

THE ROLE OF NUTRITION AND PHYSICAL EXERCISE IN THE TREATMENT OF WOMEN WITH IMPAIRED GLUCOSE TOLERANCE

Insulin resistance is the impaired homeostasis of glucose, reducing the sensitivity of muscles, adipose tissue, liver and other body tissues to insulin. The purpose of the study was to assess dietary behaviour and to analyse the impact of diet therapy and physical exercise on the condition of women diagnosed with insulin resistance or diabetes mellitus type 2. Empirical poll method in 2014 in Gdansk, Poland, in a group of 100 women over 19 years of age. All the respondents suffered from insulin resistance or diabetes mellitus type 2. Women suffering from insulin resistance or diabetes mellitus type 2, and dieting in conjunction with any form of physical activity, declared improvement of their condition. The group of respondents who did not comply with the dietary recommendations were found overweight and affected by the 1st degree obesity.

Keywords: dietary behaviour, physical exercise, BMI, insulin resistance, diabetes mellitus type 2.

INTRODUCTION

Insulin resistance is the impaired homeostasis of glucose, reducing the sensitivity of muscles, adipose tissue, liver and other body tissues to insulin [2]. Overweight and obesity are one of its causes. An essential condition for improving blood sugar, blood pressure, and lipidemia control is to reduce body weight. Reduction of weight only by 10% improves glucose tolerance, lowers insulinemia, triglyceride levels, and allows for greater improvements in the field of metabolic disorders [10].

Physical activity combined with a diet should be the primary way to treat insulin resistance and to support the diabetes mellitus type 2 treatment process. Movement and physical exercises are beneficial for all patients with diabetes, because it increases tissue sensitivity to insulin, thus improving glucose homeostasis [15]. In case of diabetes mellitus type 2, we have to deal with changes in lipid metabolism related to the increased levels of triglycerides, reduced HDL cholesterol, and a mostly proper levels of LDL cholesterol. These changes, including increasing the number of atherogenic particles of LDL cholesterol and elevated levels of triglycerides, are closely related to insulin sensitivity changes characteristic of diabetes mellitus type 2 [5, 13, 14, 17]. Due to insulin resistance in the skeletal muscles, the energy from consumed carbohydrates is used for the synthesis

of triglycerides in the liver, which in turn causes the production of a large number of large atherogenic lipoprotein particles with high contents of triglycerides, such as VLDL [9, 11]. The increase in the level of cholesterol in the blood serum, thus accelerating the development of atherogenic changes in arterial vessels, is influenced by the amount of consumed saturated fatty acids and trans isomers of fatty acids, which cause an increase in LDL cholesterol and decrease in HDL cholesterol [3, 8].

The principles of dietary prevention should determine the correct ratio of n-3 monounsaturated fatty acids to n-6 fatty acids supplied with food and the consumption of essential fatty acids (EFAS), including linoleic acid. The source of monounsaturated fatty acids in diet is olive oil, peanut oil and rapeseed oil with erucic acid content of 1–2%. Vegetable oils (sunflower and soybean oil), as well as saltwater fish (mackerel, herring and salmon) are particularly rich in EFAS. EFAS (n-3) apart from positively reducing concentrations of triglycerides, inhibit blood clotting and thus contribute to reducing the risk of myocardial infarction [1, 12, 16].

Insulin resistance has an important pathogenetic role in many other, except for diabetes mellitus type 2, conditions and disorders. It is increased during puberty, pregnancy, in old age, in people non-performing muscle work, in obesity, hypertension, dyslipidaemia, it is the risk factor of atherosclerosis, plays a role in the dysfunction of the ovaries, occurs in rare special syndromes with very high primary insulin resistance. This may be a result of taking certain medications, such as steroids, progesterone, higher doses of oestrogens, thiazides, beta-blockers and others. It occurs without symptoms in externally healthy persons, varies during the day and at longer periods, depends on physical effort, as well as diet [4].

Regular physical activity is a perfect supplement to dietary treatment. Regardless of reducing or not reducing adipose fat placed intra-abdominally, physical activity increases the sensitivity of tissues to insulin. GLUT4 transport proteins, due to physical effort move towards cell membrane and allow for passive glucose transport into the cell by the so-called facilitated diffusion. Movement not only increases the number of GLUT4 molecules in cell membrane, but also their activity. The more intense workout, the greater is the consumption of muscle glycogen and higher levels of strain GLUT4 molecules. The consequence of this is the activation of the transmembrane transport, as well as the increase in insulin intensity and improvement of glucose tolerance. Movement also increases availability of insulin to the muscles, thus causing capillaries to grow in muscle tissue. Increased insulin sensitivity is maintained even 72 hours after training [2].

The aim of the poll was to assess dietary behaviour and to analyse the impact of diet therapy and physical exercise on the condition improvement of women diagnosed with insulin resistance or diabetes mellitus type 2.

1. MATERIALS AND METHODS

The empirical poll was conducted with the diagnostic poll method in 2014 in Gdansk, Poland, in a group of 100 women over 19 years of age. All the

respondents suffered from insulin resistance or diabetes mellitus type 2. An independent questionnaire with closed-end questions was used in the poll. The study covered determination of BMI index, evaluation of the knowledge on dietary recommendations in insulin resistance and diabetes, dietary behaviour, physical activity and the types of diet used by the respondents.

2. RESULTS

One of the reasons for the prevalence of insulin resistance and diabetes mellitus type 2 is overweight and obesity, therefore, on the basis of the data on height and weight, given by the respondents, the BMI index was calculated dividing body weight (kg) by squared increase (m^2). On the basis of the obtained results, 53% of the respondents had proper body weight (BMI 18.5–24.9), 30% were overweight (BMI 25–29.9), and 17% were affected by the 1st degree obesity (BMI of 30–34.9).

It was found that only 48% of the respondents consumed recommended number of meals from 5 to 6 a day (including 15% were found to be overweight and 8% obese), 45% 3–4 meals a day (including 13% was found to be overweight and 4% obese), and 7% 1–2 meals a day (including 2% were found to be overweight, and 5% obese). Proper intervals between meals should be from 3 to 5 hours. Prolonged intervals may cause metabolic changes, as well as a reduction in the level of sugar in the blood, leading to fatigue and reduced physical and mental efficiency. It was found that 74% of the respondents consumed meals in recommended intervals of 3–5 hours (42% had a normal body weight, 26% were overweight, and 6% obese), 21% had intervals shorter than 2 hours between meals (11% had a normal body weight, 2% were overweight, and 8% obese), and 5% had intervals longer than 5 hours (2% were overweight and 3% obese). According to the dietary recommendations, it is suggested to drink from 1.5 to 2 litres of fluids a day. First and foremost, it is recommended to drink still mineral water, because carbonated beverages stimulate the appetite and provide more calories. It is also recommended to drink water before meals or 2 hours after a meal. It was found that the correct volume of fluids a day was consumed only by 47% of the respondents (including 27% had a normal body weight, 19% were overweight and 1% obese), 41% 1 litre of fluids a day (including 26% had a normal body weight, 9% were overweight, and 6% were obese), and 12% less than one litre of fluids a day (including 2% were overweight and 10% obese). 64% of the women had acquired their knowledge about the principles of healthy nutrition from the media (37% had a normal body weight, 19% were overweight and 8% obese), 18% from family home (9% had a normal body weight, 8% were overweight and 1% obese), 8% from school (7% had a normal body weight and 1% were overweight), and 10% said that they did not have knowledge on the subject. In the last group, 2% were overweight and 8% were obese.

In insulin resistance and diabetes mellitus type 2, it is important to diet in order to reduce weight. Reduction in body weight increases tissue sensitivity to insulin, and also improves blood sugar control. It also allows lowering the levels

of cholesterol and triglycerides. Reduction in body weight by 10 kg, decreases triglyceride concentration by ~ 30%, total cholesterol levels by ~ 10% and LDL-cholesterol levels by ~ 15%. 100% of the women declared consulting with a dietitian, including 88% had applied dietary recommendations (52% of the respondents had a normal body weight, 19% were overweight and 17% obese). A diet with low -glycemic index were used by 41% of the women (including 30% had a normal body weight, 8% were overweight, and 3% obese), negative energy balance diet was applied by 38% of the women (including 17% had a normal body weight, 10% were overweight, and 11% obese), 9% of the women had staple diet (including 5% had a normal body weight, 1% were overweight, and 3% obese). 12% of the respondents did not apply any diet and as many as 11% of them were overweight (only one person had a normal body weight). It was found that only 5% of the respondents had used a diet to maintain normal body weight before being diagnosed with insulin resistance (all had normal body weight), and 95% had not used nutritional therapy before (including 48% had a normal body weight, 30% were overweight, and 17% obese). All the respondents dieting before being diagnosed with the disease, applied 1200 kcal diet, i.e. a diet with high negative energy balance, which applied from 10 to 12 days, allows reducing body weight down to 10 kg.

It was found that 72% of the respondents were physically active (52% had a normal body weight, 16% were overweight, and 4% obese). In the group of women not exercising (28%), only one person had a normal body weight, 14% were overweight and 13% obese. All ladies not doing any sports declared that the only form of physical activity they could do is to walk briskly. Before the disease had been diagnosed, there were only 8% of the physically active respondents (including 7% had a normal body weight, and 1% were overweight), and as many as 64% started practicing sports after diagnosis of the disease (including 45% had a normal body weight, 15% were overweight, and 4% obese). 43% of the respondents exercised from 3 to 4 times a week (including 32% had a normal body weight, 9% were overweight, and 2% obese), 29% exercised from 1 to 2 times a week (including 20% had a normal body weight, 7% were overweight, and 2% obese). In the exercising group, 15% of the women preferred walking briskly (including 8% had a normal body weight, 5% were overweight, and 2% obese), 36% preferred slow pace running (including 26% had a normal body weight, 7% were overweight and 3% obese), 8% dancing (all the respondents had a normal body weight), and 13% preferred fitness or aerobics exercises (including 11% had a normal body weight, and 2% were overweight).

3. DISCUSSION

Diet and physical exercise are among the non-drug treatments of diabetes. The poll assessed the condition of the women by asking them a question: do you still suffer from insulin resistance or diabetes mellitus type 2 64% of the respondents declared improvement of their condition (including 51% had a normal body weight,

10% were overweight, and 3% obese). 3% of the women declared that their blood sugar level had improved after pharmacotherapy, and all had a normal body weight. The other respondents said that they owe improvement of their condition to physical exercises and to the followed dietary recommendations (61%, including 48% had a normal body weight, 10% were overweight, and 3% were affected by the 1st degree obesity). 36% of the women reported no improvement in their condition, including only 2% had a normal body weight, as many as 20% were overweight and 14% were affected by the 1st degree obesity. Kang et al. (1996) found that intense exercise performed regularly in a short period of time has a favourable effect on the insulin activity, as well as glucose tolerance [6]. It is equally important to note the relationship between exercise intensity and its duration. The greater intensity of exercise, the shorter exercise and vice versa. The session should take between 30–60 minutes. If a patient is not able to perform a continuous 30-minute workout, a short break is recommended and then return to exercise [15].

The studies showed that in a group of 66% of women using diet combined with physical activity in the treatment of insulin resistance and diabetes mellitus type 2, as many as 64% of the respondents had improved their health. The long-term interrupted physical effort of moderate intensity can decrease the prevalence of diabetes, obesity and other illnesses related to improper lifestyle [7].

CONCLUSIONS

1. The women suffering from insulin resistance or diabetes mellitus type 2, dieting and physically active, declared improvement of their condition.
2. Most of the respondents, doing any form of physical activity, had a normal body weight.
3. All examined women had consulted a dietician and most followed dietary recommendations.
4. The group of respondents, who did not comply with the dietary recommendations and were not physically active, were found overweight and affected by the 1st degree obesity, which may be the reason for difficulties in the treatment of insulin resistance and diabetes mellitus type.

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ROLA ŻYWIENIA I WYSIŁKU FIZYCZNEGO W LECZENIU KOBIET Z UPOŚLEDZONĄ TOLERANCJĄ GLUKOZY

Streszczenie

Insulinooporność jest to zaburzenie homeostazy glukozy, polegające na zmniejszeniu wrażliwości mięśni, tkanki tłuszczowej, wątroby oraz innych tkanek organizmu na insulinę. Celem badania była ocena zachowań żywieniowych oraz analiza wpływu dietoterapii i wysiłku fizycznego na poprawę stanu zdrowia kobiet ze zdiagnozowaną insulinoopornością lub cukrzycą typu 2. Badanie empiryczne przeprowadzono metodą sondażu diagnostycznego w 2014 roku w Gdańsku, w grupie 100 kobiet, które ukończyły 19. rok życia. Wszystkie respondenci chorowały na insulinooporność lub cukrzycę typu 2. Kobiety chorujące na insulinooporność lub cukrzycę typu 2, stosujące dietę w połączeniu z dowolną formą aktywności fizycznej, zadeklarowały poprawę swojego stanu zdrowia. W grupie respondentek, które nie przestrzegały zaleceń dietetycznych, stwierdzono nadwagę i otyłość I stopnia.

Słowa kluczowe: zachowania żywieniowe, dieta, aktywność fizyczna, wskaźnik BMI, insulinooporność, cukrzyca typu 2.