Association of alcohol consumption and dietary patterns in the adult population: data from the ESSE-RF study

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The alcohol consumption is associated with dietary patterns.

**Aim.** To study the associations of alcohol consumption and dietary patterns in the adult population.

**Material and methods.** The analysis was carried out using representative samples of male and female population aged 25-64 years (n=19437; men, 7306; women, 12131 women) from 13 Russian regions. The response rate was 80%. We assessed nutrition by the frequency of consuming basic food groups. The low alcohol intake (LI) category includes women and men who consume <42 g and <84 g, moderate consumption (MI) — 42 g and 84 g, high intake (HI) — 84 g and 168 g ethanol per week, respectively.

**Results.** In comparison with men who do not drink alcohol, MI and HI category representatives more often consume red meat — by 22 and 36%, meat and sausages — by 37 and 48%, and less often: fish products — by 34 and 33%, cottage cheese — by 51 and 53%, respectively. More rare consumption of poultry is significant in the MI group, vegetables/fruits — in the HI group. Consumption of pickles, cereals, pasta, liquid dairy products, cheese and sour cream does not differ between the groups in men. Compared to women who do not drink alcohol, women in the LI, MI and HI groups significantly more often consume meat and sausages — by 16, 28 and 85%, respectively. Women of the LI and MI groups more often consume red meat — by 15 and 33%, confectionery — by 29 and 24%, less often: cereals — by 9 and 18%, legumes — by 44 and 53%, cottage cheese — by 19 and 44%, respectively. Women of the LI category more often consume milk, kefir and yogurt — by 26% and less often fish products — by 18%. Women of the HI group are less likely to consume fruits/vegetables. Consumption of poultry, pickles and cheese do not differ between groups among women.

**Conclusion.** People who consume alcoholic beverages have a pronounced nutritional imbalance, characterized by a higher consumption of red meat, especially processed, high-fat dairy products, salt, and in women, confectionery.

**Keywords:** dietary pattern, eating habits, alcohol consumption, alcohol, ESSE-RF study.

**Relationships and Activities:** none.

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and proportion of consuming protective foods, such as vegetables and fruits, whole grains, low-fat dairy products, decrease, while there is a higher level of consuming animal products, coffee, tea and potatoes [4, 5]. Some researchers identify certain dietary patterns associated with the predominant consumption of a particular alcoholic beverage [8, 9]. The Danish study found the largest differences in eating habits between people who preferred wine and those who preferred beer. The beer drinkers consumed more meat, soft drinks, margarine, and savory snacks. At the same time, people who prefer wine had healthier habits, more often consumed vegetables and fruits, and had a lower energy content of the diet compared to beer drinkers [8]. In the Spanish study, wine drinkers had higher intake of dietary fiber and olive oil, as well as lower consumption of total fat, dairy products, sugar-sweetened beverages, and fast food compared to those who consume other alcoholic beverages. and non-drinkers [9]. However, the systematic review, studying the association of alcohol consumption and types of food, which included 16 studies in the analysis, demonstrated that the alcohol choice specifies the initial type of a person’s diet, and not vice versa [10]. Some researchers have suggested that the observed differences in associations between the consumption of wine, beer and other alcoholic beverages and mortality may be due to concomitant eating habits, which differ depending on the type of drink consumed. However, most studies examining the relationship between alcohol consumption and lifestyle focus on alcohol consumption in general [7, 11, 12].

One way or another, the authors of all studies note the presence of a relationship between the dietary pattern and alcohol consumption. However, the population characteristics of these associations differ between countries, which determined the conduction of this study.

The aim was to study the associations of alcohol consumption and dietary patterns in the adult population of Russia.

**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, Tyumen Oblasts; cities of Samara, Orenburg, Vladivostok, Tomsk and St. Petersburg, the Republic of North Ossetia-Alania, Krasnoyarsk Krai), examined within the ESSE-RF multicenter epidemiological study. The study was approved by ethics committees of all participating centers. All participants signed informed consent. The response was ~80% [13].

To assess nutrition and eating habits, a questionnaire was used on the frequency of intake of 13 main food groups (red meat, poultry, fish and seafood, processed meat, pickles and marinades, cereals and pasta, raw vegetables and fruits, legumes, confectionery, dairy products (milk, kefir, yogurt, sour cream/cream, cottage cheese, cheese)). Four criteria for the consumption frequency were used: “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 [14]. The criteria for assessing the adequacy of consumption and compliance with a healthy diet were determined according to the World Health Organization guidelines [15].

Consumption of confectionery, sweets, and/or daily consumption of >12 tsp/raw sugar lumps were considered “too much added sugar”. Excessive salt intake was found in the case of the simultaneous presence of 2 of 3 following elements in the diet: daily consumption of processed meat; daily consumption of pickles and marinades; adding salt to food after cooking.

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 “low intake (LI)” category included women consuming <42 g and men consuming <84 g ethanol per week; “moderate intake (MI)” — women consuming 42 g and men consuming 84 g of pure ethanol per week; “high intake (HI)” — women consuming 84 g and men consuming 168 g of pure ethanol per week.

Within this publication, statistical analysis was carried out using a cohort of respondents with complete data on dietary pattern (n=19437; men, 7306; women, 12131).

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 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 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. To study the hypothesis on the trend in the transition from the “no intake (NI)” group to the LI, MI, and HI groups, the Cochran-Armitage and Jonckheere’s trend tests were used for binary and continuous data, respectively. The equality hypothesis was tested using the Kruskal-Wallis test. Multiple logistic regression was performed with adjustments for age, marital status, educational status, income, type of residence, and smoking status. 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...
### Characteristics of the participants

|                | NI, n=4155 | LI, n=12791 | MI, n=1786 | HI, n=705 |
|----------------|------------|-------------|------------|-----------|
|                | n          | %           | n          | %         | n          | %           | n          | %         |
| **Men**        |            |             |            |           |            |             |            |           |
| Age groups     |            |             |            |           |            |             |            |           |
| 25-34 years old| 654        | 16,0        | 2759       | 67,7      | 499        | 12,2        | 166        | 4,1       |
| 35-44 years old| 661        | 17,2        | 2481       | 64,5      | 491        | 12,8        | 212        | 5,5       |
| 45-54 years old| 1149       | 21,0        | 3614       | 66,2      | 494        | 9,0         | 205        | 3,8       |
| 55-64 years old| 1691       | 27,9        | 3937       | 65,1      | 302        | 5,0         | 122        | 2,0       |
| **Women**      |            |             |            |           |            |             |            |           |
| Age groups     |            |             |            |           |            |             |            |           |
| 25-34 years old| 1201       | 16,4        | 4509       | 61,7      | 1118       | 15,3        | 478        | 6,5       |
| 35-44 years old| 2954       | 24,4        | 8282       | 68,3      | 668        | 5,5         | 227        | 1,9       |
| **Educational status** |        |             |            |           |            |             |            |           |
| Below the secondary | 244  | 28,9       | 464        | 55,0      | 75         | 8,9         | 60         | 7,1       |
| Secondary      | 2308       | 22,8        | 6488       | 64,0      | 947        | 9,3         | 400        | 3,9       |
| Above the secondary | 1603  | 19,0        | 5839       | 69,1      | 764        | 9,0         | 245        | 2,9       |
| **Residence type** |        |             |            |           |            |             |            |           |
| City           | 3182       | 20,2        | 10538      | 66,9      | 1460       | 9,3         | 567        | 3,6       |
| Village        | 973        | 26,4        | 2253       | 61,1      | 326        | 8,8         | 138        | 3,7       |
| **Marital status** |        |             |            |           |            |             |            |           |
| Single         | 611        | 21,5        | 1884       | 66,4      | 250        | 8,8         | 93         | 3,3       |
| Married        | 2538       | 20,2        | 8256       | 65,9      | 1269       | 10,1        | 473        | 3,8       |
| Divorced       | 538        | 21,1        | 1681       | 65,9      | 225        | 8,8         | 106        | 4,2       |
| Widowed        | 437        | 31,6        | 876        | 63,4      | 38         | 2,7         | 31         | 2,2       |
| **Income**     |            |             |            |           |            |             |            |           |
| Very low       | 398        | 36,8        | 596        | 55,1      | 55         | 5,1         | 33         | 3,0       |
| Low            | 1360       | 25,6        | 3404       | 64,0      | 387        | 7,3         | 164        | 3,1       |
| Moderate       | 1680       | 19,5        | 5813       | 67,6      | 817        | 9,5         | 292        | 3,4       |
| High           | 626        | 16,1        | 2608       | 67,3      | 457        | 11,8        | 186        | 4,8       |
| Very high      | 65         | 14,3        | 297        | 65,6      | 63         | 13,9        | 28         | 6,2       |
| **Region**     |            |             |            |           |            |             |            |           |
| Primorsky Krai | 590        | 34,6        | 914        | 53,6      | 158        | 9,3         | 42         | 2,5       |
| Republic of North Ossetia-Alania | 843 | 53,0        | 646        | 40,6      | 60         | 3,8         | 42         | 2,6       |
| Ivanovo Oblast | 194        | 11,1        | 1293       | 73,8      | 189        | 10,8        | 75         | 4,3       |
| Tyumen Oblast  | 257        | 18,3        | 1026       | 73,0      | 80         | 5,7         | 42         | 3,0       |
| Vologda Oblast | 243        | 16,3        | 1010       | 67,6      | 193        | 12,9        | 49         | 3,3       |
| Kemerovo Oblast| 218        | 13,9        | 993        | 63,5      | 270        | 17,3        | 84         | 5,4       |
| Tomsk Oblast   | 168        | 11,7        | 1000       | 69,7      | 163        | 11,4        | 103        | 7,2       |
| Samara Oblast  | 274        | 17,8        | 1080       | 70,3      | 143        | 9,3         | 40         | 2,6       |
| Saint Petersburg| 130     | 9,0         | 1099       | 75,7      | 144        | 9,9         | 79         | 5,4       |
| Orenburg Oblast| 290        | 20,6        | 1018       | 72,3      | 65         | 4,6         | 35         | 2,5       |
| Krasnoyarsk Krai| 225      | 16,2        | 933        | 67,4      | 189        | 13,6        | 38         | 2,7       |
| Voronezh Oblast| 420        | 28,0        | 984        | 65,6      | 67         | 4,5         | 28         | 1,9       |
| Volgograd Oblast| 303      | 25,0        | 795        | 65,6      | 65         | 5,4         | 48         | 4,0       |
| **Smoking status** |        |             |            |           |            |             |            |           |
| Never          | 2989       | 25,4        | 8011       | 68,0      | 596        | 5,1         | 180        | 1,5       |
| Former         | 556        | 16,4        | 2182       | 64,3      | 474        | 14,0        | 183        | 5,4       |
| Current        | 610        | 14,3        | 2598       | 60,9      | 716        | 16,8        | 342        | 8,0       |

**Ethanol consumption level, g per week**

|                | M          | 95% CI      | M          | 95% CI      | M          | 95% CI      | M          | 95% CI      |
|----------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|
| **Men**        |            |             |            |             |            |             |            |             |
| Never          | 0          | 0,0-0,0     | 32,8       | 32,1-33,5   | 116,9      | 115,5-118,3 | 320,3      | 299,9-340,8 |
| Former         | 0          | 0,0-0,0     | 10,8       | 10,6-11,1   | 57,4       | 56,5-58,2   | 181,7      | 156,7-206,6 |

Note: HI — high intake, CI — confidence interval, LI — low intake, NI — no intake, MI — moderate intake.
years”) and was considered as a categorical. The results were considered significant at p<0.05.

Results

The characteristics of the surveyed patients are presented in Table 1. A fifth of the adult population does not consume alcohol at all (20.4%). Among the consumers, the main group consists of persons with LI (65.0%), MI — in 10.4% and HI — in 4.2% of Russians. Men consume alcohol more often and with higher intensity than women, and a decrease in consumption is observed with age. A higher proportion of NI individuals is noted among respondents with a low educational status, living in rural areas, with a low income, as well as among never smokers and widowed persons. HI is more often observed among men 35-44 years old, people with education below secondary, smokers, with high and very high-income level. Regional differences in rates are highly variable. Thus, the proportion of NI persons varies from 9.0 to 53.0%, the LI — from 40.6 to 75.5%, the MI — from 3.8 to 17.3%, and the HI — 1.9 to 7.2%. The NI group is the largest in the Republic of North Ossetia-Alania, and the smallest in St. Petersburg. The largest number of HI people is in the Tomsk region — 7.2 vs 1.9% in the Voronezh region.

Characteristics of consumption by frequency and quantity of certain alcohol types among men and women are presented in Table 2. Men more often prefer

### Table 2

Frequency and intensity of alcohol consumption among participants

|                         | Men |       |       |       |       |
|-------------------------|-----|-------|-------|-------|-------|
|                         | LI, n=4509 | MI, n=1118 | HI, n=478 |       |       |
|                         | M | 95% CI | M | 95% CI | M | 95% CI |
| **Beer**                |       |       |       |       |       |       |
| % of consumers          | 55.3 | 82.8 | 87.2 |       | <0.0001 | 19.6 |
| % of those using less than once a week | 61.99 | 35.31 | 22.30 |       | <0.0001 | -18.4 |
| Frequency of consumption, 1 time per week | 0.7 | 0.68-0.72 | 1.26 | 1.18-1.35 | 2.59 | 2.33-2.85 | <0.0001 |
| Amount for 1 meal, ml   | 735.2 | 718.3-752.0 | 1195.7 | 1154.4-1236.9 | 1601.2 | 1496.8-1705.5 | <0.0001 |
| Amount per week, ml     | 493.7 | 477.9-509.5 | 1308.8 | 1257.1-1360.6 | 3280.3 | 2942.7-3617.9 | <0.0001 |
| **Dry winces, champagne** |       |       |       |       |       |       |
| % of consumers          | 42.5 | 41.4 | 39.1 | 0.137 | -1.5 |
| % of those using less than once a week | 92.8 | 88.9 | 74.9 | <0.0001 | -7.7 |
| Frequency of consumption, 1 time per week | 0.30 | 0.28-0.31 | 0.45 | 0.38-0.52 | 0.96 | 0.69-1.23 | <0.0001 |
| Amount for 1 meal, ml   | 258.7 | 251.8-265.6 | 366.9 | 341.8-391.9 | 539.6 | 467.3-611.9 | <0.0001 |
| Amount per week, ml     | 74.2 | 70.5-77.9 | 153.4 | 135.1-171.8 | 429.2 | 320.8-537.6 | <0.0001 |
| **Fortified wines**      |       |       |       |       |       |       |
| % of consumers          | 7.7  | 10.2 | 18.2 | <0.0001 | 7.4 |
| % of those using less than once a week | 96.3 | 90.4 | 67.8 | <0.0001 | -7.7 |
| Frequency of consumption, 1 time per week | 0.21 | 0.18-0.23 | 0.31 | 0.24-0.39 | 1.37 | 0.87-1.87 | <0.0001 |
| Amount for 1 meal, ml   | 215.4 | 200.8-230.0 | 293.4 | 260.7-326.1 | 492.6 | 392.6-592.7 | <0.0001 |
| Amount per week, ml     | 40.9 | 36.1-45.9 | 87.2 | 66.7-107.7 | 511.0 | 327.7-694.4 | <0.0001 |
| **Homemade strong liqueurs** |       |       |       |       |       |       |
| % of consumers          | 6.5  | 11.9 | 21.8 | <0.0001 | 11.8 |
| % of those using less than once a week | 90.5 | 84.3 | 65.4 | <0.0001 | -5.8 |
| Frequency of consumption, 1 time per week | 0.33 | 0.28-0.39 | 0.50 | 0.39-0.61 | 1.27 | 0.86-1.68 | <0.0001 |
| Amount for 1 meal, ml   | 179.1 | 164.1-194.2 | 247.0 | 219.3-274.7 | 440.8 | 362.4-519.3 | <0.0001 |
| Amount per week, ml     | 45.3 | 40.4-50.2 | 99.7 | 87.5-111.8 | 378.4 | 272.2-484.7 | <0.0001 |
| **Vodka, cognac, other strong beverages** |       |       |       |       |       |       |
| % of consumers          | 75.0 | 95.1 | 95.6 | <0.0001 | 16.2 |
| % of those using less than once a week | 87.3 | 66.7 | 45.3 | <0.0001 | -23.4 |
| Frequency of consumption, 1 time per week | 0.43 | 0.42-0.45 | 0.80 | 0.74-0.85 | 1.49 | 1.30-1.67 | <0.0001 |
| Amount for 1 meal, ml   | 185.8 | 181.9-189.8 | 309.4 | 299.5-319.3 | 481.8 | 444.7-518.8 | <0.0001 |
| Amount per week, ml     | 72.6 | 70.7-74.6 | 204.3 | 197.5-211.1 | 493.7 | 446.7-540.7 | <0.0001 |
| **Women**               |       |       |       |       |       |       |
| LI, n=8288              | 35.9 | 71.9 | 71.8 | <0.0001 | 19.6 |
| % of those using less than once a week | 85.7 | 62.1 | 38.7 | <0.0001 | -18.3 |
| Frequency of consumption, 1 time per week | 0.39 | 0.38-0.40 | 0.68 | 0.63-0.72 | 1.67 | 1.32-2.01 | <0.0001 |
strong drinks (vodka, cognac), beer and dry wines and to a lesser extent fortified wines and homemade liqueurs. These preferences are observed in all alcohol consumption categories in men. Women have a similar choice, but, unlike men, the preference for dry wines is shown by 1.5 times more Russian women — 64.5% vs 41.02%, and in the LI category, dry wine and champagne are the leaders in popularity of the drink. In men, there is a positive upward trend in amount of all alcohol types consumed, as well as in the proportion of consumers (except for the “dry wine” category), while the share of those who consume this drink less than once a week is decreasing. Among women, a similar situation is noted, with the only difference that the amount of drinking of all alcohol types is less than in men, and in the “dry wine” category, women have a significant downward trend in consumers’ proportion.

The dietary pattern of both men and women changes depending on the alcohol consumption level, which is reflected in the change of the daily consumption of main food groups. Table 3 presents the characteristics of the daily consumption of main foods and individual dietary habits, depending on the category of alcohol consumption. In both men and women, with an increase in alcohol consumption, there are significant upward trends in consumption of red meat, processed meat, and added raw sugar. A similar situation is observed with respect to adding more salt to cooked foods, the insufficient consumption of raw vegetables and fruits, and the use of animal fats in cooking. With an increase in alcohol consumption without sex differences, significant negative trends in the consumption of raw vegetables and fruits, fish and seafood, legumes and cottage cheese are observed. In men, there is a decrease in the consumption of poultry, liquid dairy products (milk, kefir, yogurt, etc.), cheese and an increase in the consumption of pickles with an increase in alcohol consumption, in contrast to women who do not have such trends. However, among women, there are other dietary changes. With an increase in alcohol consumption, the intake of cereals and pasta decreases and the consumption of sweets/confectionery and dairy products (except for sour cream and cream) increases. Also, women have a pronounced upward trend of excess

### Table 2. Continuation

|                        | Men |
|------------------------|-----|
|                        | LI, n=4509 | MI, n=1118 | HI, n=478 | p for trend | Trend statistics |
| Amount 1 meal, ml      | M     | 95% CI | M     | 95% CI | M     | 95% CI | <0.0001 | <0.0001 |
| Amount per week, ml    | M     | 95% CI | M     | 95% CI | M     | 95% CI | <0.0001 | <0.0001 |

| Dry wines, champagne   |       |       |       |       |       |       |<0.0001 |<0.0001 |
|% of consumers         | 70.7  | 61.7  | 61.2  |       |       |       |<0.0001 |<0.0001 |
|% of those using less than once a week | 94.8  | 74.5  | 57.6  |       |<0.0001 |<0.0001 |
| Frequency of consumption, 1 time per week | 0.23  | 0.22-0.23 | 0.50  | 0.43-0.58 | 1.23  | 0.88-1.59 |<0.0001 |<0.0001 |
| Amount 1 meal, ml      | 220.1 | 216.8-223.3 | 391.7 | 364.9-418.3 | 457.4 | 399.7-515.1 |<0.0001 |<0.0001 |
| Amount per week, ml    | 30.5  | 49.1-51.9 | 174.7 | 157.5-191.9 | 439.8 | 312.1-567.4 |<0.0001 |<0.0001 |

| Fortified wines        |       |       |       |       |       |       |<0.0001 |<0.0001 |
|% of consumers         | 8.7   | 13.0  | 15.4  |<0.0001 |6.9   |<0.0001 |<0.0001 |
|% of those using less than once a week | 96.96 | 86.21 | 68.57  |<0.0001 |<0.0001 |
| Frequency of consumption, 1 time per week | 0.17  | 0.16-0.18 | 0.31  | 0.25-0.37 | 1.13  | 0.39-1.87 |<0.0001 |<0.0001 |
| Amount 1 meal, ml      | 176.8 | 168.3-185.4 | 257.3 | 229.4-285.1 | 381.3 | 289.2-473.4 |<0.0001 |<0.0001 |
| Amount per week, ml    | 30.2  | 27.4-32.9 | 75.6  | 60.3-90.9 | 240.2 | 125.4-354.9 |<0.0001 |<0.0001 |

| Homemade strong liqueurs |       |       |       |       |       |       |<0.0001 |<0.0001 |
|% of consumers         | 5.7   | 16.6  | 23.4  |<0.0001 |14.4  |<0.0001 |<0.0001 |
|% of those using less than once a week | 97.5  | 88.3  | 49.1  |<0.0001 |<0.0001 |
| Frequency of consumption, 1 time per week | 0.18  | 0.16-0.20 | 0.34  | 0.28-0.39 | 1.49  | 0.88-2.10 |<0.0001 |<0.0001 |
| Amount 1 meal, ml      | 130.5 | 122.8-138.2 | 215.2 | 193.9-236.4 | 396.0 | 282.5-509.5 |<0.0001 |<0.0001 |
| Amount per week, ml    | 21.3  | 19.2-23.4 | 63.9  | 54.3-73.7 | 428.2 | 153.1-703.3 |<0.0001 |<0.0001 |

| Vodka, cognac and other strong beverages |       |       |       |       |       |       |<0.0001 |<0.0001 |
|% of consumers         | 47.9  | 78.4  | 78.1  |<0.0001 |16.3  |<0.0001 |<0.0001 |
|% of those using less than once a week | 96.9  | 75.6  | 51.7  |<0.0001 |28.1  |<0.0001 |
| Frequency of consumption, 1 time per week | 0.22  | 0.22-0.23 | 0.48  | 0.43-0.53 | 1.44  | 1.12-1.77 |<0.0001 |<0.0001 |
| Amount 1 meal, ml      | 118.8 | 116.5-121.2 | 239.4 | 226.4-252.5 | 341.3 | 293.1-389.5 |<0.0001 |<0.0001 |
| Amount per week, ml    | 25.6  | 24.9-26.4 | 93.4  | 88.1-98.7 | 290.7 | 239.9-341.5 |<0.0001 |<0.0001 |

Note: * — to estimate the p for trend of consumers’ proportion, the Cochran-Armitage test was used; in other cases — the Jonckheere’s trend test. LI — low intake, CI — confidence interval, MI — moderate intake, HI — high intake.
Daily dietary regimen, habits and patterns among participants with different levels of alcohol consumption

| Alcoholic consumption | NI | LI | MI | HI | p for trend* | Trend statistics |
|-----------------------|----|----|----|----|-------------|-----------------|
|                       | n  | %  | 95% CI | n  | %  | 95% CI | n  | %  | 95% CI | n  | %  | 95% CI |
| Red meat              |    |    |        |    |    |        |    |    |        |    |    |        |
| Men                   |    |    |        |    |    |        |    |    |        |    |    |        |
| Alcohol consumption   |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Women                 |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Fish, seafood         |    |    |        |    |    |        |    |    |        |    |    |        |
| Men                   |    |    |        |    |    |        |    |    |        |    |    |        |
| Alcohol consumption   |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Women                 |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Poultry               |    |    |        |    |    |        |    |    |        |    |    |        |
| Men                   |    |    |        |    |    |        |    |    |        |    |    |        |
| Alcohol consumption   |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Women                 |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Processed meat        |    |    |        |    |    |        |    |    |        |    |    |        |
| Men                   |    |    |        |    |    |        |    |    |        |    |    |        |
| Alcohol consumption   |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Women                 |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Pickles and marinades |    |    |        |    |    |        |    |    |        |    |    |        |
| Men                   |    |    |        |    |    |        |    |    |        |    |    |        |
| Alcohol consumption   |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Women                 |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Cereals and pasta     |    |    |        |    |    |        |    |    |        |    |    |        |
| Men                   |    |    |        |    |    |        |    |    |        |    |    |        |
| Alcohol consumption   |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Women                 |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Fresh vegetables and fruits |    |    |        |    |    |        |    |    |        |    |    |        |
| Men                   |    |    |        |    |    |        |    |    |        |    |    |        |
| Alcohol consumption   |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Women                 |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Legumes               |    |    |        |    |    |        |    |    |        |    |    |        |
| Men                   |    |    |        |    |    |        |    |    |        |    |    |        |
| Alcohol consumption   |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Women                 |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Sweets, confectionery |    |    |        |    |    |        |    |    |        |    |    |        |
| Men                   |    |    |        |    |    |        |    |    |        |    |    |        |
| Alcohol consumption   |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Women                 |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Milk, kefir, yogurt   |    |    |        |    |    |        |    |    |        |    |    |        |
| Men                   |    |    |        |    |    |        |    |    |        |    |    |        |
| Alcohol consumption   |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Women                 |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Sour cream, cream     |    |    |        |    |    |        |    |    |        |    |    |        |
| Men                   |    |    |        |    |    |        |    |    |        |    |    |        |
| Alcohol consumption   |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Women                 |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Cottage cheese        |    |    |        |    |    |        |    |    |        |    |    |        |
| Men                   |    |    |        |    |    |        |    |    |        |    |    |        |
| Alcohol consumption   |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Women                 |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Cheese                |    |    |        |    |    |        |    |    |        |    |    |        |
| Men                   |    |    |        |    |    |        |    |    |        |    |    |        |
| Alcohol consumption   |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Women                 |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Adding more salt to cooked food |    |    |        |    |    |        |    |    |        |    |    |        |
| Men                   |    |    |        |    |    |        |    |    |        |    |    |        |
| Alcohol consumption   |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Women                 |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Inadequate intake of vegetables/fruits |    |    |        |    |    |        |    |    |        |    |    |        |
| Men                   |    |    |        |    |    |        |    |    |        |    |    |        |
| Alcohol consumption   |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Women                 |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Excess salt intake    |    |    |        |    |    |        |    |    |        |    |    |        |
| Men                   |    |    |        |    |    |        |    |    |        |    |    |        |
| Alcohol consumption   |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |
| Women                 |    |    |        |    |    |        |    |    |        |    |    |        |
|                       |    |    |        |    |    |        |    |    |        |    |    |        |

Table 3
The rest of the differences in diets regards only certain categories of alcohol consumption. Compared with NI individuals, men from the MI and HI groups more often consume red meat (OR, 1.22; 95% CI: 1.03-1.44 (p=0.0203); OR, 1.36; 95% CI: 1.09-1.69 (p=0.0059), respectively), processed meat (OR, 1.37; 95% CI: 1.14-1.65 (p=0.001); OR, 1.48; 95% CI: 1.17-1.87 (p=0.0011), respectively), add salt to cooked food (OR, 1.26; 95% CI: 1.07-1.50 (p=0.0063); OR, 1.52; 95% CI: 1.22-1.89 (p=0.0002), respectively) and less often consume fish products (OR, 0.66; 95% CI: 0.49-0.89 (p=0.0036); OR, 0.67; 95% CI: 0.47-0.97 (p=0.0336), respectively), legumes (OR, 0.58; 95% CI: 0.38-0.89 (p=0.0124); OR, 0.44; 95% CI: 1.17-1.69 (p=0.0059), respectively), and these habits are more pronounced in the HI group.

Analysis of the logistic model showed that not all of the above differences in dietary pattern depending on alcohol consumption persist, but stable trends demonstrate reliable associations. Among all categories of alcohol consumption in men, only one eating habit stands out — the use of animal fats in cooking. So, in comparison with NI, men of the LI, MI and HI categories more often consume food prepared with animal fats (odds ratio (OR), 1.42; 95% CI: 1.23-1.64 (p<0.0001); OR, 1.36; 95% CI: 1.13-1.65 (p=0.0013); OR, 1.51; 95% CI: 1.17-1.94 (p=0.0016), respectively.

Note: * — Cochran-Armitage test; ** — Jonckheere’s trend test. LI — low intake, CI — confidence interval, MI — moderate intake, HI — high intake.

Figure 1: Prevalence of DRFs among men with different alcohol consumption levels.
Note: HTN — hypertension, AO — abdominal obesity, HI — high intake, HG — hyperglycemia, HTG — hypertriglyceridemia, HU — hyperuricemia, HC — hypercholesterolemia, LI — low intake, NU — do not use/do not use, no intake, DM — diabetes mellitus, MI — moderate intake.
There are more differences in diets among women. Compared to NI females, those of the LI, MI and HI groups significantly more often consume processed meat (OR, 1.16; 95% CI: 1.04-1.3 (p=0.0081); OR, 1.28; 95% CI: 1.04-1.58 (p=0.0215); OR, 1.85; 95% CI: 1.37-2.51 (p<0.0001), respectively), animal protein (OR, 1.17; 95% CI: 1.07-1.27 (p=0.0004); OR, 1.32; 95% CI: 1.11-1.57 (p=0.0022); OR, 1.33; 95% CI: 1.01-1.77 (p=0.0454), respectively), add salt to cooked foods (OR, 1.23; 95% CI: 1.12-1.34 (p=0.0001); OR, 1.37; 95% CI: 1.15-1.64 (p=0.0004); OR, 1.98; 95% CI: 1.5-2.61 (p<0.0001), respectively), and use animal fats in cooking (OR, 1.46; 95% CI: 1.1, 1.73 (p=0.0027), respectively). Daily consumption of cereals, pasta, liquid dairy products (milk, kefir, yogurt), cheese and sour cream did not differ between the alcohol consumption groups in men. There were no significant differences between the groups in daily consumption of pickles and marinades, however, assessment of their total weekly and daily consumption made it apparent. Thus, the frequent consumption of pickles in individuals with MI and HI is higher compared with NI individuals (OR, 1.23; 95% CI: 1.04-1.45 (p=0.015); OR, 1.39; 95% CI: 1.12-1.73 (p=0.0027), respectively). This was reflected in the integral assessment of excess salt intake, which was higher in the MI and HI groups (OR, 1.4; 95% CI: 1.17-1.67 (p=0.0002); OR, 1.6; 95% CI: 1.26-2.04 (p<0.0001), respectively). Alcohol drinkers consume high-fat dairy products, as opposed to NI individuals who prefer low-fat products. Compared to NI persons, the excess consumption of milk fat is higher in LI (OR, 1.89; 95% CI: 1.32-2.7 (p=0.0005)) and HI (OR, 3.69; 95% CI: 1.43-9.49 (p=0.0068)) men.

There are more differences in diets among women. Compared to NI females, those of the LI, MI and HI groups significantly more often consume processed meat (OR, 1.16; 95% CI: 1.04-1.3 (p=0.0081); OR, 1.28; 95% CI: 1.04-1.58 (p=0.0215); OR, 1.85; 95% CI: 1.37-2.51 (p<0.0001), respectively), animal protein (OR, 1.17; 95% CI: 1.07-1.27 (p=0.0004); OR, 1.32; 95% CI: 1.11-1.57 (p=0.0022); OR, 1.33; 95% CI: 1.01-1.77 (p=0.0454), respectively), add salt to cooked foods (OR, 1.23; 95% CI: 1.12-1.34 (p=0.0001); OR, 1.37; 95% CI: 1.15-1.64 (p=0.0004); OR, 1.98; 95% CI: 1.5-2.61 (p<0.0001), respectively), and use animal fats in cooking (OR, 1.46; 95% CI: 1.1, 1.73 (p=0.0027), respectively). Daily consumption of cereals, pasta, liquid dairy products (milk, kefir, yogurt), cheese and sour cream did not differ between the alcohol consumption groups in men. There were no significant differences between the groups in daily consumption of pickles and marinades, however, assessment of their total weekly and daily consumption made it apparent. Thus, the frequent consumption of pickles in individuals with MI and HI is higher compared with NI individuals (OR, 1.23; 95% CI: 1.04-1.45 (p=0.015); OR, 1.39; 95% CI: 1.12-1.73 (p=0.0027), respectively). This was reflected in the integral assessment of excess salt intake, which was higher in the MI and HI groups (OR, 1.4; 95% CI: 1.17-1.67 (p=0.0002); OR, 1.6; 95% CI: 1.26-2.04 (p<0.0001), respectively). Alcohol drinkers consume high-fat dairy products, as opposed to NI individuals who prefer low-fat products. Compared to NI persons, the excess consumption of milk fat is higher in LI (OR, 1.89; 95% CI: 1.32-2.7 (p=0.0005)) and HI (OR, 3.69; 95% CI: 1.43-9.49 (p=0.0068)) men.
|      | Men |         | p* for trend | p** for trend |
|------|-----|---------|--------------|--------------|
|      | N  | n   | M  | 95% CI | n   | M  | 95% CI | n   | M  | 95% CI | n   | M  | 95% CI |
| SBP  | 796 | 1201 | 818,9 | 93,5 | 4909 | 83,6 | 83,3-83,9 | 118 | 118 | 135,2-137,2 | 478 | 586 | 136,4-140,3 |
| DBP  | 796 | 1201 | 73,5 | 73,3-73,7 | 4909 | 73,5 | 72,8-74,2 | 118 | 118 | 72,8-74,2 | 478 | 586 | 68,6-78,6 |
| BMI  | 796 | 1201 | 28,5 | 28,4-28,7 | 4909 | 28,5 | 28,4-28,6 | 118 | 118 | 28,4-28,6 | 478 | 586 | 27,9-28,9 |
| WC   | 796 | 1201 | 96,1 | 95,6-96,6 | 4909 | 96,1 | 95,6-96,6 | 118 | 118 | 95,6-96,6 | 478 | 586 | 98,4-97,9 |
| TC   | 796 | 1201 | 36,1 | 35,8-36,3 | 4909 | 36,1 | 35,8-36,3 | 118 | 118 | 35,8-36,3 | 478 | 586 | 39,6-39,7 |
| HDL  | 796 | 1201 | 38,6 | 38,3-38,9 | 4909 | 38,6 | 38,3-38,9 | 118 | 118 | 38,3-38,9 | 478 | 586 | 36,0-36,1 |
| LDL  | 796 | 1201 | 5,3  | 5,2-5,4 | 4909 | 5,3  | 5,2-5,4 | 118 | 118 | 5,2-5,4 | 478 | 586 | 5,1-5,6 |
| Glucose | 796 | 1201 | 5,4  | 5,3-5,5 | 4909 | 5,4  | 5,3-5,5 | 118 | 118 | 5,3-5,5 | 478 | 586 | 5,2-5,5 |

Note: * — Cochran-Armitage test; ** — Jonckheere's trend test. LI — low intake, CI — confidence interval, MI — moderate intake, HI — high intake, DBP — diastolic blood pressure, CI — confidence interval, BMI — body mass index, HDL — high density lipoproteins, LDL — low density lipoproteins, UA — uric acid, WC — waist circumference, TC — total cholesterol, SBP — systolic blood pressure, TG — triglycerides.
a downward and U-shaped one. The RF rates in obesity, hypercholesterolemia and hypertriglyceridemia in contrast to men, hypertension, obesity, abdominal differences between the alcohol consumption categories. In general, absolutely all DRFs in men showed significant upward trends. The incidence of diabetes and hyperglycemia is characterized by downward trends. In women is also determined by the average values, where U-shaped trend forms and the comparability of NI and HI values remain.

**Discussion**

The results of this study demonstrated the relationship between the alcohol consumption level and dietary pattern. An analysis of dietary habits showed that in both men and women, an increase in alcohol consumption was associated with a higher intake of red and processed meat and a decrease in consumption of plant-based products. Alcohol drinkers are more likely to add salt to cooked food and prefer high-fat dairy foods. There is a pronounced imbalance in the eating habits of alcohol drinkers (high salt intake, animal fats; in women, consuming too much sugar). The higher the level of alcohol consumption, the more pronounced these disorders are. Similar associations with dietary disorders and a pronounced imbalance are noted in almost all studies [3-5, 7], and some also indicate macro- and micronutrient deficiency in alcohol consumers [4, 5, 7, 16].

In men, the alcohol consumption level is associated not only with a higher energy diet, but also with an upward trend of CVD DRFs, in contrast to women, where the situation is the opposite. Results of this analysis are consistent with another Russian study conducted in the Kemerovo Oblast, where such dependence of alcohol consumption and DRFs are predominantly linear n men, while in women, a U-shaped or J-shaped associations are noted [17]. Perhaps this is due to the lower alcohol consumption level among women, which is shown in this study. In addition, women prefer less strong drinks, such as wine, and, perhaps, therefore, the damaging contribution of alcohol is manifested in women to a lesser extent. Another possible reason is a higher attention of women to their RFs, whom, by changing the dietary pattern, more easily refuse or reduce the level of alcohol consumption. It should be noted that the association we found between the level of alcohol consumption and body weight in women was also noted in foreign studies with the only difference that the level of ethanol consumption among women is many times higher than the amount noted in this analysis [16].

**Conclusion**

This analysis has clearly demonstrated that alcoholic drinkers have high-energy diets with higher levels of saturated fat, added sugars and salt due to higher consumption of red meat, especially processed, high-fat dairy products, and women — also confectionery. In view of this, the idea that the negative...
effect of alcohol consumption on the body is enhanced by the unhealthy eating habits seems justified, but at the same time there are reasonable doubts on the protective role of low-dose alcohol, since the growing imbalance in the diet is already observed in the LI persons compared to NI. Doubts are growing when analyzing DRFs in the alcohol consumption categories, especially in men, among whom the prevalence of DRFs increases linearly, while among women it begins to decrease. Perhaps the sex differences observed in this analysis are associated with initial differences in the eating habits of Russians [17, 18]. All this as a whole opens up a scientific discussion more than provides answers, since this work did not assess prognostic contribution of these factors due to cross-sectional design of the ESSE-RF. It seems advisable to continue the study of associations between eating habits and type of alcohol consumed, as well as the assessment of its contribution to prognosis.

**Relationships and Activities:** none.

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