

**ASSESSMENT OF THE PREVALENCE OF NONALCOHOLIC FATTY LIVER DISEASE  
AMONG OBESE POLISH PEOPLE AND THE ESTIMATION OF THE KNOWLEDGE  
OF NUTRITIONAL RECOMMENDATIONS**

*OCENA CZĘSTOŚCI WYSTĘPOWANIA NIEALKOHOLOWEJ STŁUSZCZENIOWEJ CHOROBY  
WĄTROBY U OSÓB OTYŁYCH POLSKIEGO POCHODZENIA ORAZ OKREŚLENIE  
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Streszczenie

**Introduction.** The frequency of nonalcoholic fatty liver disease (NAFLD) all over the world is rising rapidly. The first line therapy for NAFLD is lifestyle alteration including increase in physical activity and dietetic modifications.

**Aim.** The aim of this research was to assess the prevalence of NAFLD among obese Polish people and to compare the knowledge of nutritional recommendations between two groups of patients, with NAFLD and obese without NAFLD.

**Materials and method.** The survey was conducted in 50 obese Polish patients. The research tool was ultrasonography and a questionnaire which assessed the knowledge of nutritional recommendations.

**Results.** Nonalcoholic fatty liver disease has been observed in 78% of all obese individuals. There was no statistical discrepancy in the level of knowledge of nutritional recommendations between patients with NAFLD and without fatty liver.

**Conclusion.** Due to the sudden increase in number of patients with NAFLD, there is an enormous need to raise awareness among obese people of the influence of their lifestyle on their state of health. The level of knowledge of nutritional recommendations among obese Polish people is insufficient.

KEY WORDS: NAFLD, obesity, education, diet, dietary recommendations.

Summary

**Wstęp.** Częstość występowania niealkoholowej stłuszczeniowej choroby (NAFLD) na świecie obecnie wzrasta. Pierwszym krokiem w terapii NAFLD jest modyfikacja stylu życia, w tym wzrost poziomu aktywności fizycznej oraz odpowiednie postępowanie żywieniowe.

**Cel.** Celem pracy była ocena częstości występowania niealkoholowej stłuszczeniowej choroby wątroby u osób otyłych polskiego pochodzenia oraz porównanie stopnia znajomości zaleceń żywieniowych wśród osób otyłych z NAFLD oraz bez cech stłuszczenia wątroby.

**Material i metoda.** Badaniem została objęta grupa 50 osób otyłych polskiego pochodzenia. U osób otyłych zostało przeprowadzone badanie ultrasonograficzne oraz ankieta dotycząca oceny stopnia znajomości zaleceń żywieniowych.

**Wynik.** Niealkoholowa stłuszczeniowa choroba wątroby została potwierdzona u 78% osób otyłych. Nie stwierdzono różnic istotnych statystycznie w poziomie znajomości zaleceń żywieniowych w grupie osób otyłych z NAFLD oraz bez cech stłuszczenia wątroby.

**Wnioski.** W związku ze wzrostem częstości występowania NAFLD, niezbędna jest edukacja osób otyłych w zakresie wpływu stylu życia na stan zdrowia. Pacjenci otyli posiadali niski poziom wiedzy na temat postępowania żywieniowego w otyłości oraz NAFLD.

SŁOWA KLUCZOWE: NAFLD, otyłość, edukacja, dieta, zalecenia żywieniowe.

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**Introduction**

Worldwide, the great number of people presents with excessive body weight and consequently with metabolic disturbances like diabetes mellitus type 2, hyperlipidemia or cardiovascular disease. One of these disorders is nonalcoholic fatty liver disease (NAFLD) also known as hepatic manifestation of metabolic syndrome [1, 2, 3, 4, 5, 6, 7]. NAFLD is a condition which is associated with increased accumulation of fatty compounds in hepatocytes [8]. To diagnose NAFLD, excessive alcohol con-

sumption (Women > 20 g; Men > 30 g per day) and all other causes of chronic liver disease should be excluded [3, 8]. In comparison to other causes, nonalcoholic fatty liver disease most often leads to raised liver enzymes among adults in developed countries [9, 10]. It is very important to promote this knowledge among members of medical care and as a result improve the detection rate of NAFLD.

The frequency of nonalcoholic fatty liver disease (NAFLD) all over the world is increasing rapidly. The incidence of NAFLD in United States amounts to abo-

ut 20–30% of adult population and 14–21% in European population. This rate is elevated in case of metabolic disturbances like diabetes mellitus (30 – 50% of patients) or hyperlipidemia (93% of patients) [11]. The frequency of NAFLD among obese people in United States is about 25 – 95% of population [11].

The object of this study was to evaluate the occurrence of NAFLD among obese Polish people.

The sudden increase in number of patients with NAFLD, caused scientific search for optimal course of treatment, including lifestyle modifications like weight loss and physical activity. Lifestyle alteration including dietary approach play a substantial role in a treatment of NAFLD. A hypocaloric, rich in dietary fiber and mono-unsaturated fatty acids (MUFAs) diet is recommended for patients with NAFLD [12, 13]. Well composed, limiting and tailored to personal demand diet enables weight loss and improvement in clinical picture of NAFLD. There is some evidence that nutritional status and appropriate proportions of nutrients in daily diet are of great importance in a treatment of NAFLD. Studies with humans and animals proved that dietary habits have an impact on fatty liver development and lipid peroxidation. Clinical trials conducted by Ouyang and Donnelly [14, 15] showed that diet high in fat and fructose can lead to NAFLD. Therefore appropriate nutritional education concerning culinary techniques, food choice and the influence of some nutrients on the course of NAFLD is crucial.

## Materials and Methods

### *Study participants*

The study was conducted between October 2011 and March 2012. The participants were the patients of two units of Poznan University of Medical Sciences. From among 50 patients that participated in the research, 28 were women and 22 men. Patients were assigned to the research group when they exhibited BMI above 30 kg/m<sup>2</sup> and age of 18 years minimum. Moreover, excessive alcohol consumption (women > 20 g, men > 30 per day) was excluded. Patients were expelled from this study if they suffered from viral hepatitis B and C, hemochromatosis, autoimmune hepatitis or Wilson's disease. Exposure to agents which can disturb the function of liver like carbon disulfide, hydrocarbons, carbon tetrachloride, fungal toxins or *Bacillus Cereus* toxin was also excluding factors. The study was approved by Bioethics Committee of the Medical University of Poznan and all participants provided written consent to participate in the research.

### *Study design*

The research tool was a questionnaire form which assessed the knowledge of nutritional recommendations and it was taken in all obese patients (BMI > 30 kg/m<sup>2</sup>). Afterwards, the participants (28 women and 22 men) were assigned to two groups, group of obese subjects with NAFLD and obese patients without NAFLD. The

presence of nonalcoholic fatty liver disease was tested using non-invasive method in the form of ultrasound of the liver which was conducted during patient's stay in the hospital.

The questionnaire consisted of two parts: respondent's particulars and 28 closed-ended questions. The 28 closed-ended questions were divided into two parts: test with a high and low degree of complexity. Tests included various questions concerning the source of knowledge of nutritional recommendations, the influence of some nutrients on the course of NAFLD and obesity, knowledge of body mass index and glycemic index, desired weight loss in case of patients with obesity and NAFLD, effect of rapid weight loss, the role of physical activity in a treatment of obesity, culinary techniques, recommended types of food and products which should be excluded from a diet of patients with obesity and nonalcoholic fatty liver disease (table 1).

Only one answer was correct but the participants could also choose the answer: "I don't know". The questioned people filled in the questionnaire in the presence of researcher. For each correct answer the patient received one point, with maximum score of 27 points (10 from the test with a low degree of complexity and 17 from the test with a high level of complexity). For question number 25 the point was not given, because it referred to the subjective knowledge of glycemic index notion.

### *Statistical analysis*

Data were analyzed using STATISTICA 9 software. Taking into consideration the fact that the majority of patients achieved the maximum number of points from the test with a low degree of complexity, in a statistical analysis we pondered only the knowledge of answers to the test with a high level of complexity. Two tests were used: the nonparametric Kolmogorov-Smirnov and the Mann-Whitney U test to compare the knowledge of answers to the test with a high degree of complexity between obese people with NAFLD and without fatty liver. In order to define relation between the number of points scored by patients from the test with a high level of complexity and the level of education, ANOVA Kruskal-Wallis and median tests were applied. ANOVA and median tests were used also to determine relation between declared level of knowledge of nutritional recommendations and actual number of points achieved by patients from the test with a high level of complexity.

## Results

The prevalence of nonalcoholic fatty liver disease among obese Polish patients was 78% of adult population. Taking into account the duration of NAFLD, 59% of patients were newly diagnosed (figure 1). Fatty liver occurred more often in men (56% out of all cases of NAFLD). The most cases of NAFLD were observed at the ranging from 46 to 60 years (figure 2). Considering occupational activity, 64% of patients with NAFLD were unemployed (figure 3). The majority of patients with

NAFLD declared a city (more than 500.000 inhabitants) as a dwelling place (figure 4). Pondering the level of education of patients with NAFLD, the majority had education at the university level (figure 5).

In relation to the level of knowledge of nutritional recommendations among people with NAFLD and without fatty liver, an important factor was the source of knowledge of this issue. Most patients pointed out a dietitian as a source of information but the percentage of those patients was still very low (figure 6). The number of points achieved from the test with a low degree of complexity was close to maximum in a group of people with NAFLD as well as in a group without fatty liver. The average number of points from the test with a high degree of complexity was 6.25 as compared to 17 points which were possible to score (figure 7).

When it comes to comparison of knowledge of answers to the test with a high degree of complexity between

people with NAFLD and without fatty liver, there was no significant discrepancy between these two groups. We used two tests to compare the knowledge (Kolmogorov-Smirnov and the Mann-Whitney U test) and in two cases the value of p coefficient was higher than the value of projected coefficient of statistical significance  $p = 0.05$  (table 2).

The number of scored points depended on the level of education which was confirmed statistically (table 3). We performed ANOVA Kruskal-Wallis and median tests to examine this relation. For both tests the value of p coefficient was lower than the value of projected coefficient of statistical significance  $p = 0.05$ . Elementary education was excluded from the statistical analysis due to small size of this group, below 5.

On the basis of statistical analysis we proved that there was no significant discrepancy between the number of scored points and subjective assessment of individual's

**Table 1.** Questions with a high and low degree of complexity contained in the questionnaire

Tabela 1. Pytania o wysokim oraz niskim stopniu trudności zawarte w ankiecie

Questions with a high degree of complexity	Questions with a low degree of complexity
Fructose and its influence on the course of NAFLD and obesity	The ability to point out of foodstuffs which are recommended for patients with NAFLD and obesity (alternatives: honey, sweet juices, homemade compote, saltwater fish)
Oligofructose – dietary sources and its influence on the course of NAFLD and obesity	Dietary sources of vitamin E
Effect and the dietary sources of conjugated linoleic acid (CLA)	Kinds of meat contraindicated in a diet for patients with NAFLD and obesity
Contraindicated fatty acids in a diet for patients with NAFLD and obesity	Cereal products recommended in a diet for patients with NAFLD and obesity
Dietary sources of trans fatty acids	Kinds of soups recommended for people with NAFLD and obesity
Knowledge of polyunsaturated fatty acids (PUFA)	Beverages recommended for people with NAFLD and obesity
Proper value of body mass index (BMI)	
Proper amount of weight loss per week for people with NAFLD and obesity	Cold meats recommended for people with NAFLD and obesity
Effect of rapid weight loss on the course of NAFLD and obesity	Fruits contraindicated in diet for patients with NAFLD and obesity
The role of physical activity in a treatment of patients with NAFLD and obesity	Dishes contraindicated in diet for patients with NAFLD and obesity
Knowledge of antioxidants and their influence on the function of human body	Culinary techniques recommended for patients with NAFLD and obesity
Knowledge of Glycemic Index notion	
The ability to point out products with a high glycemic index	

**Table 2.** Statistical analysis: The comparison of knowledge of answers to the test with a high degree of complexity between patients with NAFLD and without fatty liver

Tabela 2. Analiza statystyczna: Porównanie wiedzy z testu o wysokim stopniu trudności w grupie osób z NAFLD oraz bez cech stłuszczenia wątroby

Maximum positive difference	p	Group 1 (without fatty liver)	Group 2 (with NAFLD)	Standard deviation Group 1	Standard deviation Group 2	Number of individuals Group 1	Number of individuals Group 2
0.307	$p > .10$	6.818	5.692	2.750	3.221	11	39

Kolmogorov – Smirnov test; relative to variable: fatty liver  
 $p < .05000$

**Table 3.** Statistical analysis: Relation between the number of points from the test with a high degree of complexity and the level of education

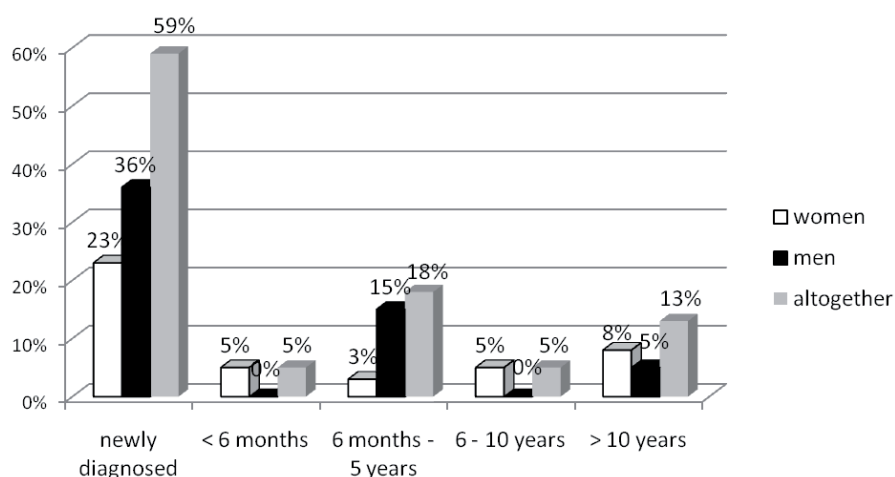
Tabela 3. Analiza statystyczna: zależność ilości zdobytych punktów w pytaniach o wysokim stopniu trudności od poziomu wykształcenia

Variable: Questions with a high degree of complexity Correct answers Level of education	ANOVA Kruskal - Wallis rank ; H (2. N= 49) = 11.22697 p =.0036			
	Code	Number of individuals	Rank Sum	Rank Average
University	101	20	660.0000	33.00000
Vocational	102	10	169.0000	16.90000
Secondary	103	19	396.0000	20.84211

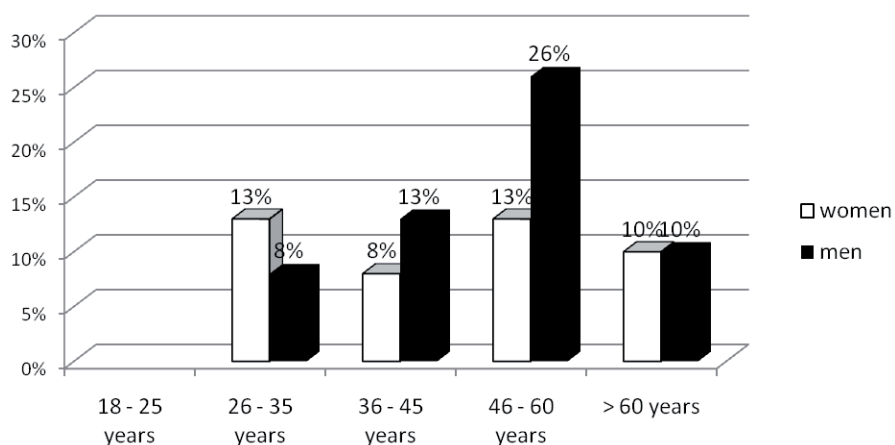
**Table 4.** Statistical analysis: Relation between the number of scored points and subjective assessment of individual's knowledge

Tabela 4. Analiza statystyczna: zależność deklarowanego poziomu wiedzy od ilości uzyskanych punktów

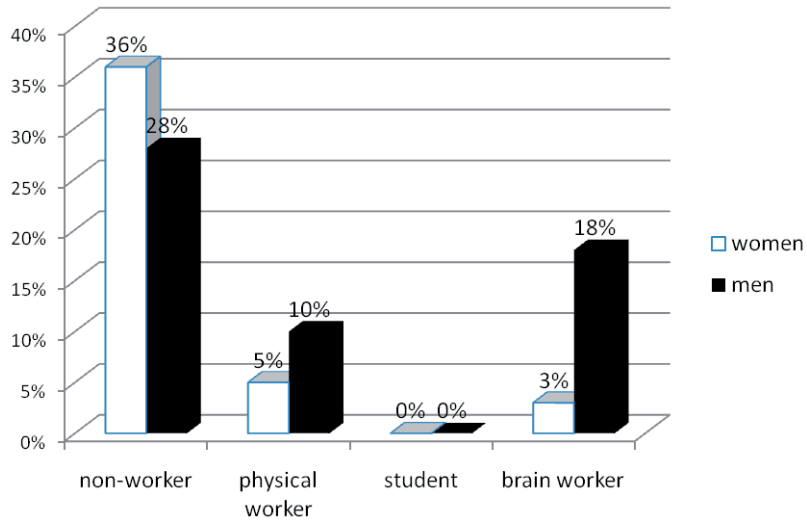
Variable: Questions with a high degree of complexity Correct answers Subjective level of knowledge	ANOVA Kruskal – Wallis rank; H (2. N= 48) = .0362492 p =.9820			
	Code	Number of individuals	Rank Sum	Rank Average
low	102	18	449.5000	24.97222
high	103	9	216.0000	24.00000
average	104	21	510.5000	24.30952

**Figure 1.** The prevalence of NAFLD depending on gender and duration of NAFLD.

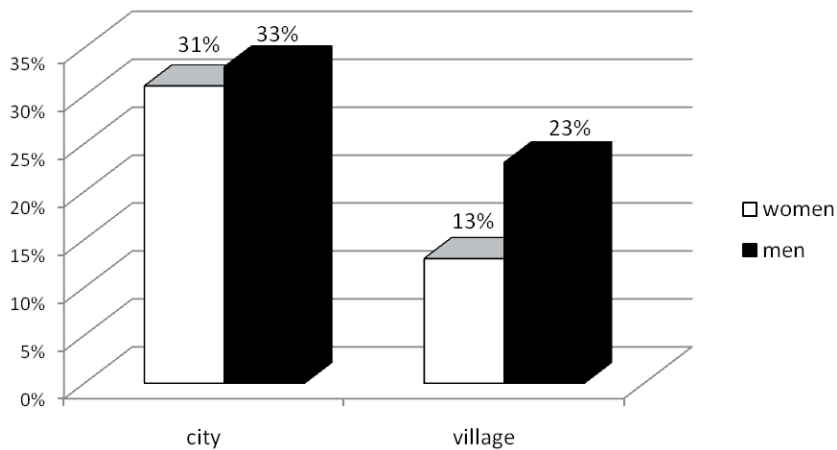
Rycina 1. Częstość występowania NAFLD w zależności od płci oraz czasu trwania NAFLD.

**Figure 2.** The prevalence of NAFLD depending on gender and age.

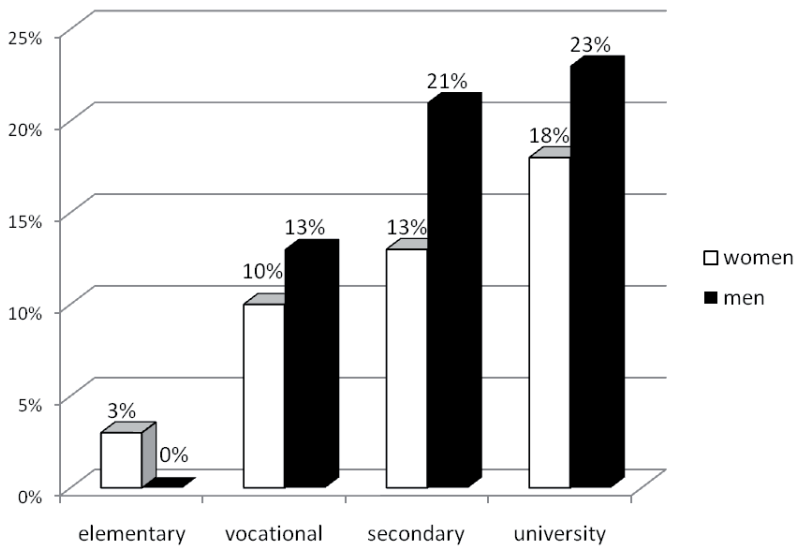
Rycina 2. Częstość występowania NAFLD w zależności od płci i wieku.



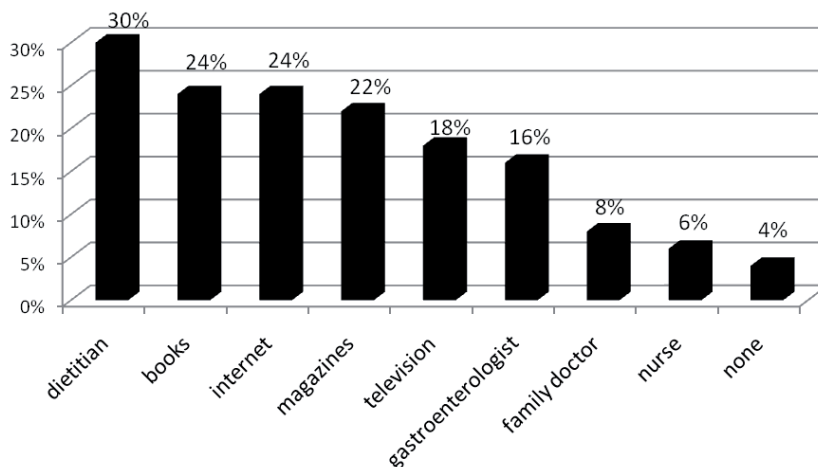
**Figure 3.** The prevalence of NAFLD depending on gender and occupational activity.  
 Rycina 3. Częstość występowania NAFLD w zależności od płci oraz rodzaju aktywności zawodowej.



**Figure 4.** The prevalence of NAFLD depending on gender and dwelling place.  
 Rycina 4. Częstość występowania NAFLD w zależności od płci oraz miejsca zamieszkania.

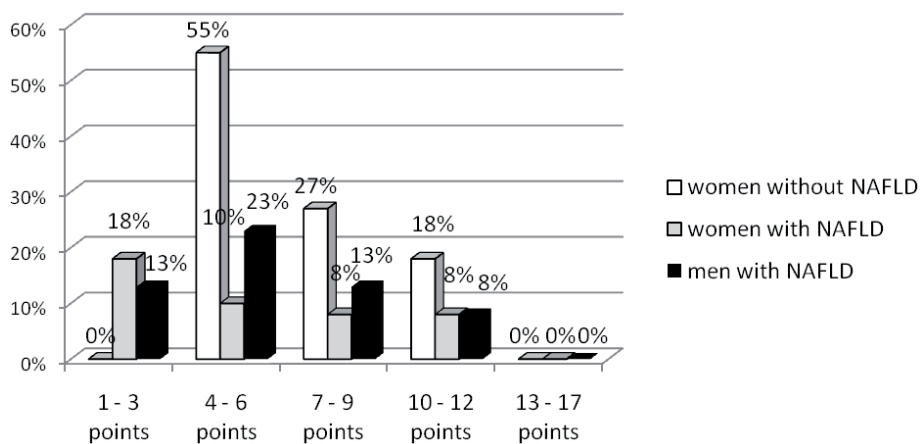


**Figure 5.** The level of education of patients with NAFLD.  
 Rycina 5. Rodzaj wykształcenia pacjentów z NAFLD.



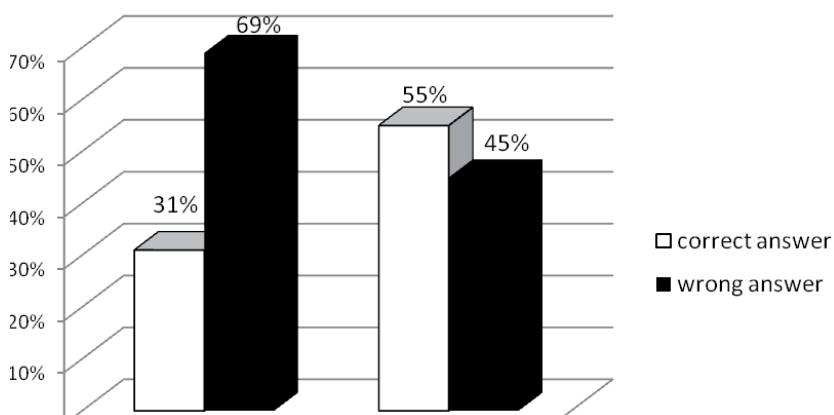
**Figure 6.** Sources of knowledge of nutritional recommendations in obesity and NAFLD among obese patients with NAFLD and without fatty liver.

Rycina 6. Źródła czerpania wiedzy na temat zaleceń żywieniowych w otyłości i NAFLD wśród osób otyłych z NAFLD oraz bez cech stłuszczenia wątroby.



**Figure 7.** The number of scored points from the test with a high degree of complexity among patients with NAFLD and without fatty liver.

Rycina 7. Liczba punktów uzyskana z testu o wysokim stopniu trudności wśród pacjentów z NAFLD oraz bez cech stłuszczenia wątroby.

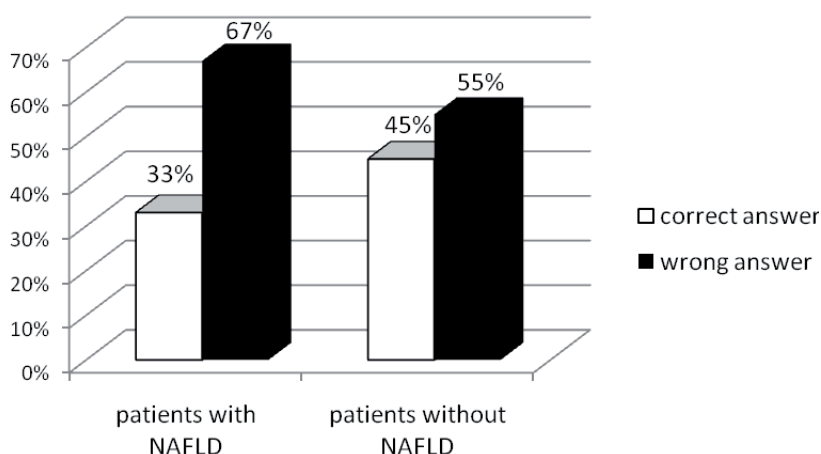


**Figure 8.** The knowledge of Body Mass Index among obese patients with NAFLD and without fatty liver.

Rycina 8. Znajomość pojęcia wskaźnika masy ciała u osób z NAFLD oraz bez cech stłuszczenia wątroby.

knowledge. Both in a group of patients who declared that have high level of knowledge and in a group of patients who declared that have low level of knowledge, the number of scored points was the same (table 4). It pointed out that respondents were unable to assess appropriately their own level of knowledge of dietary recommendations.

Noteworthy is the fact, that the majority of patients with NAFLD did not know the notion of Body Mass Index (BMI) (figure 8). Considering the knowledge of Glycemic Index (GI) the majority of patients with NAFLD as well as without fatty liver were not able to choose correct answer (figure 9).



**Figure 9.** The knowledge of Glycemic Index among obese patients with NAFLD and without fatty liver.

Rycina 9. Znajomość pojęcia indeksu glikemicznego u osób z NAFLD oraz bez cech stłuszczenia wątroby.

## Discussion

Nonalcoholic fatty liver disease is a significant clinical and social problem due to increasing number of patients who suffer from this condition. NAFLD may seem as a mild disorder because of the lack of distinct clinical symptoms but it can trigger serious consequences in form of nonalcoholic steatohepatitis (NASH), liver cirrhosis and hepatocellular carcinoma [11, 16]. Explicit treatment standards for NAFLD are not available so the healing process relies on therapeutic action on all pathogenic components of this disorder [13]. The first line therapy for NAFLD is change of lifestyle including increase in physical activity and change of dietary habits. The management of NAFLD includes also alleviation of insulin resistance, application of hypolipidemic agents, antioxidants and anti inflammatory agents [17].

The prevalence of NAFLD among obese Polish patients equals 78%. Comparing to other nations, the frequency of NAFLD in American population is about 25–93% and in Japanese about 60% of obese people [18]. The lower percentage among Japanese population can be a result of different dietary habits. Diet rich in polyunsaturated fatty acids in form of saltwater fish, drinking green tea rich in bioflavonoids and consumption of soy-

bean high in isoflavones prevent from NAFLD and obesity development [19, 20]. Nonalcoholic fatty liver disease in a Polish population occurred more often among men which confirms the earlier proven fact that NAFLD appears 3–5 times more often among men. Male sex is independent risk factor of NAFLD development [11, 13].

Analysing the group of patients with NAFLD, 59% of cases were newly diagnosed which indicates that more importance is attached to diagnosis of metabolic disturbances including nonalcoholic fatty liver disease but on the other hand it can be also a result of westernization and therefore negative change in a lifestyle which leads

to development of metabolic disturbances. NAFLD was diagnosed more often among patients from city (64% of cases) which can be explained by the easier and more convenient access to diagnostic tests like ultrasound or magnetic resonance imaging. The majority of patients with NAFLD were unemployed (64%) and had university education (41%).

Alarming is the fact that only 30% of respondents pointed out dietitian as a source of knowledge of nutritional recommendations. Qualified and experienced dietitian should educate and advise people on rational diet to increase nutritional value of their daily diet and also teach how to compose meals beneficial in the treatment of metabolic disorders like NAFLD. Significant number of patients declared that they use internet and magazines as a source of information which is often misleading.

Obese patients with NAFLD as well as without fatty liver did not possess sufficient knowledge of nutrients contained in certain products and did not know their influence on the course of NAFLD and obesity. Respondents had basic knowledge of culinary techniques, but they were not aware of the harmful impact of excessive amounts of fructose included in jams, honey and home-made compotes on the process of disease [5, 21]. The majority did not have knowledge that consuming oligo-

fructose contained in chicory, asparagus and artichoke can be beneficial for them due to their minimizing effects on the level of triglycerides and glycaemia [22, 23].

It was noted that the majority of patients did not know their body mass index which made them unable to control their own body mass. On the other hand, ignorance of glycemic index notion causes that respondents were incapable of preparing adequate and balanced meals. Knowledge of glycemic index and its application in daily practice can prevent from NAFLD development. Valtuena proved that consumption of products with high glycemic index leads to increase in total fat content and raises triglycerides level [24].

Lifestyle alteration including nutritional education is the essence of the treatment of metabolic disorders. Patients with NAFLD as well as with obesity should obtain adequate and reliable information in response to healthy products choice, knowledge of nutrients included in various food types and their impact on the course of NAFLD and obesity. Need for education especially of people with lower level of education cannot be overlooked. More attention should be paid to the education of people at the level adjusted to their own abilities. Nutritional education should be introduced immediately at the time of obesity diagnosis in order to prevent from development of metabolic complications like NAFLD. Doctors of various medical specialties should bear in mind that for successful education process of the patient crucial role is played by inner motivation as well as active patients commitment. Patient should be positively motivated in order to achieve therapeutic success.

### Conclusion

The number of patients with obesity and related metabolic disorders is increasing rapidly worldwide. The frequency of NAFLD among obese Polish people equals 78%. Due to lack of exact treatment standards for NAFLD, lifestyle alteration including increase in physical activity and dietary modifications plays important role in a prevention and treatment of NAFLD. The patient's knowledge of nutritional recommendations together with products choice, nutrients content in certain products and their impact on obesity and NAFLD course is insufficient. Ignorance of basic notion related to body mass control and preparation of proper well-balanced meal is alarming. It is essential to raise awareness among obese people of the influence of their lifestyle on their state of health and to accommodate the level of knowledge of nutritional recommendations to their own abilities.

### Abbreviations

NAFLD: nonalcoholic fatty liver disease; BMI: body mass index; NASH: nonalcoholic steatohepatitis.

### Competing Interests

No author has any conflicts of interest.

### Authors' Contributions

AK and HSK designed this research and were responsible for the statistical analysis. All authors have taken part in interpretation of results. All authors analysed and contributed to the preparation of this manuscript.

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