Dietary composition and weight loss in improving reproductive and metabolic physiology in overweight women with polycystic ovary syndrome

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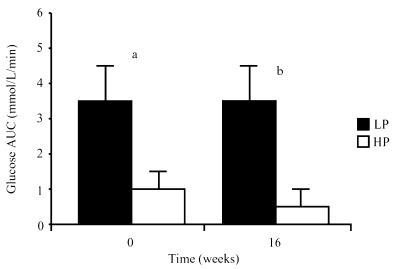
Polycystic ovary syndrome (PCOS) is a common endocrine condition in women of reproductive age associated with infertility and menstrual dysfunction and an increase in risk factors for cardiovascular disease and diabetes mellitus. Although weight loss has been shown to improve metabolic and reproductive fitness in this group (1), the effect of varying diet composition has not been researched. Recently there has been increased community interest in a high protein/low carbohydrate diet. This may aid in increased weight loss (2) due to the increased satiating power of protein and may improve insulin sensitivity through maintenance of lean body mass with weight loss (3).

This randomised controlled trial examined the differential effects of replacing dietary protein with carbohydrate in weight loss on reproductive and metabolic physiology. Overweight women (mean BMI 37.7 ± 6.5 m^2) were randomised to either a low protein (LP) (n = 14) (30% fat, 55% carbohydrate, 15% protein) or a high protein (HP) (n = 14) (30% fat, 40% carbohydrate, 30% protein) diet. The diet consisted of 12 weeks energy restriction (~ 6000 kJ) followed by 4 weeks weight maintenance with a weekly exercise and support group throughout.

Improvements in menstrual cyclicity (ovulation and menstrual cycle lengths), insulin homeostasis and lipid profile and decreases in weight (7.5%) and abdominal fat (12.5%) occurred independent of diet composition. 3 pregnancies additionally resulted (2 HP, 1 LP). Improvements in menstrual cyclicity were associated with greater decreases in insulin resistance, as measured by the homeostasis model, and fasting insulin (P = 0.011). On the LP diet, high-density lipoprotein cholesterol (HDL-C) decreased 10% in energy restriction (P = 0.008) and free androgen index (FAI) increased 44 % in weight maintenance (P = 0.027). There were no changes in HDL-C in energy restriction or FAI in weight maintenance for the HP diet. Each group was provided with a representative HP or LP test meal for that intervention and post-prandial insulin and glucose analysed as the area under the curve (AUC). Test meal AUC glucose was higher for the LP compared to the HP diet at weeks 0 and 16 (Figure 1).



Area under the curve glucose following a low protein (n = 14) or a high protein (n = 14) test meal of 3000 kJ at week 0 and week 16. [a]: 3.5 fold difference (p = 0.02) at week 0 and [b]: 4 fold difference at week 16 (p = 0.009) between the LP and HP AUC.
There was no differential effect of time on changes in AUC glucose.

In summary, weight loss from dietary and exercise intervention leads to improvements in cardiovascular and endocrine reproductive parameters which appear to be mediated by improvements in surrogate measures of insulin sensitivity. A high protein/low carbohydrate diet during weight loss may result in minor differential endocrine and metabolic improvements.

References

1. Clark AM, Ledger W, Galletly C, Tomlinson L, Blaney F, Wang X, Norman RJ. Weight loss results in significant improvement in pregnancy and ovulation rates in anovulatory obese women. Hum Reprod 1995; 10: 2705–2712.
2. Skov AR, Toubro S, Ronn B, Holm L, Astrup A. Randomized trial on protein vs carbohydrate in ad libitum fat reduced diet for the treatment of obesity. Int J Obes Relat Metab Disord 1999; 23: 528–36.
3. Piatti PM, Monti F, Fermo I, Baruffaldi L, Nasser R, Santambrogio G, Librenti MC, Galli-Kienle M, Pontiroli AE, Pozza G. Hypocaloric high-protein diet improves glucose oxidation and spares lean body mass: comparison to hypocaloric high-carbohydrate diet. Metabolism 1994; 43: 1481–1487.

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