CIUŁEK, Urszula, BILSKA, Wiktoria, DUBIŃSKA, Michalina, PADUCH-JAKUBCZYK, Wiktoria, ZDUŃCZYK, Wiktoria, ŻYDEK, Ada and DOBOSZ, Anna. Polycystic ovary syndrome: the impact of diet and physical activity on the course of the disease. Quality in Sport. 2024;19:54219. eISSN 2450-3118.
https://dx.doi.org/10.12775/QS.2024.19.54219
https://apcz.umk.pl/QS/article/view/54219

The journal has had 20 points in Ministry of Higher Education and Science of Poland parametric evaluation. Annex to the announcement of the Minister of Higher Education and Science of 05.01.2024. No. 32553.
Has a Journal's Unique Identifier: 201398. Scientific disciplines assigned: Economics and finance (Field of social sciences); Management and Quality Sciences (Field of social sciences).
Punkty Ministerialne z 2019 - aktualny rok 20 punktów. Załącznik do komunikatu Ministra Szkolnictwa Wyższego i Nauki z dnia 05.01.2024 r. Lp. 32553. Posiada Unikatowy Identyfikator Czasopisma: 201398.
Przypisane dyscypliny naukowe: Ekonomia i finanse (Dziedzina nauk społecznych); Nauki o zarządzaniu i jakości (Dziedzina nauk społecznych).

The authors declare that there is no conflict of interests regarding the publication of this paper.
Received: 11.08.2024. Revised: 19.08.2024. Accepted: 29.08.2024. Published: 01.09.2024.

Polycystic ovary syndrome: the impact of diet and physical activity on the course of the disease

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Abstract

Introduction and Objective: Polycystic ovary syndrome (PCOS) is the most common endocrine disorder in women of reproductive age, affecting between 6% and 26% of women. It is associated with a number of other conditions such as infertility, insulin resistance and obesity. The aim of this article is to discuss the current state of knowledge on the influence of dietary habits and physical activity on polycystic ovarian syndrome, and their importance in the treatment and prevention of complications of this disease.

Review and Methods: Review and summary of studies and meta-analysis of studies available in open-source format on PubMed and Google Scholar.

Abbreviated Description of the State of Knowledge: More than 50% of patients with polycystic ovary syndrome are obese, which contributes to the development of insulin resistance, hyperinsulinemia and other disorders of carbohydrate and lipid metabolism. These disorders in turn lead to weight gain and hormonal imbalance, creating a 'vicious circle' between the causes and effects of the disease.
Therefore, preventing and treating obesity itself is extremely important in PCOS. A balanced diet and regular exercise will help to reduce fat. Adopting healthy eating habits and increasing physical activity has a positive effect on hormone management, improving fertility and reducing hirsutism or acne. It also helps to improve wellbeing and reduce symptoms of mental health problems.

Conclusions: The most effective methods of treating and alleviating the symptoms of polycystic ovary syndrome are the implementation of a balanced diet and increased physical activity. It is important to individualise the treatment plan and adapt it to the needs of each patient.
Keywords: PCOS, Diet, Physical Activity

Introduction

Polycystic ovary syndrome (PCOS) is a heterogeneous disorder characterised by clinical manifestations such as menstrual irregularities, hyperandrogenism (acne, hirsutism, androgenetic alopecia) and an increased number of ultrasound-visible antral follicles [8]. PCOS affects between 6% and 26% of women of reproductive age worldwide, making it the most common endocrine disorder in gynaecology [8]. Its prevalence and association with numerous health complications highlight the importance of understanding and managing this condition.
In addition to its direct reproductive consequences, PCOS is associated with health problems such as metabolic syndrome, cardiovascular disease, insulin resistance, type 2 diabetes and psychiatric disorders [8]. The complexity of PCOS requires a comprehensive approach to its management. The aetiology of PCOS involves a combination of genetic predisposition and environmental factors, making diagnosis and treatment difficult [8].
Lifestyle changes are key to the management of PCOS. A balanced diet and increased physical activity are the best non-pharmacological treatments for PCOS. Obesity and insulin

resistance, which are often associated with PCOS, exacerbate symptoms and contribute to their severity [3]. Weight management through diet and exercise helps to reduce hyperandrogenism, improve menstrual regularity and increase insulin sensitivity [3].

Numerous studies have shown that lifestyle interventions significantly improve clinical outcomes in women with PCOS, making them the cornerstone of treatment [5]. Dietary changes, especially those that lower the glycaemic index, reduce insulin levels and improve reproductive function [6]. Regular physical activity promotes weight loss, improves insulin sensitivity and reduces the risk of cardiovascular complications [5].

The main aim of this article is to summarise what is known about PCOS, with a particular focus on the impact of diet and physical activity on the course of the disease. Recent research into the genetic basis of PCOS and the psychological impact of the syndrome will also be discussed [7].

Obesity and PCOS

A very important factor in the development and course of PCOS is obesity. It both worsens the symptoms of the condition and increases the risk of complications [7]. Studies have shown that women with a positive family history of obesity also have an increased risk of developing PCOS [1][17].

Obesity leads to the development of insulin resistance and hyperinsulinemia, which play a key role in the pathophysiology of PCOS. Insulin resistance and the resulting hyperinsulinemia lead to further weight gain[1], which fuels a cycle that is difficult to break and is associated with an increase in PCOS symptoms [2, 3]. They also contribute to increased blood androgen levels, leading to hyperandrogenism and associated clinical symptoms [3][19][20].

A 2022 study by Wahyuni et al found that women with PCOS often have a higher body mass index (BMI) than women without the condition [1]. An elevated BMI is associated with greater insulin resistance, which exacerbates symptoms such as irregular menses and hyperandrogenism [7]. In addition, the inflammation associated with obesity contributes to the general metabolic abnormalities seen in patients with PCOS [7].

The relationship between obesity and PCOS is bidirectional - increased body weight contributes to endocrine disruption, which in turn leads to further weight gain [18]. The hyperandrogenism associated with PCOS contributes mainly to central obesity [6]. Studies

have shown that visceral obesity in particular increases the risk of complications associated with PCOS [5].

Obese women have chronic low-grade inflammation, which also plays a role in the pathophysiology of PCOS [1]. Elevated levels of pro-inflammatory cytokines such as TNF-alpha and IL-6 can interfere with insulin signalling pathways, exacerbating insulin resistance, which leads to further weight gain, creating a 'vicious circle' [1][9][10].

Diet and PCOS

Diet is a factor that plays a role in the development, severity and treatment of PCOS. It is therefore important that appropriate dietary recommendations are made for both PCOS patients and women with a family history of PCOS [6]. High-calorie, high-carbohydrate foods contribute to the development of insulin resistance, which in turn leads to worsening symptoms [1]. Patients are advised to adopt a diet low in carbohydrates and high in fibre, which helps to improve insulin sensitivity and reduce androgen levels [1][5-6]. Popular diets such as the Mediterranean and DASH diets, which are based on whole grains, vegetables, fruit and lean meats, have been shown to have beneficial effects on metabolism and help maintain a healthy body weight [1][5][27]. They are also rich in antioxidants, which help to reduce the oxidative stress associated with PCOS [9]. Omega-3 fatty acids also play an important role in the diet and have a positive effect on PCOS due to their anti-inflammatory properties and counteract the development of metabolic syndrome [5][28]. Eating fish rich in omega-3 fatty acids, such as salmon or mackerel, may also help to improve the lipid profile in patients with PCOS.

When developing dietary patterns, attention should be paid not only to the composition of the diet, but also to the frequency of meals and the times of day at which they are eaten. Taking into account the natural human diurnal rhythm and changes in metabolic rate during the day, it is recommended to consume more calories in the morning and lower calorie meals in the evening [5-6]. This distribution of calories can help to stabilise blood glucose levels and reduce the risk of insulin resistance, which is key to managing PCOS [14]. In addition, the introduction of regular meals every 3-4 hours can help to keep blood glucose levels stable and prevent the hunger pangs that are common in patients with this condition.

Appropriate dietary recommendations, combined with increased physical activity, have been shown to significantly reduce the risk of PCOS complications such as infertility [6-7]. Regular consumption of meals with a low glycaemic index can also improve menstrual regularity and reduce the severity of hyperandrogenism symptoms such as acne and hirsutism [29]. In addition, a diet rich in legumes, whole grains and vegetables provides essential nutrients that support reproductive and metabolic health in women with PCOS.

Dietary programmes should be tailored to the individual patient's needs and lifestyle as much as possible [6]. Education about the role of macronutrients in maintaining hormonal balance may help to improve treatment regimens for PCOS [5]. A well-balanced diet tailored to the patient's energy needs will allow better control of body weight and insulin resistance. On the other hand, a diet rich in tryptophan and magnesium may have a positive effect on depressive-anxiety disorders, which are also a significant problem for female patients [13]. Combined with an increase in physical activity, dietary modification is one of the best non-pharmacological ways to treat patients and improve their quality of life [7][30].

A diet based on whole grains, fruits, vegetables and unsaturated fats plays an important role not only in controlling symptoms, but also in preventing their long-term consequences - contributing to a reduction in cardiovascular risk and the development of type 2 diabetes [5-7][22].

It has been suggested that a low glycaemic index diet may improve the cardiometabolic and reproductive profiles of women with PCOS [14][29]. The importance of introducing healthy eating habits and weight loss before starting fertility treatment in achieving the results of this treatment is still the subject of research [8][26]. However, it should be noted that the results of some studies do not show a direct relationship between improving cardiometabolic indices and achieving pregnancy, which highlights the importance of further research in this area [13][23].

Physical activity and PCOS

Physical activity, like diet, plays a very important role in the development and course of PCOS. Regular exercise improves insulin sensitivity, contributes to weight loss and reduces depressive and anxiety symptoms [5]. As well as reducing the severity of the syndrome's symptoms, regular physical activity helps to reduce the risk of long-term complications of the condition, such as infertility, diabetes and cardiovascular disease [6].

In 2023. Butt et al showed in a systematic review that both aerobic exercise and resistance training improved menstrual regularity and reduced the severity of hyperandrogenism [6]. Exercises such as brisk walking, cycling and swimming help to reduce cardiovascular risk and improve insulin sensitivity. Strength training, on the other hand, increases muscle mass and metabolic rate, allowing better control of body mass [6].

In 2022, a study by Wahyuni et al found that women with polycystic ovary syndrome who engaged in regular physical activity achieved a lower body mass index (BMI) and higher insulin sensitivity than those with low activity levels [1]. They also reported an increase in menstrual regularity and a reduction in androgen levels, which play an important role in the treatment of PCOS.

Regular physical activity is very important for women trying to get pregnant. It improves ovarian function and ovulation frequency, thereby improving fertility [15, 16]. An active lifestyle has also been shown to reduce androgen concentrations, thereby reducing clinical symptoms of androgenism, such as hirsutism and acne [4].

An active lifestyle is also associated with mental health benefits. Exercise has been shown to improve mood, reduce depressive symptoms and improve overall quality of life [4], which is particularly important in women with PCOS, who are at higher risk of psychological distress [14, 21]. The endorphins released during exercise have a positive effect on self-esteem and sleep quality [4].

The design of exercise programmes requires an individual approach, tailored to the patient's needs and limitations. It should take into account the person's fitness level, preferences and health status [4]. It should be emphasised that any physical activity, even the simplest, such as housework or gardening, has a positive impact on improving health and quality of life [4].

In 2020, Kongure et al. conducted a study in which they showed that personalised aerobic exercise significantly affected the mental state of women with PCOS [24]. In contrast, the FIT-PLESE randomised controlled trial showed a positive effect of physical activity on fertility [16].

Physical activity plays an extremely important role in the management and treatment of PCOS, as well as in the prevention of its long-term complications. Studies suggest that a combination of aerobic exercise and resistance training, tailored to the individual, is probably the most effective treatment for patients with PCOS [6, 25].

Diet, exercise and PCOS-related infertility

Infertility is considered one of the most serious complications of polycystic ovary syndrome and is the main reason why women with the syndrome present to their doctor, so it warrants special discussion in this article. There is growing evidence that lifestyle changes can significantly improve the chances of getting pregnant.

Studies show that a diet rich in omega-3 fatty acids, which have anti-inflammatory properties, has a beneficial effect on a patient's lipid profile, which is extremely important for women planning to become pregnant. In 2021. Taheri et al. showed that a diet rich in fruits, vegetables, whole grains and unsaturated fats improves insulin sensitivity. Improved insulin sensitivity contributes to increased menstrual cycle regularity and ovulation frequency, which is a key component of infertility treatment in patients with PCOS [28].

In 2017. Mattei et al. showed that an antioxidant-rich Mediterranean diet is associated with a reduction in oxidative stress, which is one of the factors leading to ovulatory dysfunction [27].

A study by Shang et al. found that eating foods with a low glycaemic index has a positive effect on stabilising blood sugar levels, which in turn contributes to improved ovarian function and increased chances of pregnancy [29].

Regular exercise, especially moderate-intensity exercise such as jogging, swimming or cycling, also contributes to increased insulin sensitivity and consequently improved fertility. Patten et al's meta-analysis highlighted the positive role of exercise programmes in increasing ovulation frequency and improving ovarian function [26].

In 2020, Kongure et al. showed that personalised aerobic training had a positive effect not only on the physical health but also on the psychological state of women with PCOS [24]. This is particularly important as the psychological distress often experienced by women with the condition also contributes to problems in achieving pregnancy. Reducing stress through regular exercise increases the chances of motherhood for these patients.

A well-balanced diet, combined with increased physical activity, may therefore significantly improve women's chances of conceiving and should be the subject of further research into PCOS-related infertility and its treatment options.

Conclusions

Polycystic ovary syndrome (PCOS) is a common endocrine disorder affecting women of reproductive age, which is associated with numerous complications such as obesity, insulin

resistance, infertility and metabolic and psychological problems. This article focuses on the importance of dietary habits and physical activity in the management of PCOS, highlighting that lifestyle changes are key to treating the condition and preventing its complications. More than 50% of women with PCOS struggle with obesity, which exacerbates insulin resistance and leads to a vicious circle between the causes and consequences of the condition. Introducing a balanced diet, rich in fibre and low in high glycaemic index carbohydrates, and increasing physical activity significantly improves insulin sensitivity, regulates hormone balance, increases fertility and reduces symptoms of hyperandrogenism, such as hirsutism and acne. In addition, regular exercise has a beneficial effect on mental wellbeing, reducing symptoms of depression and anxiety that often accompany PCOS. The article also highlights that individualisation of treatment plans, taking into account the needs of the patient, is crucial for the successful management of PCOS. The findings indicate that a combination of a healthy diet and regular physical activity is the foundation for the effective treatment of PCOS and the prevention of its long-term consequences, such as cardiovascular disease and type 2 diabetes. Further research into the impact of lifestyle on the course and treatment of PCOS is therefore needed to develop optimal therapeutic strategies.

Disclosure

Author's contribution

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Visualization: Żydek Ada and Dubińska Michalina
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Receiving funding - no specific funding.
All authors have read and agreed with the published version of the manuscript.

Financing statement

This research received no external funding.

Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable.

Data Availability Statement

Not applicable.

Conflict of interest

The authors deny any conflict of interest.

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