Urszula Pasiut

University School of Physical Education in Cracow
Derpartment of Biomedical Science
Section of Biological Regeneration and Corrective Procedures
Akademia Wychowania Fizycznego w Krakowie
Instytut Nauk Biomedycznych,
Zakład Odnowy Biologicznej i Korekcji Wad Postawy

The relationships of alcohol stimulant with selected somatic features and indicators of obesity and fat tissues distribution in the body, in relation to the health risk in young adults

Związki używki alkoholowej z wybranymi cechami somatycznymi i wskaźnikami otłuszczenia oraz dystrybucji tkanki tłuszczowej w ustroju w odniesieniu do ryzyka utraty zdrowia u młodych osób dorosłych

Summary
Anthropometric study and survey included a random sample of young (average age 20.84 SD = 2.02) men (N = 695) and women (N = 719) studying at the largest public universities of Cracow (UJ, EU, UP, UR, AGH, PK). The research was carried out as part of the study, concerning the level of obesity and fat distribution in the light of socio - economic status and lifestyle of students.
The aim of this paper is to investigate the associations of alcohol consumption with selected somatic features and indicators of obesity and fat distribution in the body of young women and men, In order to identify the occurrence of health risks among young people resulting from the habit of drinking alcohol.
In order to point to the effects of drinking alcohol at the level of selected biological characteristics (BM, BMI, SF,% FAT, FM, FFM, WC, WHR, WTR , CI, ESS, TSS, TER) normalized differences of somatic traits and indicators between categories selected fractions of declared alcohol drinking such as “often and a lot,” “sometimes, and moderately”, “do not drink” were analyzed, which is illustrated in the form of morphological profiles for men and women
The analyzes indicate that alcohol consumption affects with the different strength of impact, both the level of obesity and fat distribution in the body system of studied women and men. Drinking alcohol often and in large quantities differentiates surveyed women and men in opposite directions. In male subjects, frequent alcohol use in large quantities involves significantly more body fat and body fat distribution in the body in the direction of greater accumulation of fat in the abdominal region. However, the consumption of alcohol in women frequently and in large amounts is associated with the lowest indicators of body fat as well as lower values of fat distribution indicators. Moreover, the result obtained with reference to TER ratio which is greater in women drinkers often and much, shows the tendency among these women of greater accumulation of fat in the abdominal region, equally as it happens among men.
Presented in this paper results constitute the basis for a health diagnosis of the respondents in terms of overweight and obesity, including abdominal type with reference to the declared alcohol consumption.

The consumption of alcohol has been identified as a significant risk factor for health deterioration especially with reference to men, resulting from the occurrence of greater fat occurrence, in particular abdominal.
Particularly dangerous because of the negative health effects, is abdominal obesity which comprise a health risk in 2% of young women and nearly 7% of young men, as it correlates with frequent alcohol consumption and in large quantities.
Key words: Woman, Man, alcohol, somatic traits, fat tissue, health

Streszczenie

Badaniami antropometrycznymi i ankietowymi objęto próbę losową młodych (średni wiek badanych 20,84 SD = 2,02) kobiet (N = 719) i mężczyzn (N = 695) studiujących w największych publicznych uczelniach Krakowa (UJ, UE, UP, UR, AGH, PK). Badania zrealizowano w ramach badań własnych, dotyczących poziomu otłuszczenia i dystrybucji tłuszczu w świetle statusu społeczno – ekonomicznego i stylu życia młodzieży akademickiej.
Celem opracowania było prześledzenie związków konsumpcji alkoholu z wybranymi cechami somatycznymi i wskaźnikami otłuszczenia oraz dystrybucji tłuszczu w ustroju u badanych młodych kobiet i mężczyzn w odniesieniu do ryzyka utraty zdrowia wynikającego ze współwystępowania tych czynników.
Dla wykazania wpływu picia alkoholu na poziom wybranych cech biologicznych (BM, BMI, SF, %FAT, FM, FFM, WC, WHR, WTR, CI, ESS, TSS, TER) analizie poddano znormalizowane różnice między wyodrębnionymi frakcjami deklarowanego picia alkoholu („Często i dużo", „Czasem i umiarkowanie", „Nie piją"), które zobrazowano w postaci profili morfologicznych dla kobiet i mężczyzn Konsumpcja alkoholu wpływa w sposób niejednorodny, zarówno na stopień otłuszczenia ciała jak i na kierunek dystrybucji tłuszczu w ustroju badanych młodych kobiet i mężczyzn. Picie alkoholu często i w dużych ilościach różnicuje badane kobiety i mężczyzn w przeciwnych kierunkach.
U badanych mężczyzn, z częstym piciem alkoholu w dużych ilościach, wiąże się istotnie większe otłuszczenie ciała oraz rozmieszczenie tkanki tłuszczowej w ustroju w kierunku większej kumulacji tłuszczu w okolicy brzusznej. Natomiast u kobiet konsumpcja alkoholu często i w dużych ilościach, wiąże się z najniższymi wartościami wskaźników otłuszczenia ciała, a także mniejszymi wartościami wskaźników dystrybucji tłuszczu. Chociaż wskaźnik TER jest większy u kobiet pijących alkohol często i dużo, co wskazuje na tendencję u tych kobiet do występowania większej kumulacji tłuszczu w okolicy brzusznej, podobnie jak u mężczyzn.
Przedstawione w niniejszym opracowaniu wyniki badań, stanowią podstawę dla dokonania diagnozy zdrowotnej badanych, w zakresie ryzyka występowania nadwagi i otyłości w tym typu brzusznego w odniesieniu do deklarowanej konsumpcji alkoholu. Konsumpcję alkoholu zidentyfikowano jako istotny czynnik ryzyka utraty zdrowia zwłaszcza w odniesieniu do płci męskiej. Wynika on z powiązań nadużywania alkoholu z występowaniem większego otłuszczenia zwłaszcza typu brzusznego. Szczególnie niebezpieczna, ze względu na negatywne skutki zdrowotne otyłość brzuszna stanowi ryzyko utraty zdrowia dla 2% młodych kobiet i prawie 7% młodych mężczyzn, bowiem koreluje z piciem alkoholu często i w dużych ilościach.
Słowa kluczowe: kobiety, mężczyźni, alkohol, cechy somatyczne, otłuszczenie ciała, zdrowie

Introduction

Alcohol is a product that takes a specific place in the socio-cultural sphere. On the one hand, it is a product of culture and its consumption is the element of lifestyle of communities, and on the other hand it is the cause of many diseases and social harm. The specific influence of alcohol addiction and mental effects of insobriety due to excessive consumption causes social and economic disruptions. Alcohol is a risk factor for many diseases, including cardiovascular disease, gastrointestinal cancers, and contributes to immune and reproductive health disorders as well as to incidents of deaths. However, there have been reports of positive effects of consuming alcohol in small amounts, resulting from the protective influence of alcohol towards cardiovascular disease (NIAAA 2000). The report "Alcohol in Europe: A public health perspective. Report for the European Commission – Summary" (p. 127) alcohol is perceived as a third cause of deaths and malfunction in Europe, while obesity is ranked on the fourth place (Anderson, Baumberg, 2006).

In literature much information can be found on the links between alcohol consumption and obesity and a greater accumulation of fat in the abdominal area (Lahti-Koski et al. 2002, Laitinen et al. 2004, Suter, 2005, Carels et al. 2008, Luo et al. 2012). The relationship between body fat and alcohol drinking in the context of adverse health effects resulting from the combination of these factors is dealt by Tatoń (1996), in a particular way and identified as risk factors for arteriosclerosis. Abdominal obesity is defined by the author as the third most important internal factor, and excessive alcohol consumption is the fourth most important external risk factor of arteriosclerosis. Abdominal obesity is considered as particularly dangerous because of the negative health effects resulting from the links between obesity, especially visceral with metabolic abnormalities and arteriosclerosis.

In the light of information on negative health effects resulting from the coexistence of obesity, especially abdominal and alcohol abuse, the attempt of assessing risks of health damage in young adults was taken, as it is clear from the opinion of experts (Tatoń, Bernas, 2008) that metabolic disorders can occur in young age.

The aim of this paper is to investigate the associations of alcohol consumption with selected somatic features and indicators of obesity and fat distribution in the body of young women and men.

Materials and test methods

The material analyzed in the work comprises anthropometric and survey data of random sample of young men and women studying at large state Cracow's universities (Jagiellonian University - UJ, Cracow University of Economics – UE, Pedagogical University - UP Agricultural University - UR, University of Science and Technology-AGH , Cracow University of Technology - PK). The study included the students of the second full-time year, chosen in two stage lottery, with a minimum of one hundred men and a hundred women from each university. In the first stage of lottery, one faculty was selected from each of the six selected universities. In the second stage, a group of randomly selected male and female students within each of the departments. The research was carried out as part of the studies, concerning the level of obesity and fat distribution in the view

of socio-economic status and lifestyle of students. Measurements were carried out in November 2004, after obtaining the written consent of directors of particular institutions, to implement the research in physical education classes. The study included individuals whose physical activity (taken now or in the recent past) didn't display signs of competitive sports, due to the effects of exercise training, concerning people practicing different kinds of sports (Pasiut, 2012).

The study sample representing Cracow's subpopulation of students was divided by gender, and the structure of the sample was shown in Figure 1. The population which is the subject of the study comprise a homogenous sample in terms of age (average age 20.84 SD = 2.02) and social status of male and female students of state university.

The appropriate to the test, the set of anthropometric measurements was selected, and the test was performed in accordance with the methodology described in the literature (Gołąb, Chrzanowska, 2007). Anthropometric measurements included size, width and circumference of the trunk and limbs factors and skin-fat folds:

- The height of the body - BH (cm) - measured (Basis-vertex), in standing, upright position by means of antropometre, from the base measurement (Basic) to the vertex, with the adjustment of the head in the horizontal Frankfurt plane, with a precision of 1 mm;
- Body mass - BM (kg), measured on the medical scale in gymnastic outfit, but without shoes, with the precision of 100g;
- Waist circumference- WC (cm), measured perpendicular to the long axis of the body waist at the narrowest point between the lower edge of the ribs and the upper edge of the top of the iliac crest bone, with a precision of 1 mm;
- Hips circumference - HC (cm), measured by means of centimeter tape arranged perpendicular to the long axis of the body at the level of larger femoral secretaries, with a precision of 1 mm;
- Thigh circumference - TC (cm), measured by using centimeter tape arranged perpendicular to the long axis of the thigh below the gluteal fold, with equal load distribution in both lower limbs, with a precision of 1 mm;
- Arm circumference - AC (cm), measured at rest, by means of centimeter tape arranged perpendicular to the long axis of the arm in the middle of its length, with an accuracy of 1mm;

The features of body fat recognized as measurements of the thickness of fat- skin folds (mm), measured on the trunk and limbs by the use of Harpenden foldmeter with the load of 10g/mm2 of contact surface with an accuracy of 0.1 mm:

- Skin-fat fold above the arm bicep - BIC - biceps measured as longitudinal fold in half of the arm length;
- Skin-fat fold above the triceps - TRC - triceps measured as longitudinal fold on the back part in the middle of the arm length;
- Subscapular skin-fat fold - SSC - subscapular measured as slanting fold under the lower angle of the scapular bone;
- Skin-fat fold over the iliac crest - SIC - suprailiac measured as slanting fold above the iliac crest in the lateral line of the body;
- Abdominal skin-fat fold - ABD - abdominal fold measured as transversal fold about

5cm lateral and 1cm down from the navel
- Calf skin-fat fold - CLF - calf measured as longitudinal fold below popliteal.

On the basis of direct measurements of somatic features, anthropometric indicators of the degree of obesity and fat distribution pattern were calculated. As measure of body fat: body mass index - BMI, and the total thickness of three skinfolds - SF (mm) – under scapula, on the abdomen and above the triceps were calculated.

Due to the aim of the study and the method of data collection, the body composition was estimated on the basis of mathematical equations, predicting the contribution of individual tissues. The percentage of fat in the total body weight (% FAT) was calculated on the basis of mathematical equation describing the percentage of fat in total body weight.

Fat tissue mass FM (Fat Mass-kg), which is the amount of fat contained in the body in kilograms and fat-free mass FFM (Fat Free Mass - kg), was calculated by means of mathematical equation based on the estimated body fat percentage.

In order to assess the type of body fat distribution, the indicators of fat distribution based on the measurement of thickness of skinfolds and their sum, as well as indicators constructed on the basis of measurements of waist, hips, thighs circumference were used:
- TSS (Trunk Skinfolds Sum) - which is the sum of three skinfolds thickness of the body fat (mm): the shoulder, over the crest of the hip and abdomen (SSC + SIC + ABD), describing the level of central adiposity (body);
- ESS (Extremity Skinfolds Sum) - which is the sum of three skinfolds thickness of fat on the extremities (mm) above the bicep and tricep and calf (BIC + TRC + CLF) - describing the level of peripheral fat;
- TER (Trunk Extremity Ratio) - the ratio of the sum of three skin- fat folds thickness of the body (mm) TSS (Trunk Skinfolds Sum) to the sum of three skin-fat folds thickness of on the extremities (mm) EES (Extremity Skinfolds Sum). This indicator differentiates the type of fat distribution in the body. High values of this index describe the type of central fat tissue distribution;
- WHR - (Waist to Hip Ratio) is the ratio of waist circumference (cm) to hip circumference (cm). It allows for the assessment of the type of body fat distribution. Waist-to-hip ratio enables to make a classification of the type of fat distribution on androidal type, associated with the accumulation of body fat mainly in the abdominal area - including visceral tissue, or gynoidal type, resulting from the deposition of fat in the buttocks-hip area;
- Waist-to-thigh ratio - WTR (Waist to Thigh Ratio) - the ratio of waist-to-thigh;
- The rate of conicity of the body - CI (Conicity Index) - the ratio of waist circumference (m) to the and the product of an empirical index of 0.109 and root of weight (kg)/ body height (m).

Simultaneously to the studies, anthropometric surveys were conducted. The participation in the study was voluntary and the survey was anonymous (29 August Act of 1997 on Data Protection - Dz.U.1997, item 883). The questionnaire contained questions listed thematically into five groups of data: data on social and economic status, data on lifestyle and data concerning obesity among the closest family members. The data on lifestyle included questions about leisure activities including physical activity, diet, as well as the prevalence of stimulants such as nicotine and alcohol.

The aim of this thesis is to show the relationship of alcohol consumption with selected somatic features and indicators of obesity and fat distribution in the body.

The attitude of the respondents towards alcohol is described on the basis of the answers given to the questions in the questionnaire. The appropriate ranking points, given in brackets were assigned to the responses. Respondents were asked about the frequency of alcohol consumption: daily (0), regularly during the weekend (1), about three times per month (2), about once a month and less (3), occasionally in the year (4), and never (5) . The type of the most frequently used alcohol included: strong vodka (0), other rich in high percentage of alcohol (1), beer (2) cheap wine (3), high-quality wine (4), none (5).

The overall prevalence of alcohol consumption was specified by the sum of points allocated to particular categories of answers given to questions about the habit of drinking alcohol. Based on the percentile distribution of the total score, three categories were specified: up to the 25 percentile - a fraction of drinkers “often and in large quantities”, from 25 to 75 percentile “sometimes and in moderation”, while above 75 percentile of the total distribution of the scores, the category of “non-drinkers” was extracted.

The methods of results’ analysis: Tested in this work dependent variables comprise the somatic features and indicators describing the type of body fat and fat distribution, while the independent variables analyzed, comprise the elements describing the socio-economic status and lifestyle of male and female students of the Cracow’s universities.

A statistical study of the collected material was carried out in several stages (Sokal, Rohlf, 1995). At first, for each variable descriptive statistics were calculated. For the evaluation of central tendencies, mean and median were used. However, the dispersion was described by means of the standard deviation (SD). Moreover, the frequencies adopted by different categories were calculated.

In order to point to the effects of drinking alcohol at the level of selected biological characteristics, standardized differences between selected fractions of declared alcohol drinking such as “often and a lot”, “sometimes, and moderately”, “do not drink” were analyzed, which is illustrated in the form of morphological profiles for men and women

Quantitative variables were normalized according to the formula: $Xn_i = \frac{\overline{X} - X_i}{SD_x}$

Where: Xn_i – normalized value of the variable X for i-case, $\overline{X}$ - the average value of X to the cases which are the basis of the normalization SDx - the standard deviation of X calculated for cases which are the basis of the normalization.

The use of normalization facilitates the interpretation of the results, since after the normalization, the unit describing the variables is reduced to the SD base standardization. Thanks to this, we can combine with each other and collectively analyze characteristics acquiring very diverted values, as well as the measurements expressed in different units (e.g. mm and kg). Normalized values with a “positive” mark give evidence of greater value than the average of the base normalization, but with a “negative” mark of values below the average base standardization.

For variables, the distribution of which is significantly different from a Gaussian curve, a logarithmic transformation of data was performed in order to increase the data

fit to a normal distribution. In order to assess the compatibility of the distribution of variables with the normal distribution Shapiro-Wilk test was used.

In order to combine ordinal or nominal data, contingency tables and analysis of attendance: c^2 or G^2 (Likelihood ratio) were applied. Moreover, inductive statistics techniques were used to determine possible differences in the values of the features that exist between groups. In the case of quantitative variables, while comparing the two groups used t-Student's test was used. In the case of variables with distributions deviating from normal, analyzes were made on the transformed values (BM, SF, FM, FFM, ESS, TSS, TER, WC).

While performing any analysis, p = 0.05 was assumed as critical significance level.

All calculations were carried out separately for male and female sex. The results of the analyzes for the characteristics of the sample, are given in Table 2 and illustrated graphically in morphological profiles in the Figures, in groups divided into separate categories.

Description of test results

The material presented in this thesis refers to the results of the study performed on the sample group of students selected from a population in terms of the test sample material. The structure of the tested sample indicating the type of institution is illustrated in Figure 1. The population studied in this paper comprise a sociologically selected sample; of male and female students of a second year of full-time studies at the largest public universities in Cracow; homogeneous in terms of age (X=20,84; SD=2,02) and status.

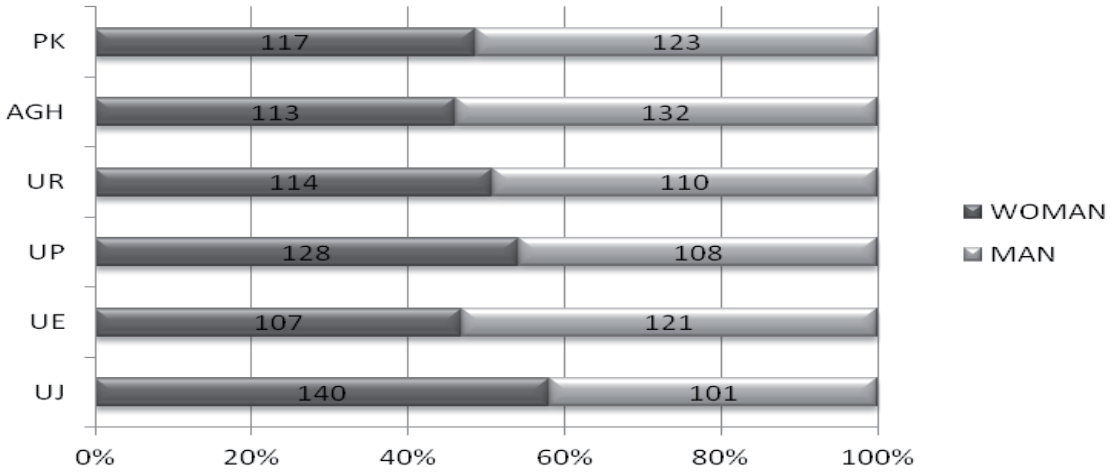


Fig. 1. The structure of the tested sample indicating the type of institution.

In the entire sample, women (N = 719) constitute 50.85% and men (N = 695) 49.15% (Fig. 1).

In terms of the prevalence of alcoholic stimulants in lifestyle, the tested sample chosen from the population of men and women studying in Cracow is diversified, which was examined by using c^2 test, specifying statistically significant level of differences between sexes (Table 1).

Tab. 1. Percentage distribution of declared alkohol consumption tested in the sample of male and female students.

	cathegory	Women N %	Men N %	p
Alkohol consumption	Often and a lot Sometimes and moderately Do not drink	14 1,95 517 71,90 188 26,15	48 6,91 561 80,72 86 12,37	F = 58,02 Df = 2, p= 0,0001

In the tested sample of young people dominated lifestyle (76.24%) in which alcohol consumption was moderate (71.90% of women and 80.72% of men). Nearly one in five students in the sample did not drink alcohol (19.38%), but four people in one hundred admitted that they drink alcohol frequently and in large amounts (4.38%). Thus, significantly greater number of women (26.15%) than men (12.37%) do not drink alcohol, however, two women in hundred (1.95%) and more than three times as many men (6.91%) report drinking alcohol often in large amounts (Table 1).

In order to point to the effects of drinking alcohol at the level of selected biological characteristics, standardized differences between selected fractions of declared alcohol drinking such as “often and a lot,” “sometimes, and moderately”, “do not drink” were analyzed, which is illustrated in the form of morphological profiles for men (Fig. 4,5) and women (Fig. 2,3). Besides, the numerical characteristics, are given in Table 2, in which also the significance of differences between groups was also estimated. First of all, it must be emphasized at the very beginning that the average size (X, Me), describing the men and women of different fractions does not exceed the limits of standards set for individual characteristics and indicators analyzed in this work (Pasiut 2012).

The influence of alcohol consumption on the size of the biological features analyzed in the test sample of Cracow’s male and female students reveals the opposite trends in terms of the direction of diversity and the level of the significance of differences among the sex groups.

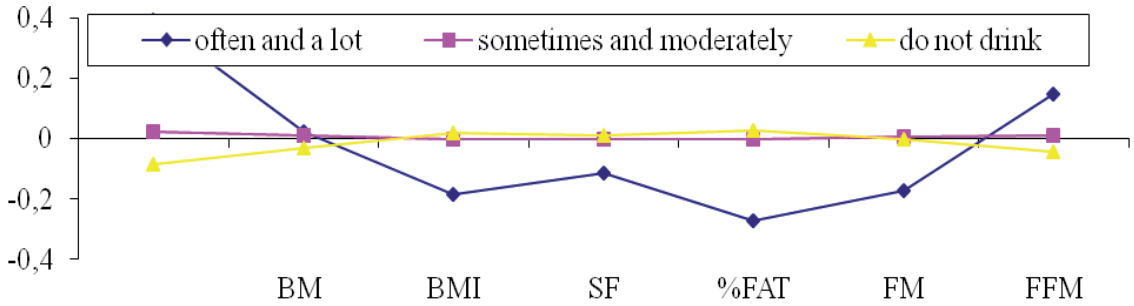


Fig. 2 Morphological profiles somatic traits and body composition in female of different categories of the declared alcohol consumption

Women who drink alcohol frequently and in large quantities, compared to female students in the group who do not drink alcohol or drink alcohol moderately, are significantly less fatty (Fig.2). However, these differences do not show statistical significance, as well as differences between groups of these indicators of fat distribution are not significant.

In the fraction of women who drink alcohol frequently and in large quantities the lowest average values of indicators of distribution (Fig.3) were noticed. The TER indicator is the exception as it has the greatest value in comparison with the remaining factions.

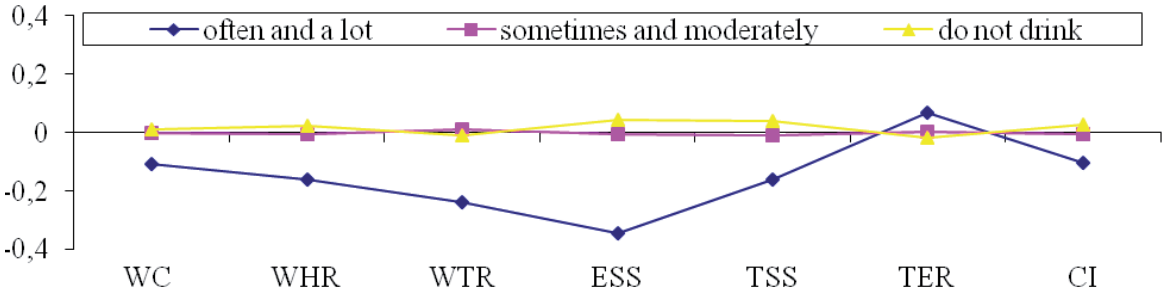


Fig.3 Morphological profiles of fat distribution indicators in female of different categories of the declared alcohol consumption

On the contrary, in the group of men, clear and statistically significant differences in the incidence of higher values of all the analyzed characteristics and indicators of obesity (Fig.4) appeared within the fraction that drink alcohol frequently and in large quantities. The sample of male students who declared abstention from alcohol is characterized by the lowest values of these indicators. The performed analyzes showed statistical significance of differences occurring between groups, within such features as the sum of three skinfolds (SF), the percentage of fat tissue in the total body weight (% FAT) and body fat mass in kilograms (FM).

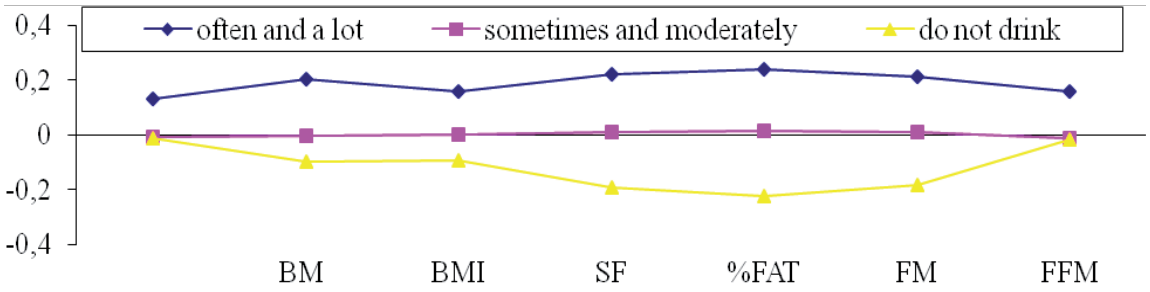


Fig. 4 Morphological profiles somatic traits and body composition in male of different categories of the declared alcohol consumption

Men drinking alcohol frequently and in large quantities, are also characterized by higher rates of fat distribution (Fig. 5), particularly in relation to the values occurring in people declaring abstention from alcohol. The statistical significance of the differences was shown in the case of indicators: waist-to-thigh (WTR), the total thickness of the skinfolds on the extremities (ESS) and the total thickness of the skinfolds on the trunk (TSS).

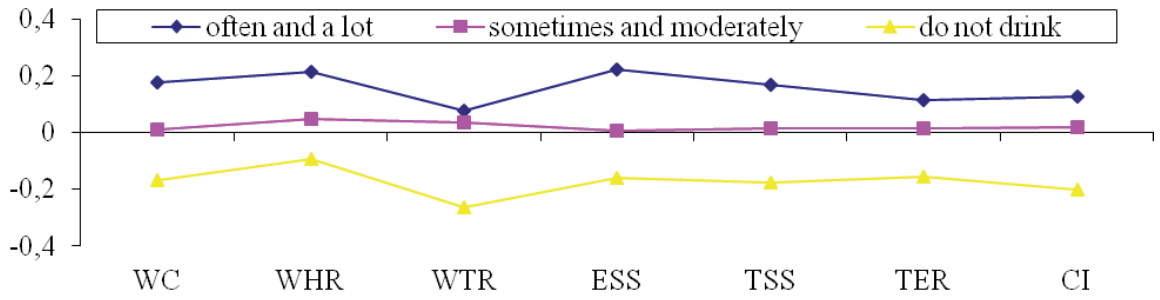


Fig. 5 Morphological profiles of fat distribution indicators in male of different categories of the declared alcohol consumption

To sum up, the analyzes indicate that alcohol consumption affects with the different strength of impact, both the level of obesity and fat distribution in the body system of studied women and men. Drinking alcohol often and in large quantities differentiates surveyed women and men in opposite directions.

Despite the fact that the differences among women are not statistically significant, average normalized differences in the analyzed indicators deviate towards the lowest values among drinking alcohol frequently and in large quantities, with the exception of TER, which in this group has the highest value.

In the group of men, the fraction of those drinking alcohol often in large quantities deviates towards the most significant values of indicators of both the level and type of fat distribution towards the center, with the lowest values of these characteristics in men declaring abstinence.

Discussion

Due to many clinical observations of correlation between obesity, especially of abdominal kind with metabolic dysfunctions and arteriosclerosis (Tatoń, Bernas, 2008), abdominal obesity is considered to be particularly dangerous because of the negative health effects. At the same time the consumption of alcohol has been recognized as factor contributing to the development of obesity, due to a positive correlation between alcohol consumption and higher values of the indicators in the central fat distribution (Suter et al. 1997, Lahti-Koski et al. 2002, Laitinen et al. 2004, Suter 2005, Luo et al. 2012).

Much information on the negative metabolic effects alcohol produces can be found in literature. Consumed alcohol causes an increase in the level of liver enzymes γ-glutamyl transferase (GGT) activity, which fosters hypoglycemia, severity of synthesis of fatty acids and triglycerides in adipocytes, which play significant role in the formation of obesity (Tatoń, 1996, Puukka et al. 2006) and thus, explain the increased risk alcohol-dependent increase of body fat. Oxidation of the ethyl alcohol is associated with disregulation of oxidation-reduction balance in hepatocytes. The induced by alcohol model of metabolism MEOS (microsomal ethanol oxidazing system) results in an increased amount of the reduced form of NAD-NADH, which fosters lipogenesis, which may occure shortly after consuming a small amounts of alcohol per day (Suter, 2000, Oneta et al. 2002, Suter, 2005). Alcohol displays suppressive effect with reference to the oxidation of lipids, which consequently leads to the deposition of non-oxidized fat in the abdominal fat tissue. Moreover, abusing

alcohol leads to dyslipidemia, increased insulin resistance and impaired glucose tolerance as well as to the endocrine changes. Alcohol stimulates adrenergic system to the release of hypothalamic hormone ACTH (Tatoń, 1996). Regular alcohol consumption increases the release of glucocorticoids and secretion of adrenocorticotropic hormone (ACTH). Alcohol-induced stimulation of glucocorticoid and the secretion of cortisol, accompany the central fat distribution (Suter, 2005).

The results of studies on the prevalence of the links between body fatness and alcohol use are not uniform. The information concerning the influence of alcohol in the direction of increased accumulation of fat tissue in the body stay in contrast with the observations of reduced body weight and body fat as well as with the incidence of malnutrition in patients who consume alcohol frequently in large quantities (Suter et al. 1992, Suter et al. 1997, Levine et al. 2000, Suter, 2000).

Also this study showed heterogeneous nature of the impact of alcohol consumption in the tested women and men, revealing contrasting trends of influence that affect the sexes. In the group of men, frequent use of alcohol in large quantities leads to significantly greater fatness and body fat distribution in the body in the direction of greater accumulation of fat in the abdominal region. However, the frequent and in large amounts consumption of alcohol in women is associated with the lowest indicators of body fat as well as lower values of fat distribution indicators. However, the result obtained in relation to TER, which is higher among women who drink alcohol often and in large amounts points to the tendency of higher accumulation of fat in their abdominal region, equally as it happens among men.

Literature, concerning associations of alcohol consumption with the occurrence of overweight and obesity suggests that conditions are multi-faceted and related to gender, age, eating habits, and other lifestyle elements.

The study revealed the influence of alcohol on the eating habits. The risk of weight gain resulting from the increase in appetite while consuming alcohol, must also be taken into consideration. It has been proven that the consumption of alcohol 30 minutes before a meal results in higher energy use, faster eating of meals, and choosing meals with a higher content of animal fat. However, co-occurrence of higher BMI with frequent alcohol and meat products consumption, were significant only for men (Suter, 2005, Carels et al. 2008).

The habit of simultaneous consumption of alcohol while eating meals promotes diet rich in fat, which at the same time correlates with a reduced feeling of satiety and eating larger food portions (Tremblay, St. Pierre, 1996, Doucet, Tremblay, 1997). It was also revealed that the simultaneous consumption of alcohol and meals promotes metabolization of carbohydrates working on the other hand suppressively against protein and fat (Suter et al .1992, Doucet, Tremblay, 1997, Suter, 2005).

However, other studies revealed the impact of physical activity, which plays an important role: within the group of people who were physically active during leisure time and drunk alcohol no significant overweight was reported (Tremblay, St. Pierre, 1996, Doucet, Tremblay 1997, Carels et al. 2008).

Thus, it can be assumed that the discrepancies between the results obtained in different studies may be caused by a different lifestyle of the respondents which allows to suppose that lifestyle factors in relation with alcohol consumption, modify fat metabolism.

Alcohol is a source of large amounts of energy, metabolically favored in relation to other energy substrates (Suter et al. 1992, Doucet, Tremblay 1997). One gram of alcohol comprise 7 calories of energy, of which 17% is absorbed by thermo genesis, while one gram of fat provides 9 calories and one gram of carbohydrates 4 calories (Suter, 2005). Thus, alcohol abuse can easily lead to excess of energy.

There is also much evidence indicating the presence of certain energy costs concerned with alcohol consumption. In the experiment (Levine et al. 2000), alcohol abusers had increased resting metabolic rate, which fell within a few days after stopping drinking, which according to the authors can be explained by the increase in BMI among these people.

As shown in our study, at risk of health damage due to excessive alcohol consumption is almost 7% of men and three times fewer women. Men and women in the test sample of students from Cracow, in terms of their lifestyle, differ in a statistically significant way in the consumption of alcohol. Women more often lead healthy lifestyles and do not drink alcohol. However, men were three times more likely than women to drink alcohol in large quantities. Among those included in the survey, one fourth of women and a half fewer men do not drink alcohol.

Summary and conclussions

Presented in this paper results constitute the basis for a health diagnosis of the respondents in terms of overweight and obesity, including abdominal type with reference to the declared alcohol consumption.

The consumption of alcohol has been identified as a significant risk factor for health deterioration especially with reference to men, resulting from the occurrence of greater fat occurrence, in particular abdominal.

In male subjects, frequent alcohol use in large quantities involves significantly more body fat and body fat distribution in the body in the direction of greater accumulation of fat in the abdominal region. However, the consumption of alcohol in women frequently and in large amounts is associated with the lowest indicators of body fat as well as lower values of fat distribution indicators. Moreover, the result obtained with reference to TER ratio which is greater in women drinkers often and much, shows the tendency among these women of greater accumulation of fat in the abdominal region, equally as it happens among men.

Heterogeneous nature of the impact of alcohol consumption, revealing contrasting trends in sex groups, probably stems from the differences in lifestyle, which comprise is different inter-correlation between various elements contained.

Particularly dangerous because of the negative health effects, is abdominal obesity which comprise a health risk in 2% of young women and nearly 7% of young men, as it correlates with frequent alcohol consumption and in large quantities.

Indicators of obesity and fat distribution indicators can be considered as a good lifestyle identifiers of the people tested for health risks associated with excessive alcohol consumption.

Tab. 2. Statistical characteristics of somatic traits male and female in fractions selected according to declared alcohol consumption (often and a lot, sometimes and moderately, not drinking).

somatic traits / alcohol		FEMALE			MALE		
		often N= 14	sometimes N = 517	not drinking N = 188	often N = 48	sometimes N= 561	not drinking N = 86
BM (kg)	X	58,08	57,97	57,64	75,26	73,12	72,13
	Me	58,90	57,00	56,20	73,30	71,60	72,00
	SD	5,787	8,387	7,847	11,238	10,478	9,568
	p	p = 0,891			p = 0,267		
BMI	X	20,70	21,18	21,23	23,27	22,82	22,55
	Me	21,26	20,82	21,14	22,98	22,40	21,63
	SD	1,798	2,643	2,519	3,158	2,815	2,849
	p	p = 0,758			p = 0,373		
SF (mm)	X	36,32	37,72	37,85	36,78	33,69	30,68
	Me	33,25	35,00	34,95	32,10	29,10	26,95
	SD	11,013	12,306	12,207	15,056	14,709	15,085
	p	p = 0,913			p = 0,010		
% FM	X	16,63	17,59	17,68	16,26	15,25	14,17
	Me	17,02	17,21	17,43	15,74	14,46	13,21
	SD	3,165	3,492	3,669	4,025	4,499	4,839
	P	p = 0,558			p = 0,028		
FM (kg)	X	9,79	10,40	10,39	12,49	11,48	10,52
	Me	9,86	9,89	9,65	12,07	10,23	9,41
	SD	2,669	3,500	3,301	4,526	4,927	5,053
	p	p = 0,860			p = 0,015		
FFM (kg)	X	48,29	47,56	47,26	62,77	61,63	61,61
	Me	48,56	47,18	46,65	61,09	61,09	62,26
	SD	3,610	5,415	5,212	8,035	6,760	6,227
	p	p = 0,633			p = 0,606		
WC (cm)	X	70,28	70,98	71,06	83,93	82,49	80,94
	Me	70,00	70,00	70,70	82,25	81,10	79,00
	SD	3,786	6,704	6,722	8,547	8,597	8,572
	p	p = 0,949			p = 0,107		
WHR	X	0,73	0,73	0,73	0,84	0,83	0,83
	Me	0,72	0,73	0,73	0,84	0,83	0,82
	SD	0,022	0,045	0,049	0,049	0,052	0,052
	p	p = 0,0784			p = 0,220		
WTR	X	1,23	1,25	1,25	1,44	1,44	1,41
	Me	1,24	1,25	1,25	1,43	1,43	1,38
	SD	0,068	0,080	0,093	0,091	0,089	0,090
	p	p = 0,651			p = 0,032		

CI	X	1,10	1,10	1,10	1,19	1,18	1,17
	Me	1,09	1,10	1,09	1,19	1,17	1,15
	SD	0,028	0,055	0,061	0,066	0,066	0,071
	p	p = 0,850			p = 0,102		
TSS	X	39,28	41,69	42,52	43,97	40,64	36,58
	Me	37,80	37,80	38,45	38,40	34,10	28,75
	SD	13,142	15,997	16,983	20,359	21,269	21,862
	p	p = 0,823			p = 0,019		
ESS	X	24,94	27,50	27,89	21,01	19,53	18,38
	Me	25,25	26,40	26,75	19,15	18,20	16,50
	SD	5,267	7,721	7,359	6,711	6,760	7,231
	p	p = 0,344			p = 0,026		
TER	X	1,55	1,53	1,52	2,11	2,05	1,94
	Me	1,52	1,45	1,42	1,84	1,89	1,83
	SD	0,270	0,415	0,418	0,853	0,624	0,570
	p	p = 0,509			p = 0,528		

Bibliography

1. Anderson P., Baumberg B. (2006) Alkohol w Europie: perspektywa zdrowia publicznego. Raport dla Komisji Europejskiej–Podsumowanie. Alkoholizm i Narkomania,19,Nr2, 121-137.
2. Carels R.A., Young K. M., Coit C., Clayton A.M., Spencer A., Wagner M. (2008) Skipping meals and alcohol consumption. The regulation of energy intake and expenditure among weight loss participants. Appetite 51, 538-545.
3. Doucet E., Tremblay A. (1997) Food intake, energy balance and body weight control. J Clin Nutr, 51, 846-855.
4. Gołąb S., Chrzanowska M. Red. (2007) Podręcznik do ćwiczeń z antropologii. Wyd.III poprawione i uzupełnione. Podręczniki i Skrypty Nr.2, AWF, Kraków.
5. Lahti-Koski M., Pietinen P., Heliovaara M., Vartiainen E. (2002) Associations of body mass index and obesity with physical activity, food choices, alcohol intake and smoking in the 1982-1997 FINRISK Studiem. Am J Clin Nutr, 75, 809-817.
6. Laitinen J., Pietilainen K., Wadsworth M., Sovio U., Jarvelin M.R. (2004) Predictors of abdominal obesity among 31-y-old men in Northern Finland in 1996. Eur J Clin Nutr, 58, 180-190.
7. Levine J.A., Harris M.M., Morgan M.Y. (2000) Energy Expenditure in chronic alcohol abuse. Eu J Clin Inves, 30, 779-786.
8. Luo W., Guo Z., Hao C., Yao X., Zhou Z., Wu M., Liu J. (2012) Interaction of current alcohol consumtion and abdominal obesity on hypertension risk, Physiol. Behav. http://dx.doi.org/10.1016/j.physbeh.2012.10.004 19.04.2013.
9. National Institute on Alcohol Abuse and Alcoholism (NIAAA) (2000) Healht Risks and Benefits of Alcohol Consumption. Alcohol Research &Health, Vol. 24, nr. 1, 5 - 11. http://pubs.niaa.nih.gov/publications/arh24-1/05-11.pdf 19.04.2013.

10. Oneta C.M., Lieber C.S., Li J., Ruttimann S., Schmid B., Lattmann J., Rosman A.S., Seitz H.K. (2002) Dynamics of cytochrome P4502E1 activity in man: induction by ethanol and disappearance during withdrawal phase. J Hepatol, 36, 47-52.
11. Pasiut U. (2012) Stan biologiczny studentów i studentek Akademii Wychowania Fizycznego na tle ogółu młodych osób dorosłych studiujących w największych państwowych uczelniach Krakowa. Antropomotoryka, Vol. 22, Nr. 60, 111-122.
12. Puukka K., Hietala J., Koivisto H., Anttila P., Bloigu R., Niemela O. (2006) Additive effects of moderate drinking and obesity on serum γ-glutamyl transferase activity. AM J CLIN NUTR, 83, 1351-1354.
13. Sokal RR., Rohlf FJ. (1995) Biometry: the principles and practice of statistics in biological research. 3rd ed. New York, W.H.Freeman.
14. Suter P.M., Schutz Y., Jequier E. (1992) The effect of ethanol on fat storage in healthy subjects. N Engl J Med, 326, 983-987.
15. Suter P.M., Maire R., Vetter W. (1997) Alcohol consumption: a risk factor for abdominal fat accumulation in men. Addict Biol, 2, 101-103.
16. Suter P.M. (2000) The paradox of the alcohol paradox-another step towards the resolution of the alcohol energy wastage controversy. Eur J Clin Invest, 30, 749-750.
17. Suter P.M. (2005) Is alcohol consumption a risk factor for weight gain and obesity. Crit Rev in Clin Lab Sci, 42, 197-227.
18. Tatoń J. (1996) Miażdżyca. Zapobieganie w praktyce lekarskiej. Wyd Lek PZWL, Warszawa.
19. Tatoń J., Bernas M. (2008) Zespół metaboliczny – kontrowersje wokół akademickiej debaty i realiów praktyki klinicznej. Endokryn, Otył i Zab Przem Mat, t.5, 1, 13-26.
20. Tremblay A., St.Pierre S. (1996) The hyperphagic effect of high-fat diet and alcohol intake persists after control for energy density. Am J Clin Nutr, 63, 479-482.

Number of signs with spaces: 40 051