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NUTRITIONAL STATUS AND NUTRITION QUALITY IN PATIENTS WITH NON-ALCOHOLIC FATTY LIVER DISEASE

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SUMMARY – Non-alcoholic fatty liver disease (NAFLD) is becoming a major health burden with increasing prevalence worldwide due to its close association with the epidemic of obesity. Currently there is no standardized pharmacological treatment, and the only proven effective therapeutic strategy is lifestyle modification, therefore it is important to determine the potential dietary targets for the prevention and treatment of NAFLD. We assessed nutritional status in 30 patients diagnosed with NAFLD using anthropometric parameters, hand grip strength, and lifestyle and dietetic parameters (physical activity, NRS2002 form and three-day food diary). The mean body mass index was 29.62±4.61 kg/m^2, yielding 86.67% of obese or overweight patients. Physical activity results indicated poorly active subjects. Excessive energy intake was recorded in 27.78% of patients. The mean intake of macronutrients was as follows: 15.5% of proteins, 42.3% of carbohydrates and 42.2% of fat, with deficient micronutrient intake of calcium, magnesium, iron, zinc, and vitamins A, B1 and B2. The results showed that the quality of nutrition in study subjects was not accordant to current recommendations and that they consumed a high proportion of fat, especially saturated fatty acids, along with low micronutrient intake. The results obtained might point to the importance of unbalanced diet as a contributing factor in NAFLD development.

Key words: *Nutritional assessment; Non-alcoholic fatty liver disease; Healthy diet; Diet therapy; Anthropometry*

Introduction

Non-alcoholic fatty liver disease (NAFLD) is defined as an excess accumulation of fat in the liver, unconnected with alcohol intake, and is the leading cause of chronic liver diseases in the world. Obesity is the main risk factor for this disease, and there are concerns that it might become the most prevalent cause of liver failure due to the increase in the prevalence of obesity in the world. The exact prevalence of NAFLD in the world is unknown, but it is estimated that it affects 10%-24% of the world population[1]. This proportion is significantly higher in western countries, where it amounts to 20%-40% of the population, with 20%-30% in Europe[2]. The prevalence of NAFLD is higher in obese persons (60%-95%), those with diabetes mellitus type 2 (28%-55%) and hyperlipidemia (20%-92%)[3,4]. It has been shown that central obesity (accumulation of fat around the waist) is a significant risk factor for NAFLD, even in persons with normal body mass index (BMI)[5]. For all these reasons, NAFLD is frequently connected with other conditions related to obesity, such as insulin resistance or metabolic syn-

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drome[6]. The most important predictor of liver related outcomes and overall mortality in patients with NAFLD is the stage of liver fibrosis[7,8]. A meta-analysis performed by Singh *et al*. revealed that 36.1% of patients with NAFLD (including both those with simple steatosis and those with non-alcoholic steatohepatitis, NASH) would develop progressive fibrosis[9]. Although simple steatosis has a relatively benign prognosis, between 10% and 30% of patients progress towards NASH, which can worsen into liver cirrhosis. The metabolic risk factors are common for NAFLD and cardiovascular diseases, therefore patients suffering from NAFLD are at an increased risk of mortality from liver-related cardiovascular diseases[10].

Although therapy for NAFLD has not yet been completely clarified, the main aim of the treatment is to change lifestyle, therefore body mass reduction, nutritional changes and moderate physical activities are recommended[11]. Diet therapy has a primary action on this disease, therefore caloric intake restriction is advised, while a diet with a reduced proportion of carbohydrates and saturated fats, and higher proportion of proteins, fibers and omega-3 fatty acids is beneficial for health.

Many studies have shown significant correlation between high consumption of non-alcoholic drinks rich in simple carbohydrates and the risk of obesity and development of diabetes, especially in children[12]. Processed foods and sweetened products such as drinks, jelly and marmalade are rich in simple carbohydrates (fructose and sucrose). Fructose boosts lipogenesis and triglyceride synthesis; studies have shown that foods rich in fructose contribute to greater accumulation of triglycerides within hepatocytes, reduce insulin sensitivity and increase serum triglyceride level[13], and that they cause liver steatosis and increase the risk of metabolic syndrome development[14]. Avoiding trans-fatty acids from processed foods is recommended[15]. Proteins should constitute approximately 20% of daily caloric intake. Clinical trials have shown that protein intake has a beneficial effect on the course of NAFLD, and that a lack of proteins, as well as malnourishment, can lead to the development of this disease.

The subject of the research was the intake and supplementation of numerous macro- and micronutrients, but there is still insufficient evidence to define a safe and accurate diet therapy for this disease. For this purpose, further studies are necessary in order to explore the lifestyle and diet of patients in greater detail for the creation of final, proof-based dietary guidelines for NAFLD[16].

In that context, the aim of this study was to examine the quality of diet and to gain an insight into the anthropometric and nutritive status of NAFLD patients.

Subjects and Methods

The research involved 30 patients treated at the Division of Gastroenterology, Zagreb University Hospital Centre. There were 15 women and 15 men, aged 30-69, without clinical, sonographic or laboratory signs of liver cirrhosis. The patients were diagnosed with NAFLD between October 2011 and March 2014 by the standard diagnostic algorithm procedure and tools including ultrasound. Further clinical evaluation excluded other liver diseases such as viral and drug-induced hepatitis, hemochromatosis, autoimmune liver diseases, Wilson's disease, malignant disease, liver cirrhosis and alcoholic liver disease (defined as intake of >40 g/day of alcohol for men and >20 g/day of alcohol for women). Prior to the research, the subjects signed a written informed consent form and were explained the study protocol in detail.

The patient anthropometric parameters were measured, including patient age and gender, body mass, height, waist circumference and hand grip strength. Body mass and height were used to calculate body mass index (BMI). Hand grip strength was tested using the Jamar hand grip dynamometer. The strength was measured in the following position: in normal shoulder position, the elbow was bent at 90°, while the forearm and wrist were in neutral position. The measurements were repeated three times and the results were shown as the mean value of these measurements. The basal metabolism rate (BMR) was determined using the Harris-Benedict equation, which is used in case of increased body mass, or Mifflin-St Jeor equation[17]. In order to determine daily recommended energy intake for patients, the aforementioned equations were corrected depending on the subjects' physical activity.

The physical activity factors were used in the calculation of daily caloric needs, which was calculated by the Mifflin-St Jeor equation using the patient body mass, height and age multiplied by the physical activity factor. The results were calculated for 18 patients who kept a diet diary.

The patient nutritional intake was estimated using a three-day diet diary. The subjects kept a diet diary for three days, of which two were working days and one was a weekend day. The amount of food eaten was determined using kitchenware, weighing or descriptions such as slices, pieces, etc. Written food records were analyzed using local database of food composition in order to calculate the intake of energy, macronutrients, micronutrients, fiber and cholesterol[18]. Values were then compared to recommendations.

The clinically validated Nutritional Risk Screening 2002 (NRS2002) form, recommended by the European Society for Clinical Nutrition and Metabolism (ESPEN), was used to estimate the patient nutritional status[19]. Nutritional risk was determined using the existing degree of nutrition and the risk of disorder due to increased needs caused by metabolic stress.

Data processing was carried out in the Microsoft Office Excel 2007 program. All results were expressed as the mean measurement value ± standard deviation (SD), or as proportion.

Results

The patient mean body mass was 87.79±14.94 kg, range from 58 kg to 115 kg. The mean BMI of all 30 subjects was 29.62±4.61 kg/m^2, falling to the excess body mass category, with female subjects having a higher mean BMI value (30.37±5.68 kg/m^2) than male subjects (28.88±3.26 kg/m^2). A total of 13.33% of subjects had normal body mass, 43.33% had excess body mass, while 43.33% were obese.

Waist circumference measurements showed the mean waist circumference of 100.43±13.88 cm in female subjects and 105.07±8.98 cm in male subjects, placing both groups above the limit for an increased risk of chronic diseases, which is >88 cm for women and >102 cm for men.

The results obtained by means of the NRS2002 method showed that all patients achieved 0 points, which indicates that none of the patients was at nutritional risk of malnourishment. Measuring the hand grip strength of the non-dominant hand using a dynamometer, the mean result was 24.78±7.49 kg in women and 45.21±16.28 kg in men. The physical activity factor for all subjects was 1.35±0.12 points, being the same in women and slightly lower (1.34±0.12 points) in men.

The total daily caloric intake and the intake and composition of macronutrients in the subject diet (N=18) according to their three-day diet diaries are shown in Table 1.

For all patients, the total caloric needs were 2117.46±383.01 kcal, while the intake was lower and amounted to 1904.94±508.50 kcal. The mean daily protein intake in all patients was 72.18±15.95 g, i.e. 15.5% of total caloric intake; the mean intake of carbohydrates was 203.92±73.40 g, i.e. 42.3% of total daily energy, and the mean intake of sugars of carbohydrate type (monosaccharides and disaccharides) was 84.57±37.14 g, i.e. 17.81% of total caloric intake of the subjects. The mean fiber intake in all patients was 18.40±6.35 g daily. The patient daily fat intake (90.85±27.50 g) was above the recommended <30% of total caloric intake. The mean intake of saturated fatty acids was 26.87±8.90 g, of monounsaturated fatty acids (MUFA) 36.12±16.24 g, and of polyunsaturated fatty acids (PUFA) 20.29±6.35 g daily. The intake of PUFA for both men and women was in accordance with the recommendations, albeit near the upper limit; in 44.44% of study patients it was greater than the recommended value, while in the rest of them it was in accordance with the recommendations. The subjects consumed a mean of 285.00±113.67 g of cholesterol daily. In female subjects, the intake was in accordance with the recommendations, but in 30% of them it was too high (>300 g), while in male patients the mean intake was greater than the recommended value, with as much as 50% of the subjects consuming more than the recommended amounts.

Figures 1 and 2 show the patient micronutrient intake expressed as proportion (%) compared to the recommended values, where the recommended values represent 0%, depending on whether the subjects consumed more or less nutrients than recommended, and the results were either negative or positive. Since there are no specific recommendations for micronutrient intake in NAFLD, the intake recommended for the general population is advised. The results are sorted by gender, and it is evident that the subject diet was deficient in most of the micronutrients.

The only micronutrients consumed in sufficient quantities by both men and women were sodium, potassium, vitamin B6 and vitamin C. Furthermore, the mean intake in men was in accordance with the recommended values for vitamin B1, while the same held

Table 1. Intake and composition of macronutrients in the subject diet (N=18) according to their three-day diet diaries

	Women	Men	Total	Recommendations		
				Female	Male	Total
Total daily energy intake/kcal % of caloric needs	1832.62±448.4 94.75	1995.34±593.7 85.03	1904.94±508.5 89.9	1934.15 ±313.54	2346.61 ±349.08	2117.46 ±383
Proteins/g % of TEI	70.41±17.14 15.3	74.40±15.18 14.9	72.18±15.95 15.5	96.71	117.33	105.87
				20%[a]		
Carbohydrates/g % of TEI	196.43±55.72 42.86	213.29±94.40 42.75	203.92±73.40 42.31	193-241	234-293	211-264
				40-50%[a]		
Sugars/g % of TEI	83.50±39.68 18.2	85.90±36.36 17.2	84.57±37.14 17.81	<48.35	<58.66	<52.9
				<10%[c]		
Fibers/g	17.55±6.03	19.46±6.99	18.40±6.35	F: 25 g[b]	M: 38 g[b]	
Fats/g % of TEI	86.82±31.75 42.6	95.88±22.12 43.2	90.85±27.50 42.9	≤64.47	≤78.22	≤70.58
				≤30%[a]		
SFA/g % of TEI	23.93±8.00 11.7	30.54±9.08 13.7	26.87±8.90 12.7	15-21.4	18.5-26.1	16.5-23.5
				7-10%[a]		
MUFA/g % of TEI	37.12±18.95 18.2	34.88±13.25 15.7	36.12±16.24 17.1	>21.5	>26.1	>23.5
				>10%[c]		
PUFA/g % of TEI	19.94±6.89 9.8	20.73±6.05 9.3	20.29±6.35 9.5	12.9-21.4	15.6-26.1	14.1-23.5
				6-10%[c]		
Cholesterol/g	263.43±98.60	311.96±131.85	285.00±113.67	<300 mg[c]		

SFA = saturated fatty acids; MUFA = monounsaturated fatty acids; PUFA = polyunsaturated fatty acids; TEI = total daily energy intake; a[36], b[37], c[32]

true for retinol and vitamin B2 in women. Men consumed more of most of the micronutrients (the minerals Na, K, Mg, Fe and Zn, and vitamins B1 and B6), while women consumed more Ca, retinol, vitamin B2 and vitamin C.

The mean sodium intake in all patients was 1994.96±859.57 mg/day. The mean potassium intake was 2882.54±851.80 mg, and only 16.67% of the subjects failed to meet their daily potassium needs. The mean calcium intake was 645.08±352.39 mg/day, 664.35±268.91 mg in women, and 60% of them failed to meet the recommended intake. The mean calcium intake in men was 620.99±455.42 mg, and as much as 75% of them failed to meet the daily intake recommendations. The subjects also failed to meet the magnesium intake recommendations, with the mean of 218.53±124.73 mg, which is 58.27% of the recommended daily intake. Women consumed from 43.73 mg to 556.27 mg daily, and only 10% of them met the recommendations. Among men, the intake was from 276.30 mg to 1685.87 mg, and the recommendations were met by 12.50% of the subjects. The mean intake of iron varied from 6.52 mg to 29.38 mg, mean 12.70±5.50 mg. Only one male subject consumed more than the recommended amount, while 30% of the women met the recommendations. The mean zinc intake was very low in both women (5.56±2.91 mg) and men (6.38±4.86 mg). With such an intake, women met 55.56% of the recommendations, while men met 63.84%; in total, only 16.67% of study subjects met the recommendations.

The recommended retinol (vitamin A) intake is 800 μg/day, while the mean intake in all study subjects was 529.03±1399.31 μg/day. Among women, the intake varied from 26.67 μg to 6,063.82 μg, and only 20% of female subjects reached the recommended daily value, while among men, the intake varied from 0 to 708.51 μg, and none of them met the daily recommendations. The mean thiamine (vitamin B1) intake was close to the recommended 1.1 mg/day and amounted to 1.30±1.27 mg/day; in women, the mean intake was 0.96±0.26 mg, satisfying 87.21% of the

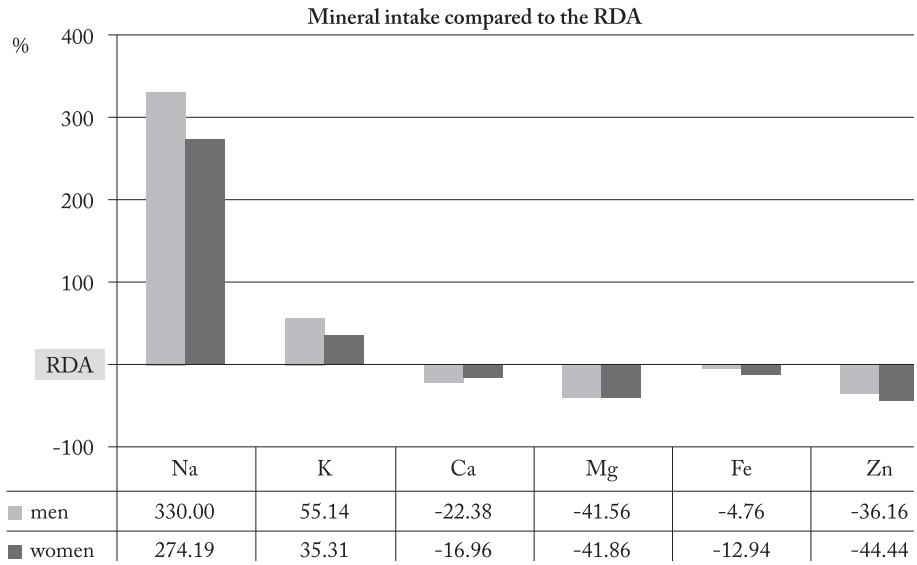

Fig. 1. Mean mineral intake (%) in the subject diet (N=18) compared to the recommended values.

RDA = recommended dietary allowance

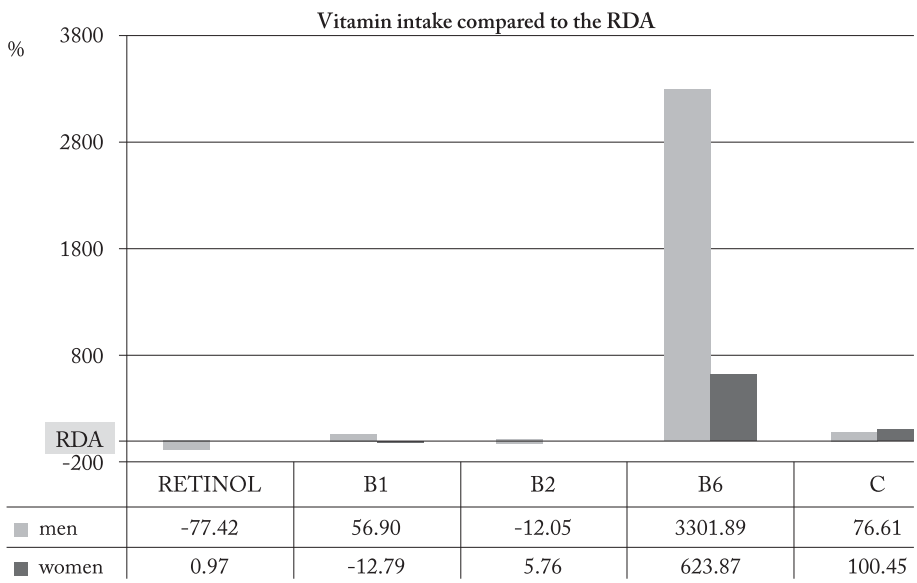

Fig. 2. Mean vitamin intake (%) in the subject diet (N=18) compared to the recommended values.

RDA = recommended dietary allowance

needs, while in men it was 1.73±1.87 mg, meeting the recommendations. The recommended vitamin B2 (riboflavin) intake is 1.4 mg daily, and the patients consumed a mean of 1.37±0.59 mg. In women, the mean intake was 1.48±0.72 mg and 40% of them met the recommendations, while in men it was 1.23±0.37 mg and only 25% of them met the recommendations. For vitamin B6 (pyridoxine), the recommended amount is 1.4 mg/day, and the mean daily intake of 26.80±76.19 mg met this value. In women, the intake varied from 0.60 mg to 42.45 mg daily, and in men from 0.60 mg to 328.65 mg/day. Therefore, 80% of women and 75% of men met the recommendations. The mean intake of vitamin C was 151.88±68.38 mg/day, which is in accordance with the recommendations of 80 mg/day. All women met the recommended daily intake, with the mean intake of 160.36±60.09 mg, while in men it was 141.29±80.51 mg and 25% of them did not meet daily recommendations.

Discussion

The mean patient BMI of 29.62±4.61 kg/m^2 matched the results of other research in the field of

NAFLD, where the mean BMI of around 31 kg/m^2 is reported[20-24]. The results on the mean waist circumference in patients (100.43±13.88 cm for female and 105.07±8.98 cm for male patients) were higher than the reference data from the literature, which are 92±13 cm[22] and 88±12 cm[23]. The greater the waist circumference, the greater is the risk of chronic disease development and cardiovascular events, with the accumulation of fat around the waist being a predictor of NAFLD development[25-27]. The results on BMI in this research are closest to the results obtained in Italy[22], while the mean waist circumference was >10% greater than in the same group of Italian subjects.

All patients achieved 0 points by use of the NRS2002 method. Such results where none of the patients was at nutritional risk of malnutrition were expected since most of the patients had excess body mass or were obese.

Results of the hand grip strength measurement in non-dominant hand using a dynamometer were compared to data reported by Mathiowetz *et al.*[28], whose results are used as reference values when using the Jamar hand grip dynamometer. These results show that the subjects' hand grip strength was roughly equal to that in the average healthy population. The physical activity factor for all subjects, both male and female, indicated that, on average, the subjects were not physically very active.

In 33.33% of patients, caloric intake was greater than necessary, while a reduced caloric intake was present in 50% of subjects as a result of an attempt to lose weight, due to which they consumed less food than usually; an additional reason could be incorrectly kept diet diaries and intake under-reporting. The mean caloric intake in our subjects was 1904.94±508.50 kcal, i.e. by 23.22% lower than the mean intake reported by other researchers (2481.1 kcal)[23,24,29,30].

The proportion of proteins in the subject diet (15.50±2.69%) was below the recommended 20%, and matched the reference data in the literature, where the mean proportion of proteins in the total caloric intake was 15.6%[19,23,24,28], which is closest to the results obtained in subjects in Germany, where the mean intake of proteins was 16±0.7%[30]. Our patients consumed less proteins when compared to the results obtained by Cortez-Pinto *et al.*[24], which amounted to 99.8±2.3 g, which is expected when taking into consideration that the patients of the aforementioned authors had a greater caloric intake as well (2252.7±88.2 kcal/day).

The intake of carbohydrates of 42.31±8.84% of the total daily energy was similar but slightly lower compared to the results recorded in the reference literature, where the mean value is 48.82% of the total caloric intake[20,23,24,29–31]. The mean intake of carbohydrates was closest to the results reported by Cortez-Pinto *et al.*[24] from Portugal, where the mean intake of 243.6±5.7 g/day was recorded, which corresponds to the proportion of 43.25% of the total daily caloric intake. The aforementioned results are at the same time the lowest results of carbohydrate intake found in the literature, which also indicates that the intake in the subjects included in this research was lower than all the aforementioned data found in the literature. The daily sugar intake should amount to <10% of total calories, while 88.88% of our subjects consumed more than the recommended values. The mean sugar intake in the literature is 104.68 g[24,29,31] and is higher by 19.2% compared to the results of this research (84.57±37.14 g). The reason for that is probably a higher caloric intake mentioned in the reference papers, and with it a greater intake of food and sugars daily.

The reason for the lower mean fiber intake than recommended in both male and female groups (18.40±6.35 g) is that the subjects consumed food which was poor in complex carbohydrates such as fibers, but was rich in simple carbohydrates such as monosaccharides and disaccharides. The fiber intake was in accordance with the reference data from the literature, with a mean of 17.66 g/day[20,23,24,29,31]. The patients consumed more fibers than the subjects from the researches conducted in the USA[20], Japan[23] and Italy[29], but less than the subjects in Portugal[24] and the obese group of subjects from Italy[31].

Both male and female groups consumed excessive amounts of fat according to the recommendations. The mean intake of total fats in our group was higher than the values found in the literature, where it is 33.98%[20,23,24,29-31], which is closest to the results recorded in 2011 in obese patients with NAFLD in Italy, where the mean daily fat intake was 155.7±53.5 g, or 40.93%[31]. The mean intake of saturated fatty acids of 12.87±2.87%, which was more than the recommended values of 7%-10%, was in accordance with the data given in the literature, where an intake of 12±3%[20] and 13.7±3.1% of the daily caloric intake was recorded[29], with the mean intake of

27.1 g[23,24,31]. Since recommendations for the intake of MUFA[32] are not strict, but rather only >10% of intake, the patient' intake of 16.90±4.78% was acceptable. The patient intake of MUFA was also in accordance with the data given in the literature, and was closest to the intake of 17.7±4.4% in Italy[29] and in Portuguese patients[24]. The intake recorded in the USA was lower, 13±4%[20], while in the obese group of patients in Italy it was higher, 64.2±23.7 g[31]. The recommendations for PUFA intake[32] are 6%-10% of the daily caloric intake, and thus the patient mean intake was according to the recommendations: 20.29±6.35 g, i.e. 9.81±2.74% of the total daily caloric intake. The result of the patient intake of PUFA exceeded the reference data from the literature, where an intake of 6±2%[20] was recorded, with a range of intake from 10.3 g to 16.66 g[23,24,29,31].

The mean cholesterol intake in patient diet (285.00±113.67 g) was in accordance with the recommendations, which advise an intake of <300 mg/day. The data were also in accordance with the data reported by Ricci *et al.*[31], where the mean daily intake of 281±149 mg cholesterol was recorded, and was lower than in the researches conducted in Portugal (307.1±14.0 mg)[24] and in Italy (506±108 mg)[29].

The results shown in Table 1 lead to a conclusion that the subjects should change their diet and consume less food rich in saturated fatty acids, PUFA and cholesterol, while at the same time they should increase their intake of food rich in MUFA; this applies to men in particular. Also, emphasis should be put on the right omega-3/omega-6 ratio, since the intake of omega-3 is shown to be beneficial for patients with NAFLD[33]. Although the total daily carbohydrate intake was in accordance with the recommendations, the subjects should consume more complex carbohydrates (fibers) and less sugar (monosaccharides and disaccharides).

As shown in Figure 1, the mean sodium intake of 1994.96±859.57 mg/day exceeded the minimum daily needs (500 mg/day), but in comparison with the WHO recommendations[32], where the recommended daily intake is <2 g, the mean daily intake was near the upper limit, while the mean intake in men was above that limit. A total of 33.33% of the subjects consumed >2 g daily, but it can be assumed that the increased intake was actually present in the majority of subjects since calculations could not include the salt added in diet, which affects the daily sodium intake most; only the sodium already contained in the food was included. The mean sodium intake was higher than the data reported by Ferolla *et al.*[34] from Brazil, where the mean daily intake of 1.2 g/day was recorded using the method of 24-hour dietary recall to calculate the data.

The mean potassium intake of 2882.54±851.80 mg was in accordance with the Croatian recommendations prescribing an intake of 2000 mg daily[35]. The mean potassium intake was greater than the data recorded in the reference literature, where the intake is 2.0 g/day[31].

The mean calcium intake of 645.08±352.39 mg/day was lower than the one reported in the literature (945.2±52.2 mg/day) by Cortez-Pinto *et al.*[24] from Portugal, and it is also below the recommended value of 800 mg/day.

The mean magnesium intake of 218.53±124.73 mg was higher than the results obtained by Ferolla *et al.*[34], with the mean intake of 183.8 mg, but lower than the results obtained by Cortez-Pinto *et al.*[24], with the mean intake of 331.8±8.0 mg/day. Only 10% of women and 12.5% of men met the recommendations. The iron intake of 12.70±5.50 mg in our subjects was below the recommended intake of 14 mg, but slightly higher than the one recorded in the reference literature, where the mean intake is 10.4 mg/day, ranging from 7.1 mg/day to 14.9 mg/day[23,24,29,34]. The mean intake in our subjects was closest to the results obtained in the research in Italy, where the mean intake was 12.1±2.3 mg/day[29]. In our study, the mean zinc intake of 5.56±2.91 mg for women and 6.38±4.86 mg for men was lower compared to the data reported in the literature, where the intake of 7.1 mg/day[34] and 7.43 mg/day[23] is reported. These data show that in our group of patients, daily recommendations of 10 mg/day were not met.

As data in Figure 2 show, the results on the retinol intake (529.03±1,399.31 μg/day) were in accordance with literature data, where the mean intake is 870.16 μg/day, ranging from 125 μg/day to 1892.4 μg/day[23,24,29,34]. Daily recommendations for retinol intake of 800 μg were not met. The mean thiamine (vitamin B1) intake of 1.30±1.27 mg/day was slightly higher than the recommended one (1.1 mg/day). Compared to literature data from Brazil, where the mean intake was 0.7 mg/day[34], the intake results in our subjects were higher. The women consumed 1.37 times more thiamine than the subjects from Brazil, while in men the intake was 2.47 times higher.

The mean riboflavin intake of 1.37±0.59 mg was higher than the mean intake recorded in the literature[34] and the recommendations for intake of 1.4 mg

daily. A greater proportion of women (40%) than men (20%) met the recommendations. Compared to the reference data in the literature on the mean pyridoxine intake amounting to 0.7 mg/day[34], the mean intake in our subjects was much higher (26.80±76.19 mg/day) and was not in accordance with the literature. A large proportion of women (80%) and men (75%) met the recommendation, which is 1.4 mg/day. The mean daily vitamin C intake of 151.88±68.38 mg/day was in accordance with the data given in the literature, where the mean intake in all researches is 167.2 mg/day, ranging from 84.3 mg to 360.0 mg[23,24,29,34]. Among the aforementioned literature data, the closest intake was recorded in Portugal in 2006, when the patients consumed a mean of 130.7±8.9 mg/day[24]. All women met the recommended daily intake of 80 mg, while 25% of men did not meet daily recommendations.

In conclusion, all study results indicated that the patients mostly had increased body mass, and most of them belonged to the category of excess body mass or obesity. In accordance with such BMI results, none of the subjects was at nutritional risk of malnourishment. The research results also indicated that the subjects' diet quality was not in accordance with the contemporary recommendations, and that they consumed too much fat, especially animal fats, while protein intake was lower than the recommended intake. The carbohydrate intake was in accordance with the recommendations in terms of quantity, but that intake consisted mostly of simple carbohydrates, not complex ones. The subjects were deficient in numerous micronutrients. The only micronutrients the intake of which was adequate according to the recommendations for both genders were sodium, potassium, vitamin B6 and vitamin C. The men consumed mostly larger quantities of micro- and macronutrients than the women, which is in accordance with the higher caloric intake and the larger quantity of food consumed. The results obtained might point to the importance of unbalanced diet for the development of NAFLD.

There were some limitations to this study. The number of the study subjects was very small (N=30, of which only 18 had filled-in their diet diary), which clearly limits the conclusions. Additionally, the possibility of incorrectly kept diet diaries and intake underreporting also were limitations to the study. Namely, it is not possible to draw any conclusions on the impact of total caloric intake on the development of NAFLD in such a small group of subjects (N=30), of which some had already started practicing the diet with reduced caloric intake, which added to the study group heterogeneity.

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Sažetak

STANJE UHRANJENOSTI I KVALITETA PREHRANE U BOLESNIKA S NEALKOHOLNOM BOLEŠĆU MASNE JETRE

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Nealkoholna bolest masne jetre (NAFLD) postaje velik zdravstveni problem s povećanom učestalosti u svijetu zbog bliske povezanosti s epidemijom pretilosti. Kako zasad ne postoji standardizirano farmakološko liječenje i jedina dokazana učinkovita terapijska strategija je promjena načina života, važno je odrediti potencijalne prehrambne ciljeve za prevenciju i liječenje NAFLD. Procijenili smo nutritivni status 30 bolesnika s dijagnosticiranim NAFLD primjenom antropometrijskih parametara, mjerenjem snage ruke dinamometrom i dijetetskim parametrima (tjelesna aktivnost, upitnik NRS 2002 i trodnevni dnevnik prehrane). Srednja vrijednost indeksa tjelesne mase bila je 29,62±4,61 kg/m^2 s 86,67% bolesnika koji su bili prekomjerne tjelesne mase ili pretili. Rezultati tjelesne aktivnosti pokazuju da su ispitanici bili slabo aktivni. Prekomjerni energetski unos u odnosu na dnevne potrebe imalo je 27,78% bolesnika. Prosječan dnevni unos makronutrijenata je iznosio: 15,5% proteina, 42,3% ugljikohidrata i 42,2% masti s nedostatnim unosom sljedećih mikronutrijenata: kalcij, magnezij, željezo, cink, vitamini A, B1 i B2. Rezultati istraživanja pokazuju da kvaliteta prehrane naših ispitanika nije bila u skladu s aktualnim preporukama i da su konzumirali velike količine masti, pogotovo zasićenih masnih kiselina s niskim unosom mikronutrijenata. Dobiveni rezulatati bi mogli ukazati na ulogu nepravilne prehrane kao važnog čimbenika razvoja NAFLD-a.

Ključne riječi: *Nutritivni status, procjena; Nealkoholna bolest masne jetre; Zdrava prehrana; Dijetoterapija; Antropometrija*