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Assessment of anthropometric parameters of alcohol dependent inpatients – selected clinical characteristics

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Abstract – *Introduction*. The aim of the research was to assess the anthropometric parameters of alcohol-dependent inpatients. The analysis of the results also included the assessment of the relationship between selected clinical characteristics and the nutritional status of the examined patients.
Material and Methods. The examined group was composed of 50 alcohol-dependent men aged 27 to 69 undergoing alcohol dependence inpatient treatment. A social and demographic interview was carried out for the patients, their anthropometric measurements and blood samples were taken for laboratory tests.
Results. The anthropometric research demonstrated that 53.1% of the examined men had BMI scores above the norm (no BMI below proper values were found), and the WHR index (≥ 0.9) in over 90% patients exceeded the norm. The percentage content of fat tissue in 4.2% of the examined persons was below the norm and it exceeded the upper limit of the norm in 25% of the patients. No protein nutrition deficiencies were found in the examined group.
Conclusions. It was found that nutritional status indices in the examined alcohol-dependent inpatients did not show malnutrition and quite often exceeded the upper limits of normal values.

Key words: alcohol dependence, nutritional status, nutritional indices

INTRODUCTION

It is assumed that 15% of people in Poland abuse alcohol and 2% of the population is alcohol-dependent (1, 2). Health damage to persons abusing alcohol results not only from the direct effects of ethanol and its metabolite – acetaldehyde – on the human body, but also from the secondary effects of alcohol abuse, such as deficiency factors related to nutritional deficits or absorption disorders. Furthermore, the susceptibility to post-alcoholic problems is affected not only by genetic conditions but also other

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factors (e.g. health status and diet) related to the nutritional status (malnutrition, deficiency of vitamin $B_{1,}$ folic acid) (3, 4). As research shows, alcohol-dependent persons often do not consume appropriate energy and building compounds with their diet (5). In turn, alcohol disturbs the digestion processes (e.g. by blocking the secretion of pancreatic digestive enzymes) and also, by a pro-inflammatory effect on mucous membranes of the stomach and intestines, it impedes absorbance of nutrient compounds and disturbs metabolic transformations of nutritional compounds (proteins, micro- and macro-elements) and contributes to their deficiency (6, 7). According to Feinman, some alcohol-dependent persons derive as much as 50% of their daily energy requirements from consumed alcohol (7), but this energy is not fully used by the body (8). According to the aforementioned, the excessive intake of alcohol, its effect on digestion processes, as well as the quality of the diet affect the nutritional status of an individual. According to the research, the diet of alcohol-dependent persons is deficient, i.e. with low protein, fat, energy, vitamins and quantity value (9, 10). Malnutrition is usually not so often found in alcohol-abusing persons, but is rather more common in persons consuming large amounts of alcohol who suffer from health problems (11). The survey research carried out in France found that persons drinking alcohol consume food products with higher calorific value, higher fat content and a slightly higher amount of proteins than persons who do not drink alcohol (10).

Few studies have been conducted concerning the nutritional status of alcohol-dependent persons. The various opinions concerning the diets of those persons and growing intake of alcoholic beverages presenting a constant health risk prompt scientific research into the relationships between alcohol drinking and nutritional status.

The assessment of factors affecting the nutritional indices of alcohol-dependent subjects can have an effect on predicting some health problems and providing adequate treatment, nursing or dietary education in clinical practice thus preventing post-alcoholic complications. It seems that an alcoholism treatment programme that includes an assessment of nutritional parameters could help identify risk factors associated with somatic health problems depending on the nutritional status of people with alcohol dependence.

Aim of the research. The aim of the research was to assess the anthropometric parameters of alcohol-dependent inpatients under treatment for alcohol dependence syndrome. The analysis of the results also included an assessment of the relationships between selected clinical characteristics and the nutritional status of the examined subjects.

MATERIAL AND METHODS

The examined population. The examinations were carried out for 50 alcohol-dependent men aged 27–69 (on average 42.7 ± 10.2 years old) hospitalised in the Addiction Treatment Unit, Psychiatry Clinic of the University Hospital in Bydgoszcz

in 2008–2010. The diagnosis of alcohol dependence was conducted according to the criteria of the International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10) (12). Subjects reporting serious somatic diseases, such as diabetes, cirrhosis of the liver or neurological or mental disorders were excluded from the study. Additionally, the research also excluded persons addicted to psychoactive substances other than alcohol and nicotine, i.e. benzodiazepine, amphetamine and marijuana. The examined patients all received information concerning the subject of research, its purpose, course and method of participation. The research was carried out with the consent of the Bioethical Committee of Collegium Medicum in Bydgoszcz (decision number: KB 243/2008).

Methods. During their first week's stay at the hospital unit, patients qualified for the study were subject to psychometric tests with the authors' own survey, which included:

- a social and demographic interview (age, place of residence, marital status, education, source of income),
- a clinical interview (duration of alcohol dependence, amount of alcohol taken in within one month before the alcohol dependency treatment),
- and the SADD (Short Alcohol Dependence Data Questionnaire) used to assess the severity of addiction and produce a specific score for each person. The total score on the SADD scale amounting to 0 means there is no alcohol addiction, between 1 and 9 – gentle intensification of addiction, between 10 and 19 – moderate alcohol addiction, and between 20 and 45 – severe addiction (13, 14).

The amount of various types of alcohol was converted into the number of standard drinks (12–12.5 g of ethanol 100%) consumed by the examined men. It was assumed that 250 millilitres (ml) of light beer (5% alcohol) is an equivalent of one standard drink, the same with 100 ml of wine (12% alcohol), 30 ml of vodka (40% alcohol) (15), and 73.5 ml of sweet vermouth (with alcohol content assumed at the level of 17%). Daily alcohol consumption was assessed on the basis of the annual analysis of consumption of alcoholic drinks by an interview questionnaire of food consumption frequency (FFQ) (16) (every patient listed the amount of alcoholic beverage drunk in litres, on a daily, weekly, monthly or annual basis), the final score was converted into a standard drink.

The assessment of the nutritional status applied anthropometric methods (17, 18, 19) based on the following measurements: body height (cm), body weight (kg), arm, waist and hip circumferences (cm) and thickness of 4 skinfolds (mm): triceps skinfold thickness (TSF), biceps skinfold thickness (BSF), subscapular skinfold thickness (SCSF) and suprailiac skinfold thickness (SISF). The following values were calculated on the basis of the measurement performed: weight/height ratio (BMI, kg/m^2), waist/hip ratio (WHR), fat-free arm muscle circumference (AMC, cm), body fat mass (FM, kg), fat-free body mass (FFM, kg), and the percentage of body fat mass (%FM) (17, 18, 19).

The subjects were divided into subpopulations. First, groups of older and younger persons were identified. The second division of the examined population aimed at obtaining subpopulations addicted to alcohol for a longer and a shorter time. The

third division led to obtaining two subpopulations of persons taking in smaller and larger amounts of alcohol in an annual assessment (one year before the alcohol dependency treatment) as per one standard drink (10 g of 100% ethanol) per day. The fourth division took into consideration (according to the SADD score) a subpopulation moderately addicted to alcohol and a severely dependent on alcohol. The fifth subdivision into two subpopulations was made according to the activity of the liver enzyme, asparagine aminotransferase (AspAT), as a determinant of the liver function, where laboratory results for one subpopulation of the examined persons demonstrated the activity of the above enzyme within the norm and the other subpopulation had above the norm. The final analysis concerned the subpopulation of smoking and non-smoking men. The effects of the aforementioned variables on the nutritional status were analysed for the above-listed populations.

In order to determine the activity of liver enzymes in blood serum (asparagine aminotransferase – AspAT), the level of triglyceride, total protein, creatinine and glucose, blood samples were taken from the examined subjects in fasting status (in the first week of their hospitalisation) from the cubital vein to a dry test tube (native blood sample).

The obtained results were presented with calculation of the mean value (x) and the standard deviation (SD) for the analysed characteristics. For classified parameters, the percentage of persons included in a given class was determined. The characteristics were analysed using the Fisher's exect test (GraphPad Software (online)) and U Mann-Whitney test. The statistical analysis of the results was performed using the SPSS 20 computer application at a significance level of $p \leq 0.05$.

RESULTS

The examined population was characterised on the basis of general information concerning the subjects (table 1). The majority of the examined persons (about 80%) were urban residents. Married men made up the largest group (52%), every fifth examined person was a bachelor and every fourth a divorcee. Almost half (46%) of subjects had vocational education and 34% ended their education in secondary school. About 60% of the examined men worked for a living, almost 20% were on a pension or allowance and 18% were unemployed.

An assessment of clinical variables of alcohol dependence was taken into consideration at a subsequent stage of result analysis. As seen in table 2, the duration of addiction averages 12.6 years, the average result concerning the number of days of drinking in the four last weeks is more than 12 and the mean value of the SADD scale score is over 19 points. The average number of standard drinks consumed before the current hospitalisation in an alcohol dependency treatment unit was more than 9.6 per day in the last year. The average result of activity of asparagine aminotransferase (AspAT) in serum obtained from blood of the examined persons was 43.16 U/l. Mean triglyceride levels laboratory results (almost 145 mg/dl) and total protein (more

Table 1
Social and demographical characteristics of the examined men (n = 50)

Variable		x ± SD or quantity (%)
Age (years – mean, SD, range)		42.7 ± 10.2 (27–69)
Place of residence	Rural	11 (22%)
	Urban	39 (78%)
Marital status	Married	26 (52%)
	Divorced	13 (26%)
	Widower	1 (2%)
	Bachelor	10 (20%)
Education	Primary	2 (4%)
	Vocational	23 (46%)
	Secondary	17 (34%)
	Higher	8 (16%)
Source of maintenance	Unemployed	10 (20%)
	Work	29 (58%)
	Pension/allowance	9 (18%)
	Family members	2 (4%)

Table 2
Clinical variables of the examined men (n = 48–50)

Variables	x ± SD (range or quantity)
Addiction time	12.62 ± 9.21 (2–40 years)
Number of standard drinks (12–12.5 g of 100% ethanol) per day in the annual assessment	9.64 ± 6.45 (0.79–32.72)
SADD	19.09 ± 6.53 (2–40 points)
AspAT (as liver damage marker) (laboratory norm 4–34 U/l)	43.16 ± 47.55 (14–308 U/l)
Triglycerides (norm < 150 mg/dl)	144.91 ± 91.76 (52–617 mg/dl)
Total protein (norm 6.0–8.0 g/dl)	7.16 ± 0.60 (6–9 g/dl)
Glucose (norm 70–105 mg/dl)	93.65 ± 0.86 (70–135 mg/dl)
	Number of persons (%)
Severity of alcohol addiction (SADD score) Gentle addiction Moderate addiction Severe addiction	 4 (8.3%) 21 (43.8%) 23 (47.9%)
Non-smokers Smokers	17 (35.4%) 31 (64.6%)

than 7 g/dl) in plasma were not different from the norm. Almost half of the subjects were severely alcohol-dependent and more than 64% smoked.

The mean values of fat percentage in the body, weight/height ratio and waist circumference indicate the appropriate nutritional status of most of the examined men (table 3). In turn, the average values of fat-free arm muscle circumference and waist/hip ratio significantly exceeded the norm in most of the examined subjects. The frequencies of the occurrence of indicator values were as follows:

Table 3
Somatic parameters of the examined men

Variables	n = 48–50	
	(x±SD) (range)	Number of persons (%)
Body height (cm)	176.27 ± 6.65 (162–188.5)	–
Body weight (kg)	79.05 ± 13.58 (59.50–120)	–
Arm circumference (cm)	28.50 ± 2.71 (24–36)	–
Waist circumference (cm)	92.25 ± 10.94 (73–122.5)	Norm 41(82%) Above the norm 9 (18%)
Hip circumference (cm)	97.74 ± 6.24 (89–114.5)	–
Triceps skinfold thickness (TSF) (mm)	8.9 ± 3.29 (4.1–21.3)	–
Biceps skinfold thickness (BSF) (mm)	5.88 ± 4.44 (2.3–28.5)	–
Subscapular skinfold thickness (SCSF) (mm)	14.5 ± 6.62 (5.6–34.6)	–
Suprailiac skinfold thickness (SISF) (mm)	12.35 ± 6.32 (4.6–28.3)	–
BMI (kg/m^2)	25.46 ± 4.23 (19.2–36.4)	Norm 23 (46.9%) Overweight 18 (36.8%) 1st degree obesity 6 (12.2%) 2nd degree obesity 2 (4.1%)
Waist/hip ratio (WHR) (values: limit 0.9; > 0.9 above the norm)	0.94 ± 0.73 (0.79–1.1)	Norm 5 (10.2%) Limit values and above the norm 44 (89.8%)
Fat mass content (%FM)	20 ± 5.21 (11.6–32.6)	Below the norm 2 (4.2%) Norm 34 (70.8%) Above the norm 12 (25%)
Body fat mass (FM) (kg)	16.27 ± 6.66	–
Fat-free body mass (FFM) (kg)	62.77 ± 8.33	–
Fat-free arm muscle circumference (AMC) (cm)	25.71 ± 2.41 (21.2–32.30)	Within the norm 7 (14.3%) Above the norm 42 (85.7%)

- Twenty five percent of the examined group had a fat tissue content higher than the norm.
- In two persons a too low content of fat tissue was found.
- Fat-free arm muscle circumference as a protein nutrition indicator was found in almost 86% of men above the norm.
- Almost 47% of the examined persons had a body mass within the norm according to the body mass index (BMI), while the others, 36%, showed characteristics of being overweight, first degree obesity – 12% and second degree obesity – 4%.
- The waist/hip ratio (WHR) exceeded the norm in almost 90% of the examined, which in 82% cases were characterised by a normal waist measurement.

Afterwards, an analysis of the nutritional status examinations took smoking or non-smoking into consideration. The results of selected parameters are as follows for the group of smokers and non-smokers: BMI, WHR and %FM. As table 4 shows, a higher percentage of above-norm BMI persons was found for non-smokers, and persons with normal BMI were a majority in the group of smokers. Among smokers, 83% of persons were characterised by features of android obesity, whereas in non-

Table 4
Smoking cigarettes and selected somatic parameters of the examined men (Fisher's exact test)

Variables		Non-smokers n=17 Number of persons (%)	Smokers n=31 Number of persons (%)	P
BMI	Norm	4 (23.5%)	19 (61.3%)	0.016
	Above the norm	13 (76.5%)	12 (38.7%)	
WHR	Norm	0 (0.0%)	5 (16.1%)	0.145
	Above the norm	17 (100%)	26 (83.9%)	
%FM	Below the norm	0 (0.0%)	2 (6.5%)	0.018
	Norm	9 (52.9%)	25 (80.6%)	
	Above the norm	8 (47.1%)	4 (12.9%)	

BMI – Body Mass Index, WHR – Waist/hip ratio, %FM – Fat mass content

smokers, this form of obesity was found for 100% of the examined persons. It was found that the share of persons with high values of body fat mass percentage was higher in the group of non-smokers than in the group of smokers.

In the next step, somatic parameters were evaluated in individual subgroups of the examined persons, who were divided according to selected variables: age and clinical variables (tables 5–9).

As table 5 demonstrates, the values of selected somatic parameters in older persons addicted to alcohol are higher than in the group of younger persons, except for

Table 5
Age and somatic parameters of the examined men (U Mann-Whitney test)

Variables	Patients aged ≤ 42 (x ± SD) n = 26	Patients aged > 42 (x ± SD) n = 23	P
Body height (cm)	177.38 ± 5.66	174.68 ± 7.68	0.199
Body weight (kg)	77.88 ± 12.90	80.23 ± 14.82	0.495
Arm circumference (cm)	28.30 ± 2.64	28.69 ± 2.87	0.688
Waist circumference (cm)	89.57 ± 10.94	95.5 ± 10.48	**0.050**
Hip circumference (cm)	96.81 ± 6.14	98.65 ± 6.45	0.249
TSF (mm)	8.77 ± 2.80	9.03 ± 3.90	0.896
BSF (mm)	6.03 ± 5.55	5.73 ± 2.96	0.186
SCSF (mm)	14.65 ± 8.13	14.48 ± 4.68	0.258
SISF (mm)	11.93 ± 6.86	12.95 ± 5.86	0.270
FM (kg)	14.59 ± 6.20	18.25 ± 6.93	**0.046**
FFM (kg)	63.29 ± 8.02	61.98 ± 8.95	0.679
%FM	18.20 ± 5.08	22.14 ± 4.75	**0.017**
BMI	24.81 ± 4.23	26.24 ± 4.29	0.189
AMC (cm)	25.54 ± 2.47	25.86 ± 2.44	0.652
WHR	0.92 ± 0.69	0.97 ± 0.71	**0.045**

TSF – Triceps skinfold thickness, **BSF** – Biceps skinfold thickness, **SCSF** – Subscapular skinfold thickness, **SISF** – Suprailiac skinfold thickness, **FM** – Body fat mass, **FFM** – Fat-free body mass, **%FM** – Fat mass content, **BMI** – Body Mass Index, **AMC** – Fat-free arm muscle circumference, **WHR** – Waist/hip ratio

Table 6
Duration of alcohol addiction and somatic parameters of the examined men (U Mann-Whitney test)

Variables	Addiction time ≤ 10 years (x ± SD) n = 24	Addiction time > 10 years (x ± SD) n = 23	P
Body height (cm)	177.63 ± 6.83	175.15 ± 6.21	0.165
Body weight (kg)	77.53 ± 12.90	80.62 ± 14.53	0.368
Arm circumference (cm)	27.88 ± 2.54	29.14 ± 2.84	0.088
Waist circumference (cm)	89.33 ± 10.82	95.43 ± 10.97	**0.041**
Hip circumference (cm)	96.26 ± 6.11	99.15 ± 6.38	0.057
TSF (mm)	8.32 ± 2.18	9.68 ± 4.21	0.418
BSF (mm)	4.44 ± 1.87	7.58 ± 5.88	**0.022**
SCSF (mm)	13.18 ± 5.98	16.11 ± 7.41	0.213
SISF (mm)	11.39 ± 5.42	13.82 ± 7.27	0.302
FM (kg)	14.01 ± 5.68	18.67 ± 7.24	**0.021**
FFM (kg)	63.52 ± 8.22	61.94 ± 8.31	0.652
%FM	17.59 ± 4.46	22.48 ± 5.18	**0.002**
BMI	24.66 ± 4.42	26.23 ± 4.19	0.095
AMC (cm)	25.27 ± 2.47	26.10 ± 2.38	0.154
WHR	0.92 ± 0.71	0.97 ± 0.71	**0.035**

Abbreviations: see table 5

Table 7
Number of standard drinks (12–12.5 g of 100% ethanol) consumed per day and somatic parameters of the examined men (U Mann-Whitney test)

Variables	Daily intake of pure alcohol < 8.67 standard drinks (x ± SD) n = 23	Daily intake of pure alcohol ≥ 8.67 standard drinks (x ± SD) n = 25	P
Body height (cm)	175.06 ± 6.79	176.9 ± 6.75	0.326
Body weight (kg)	77.48 ± 13.04	80.00 ± 14.64	0.639
Arm circumference (cm)	28.18 ± 2.48	28.78 ± 3.01	0.542
Waist circumference (cm)	92.15 ± 10.47	92.22 ± 11.82	0.959
Hip circumference (cm)	97.02 ± 6.10	98.19 ± 6.64	0.606
TSF (mm)	8.57 ± 3.69	9.34 ± 2.97	0.200
BSF (mm)	5.21 ± 3.20	6.58 ± 5.45	0.421
SCSF (mm)	13.47 ± 5.19	15.48 ± 7.88	0.613
SISF (mm)	11.95 ± 6.22	12.80 ± 6.73	0.804
FM (kg)	15.73 ± 6.90	16.61 ± 6.81	0.587
FFM (kg)	61.75 ± 7.17	63.38 ± 9.56	0.601
%FM	19.65 ± 5.12	20.20 ± 5.56	0.543
BMI	25.31 ± 4.23	25.58 ± 4.49	0.915
AMC (cm)	25.49 ± 1.63	25.85 ± 3.05	0.780
WHR	0.95 ± 0.06	0.94 ± 0.07	0.767

Abbreviations: see table 5

Table 8
Severity of alcohol dependence and somatic parameters of the examined men (U Mann-Whitney test)

Variables	Moderately dependent patients (SADD score = 10–19) (x ± SD) n = 20	Severely dependent patients (SADD score = 20–45) (x ± SD) n = 23	P
Body height (cm)	176.62 ± 7.35	175.45 ± 5.85	0.512
Body weight (kg)	77.16 ± 13.90	83.14 ± 13.48	0.115
Arm circumference (cm)	28.24 ± 2.98	29.16 ± 2.50	0.099
Waist circumference (cm)	91.42 ± 11.83	95.58 ± 10.28	0.131
Hip circumference (cm)	97.17 ± 6.52	99.23 ± 6.29	0.233
TSF (mm)	7.75 ± 3.63	10.08 ± 2.98	**0.006**
BSF (mm)	4.73 ± 2.67	7.44 ± 5.71	0.061
SCSF (mm)	12.29 ± 4.69	17.57 ± 7.70	**0.013**
SISF (mm)	10.59 ± 5.41	14.84 ± 6.93	**0.043**
FM (kg)	15.43 ± 7.15	18.22 ± 6.46	0.080
FFM (kg)	61.73 ± 7.84	64.91 ± 8.98	0.230
%FM	19.3 ± 5.27	21.49 ± 5.33	0.195
BMI	24.76 ± 4.38	27.01 ± 4.11	0.061
AMC (cm)	25.81 ± 2.28	25.98 ± 2.57	0.407
WHR	0.94 ± 0.81	0.96 ± 0.61	0.420

Abbreviations: see table 5

Table 9
Activity of asparagine aminotransferase (AspAT) as a measure of liver functions and somatic parameters of the examined men (U Mann-Whitney test)

Variables	AspAT (within the norm 4–34 U/l) (x ± SD) n = 27	AspAT (above 34 U/l) (x ± SD) n = 17	P
Body height (cm)	175.15 ± 7.67	178.00 ± 4.84	0.145
Body weight (kg)	75.13 ± 9.94	85.99 ± 16.34	**0.014**
Arm circumference (cm)	28.32 ± 2.30	29.05 ± 3.29	0.514
Waist circumference (cm)	89.00 ± 9.42	98.44 ± 11.68	**0.008**
Hip circumference (cm)	95.92 ± 5.12	100.47 ± 7.33	**0.035**
TSF (mm)	8.69 ± 2.90	9.35 ± 4.19	0.923
BSF (mm)	6.0 ± 5.27	6.06 ± 3.61	0.682
SCSF (mm)	13.63 ± 5.86	17.16 ± 7.93	0.177
SISF (mm)	11.31 ± 5.54	15.46 ± 7.09	**0.058**
FM (kg)	14.65 ± 5.28	19.51 ± 8.04	**0.038**
FFM (kg)	60.48 ± 6.67	66.47 ± 9.50	0.062
%FM	19.16 ± 5.11	21.95 ± 5.37	0.146
BMI	24.58 ± 3.64	27.12 ± 4.93	0.074
AMC (cm)	25.50 ± 2.22	26.12 ± 2.76	0.462
WHR	0.93 ± 0.74	0.98 ± 0.62	**0.023**

Abbreviations: see table 5

biceps skinfold thickness (BSF) and subscapular skinfold thickness (SCSF) and fat-free body mass (FFM), but a statistically significant difference concerns the percentage of body fat mass (%FM), body fat mass (FM), waist circumference and waist/hip ratio (WHR).

The analysis in table 6 concerned the assessment of selected somatic parameters in the subgroup of subjects with various length of alcohol dependence. After analysing the results presented in table 6, it was found that persons addicted to alcohol for more than 10 years were characterised by higher values describing the nutritional status and higher results of anthropometric measurements. Subjects addicted to alcohol for longer had a statistically significantly higher content of fat tissue, reached a higher waist/hip ratio (WHR), biceps skinfold thickness (BSF), waist and hip circumference and had higher fat mass in the body (FM, %FM) than persons with a shorter addiction time.

Afterwards, the values of selected somatic values were analysed in the subgroups of persons consuming less alcohol per day and of persons consuming more ethanol. As table 7 shows, there are no statistically significant differences between the values of selected somatic parameters between the population consuming less alcohol monthly, and the subpopulation drinking more. In spite of this, higher anthropometric and nutritional parameters were demonstrated in the subpopulation of subjects who drank more.

In the next step, the nutritional status was assessed in subpopulations of subjects moderately and severely addicted to alcohol (table 8). In the analyses conducted, statistically significant differences were observed: the values of triceps skinfold thickness (TSF), subscapular skinfold thickness (SCSF) and suprailiac skinfold thickness (SISF), while there was a lack of statistical differences in other parameters of the nutritional status assessment, such as body weight, arm, waist and hip circumference, biceps skinfold thickness (BSF, FM, FFM, %FM, BMI, AMC, WHR) between moderately and severely alcohol-dependent persons.

The nutritional status was then assessed for subjects with normal AspAT activity and subjects in whom the activity of this enzyme was higher than the norm. The values of the somatic parameters presented in table 9 were higher in subjects with higher AspAT activity, in which only the following indicators: body mass, waist and hip circumferences, suprailiac skinfold thickness (SISF), waist/hip ration (WHR) and fat mass in the body (FM) assumed statistically significantly higher values than in persons with normal AspAT result.

DISCUSSION OF RESULTS

The subjects in this study (mean age of 42) were similar in terms of social and demographical features to the population of alcohol-dependent inpatients in other studies. However, in terms of clinical characteristics of alcohol dependence, the examined group demonstrated slight differences in the results obtained (20). The

majority of persons in the examined group were urban residents, were married, had a vocational education level and had a job. The mean time of alcohol addiction was slightly above 12 years, the average daily alcohol intake before hospitalisation was 9.6 standard drinks, the majority of the examined persons were severely alcohol-dependent (the average score in the SADD scale was 19 points) and 65% of them smoked. In other studies, in which the group of the examined subjects included persons with alcohol-dependence syndrome undergoing institutional alcohol-dependency treatment, the demographical and clinical characteristics of alcohol addiction were approximate, i.e. the age of the examined was slightly lower (40.8 years), the average number of days of drinking in the month preceding the hospitalisation was 17, the average daily number of standard drinks before the treatment was much lower at 8.5, and the addiction time was longer than in the case of subjects examined in this study, amounting to more than 17 years (20, 21). The average SADD scale score was also higher, i.e. 25 points (20, 21).

The activity of liver enzyme AspAT in the blood serum of the examined persons reached an average result of 45 U/l, which proves the impaired function of the liver. Other studies found, for a similar population, a lower mean result of the AspAT activity, amounting to 31.6 U/l (21).

It should be noted that the anthropometric methods used to evaluate nutritional status might have some limitations in people with alcohol dependence (2). The motivation for the selection of these methods was their availability, ease of use and common use by other researchers in studies of different populations in the assessment of nutritional status of persons abusing alcohol. In further studies, it would be worthwhile to increase the sample of examination subjects, and despite anthropometric factor norms, add a control group to the results for the sake of comparison.

For the purposes of this project, clinical characteristics of younger and older alcohol-dependent subjects were also compared in order to identify non-clinical factors affecting nutritional indicators. On the basis of the above comparisons, it was found that the older subjects were longer dependent on alcohol to a statistically significant extent, while their daily alcohol consumption was lower and smoking less frequent. Another characteristic was less severe alcohol dependence than in the younger group of examined persons.

Despite the existing belief about the malnutrition of people abusing alcohol, the persons examined with anthropometric methods achieved a high average result of body mass index (BMI) (25.46) and being overweight and obesity were found for the majority of subjects (53%). In 25% of the examined persons the fat tissue content exceeded the upper limit of the norm. The protein-calorific nutrition determined by arm circumference (AMC) in 87% was also above the norm. The indicator determined by the waist/hip circumference ratio (WHR) correlating with the occurrence of cardiological diseases exceeded the norm in almost 90% subjects. It should be noted that the study included WHR values equal to (limit) and higher (pathological) than 0.9 (22), hence the proportion of men with a predisposition to abdominal obesity being so high. Waist circumference, which is a determinant

of abdominal obesity, exceeded the desired values (below 102 cm) in 18% of the examined men. As demonstrated by research results conducted in 2005, alcohol-dependent subjects treated in hospital are characterised by a BMI mean of 24.9 (a value within the norm) and a WHR index of 0.97 (values above the norm, as in the present study) (21). The works of other researchers show different nutritional status results for people with alcoholism to the ones presented in this study. The most frequent conclusion is that alcohol abuse can lead to malnutrition (23). The Polish study from 2010 conducted on a group of Alcoholics Anonymous reveals more than 27% of the subjects being definitely underweight, nearly 42% of normal weight and 31% overweight and obese (the assessment of nutritional status was based on BMI results) (24). The differences in the nutritional status of the two populations of men addicted to alcohol found in the present study may be due to the fact that it is people who observe dietary problems in themselves or have an excessive weight who apply to participate in the study.

An assessment of the nutritional status of the Polish population in 2003 to 2005 (project WOBASZ), showed that slightly above 40% of the studied men were overweight and over 21% had obesity (25). This means that being overweight (almost 37%) and obesity (more than 16% of men) was slightly less frequent in the studied population of inpatients undergoing alcohol dependence treatment than in the general population.

Portuguese studies in a group of patients (men and women) from a detoxification unit showed that 53% of the subjects were at risk of malnutrition, despite the fact that as many as 88% of patients had correct BMI (26).

Exceeding the upper values of indicators could be a result of the improper dietary patterns of alcohol abusers, namely, dietary restrictions occurring during drinking binges, followed by periods of gorging and consuming of high-calorie food products after stopping drinking. At the same time, this type of behaviour (periods of fasting, undernourishment and gorging) can result in the so-called *yo-yo* effect, and therefore an increase in body weight and specifically, the accumulation of energy reserves (27). According to French researchers, persons who consume alcohol eat more calorific products with a higher content of fat and protein compared to teetotalers (10). Kokavec sees the relationship between various aspects of alcohol use (e.g., frequency, amount and type of alcohol consumed, such as red and white wine, beer), and metabolic processes (secretion of cortisol, a function of hypothalamic-pituitary-adrenal axis – HPA, insulin and hypoglycemia), which may have an impact on nutrition (such as hunger and its severity) (28).

However, Japanese studies conducted on a group of more than 460 alcohol-dependent men demonstrated that malnutrition is more common in people with health disorders secondary to addiction, such as aero-digestive tract cancer, serious metabolic disorders or Wernicke's encephalopathy (29). In the same study, it was observed that more than a half of the alcohol-dependent subjects consumed three meals a day and over 32% of the subjects two meals (these consisted mainly of pro-

teins and carbohydrates). The frequency of alcohol consumption correlated inversely with the frequency of meals and drinking milk (29). According to the authors, malnutrition was diagnosed in more than 19% of the subjects and more than 11% had BMI equal to/greater than 25 (29). Japanese researchers have also confirmed that smoking is significantly associated with a decrease in nutritional parameters such as BMI (29), which has been confirmed by the presented study (38% of smoking men had a BMI higher than normal, and among non-smokers over 78%). In this study a group of smokers was only about 64% of all subjects, which is significantly lower than that cited by other researchers (30).

The percentage content of fat tissue was significantly higher statistically in older persons, for whom the values of nutrition indices, such as WHR index ($p = 0.045$), waist circumference ($p = 0.05$), body fat mass FM ($p = 0.046$) and fat mass content %FM ($p = 0.017$), were also higher, but preserving the trend towards significance in comparison with younger persons. It is supposed that in patients with alcoholism, irrespective of factors such as the frequency or amount of alcohol consumption, fat tissue accumulates in the body with age, just as in the population of non-alcoholics (31).

Persons with a longer period of alcohol addiction were characterised by a higher content of fat mass %FM ($p = 0.002$) and a higher WHR index ($p = 0.035$), waist circumference ($p=0.041$), biceps skinfold thickness BSF ($p = 0.022$) and body fat mass FM ($p = 0.021$) than persons addicted for a shorter time. As shown in this study, patients with longer alcohol dependence are elderly people, in whom fat tissue increased with age (31).

The main determinants of nutrition status (BMI, FM, FFM, %FM, WHR, AMC, body mass, waist circumference) were higher in subjects severely addicted compared to moderately addicted persons, and in subjects who consumed larger, rather than smaller, amounts of alcohol although these differences were not statistically significant. Of the group of main indicators of nutrition, only BMI difference was close to statistical significance. Individuals who drink larger amounts of alcohol per day had a higher BMI (above normal, i.e. 27) than those who drank less alcohol (BMI in these patients was normal, i.e. 24). On the other hand, a statistically significant difference was revealed between triceps skinfold subcutaneous tissue thickness (TSF) ($p = 0.006$), subscapular skinfold thickness (SCSF) ($p = 0.013$) and suprailiac skinfold thickness (SISF) ($p = 0.043$) in subjects who drank less rather than more standard drinks per day. These results suggest that people who drink larger amounts of alcohol (higher caloric intake, deeper states of hypoglycemia leading to overeating) may have a tendency to gain weight by accumulation of fat tissue under the skin surrounding the shoulder blades and muscles and the hips. Perhaps the people who consumed higher amounts of alcohol maintained longer abstinence (e.g. due to detoxification or health problems) prior to the hospitalisation during which the study was conducted. It was demonstrated that, in the period of abstinence, supplementation of nutritional deficiencies in the body may occur (32). In the subject literature, the results of the 2008 study showed a connection between alcohol consumption and obesity (an

increase of ghrelin hormone levels correlates positively with alcohol consumption and weight gain) (33, 34).

A statistically higher body mass ($p = 0.017$), higher values of WHR index ($p = 0.023$), body fat mass FM ($p = 0.038$), waist ($p = 0.035$) and hip ($p = 0.008$) circumference and higher percentage content of fat-tissue (without statistical significance) and higher BMI ($p = 0.074$) (without statistical significance) were found in subjects with a higher activity of asparagine aminotransferase compared to persons with normal results of AspAT. According to the literature, an increased activity of asparagine aminotransferase is related to higher BMI values (21). Taiwanese research suggests that such nutritional parameters as BMI and waist circumference may be an indicator of impairment of liver enzymes AST and ALT activity (35, 36). Moreover, McClain et al. suggest that for a better assessment of nutritional status in liver diseases, laboratory analysis of proteins (visceral proteins) such as albumin, prealbumin, and retinol binding protein was used in addition to anthropometric measurements (37). Thus, it would be worth including such analyses in future study.

In caring for a subject with alcohol dependence syndrome, another important step after assessing nutritional status using laboratory parameters (e.g. cholesterol level or liver enzyme activity), would be to determine total energy expenditure (including physical activity) and to establish the subjects' energy, protein, calorie and fat requirements, which should be used to introduce a balanced diet to support the therapy.

As mentioned above, older persons addicted to alcohol had a higher fat tissue content, WHR and BMI indices and waist circumference.

The above research results encourage further studies into the nutritional status of the alcohol-dependent, taking into consideration such factors as: age, length of dependence, laboratory tests and the smoking status of subjects. This seems particularly important since current knowledge indicates that alcohol dependence syndrome coexists with nicotinism and disturbances of carbohydrate and fat balance as well as the liver functions (38, 39).

This study has shown that in dependence treatment, nutritional status, nutrition education and prevention of many diseases in older patients (over 42 years of age) should be paid special attention, with long and deep addiction to alcohol and laboratory-confirmed higher AspAT activity due to the risk of complications associated with excess body weight and body fat accumulation occurring in these patients.

CONCLUSIONS

1. It was found that nutritional status indices in the examined alcohol-dependent men were within the norm and quite often exceeded the upper limits of normal values, while fat tissue content below the norm was found only in 2 examined subjects.
2. The main indicators of the nutritional status, such as FM, %FM, WHR and waist circumference were higher in older than younger men addicted to alcohol.

3. FM, %FM, WHR, waist circumference, biceps skinfold thickness (BSF) showed statistically significant values higher in persons addicted to alcohol for longer, while other results of nutritional parameters were not statistically significantly different in those groups of subjects.
4. Body mass, waist and hip circumference, FM, WHR or skinfold thickness (SISF) were statistically significantly higher in persons with high activity of asparagine aminotransferase than in persons with normal values of this enzyme.
5. The accumulation of fat around the shoulder (SCSF), hips (SISF) and muscle triceps (TSF) was significantly higher in patients severely rather than moderately addicted to alcohol.

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