

Original Research Paper

# Analysis of the Propensity to Fruit Consumption among Young People through the Cumulative Proportional Odds Model

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**Abstract:** After in-depth studies, the World Health Organization (WHO), asserts and suggests that in order to improve human health and well-being it is necessary to eat 400 grams of fruit and vegetables on a daily basis, as well as to consume potatoes and other starchy tubers such as manioc. In Europe, recommendations vary from country to country. Generally, these suggestions are in line with those of the WHO. However, some countries recommend a greater amount: For example, Denmark suggests more than 600 grams each day. The main goal of the present work is to analyse the fruit-consumption behaviour among young people, particularly university students and to identify the target of young people who frequently consume fruit. The present survey, therefore, has the aim of establishing a scientific reference framework regarding the propensity to “fruit” consumption in the diet of the students attending the University of Messina. In order to identify the existence of possible variables that may influence the frequency of fruit consumption, it was deemed appropriate to estimate an adequate regression model. Since the response variable was one of ordinal type on 4 levels (0 = never; 1 = once or twice a week; 2 = 3-5 times a week; 3 = each day) the Cumulative Proportional Odds Model, an extension of the general linear model to ordinal categorical data, was used.

**Keywords:** Consumption, Cumulative Proportional Odds Model, Fruit, Analysis, Life-Style Students

## Introduction

Fruit and vegetables consumption must be the basis of the healthy food model (Lanfranchi and Giannetto, 2014). Fruit is a source of vitamins, minerals and fibres, as well as of an important amount of energy (Crescimanno *et al.*, 2014; 2002). The most recent epidemiological studies have highlighted how diets based on high levels of fruit and vegetables are associated with a low risk of cardiovascular diseases, of type 2 diabetes and of certain kinds of cancer. Actually, in many countries the fruit per capita consumption among young people in Europe is still below the intake recommended by the WHO (Asciuto *et al.*, 2014). The main goal of the present work is to analyse the fruit-consumption behaviour among young people, particularly university students and to identify the target of young people who frequently consume fruit (Lanfranchi *et al.*, 2014a; 2014b). The work starts from

the observation that the definition of fruit itself varies according to the country, since some take on board the WHO recommendations and exclude the starch category, while others such as Norway include even potatoes in the fruit category. Thus, the analysis of consumption at European level does not appear to be aligned and the food model itself proves to be distorted by these extensive interpretations of the term “fruit”, which in most cases includes also the fruit juice. Among the various methodologies that we may find in the scientific literature regarding the analysis of the measurement of food consumption, the direct survey through interview and administration of the questionnaire, despite being more expensive, seems to be the one which best expresses the consumer’s behaviour (D’Amico *et al.*, 2014a; 2014b). In this study we decided to restrict the definition of fruit consumption exclusively to the product coming from the agricultural sector to be supplied fresh without

having undergone any alterations and/or transformations. Moreover, we took as a reference the daily consumption of fruit and vegetables recommended by the WHO, equal to at least 400 grams. In Europe the average consumption of vegetables is 200 grams per day and only 166 grams of fruit (Tudisca *et al.*, 2015). In Italy the recommendation of consuming 400 gr of fruit per capita per day is exceeded. Indeed, if we consider also fruit juices, the ratio rises to 452 gr (Di Vita *et al.*, 2014; 2013).

## Research Objective

The present survey, therefore, has the aim of establishing a scientific reference framework regarding the propensity to “fruit” consumption in the diet of the students attending the University of Messina. In particular, we analysed the answers given by the surveyed students in relation to certain personal characteristics, such as: Age, sex, number of family components, municipality of residence, year of the course (distinguishing between three-years degree courses and specialistic degree courses), parents’ study title and a series “control” variables concerning their life-style: Smoking, alcohol, sporting activity and eating habit.

## Materials and Methods

The data collection technique which was employed was the administration of an anonymous distributed questionnaire by interviewing a sample of university students in a direct way, with the face to face method and by using a questionnaire form that was prepared ad hoc. The data collection was conducted in order to respect as far as possible the dislocation of university departments within the scientific community (Lanfranchi *et al.*, 2014c; 2014d; Schimmenti *et al.*, 2013; Sgroi *et al.*, 2015). The surveys were carried out within the departments of the University of Messina in the months of April and May 2015. The sample chosen as the object of the investigation is composed of 305 students. Although it does not constitute a purely statistical sample, owing to the unavailability of the information basis for the random sampling of the respondents’ names, the obtained results can be regarded as relevant, considering the sample size and the data quality (Caracciolo *et al.*, 2014; Verneau *et al.*, 2014; De Magistris *et al.*, 2015). In order to identify the existence of possible variables which may influence the frequency of fruit consumption, the Cumulative Proportional Odds Model, an extension of the general linear model to ordinal categorical data, was used. It can be implemented through the Polytomous Universal Model (PLUM) procedure of the statistical software SPSS.

## Analysis of the Preference of Fruit Consumption among the Students of the University of Messina: Sample Characteristics

The subdivision of the effective sample (305 respondents) was performed according to certain socio-demographic characteristics: Age, gender, area of residence, parents’ study title, department affiliation and year of the course. The average age of the surveyed university students is approximately 23. It should be noted that the range is between 19 and 47 years old (the latter is attributable to university student who have not passed all their exams within the prescribed period of time or to those who are registered in a second degree course). Going into detail of socio-demographic characteristics, it emerges that the sample composition consists of 35,4% males (108 units) and of 64,6% females (197 units). The surveyed students are residents of: Messina (28,1%), Province of Messina (25,3%), another Sicilian town (18,8%) and Calabria/other (27,7%). On average, the number of the household members is of 4 components. As regards the parents’ study title, 52% of the fathers and 54,6% of the mothers have a secondary school certification, while 21,3% of the fathers and 19,3% of the mothers have achieved a university degree (Lanfranchi *et al.*, 2014e; Sgroi *et al.*, 2014).

## Analysis of the Measurement of Fruit Consumption among University Students: The Food Model

The surveyed students declare that in the last few years their fruit consumption has remained constant (46,6%), only 9,5% states that it has decreased (Table 1). Consumption habitually takes place between meals (38%) and at lunch (35%) and only 5% of the surveyed students consumes fruit at dinner (Fig. 1). The main place of purchase is the greengrocer (55,1%), followed by the supermarket (33,4%) (Table 2). The channel of direct sales in the company (Km0) is still seldom used. If we analyze the period of the year when there is a higher frequency of fruit purchase, it is possible to see that summer is the season in which an increased consumption is reported, while autumn is the season that registers a decreased interest in this agricultural product (Fig. 2). The fruit which the university students of Messina prefer is the seasonal one, while there is a very low consumption of wild berries or of dried fruit (Fig. 3). As concerns the weekly expenditure on fruit shows that around 37% of the respondents spend between 10 and 20 euros (Table 3). Only 14,4% are willing to spend more than 20 euros. Finally, in relation to their purchasing attitudes, we asked them if they paid attention to labeling.

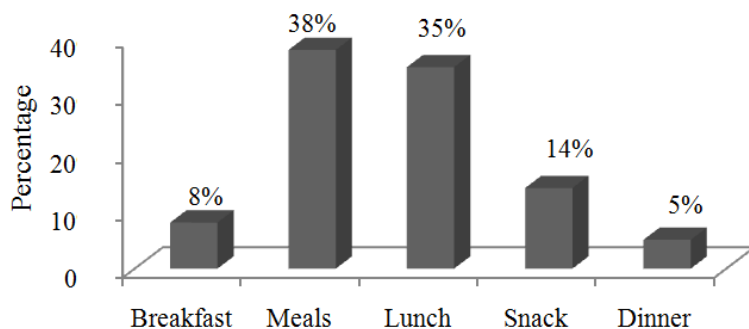


Fig. 1. Preferably fruit consumption during the day

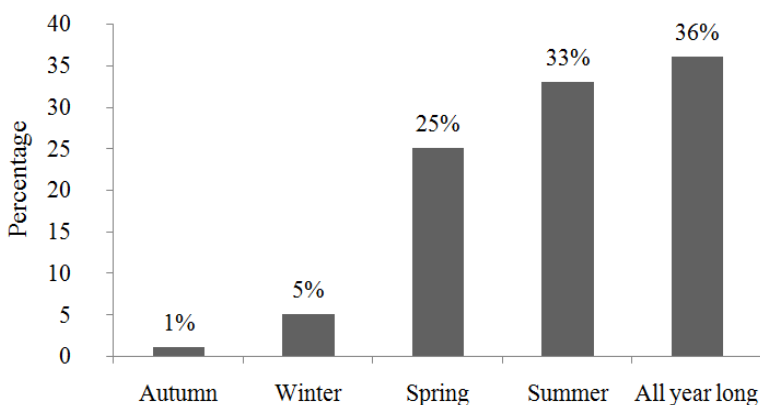


Fig. 2. Season habitual consumption of fruit

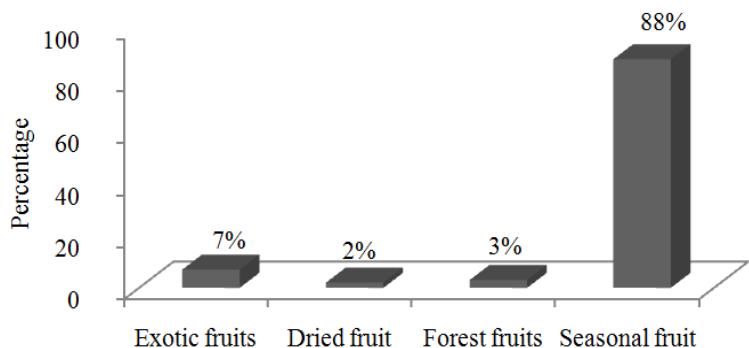


Fig. 3. Type of fruit consumed regularly

	<=21 age	22-24 age	>=25 age	Total
Everyday	44 44,90%	46 40,40%	40 47,10%	130 43,80%
3-5 times	28 28,6%	33 28,9%	25 29,4%	86 29%
1-2 times	23 23,5%	32 28,1%	20 23,5%	75 25,3%
Never	3 3,10%	3 2,60%	0 0,00%	6 2,00%
Total	98 100%	114 100%	85 100%	297 100%

	Students	(%)
Supermarket	102	33,4
Greengrocer	168	55,1
Peddler	10	3,3
Retail sales (Km0)	4	1,3
Farmer's market	8	2,6
Total	292	95,7
Do notrespond	13	4,3
Total	305	100

Table 3. Weekly shopping buying fruit

	Students	(%)
Lessthan 10 €	94	30,8
Between 10 € and 20 €	112	36,7
More than 20 €	44	14,4
Total	250	82
Do notrespond	55	18
Total	305	100

Table 4. Check the label or the origin of the fruit purchased

	Students	(%)
Yes	97	31,8
No	68	22,3
Sometimes	127	41,6
Total	292	95,7
Do notrespond	13	4,3
Total	305	100

Many of the respondents seldom check the purchased product's label, the provenance of the product or they even disregard this kind of information. Only 31,8% of them claim that they actually read the label and that they pay attention to the fruit's area of origin (Table 4).

### Analysis of the University Student's Fruit Consumption in Relation to his Life-Style

If we specifically analyze the life-style of the university students attending the University of Messina, we can underline that more than 63% do not smoke, 45,7% do not consume alcoholic drinks, 39,7% practice sport activities once or twice a week and 95,4% proclaim themselves to be omnivorous. According to the data derived from the sample, 71,5% of the respondents declare to be attending a three-year degree course, while 26,6% claims to be attending a master's degree course. Turning to the analysis of the percentage profiles in relation to sex, we can notice that women consume more fruit than men (Table 5), a data which is in line with what was highlighted by other studies on this topic. Considering the respondent's life-style, there is a tendency of non-smoking students (47,9%) to consume fruit every day (significant Pearson's Chi-square Test with  $p < 0.05$ ) (Table 6). The following table, instead, indicates the tendency to consume fruit on a daily basis of those who do not make use of alcoholic drinks (Table 7). Moreover, we can notice a higher daily fruit consumption among the students coming from small size families (less than or equal to three components). Finally, the relationship between fruit consumption and age group was analyzed. The students who mainly consume fruit are aged on average between 22 and 24 (Table 8).

Table 5. How many times a week fruit consumption?

	Male	Fermale	Total
Everyday	45	89	134
	41,7%	45,4%	44,1%
3-5 times	35	51	86
	32,4%	26%	28,3%
1-2 times	27	50	77
	25%	25,5%	25,3%
Never	1	6	7
	0,90%	3,10%	2,30%
Total	108	196	304
	100%	100%	100%

Table 6. How many times a week fruit consumption? Do you smoke?

	Do yousmoke?			Total
	Yes	No	Ex	
Everyday	35	92	7	134
	36,5%	47,9%	46,7%	44,2%
3-5 times	27	59	0	86
	28,1%	30,7%	0,00%	28,4%
1-2 times	30	39	7	76
	31,3%	20,3%	46,7%	25,1%
Never	4	2	1	7
	4,2%	1%	6,7%	2,3%
Total	96	192	15	303
	100%	100%	100%	100%

Table 7. How many times a week fruit consumption? Alcoholconsumtion?

	Alcoholconsumtion?			Total
	Yes	No	Rarely	
Everyday	15	67	52	134
	37,5%	48,6%	41,6%	44,2%
3-5 times	13	38	35	86
	32,5%	27,5%	28%	28,4%
1-2 times	10	30	36	76
	25%	21,7%	28,8%	25,1%
Never	2	3	2	7
	5%	2,2%	1,6%	2,3%
Total	40	138	125	303
	100%	100%	100%	100%

Table 8. How many times a week fruit consumption? Age group

	<=21 age	22-24 age	>=25 age	Total
Everyday	44	46	40	130
	44,9%	40,4%	47,1%	43,8%
3-5 times	28	33	25	86
	28,6%	28,9%	29,4%	29%
1-2 times	23	32	20	75
	23,5%	28,1%	23,5%	25,3%
Never	3	3	0	6
	3,1%	2,6%	0,00%	2%
Total	98	114	85	297
	100%	100%	100%	100%

## Statistical Analysis

In order to identify the existence of possible variables that may influence the frequency of fruit consumption, it was deemed appropriate to estimate an adequate regression model. Since the response variable was one of ordinal type on 4 levels (0 = never; 1 = once or twice a week; 2 = 3-5 times a week; 3 = each day) the Cumulative Proportional Odds Model, an extension of the general linear model to ordinal categorical data, was used. It can be implemented through the Polytomous Universal Model (PLUM) procedure of the statistical software SPSS, within which it is possible to specify five targeted link functions. In the present work the logit link function was used (Norusis, 2009). We estimated as many models as the explanatory variables to be tested. In each model there are 3 constants, equal to the number of categories of the response variable less one. The model results are reported below. For

each model, the degree of association between the dependent variable and the explanatory variables is estimated. For this purpose we estimated Cox and Snell's test, Nagelkerke's tests and McFadden's texts which have provided, in all the models, specific results that denote an adequate degree of adaptation to the data (Table 9). According to the results obtained by the estimate of the above mentioned model, it emerged that only two of the analyzed variables have a significant influence on the weekly frequency of fruit consumption and precisely smoking and the frequency of sport activity. In particular, the sign of the coefficient associated with smoking is negative, thus denoting that the students who do not smoke consume fruit more frequently; the positive sign of the coefficient related to the frequency of sport activities shows that those who assiduously attend a gym or, in general, practice a sport, are the same who habitually consume fruit.

Table 9. Cumulative results of the proportional odds Model for the dependence of the weekly frequency of fruit consumption by college students from the University of Messina

Variable	Estimate	Confidence interval at 95%		p-value
		Lower limit	Upper limit	
Constant 1	-2.720	-4.354	-1.086	0.001
Constant 2	0.186	-1.268	1.639	0.802
Constant 3	1.424	-0.037	2.885	0.056
Age	0.050	0.012	0.112	0.112
Constant 1	-3.756	-4.522	-2.991	0.000
Constant 2	-0.972	-1.267	-0.676	0.000
Constant 3	0.229	0.045	0.503	0.101
Gender	-0.024	-0.458	0.411	0.915
Constant 1	-4.726	-6.039	-3.414	0.000
Constant 2	-1.747	-2.741	-0.753	0.001
Constant 3	-0.508	-1.482	0.466	0.307
Number of family members	-0.170	-0.406	0.066	0.158
Constant 1	-3.573	-4.582	-2.563	0.000
Constant 2	-0.719	-1.384	-0.055	0.034
Constant 3	0.508	-0.153	1.169	0.132
Title father's study	0.131	-0.184	0.447	0.415
Constant 1	-3.990	-5.006	-2.974	0.000
Constant 2	-1.103	-1.766	-0.439	0.001
Constant 3	0.128	-0.523	0.779	0.700
Title studio mother	-0.061	-0.376	0.254	0.705
Constant 1	-3.940	-4.710	-3.170	0.000
Constant 2	-1.151	-1.450	-0.852	0.000
Constant 3	0.072	-0.195	0.339	0.597
Smoke	-0.528	-0.975	-0.080	0.021
Constant 1	-3.930	-4.721	-3.140	0.000
Constant 2	-1.155	-1.503	-0.806	0.000
Constant 3	0.060	-0.262	0.382	0.716
Alcohol	-0.319	-0.740	0.102	0.137
Constant 1	-4.112	-5.350	-2.874	0.000
Constant 2	-1.325	-2.337	-0.312	0.010
Constant 3	-0.130	-1.131	0.871	0.799
Style food	-0.386	-1.408	0.636	0.459
Constant 1	-4.036	-4.913	-3.159	0.000
Constant 2	-1.091	-1.509	-0.673	0.000
Constant 3	0.111	-0.287	0.509	0.585
Frequency sport	0.943	1.802	0.083	0.032

Therefore, it can be affirmed that a healthy life-style is closely related to healthy eating habits. Lastly, in order to outline “the ideal consumer’s profile”, according to what emerged from the analysis of the sample which is the object of study, it is possible to affirm that it is that of a woman; who does not smoke, regularly practices sporting activity, does not drink alcohol, consumes fruit for the whole year (mainly seasonal fruit) both at lunch and between meals, purchases mainly at the greengrocer’s or at the supermarket and spends an average of 10 and 20 € each week.

## Conclusion

The present survey establishing an informative reference framework regarding the propensity to fruit consumption in the diet of the students attending the University of Messina. The work highlighted that only 44,1% of the surveyed young people declare a daily fruit consumption of 75%, compared with the national data. Therefore, the prevalent food model is still far from the desirable one which implies the consumption of 3 or more portions of fruit each day (recommended quantity). Essentially, the majority of the sample consumes fruit every day, but only a percentage inferior to 10% eats more than three portions, namely a quantity which may represent an effective preventive action against a broad range of diseases. In most cases, the consumer doesn't know the meaning the healthy effects of the Mediterranean Diet. Consequently, the study which was carried out leads to propose the implementation of a dietary education and information system such as to favour the diffusion of healthy food models able to correct young people’s eating habits. In conclusion, although the results produced by this survey cannot be considered as originating from a typical random sampling procedure, they can definitely be used for cognitive purposes and for future researches. Indeed, it is a pilot survey on a good number of interviewed subjects in which the informative element is one of particular interest.

## Author’s Contributions

The work is the result of a full collaboration of the authors. However, Maurizio Lanfranchi, in addition to 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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