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Editorial

Low or High Carbohydrate Diets for Diabetes? - Concise Critical Review of Scientific Evidence of Proportion of Carbohydrate in Diabetic Diet

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Diabetes is characterised by hyperglycaemia and the inability to metabolise carbohydrate effectively. Dietary management is therefore fundamental for the effective management of diabetes and is a key component in achieving optimal glycaemic control [1]. However controversy exists as to the ideal proportions of carbohydrate required in the diet to optimise health outcomes and to date evidence is inconclusive [1]. Evidence exists to suggest that high carbohydrate diets may exacerbate obesity and hyperglycaemia [2] whilst low carbohydrate diets (of which Atkins is probably best known) may be beneficial in the management of hyperglycaemia, hyperlipidaemia and weight management in type 2 diabetes [3]. This editorial aims to review the controversy surrounding carbohydrate in the management of diabetes.

Historically before the advent of insulin, carbohydrate restriction was the only form of treatment which resulted in diets generally being high in fat. However, following concerns regarding cardiovascular complications, nutritional recommendations were revised to promote a more balanced diet with moderate consumption of fats and greater carbohydrate intake. This led to dietary guidance which reflected that of the general public with an acceptable macronutrient distribution range for carbohydrate 45-65% of total energy intake [4]. Recent guidelines acknowledge that evidence is inconclusive for an ideal amount of carbohydrate [1] and therefore do not specific any guidance.

Carbohydrates consist of starch, fibre and sugars which are primarily responsible for providing glucose for cellular activity [5]. Blood glucose concentrations postprandial are determined by the rate of absorption of glucose and its clearance. It is known that dietary carbohydrate is the only macronutrient that influences postprandial glycaemia [6] and that the amount of carbohydrate and available insulin may be the most important factor influencing glycaemic response after eating [1]. This has consequently led to greater flexibility in the amount of carbohydrate required by many who are now encouraged to count or estimate the carbohydrate content of foods and adjust insulin doses to maintain good glycaemic control. This concept of balancing carbohydrate intake with insulin dose has led to some taking a reduced carbohydrate load and therefore less insulin and others who take more carbohydrate and increased doses of insulin. This observation has fuelling the discussion surrounding the ideal proportion of carbohydrate and whether the proportion of carbohydrate should be lower to maintain good health for all with diabetes regardless of treatment.

Severe restriction of carbohydrate and therefore limited glucose availability results in weight loss by stimulation of fat oxidation for energy [7] and production of ketoacids. Broad consensus suggests <50g - 60g/day carbohydrate constitutes a low carbohydrate diet [3,8] which is based on evidence that ketosis readily occurs at carbohydrate intakes below a level of 50g/day [9]. Substantial evidence exists to suggest that low carbohydrate diets lead to improvements in glycaemic control and/or body weight [3,8,10,11]. However limitations in the strength of these studies for example the length must be considered when interpreting these findings. Trials which were of short term and lasting less than six months demonstrated benefits, however when of longer duration (> 6 months) benefits were less apparent in that initially weight loss was rapid [12] although after this time partial rebound and plateau in weight status was reported [13]. Despite the increases in weight and glycosylated haemoglobin, results remained lower than those at the start of the trial [14] which could suggest that low carbohydrate diets may have lasting effects. However it could also simply be that weight loss is due to a reduction in total energy intake and not specifically due to carbohydrate restriction [15,11,16]. It should also be noted that many of these trials had varying degrees of carbohydrate restriction from as low as 20g/day to 45% of daily energy. However severe restriction of carbohydrate (<50g/day) is difficult to sustain and is highly likely to compromise nutritional intake by restricting and/or limiting the intake cereals, grains, fruit, vegetables and milk products therefore likely to be providing a diet higher in fat (especially saturated) and protein. However there is no evidence to support or refute these claims [8].

The use of less stringent carbohydrate intakes in the management of hyperglycaemia are now the subject of growing debate. It is well recognised that the quantity (glycaemic load), type (high or low glycaemic index) and source of carbohydrate (starch or sugar) found in foods influence postprandial glycaemia [1,6] and that the total amount of carbohydrate consumed is a strong predictor of glycaemic response [17]. A recent systematic review [3] provided evidence of the benefit of low carbohydrate and potential benefits on glycaemic control and weight loss although this review included a wide range of restrictions from 13 – 45% these results would suggest that moderate carbohydrate intake (as opposed to high) may be beneficial to glycaemic control. Equally important is the association between hyperglycaemia and requirement for glucose lowering therapy. Evidence exists to indicate that on adopting a reduced carbohydrate diet a reduction in medication was required and in some cases

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discontinued [16,18-20]. Therefore as type 2 diabetes is a disorder of carbohydrate metabolism, it is possible that excessive dietary carbohydrate may exacerbate hyperglycaemia resulting in increased insulin secretion (or injection), more insulin resistance and more hyperglycaemia [5].

However it must be remembered that altering the proportion of carbohydrate in the diet will impact on the proportions of fat and protein which may adversely impact on health. Weight loss and improved glycaemic control is only part of the risk reduction for those with type 2 diabetes [21]. Other risk factors include high blood pressure, altered lipid profile and central obesity which increase the risk of cardiovascular disease and are a major cause of morbidity and mortality for people with type 2 diabetes. More research is required to investigate the effects of moderate carbohydrate intake on weight loss, glycaemic control and nutritional adequacy in people with diabetes.

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