



Metabolic alterations in polycystic ovary syndrome: Protective effect of resistance training

Chief Investigators

Dr Nadia Tejani	- Endocrinologist, Prince of Wales Hospital and UNSW
Dr David Simar	- Exercise Physiology, School of Medical Sciences, UNSW
Mr Chris Tzar	- Accredited Exercise Physiologist, Lifestyle Clinic, UNSW
Ms Tina Cheng	- Accredited Exercise Physiologist, Lifestyle Clinic, UNSW

Rationale

Polycystic ovary syndrome

Polycystic Ovarian Syndrome (PCOS) is a common disorder affecting approximately 5-10% of reproductive-aged women. PCOS represents the main cause of infertility in women and is also associated with chronic anovulation and an excess of the hormone androgen (hyperandrogenism). Women affected by PCOS are also characterised by overweight, insulin resistance, dyslipidemia, hypertension, glucose intolerance and diabetes. This significantly increases the risk of cardiovascular disease and/or events¹.

Insulin resistance and PCOS

Although the exact physiopathology of PCOS is not yet fully understood, a strong link has been described with insulin resistance². Approximately 30 to 40% of women with PCOS are insulin resistant and the rate of conversion to type 2 diabetes is 5 to 10 times higher than in the general population³. Research has shown that treatments that result in lower blood insulin levels improve PCOS symptoms. Both metformin and troglitazone are known to decrease circulating levels of insulin for both insulin resistance and type 2 diabetes. Surprisingly, their use in the treatment of PCOS resulted not only in decreased levels of insulin but also reduced androgen levels and improved reproductive outcomes. However, there is still a lack of research data concerning the safety and efficacy of such treatments in the long term in a non-diabetic population and especially in the context of PCOS⁴.

Obesity and PCOS

Obesity and particularly abdominal fat accumulation is correlated with reduced fertility, menstrual disorders and excess insulin (hyperinsulinaemia). This can be explained by the strong correlation reported between the body mass index (BMI) and circulating androgen levels, and a high BMI seems to exert an additive effect with insulin resistance on PCOS symptoms⁵. Weight loss is known to improve the endocrine profile, the menstrual cycle, and the likelihood of ovulation and of a healthy pregnancy⁶. Even a modest weight loss of 2-5% of total body weight can restore ovulation in overweight women with PCOS as well as achieving a reduction in central (abdominal) fat and an improvement in insulin sensitivity.

Physical activity

Lifestyle modification through increased physical activity is now well recognised to exert some beneficial effects on insulin resistance and weight management. Resistance training has been shown to contribute to improved lipid profile, lower blood pressure, improved insulin sensitivity and contribute to decrease fat mass ⁷. One of the pathways involved in the improvement of insulin sensitivity in response to resistance training could be through the over-expression of heat shock proteins (HSP) known to exert some protective effects against various types of stressors ⁸. Those heat shock proteins could counteract the negative impact of inflammatory pathways involved in insulin resistance development. However, the impact of resistance training on PCOS symptoms and its associated metabolic alterations has yet to be investigated.

Aim and Hypothesis

The aim of the study is to investigate the **impact of resistance training on PCOS symptoms** and the **related metabolic alterations** often observed in this disease. We hypothesise that performing **regular physical activity** should facilitate **increased insulin sensitivity** and decreased fat mass, consequently resulting in the **improvement of PCOS symptoms**.

In this study, insulin **stimulated glucose uptake** will be assessed using an **innovative approach by measuring glucose transporters expression on monocytes**. This study has the potential to provide a very novel and innovative approach to treat PCOS symptoms and decrease cardiovascular risks associated with this disease.

Methods

Resistance training sessions will be performed 3 times per week under the supervision of exercise physiologists for 12 weeks. The sessions will be conducted in the Lifestyle Clinic (UNSW). Training will comprise 8 different exercises mobilising large muscle mass from both the upper and lower body. Those exercises will be performed in 3 sets of 10 repetitions at maximal effort (10RM). The rate of perceived exertion will be measured before and after the end of each exercise and will be used to monitor improvements during the program. The 10RM will be determined regularly to readapt the intensity of training. Heart rate will be continuously monitored during the training using heart rate monitors.

Expected Outcomes

It is expected that **resistance training** should **improve the metabolic profile** of the subjects as well as their **PCOS symptoms**. More specifically, inducing **heat shock proteins** over expression should **improve GLUT4 translocation** and results in **increased insulin sensitivity**. This should also be associated with a **better glucose and fat disposal**, reducing blood glucose levels and normalising lipid profile.

Resistance Training Study at the Lifestyle Clinic

The Lifestyle Clinic at the University of New South Wales is conducting a study to investigate the **impact of resistance training on PCOS symptoms** and the **related metabolic alterations** often observed in this condition. This study has the potential to provide a very novel and

innovative approach to treat PCOS symptoms and decrease cardiovascular risks associated with the condition. Of what we know, this will be the first study in the world to investigate the effects of resistance training on PCOS symptoms.

To participate in this study, you will be required to:

- attend the **Lifestyle Clinic** and undergo a medical screening to establish your eligibility
- attend the Prince of Wales Hospital **following an overnight fast to perform an oral glucose tolerance test**
- participate in a **12-week resistance training program at the Lifestyle Clinic** (corner of Botany and High Streets in Randwick). This program will comprise 3 sessions per week of resistance training under the supervision of an exercise physiologist.

The chief investigators in the study are Dr Nadia Tejani (Endocrinologist and Conjoint lecturer, University of NSW); Dr David Simar (Exercise Physiology, Faculty of Medicine, University of NSW); Chris Tzar (Exercise Physiologist); Tina Cheng (Exercise Physiologist).

Women with PCOS aged 18 to 45 years who want to take part in this study can contact the Lifestyle Clinic on (02) 9385 3352 or email lifestyleclinic@unsw.edu.au.

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