

Review

# Egg Consumption among Young People: A Study through the Application of the Logistic Regression Model

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**Abstract:** The purpose of the present survey is to study and to investigate the proper eating style, focusing the attention on the propensity to “egg” consumption, in the diet of young people, with reference to the students attending the University of Messina. The data collection technique that was used consisted of the administration of a distributed anonymous ad hoc questionnaire by directly interviewing a sample of university students. In order to individualize the possible variables which may influence the frequency of egg consumption, a logistic regression model was used. It is a particular case of generalized linear model whose link function is the log it function. It is frequently applied when the dependent variable  $y$  is, dichotomous. The research results indicate that the only two statistically significant variables are the eating style and the reading of the product label. Moreover, the Hosmer and Leme show test for model’s adequacy guaranteed that the estimates provided by the model are not significantly different from the observations.

**Keywords:** Egg Consumption, Young People, Eating Style, Food Model, Generalized Linear Model, Goodness-of-Fit Test

## Introduction

According to the World Health Organization (WHO), the eggs which are properly consumed can help improve health, with the contribution of high quality proteins and a wide range of mineral salts and vitamins. In Europe, several interventions have been carried out in order to promote and improve the consumer safety, the farming and processing of eggs and of the derivative products (Cembalo *et al.*, 2015; Migliore *et al.*, 2015a). These safety measures, together with a correct manipulation, make this food a natural ingredient that is also safe for consumption (Fearne and Lavelle, 2011; Migliore *et al.*, 2015b). To date, therefore, the security risk due to eggs has been almost completely overcome. Therefore, the contribution to health improvement is important for all ages. According to the guidelines for a healthy diet drawn up by the WHO, it is possible to consume eggs (60 g) on average twice or 4 times a week (for a requirement of 2100 kcal). When calculating the weekly portions of eggs, the part of the egg which is used in food preparations (homemade egg pasta, sweets, biscuits, etc.) must be considered as well (Heuer *et al.*, 2015; Memon *et al.*, 2009; Maga, 1982).

In Italy, egg consumption is experiencing a significant growth phase. This tendency is favoured both by the innovations in farming supported by the major producers and by a marketing activity aimed at orientating

communication towards consumer welfare and health (Andersen, 2011; Sumner *et al.*, 2011; Lanfranchi *et al.*, 2014a). The action of the leading industries was directed to the promotion of the freshness and food safety aspect which are today two essential elements for purchasing choices. The introduction of the marking for each single egg bearing the laying date, has reassured consumers and has strengthened the whole category (Kosa *et al.*, 2015; Tonsor, 2011). The considerable development of this important economic sector is demonstrated by the evolution of the production from around 4 billion units of 1958 to the current 12,5 billion. About 2.500 people used to work in poultry holdings (Hayat *et al.*, 2010). The severe economic crisis which has hit our Country has continued to favour the purchases of eggs, to the extent that the average per capita annual consumption in 2014 was of 218 units (around 13,77 kg), 142 of which are eaten “fresh” and the remaining ones as ingredients in other dishes. In the early 1950 s every Italian consumed on average around 120 eggs (6,43 kg) (Table 1). The increase in egg consumption is in line with the Engel’s law and with the well-known Giffen’s paradox (Pecorino *et al.*, 2016; Tudisca *et al.*, 2015; Migliore *et al.*, 2015c). In fact, since households, especially those with lower income, could not avoid some necessary expenses, such as rent, medical expenses and transport, they were forced to remodel their food basket

by mainly purchasing basic foodstuffs, such as pasta, eggs and bread (Caracciolo et al., 2015; Tudisca et al., 2014; Wilkins et al., 2000). This tendency has led to a contraction in the purchase of olive oil, drinks, beef, fresh fish and fresh milk (Winkler, 2015). In the world, the average per capita consumption in 2014 was of 139 eggs per year, 8 eggs per person (-5,4%) less than 2013. The most egg consuming country is South Africa (153 eggs per person each year). The following figure shows the main countries of the world for average per capita egg consumption (Fig. 1).

Italy manages to almost entirely cover the need for eggs, which is equal to 94,8%. The recent alignment of laying hens farms with the European legislation on laying hen welfare has influenced the production causing a contraction (Table 2). However, in order to satisfy the internal demand, it was necessary to resort to imports which, according to recent studies conducted by Istat, have decreased by 20% compared to 2013 (Katz et al., 2005; EUFIC, 2010). Considering the balance between import and export, 694 million eggs have been imported into the Italian territory. In terms of profitability, the framework is more complex. Prices have increased by 58,6% for eggs for consumption. In the same period, the production costs have gone up on average by about 13%, owing to the increase in the prices of soybean cereal raw materials and of rearing costs (Schimmenti et al., 2013; Oliveira et al., 2013; Mesias et al., 2011).

#### Research Objective

The purpose of the present survey is to study and to investigate the proper eating style, with a particular

focus on the propensity to "egg" consumption, in the diet of young people, with particular reference to the students who attend the University of Messina. We analyzed the answers provided by the interviewed students, with reference to some personal features, such as: Age, gender, number of members in the household, municipality of residence, year of the course, parents' studies and some other variables related life style: Smoke, alcohol consumption, sports activity and food style. The results produced by this survey can certainly be used for cognitive purposes and for future research, even though they cannot be considered as originating from a typical random sampling procedure. Indeed, it is a pilot survey on a large number of respondents in which information seems particularly important for the reduction of information asymmetry, a condition to which the consumer is subject at the time of purchase.

Table 1. Average per capita annual egg consumption in Italy from 1950 up today

Year	Per capita consumption (kg)
1950	6,43
1960	8,88
1970	12,6
1980	12,03
1990	13,67
2000	13,7
2010	13,2
2013	13,86
2014	13,73

Source: Unaitalia processing on Istat data 2015

Table 2. Italian balance of eggs for consumption (n. of item)

	2013	2014	differential 2013/2014
Production	12.168.000.000	12.534.000.000	3%
Import	1.766.000.000	1.398.000.000	-20,80%
Export	439.000.000	704.000.000	60,40%
Balance shell eggs	1.327.000.000	694.000.000	-47,70%
Internal use	13.495.000.000	13.228.000.000	-1,90%
Per capita consumption	220	218	-1,40%

Source: Unaitalia processing on Istat data 2015

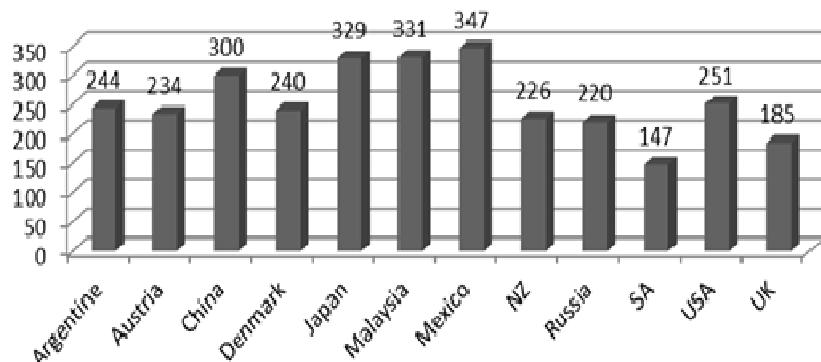


Fig. 1. Per capita egg consumption in the main countries of the world in 2014

## Materials and Methods

The data were collected by means of the administration of a distributed anonymous ad hoc questionnaire, directly interviewing a sample of university students (Lanfranchi *et al.*, 2014b). The data collection was conducted in such a way as to respect the dislocation of university departments within the scientific community as much as possible. The surveys were conducted within the departments of the University of Messina during September and November 2015. The sample is formed by 305 students. Even if it does not represent a properly statistical sample, due to the lack of a database for the random extraction of the respondents' names, the obtained results can be regarded as indicative, considering not only the size of the sample but also the quality of the data. To identify the existence of any variables that may affect the frequency of egg consumption, a logistic regression model was used. It is a particular case of generalized linear model whose link function is the log it function. It is a regression model which is applied in those cases when the dependent variable  $y$  is, indeed, dichotomous, referable to a value of 0 and 1. In recent years, several searches have been conducted and many theories have been formulated regarding the quality of eggs, farming methods and the benefits a man can receive by consuming this product. Most of these studies are also focused on the problems that this food can generate, such as that of salmonellas is (especially the type caused by enteric serotype Enteritidis Salmonella, for its peculiar capability of colonizing hens' ovarian tissue and of being present inside intact shell-eggs), risks of vascular diseases (Zazpe *et al.*, 2011), or, on the basis of the latest events, that of dioxin, which is originated from the problem of avian flu (Winkler, 2015; Lanfranchi *et al.*, 2014c). For example, a study by Maga (1982), focuses on the chemical composition of eggs and on the relationship among the variations in chemical composition. Maga (quoting a former study by Colas *et al.*, 1979) states that changes in breeding and in the protein content of eggs may alter their quality, but not their flavour. In the literature it is pointed out that contamination may occur more easily in small rural farms than in the big industrial production. Therefore, according to these studies, the sources of supply of eggs for consumption play a fundamental role in determining the risks for the consumer. Despite the availability of a wide range of information on the nutritional aspects of eggs related to the outbreak of some diseases in humans (cardio-vascular and tumorous diseases), detailed and updated information on the average consumption of eggs in Italy is not available. The available data on consumption are generally collected by using types of aggregation and units of measurement (expenditure on purchase) (Zazpe *et al.*, 2011). The following are brief other international scientific studies relating to the

benefits related to a proper consumption of eggs. An example is the study of Luc Djoussé and Gaziano (2008). Another study was carried out by Song and Kerver (2000). Another research is to Menonetal..

*it was concluded that egg consumption showed positive trend and most of consumers preferred 1-3 commercial eggs daily especially at breakfast as first preference to eat omelet after cooked by their wives, but the low purchase power resulted weaker purchasing frequency. Egg consumption was increased in winter as compared to summer, in increasing egg prices and no considerable effect of any disease outbreak was found. Consumers sacrifice the eggs in serious sickness for their early healthiness/remedy from diseases. Consumers also showed positive response in consuming eggs in summer season as well.*

## *Analysis of the Egg Consumption Preference among the Students of the University of Messina: Sample Selection and Characteristics*

The actual sample (305 respondents) has been subdivided according to some socio-demographic segmentation variables: Gender, city of birth, age, qualification. The average age of the interviewed is about 23. The age group range from 19 and 47 (this latter data is attributable to those students who are behind in the course schedule and to those who are enrolled in another degree course). When analyzing the social and demographic features of the sample, we can note that the sample is composed by 35.4% males (108 units) and 64,6% women (197 units). The interviewed students are resident in Messina province (25,3%), in other Sicilian municipalities (18,8%) and in Calabria (27,7%). The average number of the household members is 4. With reference to the parental education, 52,8% of fathers and 54,6% of mothers have a degree, while 21,3% of fathers and 19,3% of mothers achieved a university degree. When we analyze the lifestyle of the students who attend the University of Messina, we can highlight that about 63% do not smoke and 45,7% do not consume alcohol. Besides, those who practise sporting activities once or twice a week represent 39,7% of the sample and 95,4% of young people do not exclude any food in their daily diet. Based on the responses obtained from the administered questionnaire, 71,5% of the respondents claim to attend a three-year university degree course, while 26,6% claim to attend a master degree course. The statistical analysis outlines a particular transversality in the weekly consumption as regards gender, while in the other socio-demographic characteristics no relevant percentage differences were recorded.

### *Analysis for Measuring Egg Consumption Among University Students: The Food model*

About 65,5% of the interviewed students state that they consume eggs once or twice a week, 12% never eat them and only 3% consume them every day (Table 3). As regards the respondents' knowledge of the information provided by the label, the obtained data is substantially balanced. About 54% of the students declare that they can read the label, while 46% are not sufficiently informed. In order to verify the respondent's degree of information asymmetry concerning the methods of producing the product and its provenance, he was asked if he is aware of the difference between the production of biological eggs and that through industrial farming. In this case, the student seems to be more informed. Indeed, 75% of the respondents claim to know the difference. As regards the consumption patterns, the respondent was asked if he consumes eggs "alone" or with other ingredients (Table 4). As may be seen in Table 4, most of the respondents prefer to consume eggs as an ingredient of other dishes. As regards purchases, he was asked how much he is willing to spend in order to consume biological eggs (Table 5). Many respondents (32%), being aware that the consumption of biological eggs represents an additional guarantee in terms of food safety, are willing to buy an egg even at a price higher than 50 euro cents.

### *Analysis of the University Student's Egg Consumption in Relation to his Lifestyle*

A specific analysis of the lifestyle of the university students attending the University of Messina shows that more than 63% of the sampled respondents do not smoke, 45,7% do not take alcohol, 39,7% play sport once or twice a week and 95,4% declare themselves omnivorous. On the basis of the data deriving from the descriptive analysis, 71,5% of the interviewed students is attending a three-year degree course, while 26,6% are enrolled in a master degree course (Lanfranchi et al., 2015). If we analyze the percentage profiles concerning to the gender, we can note that women habitually consume more eggs than men (Table 6). Considering the respondents' lifestyle, there is a tendency of those students who smoke (36,5%) to consume

eggs every day (Pearson's chi-square test significant with  $p<0.05$ ) (Table 7). The following table, instead, shows the tendency of those who do not drink alcohol to consume eggs more frequently (Table 8). Moreover, we also analyzed the relationship between egg consumption and the sport activities practised by students. The results show that those who occasionally practise sport activities (once or twice a week), are more inclined to consume eggs (Table 9). We can also highlight a higher daily egg consumption among the students coming from large households (Table 10). Finally, the students who mostly consume eggs are aged on average between 21 and 22 (Table 11).

Table 3. Weekly consumption of eggs

Everyday	8	2,70%
3-5 times a week	62	20,95%
1-2 times a week	191	64,53%
Never	35	11,82%

Table 4. Consumption mode

Individual consumption	46,50%
Consumption with other ingredients	53,50%

Table 5. Availability spending

Up to 30 cents	21%
Up to 50 cents	32%
I do not know	47%

Table 6. Consumption mode for gender

Man			
Weekly consumption of eggs			
Everyday	45	42,00%	
3-5 times a week	35	32,00%	
1-2 times a week	27	25,00%	
Never	1	1,00%	
Total	108	100,00%	
Do not respond	9		
Woman			
Weekly consumption of eggs			
Everyday	89	44,10%	
3-5 times a week	51	28,30%	
1 - 2 times a week	50	25,30%	
Never	6	2,30%	
Total	196	100,00%	
Do not respond	9		

Table 7. How many times a week do you eat eggs? Do you smoke?

Do you smoke?				
	Yes	No	Ex	Total
Everyday	35	92	7	134
	36,50%	3,20%	0,00%	39,70%
3-5 times	23	35	4	62
	24,50%	18,50%	30,80%	20,90%
1-2 times	58	126	7	191
	61,70%	66,70%	53,80%	64,50%
Never	11	22	2	35
	11,70%	11,60%	15,40%	11,80%
Total	94	189	13	296
	100,00%	100,00%	100,00%	100,00%

Table 8. How many times a week do you eat eggs? What about alcohol consumption?

Alcohol consumption?				
	Yes	No	Rarely	Total
Everyday	0 0,00%	6 4,40%	2 1,70%	8 2,70%
3-5 times	11 27,50%	23 17,00%	28 23,10%	62 20,90%
1-2 times	26 65,00%	90 66,70%	75 62,00%	191 64,50%
Never	3 7,50%	16 11,90%	16 13,20%	35 11,80%
Total	40 100,00%	135 100,00%	121 100,00%	296 100,00%

Table 9. How many times a week do you eat eggs? How many times a week do you practise sport activities?

	Everyday	3-5 times	1-2 times	Never	Total
Everyday	2 10,50%	2 2,30%	2 1,70%	2 2,80%	8 2,70%
3-5 times	8 42,10%	19 21,60%	18 15,40%	17 23,60%	62 20,90%
1-2 times	9 47,40%	56 63,60%	83 70,90%	43 59,70%	191 64,50%
Never	0 0,00%	11 12,50%	14 12,00%	10 13,90%	35 11,80%
Total	19 100,00%	88 100,00%	117 100,00%	72 100,00%	296 100,00%

Table 10. How many times a week do you eat eggs? How many people are there in your family?

	<= 3 comp.	4 comp.	>= 5 comp.	Total
Everyday	1 1,40%	2 1,50%	5 6,60%	8 2,80%
3-5 times	17 23,90%	29 21,30%	12 15,80%	58 20,50%
1-2 times	46 64,80%	91 66,90%	46 60,50%	183 64,70%
Never	7 9,90%	14 10,30%	13 17,10%	34 12,00%
Total	71 100,00%	136 100,00%	76 100,00%	283 100,00%

Table 11. How many times a week eggs consumption? Which age group do you belong to?

	<= 21 age	22-24 age	>= 25 age	Total
Everyday	3 3,10%	3 2,70%	2 2,40%	8 2,80%
3-5 times	22 22,90%	23 20,70%	15 18,30%	60 20,80%
1-2 times	62 64,60%	69 62,20%	56 68,30%	187 64,70%
Never	9 9,40%	16 14,40%	9 11,00%	34 11,80%
Total	96 100,00%	111 100,00%	82 100,00%	289 100,00%

#### *Analysis of the University Student's Egg Consumption: Economic Interpretation of the Results*

The data collection technique that was used consisted of the administration of a distributed anonymous

questionnaire by directly interviewing a sample of university students with the face to face method and by using a questionnaire form which was prepared ad hoc. It has provided a good estimate on the average consumption of eggs by the university population of Messina, offering the advantage of flexibility in data

management. This research demonstrated that the employed model was appropriate to characterize the economic analysis realized. The estimate of food consumption is an indispensable means for assessing the exposure of consumers to the dangers involved in food intake. The data collected from this survey can integrate information, so far insufficient, on the consumption of eggs in shell by the student population of Messina. The survey revealed interesting differences in consumption patterns, due to different lifestyle (sports, smoking and alcohol consumption), to the area of residence, to the age group, to the number of family members. The survey has highlighted two economic implications which satisfactorily identify the dynamics of egg consumption. The conducted analysis shows that the domestic purchases of eggs are not affected by changes in the prices of possible substitutes (Fig. 2).

In agreement with the theory of consumer, the pattern of purchases is inversely related to their price (Fig. 3).

The economic theory that studies the elasticity of the demanded quantity of a good by altering another quantity (price, income and price of other goods), states that the degree of responsiveness of demand with respect to price is also dependent on the availability or otherwise of substitute products. Therefore, since eggs have no viable substitutes, they have a more inelastic demand that reacts less to the market price fluctuations. Despite the recent period of economic crisis that has affected the company and despite the reduction in income, the share of food consumption of eggs has not diminished (as provided by the law of Engel) (Fig. 4).

This phenomenon is also determined by the fact that students are more aware of the health benefits that agricultural products can provide. Certainly the breadth and diversity of egg supply has enabled consumers to seize savings opportunities more easily. The loss of purchasing power that has particularly affected young people, has created more rational consumption policies

leading to a reduction in waste, especially in the food sector. This phenomenon has also involved the consumption style of the students of Messina (Fig. 5). The Fig. 5 shows an estimate of the amount of uneaten food that goes to waste. The 35% of consumers say that sheds little food, the 45% of respondents said they dispose of very little uneaten food. The 16% of respondents are not wasting food while only 4% say they produce many food waste from food still not used.

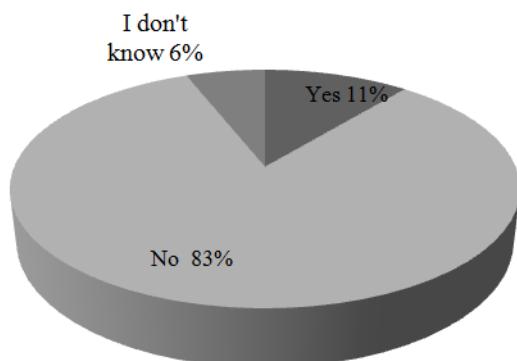


Fig. 2. The purchase of eggs is influenced by changes in the prices of possible substitutes?

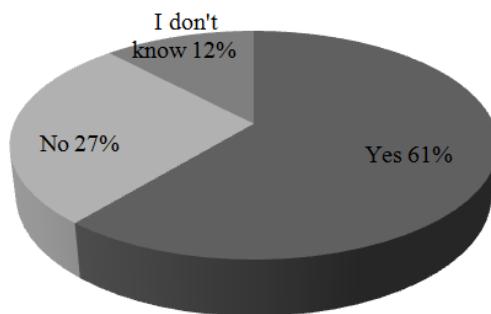


Fig. 3. The purchases of eggs depends on their price?

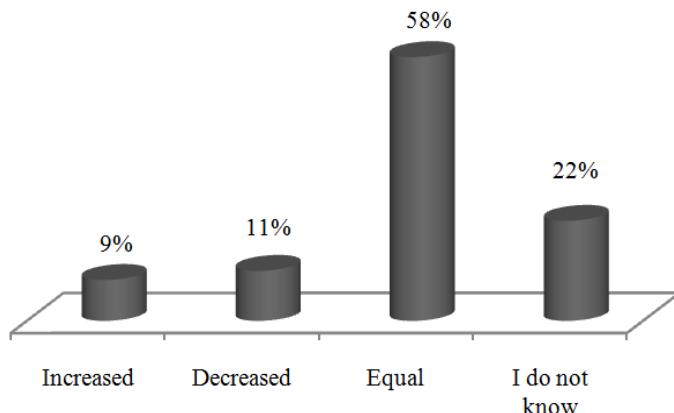


Fig. 4. Amount of uneaten food in the waste

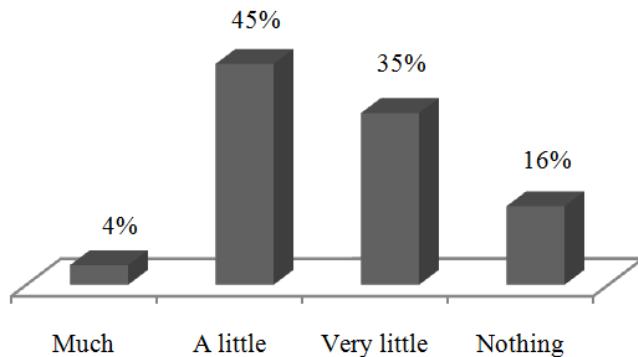


Fig. 5. Amount of uneaten food in the waste

With reference to the structure of the Italian meal the consumption of bread and cereals (pasta, rice, biscuits, ready meals), meat (including sausages), milk, cheese and eggs prevails. The health consciousness has created in twenty years an increase monthly of per capita spending of 3 euro for the consumption of fruit and 5 euro for that of vegetables. The carried out study leads, therefore, to propose the implementation of a nutritional education and information system that will foster the dissemination of healthy eating patterns able to correct the eating habits of young people in order to prevent any diseases in adulthood related to incorrect food styles. The main application of the results obtained in this study consists on one hand to provide useful information for the study of consumer behavior and his willingness to pay a price surplus for a quality product that gives a greater guarantee of food safety and on the other hand, a possible reduction of the costs related to the national health system and generated by incorrect feeding patterns.

#### *Logistic Regression Model: Theoretical Foundations*

To verify the possible dependence of the dichotomous variable "Customer loyalty" by some potential predictors, we decided to estimate a Generalized Linear Model, in particular the Binary Logistic Regression Model. This kind of model (Kleinbaum and Klein, 2010) formalizes the dependence between a dichotomous outcome variable and one or more independent covariates. It estimates probabilities using a logistic function, i.e., the cumulative logistic distribution. It calculates the probability that a feature is present (e.g., probability of "success") given the values of explanatory variables, that is a single categorical variable:

$$\pi = \Pr(Y = 1 | X = x)$$

Let Y be a binary outcome variable:

- $Y_i = 1$  if the trait is present in observation (unit, person, etc...)*i*
- $Y_i = 0$  if the trait is not present in observation *i*
- $X = (X_1, X_2, \dots, X_k)$  be a set of explanatory variables; they can be discrete, continuous or a combination.  $x_i$  is the observed value of the explanatory variables for observation *i*

The aim of logistic regression is to find the best fitting model to explain the relation between the dichotomous feature of interest (response or outcome variable) and some independent explanatory variables (predictors). In logistic regression model the coefficients and its standard errors predict a *logit* transformation for the probability of presence of the interest feature.

Focusing on a single variable *X*, the model is expressed by:

$$\pi_i = \Pr(Y_i = 1 | X_i = x_i) = \frac{\exp(\beta_0 + \beta_1 x_i)}{1 + \exp(\beta_0 + \beta_1 x_i)}$$

Or:

$$\text{logit}(\pi_i) = \log\left(\frac{\pi_i}{1 - \pi_i}\right) = \beta_0 + \beta_1 x_i = \beta_0 + \beta_1 x_{i1} + \dots + \beta_k x_{ik}$$

In this way, the log odds of the outcome is a linear combination of the predictive variables. Binary Logistic Regression is based on certain assumptions:

- The data  $Y_1, Y_2, \dots, Y_n$  are independent and identically distributed
- Distribution of  $Y_i$  is  $\text{Bin}(n_i, \pi_i)$ , i.e., binary logistic regression model assumes binomial distribution of the outcome variable
- It does not assume a linear relationship between the dependent variable and the independent covariates, but it assume linear relationship between the logit of the response and the explanatory variables:

$$\log it(\pi) = \beta_0 + \beta_1 X$$

- The homogeneity of variance does not need to be satisfied
- Errors need to be independent but not normally distributed
- It uses Maximum Likelihood Estimation (MLE) rather than Ordinary Least Squares (OLS) in order to estimate the parameters

- Goodness-of-fit measures are based on sufficiently large samples

For overall goodness-of-fit statistics of logistic regression model (NorušisMarija, 2009), we considered some measures as -2log Likelihood value, the Hosmer-Lemeshow test (Hosmer and Lemeshow, 2000); Cox and Snell R-Square and Nagelkerke R-Square.

Table 12. Results of the univariate logistic regression models for eggs consumption

Predictors	B	S.E.	Sig.	Exp(B)	95% C.I.
Age	-0,003	0,051	0,960	0,997	0,903-1,101
Constant	2,110	1,198	0,078	8,245	-
Sex	-0,356	0,365	0,329	0,701	0,343-1,432
Constant	2,180	0,236	0,000	8,850	-
Number of family members	-0,351	0,205	0,087	0,704	0,471-1,052
Constant	3,456	0,885	0,000	31,698	-
Father educational level	0,102	0,268	0,702	1,108	0,656-1,872
Constant	1,789	0,545	0,001	5,984	-
Mother educational level	-0,170	0,272	0,531	0,844	0,495-1,437
Constant	2,372	0,571	0,000	10,718	-
Smoke	0,008	0,387	0,984	1,008	0,472-2,152
Constant	2,037	0,217	0,000	7,667	-
Alcohol consumption	0,001	0,361	0,999	1,000	0,493-2,027
Constant	2,040	0,266	0,000	7,687	-
Sport practice	0,253	0,401	0,528	1,287	0,587-2,823
Constant	1,856	0,340	0,000	6,400	-
Food style	2,560	0,577	0,000	12,938	4,179-40,061
Constant	-0,288	0,540	0,594	0,750	-
Read of the product label	1,417	0,585	0,015	4,126	1,310-12,992
Constant	2,180	0,293	0,000	8,846	-
Knowledge of rearing hens type	-0,041	0,595	0,946	0,960	0,299-3,079
Constant	2,818	0,515	0,000	16,750	-
Spending availability for organic egg	0,803	0,379	0,034	2,232	1,063-4,684
Constant	2,308	0,300	0,000	10,052	-

Table 13. Results of the multivariate logistic regression model for eggs consumption

Predictors	B	S.E.	Sig.	Exp(B)	95% C.I.
Constant	3,861	3,285	0,240	47,510	-
Age	-0,133	0,095	0,158	0,875	0,727-1,053
Sexo	-0,558	0,751	0,458	0,572	0,131-2,495
Number of family members	-0,384	0,373	0,303	0,681	0,328-1,414
Father educational level	0,839	0,619	0,175	2,315	0,688-7,784
Mother educational level	-0,999	0,608	0,100	0,368	0,112-1,211
Smoke	-0,378	0,692	0,585	0,685	0,176-2,661
Alcohol consumption	0,439	0,678	0,517	1,551	0,411-5,859
Sport practice	1,211	0,739	0,101	3,356	0,788-14,284
Food style	3,428	0,969	0,000	30,803	4,606-205,98
Read of the product label	1,614	0,752	0,032	5,022	1,150-21,923
Knowledge of rearing hens type	-1,370	0,839	0,103	0,254	0,049-1,316
Spending availability for organic egg	0,906	0,475	0,056	2,474	0,975-6,274

Table 14. Goodness of fit for multivariate model

Statistics	Value	p-value
-2 Log-Likelihood	88,137	
Cox and Snell R-Square	0,171	
Nagelkerke R-Square	0,281	
Hosmer-Lemeshow Test	5,928	0,655

For the parameters estimation, we used the Maximum Likelihood Estimator (MLE): In particular the ML estimates are obtained by using iterative algorithms such as Newton-Raphson (NR) or Iteratively Re-Weighted Least Squares (IRWLS) (Agresti, 2013).

### Results of the "Logistic Regression Model" Estimation

In order to assess the dependence of the dichotomous variable "Eggs consumption" by a set of potentially predictive explanatory variables, the logistic regression model was estimated. At first we estimated univariate models for each potentially predictive variables (Table 12) and, then, multivariate model (Table 13). For every model we reported the B coefficient with the Standard Error (S.E.), the p-value, the exponential of B value with 95% Confidence Interval (C.I.). Based on the results obtained from the univariate regression models estimation (Table 12), we can conclude that the only statistically significant variables are the food style of the consumer, the read of the product label and the spending availability for organic egg. By the results shown in Table 13 we can notice that the only two variables, that are statistically significant in multivariate approach, are the food style and the read of the product label. In Table 14 we showed the value of -2 Log-Likelihood, Cox and Snell R-Square and Nagelkerke R-Square to assess the goodness of fit, within a Binary Logistic Regression Model; these three statistics guarantee the appropriate degree of model fit to our data, since the value is quite small. Moreover, we also reported the Hosmer and Lemeshow test that provides measures about the adequacy of the model to observed data; it does not result statistically significant, ensuring that the theoretical values obtained from the model estimation do not significantly differ from the empirical values.

## Conclusion

The investigation has highlighted that only 64,53% of the interviewed young people declare a consumption of about two eggs a week, a slightly lower data compared to the national one, which is equal to around three eggs a week. However, this data is in line with the national ones, which show that Italy, compared to the other EU countries, makes very limited use of eggs, exceeding in meat consumption, instead. In essence, most of the sample declares to consume eggs on a weekly basis. Therefore, the carried out study leads us to propose the implementation of a food education and information system likely to encourage the spread of healthy food models, which are aimed at correcting young people's eating habits (Gracia et al., 2014). In conclusion, the results produced by this survey can certainly be used as an important starting point for future research. Indeed, it is a pilot survey on an adequate number of interviewed people in which information appears to be of particular

importance. In fact, 46% of the interviewed youngsters declare to be not sufficiently informed on proper eating styles and on the indications given on the label. Lastly, even the percentage of those who are willing to spend more for purchasing biological eggs because they consider them to be of better quality and attach a greater food security to them, is significant.

## Author's Contributions

The work is the result of a full collaboration of the authors.

**Maurizio Lanfranchi:** He participated coordination and setting of the study, designed the research plan, interpretations of data and contributed to the writing and reviewing the manuscript.

**Carlo Giannetto:** Involved in data investigation and drafting the manuscript.

**Agata Zirilli and Angela Alibrandi:** Contributed to the writing related statistical analysis and to the interpretations of data.

## Ethics

This article is original and has not published elsewhere.

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