5000 and 5000+₺ was "several times a week", according to Figure 5a. In terms of egg types, participants with income of 1501-2500₺ and 2501-3500₺ preferred village, 0-1500₺ - organic, 3501-5000 and 5000+₺ - industrial and free-range types of eggs. Particularly, the 0-1500₺ income level participants preferred organic eggs, though these are not certified products but eggs from their villages, they do not mean commercial products (Figure 5b). The most important purchasing factor of egg was determined to be "price" and "colour" for the participants with 0-1500 and 1501-2500₺ income levels. From Figure 5c, it can be seen that egg "trademark" was the most effective attribute for the participants with 5000₺+ income levels. Ronald, (2000) reported that particularly consumers with low-income level purchased eggs due to high nutritive value hence; they used eggs as a source of nutrients at economical price. Adejoro, (2001) indicated that egg consumption decreased with decreasing income level of the consumers.

In another study reported that "egg price" was the major attribute determining consumer preferences (Mesías et al., 2011). Literature findings are close to our findings. There was statistically significant relationship between sports and egg consumption frequency (P<0.05) (Figure 6). There was positive linear correlation between egg consumption frequency and sports doing frequency. It was determined that regular sports participants consumed several times egg per day and once a week sports participants consumed egg several times a week. Sport activities were not effective on the consumed egg types and egg purchasing factors of the participants (P>0.05, data not shown).

Disorders were most effective on egg consumption frequency, preferred egg types and information resources of participants (P<0.05). The relationship between egg consumption and disorders was clear, (Figure 7a). In particular, from Figure 7a it can be observed that participants who did not have any disease consumed eggs frequently. Results demonstrated that the participants did make a clear connection between egg consumption and disorders. Previous research reported that the reasons of not consuming egg were medical advice (41.70%), my own decision (20.80%), cholesterol (33.30%) and other (4.20%) (Mizrak et al., 2012). On the other hand, Figure 7b indicated that participants with cardio-vascular disorders preferred village type of eggs. Participants who did not have health problems preferred mostly organic type of eggs. In literature reported that consumers interested in healthy diets usually bought special eggs such as enhanced, free-range and organic (Boxall et al., 2007).

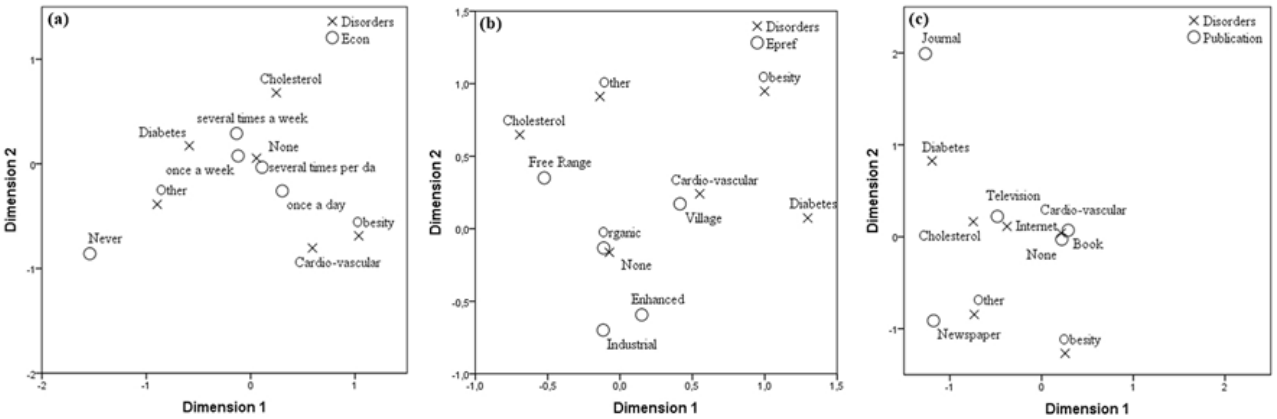

Figure 7. Relationships among Egg Consumption Frequency (a), Preferred Type of Eggs (b), Information Resources (c) and Participants Disorder
Econ: egg consumption, Epref; preferred egg types

The results about information retrieval type of the respondents with disorders are given in Figure 7c. In Figure 7c, it was presented that especially participants with cholesterol and cardiovascular disorders were following television and internet. Additionally, participant without disorders were following book and internet. The participants with obesity and diabetes disorders were not regularly following any publication for information about relation between disorders and egg consumption. Results demonstrated that television and internet were most referenced resources for information about relationship between disorders and egg consumption.

Conclusion

The present study showed that only 3% of the participants never consumed eggs. The older consumers consumed eggs more frequently than younger consumers. Consumers older than 55 preferred village type of eggs that were obtained from hens fed in village. The results showed that the most important attribute of eggs was price for consumers older than 35. Education level did not affect the frequency of egg consumption, while it was mostly effective on purchased egg type. Egg consumption frequency increased depending on incoming level decrease. Healthy participants consumed more frequently eggs than participants with disorders. It was determined that the best retrieval resource in informing healthy individuals was the internet. Consumers should be directed to the right information sources about relation between egg consumption and health.

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