

The role of lifestyle changes in the treatment of polycystic ovary syndrome

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Abstract

Polycystic ovary syndrome is one of the most common endocrinopathy of the reproductive age. Heterogeneity of its clinical symptoms is related to the presence of a number of phenotypes of this dysfunction, hence the necessity for individualized treatment is needed. A change of a lifestyle, well-balanced diet and physical activity are the most effective medical way contributing to the improvement of carbohydrate metabolism parameters and weight reduction which reactivates regular ovulation and facilitates getting pregnant. A change of diet should encompass determination for appropriate calorie requirements, content of particular macroelements as well as selection of the products with low glycemic index. Vitamin D supplementantation as well as inositol is of great importance as well. Both these ingredients are extremely effective in treating the disorders resulting from polycystic ovary syndrome. Adding them to a daily diet contributes to improving carbohydrate metabolism and reducing insulin resistance. Additionally, they accelerate weight loss, regulate menstrual cycles and enhance reinstating regular ovulation, hence facilitate to get pregnant. Together with introducing dietary changes, patients should be reminded about the crucial role of physical activity. A kind of exercises should be chosen according to a patient's preferences and be adjusted to her actual health condition. Only physical activity done with pleasure may become a healthy custom improving the effects of a proper diet.

INTRODUCTION

Lifestyle is one of the most important factors influencing general health condition. Individually adjusted diet as well as physical activity contribute to metabolism regulation and healthy weight maintenance. More and more scientists inform that overweight is not only a risk factor in case of the diseases such as: type 2 diabetes, arterial hypertension, cancer, liver and bile duct diseases

or osteoarthritis, but also negatively influences regulation of menstrual cycle and ovulation and, consequently, impedes fertility and getting pregnant (Pasqualin *et al.* 1997; Pettigrew & Hamilton-Fairley 1997; Hajduk 2012). Due to the various phenotypes of the patients with polycystic ovary syndrome, they suffer from different clinical symptoms and require an individual approach (Shi *et al.* 2007). The treatment based on a change of lifestyle, an appropriate diet and physical activity,

is the effective way to overcome overweight, obesity, metabolic and hormonal disruption as well as ovulation and menstrual cycle disorders (Lagro 2002; Stanska *et al.* 2011). The group of overweight patients require such diet and physical effort which, on one hand, will cause weight reduction and stabilization of carbohydrate and lipid metabolism, and on the other hand, will be adjusted to body constraints resulting from overweight and reduced physical efficiency. In the group of patients with healthy weight, the ones suffering from insulin resistance, hence fraught with high risk of diabetes and cardiovascular diseases should to be paid special attention (Kuligowska-Jakubowska *et al.* 2012). Reaching healthy weight and reducing the level of insulin resistance contribute to lowering the lever of androgen concentration, regulating ovulation and menstrual cycles and, consequently, boosting fertility and increasing the chance for getting pregnant. Therefore, it should be emphasized that a change of lifestyle based on a proper diet with the appropriate energy requirements and macronutrients proportions as well as physical activity which intensity and duration is adjusted to a patient's health condition should be fundamental procedure in PCOS treatment.

DIET

A well-balanced diet considering the appropriate caloric intake and proportions of the particular macroelements: proteins, fats and carbohydrates is the basic tool in healthy weight maintenance. Each patient's body weight should be calculated by BMI classification and waist circumference. The patients suffering from overweight or obesity require such dietary treatment which will cause effective and lasting loss of weight. The Polish Diabetes Society (2015) recommends a diet with a lower caloric intake in relation to the individual energy requirements determined on the basis of the resting metabolic rate. The caloric deficit of 500–800 kcal per day which enables the loss of 0.5–1 kg per week is considered as the safe one (Respondek 2011). One should remember that weight loss being a result of its reduction may result in lowering the basal energy expenditure and prolonging the time of weight loss. Therefore, the patients under dietary treatment require constant monitoring of weight loss and adjusting the current energy requirements to the present weight. A choice of particular macroelements proportion should be adjusted to the individual patient's needs and pref-

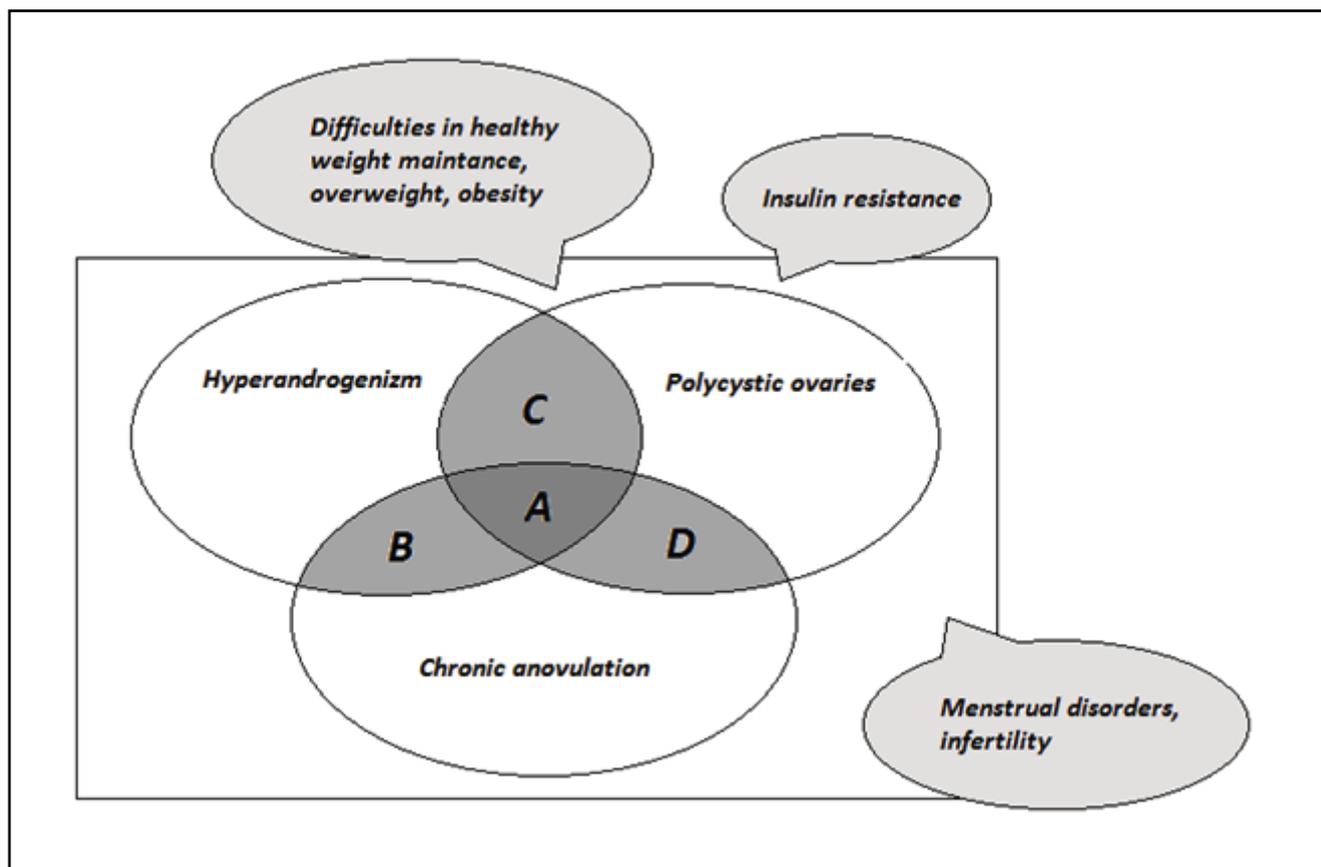


Fig. 1. The diversity of phenotypes of PCOS. A – hyperandrogenism, polycystic ovaries (USG), chronic anovulation, B – hyperandrogenism, chronic anovulation, C – hyperandrogenism, polycystic ovaries (USG), D – chronic anovulation, polycystic ovaries (USG). [Sarantis L, Diamanti - Kandarakis E. Polycystic ovary syndrome: Definitions, Phenotypes and Diagnostic Approach (2013). Polycystic Ovary Syndrome. Novel Insights into Causes and Therapy. Front Horm Res. Basel, Karger, 2013, vol 40, 1–21 – in modification of Smyka M.]

erences. They may be as follow: 10–25% for proteins, 45–65% for carbohydrates, 20–35% for fats of the entire diet energy (PTD 2015). However, the Gower's (2013) research shows that a diet with lowered amount of carbohydrates (lower-CHO: 55% carbohydrates, 18% proteins, 27% fats vs. STD: 43% carbohydrates, 18% proteins, 39% fats) is more effective in reducing adipose tissue and standardizing the carbohydrate metabolism parameters (Figure 2). It is especially important in the group of patient suffering from insulin resistance, therefore ovulation disorders and difficulties in getting pregnant.

The right selection of products as far as glycaemic index is concerned is the key in changing a diet. Glycaemic index (GI) is defined as blood glucose increment in two hours after consuming a particular product containing 50 grams of digestible carbohydrates, which is presented as the percentage of the same carbohydrates amount included in white bread. The choice of the products with low glycaemic index GI (0–55) rather than those of intermediate (56–70) or high GI (>70) guarantees lower blood glucose increment and, consequently, the lower insulin dump. This effect is beneficial, especially for the patients with obesity and insulin resistance or type 2 diabetes (Radulian *et al.* 2009, Marsh *et al.* 2010). Furthermore, consumption of low GI products generates the growth of energy expenditure in the form of thermogenesis and fat burning intensification, which may contribute to reducing the adipose tissue. It should be noticed that GI level is influenced not only

by a type of product, but also a form of its consumption as well as the other ingredients present in the diet at the same time (Radulian *et al.* 2009, Respondek 2011).

In order to achieve the lasting results, it is crucial to make the patients aware of the fact that proper weight maintenance is connected with introducing some general dietary changes rather than short restrictions and falling back into old diet habits.

VITAMIN D

Recent years of research on pleiotropic effects of vitamin D has revealed its significant role in developing risk factors for cardiometabolic diseases: type 2 diabetes, arterial hypertension, and metabolic syndrome. Numerous papers emphasise that vitamin D deficiency contributes to pathogenesis of insulin resistance, dyslipidaemia and induction of inflammations and affects calcium metabolism. Moreover, vitamin D influences the level of androgens and conduces to regulation of menstrual cycle and ovulation, thus influences fertility (Misiorowski 2012, Thomson *et al.* 2012, Brzozowska & Karowicz-Bilińska 2013). It has been proved that the excess of adipose tissue in obese people reduces the bioavailability of vitamin D, which ensues from its sequestration in excessively developed adipose tissue. Further research has proved that sequestered vitamin D can be released to blood during loss of body mass (Wąsowski *et al.* 2012). The result of the research comparing the level of 25(OH)D in the serum of healthy women and

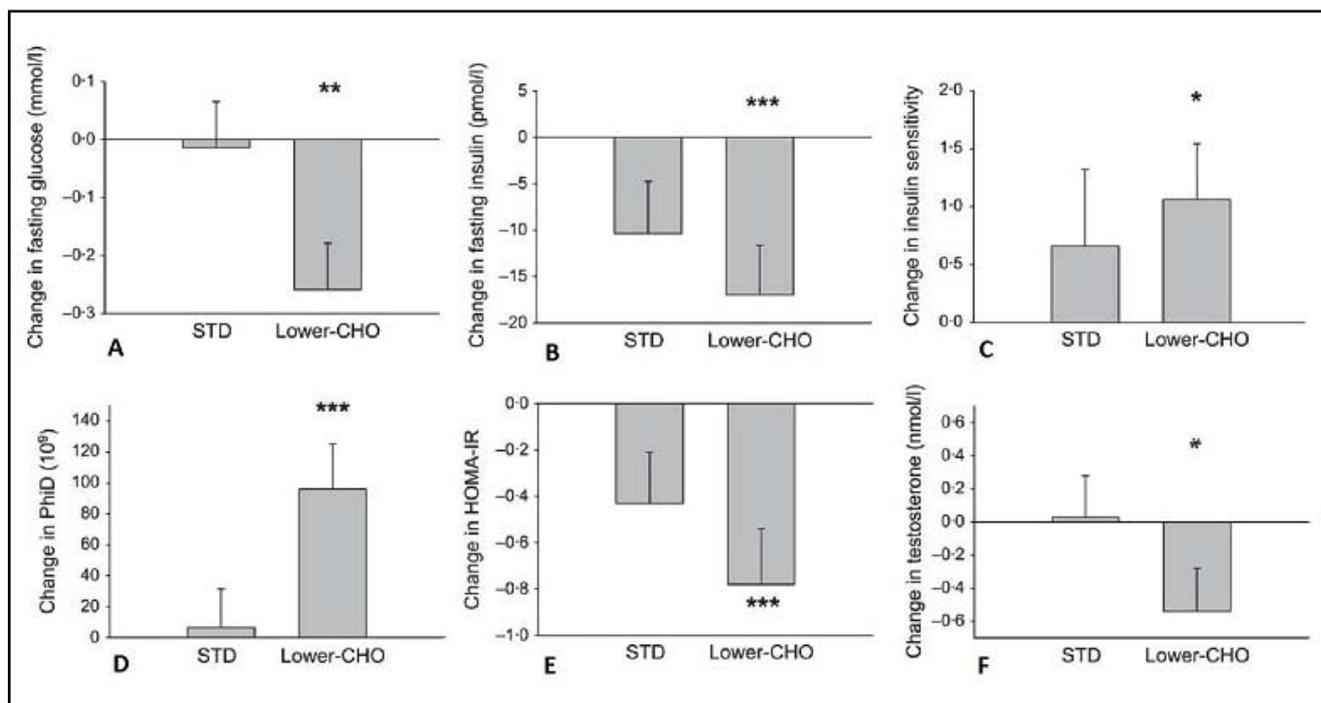


Fig. 2. Comparison of standard diet (STD) and the one with lower amount of carbohydrates (lower-CHO): A – fasting glucose level, B – fasting insulin level, C – insulin sensitivity, D – change of beta cell response for glucose increment, E – HOMA-IR, F – testosterone level. [Gower BA, Chandler-Laney PC, Ovalle F, Goree LL, Azziz R, Desmond RA, *et al.* (2013). Favourable metabolic effects of a eucaloric lower-carbohydrate diet in women with PCOS. *Clin Endocrinol (Oxf)*. **4**: 550–557].

Tab. 1. The factors influencing the level of glycaemic index of the products present in a diet.

Factors contributing to GI reduction:	Factors contributing to GI increment:
High fiber content	Low fiber content
High ratio of amylose to amylopectin	Low ratio of amylose to amylopectin
Presence of proteins and fats	Lack of other macroelements
Presence of galactose and sucrose	Presence of fructose and lactose (but may contribute to insulin resistance and hepatic steatosis)
Raw products	Processed food: boiled, roasted, grinded
Slow food consumption	Fast food consumption

[Radulian G, Rusu E, Dragomir A, Posea M (2009). Metabolic effects of low glycaemic index diets. Nutr J. 8: 5 – in modification of Smyka M.]

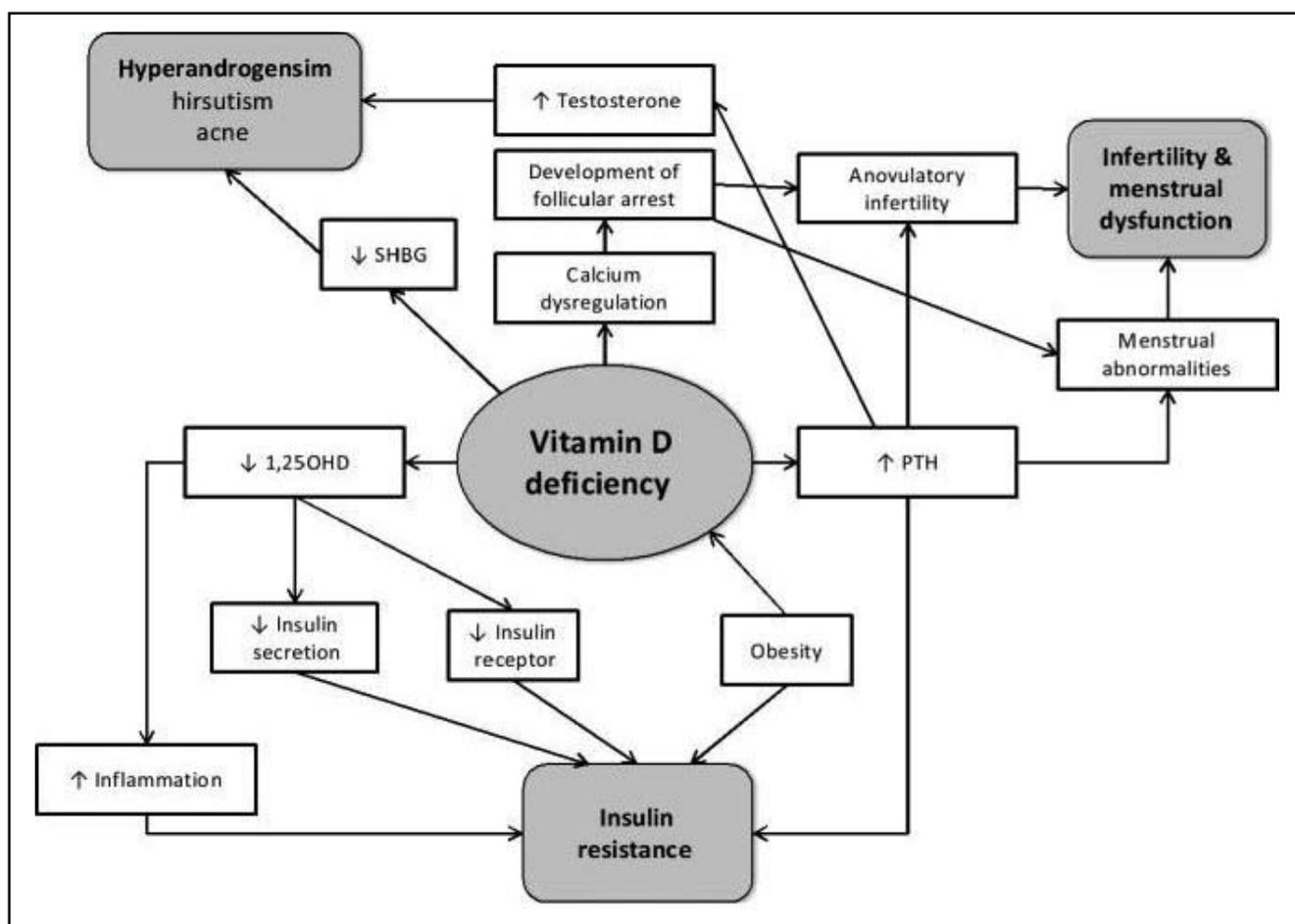


Fig. 3. The influence of vitamin D on hormone balance. [Thomson RL, Spedding S, Buckley JD (2012). Vitamin D in the Aetiology and Management of Polycystic Ovary Syndrome. Clin Endocrinol (Oxf). 3: 343–350]

women with PCOS indicates significant discrepancies. It is certain, however, that 25(OH)D level in obese women with PCOS is really decreased (Thomson *et al.* 2012). Total vitamin D demand is satisfied through its dermal synthesis from ultraviolet radiation and, to a slight extent, through food intake. Owing to the latitude in which Polish population lives, it is particularly prone to vitamin D deficiency, especially in the autumn-winter time. Moreover, patients with PCOS, due to lack

of acceptance of their appearance and, frequently, difficulties in body exposure, are to even greater degree prone to insufficient dermal synthesis (Wąsowski *et al.* 2012, Kozłowski *et al.* 2014). Vitamin D supplementation proves successful especially in the group of obese patients, patients with insulin resistance and low ovarian reserve, as it decreases insulin resistance and conduces to infertility treatment (Brzozowska *et al.* 2013, Grzechocińska *et al.* 2013). Taking into consideration

numerous advantages ensuing from vitamin D intake and the common occurrence of its deficiencies in general population, the most recent guidelines recommend vitamin D supplementation (800–2000 IU/day) to all adults, depending on the body mass, from September to April or throughout the year in case of insufficient dermal synthesis, and increased dose of 1600–4000 IU/day for obese people throughout the year (Pludowski *et al.* 2013).

INOSITOL

Inositol and its stereoisomers: myo-inositol (MYO) and D-chiro-inositol (DCI) gained recognition in PCOS treatment owing to their regulatory influence on hormone balance. Myo-inositol, endocellular relay of insulin signal, conduces to the improvement of parameters determining insulin resistance: HOMA index and the concentration of insulin in glucose tolerance test. Moreover, it decreases LH and prolactin concentration, improves LH/FSH relation and decreases the concentration of free testosterone, contributes to a significant decrease in the concentration of dehydroepiandrosterone (PTG 2004, Constantino *et al.* 2009, Jakimiuk & Szamatowicz 2014). It regulates menstruation cycles and the ovulation occurrence, which facilitates conception. The research comparing the application of myo-inositol and metformin in the treatment of metabolic and hormonal disorders in patients with PCOS shows their similar effectiveness as regards reduction of body mass, regulation of menstrual cycles and improvement of metabolic parameters, however, only myo-inositol proved effective in decreasing HOMA index. It is considered more effective also because of the fact that it is better tolerated and does not cause side effects, which are frequently caused by metformin: nausea, emesis, stomach ache and diarrhoea (Riju *et al.* 2015). Owing to numerous advantages and safety, Polish Gynaecological Society (2004) recommends taking medicines containing myo-inositol to regain correct metabolic and endocrinological parameters and regulate ovulation.

PHYSICAL ACTIVITY

Numerous publications indicate that diet and regular physical activity, facilitating body mass maintenance or reduction, diminish hormone imbalance in patients with PCOS. Reduction of insulin resistance, decrease in testosterone concentration and increase in SHBG concentration regulate menstruation and spontaneous ovulations, which improves fertility. One of the bigger observation research conducted on a group of women with PCOS indicated that a group of physically active women were characterised by lower BMI (29.9 kg/m² +/- 7.8 vs. 33.7 kg/m² +/- 9.3 *p*=0.009), lower waistline (88.9 cm +/- 18.5 vs. 98 cm +/- 24.4 *p*=0.03) and lower body mass fluctuation (19.2 +/- 17.3 vs. 28.0 +/- 22.3 *p*=0.008) in comparison with a group of inactive

women. Greater concentration of sex hormones binding proteins SHBG (68.4 nmol/L +/- 7.3 vs. 40.4 nmol/L +/- 5.9 *p*=0.006) and lower values of fasting glycaemia (87.8 mg/dl +/- 12.1 vs. 94.0 mg/dl +/- 21.3 *p*=0.04) were detected in active women. Moreover, it has been observed that physically active women are half as much in threat of depression, which is extremely important as regards disorders they face (Lamb *et al.* 2011). Knowler's (2002) research has shown that modification of lifestyle is far more effective in diabetes prevention than metformin. It has been observed in a group of over 3000 thousand patients with carbohydrate tolerance disorders that the introduction of physical activity at least 150 min. a week, the aim of which is at least 7% reduction of the initial body mass, decreased the number of diabetes cases of 58%, whereas in a group of patients taking metformin (2x850 mg/day) the reduction equalled 31%. Glycaemia improvement obtained as a result of "exertion therapy" ensues not only from body mass reduction but it is after-exertion intensification of insulin activity, which is necessary for the reproduction of used muscle glycogen. The greater the physical exertion, the greater glycogen use, thus greater concentration and activity of GLUT4 proteins. GLUT4 proteins increase transmembrane glucose transport, insulin activity and glucose tolerance (Wright & Swan 2001; Bogdański *et al.* 2008). The introduction of additional physical activity to daily routine requires thorough analysis of patient's health, determination of her preferences as regards physical activity, motivation to regular exercises and a meticulous plan of their intensity, duration and frequency. A preferred form of activity is long-term oxygen exertion involving big muscles groups: endurance march, cycling, swimming, aerobic, team games and dancing. Obese patients require special selection of the form of activity. Owing to considerable loading on the locomotor system and movement restrictions, physical activity should be planned in a way that it does not constitute additional loading on joints. Swimming, aqua gym, and cycling prove a good choice. The intensity of exercises should be determined on the basis of 60–70% of maximum pulse, which can be easily calculated with the following equation: HR_{max}=220–age (Plewa & Markiewicz 2006; Respondek 2011). From a practical point of view, it transpires that controlling one's own pulse can be onerous. In this case, it is useful to apply the rule "go and talk", according to which it is accepted that the possibility of talking freely during physical exercises indicates oxygen character of exertion. It is recommended that additional physical exertion is undertaken every day, at least for 30 min. However, in the initial stage of exercising, if the patient is not able to continue exertion for the recommended time, trainings should be started as 10–15 minute sessions and their duration gradually increased. Additional sessions of resistance training undertaken 2–3 times a week, involving 30–50% of maximum muscle strength are beneficial in respect

of prevention of muscle tissue mass decrease, which results in decrease in resting metabolic rate, which can occur during body mass reduction in overweight or obese patients (Plewa & Markiewicz 2006). An important aspect, which should be taken into consideration is that the undertaken physical activity should constitute a pleasurable alternative of spending free time. Only willingly undertaken exertion will have the chance of becoming a healthy habit that bring expected and lasting results.

CONCLUSIONS

- Due to the numerous advantages, a change of a lifestyle including a well-balanced diet and physical activity should be the preferred way of PCOS treatment proposed to each patient.
- Individually adjusted diet needs to consider a patient's preferences, adequate energy requirements and proportions of the particular macroelements. Selection of low glycemic products GI<55 is advisable. Patients needs to be instructed that a new diet is not a short-term therapy but a long-lasting change of habits.
- D vitamin supplementation is advisable in a daily dose of 800–2000 IU for the patients with healthy weight and 1600–4000 IU for the patients with obesity in the period of September till April or throughout the whole year in case of insufficient skin synthesis.
- Inositol dosage is the preferred treatment especially in case of patients suffering from hyperandrogenism, insulin resistance as well as ovulation and menstrual cycle disorders.
- The additional physical activity should be individually adjusted to each patient's preferences and health condition. At least 30 minutes aerobic exercises per day are advisable. Adding further sessions of resistance training is advantageous in preventing the muscle mass reduction and lowering the resting metabolic rate.

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