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Effect of a Very Low Carbohydrate Diet on Insulin Resistance and Body Composition in Adults with Prediabetes and Obesity: A Randomized Controlled Trial

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Introduction:
Prediabetes and obesity are major risk factors for the development of type 2 diabetes mellitus (T2DM) and cardiovascular disease. Lifestyle modification remains the cornerstone of diabetes prevention. A very low-carbohydrate diet (VLCBD); carbohydrate intake of less than 50g/day, has shown metabolic benefits in patients with T2DM, but evidence in adults with prediabetes and obesity remains limited. This study aimed to determine the efficacy of VLCBD to reduce insulin resistance in this group of patients.

Methods:
This investigator-initiated, single-centre, randomized controlled trial was conducted at the Endocrine Clinics Universiti Teknologi MARA (UiTM), Malaysia. Adults aged 30–65 years with BMI 23–37.5kg/m² were randomized in a 1:1 ratio to receive either VLCBD or a standard balanced diet for 12 weeks. Both groups received isocaloric dietary prescriptions (≤2000 kcal/day) and standardized lifestyle counselling.

Results:
Thirty participants completed the study (VLCBD n=17; control n=13). Baseline demographic and metabolic characteristics, including HOMA-IR and body fat percentage, were comparable between groups (all $p>0.05$). At 12 weeks, the VLCBD group demonstrated significantly greater reductions in body weight (−4.73±2.83 vs −1.16±2.50 kg, $p=0.001$), BMI (−1.87±1.01 vs −0.62±0.78 kg/m², $p=0.005$), waist circumference (−5.0±3.1 vs −1.5±3.9 cm, $p=0.011$), and body fat percentage (−2.22±1.63 vs +0.30±1.80%, $p=0.005$) compared with the control group. Reductions in fasting insulin and HOMA-IR were observed in the VLCBD group; however, these differences were not statistically significant between groups. Renal function remained stable, and no serious adverse events were reported.

Conclusion:
A 12-week VLCBD significantly improved body composition in adults with prediabetes and obesity compared with standard dietary therapy without compromising renal safety. Insulin resistance showed a favourable trend in the VLCBD group, although this did not reach statistical significance. These findings support VLCBD as an effective and safe dietary strategy for metabolic risk reduction and diabetes prevention in multi-ethnic Asian populations.