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Research Article

Overweight and Obesity in the Russian Population: Prevalence in Adults and Association with Socioeconomic Parameters and Cardiovascular Risk Factors

Anna Kontsevaya[a] Svetlana Shalnova[a] Alexandr Deev[a] Joao Breda[b] Jo Jewell[c] Ivo Rakovac[b] Alexandra Conrady[d] Oxana Rotar[d] Yulia Zhernakova[e] Irina Chazova[e] Sergey Boytsov[e]

[a]National Research Center for Preventive Medicine, Moscow, Russia; [b]World Health Organization European Office for Prevention and Control of Noncommunicable Diseases, Moscow, Russia; [c]World Health Organization Regional Office for Europe, Copenhagen, Denmark; [d]Federal Almazov North-West Medical Research Centre, St. Petersburg, Russia; [e]Russian Cardiology Research and Production Complex, Moscow, Russia

Keywords

Obesity · Overweight · Epidemiology · Russian Federation · Prevalence · Risk factors · Socioeconomic factors

Abstract

Objective: To evaluate the prevalence and geographic distribution of overweight and obesity in Russian adults aged 25–64 years as well as the association between chronic risk factors and obesity. ***Methods:*** Data were obtained from the survey "Epidemiology of Cardiovascular Diseases and Its Risk Factors in Some Regions of the Russian Federation" (ESSE-RF). This is a large cross-sectional multicenter population-based study that included interviews and medical examination (anthropometry, blood pressure [BP] measurement, and laboratory analysis) applied in 2012–2014. ***Results:*** The sample included 20,190 adults (response rate 79.4%) aged 25–64 years. Approximately one third of participants (30.3%) had obesity and another third (34.3%) were classified as overweight. BMI increased with age in both sexes. The prevalence of obesity between regions ranged from 24.4 to 35.5%. Overweight and obesity levels decreased with higher education (men only). Overall obesity rates were higher in rural than urban populations, but rates of overweight were similar in rural and urban populations. Participants with obesity were more likely to have BP > 160/100 mm Hg (odds ratio > 2.0) and also > 140/90 mm Hg, raised blood glucose, and high triglycerides. ***Conclusion:*** The prevalence of overweight and obesity in Russian adults aged 25–64 years is not evenly distributed geographically, but it is comparable to that of other European countries. Individuals with obesity were also more likely to have indicators of poor cardiovascular and metabolic health.

Dr. Anna Kontsevaya
National Research Center for Preventive Medicine
Petroverigski Lane 10
RU–101990 Moscow (Russia)
E-Mail vnokk@mail.ru

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Introduction

Obesity is a chronic disease and a risk factor that has been increasing in prevalence worldwide [1]. In line with these global trends and based on currently available data, Russia has seen an increase in obesity by 33% between 1995 and 2004 [2]. Data from the Russian Longitudinal Monitoring Surveys (RLMS) in 2005 and 2011–2012 indicate that obesity (body mass index [BMI] ≥30) is increasing at a rate of 0.4% per year across all regions sampled, continuing a trend from 1994 [3]. Existing data also indicate that although obesity rates are higher in women, overall rates are increasing more rapidly in men.

The World Health Organization (WHO) Study on Global Ageing and Adult Health (SAGE), which studied BMI and weight, also found that levels of obesity in Russian women aged 50 years and older was higher than in men. Overall, this study estimated that 36.0% of Russian adults have obesity, with the burden of disease shifting to low socioeconomic status groups.

Data related with other risk factors for noncommunicable chronic diseases (NCDs) in the Russian Federation are scarce. However, based on the SAGE study, the prevalence of central obesity, inadequate vegetable and fruit intake, and hypertension are the most common risk factors for NCDs in Russian adults ≥50 years old. Overall population rates of hypertension, for example, were estimated to be 69.2%.

While these studies have provided valuable information on overall population trends, they do not include specific surveillance of geographic variations in diseases and risk factors, such as obesity and indicators of metabolic and cardiovascular health. Additional population-based studies are needed in order to evaluate the association between cardiovascular and metabolic risk factors and obesity. Furthermore, since cardiovascular and metabolic risk factors are not necessarily linearly related to BMI, further information on the associations of body mass with other risk factors in Russian populations is needed.

Geographic variations in obesity prevalence have been observed in other regions of the world [1, 4]. Such geographic patterns have been partly explained by different socioeconomic conditions, urbanization, and globalization factors leading to differences in physical activity and nutrition levels. In order to guide public health efforts to prevent and reduce obesity at the population level, information regarding the geographic distribution of obesity in Russia is needed.

The present paper seeks first to determine the prevalence and geographic distribution of overweight and obesity in Russia among adults aged 25–64 years. The second objective is to determine the association between chronic disease risk factors and obesity.

Methods

Study Design, Study Population, and Definitions

The data were obtained from a large cross-sectional multicenter population-based study called "Epidemiology of Cardiovascular Diseases and Its Risk Factors in Some Regions of the Russian Federation (ESSE-RF)." The authors of the paper were involved in this study at all stages: protocol development, training of people in different regions, data analysis, and so on. The study included 12 regions from all 8 federal areas in Russia: North Ossetia (Alania) Republic (North Caucasus), Volgograd (South), Vologda (North-West), Voronezh (Center), Ivanovo (Center), Kemerovo (West Siberia), Krasnoyarsk (East Siberia), Orenburg (Volga Region), Vladivostok (Far East), St. Petersburg (North West), Tomsk (West Siberia), and Tyumen (Ural).

The ESSE-RF used a multistage clustered sample design based on district outpatient departments (polyclinics) that were selected randomly as primary sampling units. This is a survey of the general population, as the majority of the population are covered by obligatory health insurance. These primary sampling units covered neighborhoods with 30,000–80,000 adult residents. One polyclinic in each of the 12 regions was located in a rural setting; all others were located in urbanized areas. Further details on the methodology used by the ESSE-RF are available elsewhere [5].

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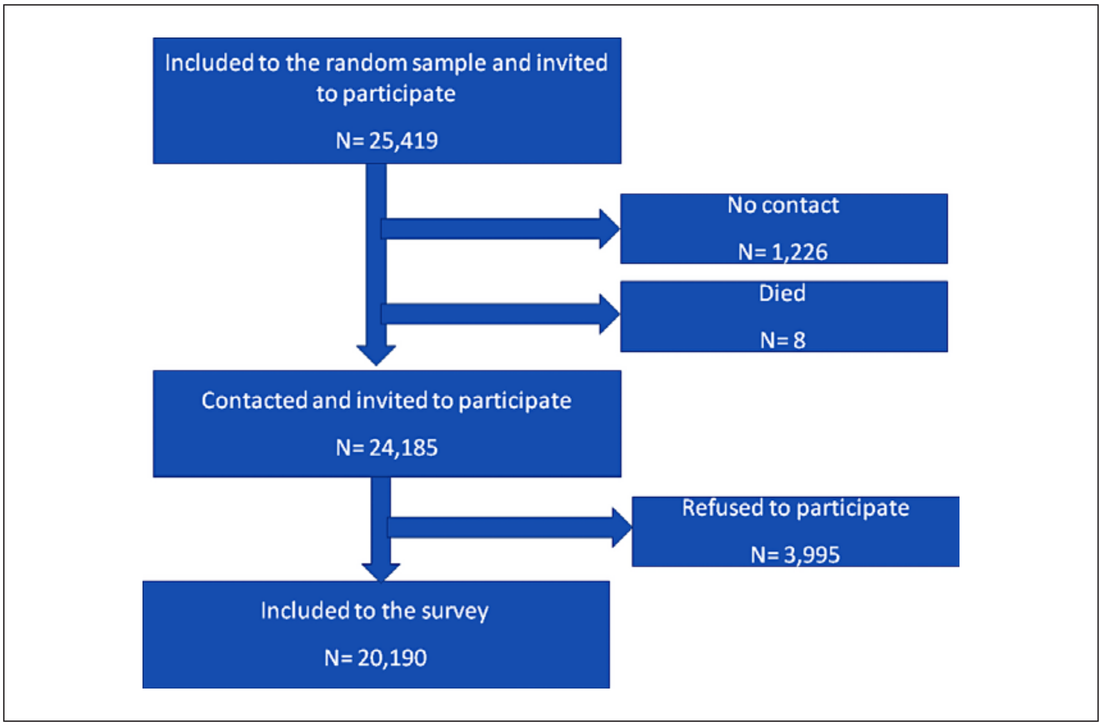

Fig. 1. Sampling flow diagram.

In each polyclinic, we randomly selected client lists from 5 physicians working in that polyclinic to serve as secondary sampling units. Each secondary sampling unit had approximately 2,000 adults aged 25–64 years. We then randomly selected 100 households from each secondary sampling unit. The total sample identified was approximately 2,000 subjects in each of the 12 regions. The sampling flow diagram (Fig. 1) demonstrates the numbers of patients invited, contacted, and included in the survey.

We recruited participants through letters and through phone, asking them to visit the clinic in the morning in a fasting state. Each participant signed a written informed consent form before any measurements were collected. Trained staff conducted all the interviews and collected measurements. The study ran between the 1st November 2012 and the 25th November 2014. We obtained ethics approval from 3 ethics committees: the National Research Center for Preventive Medicine (8 centers), the Russian Cardiology Research-and-Production Complex (2 centers), and the Federal Almazov North-West Medical Research Centre (2 centers).

Anthropometric Measurements

Height and weight measurements were performed by trained professionals and standardized according to WHO recommendations by the same models of instruments for anthropometry across all the regions. BMI was calculated by dividing weight by height squared (kg/m^2). All participants were classified according to BMI: (1) normal weight (including underweight: BMI <25 kg/m^2); (2) overweight and obese (BMI 25–29.9 kg/m^2); and (3) obese (BMI ≥30 kg/m^2). To insure the standardization of the weight and height measurements, the central study team provided the training to all regional teams, and the same equipment was bought and distributed to the regions.

Other Measurements

Blood Pressure

Blood pressure (BP) was measured with a calibrated automatic sphygmomanometer (Omron). We used a BP cuff that fits the participants' arm circumference. Measurements were performed in a seated position after a 5-min rest. Two measurements were taken by the same staff member with 5-min interval using the same equipment, and the mean value was recorded for the study.

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Two threshold levels were defined: (1) systolic BP ≥140 mm Hg or diastolic BP ≥90 mm Hg and (2) systolic BP ≥160 mm Hg or diastolic BP ≥100 mm Hg.

Blood Samples

Samples were taken after fasting >10 h. Analysis was performed in a central standardized laboratory on fresh blood or aliquots of serum stored at –80 °C in samples not previously thawed. Triglycerides, glucose, and total and high-density lipoprotein (HDL) cholesterol were measured using standard methods. The cutoff points for blood analysis were estimated according to the guidelines of the European Society of Cardiology.

Total Cholesterol

Participants were classified into 2 groups: (1) normal total cholesterol (<5.0 mmol/L) and (2) high total cholesterol (≥5.0 mmol/L).

Triglycerides

Participants were classified into 2 groups: (1) normal triglycerides (<1.7 mmol/L) and (2) high triglycerides (≥1.7 mmol/L).

HDL

Participants were classified into 2 groups: (1) normal HDL (≥1.0 mmol/L in males and ≥1.2 mmol/L in females) and (2) low HDL (<1.0 mmol/L in males and <1.2 mmol/L in females).

Fasting Glucose Level

Participants were classified into 3 groups: (1) normal glucose (≤5.5 mmol/L), (2) high glucose (5.6–7.0 mmol/L), and (3) very high glucose (>7.0 mmol/L).

Interviews

Specially trained interviewers conducted the interviews. Standardized questionnaires were used to collect sociodemographic variables, risk factors, and previous history of cardiovascular disease and diabetes.

The questionnaires included 5 social and demographic variables: sex, age, educational level, residential location, and household income. The questionnaires also included 2 behavioral risk factors: smoking and alcohol consumption.

Sex

Separate analyses were performed for men and women.

Age

Patients were categorized into the following age groups: 25–34, 35–44, 45–54, and 55–64 years.

Educational Level

Educational level was divided into 3 groups: low (less than secondary school), medium (secondary school and/or college), and high education (university).

Residential Location

This variable was divided into 2 categories: urban (towns and cities) and rural (villages).

Prosperity/Poverty Level

This parameter was assessed with a special scale, which defines 4 categories: poor, medium, relatively rich, and rich. Scores are based on the responses to 3 questions: the percentage of income spent on food, the description of family financial opportunities to buy different things, and a subjective evaluation of status compared with other families. The scale has been used for the same purpose in previous studies in Russia [6].

Smoking Habits

Respondents were divided into 3 groups based on current tobacco consumption: (1) those who had never smoked, (2) former smokers (regardless of when they stopped smoking), and (3) daily smokers (occasional smokers were not included).

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Table 1. Demographic characteristics of the study population

	Males		Females		All	
	n	%	*n*	%	*n*	%
Age groups						
25–34 years	1,943	25.5	2,166	17.2	4,109	20.3
35–44 years	1,614	21.2	2,375	18.9	3,989	19.8
45–54 years	1,978	26.0	3,690	29.3	5,668	28.1
55–64 years	2,078	27.3	4,346	34.6	6,424	31.8
Education						
Low	403	5.3	523	4.2	926	4.6
Medium	3,857	50.7	6,667	53.0	10,524	52.1
High	3,353	44.0	5,387	42.8	8,740	43.3
Settlement						
Urban	6,303	82.8	9,947	79.1	16,250	80.5
Rural	1,310	17.2	2,630	20.9	3,940	19.5
Total	7,676	100.0	12,656	100.0	20,190	100.0

Alcohol Consumption

Responders were divided into 3 categories (1): abstinent or sporadic consumers (≤2 units/occasion) during the last year, (2) regular drinkers (<40 g pure alcohol/day or 280 g/week in men and <20 g/day or 140 g/week in women, and (3) heavy drinkers (>280 g/week in men and >140 g/week in women).

Statistical Analyses

The prevalence of the BMI categories was calculated by sex, standardized for the European age distribution (1976), for each region separately. We summarized the prevalence of the different characteristics in 3 groups (i.e., normal weight, overweight, and obesity).

To determine whether the associations found between BMI and sociodemographic parameters and disease risk factors were independent of age, we fitted logistic regression models, adjusting for age and sex and using the region as independent variable. All statistical analyses were performed using SAS® 6.12 (SAS Institute Inc., Cary, NC, USA).

Results

A total sample of 20,190 individuals completed both an interview and a medical examination (response rate 79.4%, interquartile range between regions 78.9–80.9%). Regional samples ranged from 1,438 adults (Volgograd) to 2,115 adults (Vladikavkaz). Demographic characteristics of the study population are described in Table 1.

Figures 2 and 3 present the male and female prevalence of overweight (including obesity, BMI >25) and obesity (BMI <30) standardized to the European population in each of the 12 regions of the ESSE-RF study; a tabulated version of these results with 95% confidence interval (CI) is provided in online supplementary Table 1 (for all online suppl. material, see www.karger.com/doi/10.1159/000493885).

Two thirds of the participants (64.6%) were classified as overweight or obese. Having a BMI 25–29.9 kg/m^2 was more common in men (42.3%) than women (28.7%). Of the sample, approximately a third of the participants (30.3%) had obesity. Contrary to what was observed for overweight, the prevalence of obesity was higher in women (31.4%) than men (27.5%). There were substantial geographic variations in the prevalence of obesity. St. Petersburg had

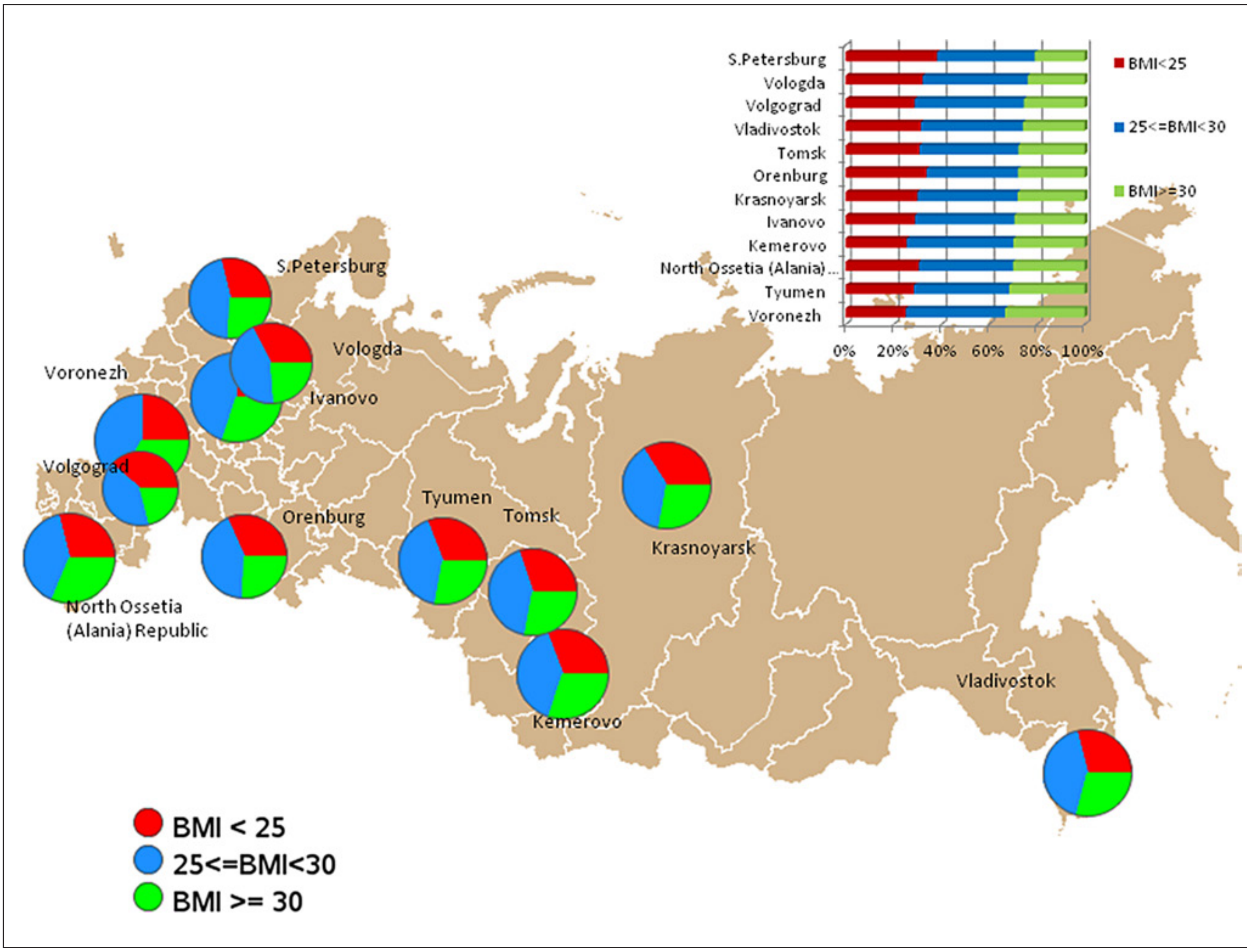

Fig. 2. Prevalence of overweight and obesity in Russian regional populations (males).

the lowest prevalence (24.4%) while Voronezh had the highest prevalence (35.4%) of obesity. There were no clear geographic gradients in the obesity and overweight rates.

Figure 4 indicates the prevalence of overweight (including obesity) and obesity by age group. In all cases, BMI was observed to increase with increasing age. While only 41.9% of the sample aged 25–34 had a BMI >25 kg/m^2, this rose to 83.1% in the group 55–64 years old. Similarly, the percentage of adults with obesity more than tripled in those same age groups (13.0 vs. 47.4%).

When the prevalence was stratified by sex, an interaction was observed between age and sex. While females reported a lower prevalence of obesity in the groups 25–34 and 35–44 years old, they reported a higher proportion in the 2 older age groups, suggesting that the proportion of women with obesity increases more rapidly than for men with age. In fact, in the group aged 55–64 years, every third man and every second woman was obese. Similar trends were found for the prevalence of overweight. The interaction of obesity and overweight prevalence with age was statistically significant ($p < 0.001$).

Table 2 shows overweight and obesity prevalence by education, residential location, and prosperity. Numbers of people in the low-education group were relatively small compared with the medium- and higher-education groups. There appears to be a mild educational

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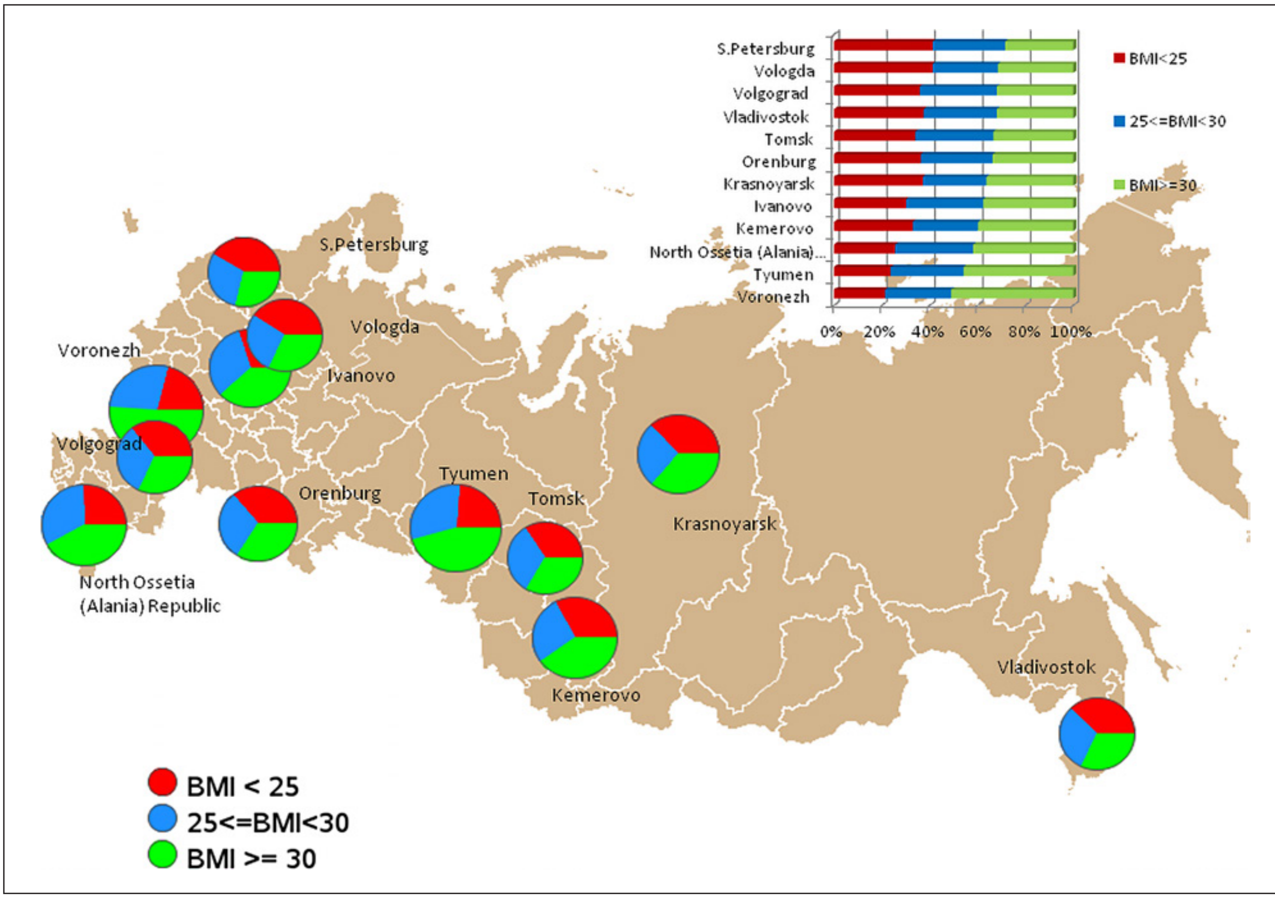

Fig. 3. Prevalence of overweight and obesity in Russian regional populations (females).

gradient in overweight and obesity prevalence in men, with the highest prevalence of obesity in the higher-education group. For women, the trend is in the opposite direction, with lower obesity rates in the higher-education groups. However, for women, the highest prevalence of obesity (35.9%) was in the medium-education group while for men the highest prevalence of obesity (28.0%) was in the high-education group. Interaction of education with overweight and obesity was significant only in females but not in males.

Overall obesity rates were higher in rural than urban populations (33.7 vs. 29.4%). Rates of overweight were similar in rural and urban populations (33.9 and 34.4%). Obesity was significantly associated with rural settlement ($p < 0.04$).

Obesity prevalence in relation to prosperity varied according to sex. In males, there is a clear trend to lower obesity prevalence and prosperity, with obesity rates being higher among men with the lowest income (but it did not reach significance). In women, there is no clear association of the prosperity level with obesity although the highest prevalence is among relatively rich women and the lowest prevalence among women who live in poverty.

Results from the multivariable logistic regression are reported in Table 3. Participants with obesity were more likely to have blood pressure >160/100 mm Hg and diabetes (odds ratio [OR] >2.0). Those with obesity were also more likely to have blood pressure >140/90 mm Hg, raised blood glucose, and high triglyceride levels (OR >1.5). Those with overweight (BMI ≥25 kg/m^2) were more likely to have low HDL, blood pressure >160/100 mm Hg, and raised triglyceride levels (OR >2.0).

Table 2. Prevalence of overweight and obesity by education, residential location, and prosperity level

	Overweight (BMI 25–29.9 kg/m^2)						Obesity (BMI ≥30 kg/m^2)					
	males		females		all		males		females		all	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Education												
Low	166	40.8	146	28.0	312	35.2	107	26.2	170	32.7	277	31.0
Medium	1,601	41.6	2,001	30.0	3,602	34.8	1,054	27.4	2,394	35.9	3,448	33.1
High	1,457	43.4	1,519	28.2	2,976	34.2	940	28.0	1,417	26.3	2,357	27.0
Residential location												
Urban	2,702	42.9	2,800	28.2	5,502	34.4	1,707	27.1	3,009	30.3	4,716	29.4
Rural	515	39.2	821	31.0	1,336	33.9	389	29.6	932	35.2	1,321	33.7
Prosperity level												
Poor	2,060	42.6	1,805	28.3	3,865	34.7	1,373	28.4	1,907	29.9	3,280	29.6
Medium	770	41.8	1,119	29.3	1,889	33.7	488	26.5	1,264	33.1	1,752	31.3
Rich	329	41.6	685	30.6	1,014	34.0	194	24.6	756	33.8	950	31.6
Unknown	64	43.9	37	25.6	101	35.8	35	23.9	44	30.7	79	28.1

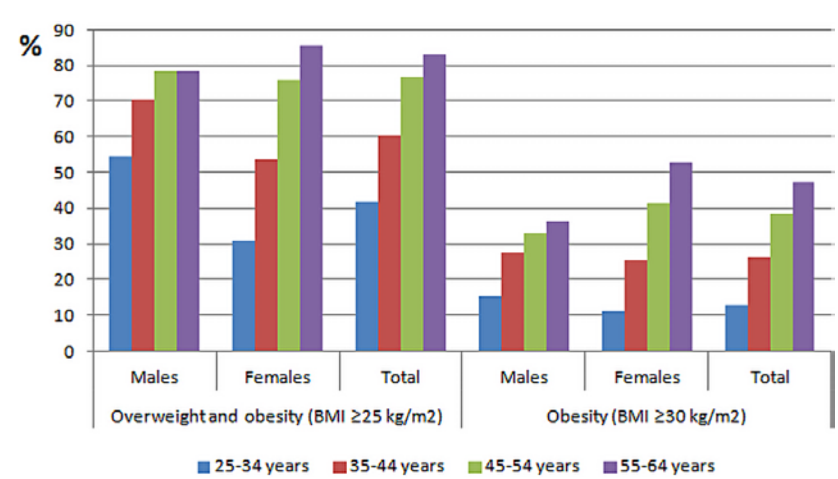

Fig. 4. Prevalence of overweight (including obesity) and obesity by age groups.

Those with overweight and obesity were also more likely to be former smokers. On the other hand, current smokers were found to be less likely to have overweight or obesity. Finally, those who had overweight or obesity showed significantly increased odds of being heavy drinkers.

Discussion

This study is the first during the last 2 decades to demonstrate the prevalence of overweight and obesity among a representative sample of the adult population in 12 regions of the Russian Federation.

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Table 3. Logistic regression, modeling the factors associated with overweight and obesity in the Russian population, adjusting for age and sex

	Overweight including obesity (BMI ≥25 kg/m^2)		Obesity (BMI ≥30 kg/m^2)	
	OR (95% CI)	*p* value	OR (95% CI)	*p* value
Social and demographic factors				
Each 10 years of age	1.60 (1.55–1.66)	<0.001	1.36 (1.32–1.41)	<0.001
Sex (females)	0.81 (0.75–0.87)	<0.001	1.56 (1.44–1.68)	<0.001
Medium education level	1.27 (1.18–1.36)	<0.001	1.21 (1.03–1.41)	0.02
Rural residence	1.20 (1.09–1.31)	<0.001	1.25 (1.17–1.34)	<0.001
Risk factors				
Ex smoking	1.25 (1.13–1.38)	<0.001	1.22 (1.12–1.33)	<0.001
Current smoking	0.79 (0.72–0.86)	<0.001	0.78 (0.72–0.85)	<0.001
Heavy drinkers	1.67 (1.21–2.30)	0.002	1.83 (1.37–2.43)	<0.001
Metabolic parameters and blood pressure				
High cholesterol	1.30 (1.21–1.41)	<0.001	1.09 (1.01–1.18)	0.03
Low HDL	2.32 (2.09–2.57)	<0.001	1.20 (1.83–2.18)	<0.001
High triglycerides	2.56 (2.33–2.85)	<0.001	1.96 (1.82–2.12)	<0.001
High glucose (5.6–7.0)	1.67 (1.51–1.84)	<0.001	1.70 (1.56–1.85)	<0.001
Very high glucose (glucose >7.0 mmol/L)	1.90 (1.54–2.35)	<0.001	2.40 (2.08–2.77)	<0.001
BP >140/90 mm Hg	1.84 (1.68–2.01)	<0.001	1.88 (1.74–2.03)	<0.001
BP >160/100 mm Hg	2.60 (2.28–3.00)	<0.001	2.77 (2.52–3.06)	<0.001

Almost one third of Russian adults have obesity (30.3%), which approaches the figure for adults in the United States of America (34.9%) [7] and is higher than the prevalence reported in any recent survey in the European Union [8] and most OECD member states [9]. Overweight or obesity (BMI ≥25 kg/m^2) was found in 64.6% of the adults surveyed in Russia, approaching prevalence levels in the USA (68%) [7], and higher than the prevalence reported in any recent survey in the European Union [8].

Geographic variations in obesity prevalence occur in other countries [4]. Russian regions showed a variation in obesity prevalence from 24.4 to 35.4% in adults, which indicates that even in the lowest-affected region obesity affects nearly a quarter of all adults. The prevalence of overweight including obesity varied from 59.0 to 68.4% across the regions. Regional differences were also varied between women and men. Women in the St. Petersburg region had the lowest prevalence of overweight and obesity, whereas women in the Tyumen and Vladikavkaz regions had the highest levels. Men in the Volgograd region had the lowest prevalence of overweight and obesity, whereas men in the Ivanov region had the highest levels. Local factors may help to explain differences in geographic prevalence rates, including educational opportunities, income levels, ethnicity, and globalization drivers of obesity [10, 11], and these differences may impact men and women differently. These findings have implications for geographically or socially targeted interventions addressing obesity [12].

Age gradients in the prevalence of obesity are found in most developed economies, although it is worth noting that in Russia more than half of all women aged 55–64 years have obesity, and a further third of all women in that age group were in the overweight category. The figures are lower for men, but nearly 80% in the groups aged 45–54 and 55–64 years had overweight and obesity. This can have implications for the delivery of health services since a large segment of the middle-aged and older adult population will be living with obesity, and obesity is associated with additional health impairments [13].

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Educational attainment has been found to be inversely associated with the risk of obesity in Western European countries, especially for women [14]. However, in Eastern European countries this is not the case, as in these countries higher educational status may be associated with higher levels of overweight and obesity, especially among men [14]. Our study found that in Russian men there was a mild but direct association of obesity with educational level, while in Russian women higher education was associated with a lower prevalence of obesity. Further investigation of regional differences may help to cast light on this issue.

Results from medical examinations revealed a strong association between overweight and obesity and all the indicators of cardiovascular and metabolic diseases reported. Independent of age, those who had overweight and obesity were significantly more likely to have high blood cholesterol, low HDL, high blood triglycerides, high fasting glucose, and hypertension. These results are consistent with the existing literature on the metabolic syndrome and cardiovascular disease risk [15].

As a large-scale surveillance study focusing on people in the community across Russia, our study contributes important information to help guide future public health interventions. Looking at the geographic distribution of obesity and cardiometabolic diseases, public health policy makers can plan future interventions. Another key strength of our study is the fact that we used objectively measured height and weight.

Our study is not without limitations. First, there is a potential for survivorship bias by age. This would suggest that the relationships we observed could be underestimated. Secondly, we are unable to explain why regional differences exist since our study was more ecological in nature. More comprehensive studies are needed to understand the reasons behind regional differences. Finally, since our study is a cross-sectional study, we cannot infer temporality. Thirdly, the 12 regions do not completely represent the Russian Federation, but they are representative of a substantial part.

Unlike in tobacco control, injury prevention, or infectious disease control, there are no exemplary populations in which obesity has been reversed by public health measures [16]. However, one of the recent systematic reviews in the area of obesity underlines the need for long-term population research and evaluation at different levels as well as of policy and environmental factors or "whole community" interventions in order to discover effective ways to deal with the obesity epidemic [17]. Similarly, emerging evaluations of real-world population level interventions do indicate positive effects on dietary behaviors (purchase, consumption, and overall caloric intake), which are in turn directly associated with overweight and obesity. These findings point to the potential value of strengthening food policies to prevent obesity. Possible priorities for Russia might be expanding school food policies, improving the labeling provisions on food packaging, restricting marketing, and influencing the price of foods high in fats, salt, and free sugars [18, 19]. Effective interventions on associated risk factors such as BP and cholesterol may be available when diagnosed, and they might help to lessen the cardiovascular effects of obesity [20]. Interventions to achieve weight management in overweight adults can improve the prevention of type 2 diabetes as well as maintain improvements in sleep apnea, physical mobility, and other obesity-related conditions [1, 20, 21]. The prevention of the full range of comorbidities associated with obesity requires comprehensive obesity prevention and management strategies, in line with the WHO European Charter on counteracting obesity [22].

Conclusion

This large-scale, national study demonstrates that the prevalence of objectively measured overweight and obesity among Russian adults is higher (30.3%) than in most OECD countries. The size and diversity of the Russian population make implementing national obesity prevention and reduction strategies challenging, and examining whether there are specific, modifiable determinants of obesity that are common to all regions could allow for actionable public health policies. Our study indicates that future community-based interventions can target key geographic areas and address social determinants of health, including income, sex, and education. Availability of data/results from surveys like this will be useful to evaluate the long-term impact of NCD/obesity prevention strategies. It is necessary to have regular national level data.

Acknowledgments

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Statement of Ethics

Each participant signed a written informed consent form before any measurements were collected. Ethics approval was obtained from 3 ethics committees: the National Research Center for Preventive Medicine (8 centers), the Russian Cardiology Research-and-Production Complex (2 centers), and the Federal Almazov North-West Medical Research Centre (2 centers).

Disclosure Statement

The authors declare no conflict of interest.

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