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Relationship between obesity index and cardiovascular risk in primary care patients on Crete, Greece: a data driven sub-analysis

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Key words: Obesity, Cardiovascular risk, Primary care, Lifestyle
Parole chiave: Obesità, Rischio cardiovascolare, Assistenza primaria, Stili di vita

Abstract

Background. *The present sub-analysis aimed to examine the relationship between obesity index and cardiovascular risk among primary care attendees.*
Study design. *Stratified random sampling was previously used to recruit general practitioners, practicing on Crete island, Greece, whose patients were then enrolled.*
Methods. *Initial sample included 815 primary care attendees (55.7% women; mean age 65.2 years; range 40–98 years). Due to missing values regarding 13 participants, data from 802 patients were included for the current analysis. Body measurements (weight, height), among other bio-clinical parameters, were recorded upon practice visit. The 10-year cardiovascular disease risk was estimated using the European Society of Cardiology (and other societies), 10-year Systematic Coronary Risk Estimation and multivariate linear regression was used to assess relationships between Obesity Index and cardiovascular disease risk.*
Results. *Higher risk is shown to be significantly related with male gender, older age, unemployed/retired status, urban area of living or smoking ($p<0.05$), as well as with higher levels of obesity index (stand. beta=0.048, p=0.028).*
Conclusions. *Obesity Index may be useful for cardiovascular disease risk prediction and correction at the primary care settings, since obesity is easily addressed during the first medical contact.*

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Introduction

Excessive body weight, and in particular obesity, is an important risk factor for cardiovascular disease (CVD) (1). Rates of obesity have been rising across the island of Crete in Greece; this is in parallel to documented increases in rates of CVD and other CVD risk factors in recent years (2). In distinct contrast to the latest trends, some few decades ago the island's population had been considered as low-risk for CVD, with the landmark Seven Countries Study showcasing the benefits of the local Mediterranean diet (3). Supporting this trend shifting, earlier findings from Greece, during 2002-2012, showed a 10-year CVD incidence to have significantly increased, independently of age, in people with body mass index (BMI) ≥ 25 kg/m^2 (4).

In a cross-sectional study that was carried-out in primary care settings in urban and rural Crete, our research group at the School of Medicine at the University of Crete explored the rates of metabolic syndrome (MetS), and CVD risk factors among primary care attendees (5). The present sub-analysis expands the previous analysis, aiming to examine the relationship between obesity index (BMI) and cardiovascular risk in the studied sample.

Methods

Stratified random sampling was employed to select general practitioners (GPs) practicing on Crete island, in order to recruit consecutive patients with specific eligibility criteria (5). Patients were included if: 1) aged 40 years or older, 2) they were permanent residents of each district and 3) their data were available within the past three months, including at least three of the following: HbAc1, fasting glucose, HDL cholesterol, total serum cholesterol, fasting triglycerides, systolic and diastolic blood pressure or CRP (5).Total sample included 815 primary care attendees (55.7% women; mean age 65.2 years; range 40–98 years) (5). Emphasis was given from GPs to retrieve information from medical records and personal history (5). Blood pressure and total cholesterol levels were commonly available and retrievable data during primary care visits. Due to missing values for 13 participants, data from 802 patients were available and could be analyzed. Body measurements (weight, height), among other bio-clinical parameters, were recorded upon practice visit. Participating patients were grouped using the World Health Organization (WHO) thresholds for BMI (6). The 10-year CVD risk was estimated using the European Society of Cardiology (and other societies), 10-year Systematic Coronary Risk Estimation (SCORE) (7), which classifies patients into three categories: very high CVD-risk (SCORE≥10%), high-risk (SCORE≥5% and <10%) and low to moderate-risk (SCORE<5%). Multivariate linear regression was used to assess relationships between BMI and CVD risk.

Results

Data of 802 patients were analyzed (Table 1), and 13.4% (95% Confidence Interval, CI: 11.1 - 15.9) of them showed a very high CVD-risk score. Our sub-analysis demonstrated a substantially high proportion of overweight/obese patients in our sample of Cretan primary care patients, aged 40 years or older.

Mainly, our investigation indicated an apparent association between higher BMI and 10-year cardiovascular risk, with increased rates of high CVD-risk participants. The mean 10-year CVD risk score of the overall sample was 5.7% (±3.6) (Table 1). Compared to participants having a normal weight, participants with obesity, were

Table 1 - 10-year Cardiovascular Risk based on the European Society's 10-year Systematic Coronary Risk Estimation (SCORE), in relation to Body Mass Index in 802 primary care patients.

			10-year Cardiovascular Risk - SCORE			
			Low-to-moderate risk persons (<5%)	High-risk persons (5-9%)	Very high-risk persons (10%+)	
		n	n (%; 95%CI)			*p*-value
Total		802[a]	313 (39.0;35.5, 42.4)	382 (47.6;44.1, 51.1)	107 (13.4;11.1, 15.9)	-
Body Mass Index, *kg/m*$^{-2}$	normal (<25.0)	151	78 (51.6)	62 (41.1)	11 (7.3)	0.002
	overweight (25.0-29.9)	310	110 (35.5)	147 (47.4)	53 (17.1)	
	obese (30.0+)	341	125 (36.7)	173 (50.7)	43 (12.6)	

95%CI, 95% confidence interval (estimations based on bootstrap techniques).
Overall mean 10-year cardiovascular risk score: 5.7% (standard deviation 3.6; median 5.0; min 1.0; max 20.0).
aAnalysis based on patients with or without any cardiovascular disease.
Chi-square (χ^2) test.

significantly more likely to have a very high CVD-risk score, (12.6% vs. 7.3%, p=0.002). Among various risk factors (Table 2), higher risk appears to be significantly related with male gender, higher age, unemployed/retired status, urban area of living, or smoking (p<0.05), as well as with higher levels of BMI (stand. beta=0.048, p=0.028). In Table 3, we present an alternative option, by showing odds ratios across our analysis. However, as observed in some variables (e.g., gender, occupation, smoking, BMI), due to splitting, odds ratios are shown with long intervals of confidence.

Discussion

Local studies investigating the link between socioeconomic well-being and obesity during the austerity period have indeed demonstrated an inverse association (8).Our findings are in agreement with the international literature, where a prospective cohort of US adults demonstrated a clear link between higher BMI and mortality from CVD (9). A study comparing BMI and MetS-related risk factors as predictors of prospective CVD risk among healthy women aged 45 years or older implied that the presence of MetS might act as a confounding factor and be accountable for the association between BMI and increased CVD risk (10). In a second study, assessing how well several obesity markers predict the 10-year risk of fatal CVD, BMI was shown to have the lowest correlation compared to body fat, waist/hip ratio and waist circumference (11). However, BMI remains the main tool used by GPs for obesity classification (12, 13) and its importance in early screening for CVD risk remains notable.

Our study has some limitations. Inclusion criteria may form a population group with higher burden of chronic conditions and CVD-risk than the general primary care population. We also note that this study was observational and its data sources (GPs records and patient self-reporting) may represent its main limitations.

Table 2 - Hierarchical models with linear regression analysis of 10-year Cardiovascular Risk in 802 primary care patients and in relation to their sociodemographic characteristics, co-morbidity, behavioral risk factors and BodyMass Index.

Predictive factors	10-year Cardiovascular Risk - SCORE							
	1st model				2nd model			
	betas		t	p-value	betas		t	p-value
	un-standardized	standardized			un-standardized	standardized		
Gender (1:males, 2:females)	-2.934	-0.403	-19.1	<0.001	-2.907	**-0.399**	-18.9	<0.001
Age (years)	0.192	0.637	23.0	<0.001	0.194	**0.644**	23.1	**<0.001**
Education (years)	-0.007	-0.008	-0.4	0.714	-0.006	-0.006	-0.3	0.775
Occupation (1:employed, 2:unemployed, retired)	0.380	0.053	2.0	0.047	0.383	**0.0**53	2.0	**0.046**
Area of living (1:rural, 2:urban)	0.865	0.115	5.3	<0.001	0.832	**0.110**	5.0	**<0.001**
Co-morbidity (diseases without CVDs)	0.047	0.025	1.1	0.258	0.020	0.011	0.5	0.644
Physical inactivity [a] (1:no, 2:yes)	-0.065	-0.007	-0.3	0.741	-0.114	-0.012	-0.6	0.562
Smoking (1:no, 2:yes)	2.340	0.256	11.9	<0.001	2.383	**0.260**	12.1	**<0.001**
Low consumption of fruits/vegetables [a] (1:no, 2:yes)	-0.120	-0.016	-0.8	0.443	-0.100	-0.014	-0.6	0.521
Body Mass Index (kg/m^{-2})	-	-	-		0.033	**0.048**	2.2	**0.028**
R^2 adjusted		0.66				0.67		

SCORE, 10-year Systematic Coronary Risk Estimation.

[a] Physical inactivity was defined as the lack of moderate-to-vigorous activities for max 20 minutes, at least 2 times per week and the low consumption of fruits/vegetables as the consumption of less than 2 times per week.

Table 3 - Logistic regression analysis of 10-year Cardiovascular Risk in 802 primary care G patients and in relation to their sociodemographic characteristics, co-morbidity, life style determinants and Body Mass Index.

	10-year Cardiovascular Risk							
	High *vs.* **Low** *(ref. cat.)*				**Very High** *vs.* **Low** *(ref. cat.)*			
Predictive factors	Odds Ratio	95%CIs		p-value	Odds Ratio	95%CIs		p-value
Gender (*females vs. males*)	**0.10**	0.06	0.19	<0.001	**0.004**	0.001	0.022	**<0.001**
Age *(per year change)*	**1.30**	1.25	1.37	<0.001	1.40	1.25	1.55	**<0.001**
Education *(per year change)*	1.02	0.95	1.09	0.607	0.98	0.83	1.17	0.836
Occupation *(unemployed and retired vs. employed)*	1.21	0.70	2.10	0.497	3.44	0.92	12.78	0.065
Area of living *(urban vs. rural)*	1.01	0.59	1.71	0.978	1.78	0.54	5.81	0.340
Co-morbidity (*per disease change* - without CVDs)	1.06	0.93	1.21	0.383	0.93	0.70	1.25	0.644
Physical inactivity [a] *(yes vs. no)*	0.84	0.48	1.45	0.529	0.46	0.11	1.91	0.285
Smoking *(yes vs. no)*	**3.31**	1.71	6.44	<0.001	**21.10**	4.16	107.18	**<0.001**
Low consumption of fruits & vegetables [a] *(yes vs. no)*	1.12	0.68	1.84	0.670	3.12	0.86	11.32	0.084
Body Mass Index *(obese vs. normal and over-weight)*	**1.67**	1.02	2.74	0.042	**11.56**	2.44	54.72	**0.002**
adjusted $R^2_{Nagelkerke}$	0.702				0.887			

SCORE, 10-year Systematic Coronary Risk Estimation.
[a] Physical inactivity was defined as the lack of moderate-to-vigorous activities for max 20 minutes, at least 2 times per week and the low consumption of fruits/vegetables as the consumption of less than 2 times per week.

Conclusions

The present study adds to the evidence supporting the direct or indirect association of obesity, as defined by BMI, with CVD risk. BMI may be an essential tool of prompt risk assessment for primary care patients, since obesity index is, immediately and easily, addressed through simple and cost-free procedures. In this context, the importance of educating GPs in screening and providing appropriate lifestyle advice and effective interventions to reduce CVD risk becomes feasible.

List of abbreviations:
CVD: Cardiovascular Disease
GPs: General Practitioners
MetS: Metabolic Syndrome
SCORE: European Society's 10-year Systematic Coronary Risk Estimation

Ethics approval: The study was approved by the Commission of Bioethics of the 7th Health Region of Crete, Greece, (Protocol No. 2774). All participants provided signed informed consent. Upon assessment,

participants received an informative letter regarding their cardiovascular risk, along with advice on risk reduction.

Competing interests: All authors declare that they have no competing interests.

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Authors' contributions: CL conceived and shaped the idea and provided clinical and technical input. CL and ML prepared the study protocol. ML performed data entry and analysis. DA and EKS participated in the study as local coordinators. LB, MA, SP and EKS prepared the draft of the manuscript. EKS, SP, MA and CL provided additional critical review for intellectual content. All authors read, revised and approved the final manuscript.

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Riassunto

Rapporto tra indice di obesità e rischio cardiovascolare in pazienti oggetto di cure primarie in Grecia, a Creta: una sub-analisi sulla base dei dati rilevati

Premessa. La presente sottoanalisi intende esaminare il rapporto che corre tra l'indice di obesità (indice di massa corporea) e l'indice di rischio cardiovascolare tra i pazienti di cure primarie.

Disegno dello studio. Con un campionamento randomizzato stratificato sono stati prescelti i medici di medicina generale (cure primarie) operanti sull'isola di Creta, tra i cui assistiti sarebbero poi stati campionati i soggetti da studiare.

Metodi. Il campione iniziale era composto da 815 soggetti (55.7% donne; età media 65.2 anni, intervallo d'età 40-98). Per l'incompletezza dei dati di tredici soggetti, il campione si è ridotto a 802. Le misure corporee (peso ed altezza), nonché altri parametri di natura bioclinica, sono stati raccolti con apposite visite. Il rischio di patologia cardiovascolare a 10 anni è stato calcolato utilizzando la stima sistematica di rischio coronarico a 10 anni della Società Europea di Cardiologia (et altre società), e la regressione lineare multivariata è stata usata per verificare la relazione tra l'indice di obesità ed il rischio di patologia cardiovascolare.

Risultati. Un rischio significativamente più elevato è stato documentato per il sesso maschile, l'età più avanzata, lo stato di disoccupazione/pensionamento, la residenza urbana e l'abitudine al fumo ($p < 0.05$), così come per indici più elevati di obesità (stand. Beta=0.048, p=0.028).

Conclusioni. L'indice di obesità può essere utile per predire e correggere il rischio di malattia cardiovascolare nella fase di impostazione delle cure primarie, dacché gli interventi contro l'obesità possono essere facilmente programmati al primo contatto con il medico delle cure primarie.

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