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The social and economic determinants of obesity: an empirical study in Italy

A. Banterle[1] and A. Cavaliere[1]

[1]Department of Agricultural, Food and Environmental Economics,
Università degli Studi di Milano, Italy
e-mail: alessandro.banterle@unimi.it, alessia.cavaliere@unimi.it

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A. Banterle[1] and A. Cavaliere[1]

[1]Department of Agricultural, Food and Environmental Economics,
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e-mail: alessandro.banterle@unimi.it, alessia.cavaliere@unimi.it

Abstract. Obesity problems are no longer limited to the USA as, in recent years, obesity rates in the EU countries have increased dramatically, leading to serious consequences in terms of direct health care costs and productivity losses, and indicating the existence of a negative externality connected with obesity. Several studies have investigated the private and social costs of obesity, and possible interventions to reduce this pathology. Moreover, a number of economic studies deals with the analysis of variables affecting overweight. Following this last approach and focusing on Italy, the purpose of this paper is to analyse the socio-economic variables affecting obesity, by means of a survey conducted on a sample of 955 consumers resident in Lombardy. The sample was stratified by the variables of gender, age, and residence of the interviewees and was representative of the Lombardy population. We used an ordinal regression model as the dependent variable is expressed in terms of BMI ordinal categories. The independent variables in the model are 14, and are connected to socio-demographic characteristics, nutritional claims, food product attributes, consumer healthy life attitude. The results show that the condition of the seriously overweight, and obese people, increases with age, and this is especially so in people over 65 where the obesity rate is quite high. Also gender is correlated with the pathology, those affected being more likely to be men. Furthermore, there is an inverse relation between obesity and education, obesity decreasing with increasing level of education. Therefore, the analysis underlined that disadvantaged social categories are more susceptible to obesity and overweight. Interestingly, it was found that an inverse relation exists between obesity and quality and marketing attributes of food products.

Keywords: Economics of obesity, BMI, consumer, ordinal regression model.

1. Introduction

Obesity has reached epidemic proportions globally, with more than 1 billion adults overweight - at least 300 million of them clinically obese - and is a major contributor to the global burden of chronic disease and disability (WHO, 2004).

Sowers (2003) has found evidence of an association between a high body mass index (BMI) and cardiovascular disease risk factors. The major complications of excess weight are: diabetes; high blood pressure; high total and LDL cholesterol, and low HDL cholesterol; high triglyceride levels; stroke; a set of cancer types; arthritis. A series of disabilities and psychological problems are linked directly to excessive weight.

The key causes are connected to increased consumption of energy-dense foods, with high level of saturated fats and sugars, and reduced physical activity. The World Health Organization stated that obesity is spreading around the world like a 'global epidemic' (WHO, 2004).

For three main reasons obesity is now a primary concern in the European Union (Mazzocchi and Traill, 2008). First, high obesity rates are no longer limited to the USA, as the UK and other European countries (even some developing countries) are experiencing sharp increases (Lang and Rayner, 2005). Second, as seen above, obesity rates have been associated with serious health consequences, which mean high direct health care costs and productivity losses (WHO, 2004). Third, such costs are borne by all taxpayers, indicating the existence of an externality and a market failure connected with overeating (Yach *et al.*, 2006).

Focusing on Italy, the purpose of this paper is to analyze the socio-economic variables affecting obesity by means of a survey conducted on a consumer sample.

In Italy the percentage of obese individuals is about 9% in the total population, thus less important than in other EU countries. Even so, we have chosen this topic for three main reason: first, in Italy an high rate of overweight people is observed, therefore there is a risk to increase the number of obese people; second, the Italian situation concerning obesity is characterized by an high dualism between the southern regions and the northern regions; third, a great percentage of children obese due to unhealthy diet of family is revealed in this country.

The paper is organized as follows: section 2 shows data related to obesity rates in the EU and in Italy and provides a background on the literature of economic issues related to obesity; section 3 analyses socio-economic variables affecting obesity; section 4 describes the method and the empirical model utilized; section 5 reports and evaluates the results of our empirical analysis; in section 6 the concluding remarks are set down.

2. Economic issues

2.1 A general overview of obesity

The World Health Organization, in 2006, announced that overweight adults are one billion in the world and more than 30% of those are obese. According to International Obesity Task Force (IOTF), childhood obesity is increasing rapidly: in Italy, for example, 33% of children in the age from 6 to 13 are overweight or obese, whereas 20% are overweight or obese in the US (Lobstein and Frelut, 2003).

Exact standards for allowable fat percentages have not been established yet. However, men with more than 25% body fat and women with more than 30% should be considered obese. These figures should not be confused with the body mass index (BMI), which is more commonly used by health care professionals to determine the effect of body weight on the risk for some diseases (NIH, 2004).

In the United States obesity has grown dramatically over the past fifteen years. According to OECD data, the percentage of obese people in the population increased from 12% in 1990 to 34.3% in 2006. In the European Union, WHO data for 2004 revealed the highest obesity rates in the population in the United Kingdom (24%), Malta (23%), Germany (19.4%), Hungary (18.8%), and Poland (18%) (fig. 1). Obesity rates between 10% and 15% are observed in Slovenia, Slovakia, Finland, Ireland, Spain, Estonia, Belgium, Cyprus, France, Greece, Austria, the Netherlands, and Sweden, whereas, the countries with the lowest rates are Denmark, Italy, Luxembourg and Portugal.

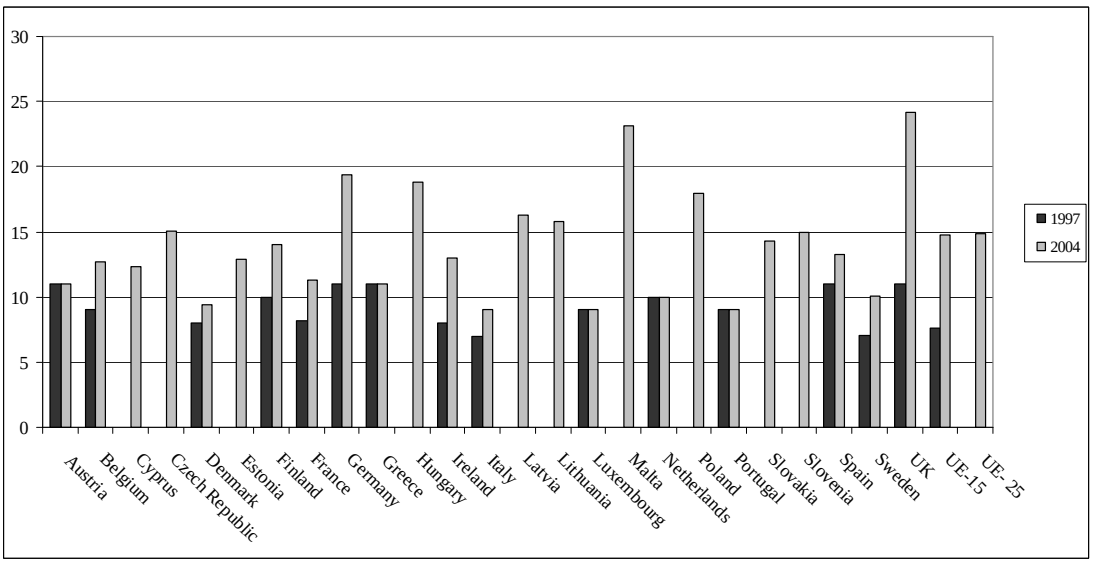

Figure 1. Rate (%) of obesity among UE adults in 1997 and 2004
Source: Own calculation based on WHO data

In Italy the percentage of obese people in the total population was 9% in 2004, but the trend is increasing in recent years. At regional level the distribution of obesity rates is different between northern and

southern part of the country (fig. 2). The data of the Italian Central Institute of Statistics (ISTAT) revealed the highest overweight and obesity rates in the southern regions: Campania (40.1% overweight and 11.7% obese); Molise (37.7% overweight and 13.1% obese); Sicily (38.5% overweight and 11.6% obese); Apulia (38.2% overweight and 11.5% obese); Basilicata (36.3% overweight and 13.3% obese); Calabria (38% overweight and 11.3% obese). On the opposite, the northern regions with the lowest rates are Piedmont, Lombardy, and Trentino-AltoAdige.

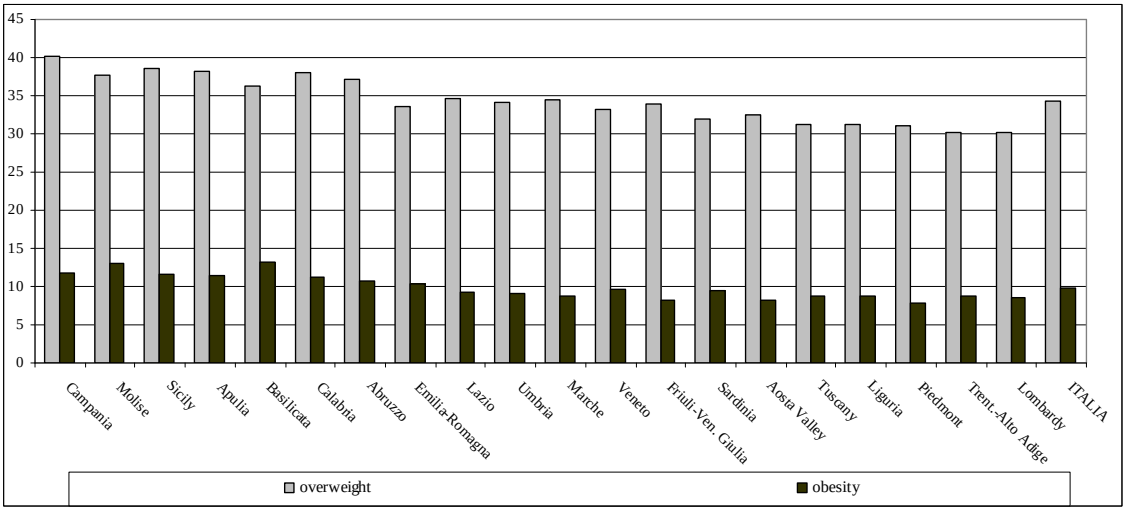

Figure 2. Rate (%) of overweight and obesity among adults in Italy in 2005
Source: Own calculation based on ISTAT data

2.2 Economic literature analysis

The reasons which can explain the growth of obesity rates over the last fifteen years in the United States have been analyzed by several studies. In 2002 Lakdawalla and Philipson observed that the increase in obesity rates stems from technological change leading to relatively cheaper calories, while exercise becoming relatively more expensive. The outcomes of industrialization, urbanization and concomitant economic growth in the last century are sedentary work and activities that are reduced energy expenditure (Finkelstein *et al*., 2005; Philipson, 2001). Moreover, dietary habits have shifted to the consumption of highly caloric foods, with high contents of fats, saturated fats, and sugars.

Some studies based on behavioral models of obesity suggested the following elements as determinants of the quantity of calories consumed: changes in relative food prices and in the density of fast food restaurants (Chou *et al*., 2004; Currie *et al*., 2009); reductions in time for preparing meals (Cutler *et al*., 2003); unemployment and job strenuousness (Ruhm, 2000).

From an economic point of view, the spreading of obesity leads to direct and indirect social costs to the economic system. The greater part of these (more than 60%) is due to increased drug expenses and hospital admissions, creating a notable increase in the burden for the national sanitary system (Runge, 2007). Besides direct costs, we can also consider the indirect costs: less job productivity and consequent discrimination, greater frequency of disability pensions and higher insurance premiums (Runge, 2007).

A negative externality connected with high rates of people overweight and obese can come from the higher consumption of medical care, mainly paid by society rather than individuals (Miljkovic, 2006; Finkelstein *et al*., 2005). This case represents a typical form of market failure caused by a negative externality, namely an external cost imposed (without compensation) to some individuals by the economic activity of others (Kuchler and Ballenger, 2002; McCormick and Stone, 2007).

In Italy, according to WHO data, the total cost due to obesity amounts to 23 billion euros per year. In some European countries the costs of obesity to society are enormous, approaching 1% of the gross domestic product (WHO, 2006). Further, obesity in adults can account for up to 6% of direct health costs. The costs of obesity per capita are different from country to country: following WHO data, in Sweden, for

instance, direct costs of obesity are estimated to be 45 dollars per capita and per year, and indirect costs 157 dollars; in Germany direct costs are evaluated in 35 dollars per capita and per year; similar figures are observed in the Netherlands (32 dollars). These costs are rising dramatically, considering that the direct cost of obesity per capita and per year in the United Kingdom rose from 13 dollars in 1998 to 25-31 in 2002 (WHO, 2006).

Another research area concerning obesity issues regards possible interventions to reduce this pathology and eliminate the difference between private and social costs (Mazzocchi, 2005). The spectrum of adoptable measures is very wide: the introduction of taxes or subsidies on the nutrients contained in food products; information campaigns to increase consumer awareness and food knowledge; regulations to limit advertising of unhealthy food; programs of nutritional education in schools (Kuchler and Golan, 2004).

Following the classification of Mazzocchi and Traill developed in 2005, nutrition and health policies targeting on obesity issues can be classified into three categories.

- The first category concerns policies aimed to orient consumers toward better informed choices thanks to information campaigns, advertising regulations and nutrition education programs.
- The second category concerns market policies, such as taxes and subsidies affecting the consumer's choice. Examples of such intervention can include a tax on unhealthy foods, i.e. foods eaten in excess, or price subsidies for healthy foods with the purpose of improving diets (Schmidhuber, 2004; Martin, 2005). Moreover, a so-called fat tax on high fat content foods could be considered to discourage consumption of fats and encourage food manufacturers to reduce such ingredients. Nonetheless, to avoid penalization of lower income families, incentive policies and reduction of prices for some foods would be preferable to a taxation system on caloric products (Nayga, 2008).
- The third category concerns supply side policies, providing regulations about the liability of food companies, which should make them legally responsible for negative externalities when selling certain types of foods (Mazzocchi and Traill, 2005).

3. Conceptual framework

A number of economic studies has analysed variables that can affect obesity. Some studies have investigated the role of socio-demographic characteristics such as age, gender, education, income, geographic distribution.

The spread of obesity increases progressively with age: in the United States especially in men over 75 of age and in women between 65 and 74 (Miljkovic *et al.*, 2008; Chang *et al.*, 2006). With regard to gender, men have more greater prevalence towards overweight than women, however, women have greater obesity rates than men (Miljkovic *et al.*, 2008).

The majority of the studies agree that obesity is more diffused among the disadvantaged social categories who have lower levels of instruction, and greater difficulties in accessing medical assistance (Drewnowski and Darmon, 2005). Among the educated upper-middle class adults, the percentage of obese individuals is quite low, the percentage increasing notably among adults with only elementary schooling or without any education at all (Loureiro and Nayga, 2005). Low incomes and low education levels tend to be associated with higher obesity rates in women, rather than among man (Flegal *et al.*, 2002; Paeratakul *et al.*, 2002). Also the kind of job can influence the weight gain, considering that obese women work mostly in relatively low-paying occupation and are excluded from high-paying managerial occupations (Pagan and Davila, 1997; Cawley, 2004). Furthermore, the geographic distribution can affect obesity: for example, in Italy the problem tends to be more evident in the southern regions and in the areas with low-income per capita (Mazzocchi, 2005).

Another issue, analysed in economic studies, that can affect obesity concerns consumer information. It is interesting to note that obesity rates are more elevated when consumers have insufficient information to make more aware choices; in fact, when there is imperfect information, the people do not know exactly the link between their diet and health. Nutritional labeling is a method to reduce this shortage of information. The role of this labeling is to help consumers to choose optimally during purchasing (Drichoutis *et al.*, 2005 and 2008). The information on food products in the EU is destined to become

more clearly worded and transparent, increasing the degree of protection provided to consumers (Nayga, 1996).

In the European Union nutrition labeling is voluntary and in 2006 the Regulation 1924 has provided a legal scheme for using nutrition claims. The Regulation 1924/2006 have established the rules to put on food labels fixed short messages concerning the nutritional content of products, as energy, fat, sugar, sodium, fiber, vitamin, etc. These claims regard the content of nutrient in the food product. For example for "energy" the claims are low energy, energy-reduced, energy free. Similar claims are provided for the other nutrient categories (low fat, fat-free, low saturated fat, saturated fat-free; low sugar, sugar-free, with no added sugar; low sodium/salt, very low sodium/salt, sodium-free or salt-free; source of fiber, high fiber; etc.).

The improving of the nutritional information is considered relevant, as Variyam and Cawley (2006) found studying the efficiency of nutritional labeling on food packaging and analyzing changes before and after the implementation of Nutritional Label in USA. The new labels were associated with a decrease in body weight and in probability of obesity. Moreover, Variyam (2008), applying a difference-in-difference model, has found that nutritional labels might increase fiber and iron intakes of label users compared with non-label users. These findings suggest that nutritional label use can improve the dietary quality of consumers.

Further variables that can affect obesity are related to healthy life attitude of consumers, such as fitness activity and smoking status. Lakdawalla and Philipson (2002) have found a robust negative association between physical activity and obesity. Also smoking status seems to be correlated with obesity, as smokers consume fewer calories than nonsmokers. Specifically, cigarette smoking is associated with lower weight because it tends to increase metabolism and suppress appetite, showing a negative effect on BMI (Huffman and Rizov, 2008).

4. Methodological issues

To analyse the elements that influence consumer weight, a 5-day telephone survey based on a specific system called C.A.T.I. (Computer Aided Telephone Interview) was carried out in December 2006 to collect necessary data. On the total of the contacted households (adults over 18), the refusal rate to participate in the survey was about 12%, while no contact rate resulted to be 20%. With the aim to maximise response rate and minimise error rate to answers, the questionnaire was checked by performing a previous pilot survey.

The sample is composed by 955 consumers resident in Lombardy, a region in northern Italy. This sample was stratified by the variables of gender, age, and residence of the interviewees and was representative of Lombardy population. Answers to the questions were arranged in a multiple-choice format with rating or dichotomic scales.

We used an *Ordinal Regression Model* where the dependent variable is expressed in terms of BMI ordinal categories. The BMI, calculated as weight (Kg) divided by height squared (m^2), does not measure body fat level directly but it is considered a reliable proxy for total body fat for the majority of adults (Martin *et al.*, 2000). BMI has limitations as it do not consider body composition (muscular people, such as athletes, may be classified as overweight incorrectly) (Rosin, 2008)[1].

We take into consideration four consumer categories: normal weight (18.5<BMI<25), slightly overweight (25<BMI<27.5), seriously overweight (27.5<BMI<30) and obese persons (BMI>30). In the ordinal logistic regression the normal weight correspond to value 1, slightly overweight to value 2, seriously overweight to value 3 and obese consumers to value 4. Ordinal logistic model takes the following form (McCullagh, 1980):

[1] Other methods to assess obesity are: waist circumference and waist–hip ratio, representing simple measures and good indicators of abdominal fat which is important as a predictor of risk for heart diseases and other illnesses. Underwater weighing and skin-fold thickness can be also considered, as well as more accurate measurements of body fat by computerized tomography and magnetic resonance imaging, but most of these methods are expensive.

$$C_j(X_i) = \ln\left\{\frac{P(Y > j|Xi)}{P(Y \leq j|X_i)}\right\} = \beta_1 X_{i1} + ... + \beta_k X_{ik} - \tau_{j+1} \qquad [1]$$

Where:
i= 1,...955; corresponds to the number of consumers considered,
j= score from 1 to 4,
k= 1,...14; corresponds to the number of independent variables,
Y= response variable,
Xji= independent variables (answers for each consumers)
β= regression coefficients,
τ= parameter referred to as "cut points" between intervals of value of response variable.
In this kind of model β coefficients represent the log odds ratio of scoring > j versus ≤ j for a one unit change in X.

According to recent economic literature concerning consumers and obesity, we assume that the following independent variables (Xji), grouped in five categories, can affect the BMI:

- socio-demographic characteristic variables (age, gender, education, income, components of family and food knowledge);
- nutrition claim variables that regard the consumer interest for claims introduced by Reg. 1924/2006 (content of energy, fat, sugar, sodium, fibre-vitamin, light) and for nutritional label, and the use of nutritional labelled information;
- variables related to marketing and quality attributes of food products (importance of price, brand, flavour, nutritional properties, origin of products, traceability and quality certifications);
- variables related to consumer food safety attitude (attention to food safety issues, check of the expiry date, and control of ingredients);
- variables related to consumer healthy life attitude (fitness activity and smoking status).

Definitions, means, and standard deviations of all variables employed in the model are reported in table 1. Before estimating the Ordinal Regression Model, we have reduced the variables into factors by using the *Principal Components Analysis* (PCA).

Table 1. Variable definitions

Variable name	Variable type	Description	N	Mean	SD
Age	scale (1-6)	The interviewee's age group (18-24; 25-34; 35-44; 45-54; 55-64; > 65)	955	4.05	1.54
Gender	dummy (0-1)	1 female, 0 male	955	-	-
Education	scale (1-4)	Education levels (primary school; secondary school; higher education; degree)	955	2.45	0.89
Income	scale (0-4)	Can your family income meet your monthly expenses	955	2.33	1.00
Family members	scale (1-4)	4 possible classes of family members	955	2.27	0.81
Food knowledge	scale (0-4)	5 classes of dummy questions about vegetables, eggs, sugar, cholesterol	955	2.53	0.93
Low energy	scale (0-5)	Choosing a food its low energy is important	955	3.32	1.28
Low fat	scale (0-5)	Choosing a food its low fat content/ fat free is important	955	3.71	1.20
Low sugar	scale (0-5)	Choosing a food its low sugar content/ sugar free is important	955	3.51	1.25
Low sodium	scale (0-5)	Choosing a food its low salt content/ salt free is important	955	3.41	1.27
High fibre- vitamin	scale (0-5)	Choosing a food its high vitamin content is important	955	3.82	1.22
Light	scale (0-5)	Choosing a food its being light is important	955	2.84	1.36
Nutritional label	scale (0-5)	Choosing a food its nutritional label is important	955	3.83	1.27
Nutritional labelled information use	dummy (0-1)	Before purchasing a food do you check its nutritional labelled information	955	-	-
Price	scale (0-5)	Purchasing a food its price is important	955	3.76	1.11
Brand	scale (0-5)	Purchasing a food its brand is important	955	3.18	1.23
Flavour	scale (0-5)	Purchasing a food its flavour is important	955	4.42	0.94
Nutritional properties	scale (0-5)	Purchasing a food its nutritional properties is important	955	4.40	0.99
Origin of products	scale (0-5)	Purchasing a food its origin is important	955	4.17	1.13
Traceability	scale (0-5)	Purchasing a food its tracebility is important	955	4.28	1.09
Certification of quality	scale (0-5)	Purchasing a food its certification is important	955	4.25	1.10
Food safety	scale (0-5)	I am concerned with food safety	955	4.47	0.84
Expiry date	dummy (0-1)	1 if check the expirity date of product, otherwise 0	955	-	-
Ingredients	dummy (0-1)	1 if read the list of ingredients, otherwise 0	955	-	-
Fitness activity	dummy (0-1)	If you make a fitness activity regularly	955	-	-
Smoke	dummy (0-1)	1 smoke, 0 no smoke	955	-	-

5. Results

5.1 Descriptive analysis

The sample is composed mainly by normal weight consumers which represents 60.4% of the individuals interviewed, whereas 31.4% are overweight, and 8.2% of the sample are obese. Figure 3 shows a non-parametric estimate of the BMI distribution. It is a normal distribution with maximum frequency around the 24.5 BMI value, or rather between normal weight and overweight. This distribution has been confirmed by Chi-squared and Kolmogorov-Smirnov tests.

Figure 4 shows the increase of BMI among men and women per age groups. The highest increases are shown in two oldest age groups (55–64 years and 65 and older). Regard gender, being seriously overweight and obese is far more likely for men than for women, and greater percentages of obesity were found in the male sample. For men, the maximum average value of BMI in the sample is about 26, whereas for women the value is 25.5.

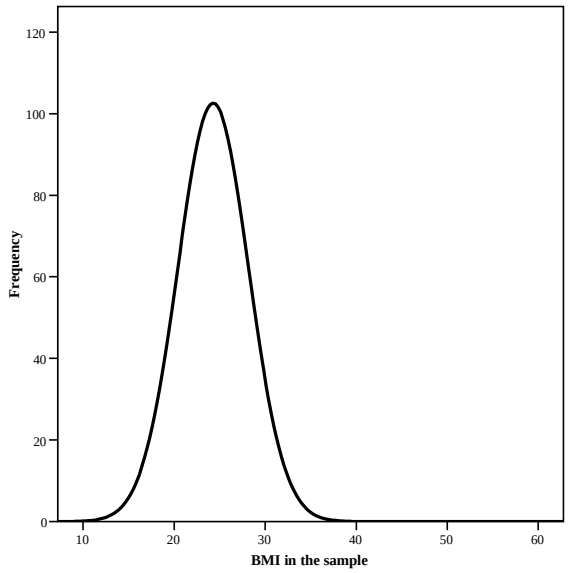

Figure 3. BMI distribution in the sample

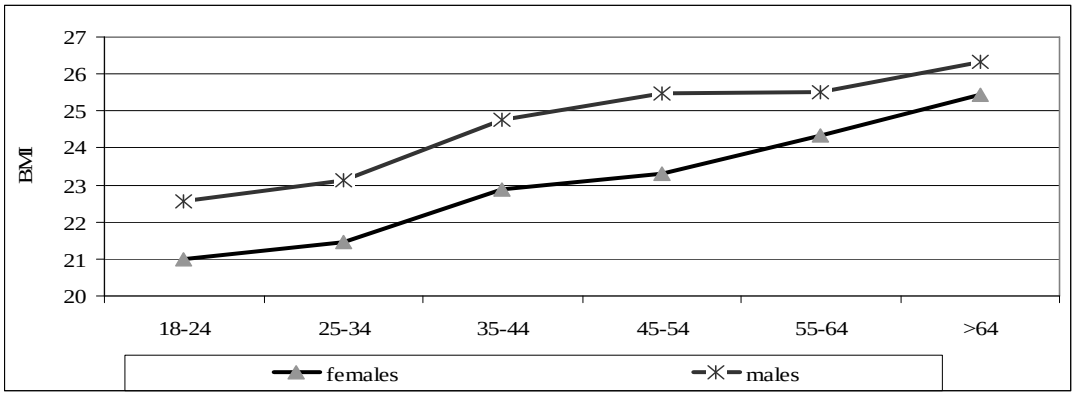

Figure 4. BMI average values according to age in females and males in the sample

Figure 5 shows the main differences between normal weight and obese people of the sample with regard to the interest for some nutrition claims (low energy, low fat and low sugar) and the importance of some product attributes (brand, flavour, nutritional characteristics).

The results highlight that obese people reveal higher interest for these nutritional claims than normal weight consumers, confirming the importance of nutrition information found in the literature. On the contrary, for the product attributes the survey shows that normal weight consumers ascribe a higher importance to flavour and nutritional characteristics of products than obese people, underling that the latter are not so interested in quality attributes of food products.

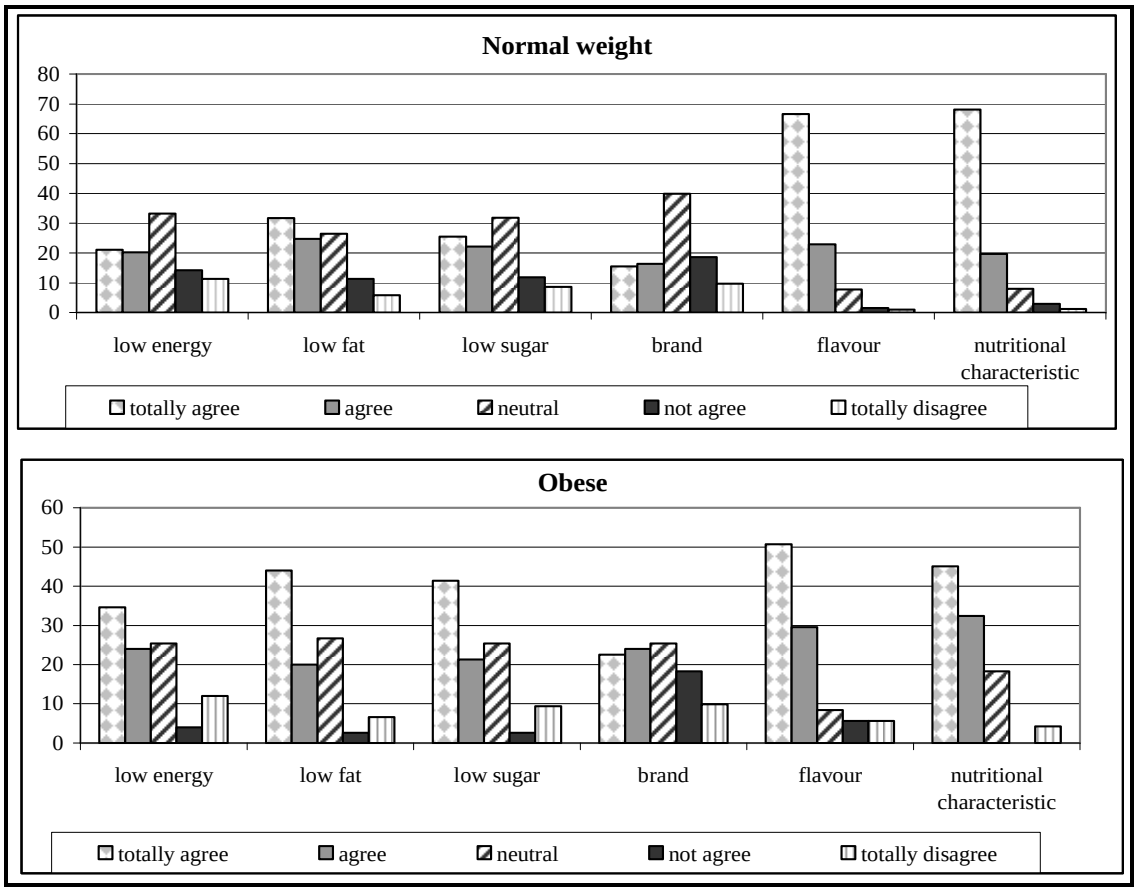

Figure 5. Importance of some claims and some attributes among normal weight and obese people

5.2 Principal Components Analysis

PCA was applied, before estimating the Ordinal Regression Model, to reduce the number of independent variables in the model and to obtain relevant factors that can explain the issues affecting obesity. We have applied PCA for the variables concerning nutrition claims (low energy, low fat, low sugar, low sodium, high fibre-vitamin, light, nutritional label), marketing and quality attributes (price, brand, flavour, nutritional properties, origin of products, traceability, certification of quality) and food safety (tab. 2).

As a result of PCA application, three factors were obtained: 'Nutritional label & claims' (F_1), 'Product quality attributes' (F_2) and 'Product marketing attributes' (F_3) with an aggregate weight of 53.3%. The Cronbach's Alpha reliability test shows that the items contribute well to each factors. These factors have been utilized as independent variables in estimating the Ordinal Regression Model.

In the Ordinal Regression Model we have considered separately the set of variables concerning socio-demographic characteristics (age, gender, education, income, family members, food knowledge) and the dummy variables (nutrition labelled information use, expiry date, ingredients, fitness activity, smoke).

Table 2. PCA results

Variables	Factor 1 Nutritional label & claims (F_1)	Factor 2 Product quality attributes (F_2)	Factor 3 Product marketing attributes (F_3)
Low energy	**0.788**	0.090	0.194
Low fat	**0.832**	0.090	0.070
Low sugar	**0.838**	0.161	0.047
Low sodium	**0.800**	0.188	-0.006
High fibre- vitamin	**0.698**	0.244	0.006
Light	**0.683**	0.103	0.318
Nutritional label	**0.590**	0.297	-0.027
Nutritional properties	0.181	**0.629**	0.044
Origin of products	0.125	**0.705**	0.087
Traceability	0.073	**0.767**	0.006
Certification of quality	0.172	**0.617**	0.099
Food safety	0.190	**0.531**	0.147
Brand	0.160	-0.030	**0.639**
Price	0.108	0.092	**0.682**
Flavour	-0.063	0.225	**0.609**
Cronbach's Alfa: 0,844	Total Explained variance: 53,277%		
Keiser Meyer Olkin test: 0,894	Rotation method: Varimax		
Bartrlet Test:	χ^2	4614.74	
	gl	105.00	
	Sig.	0.00	

5.3 Estimation results

Maximum likelihood estimation method was utilised to estimate equation [1]. Adequate goodness of fit is shown by Pearson's Chi-Square Statistics and Nagelkerke's R^2.

Table 3 shows that in our survey BMI is affected by several socio-demographic variables, such as age, gender, education and the number of family members, in accordance with the findings of the recent economic literature, whereas income and food knowledge are not significant.

The results reveals a positive and significant relation between age and obesity (0.391), highlight that the condition of seriously overweight and obese increases with age, especially in people over 65. The relation between gender and BMI is significant and negative (-0.817), outlining that being seriously overweight and obese is far more likely for men than for women.

An inverse relation was shown between obesity and education (-0.292): obesity decreases with increasing level of education, and is higher in people with less education. This evidence is in line with the empirical analyses found in the literature. The variable related to family members appears significant and positive (0.187), affecting BMI. Therefore, people living in large household tend to have higher levels of BMI than single (and divorced) individuals, in accordance with a study showing that being married increases the probability of obesity, and single or divorced individuals are less likely to be obese (Costa-Font and Gil, 2005).

Obesity is negatively related to fitness activity (-0.439). This negative relation is well recognized in the literature. Those who spent their spare time playing sports several times a week have a low obesity rate, whereas, a sedentary life-style is associated with a high obesity rate.

The first factor (F_1) obtained through PCA, concerning the consumer interest for nutritional label and claims, does not appear significant, even though in the descriptive analysis we have pointed out the higher interest of obese people for nutritional claims than one of normal weight individuals. As we have

underlined above, several economic studies have highlighted the importance of information for the obesity conditions.

The regression analysis reveals that the second factor (F_2) obtained through PCA, concerning product quality attributes, shows a significant and negative coefficient (-0.145). Thus, the overweight and obese people, during the formulation of purchasing decisions, do not pay attention to these attributes, such as nutritional properties, product origin, traceability, certification of quality, and food safety.

A similar negative relation is revealed between BMI and marketing attributes (F_3) (-0.135). Therefore, product attributes like price, brand and flavour do not seem to influence the food choices of obese consumers.

Table 3. Estimate of the model

	Body Mass Index (BMI)	
	β	**Sig.**
α_1	0.714	0.223
α_2	1.999	0.001
α_3	2.902	0.000
Age	**0.391**	0.000
Gender	**-0.817**	0.000
Education	**-0.292**	0.001
Income	-0.051	0.463
Family members	**0.187**	0.037
Fitness activity	**-0.439**	0.002
Smoke	-0.050	0.770
Food knowledge	-0.098	0.176
Nutritional labelled information use	-0.030	0.840
Expiry date	0.011	0.974
Ingredients	-0.117	0.435
Nutritional label & claims (F_1)	0.097	0.191
Product quality attributes (F_2)	**-0.145**	0.036
Product marketing attributes (F_3)	**-0.135**	0.042
Chi-Square	146.108	0.000
Pseudo R^2 (Nagelkerke)	0.161	

6. Concluding remarks

The survey concerning the Italian situation related to overweight and obesity was aimed to analyze socio-demographic and economic variables affecting obesity, applying an Ordinal Regression Model for the empirical estimation.

Our analyse revealed that socio-demographic, economic and cultural variables affect the increasing rate of obesity in Italy. According to previous economic studies found in the literature, the results highlighted that disadvantaged social categories, such as elderly people and those with a low level of education, are more susceptible to the problem of overweight and obesity. The age increase tends to be accompanied by an increase in overweight and obesity.

Another variable that plays an important role in affecting BMI is fitness activity, as our results indicated a significant and negative relation between physical activity and BMI. Moreover, our analysis has shown that overweight and obese people do not pay attention, during the formulation of purchasing decisions, to quality attributes of food products, such as nutritional properties, product origin, traceability, quality

certification, and food safety. A similar evidence was found for marketing attributes of food products, like brand, price, and flavour.

The policy implications deriving from the analysis, to face obesity problems, are multiple. First, given the propensity of some social groups to be overweight, the policy measures should focus on this consumer segments to improve their health and food awareness.

Second, since overweight and obesity problems seem affecting the disadvantaged groups of the society, the system of taxation applied to caloric products (as the fat tax), or other system of taxation, would penalize the families with lower income. For this reason, policies of incentives, reduction of prices, and other types of subsidies could be preferable.

Third, the increase of education level can significantly contribute to reduce the overweight and obesity rate in the population. The education has a significant impact on obesity, as educated and well informed consumers are able to understand nutritional labels and can make a decision about their diet, taking into account their preferences and health concerns. This could probably lead to healthier product choices.

Future researches involve comparisons among our results and other situations in Italy, for example considering a region in the south of the country where the obesity rates are higher, and in other European countries.

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