



Associations of dietary patterns and abdominal obesity in the adult population. Results of the Russian epidemiological ESSE-RF study

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Abdominal obesity (AO) is an alimentary-dependent risk factor, the development and prognosis of which is directly specified by eating habits.

Aim. To study the associations of dietary patterns and AO among the adult Russian population.

Material and methods. The analysis was carried out using representative samples of male and female population aged 25-64 years ($n=19297$; men, 7342; women, 11955) from 13 Russian regions. The response was about 80%. Nutrition was assessed based on the prevalence of consumption of the main food groups forming the daily diet. Results are presented as odds ratios and 95% confidence intervals.

Results. Men with AO, compared with men without AO, more often consume red meat and vegetables/fruits daily by 12% and 13%, respectively, as well as less often eat cereals and pasta, confectionery, sour cream, and cottage cheese by 17%, 24%, 14%, and 19%, respectively. In women with AO, compared to women without AO, there are more differences in the diet, as they more often daily consume red meat by 28%, fish and seafood by 26%, poultry by 23%, meat and sausages and fruits/vegetables by 14%, milk, kefir, yogurt by 11%, as well as less often — cereals and pasta, sweets, and sour cream by 11%, 14%, and 8%, respectively. In women with AO, the prevalence and amount of drinking beer and dry wines is lower, but they consume spirits more frequently ($p=0,0001$), but without significant differences in amount. Men with AO have a higher prevalence and amount of drinking dry and fortified wines, as well as strong alcoholic drinks. Men with AO drinks higher amount of beer. In addition, men with AO showed a positive association with alcohol consumption ($\chi^2=53,64$, $p<0,0001$), while women with AO had a negative association

($\chi^2=28,64$, $p<0,0001$). Cardioprotective eating habits are more often (17%) present among people with AO without sex differences.

Conclusion. The study revealed significant differences in dietary patterns of persons with AO compared with those without AO, most pronounced in women.

Keywords: dietary patterns, dietary structure, abdominal obesity, obesity, eating habits, diet, alimentary-dependent risk factors.

Relationships and Activities: none.

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Obesity is a significant global problem, rapidly growing in modern society and becoming an epidemic [1]. In Russia, according to the ESSE-RF large-scale epidemiological study, the prevalence of general obesity is 30,8% among women and 26,9% among men, while abdominal obesity (AO) — 38,4% and 24,3%, respectively [2]. Over the decade of 2003-2013, the obesity rate among women increased by 30%, and among men — 2,5 times [2]. The increase in obesity is noted both among the urban and rural population, which, given the difference in physical activity, indicates the increasing role of inadequate nutrition in obesity development. AO is a nutrition-dependent risk factor, the development and prognosis of which is directly determined by the diet. AO is a key risk factor for metabolic syndrome, forming a whole cluster of metabolic disorders and increasing the adverse effect on the patient prognosis.

The study of associations between nutrition and obesity is becoming extremely relevant and in demand for the development of preventive programs. The performed analysis of associations is carried out both with nutritional models [3, 4], characteristics of energy and nutritional status [5-8], and with individual food groups, covering both products from the daily diet (dairy products, fruits and vegetables, meat, etc.) [9-18] and banquet products (confectionery, sugary drinks, processed products) [19]. The interest of researchers is attracted by the contribution of obesity of both raw products [9, 14, 20] and products of various processing degrees [6, 10-12, 19, 21], and regarding dairy products — the fat content [13].

At the moment, the numerous studies in this area are a topic for active scientific discussion, since they are multidirectional in nature and have significant differences depending on the dietary structure in the population.

The aim was to study the associations of dietary patterns and AO among the adult Russian population.

Material and methods

The material was representative samples of male and female population aged 25-64 years (n=22217; men, 8519; women, 13698) from 13 Russian regions (Voronezh, Ivanovo, Volgograd, Vologda, Kemerovo, and Tyumen Oblasts; Republic of North Ossetia-Alania, Krasnoyarsk Krai; Samara, Orenburg, Vladivostok, Tomsk and St. Petersburg), examined as part of the ESSE-RF multicenter epidemiological study. The study was approved by the National Medical Research Center for Therapy and Preventive Medicine, Russian Cardiology Research and Production Complex, Almazov National

Medical Research Center, and all other participating centers. All subjects signed an informed consent. The response rate was ~80% [22].

To assess nutrition and dietary habits, a standard questionnaire was used on consumption of the main food groups (red meat, poultry, fish and seafood, sausages and meat delicacies, pickles, cereals and pasta, raw vegetables and fruits, legumes, confectionery and sweets, dairy products: milk, kefir, yoghurt, sour cream/cream, cottage cheese, cheese) with 4 criteria — “not consume/rarely”; “1-2 times a month”; “1-2 times a week” and “daily/almost daily”. Dairy products by fat content were grouped according to the criteria of Russian regulatory documents [23]. The criteria for assessing a diet were determined in accordance with the World Health Organization criteria [24].

Daily consumption of confectionery, sweets, and/or consumption >12 tsp/raw sugar lumps were considered “consuming too much added sugar”. Excessive salt intake was determined when there were simultaneously 2 out of 3 following items in the diet: daily consumption of sausages and meat delicacies; daily consumption of pickles and marinades; adding more salt to cooked dishes. The protective dietary pattern included the 4 following items: daily consumption of vegetables and fruits, fish consumption at least 1-2 times a week, consuming only vegetable oils, and the consumption of low-fat dairy products.

Alcohol consumption was assessed by the frequency and intensity of its usual intake once and per week. The following types of alcoholic beverages were evaluated: beer, dry wines and champagne, fortified wines, house wines and liqueurs, spirits (vodka, cognac, etc.). Additionally, the calculation of ethanol consumption per day was carried out in total from each type of alcoholic beverages. The “high consumption” category included women consuming 84 g and men consuming 168 g of pure ethanol per week; “moderate consumption” — women consuming 42 g and men consuming 84 g of pure ethanol per week; “low consumption” — women consuming <42 g and men consuming <84 g ethanol per week.

AO was recorded at waist circumference (WC) ≥ 102 cm in men and WC ≥ 88 cm in women. Anthropometric measurements were carried out using standard techniques and is described in the study protocol [22].

Statistical analysis was carried out on a cohort of respondents who have complete data on dietary pattern (n=19297; men, 7342; women, 11955).

There were gaps in the answers about alcohol consumption. To recover the missing data in the answers to the questions “How often do you drink

Table 1

Prevalence of daily consumption of basic foods groups and eating disorders among respondents

	Without AO men n=5537, women n=6600		AO men n=1805, women n=5355		p
	n	%	n	%	
Red meat					
Men	2844	51,4	977	54,1	0,0412
Women	2434	36,9	2128	39,7	0,0014
Fish, seafood					
Men	587	10,6	228	12,6	0,0171
Women	567	8,6	629	11,7	<0,0001
Poultry					
Men	1454	26,3	438	24,3	0,0926
Women	1777	26,9	1644	30,7	<0,0001
Processed meat					
Men	1502	27,1	475	26,3	0,5001
Women	1263	19,1	1133	21,2	0,006
Pickles and marinades					
Men	626	11,3	190	10,5	0,3602
Women	564	8,5	552	10,3	0,001
Cereals, pasta					
Men	2397	43,3	704	39	0,0014
Women	2721	41,2	2095	39,1	0,0196
Fresh vegetables and fruits					
Men	2717	49,1	996	55,2	<0,0001
Women	4226	64	3635	67,9	<0,0001
Legumes					
Men	232	4,2	71	3,9	0,6343
Women	302	4,6	265	4,9	0,3401
Sweets, confectionery					
Men	2499	45,1	684	37,9	<0,0001
Women	3593	54,4	2567	47,9	<0,0001
Milk, kefir, yogurt					
Men	2482	44,8	795	44	0,562
Women	3493	52,9	2984	55,7	0,0023
Sour cream, cream					
Men	1197	21,6	353	19,6	0,0624
Women	1382	20,9	1092	20,4	0,4627
Cottage cheese					
Men	836	15,1	244	13,5	0,0997
Women	1371	20,8	1230	23	0,0038
Cheese					
Men	1963	35,5	650	36	0,6668
Women	2910	44,1	2340	43,7	0,6664
Adding more salt to cooked food					
Men	2634	47,6	892	49,4	0,1725
Women	2724	41,3	2251	42	0,4001
Excess salt intake					
Men	3497	63,2	1162	64,4	0,35
Women	3605	54,6	3048	56,9	0,0119

Table 1. Continuation

	Without AO men n=5537, women n=6600		AO men n=1805, women n=5355		p
	n	%	n	%	
Consuming too much added sugar (10% of the daily value or more)					
Men	2680	48,4	728	40,3	<0,0001
Women	3668	55,6	2608	48,7	<0,0001
Excessive intake of salt, sugar and milk fat					
Men	1673	30,2	475	26,3	0,0016
Women	1994	30,2	1477	27,6	0,0016
Cardioprotective diet					
Men	1311	23,7	525	29,1	<0,0001
Women	2255	34,2	2126	39,7	<0,0001

Abbreviation: AO — abdominal obesity.

Table 2

**Daily food consumption, dietary habits and nutrition patterns
of respondents with AO in comparison with those without AO***

	Men			Women		
	OR	95% CI	p	OR	95% CI	p
Daily consumption						
Red meat	1,12	1,00-1,25	0,0482	1,28	1,18-1,39	<0,0001
Fish, seafood	1,10	0,93-1,30	0,2750	1,26	1,11-1,44	0,0004
Poultry	0,93	0,82-1,06	0,2654	1,23	1,13-1,34	<0,0001
Processed meat	1,01	0,89-1,14	0,8890	1,14	1,03-1,26	0,0087
Pickles and marinades	0,92	0,77-1,10	0,3783	1,10	0,97-1,26	0,1504
Cereals, pasta	0,83	0,74-0,93	0,0010	0,89	0,82-0,96	0,0043
Fresh vegetables and fruits	1,13	1,01-1,27	0,0310	1,14	1,05-1,24	0,0017
Legumes	0,93	0,70-1,22	0,5929	0,96	0,80-1,15	0,6281
Sweets, confectionery	0,76	0,67-0,85	<0,0001	0,86	0,80-0,93	0,0002
Milk, kefir, yogurt	0,94	0,84-1,05	0,2715	1,11	1,03-1,20	0,0086
Sour cream, cream	0,86	0,75-0,99	0,0317	0,92	0,83-1,01	0,0786
Cottage cheese	0,81	0,68-0,94	0,0079	0,94	0,85-1,03	0,1668
Cheese	1,01	0,90-1,14	0,8154	0,96	0,89-1,04	0,3359
Eating disorders						
Excess salt intake	1,05	0,94-1,18	0,3967	1,04	0,96-1,13	0,3281
Adding more salt to cooked food	1,07	0,96-1,19	0,2416	0,99	0,92-1,08	0,8886
Excessive intake of salt and sugar	0,86	0,75-0,98	0,0236	0,88	0,81-0,97	0,0098
Excessive intake of salt, sugar and milk fat	0,84	0,74-0,95	0,0064	0,90	0,82-0,98	0,0145
Cardioprotective diet	1,17	1,03-1,33	0,0133	1,17	1,08-1,27	0,0002

Note: * — reference — persons without AO; standardization based on age, marital status, educational status, income level, type of residence, smoking status and level of alcohol consumption.

Abbreviations: AO — abdominal obesity, CI — confidence interval, OR — odds ratio.

alcohol?” and “How much do you usually drink in one meal?” data recovery algorithm was used. For each category of alcoholic beverages, a table was formed with the columns “sex”, “age group”, “education status”, “type of residence”, “average consumption frequency per week”, “average quantity

in ml per one meal”. Every possible combination of values in the first four columns identified a subgroup to which the respondents might belong. For each subgroup, the mean values indicated in the last two columns were calculated. In the case when the respondent missed the answer to the question “How

Table 3

**Comparison between groups of subjects with and without AO,
depending on the level of alcohol consumption**

	Men					Women				
	Without AO n=5537		AO n=1805		p	Without AO n=6600		AO n=5355		p
	n	%	n	%		n	%	n	%	
No consumption	909	16,4	317	17,6	0,2571	1380	20,9	1324	24,7	<0,0001
Low consumption	3406	61,5	963	53,4	<0,0001	4771	72,3	3688	68,9	<0,0001
Moderate consumption	901	16,3	352	19,5	0,0015	350	5,3	246	4,6	0,0764
High consumption	321	5,8	173	9,6	<0,0001	99	1,5	97	1,8	0,1824

Abbreviation: AO — abdominal obesity.

often do you drink alcohol?” or “How much do you usually drink in one meal?”, the missing value was restored by the average of the column “Average consumption frequency per week” or “average quantity in ml per one meal”, respectively, from the subgroup to which the respondent belonged.

Statistical analysis was performed using the Scipy 1.1.0, NumPy 1.14.3 libraries for Python 3.6.5 (Python Software Foundation, Delaware, USA) and free R 3.6.1 environment. We calculated the mean and 95% lower and upper confidence intervals (CI) of the mean. The significance of differences between two independent samples was assessed using the Z-test for proportions in the case of binary data and the nonparametric Mann-Whitney U-test in the case of continuous one. The association between categorical data was assessed using the Pearson chi-squared test. The significance of differences between groups with different frequency of consuming a particular product was assessed using the Kruskal-Wallis test. For univariate and multivariate logistic regression, the glm function of the R 3.6.1 environment was used with an estimation of odds ratio (OR) and a 95% CI. The continuous variable “Age” was divided into 4 groups by decades (“25 years — 34 years” — the reference group, “35 years — 44 years”, “45 years — 54 years”, “55 years — 64 years”) and was considered as a categorical. The results were considered significant at $p < 0,05$.

Results

The central socio-demographic characteristics of subjects have already been presented in detail in previous publications [2].

The characteristics of the daily dietary patterns are presented in Table 1. There are significant differences in the dietary pattern of persons with AO, compared with those without AO. Thus, persons with AO, both men and women, more often consume red meat, fish and seafood, fruits and vegetables, less often

sweets and confectionery, cereals and pasta. Also, persons with AO without sex differences are less likely to consume raw sugar. Sugar consumption per day among women with and without AO is 4,1 (4,0-4,2) vs 4,6 (4,5-4,7) tsp ($p < 0,0001$), while among men: 5,4 (5,2-5,6) vs 6,2 (6,1-6,4), respectively ($p < 0,0001$). Differences in consumption of other foods are observed only in women. So, Russian women with AO more often consume poultry, sausages and meat delicacies, pickles, liquid dairy products (milk, kefir, yogurt) and cottage cheese. Excessive salt intake among women with AO is observed significantly more often. It is noticeable that the diet of women with AO often contains foods with a high salt content (processed meat products, pickles), which form an excessive salt intake. There are no differences in the prevalence of adding more salt to cooked food among women with AO. Among men, these features are not observed. However, in the general population, the consumption of processed products among men is higher and is one of the population characteristics of dietary pattern [25].

Among people with AO, the consuming too much sugar is lower, and the pattern of excessive intake of salt, sugar and milk fat is less common. There is also a higher rate of people adhering to a healthy diet (adequate consumption of vegetables and fruits, fish products, using only vegetable oils and consumption of low-fat dairy products).

The logistic regression made it possible to detail the differences in the diet of individuals with AO, as well as to demonstrate sex differences. The results of the analysis are presented in Table 2. Thus, among the differences in the dietary pattern of men with AO compared with those without AO, only a higher consumption of red meat and fruit and vegetable products remained, while rarer — cereals, pasta, sweets, including confectionery, cottage cheese and high-fat dairy products (sour cream and cream). In the diet of women with AO, a wider range

Table 4

Characteristics of the frequency and intensity of alcohol consumption depending on the AO

	Men					Women				
	No AO, n=5537		AO, n=1805		p	No AO, n=6600		AO, n=5355		p
	M	CI (lower-upper)	M	CI (lower-upper)		M	CI (lower-upper)	M	CI (lower-upper)	
Beer										
% of those who consume	54,11		48,48		<0,0001	32,91		25,14		<0,0001
Consumption frequency, times a week	1,02	0,98-1,07	1,04	0,95-1,12	0,9907	0,50	0,47-0,53	0,46	0,43-0,49	0,0002
Intensity per meal, ml	946,50	922,93-970,07	1068,77	1018,63-1118,91	<0,0001	568,75	551,99-585,50	534,82	511,29-558,36	<0,0001
Intensity per week, ml	985,09	931,77-1038,42	1153,30	1034,71-1271,89	0,0038	319,76	294,34-345,18	287,65	256,70-318,60	<0,0001
Dry wines, champagne										
% of those who consume	33,56		28,86		0,0002	60,08		50,10		<0,0001
Consumption frequency, times a week	0,35	0,32-0,38	0,40	0,34-0,46	0,0174	0,28	0,26-0,29	0,26	0,24-0,27	<0,0001
Intensity per meal, ml	300,15	289,46-310,85	326,18	302,35-350,02	0,3205	244,22	238,95-249,48	226,05	220,40-231,70	<0,0001
Intensity per week, ml	107,42	97,33-117,51	138,59	112,29-164,89	0,0290	71,51	66,74-76,28	61,32	56,55-66,08	<0,0001
Fortified wines										
% of those who consume	7,30		7,53		0,7758	7,06		6,80		0,5983
Consumption frequency, times a week	0,31	0,24-0,38	0,43	0,26-0,60	0,0391	0,22	0,17-0,26	0,24	0,18-0,30	0,2120
Intensity per meal, ml	263,77	240,89-286,64	314,57	263,18-365,97	0,2623	198,16	185,61-210,70	185,45	172,20-198,70	0,1508
Intensity per week, ml	95,92	63,87-127,97	149,94	83,85-216,03	0,0220	43,59	35,00-52,18	46,19	35,99-56,38	0,5323
Homemade liqueurs										
% of those who consume	7,46		7,81		0,6569	5,23		4,84		0,3534
Consumption frequency, times a week	0,50	0,41-0,58	0,50	0,36-0,64	0,3091	0,30	0,22-0,37	0,29	0,21-0,36	0,8383
Intensity per meal, ml	254,25	228,65-279,85	248,14	213,67-282,61	0,8687	159,01	142,59-175,44	146,64	133,97-159,31	0,5706
Intensity per week, ml	119,07	92,01-146,13	112,47	88,92-136,02	0,1915	63,75	21,84-105,67	39,09	30,08-48,11	0,6251
Vodka, cognac and other spirits										
% of those who consume	68,16		72,08		0,0019	35,00		41,76		<0,0001
Consumption frequency, times a week	0,57	0,55-0,60	0,69	0,64-0,74	<0,0001	0,29	0,27-0,32	0,31	0,29-0,33	0,0002
Intensity per meal, ml	240,38	233,98-246,77	271,6	259,88-283,31	<0,0001	129,2	125,55-132,85	131,47	127,11-135,83	0,5645
Intensity per week, ml	133,09	126,38-139,79	176,2	164,14-188,26	<0,0001	39,37	35,39-43,35	42,50	39,03-45,98	0,1295

Abbreviations: AO — abdominal obesity, CI — confidence interval.

Table 5

Distribution of mean WC values by frequency of consuming main food groups*

	Do not consume/rarely		1-2 times a month		1-2 times a week		Daily/almost daily		p**
	M	SD	M	SD	M	SD	M	SD	
Men, n=7860									
Red meat	94,0	13,4	92,1	14,1	92,3	13,8	93,5	13,3	<0,0001
Fish, seafood	89,9	13,5	92,0	13,8	93,4	13,5	94,4	13,1	<0,0001
Poultry	92,6	13,0	92,1	13,3	93,4	13,6	92,3	13,6	0,00656
Processed meat	93,5	13,1	92,8	13,8	93,0	13,6	92,6	13,8	0,28688
Pickles and marinades	92,6	13,6	92,5	13,2	93,9	13,7	91,9	13,9	<0,0001
Cereals, pasta	94,6	14,8	93,1	13,9	93,7	13,4	91,9	13,4	<0,0001
Fresh vegetables and fruits	93,9	14,4	91,4	13,6	92,3	13,7	93,7	13,4	<0,0001
Legumes	92,6	13,7	93,3	13,4	92,9	13,6	92,3	13,7	0,15308
Sweets, confectionery	95,1	14,4	93,2	14,0	92,9	13,9	92,2	12,8	<0,0001
Milk, kefir, yogurt	93,8	13,4	92,3	13,3	92,8	14,1	93,1	13,2	0,09485
Sour cream, cream	93,8	13,8	92,5	13,4	93,2	13,9	92,2	12,8	0,02455
Cottage cheese	93,5	13,9	92,7	13,3	93,1	13,6	92,2	13,3	0,11555
Cheese	93,6	13,7	93,0	13,7	92,9	13,5	92,8	13,5	0,70581
Women, n=13100									
Red meat	87,3	16,1	86,1	15,2	86,1	14,9	86,9	15,1	0,01723
Fish, seafood	85,3	15,4	84,7	14,8	87,1	15,1	89,0	15,5	<0,0001
Poultry	86,5	16,6	85,6	15,2	86,2	14,8	87,3	15,6	0,00024
Processed meat	86,5	14,7	85,6	15,1	86,6	15,4	87,1	15,3	0,00083
Pickles and marinades	86,7	14,9	85,4	15,1	86,9	15,2	88,2	15,6	<0,0001
Cereals, pasta	88,9	15,2	87,2	15,3	86,4	15,1	85,9	15,1	<0,0001
Fresh vegetables and fruits	90,1	15,7	85,0	15,2	85,2	15,0	86,9	15,1	<0,0001
Legumes	86,9	15,0	85,9	15,1	86,6	15,4	86,5	15,4	0,00095
Sweets, confectionery	90,7	15,9	87,7	15,7	86,6	15,3	85,1	14,5	<0,0001
Milk, kefir, yogurt	87,5	14,9	85,1	14,9	85,9	15,2	86,8	15,1	<0,0001
Sour cream, cream	88,2	15,4	85,5	15,4	86,3	14,6	86,2	15,5	<0,0001
Cottage cheese	86,3	15,6	85,4	15,4	86,8	14,9	86,9	14,8	<0,0001
Cheese	88,6	16,2	86,9	16,1	86,1	15,1	86,3	14,6	0,00042

Note: * — expanded sample of subjects excluding alcohol consumption and smoking status, ** — p — value is given for the difference between groups of different product consumption frequency according to the Kruskal-Wallis test.

Abbreviations: M — sample mean, SD — standard deviation.

of differences is noted. There was more common consumption of not only red meat, but fish products, poultry, meat and sausage products, and liquid dairy products, as well as fruits and vegetables, while there is a rarer presence in the diet of cereals, pasta, sweets, and high-fat dairy products (sour cream, cream). However, in this analysis, there are no longer any differences in excessive salt intake among women with AO. Of the positive aspects of the diet, both among men and women with AO, there is a rarer excessive consumption of sugar, salt, milk fat, and a more common use of cardioprotective diet.

Significant differences are observed in the level of alcohol consumption. So, among men with AO, the indicator is lower in the category “low con-

sumption” and higher in the categories “moderate consumption” and “high consumption” (Table 3). Among men with AO, the percentage of people with a high alcohol consumption significantly higher than in those without AO (OR, 1,72 (95% CI 1,42-2,09), $p<0,0001$). In women, the situation is the opposite: persons with AO are less likely to consume alcoholic beverages. Thus, the indices in “non-users” group are higher, and in the group of “low consumption” — lower in comparison with similar indices in women without AO ($p<0,0001$). There are no significant differences in the categories “moderate consumption” and “high consumption”. The characteristics of alcohol consumption by persons with and without AO are presented in Table 4.

Men with AO, compared with men without AO, have a higher frequency and intensity of consuming dry and fortified wines, strong drinks (vodka, cognac). Differences were also observed in the form of greater intensity of beer consumption by men with AO. Among women, the situation is the opposite: persons with AO are less likely to consume alcoholic beverages. There was a lower frequency and intensity of beer and dry wine consumption among women with AO compared to those without AO. However, the frequency of drinking spirits among women with AO is higher, but without significant differences in intensity. In general, men with AO showed a positive association with alcohol consumption ($\chi=53,64$, $p<0,0001$), while women with AO had a negative association ($\chi=28,63$, $p<0,0001$).

The average WC values depending on the consumption of a particular food product are presented in Table 5. There are significant differences in WC among men between groups with different frequency of consumption of most food products analyzed in the study (red meat, fish, poultry, pickles, vegetables/fruits, cereals, sweets), with the exception of meat and sausage products, legumes, and dairy products, except for sour cream/cream. Among women, significant differences in WC are observed with different frequency of consumption of all analyzed food products.

Discussion

The performed analysis demonstrates differences in dietary pattern of persons with AO in comparison with Russians without AO. These differences are observed both in men and women with AO. In women, there are more differences than in the diets of men, which is reflected in the more frequent consumption of animal and processed products. Sex differences can also be traced in the level of alcohol consumption. Thus, men with AO more often and with higher intensity consume alcoholic beverages, in contrast to women with AO, in whom these indicators are lower than in those without AO.

It is also noticeable that persons with AO are more likely to consume energy-intensive foods — red meat, as well as men with AO — also alcoholic beverages, and women with AO — processed meat and sausages, liquid dairy products, fish and poultry.

The habit of consuming dairy products, even at the population level, is very widespread [25, 26]. Therefore, the analysis of association between consuming dairy products and the obesity is of interest in many studies [10–18]. However, the results of analyzes are very different: from AO risk reduction [10, 12, 14–16] and the absence of differences [9, 10] to positive associations with certain types of dairy products [17]. Results similar to those obtained in this study

regarding higher consumption of milk, kefir and yogurt in women with AO were also noted in another Russian study [11], carried out using the “Selective observation of the diet of the population” conducted in 2013 [27]. However, after standardization for age, educational status and income level, association was observed only in men, in contrast to the present study. The consumption of cottage cheese in women was associated with a decrease in obesity risk [11]; in the present study, no significant associations were found. It should be noted that the cited and present studies differed in anthropometric measurements and, accordingly, determining the body weight category. In the present study, anthropometric measurements were carried out according to standard methods by physician investigators, and in “Selective observation of the diet of the population” — by the respondents themselves. However, despite some differences in the results obtained, in general, there were positive associations between the consumption of liquid dairy products (in particular, kefir) and the obesity.

In the present study, no associations of consuming too much added sugar, confectionery and other sweets with the AO were observed, which may be related to the assessment of consumption frequency, but not intensity, as in other studies [19]. However, results similar to the present ones were obtained in another study [6], which included 2043 persons of both sexes from Moscow, Kaluga, Michurinsk and Tambov. The study demonstrated that, despite the overall high intake of added sugar from various foods, there was no association with obesity among the respondents [6].

The positive association of high consumption of red meat and the obesity [9] is confirmed in almost all studies on this topic. The present analysis also noted a higher consumption of red meat in both men and women with AO.

The positive association noted by many researchers of the common consumption of processed red meat (sausages and meat delicacies) and the presence of general and AO [6, 19] is also observed in this analysis among women. Alcohol use has also been positively associated with obesity in studies [14], whereas in the current analysis this has been confirmed among men.

In general, the analysis demonstrates both unfavorable accents in the nutritional pattern of persons with AO, and at the same time, protective ones in comparison with persons without AO. Among persons with AO of both sexes, along with a higher consumption of red meat, a higher presence of vegetables and fruits in the diet is also noted. Also, among persons with AO without sex differences, the cardioprotective nutrition pattern is more common. Among the unfavorable dietary characteristics

of persons with AO, the consumption of energy-intensive foods without significant nutritional value — alcoholic beverages for both sexes, as well as processed meat — for women. One should also take into account the general dietary disturbances: low daily consumption of fruits and vegetables, cereals, legumes; high consumption of red meat, processed meat, and confectionery [25, 26].

This analysis clearly demonstrated the dietary characteristics of individuals with AO and revealed sex differences. The nutritional imbalance observed in

individual diets is not always reflected in the population analysis. However, this analysis demonstrates a lot of emphasis on disorders in the eating habits of people with AO, which forms a scientifically grounded basis for preventive and rehabilitative measures. The research results can be used in developing preventive population-based programs aimed at preventing obesity, in estimating public health indicators and in making targeted management decisions.

Relationship and Activities: none.

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