PREVALENCE OF OVERWEIGHT AND OBESITY IN A ROMA POPULATION FROM SOUTHERN ROMANIA - CALARASI COUNTY

G. Enache^{1,5}, E. Rusu^{1,3,*,**}, A. Ilinca¹, F. Rusu⁴, A. Costache¹, M. Jinga^{1,4}, C. Pănuș⁶, G. Radulian^{1,2,**}

¹“Carol Davila” University of Medicine and Pharmacy, ²“Prof. N.C. Paulescu” National Institute of Diabetes, Nutrition and Metabolic Diseases, ³“Nicolae Malaxa” Clinical Hospital Bucharest, ⁴“Carol Davila” Clinical Emergency Military Hospital, Bucharest, ⁵“Dr Pompei Samarian” County Emergency Hospital, Calarasi, ⁶County Clinical Emergency Hospital of Craiova, Craiova, Romania

Abstract

Introduction. The prevalence of obesity has reached alarming levels in the European Union, including in Romania. Data on the prevalence of obesity is only available at the national populational level, but this may hide the increased levels in disadvantaged groups. The purpose of this study was to evaluate the prevalence of overweight and obesity in the Roma population in Southern Romania.

Material and method. This cross-sectional, epidemiological, non-interventional study was conducted from March 2014 to May 2017 in several settlements from Calarasi County. Screening procedures included interviews about medical history, lifestyle, anthropometric and clinical measurements and fasting capillary glucose.

Results. The study population consisted of 1120 adult subjects, of which 735 Roma. In Roma population group, the prevalence of underweight, normal weight, overweight and obesity was 4.5% (n=33), 25% (n=184), 25.3% (n=186) and 45.2% (n=332) respectively. In Romanian Caucasians group, the prevalence of underweight, normal weight, overweight and obesity was 2.3% (n=9), 20% (n=77), 33.8% (n=130) and 43.9% (n=169) respectively. Among the Romanian Caucasians significant predictors of obesity were a sedentary lifestyle and current smoking. The odds of being obese in Roma population were higher in sedentary lifestyle persons and lower in current smokers, with primary education, and in those living in rural settlements. The family history of obesity had a significant association with obesity only in Roma population.

Conclusions. Our results confirm the need to implement prevention programs in high-risk populations due to the double burden of malnutrition, lack of medical education and preventive healthcare, low socio-economic level.

Key words: Roma minority, overweight, obesity, prevalence, lifestyle.

INTRODUCTION

The prevalence of obesity has reached alarming levels in the European Union, including in Romania, where there is an estimated prevalence of 20-25% (1-4). Data on the prevalence of obesity is only available at the national populational level, but this may hide the increased levels in disadvantaged groups. Thus the data should be analysed on each social group level. Furthermore, ethnic inequalities have been observed in relation to obesity and other non-communicable conditions; the socio-economically disadvantaged groups are presenting a higher prevalence of obesity. At the same time health policies are more difficult to be implemented at this level in many European countries, thus increasing inequities in obesity.

Individuals from different ethnic or socio-economic groups require different approaches to change their eating habits and lifestyle. Factors that influence health and increase the risk of obesity are specific to different ethnic groups (5).

In Romania the Roma population has a substantial share (3.39% of the population, 621.573 Roma ethnics) (6). According to the National Statistics Institute, the Roma population in Calarasi County is around 22.939 persons (7.8% of the total population), 15.513 living in rural settlements (7).

The Roma population is one of the ethnic minorities with a long history of malnutrition, with a high prevalence of childhood denutrition and mortality. At the same time the prevalence of overweight and obesity is increasing in all age groups. Undernutrition and overweight coexist within the Roma population, being one of the ethnic groups facing the double burden of malnutrition.

*Correspondence to: Emilia Rusu MD, PhD, “Carol Davila” University of Medicine and Pharmacy-Diabetes, Nutrition and Metabolic Diseases, Bucharest, Romania, E-mail: emiliarusumd@yahoo.com

** These authors contributed equally to this work

Health determinants in the Roma population are genetic, social (poverty, underdeveloped economic areas, low education rates, increased number of social assisted persons, poor nutrition, poor housing conditions, lack of medical education, limited access to primary and medical services due to financial impossibility or discrimination, dependency behaviours) and also cultural (specific attitudes and perceptions towards health) (8).

Within these minority groups, there are a significant number of health problems, difficulty to access health care, and inadequate food sources or other lifestyles such as physical inactivity are frequently encountered.

One factor influencing demographic behaviour is health and access to education and healthcare; all these segments are deficient in the Roma population.

The purpose of this study was to evaluate the prevalence of overweight and obesity in the Roma population in Southern Romania, Calarasi County, and its associated risk factors.

MATERIAL AND METHOD

Study design and setting

This cross-sectional, epidemiological, non-interventional study was conducted from March 2014 to May 2017 in several settlements and cities from Calarasi County, in Calarasi Municipality, Budesti, and in the villages of Curcani, Chirnogi, Chiselet, Dalga-Dor Marunt, Dragalina, Radovanu, Galbinași, Modelu-Tonea, Plătărești, Sohata, Spanțov, Ulmeni. Screening action was promoted by the local media and newspapers in Calarasi, through general practitioners and by local Roma leaders. The screening procedures performed for all participants included interviews about personal medical history (diabetes, obesity, hypertension, dyslipidemia, heart disease, stroke, thyroiditis, cancer), level of physical activity, food consumption, smoking, alcohol consumption, educational attainment, employee status, matrimonial status, anthropometric and clinical measurements and fasting capillary glucose (FCG). All participants completed the Finnish Diabetes Risk Score questionnaire.

Family history of obesity, diabetes, hypertension, cardiac disease, stroke, thyroid disease (including parents, grandparents, brothers and sisters) was also recorded. All study participants have signed the informed consent. The study has the approval of the ethics committee of "Prof. N. Paulescu" National Institute of Diabetes, Nutrition and Metabolic Diseases.

Study population

The study population consisted of 1120 subjects, of which 735 Roma (242 males/493 females) and 385 Romanian Caucasians (156 males/229 females), aged between 18 and 88 years.

Inclusion criteria: women and men aged over 18 years born and residing in Romania, who were able to read and understand the informed consent.

Exclusion criteria: people who refuse to sign the informed consent; participants <18 years (n=103); pregnant or nursing women (n=34).

Outcome measures

Following standard anthropometric measurements, the following indicators were assessed for each participant in the study population according to standard procedures: height, weight, waist/abdominal circumference (WC), hip circumference (HipC), neck circumference (NC). Body Mass Index (BMI=weight (kg)/square height (m²), waist to hip ratio (WHR), waist to height ratio (WHR) (9); body adiposity index (BAI) and percentage body fat (BF%) were calculated according to Bergman RN *et al.* (10) and Deurenberg P *et al.* (11), respectively.

Independent variables: socio-demographic factors

Data related to physical activity (min/day, min/week), family history of diabetes, use of blood pressure medication, history of elevated blood glucose, and daily consumption of fruit and vegetables were obtained using the Finnish Diabetes Risk Score (FINDRISC) questionnaire completed by the research team (12). A person was considered sedentary if he reported less than 150 minutes of moderate physical activity every week.

In order to assess the education levels we referenced the last attended institution in three categories: primary school (<8 years of education), secondary (8-12 years of education) and university (>12 years of education). Employment status was determined based on participants' responses. We classified the marital status as single, married or cohabiting, divorced, and widowed. For smoking assessment participants were categorized as follows: never smokers, ex-smokers (individuals who have smoked more than 100 cigarettes in their lifetime and have not smoked any cigarette in the past 28 days), and current smokers. The amount and frequency of alcohol consumption were estimated using questions about the proportion and frequency of drinking alcoholic beverages. According to self-evaluation of drinking

behaviour participants were classified as non-drinkers (lifetime abstainers or former drinkers), light drinkers with 1-4 servings per day or moderate/heavy drinkers consuming more than four servings on average per day. One alcohol serving or a portion drink was considered as 14 grams of ethanol corresponding to 350 ml of beer, 150 ml of 12% wine, or 44 ml of spirit.

Definitions

BMI was classified using the definitions of World Health Organization (13): BMI <18.5 kg/m² was defined as underweight, a BMI value between 18.5-24.9 kg/m² was defined as normal weight, a BMI of 25-29.9 kg/m² was defined as overweight, and obesity as a BMI over 30 kg/m². The cut-points used to define excessive body fat (BF) were %BF ≥ 20% for males, and %BF ≥ 33% for females (14). According to International Diabetes Federation recommendations we defined the metabolic waist or central obesity as WC ≥94 cm for men and ≥80 cm for women (15). The thresholds for WHR were >0.9 in males and >0.85 in females (16). Central fat distribution was defined by a WHtR value over 0.5 for both males and females (17).

Hypertension was defined as systolic blood pressure (SBP) higher than 140 mm Hg or diastolic blood pressure (DBP) higher than 90 mm Hg, or currently using BP-lowering medication, or medical history of physician-diagnosed hypertension.

Laboratory assays

We used Accu-Chek® Active (Roche Diagnostics GmbH, Mannheim, Germany) glucose meter to determine fasting capillary glucose (FCG) after 10 hours overnight fast. Patients identified with FCG > 100 mg/dL were recalled for biochemical analyses including fasting plasma glucose and HbA1c.

Statistical Analyses

Statistical Package for the Social Sciences (SPSS) version 19 for Windows was used for the statistical analysis; the normality of data was verified using Kolmogorov-Smirnov test. The continuous variables were presented as mean±SD and the categorical variables as absolute counts and percentages. Statistical significance was set at 95% confidence interval. Comparisons among groups were made by use of ANOVA for quantitative variables and the χ^2 test for categorical variables. Simple binary logistic regression and backward stepwise multiple logistic analyses were performed to identify factors influencing obesity.

RESULTS

Socio-demographic characteristics of groups

Data from 1120 participants were analysed in the study; gender distribution in Roma population group was 33.9% (n=242) males and 67.1% (n=493) females; in Romanian Caucasian population group 41.5% (n=156) were males. Women had a higher percentage in both groups. The average age was lower in Roma population (50.21±14.28 vs. 56.2±14.28 years, p<0.001).

Age distribution was uniform in both groups. Most of the participants were from rural settlements (n= 660, 89.8% Roma vs. n= 318, 82.6% Caucasian Romanians).

Most Roma participants 83.67 % (n=615) had primary education (under eight classes); however, 40.8% (n = 157) of Caucasian Romanians also reported primary education. Roma women had less access to education comparing to Roma men (92.1% (n=454) vs. 66.5% (n = 161)) and Romanian Caucasian women (92.1% (n = 454) vs. 49.3% (n= 113)). A large percentage of the participants were married or living together without legal documents and the divorce rate was lower in Roma study population (Table 1). Almost half of the Roma subjects had no income sources (Table 1).

Smoking and alcohol consumption accounted for 39.9% (n=293) and 40.4% (n=152) of Roma participants, and 22.1% (n=85) and 40.6% (n=295) in Romanian Caucasians, respectively. The prevalence of smoking was twice as high in Roma men vs. Romanian Caucasians. In both groups there was a higher smoking prevalence in men (Table 1). Alcohol consumption was higher in Romanian Caucasians participants (Table 1). Over 56.5% (n=632) of the population included in this study was sedentary (51.3%, n=197 of Romanian Caucasians vs. 59.2%, n = 435 of Roma participants) (p=0.012). A large proportion of Roma women reported low physical activity (62.9%, n = 310).

Prevalence of underweight, overweight and obesity

In Roma population group, the prevalence of underweight, normal weight, overweight and obesity was 4.5% (n=33), 25% (n=184), 25.3% (n=186) and 45.2% (n=332) respectively. In Romanian Caucasians group, the prevalence of underweight, normal weight, overweight and obesity was 2.3% (n=9), 20% (n=77), 33.8% (n=130), and 43.9% (n=169) respectively (Table 2).

Table 1. Socio-demographic characteristics of groups

Variables	Romanian Caucasians (n=385)		p*	Roma population (n=735)		p*	p#
	Females	Males		Females	Males		
Sex distribution	229	156		493	242		0.012
Environment (n, %)							
Urban	16 (7.1%)	51 (32.7%)	<0.001	36 (7.3%)	39 (16.1%)	<0.001	<0.001
Rural	213 (93%)	105 (67.3%)		457 (92.7%)	203 (83.9%)		
Marital status (n, %)							
Single	8 (3.5%)	10 (6.4%)	0.12	13 (2.6%)	13 (5.4%)	0.278	0.039
Married/Concubinage	182 (79.5%)	129 (79.5%)		439 (89%)	209 (86.4%)		
Divorced	27 (11.8%)	20 (12.8%)		6 (1.2%)	4 (1.7%)		
Widowed	12 (5.2%)	2 (1.3%)		35 (7.1%)	16 (6.6%)		
Educational level (n, %)							
< 8 classes	113 (49.3%)	44 (28.2%)	<0.001	454 (92.1%)	161 (66.5%)	<0.001	<0.001
9-12 classes	81 (35.4%)	65 (41.7%)		33 (6.7%)	55 (22.7%)		
>12 classes	35 (15.3%)	47 (30.1%)		6 (1.2%)	26 (10.7%)		
Employment status (n, %)							
Unemployed	23 (14.7%)	62 (27.1%)	<0.001	126 (52.1%)	257 (52.1%)	<0.001	<0.001
Smoking (n, %)							
Current smoker	46 (20.1%)	39 (25%)	<0.001	129 (53.3%)	164 (33.3%)	<0.001	<0.001
Former smoker	25 (10.9%)	51 (32.7%)		44 (18.2%)	90 (18.3%)		
Never smoker	158 (69%)	66 (42.3%)		69 (28.5%)	239 (48.5%)		
Alcohol (n, %)							
Non-drinkers	30 (19.2%)	138 (60.3%)	<0.001	72 (29.8%)	311 (63.1%)	<0.001	0.004
Light drinkers	49 (31.4%)	54 (23.6%)		91 (37.6%)	(%)		
Moderate/heavy drinkers	77 (49.4%)	37 (16.2%)		79 (32.6%)	(%)		
Sedentary lifestyle in min/week (<150 min/week) (n, %)							
	109 (47.8%)	88 (56.4%)	0.098	310 (62.9%)	125 (51.7%)	0.004	0.012

p* between females and males in the same group; p# between Romanian Caucasians and Roma population.

Figure 1. Prevalence of obesity in Romanian Caucasian and Roma population stratified by age groups. UW= underweight, NW=normal weight, OW= overweight.

In Roma population, prevalence of central obesity by WC was 78.6% (n=578), by WHR it was 70.1% (n=515) and by WHtR it was 82.6% (n=607) (Table 2). Moreover 83.6% (n=322) from Romanian Caucasians presented central obesity using WC.

Underweight had the highest prevalence in the 18-29 age group (n=4, 17.4%) in Romanian Caucasians (Fig. 1). The prevalence of underweight was higher in Roma population compared to Romanian Caucasians,

with a significantly higher rates in the young age groups, 7.7% in 18-29-year age group and 7.8% in 30-39-year age group as well as in the age group of over 70 years (6.9%) (Fig. 1).

In the Romanian Caucasians study population, the prevalence of overweight was 42.9% (n=42) in the 50-59-year age group, 33.3% (n=40) in 60-70-year age group and 32.2% (n=20) in those over 70 years (Fig. 1). In the Roma population the highest prevalence of overweight was found in the 50-59-year age group (31.2%, n=48) and in the age group of over 70 years (31.2%, n=32); in the 18-29-year age group the prevalence was 16.3% (n=17), 25.2% (n=26) in the 30-39-year age group, 25.2% (n=35) in 40-49-year age group, and 21.1% (n=28) in 60-69-year age group (Fig. 1).

The prevalence of obesity in the Romanian Caucasians was 8.7% (n=2) in 18-29-year age group, 23.5% (n=8) in the 30-39-year age group, 50% (n=24) in the 40-49-year age group, 36.7% (n=36) in 50-59-year age group, 51.7% (n=62) in the 60-69-year age group, and 59.7% (n=37) in the age group of over 70 years (p<0.001) (Fig. 1). In the Roma population, the highest prevalence of obesity was in the 40-49-year age

Table 2. Characterization and distribution regarding anthropometric parameters and comorbidities

Variables	Romanian Caucasians (n=385)		p*	Roma population (n=735)		p*	p#
	Female	Male		Female	Male		
Sex distribution	229	156		493	242		0.012
BMI (kg/mp) (n, %)							
<18.5	7 (3.1%)	2 (1.3%)		22 (4.5%)	11 (4.5%)		
18.5-24.9	54 (23.6%)	23 (14.7%)	0.029	121 (24.5%)	63 (26%)	0.063	0.005
25-29.9	66 (28.8%)	64 (41%)		112 (22.7%)	74 (30.6%)		
>30	102 (44.5%)	67 (42.9%)		238 (48.3%)	94 (38.8%)		
Abdominal obesity (>80 cm in female, >94 cm in male) (n, %)							
Yes	195 (85.2%)	127 (81.4%)	0.33	412 (83.6%)	166 (68.6%)	0.001	<0.001
WHR (>0.85 in female, >0.95 in men) (n, %)							
Yes	172 (75.1%)	101 (64.7%)	0.028	379 (76.3%)	139 (57.4%)	<0.001	<0.001
WhtR >0.5							
Yes	200 (87.3%)	140 (89.7%)	0.47	200 (87.3%)	140 (89.7%)	0.067	0.34
HTA (n, %)							
Yes	141 (61.6%)	124 (79.5%)	<0.001	280 (56.8%)	140 (57.9%)	0.786	0.008
Dyslipidemia (n, %)							
Yes	75 (32.8%)	52 (33.3%)	0.152	114 (23.1%)	44 (18.2%)	0.125	0.449
Diabetes (n, %)							
0	197 (86%)	112 (71.8%)		441 (89.5%)	216 (89.3%)		
Type 1	0	2 (1.3%)	0.01	0	2 (0.8%)	0.126	0.002
Type 2	32 (14%)	42 (26.9%)		52 (10.5%)	24 (9.9%)		

p* between female and male in the same group; p# between Romanian Caucasians and Roma population.

Table 3. Gender and age specific means of body mass index in Romanian Caucasians and Roma population

Age groups (years)	BMI (kg/m ²)						p*	p**	p#
	Males		Females		Total Romanian Caucasians (n=385)	Total Roma Population (n=735)			
	Romanian Caucasians (n=156)	Roma population (n=242)	Romanian Caucasians (n=229)	Roma population (n=493)					
18-29	23.87±2.76	26.05±6.39	24.06±5.42	25.20±5.16	24.00±4.70	25.53±5.66	0.382	0.440	0.230
30-39	24.40±2.93	27.43±7.91	25.91±4.23	25.90±6.43	25.55±3.97	26.43±6.98	0.297	0.994	0.488
40-49	29.27±4.48	31.87±6.24	27.84±5.56	33.06±7.59	28.50±5.09	32.57±7.07	0.079	0.002	0.000
50-59	28.76±4.16	29.22±6.49	28.68±4.55	30.93±5.77	28.72±4.35	30.44±6.01	0.685	0.015	0.015
60-69	29.66±2.81	29.28±6.03	29.00±4.55	29.97±7.52	29.24±4.00	29.78±7.13	0.711	0.320	0.463
Over 70	29.75±3.52	28.16±8.44	30.09±4.31	29.57±5.84	29.93±3.93	29.20±6.61	0.358	0.649	0.432
Total	28.83±3.92	28.93±7.03	28.26±4.89	29.47±6.97	28.49±4.53	29.30±6.99	0.863	0.170	0.040

p* between male Romanian Caucasians and Roma population in the same group; p** between female Romanian Caucasians and Roma population; p# between Romanian Caucasians and Roma population. Abbreviations: BMI, body mass index.

group (59.7%, n=83); in the 18-29-year age group the prevalence of obesity was 26.9% (n=28), 24.3% (n=25) in the 30-39-year age group, 50.6% (n=78) in 50-59-year age group, 53.4% (n=71) in 60-69-year age group and 46.1% (n=47) in the age group of over 70 years (p<0.001) (Fig. 1).

An examination of BMI by age groups highlighted an increase in BMI with age group, which was found both in Romanian Caucasians and Roma group, women or men; the highest BMI peak was found for the 40-49 age Roma group (Table 3).

Health-related anthropometric characteristics

Regarding anthropometric parameters, the Roma population group had a lower height (both in women and men), higher BMI, WHtR and BIA and smaller neck circumference compared to Romanian Caucasians (Table 4); there were no statistically significant differences for WC, HipC, WHR, BF (%).

In Roma population, there were significant differences in height, weight, HipC, neck circumferences, WHR, WHtR, BAI and BF (%) between genders but no significant differences for BMI, and WC (Table 4).

Table 4. Health-related anthropometric characteristics according to gender

	Romanian Caucasian men (n=156)		Roma men (n=242)		p*	Romanian Caucasian women (n=229)		Roma women (n=493)		p*	p#
	Mean	Std. Deviation	Mean	Std. Deviation		Mean	Std. Deviation	Mean	Std. Deviation		
Age (years)	56.82	13.33	48.14	16.43	<0.001	55.77	14.92	51.22	16.41	<0.001	<0.001
Height (cm)	171.18	5.00	169.12	8.34	0.006	159.50	6.86	156.67	7.08	<0.001	<0.001
Weight (kg)	84.60	12.89	83.14	21.95	0.451	71.98	13.65	72.58	18.91	0.666	0.379
BMI (kg/m ²)	28.83	3.92	28.93	7.03	0.863	28.26	4.89	29.47	6.97	0.017	0.040
WC (cm)	103.22	11.14	100.55	18.35	0.103	95.89	13.36	98.40	17.42	0.053	0.807
HipC (cm)	106.55	8.51	104.37	12.84	0.062	107.60	11.53	107.14	15.38	0.692	0.261
WHR	0.97	0.07	0.96	0.11	0.390	0.89	0.08	0.92	0.09	<0.001	0.115
WhtR	0.60	0.06	0.59	0.11	0.366	0.60	0.09	0.63	0.11	0.001	0.017
NC (cm)	41.24	3.74	39.79	5.15	0.003	35.52	3.88	34.85	4.50	0.054	<0.001
BAI	29.61	3.86	29.55	5.98	0.910	35.50	5.91	36.75	7.95	0.035	0.007
BF (%)	31.53	6.26	29.59	9.65	0.027	41.34	7.74	41.75	9.75	0.571	0.558

Data were expressed as mean and standard deviation.

p* between men (Romanian Caucasians and Roma men) and women (Romanian Caucasians and Roma women); p# between Romanian Caucasians and Roma population. Abbreviations: BMI, body mass index; WC, waist circumference; HipC, hip circumference; WHR, waist to hip ratio; WhtR, waist to height ratio; NC, neck circumference; BAI, body adiposity index; BF (%), percentage body fat.

Table 5. Factors associated with obesity

Variables	B	SE	p-value	OR	95% CI	
					Lower	Upper
In Romanian Caucasian						
Sedentary lifestyle (<150min/week)(yes/no)	1.866	0.151	<0.001	6.462	4.802	8.695
Age (over 40 years)	-0.236	0.181	0.193	0.79	0.554	1.127
Current smoking (yes/no)	-0.527	0.149	<0.001	0.59	0.441	0.791
In Roma population						
Sedentary lifestyle (<150min/week)(yes/no)	2.08	0.2	<0.001	8.01	5.44	11.81
Family history of obesity (yes/no)	1.41	0.18	<0.001	4.12	2.87	5.9
Current smoking (yes/no)	-0.83839	0.19	<0.001	0.43	0.3	0.63
Primary educational level (yes/no)	-0.44042	0.23	0.06	0.64	0.41	1.02
Place of residence (rural/urban)	-0.67003	0.3	0.03	0.51	0.28	0.92

Logistic regression coefficient and odds ratio (95% CI); Significant at p-value <0.05 levels. Abbreviations: SE, standard error; OR, odds ratio; CI, confidence interval.

Risk factors for obesity

To evaluate the factors associated with obesity in the two ethnic groups we used multi-variable backward stepwise logistic regression. Variables that were significantly associated with obesity in bivariate analysis were included in the models. For Romanian Caucasians, these variables were: sedentary lifestyle (<150 min/week), age over 40, and current smoking; for Roma population, the variables were a family history of obesity, age over 40, smoking, gender distribution, low educational level (under eight classes), rural environment, sedentary lifestyle.

Among the Romanian Caucasians, in multivariate adjustment for all covariates in a backward stepwise elimination procedure, significant predictors of obesity were a sedentary lifestyle and current smoking (Table 5).

The odds of being obese in Roma population were higher in sedentary lifestyle persons and lower in current smokers, with primary education, and in Roma population living in rural settlements (Table 5). The family history of obesity had a significant positive association with obesity only in Roma population (Table 5).

Co-morbidities

In our study, the prevalence of hypertension was 61.2% (n=685), 68.8% in Caucasian Romanians (n=265) and 57.1% (n=420) in Roma population. Overall, 15.6% (n=175) of study participants had undiagnosed hypertension. Approximately one-quarter of the participants (25.4%, n=285) reported the presence of dyslipidemia, with a lower rate of self-reporting in Roma women. The most likely the real frequency of dyslipidemia is much higher.

The prevalence of self-reported diabetes was 13.4% (n=150), 19.2% in Romanian Caucasians (n=74) and 10.3% (n=76) in the Roma population. However, the real prevalence is much higher if we analyze the glycemic values obtained from capillary blood (data not shown).

DISCUSSION

The purpose of this study was to evaluate the prevalence of overweight and obesity in Roma population from Calarasi County, Southern Romania, and its associated risk factors.

This study brings new data on the prevalence of underweight, overweight and obesity in Roma population as well as in Romanian Caucasians from Calarasi County, southern Romania. Of the adult population included in this study more than half presented obesity (44.7%) and overweight (28.2%). These data are in agreement with the World Health Organization (WHO) who predicted that more than two-thirds of adults in Romania (69%) would be either overweight or obese by 2025, up from 66% in 2015 (18). However, the latest data for Romania (2014-2015) related to the prevalence of obesity and overweight come from the study conducted by the Romanian Association for the Study of Obesity (RASO), which included a representative population of adults from eight regional centers; 31.1% of the participants included in this study were overweight, and 21.3% of those aged over 18 were obese (2). In the study Prevalence of Diabetes, Prediabetes, Overweight, Obesity, Dyslipidemia, hyperuricemia and chronic kidney disease (PREDATORR), performed at the national level (2728 subjects), obesity prevalence was at 31.4% while overweight prevalence was at 34.6% (19). In another study conducted in northeastern Romania, the village of Deleni, Iasi County, the prevalence of obesity increased with aging reaching a maximum in the 55-59 age group (29.8%) (20). In another cohort which included 511 Roma subjects from Romania the prevalence of obesity was 34.4%, and of visceral obesity it was 50.8% (21).

The current study found 78.6% respondents with abdominal obesity (83.6% in women and 68.6% in men). In contrast, in Hungary the prevalence of central obesity was 66.16% (95% CI 61.0-70.81) in women and 52.17% (95% CI 56.19-64.45) in men (22).

In the European Union, the prevalence of obesity varies widely between 18-30% (23). At European level, overweight and obesity were found in almost half of the evaluated adults, 47.6 % overweight adults (54.5 % men

and 40.8 % women), and 12.8 % obese (14.0 % men and 11.5 % women) (1). According to WHO data in 2016, overweight was found in 58.7 % of European adult population (54.3% of women and 63.1 % of men aged 18 and over). The prevalence of overweight in Europe varied from 54.3 % in Austria and Switzerland to 62.3% in Greece and 63.7 % in England (18). Data from the research study conducted by Gallus S *et al.* reported a lower obesity prevalence of 11.1 % in Western and Southern European countries comparing to 12.4 % in Central, Eastern and 18.0 % in Northern European countries. The prevalence of obesity varied from 7.6 % in Italy to 20.1 % in England and 21.5 % in Croatia (1).

In Roma populations the prevalence of obesity varies from 23% to 51.7% (24, 25). In eastern Croatia, the region of Baranya, the prevalence of overweight and obesity in Roma was 30% and 23% respectively (24). In western Serbia, in Drenovac village, Roma population had a mean BMI of 25.11 ± 3.16 kg/mp in males and 22.61 ± 2.79 kg/mp in women (26). In the eastern part of Slovakia, overweight was present in 53.4% of all Roma women (significantly greater than women control population) and in 55.8% of Roma men; obesity was present in 26.2% of women and 28.8% of men (all $p < 0.05$) (27). In a young Roma population (19-35 years) from Slovakia obesity was present in 20% of the subjects (27). In Spain, in the Greater Bilbao region, 51.7% of Roma individuals were obese (25). In Italy, in a small study (70 adult Roma immigrants) the prevalence of obesity was 32.2% in males and 12.8% in females (28).

In our study, Roma population (women and men) were significantly smaller in stature than Romanian Caucasians. This aspect was also reported by Gallagher A *et al.* (26) referring to Gurbet Roma and by Zajc M *et al.* (24) referring to Bayash ethnicity; the Bayash had low values of both primary anthropometric indicators. Bayash women were under the Croatian 10th percentile, and men follow the 10th percentile. Both sexes approximate the 25th percentile for body weight (24).

Most studies, which included Roma population, reported a high prevalence of smoking (29, 30, 31). Similarly, in our study about 40% of Roma population, were current smokers (53.3% of men and 33.3% of women) reinforcing that smoking seems to be an important part of the cultural and ethnic identity of the Roma ethnicity. Bartos D, Badila E reported a smoking prevalence of 25.8% for Roma population (21). In a study conducted in Slovakia there were more smokers in the minority groups (55% vs. 25%) (27). Similar to other studies, in our study obesity was less frequent in current smokers (1).

Our research data indicates a prevalence of underweight of 4.5% in the Roma population and 2.3% in the Caucasian Romanian population. The prevalence of underweight was significantly higher in Roma population in young age groups (18-29 and 30-39 years) as well as in the age group of over 60 years. Reduced BMI is associated with increased morbidity and mortality (32). In a Roma population from eastern Croatia, underweight rates were especially high in women (11%) compared to men (4%) (24).

The involvement of genetic factors is evident. BMI is a polygenic feature. Height plays a key role in BMI calculation. The high prevalence of obesity in this population is attributed to a particular phenotype development called “Thrifty phenotype”. This hypothesis assumes that undergoing a sudden transition from starvation to a high level of nutrition is associated with an increased risk of obesity, impaired glucose tolerance, impaired lipid metabolism as well as increased risk of heart disease (33). This is perhaps due to an unbalanced evolutionary process, which has led to the development of an efficient metabolism meant to maximize the storage of energy in the form of lipids and decrease the energy expenditure.

In our study most Roma participants had a primary education; our results confirmed that Roma women are even a more vulnerable group as they had less access to education comparing to Roma men and Romanian Caucasian women. A large percentage of the participants were married or living together without legal documents. Almost half of the Roma subjects had no income sources. Smoking and alcohol consumption had a high prevalence among Roma participants.

Our results confirm that socio-economic determinants like poverty and improper housing conditions, low education rates, lack of medical education, lack of preventive healthcare, and high unemployment levels as well as unhealthy lifestyle, decreased physical activity, poor nutrition and dependency behaviours such as smoking, alcohol consumption contribute to their poor health outcomes.

Access to primary health care and medical services is limited not only due to poverty, discrimination, but also because of superstition and cultural beliefs (specific attitudes and perceptions towards health that include concepts of defilement, cleanliness, ideal weight, death, good-luck, and misconceptions over medical procedures such as immunizations and surgery).

We found a higher prevalence of obesity compared to previous reports; the differences may be explained by the large proportion of people over 50 years

included in the study (72.7% in Romanian Caucasians and 52.9% in Roma population) and also by the direct measurement of anthropometric indicators rather than using self-reported anthropometric data for each study participant.

The strengths of the present study are the high enrolment rate given by recruitment from a significant Roma population area, Southern Romania, Calarasi County, as well as the large sample of Roma patients, which is unique in this field of research. However, when interpreting our results, we do take into consideration certain limiting factors. A first factor is an assessment of belonging to Roma ethnicity. Belonging to Roma ethnicity is based on the declaration of each participant, which can be unreliable in some cases. Some Roma people chose not to share their ethnic identity. This leads to the underestimation of the Roma population group. Another limiting factor is represented by the fact that our group of Roma participants consisted of Roma population from Calarasi County. Therefore it may not be representative of the entire Roma population from Romania. The prevalence of associated chronic diseases, such as dyslipidemia, diabetes, and hypertension, was based on self-reported data in a population group with limited addressability to the health system, resulting in an underestimation of this disease and its risk factors in the Roma people.

In conclusion, similar to other published data on Roma population, we found a higher prevalence of obesity and abdominal obesity compared to Romanian Caucasians. The odds of being obese in Roma population were higher in sedentary lifestyle persons and lower in current smokers, with primary education, and in Roma population living in rural settlements. The family history of obesity had a significant positive association with obesity only in Roma population.

We also found a higher prevalence of underweight in Roma population, confirming that Roma community is one of the ethnic groups facing the double burden of malnutrition.

Our results confirm and reinforce the need to implement prevention programs in high-risk populations such as the Roma population, due to the double burden of malnutrition, low access to the health system, lack of medical education and preventive healthcare, limited access to education, low socio-economic level. This work will contribute to a better understanding of the nutritional status of Roma population and will help improve the health of Roma patients. Lastly, it is imperative that health services will adjust their intervention and understand the particularities of risk profiles of different ethnic and social groups.

Conflict of interest

The authors declare that they have no conflict of interest.

References

- Gallus S, Lugo A, Murisic B, Bosetti C, Boffetta P, La Vecchia C. Overweight and obesity in 16 European countries. *Eur J Nutr* 2015; 54(5):679-689.
- Roman G, Bala C, Crețeanu G, Graur M, Morosanu M, Amarin P, Pircalaboiu L, Radulian G, Timar R, Achimas Cadariu A. Obesity and health-related lifestyle factors in the general population in Romania: a cross sectional study. *Acta Endocrinologica* 2015; 11:64-72.
- Dorobantu M, Badila E, Ghiorghe S, Darabont RO, Olteanu M, Flondor P. Total cardiovascular risk estimation in Romania. Data from the SEPHAR study. *Rom J Intern Med* 2008; 46(1):29-37.
- Cinteza M, Pana B, Cochino E, Florescu M, Margulescu A, Florian A, Vincreanu D. Prevalence and control of cardiovascular risk factors in Romania cardio-zone national study. *Mædica A Journal of Clinical Medicine* 2007; 2(4):277-282.
- INSERM, Kantar Health, Roche. ObÉpi 2012: enquête épidémiologique nationale sur le surpoids et l'obésité. Paris: ObÉpi-Roche; (Accessed at site http://www.roche.fr/content/dam/corporate/roche_fr/doc/obepi_2012.pdf)
- Center for Documentation and Information on Minorities in Europe-Southeast Europe (CEDIME-SE). Minorities in Southeast Europe. Roma of Romania 2001; (Accessed at site http://www.edrc.ro/resurse/rapoarte/Roma_of_Romania.pdf)
- <http://colectaredate.insse.ro/phc/aggregatedData.htm>
- Hajduchová H, Urban D. Social determinants of health in the Romani population. *Kontakt* 2014; 16:e39-43.
- Hsieh SD, Yoshinaga H. Abdominal fat distribution and coronary heart disease risk factors in men-waist/height ratio as a simple and useful predictor. *Int J Obes Relat Metab Disord* 1995; 19:585-589.
- Bergman RN, Stefanovski D, Buchanan TA, Sumner AE, Reynolds JC, Sebring NG, Xiang AH, Watanabe RM. A better index of body adiposity. *Obesity (Silver Spring)* 2011; 19:1083-1089.
- Deurenberg P, Weststrate JA, Seidell JC. Body mass index as a measure of body fatness: age and sex specific prediction formulas. *Br J Nutr* 1991; 65:105-114.
- Lindström J, Tuomilehto J. The diabetes risk score: a practical tool to predict type 2 diabetes risk. *Diabetes Care* 2003; 26(3):725-731.
- World Health Organization. Obesity: preventing and managing the global epidemic. WHO Technical Report Series 2000; 1-252.
- Gallagher D, Heymsfield SB, Heo M, Jebb SA, Murgatroyd PR, Sakamoto Y. Healthy percentage body fat ranges: an approach for developing guidelines based on body mass index. *Am J Clin Nutr* 2000; 72:694-701.
- Alberti KG, Zimmet P, Shaw J. Metabolic syndrome- a new world-wide definition. A Consensus Statement from the International Diabetes Federation. *Diabet Med* 2006; 23:469-480.
- Welborn TA, Dhaliwal SS. Preferred clinical measures of central obesity for predicting mortality. *Eur J Clin Nutr* 2007; 61(12):1373-1379.
- Ashwell M, Hsieh SD. Six reasons why the waist-to-height ratio is a rapid and effective global indicator for health risks of obesity and how its use could simplify the international public health message on obesity. *Int J Food Sci Nutr* 2005; 56:303-307.
- The UK Health Forum, Forecasting/projecting adulthood obesity in 53 WHO EU region countries; a report for the World Health Organisation August 2015.
- Mota M, Mota E, Popa SG, Catrinou D, Cheta D, Graur M, Guja C, Hancu N, Ionescu-Targoviste C, Lichiardopol R, Mihai B, Popa A, Radulian G, Roman G, Serafinceanu C, Serban V, Timar R, Veresiu IA, Vlad A. The national study on the prevalence of diabetes mellitus, prediabetes, overweight, obesity, dyslipidemia, hyperuricemia and chronic kidney disease in Romania-Final results. *Acta Diabetologica Romana* 2014; 40:24-26 (Abstract).
- Mihalache L, Graur LI, Popescu DS, Boiculese L, Badiu C, Graur M. The prevalence of the metabolic syndrome and its components in a rural community. *Acta Endocrinologica* 2012; 8(4):595-606.
- Bartos D, Badila E. Prevalence of arterial hypertension and other cardiovascular risk factors in an adult gypsy population from Romania. *Romanian Journal of Cardiology* 2011; 21.
- Kósa Z, Moravcsik-Kornyicki Á, Diószegi J, Roberts B, Szabó Z, Sándor J, Ádány R. Prevalence of metabolic syndrome among Roma: a comparative health examination survey in Hungary. *Eur J Public Health* 2015; 25(2):299-304.
- Blundell JE1, Baker JL, Boyland E, Blaak E, Charzewska J, de Henauw S, Frühbeck G, Gonzalez-Gross M, Hebebrand J, Holm L, Kriaucioniene V, Lissner L, Oppert JM, Schindler K, Silva AM, Woodward E. Variations in the Prevalence of Obesity Among European Countries, and a Consideration of Possible Causes. *Obes Facts* 2017; 10(1):25-37.
- Zajc M, Smolej Narančić N, Škarić-Jurić T. Body mass index and nutritional status of the Bayash Roma from Eastern Croatia. *Coll Antropol* 2006; 30:783-787.
- Poveda A, Ibáñez ME, Rebato E. Obesity and body size perceptions in a Spanish Roma population. *Ann Hum Biol* 2014; 41(5):428-35.
- Gallagher A, Cvorović J, Strkalj G. Body mass index in Serbian Roma. *Homo* 2009; 60(6):567-578.
- Krajcovicova-Kudlackova M, Blazicek P, Spustova V, Valachovicova M, Ginter E. Cardiovascular risk factors in young Gypsy population. *Bratisl Lek listy* 2004; 105(7-8):256-259.
- Gualdi-Russo E, Zironi A, Dallari GV, Toselli S. Migration and health in Italy: a multiethnic adult sample. *J Travel Med* 2009; 16:88-95.
- Health and the Roma Community, Analysis of the Situation in Europe Madrid, Published by: EFXINI POLI- Local Authorities for Social, Cultural, Tourist, Environmental and Agricultural Development. Greece. FSG – Fundacion Secretariado Gitano. Spain. OFFICE OF THE COUNCIL FOR ROMA COMMUNITY AFFAIRS. Czech Republic.PDCS-Partners for Democratic Change Slovakia. REAPN-Rede Europeia Anti-Pobreza.Portugal. ROMANI CRISS-Roma Center for Social Interventions and Studies. Romania. THRPf-The Health of Romany People Foundation. Bulgaria 2009.
- Zeljko H, Skaric-Jiiric T, Smolej N. Traditional CVD Risk Factors and Socio-Economic Deprivation in Roma Minority Population of Croatia. *Coll. Antropol* 2008; 32:667-676.
- Masseria C, Mladovsky P, Hernández-Quevedo C. The socio-economic determinants of the health status of Roma in comparison with non-Roma in Bulgaria, Hungary and Romania. *Eur J Public Health* 2010; 20(5):549-554.
- Zheng W, McLerran DF, Rolland B, Zhang X, Inoue M, Matsuo K, He J, Gupta PC, Ramadas K, Tsugane S, Irie F, Tamakoshi A, Gao YT, Wang R, Shu XO, Tsuji I, Kuriyama S, Tanaka H, Satoh H, Chen CJ, Yuan JM, Yoo KY, Ahsan H, Pan WH, Gu D, Pednekar MS, Sauvaget C, Sasazuki S, Sairenchi T, Yang G, Xiang YB, Nagai M, Suzuki T, Nishino Y, You SL, Koh WP, Park SK, Chen Y, Shen CY, Thornquist M, Feng Z, Kang D, Boffetta P, Potter JD. Association between body-mass index and risk of death in more than 1 million Asians. *N Engl J Med* 2011; 364:719-729.
- Hales CN, Barker DJ. The thrifty phenotype hypothesis. *Br Med Bull* 2001; 60:5-20.