OVERWEIGHT AND OBESITY IN SOUTHERN ITALY: THEIR ASSOCIATION WITH SOCIAL AND LIFE-STYLE CHARACTERISTICS AND THEIR EFFECT ON LEVELS OF BIOLOGIC MARKERS.

SOBREPESO Y OBESIDAD EN REGIÓN SUR DE ITALIA: ASOCIACIÓN CON LAS CARACTERÍSTICAS SOCIALES Y ESTILOS DE VIDA Y SU EFECTO SOBRE MARCADORES BIOLÓGICOS.

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Abstract

Background: In the last decades, overweight and obesity have been transformed from minor public health issues to a major threat to public health affecting the most affluent societies and also the less developed ones.
Objectives: To estimate overweight-obesity prevalence in adults, their association with some social determinants and to assess the effect of these two conditions on levels of biologic and biochemical characteristics, by means of a population-based study.
Methods: A random sample of the general population of Putignano was drawn. All participants completed a general pre-coded and a Food Frequency questionnaire; anthropometric measures were taken and a venous blood sample was drawn. All subjects underwent liver ultra-sonography. Data description was done by means of tables and then Quantile Regression was performed.
Results: Overall prevalence of overweight and obesity were 34.5% and 16.1% respectively. Both overweight and obesity were more frequent among male, married and low socio-economic position subjects. There were increasing frequencies of normal weight with higher levels of education. Overweight and obese subjects had more frequently Nonalcoholic Fatty Liver Disease, Hypertension and altered biochemical markers. Quantile regression showed a statistically significant association of age with overweight and obesity (maximum about 64.8 yo), gender (female) and low levels of education in both overweight and obesity. More than 10 gr/day of wine intake was associated with overweight.
Conclusions: The prevention and treatment of overweight/obesity on a population wide basis are needed. Population-based strategies should also improve social and physical environmental contexts for healthful lifestyles.
Keywords: overweight, obesity, prevalence, population-based, lifestyle.

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Antecedentes: En las últimas décadas, el sobrepeso y la obesidad se transformaron en una importante amenaza a nivel de Salud Pública, afectando a los grupos poblacionales en todos los estratos de la sociedad.
Objetivo: Estimar la prevalencia de preobesidad y obesidad en la población adulta, identificar su asociación con diversas características sociales y evaluar el efecto de estas dos condiciones sobre algunos marcadores biológicos en el contexto de un estudio de base poblacional.
Material y Métodos: Una muestra aleatoria representativa de la población de Putignano fue extraída. Los participantes completaron un cuestionario alimentario, se tomaron las medidas antropométricas y una muestra de sangre. A todos los participantes se les realizó una ecografía hepática. Los datos se describieron mediante tablas y luego se llevó a cabo un análisis de regression por cuantiles.
Resultados: La prevalencia de preobesidad y obesidad fueron 34.5% y 16.1% respectivamente. Ambas fueron más frecuentes en hombres, casados y de bajo estrato socioeconómico. Los grupos de mayor frecuencia de sujetos con normo-peso correspondieron a los niveles educativos más altos. Sujetos preobesos y obesos presentaron mayor frecuencia de esteatosis hepática, hipertensión arterial, así como valores de sus marcadores biológicos alterados. La regresión por cuantiles mostró una asociación positiva estadísticamente significativa de la edad con la preobesidad y la obesidad (máximo en torno a los 64.8 años de edad), el género (mujeres) y bajos niveles educativos, tanto en los sujetos preobesos como en aquellos con obesidad. Consumir más de 10 g/día de vino estuvo asociado con la preobesidad.
Conclusiones: Es necesario la prevención y el tratamiento de la preobesidad y la obesidad como políticas de población. Estas políticas poblaciones ayudarían tambien a mejorar el ambiente físico y social para obtener estilos de vida más saludables.

Palabra clave
Preobesidad, Obesidad, Prevalencia, Estudio de base poblacional, Estilo de vida.

Introduction

In the last decades, overweight and obesity have been transformed from minor public health issues to a major threat to public health affecting the most affluent societies and also the less developed ones[1]. The epidemiology of overweight and obesity as indicated by the body mass index (BMI) has presented some difficulties because many countries had their own definition criteria. Classification criteria suggested by World Health Organization (WHO)[2] has partially unified the definition of overweight and obesity although the debate about interpretation of BMI in some populations still persists[3].

The prevalence of obesity is increasing at an alarming rate in many parts of the world including Europe[4], USA[5,6] and Canada[7]. In all these regions the prevalence is high in men and women as well as in children. Evidence of increasing rates is also available from Australia[8,] New Zealand[9] and some areas of the Pacific Islands which have extremely high rates of obesity[10]. Furthermore, in many Latin American and Caribbean countries, a notable increase in the prevalence of overweight and obesity has been reported[11,12].

As overweight/obesity has evidenced, particular attention must be paid to a wide range of health consequences of adult weight gain and obesity. Several cross-sectional and longitudinal studies[13,14] have shown the strength of the association between BMI and Type 2 Diabetes Mellitus (T2DM). Health problems associated with obesity include increased (gallbladder disease, dyslipidaemia, insulin resistance, non-alcoholic fatty liver disease (NAFLD), breathless and sleep apnoea), moderately increase (congestive heart disease (CHD), hypertension, osteoarthritis, hyperuricaemia and gout) and slightly increased (reproductive hormone abnormalities, polycystic ovario

syndrome, impaired fertility, lowback pain, fetal defects associated with maternal obesity) relative risk conditions[2]. The relationship between obesity and cancer has been evidenced more recently and epidemiological association are now well established for a number of major cancers[15].

In Italy, as other European countries, overweight and obesity are of public health concern. Data available from WHO16 showed in 2005 an overall prevalence of 43.2% and 15.8% for overweight and obesity among adults respectively. Male prevalence rates for overweight (42.5%) and obesity (10.5%) where higher than in women (26.6% and 9.1% respectively). Trend of overweight and obesity in Italy are less unfavorable than in several developed countries although about 15 million of Italian adults are overweight and 4 million obese. In the Apulian region (Southern Italy), overall prevalence rates for overweight (38.2%) and obesity (11.5%) are lower than in other Italian areas. However, data about sex and age prevalence rates as well as on biological effect of overweight and obesity are missing.

Southern Italy has been traditionally the less industrialized area of Italy with an economy relying on agricultural and cattle ranch grounds where the Mediterranean diet is the most prevalent way of eating. In this paper data on overweight and obesity from a semi-rural area of southern Italy are reported. The objective of this work was to estimate the prevalence of overweight and obesity in adults and their association with some social determinants and to assess the effect of these two conditions on levels of biologic and biochemical characteristics in a population-based random sample of adult general population.

Material and Methods

Details of the overall design of this survey have been published elsewhere[17]. Briefly, the survey was conducted at the National Institute of Gastroenterology Saverio de Bellis (Castellana Grotte, Bari, Italy) in collaboration with 12 General Practioners (GPS) working in Putignano (Bari, Italy) and covering 83% of the population of more than 18 years old. The study period was from July 2005 to January 2007.

Using a systematic random 1-in-5 sampling procedure, a sample of the general population ≥ 18 years old of age was drawn from the GPs list of records. The GPs records, instead of a drawing from the census, were used because no significant difference was found between the age-sex distribution of the general population from Putignano and the subjects in GPs records.

Thus, 2,550 subjects were invited by letter to participate in the survey; of these 2,301 (90%) agreed to participate providing written informed consent according to the Helsinki Declaration.

Respondent subjects were interviewed by the same physician (ARO) in order to complete a pre-coded questionnaire. The questionnaire included questions on socio-demographic factors, medical history and potential risk factors for some liver diseases. Moreover subjects completes the Lifetime Drinking History Questionnaire[18], which has been widely validated. All participants also completed the European Prospective Investigation on Cancer (EPIC) questionnaire about dietary habits. All subjects underwent LUS performed with a Hitachi HI Vision E. A fasting venous blood sample was also collected in the morning of enrollment. Liver function tests and others biochemical serum markers were carried out by standard laboratory test techniques.

In this paper variables associated with social and life-style characteristics, some biological and biochemical parameters and presence and grade of NAFLD were used to explore the overweight and obesity pattern. Age at enrollment was recorded and categorizes into ten-years classes with to open classes (< 30 and ≥ 80). Anthropometric measures such as current weight and height were taken always with the same instruments. For descriptive purposes BMI was categorized into Normal (<25), Overweight (25.0-29.9) and Obesity (≥30.0). For subjects who had become a pensioner at enrollment, the work done during the working life was considered. A composite indicator of socio-economic position (SEP) was built, following Oakes and Rossi[19]. Age at enrollment, number of households, education, job, civil status and to be a pensioner varia-

bles were used in a Factor Analysis (FA). Internal consistency reliability as measured by Chronbach's alpha was 0.35%. A varimax rotation was then performed. Four factors were retained which explained 89.7% of total variation. The first factor was characterized by a strong factor loading on job (25%), the second one by education (49% cumulative variance), the third one by marital status (70.4% cumulative variance) and the fourth factor by number of households. The resulting scale was then standardized and reversed so that high values correspond to high SEP. Finally the variable was categorized as low (<0.25 quantile), medium (0.25-0.74 quantiles) and high ≥ 0.75 quantile). For analytical purposes the following variables were dichotomized into normal and high categories: Systolic Blood Pressure (SBP) (> 120mmHG), Diastolic Blood Pressure (> 80 mmHg), Glucose (≥126 mg/dl), Glutamic pyruvic (SGPT) transaminases (≥ 40U/l), Triglycerides (≥ 165 mg/dl), Cholesterol (≥ 200 mg/dl for men and ≥ 220 mg/dl for women) and Gamma-glutamyl transpeptidase (Gamma-GP) (> 25 UI/l for men and > 14 UI/l for women). Data description was carried out by performing cross-tabulation between categories of BMI and selected variables. Proportion differences were assessed through x^2. Data description was completed by comparing mean (standard deviation) BMI between biological and biochemical variables stratified by sex. 95%CI were built to compare means.

Quantile Regression (QR) models were fitted to provide information about the relationship between BMI and the covariates at different points of the conditional distribution of BMI20. The standard linear regression is a useful tool for summarizing the average relationship between the outcome variable of interest and a set of independent variables but this provides only a partial view of the relationship. The distribution of the dependent variable, BMI in this case, may change in several ways that are not revealed or are only incompletely revealed by an examination of averages. A more complete picture that would provide information about the relationship between the conditional distribution of BMI and the independent variables is performed by QR analysis. So, 0.47 and 0.83 quantiles were chosen as cut-off points because they represent BMI ≥ 25.0 and ≥ 30.0 respectively. To assess whether the relationship between age and BMI was non-linear, the significance of a quadratic term for age was examined. A p value ≤ 0.005 was considered as statistically significant.

All statistical analysis were performed by using Stata software, version 12.1 (Statacorp LP, Lakeway Drive, TX, USA).

Results

(Table 1) shows the baseline characteristics of the population according to selected demographic variables. Overall prevalence of overweight and obesity were 34.5% and 16.1% respectively. Both overweight and obesity were more frequent in male, particularly for overweight (p<0.001); 61.3% of married subjects showed BMI greater than 25.0, from which 19.5% were obese whereas most of normal weight subjects were single or widowed (p<0.001). Farmer was the job category with the higher frequency of overweight subjects (p< 0.001) whereas low SEP had higher values for both overweight and obesity (p<0.001). There were increasing frequencies of normal weighty with higher levels of education (with an inverted trend for overweight and obesity) (p<0.001). Eighty percent of subjects with some degree of NAFLD were overweight (39.4% obese) (p< 0.001). Increasing degree of NAFLD severity was observed among obese subjects whereas the opposite was observed among overweight ones (p<0.001). Normal weight subjects tended to be no or light drinkers of wine (p<0.001) whereas there were no differences of beer and spirits daily intake among different categories of BMI. High levels of SBP and DBP were more prevalent among overweight or obesity subjects (p<0.001) as well as high levels of SGPT (p<0.01), Gamma-GT, Glucose, Cholesterol and Triglycerides (p<0.001). (Figure 1) shows that a higher prevalence rate in men occurs at earlier ages; it also shows that although percentages of subjects with obesity at older ages were similar in male and female, the occurrence before age 30 is lower in women. From another point of view, (Table 2) describes how BMI means vary between biochemical markers categories for both sexes. With the exception of SGPT, BMI means for high levels of SBP; DBP, Glucose, Cholesterol, Triglycerides and Gamma-GT

Table 1: Baseline characteristics of the study population according to selected demographical, lifestyle, biological and biochemical variables. NUTRIHEP, Putignano (BA), Italy, 2005-2007.

BMIa	Normal		Overweight		Obese	
	N	%	N	%	N	%
Sex*						
Male	418	40.5	429	41.5	186	18.0
Female	719	56.7	364	28.7	185	14.6
Status*						
Single	386	76.6	90	17.9	28	5.6
Divorced	22	61.1	9	25.0	5	13.9
Widowed	19	26.8	26	36.6	26	36.6
Married	619	38.7	668	41.8	311	19.5
Job*						
Jobless	69	71.1	15	15.5	13	13.4
Worker	146	49.7	105	35.7	43	14.6
Employee	297	61.2	146	30.1	42	8.7
Housewife	143	42.2	119	35.1	77	22.7
Student	106	79.7	24	18.0	3	2.3
Craftsman	33	41.3	26	32.5	21	26.3
Farmer	109	23.1	242	51.4	120	25.5
Freelance	129	52.2	87	35.2	31	12.6
Education*						
Illiterate	13	18.8	34	49.3	22	31.9
Elementary School	136	26.1	228	43.8	157	30.1
Middle School	275	42.4	257	39.6	117	18.0
High School	486	63.4	217	28.3	63	8.2
College	128	65.6	57	29.2	10	5.1
SEPb,*						
Low	169	29.3	286	49.7	121	21.0
Medium	555	48.3	400	34.8	195	17.0
High	413	71.8	107	18.6	55	9.6
NAFLDc,*						
No	1043	59.9	548	31.5	151	8.7
Yes	94	16.8	245	43.8	220	39.4
Grade of NAFLD*						
No	1043	59.9	548	31.5	151	8.7
Light	78	22.5	160	46.2	108	31.2
Middle	16	8.2	81	41.5	98	50.3
Severe	0	0.0	4	22.2	14	77.8
Daily Alcohol Intake from Wine (g)*						
No	416	54.7	218	28.6	127	16.7
Less than 5.0	688	47.5	536	37.0	225	15.5
5.0-9.9	31	37.8	36	43.9	15	18.3
10.0 or more	2	22.2	3	33.3	4	44.4

Daily Alcohol Intake from Beer (g)**						
No	736	51.1	469	32.6	234	16.3
Less than 5.0	381	46.6	305	37.3	131	16.0
5.0-9.9	14	43.8	13	40.6	5	15.6
10.0 or more	6	46.2	6	46.2	1	7.7
Daily Alcohol Intake from Spirits (g)***						
No	994	49.7	679	34.0	325	16.3
Less than 5.0	129	45.9	108	38.4	44	15.7
5.0-9.9	11	64.7	5	29.4	1	5.9
10.0 or more	3	60.0	1	20.0	1	20.0
Systolic Blood Pressure*						
Normal	1063	54.4	637	32.6	254	13.0
High	74	21.3	156	45.0	117	33.7
Diastolic Blood Pressure*						
Normal	1051	56.4	595	31.9	218	11.7
High	86	19.7	198	45.3	153	35.0
SGPTd,******						
Normal	1120	49.8	770	34.3	357	15.9
High	17	31.5	23	42.6	14	25.9
Gamma-GTe,*						
Normal	1056	51.6	697	34.0	294	14.4
High	81	31.9	96	37.8	77	30.3
Glucose*						
Normal	1109	51.1	737	34.0	323	14.9
High	28	21.2	56	42.4	48	36.4
Cholesterol*						
Normal	836	54.3	486	31.6	217	14.1
High	301	39.5	307	40.3	154	20.2
*Tryglicerides**						
Normal	1043	53.8	621	32.1	273	14.1
High	94	25.8	172	47.3	98	26.9
Total	1.137	49.4	793	34.5	371	16.1

Pearson x^2: *p<0.01; **p = 0.29; ***p = 0.57; p = 0.05.

a Body Mass Index, b Socio-economic Position, c Non-alcoholic Fatty Liver Disease, d Sierical Glutamate-Pyruvate Transaminase, e Gamma-Glutamyl Transferase.

were significantly higher than those estimated in the normal levels. (Table 3) shows results from QR: Overweight and obesity were positively associated with age and men. Decreasing educational level (this been more evident for obesity). Age showed a statistically significant quadratic relationship with BMI across the two quantiles in QR with a maximum at about 64.8 years old. Only one category of job, farmers, was associated with overweight. Daily wine consumption greater than 10g was positively associated with overweight; as regard other beverages (beer and spirits) consumption were not associated neither with obesity nor with obesity. When SEP was included in the model (omitting its former variables) the results remained substantially unchanged (data not shown). Consequently, the QR included

	SEX					
	Male		Female		Total	
	Mean BMIa	95%CI	Mean BMI	95%CI	Mean BMI	95%CI
Systolic Blood Pressure						
Normal (n=1.954)	26.25	25.99 -26.51	24.65	24.38 -24.92	25.34	25.14 -25.53
High (n=347)	29.13	28.46 -29.79	28.36	27.58 -29.14	28.76	28.25 -29.27
Diastolic Blood Pressure						
Normal (n=1.864)	26.05	25.79 -26.32	24.51	24.24 -24.78	25.16	24.96 -25.35
High (n=437)	29.06	28.51 -29.61	28.45	27.76 -29.13	28.78	28.35 -29.21
SGPTb						
Normal (n=2.247)	26.75	26.49 -27.01	25.13	24.87 -25.40	25.84	25.65 -26.03
High (n=54)	27.73	26.43 -29.03	27.40	24.09 -30.72	27.65	26.39 -28.92
Gamma-GTc						
Normal (n=2.047)	26.57	26.30 -26.84	24.85	24.58 -25.11	25.62	25.42 -25.81
High (n=254)	28.66	27.94 -29.38	27.56	26.63 -28.49	28.03	27.41 -28.65
Glucose						
Normal (n=2.169)	26.53	26.27 -26.78	24.98	24.72 -25.24	25.65	25.46 -25.84
High (n=132)	29.81	28.84 -30.79	29.53	27.76 -31.29	29.71	28.81 -30.61
Cholesterol						
Normal (n=1.539)	26.24	25.91 -26.57	24.83	24.51 -25.15	25.38	25.14 -25.62
High (n=762)	27.59	27.20 -27.98	26.05	25.60 -26.51	26.90	26.60 -27.20
Tryglicerides						
Normal (n=1.937)	26.34	26.06 -26.62	24.81	24.53 -25.08	25.43	25.23 -25.63
High (n=364)	28.30	27.77 -28.84	28.22	27.49 -28.95	28.27	27.84 -28.71
Total (n=2.301	26.79	26.53 -27.04	25.15	24.89 -25.42	25.88	25.69 -26.07

Table 2. Quantile Regression: Mean Body Mass Index by biological and biochemical variables and sex. NUTRIHEP, Putignano (BA), Italy, 2005−2007.

only the variables that were used to build SEP index. The effect of categories of Educational Level on BMI is shown in (Figure 2).

Discussion

The present work offers updated estimates of overweight and obesity prevalence in southern Italy and identifies some social and economic characteristics determinants associated with these conditions as well as differences in frequencies and mean BMI between normal and high categories of some biological and biochemical markers for both sexes.

Obesity is still an increasingly worrying issue for public health in the world. Indeed, WHO estimates that by 2015 approximately 2.3 billion adults will be overweight and more than 700 million will be obese[21]. Obesity prevalence has tripled in many countries of the European Region since the 1980s and the number of those affected continue to rise at an alarming rate. Our data show that more than 50% of the studied subjects are beyond of normal weight cut-off and that compared to females, males are more likely to be overweight and obese. Although various causes have been suggested for such sex differences[22], sex-specific attitudes concerning body weight and different methods of controlling body weight seem to be important. Of particular relevance is the fact that, as society develops, negative attitudes about obesity tend to be stronger in females than males[23]. The social perspective toward obesity is also stricter in females than in males and, as a result, females quickly adjust their life-style to maintain a slimmer body

	Overweight		Obesity	
	Coefficient‡	95%CI	Coefficient‡	95%CI
Age	0.24***	0.15,0.34	0.42***	0.27,0.57
Gender				
Male (ref)				
Female	-2.09***	-2.51,-1.68	-2.08***	-2.90,-1.27
Job				
Jobless (ref)				
Worker	0.01	-0.87,0.90	-0.99	-2.90,0.91
Employee	0.28	-0.32,0.87	-0.71	-2.39,0.96
Housewife	0. 90	-0.03,1.83	-0.05	-2.00,1.90
Student	0.06	-0.86,0.98	0.20	-1.65,2.06
Craftsman	0.01	-1.16,1.18	-0.64	-3.45,2.18
Farmer	1.04*	0.16,1.92	-0.19	-2.42,2.03
Freelance	0.31	-0.41,1.02	-0.55	-2.50,1.41
Education				
Illiterate (ref)				
Elementary School	-1.12**	-1.87,-0.37	-0.71	-2.21,0.79
Middle School	-2.13***	-3.02,-1.25	-2.01*	-3.76,-0.25
High School	-3.03***	-3.90,-2.16	-3.87***	-5.57,-2.18
College	-3.46***	-4.40,-2.51	-4.93***	-6.71,-3.14
Daily Alcohol Intake from Wine (g)				
No (ref)				
Less than 5.0	-0.47	-1.04,0.10	-0.95*	-1.77,-0.13
5.0-9.9	0.19	-0.72,1.09	-1.47*	-2.88,-0.06
10.0 or more	4.36*	0.68,8.04	1.51	-0.71,3.72

Table 3: Quantile Regression: Effect of selective variable on overweight and obesity. NUTRIHEP, Putignano (BA), 2005-2007.

shape. Contrary to our expectations, a significant marital status differences in the prevalence of overweight and obesity was not observed while a little promotion effect of farmer job category on overweight was found. This result appeared against the typical finding in obesity research as rural workers are more likely to be into the normal category of BMI because they tend to be less sedentary and indulge more often on foods variety as compared to their other counterparts. But all farmers in our study were pensioners and it may be they adopted a more sedentary life-style.

Environmental and life-style have all been

Figura 1

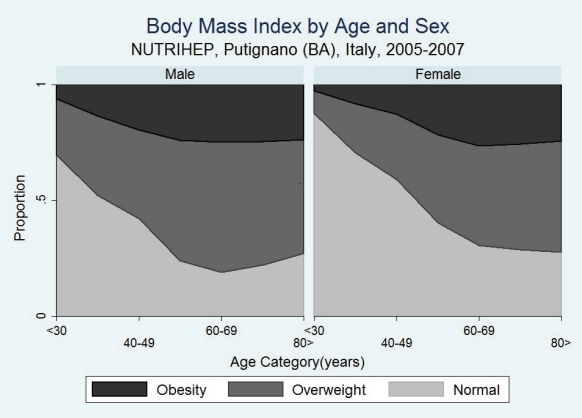
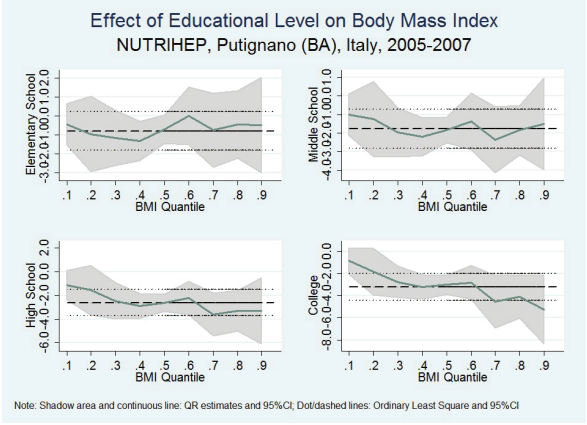


Figura 2



discussed as possible causes of obesity. Socioeconomic variable are also shown to increase the risk of obesity[24,25]. For example, the prevalence of obesity is higher in subjects (mainly females) of high SEP in nations with a low human development index (HDM) and in subjects of low SEP in the high-HDI nations, like Italy. Commonly, such differences are mainly found in females and are much less frequent in males[26].

Our study found that education was inversely associated with both overweight and obesity and that this relationship does not depend on sex (interactions not statistically significant). Thus, the relationship between obesity and SEP was similar to the pattern in other developed countries[27]. However, because this was a cross-sectional study, we were unable to identify the mechanism that underlies development of obesity. Therefore, additional studies are needed to investigate the socioeconomic factors and pathways that are related to the development of obesity.

Obesity epidemic has uncovered a wide range of health consequences of adult weight gain and obesity. In addition to causing various physical disabilities and psychological problems, excess weight drastically increases a person's risk of developing a number of non-communicable diseases including cardiovascular disease (CVD)2, T2DM[13,14] and cancer[15]. The risk of developing more than one of these diseases (co-morbidity) also increases with increasing body weight. Moreover, obesity itself is associated with early death and it is recognized as a risk factor for many health complications. However, since total body fat, reflected by waist or BMI, increases with age, it is sometime difficult to disentangle the consequences of ageing from those of weight gain[28].

Several population-based studies have assessed the prevalence of NAFLD[29-31]. Overall, prevalence of NAFLD in our study was similar to other Italian study[30] indicating a homogeneous geographical distribution of this condition. Moreover, the prevalence and grade of severity of NAFLD were higher in overweight/obese subjects. This result confirm that BMI is an independent risk factor for NAFLD[32-34]. Unfortunately, data about waist circumference were not available, so an estimate of Metabolic Syndrome was impossible. Waist circumference is a surrogate of visceral adiposity and a risk factor for cardiovascular and metabolic disease[2].

Significant negative effect of low to moderate alcohol consumption was observed for obesity whereas more than 10 g of daily wine intake was found to be positively associated with overweight. Although alcohol intakes was measured by means of a validated questionnaire[18], some confounding may still be present. Overweight or obese subjects were more likely than normal ones to drink some type of alcoholic beverage. Furthermore, levels of alcohol intake may have been underestimated because one would expect a bias toward "socially desirable" answers, but the effect would not have differential and the estimates would have tended to the null. Unlike other populations[35,] fort persons in the area we studied it is likely that alcohol consumption plays a minor role in determining overweight and obesity[36]. In this area, drinking pattern is characterized by steady daily consumption of wine with meals. Therefore, in addition to overall levels of alcohol intake, modalities of consumption and the typical Mediterranean diet might be important with regard to the modulation of overweight or obesity process[37]. Moreover, in Italy moderate drinkers have a longer life expectancy than occasional and heavy drinkers[38].

A strong relationship between obesity and CVD has been documented in numerous prospective studies[39-41]. As other authors have informed[42], hypertension occurred in about 20% of our normal weight subjects but much of what it was considered essential hypertension in past, may be now attributable to weight gain and obesity. Indeed, in our population the prevalence of hypertension raised to about 45% and 35% for overweight and obese individuals respectively. Although obesity is a recognized risk factor for coronary heart disease (CHD), it is not yet included in global risk assessment tools[43] because it is believed that the effect of obesity is entirely mediated through established risk factors such as hypertension, dyslipidemia and T2DM. But, when estimating the association between BMI and CHD (taking into account such intermediate metabolic risk factors) has evidenced attenuated relative risks[39-41]. So, evidence suggests that hypertension and higher cholesterol are important

pathways through which obesity modulates the risk of CHD but a clear explanation is not yet available. Some mechanism as renal structural changes[44] and increased sympathetic nervous system activity[45] have been proposed.

Overweight and obesity are the most important modifiable risk factors for hypertension[46] and are the most important lifestyle risk factors for T2DM. Moreover, the strength of the association with BMI has been widely shown[13,14]. In this sense a great proportion of subjects with abnormal glucose levels were overweight or obese in our study. Adult weight gain between 19 and 34 years old seems to have a strength effect on diabetes occurrence. Unfortunately, data about diabetes incidence were not available for us. However, it is evident from the age-sex distribution of overweight and obesity the increase in prevalence in both sexes in the fourth decade of life. It is worthy to note that even in presence of optimal clinical management, the risk of CHD in T2DM patients can be reduced only about 10%[47]. These medical consequences and the high costs to health care systems of T2DM strongly argue for effective weight-loss intervention because it has been shown that more than 50% is prevented by a diet and life-style interventions[48,49].

Some methodological issues need to be considered. This study was conducted in the general population and a strength is the high respondent rate. Methodological problems may arise from measurements such as alcohol intake, biological and biochemical markers and NAFLD diagnosis. Alcohol intake was measured by using a validated questionnaire whereas blood pressure was determined always by the same operator and in a standard setting. Laboratory test were performed following international standard techniques. Another limitation may be the use of LUS. Although LUS is reasonably accurate, some fatty infiltration of liver below a threshold may have remained not identified. But that misclassification would be non differential so estimates would tend to the null.

In conclusion, our study shoes that in the general population of southern Italy overweight and obesity are highly prevalent completing in this was the epidemiological transition. Some medical consequences of overweight/obesity are also highly prevalent in this population. The prevention and treatment of overweight and obesity on a population wide bases are needed. Population-based strategies should improve social and physical environmental contexts for healthful lifestyles.

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