Position statement May 2015: The evidence supporting a low carb high fat (LCHF) dietary approach

Humans can survive without an exogenous supply of carbohydrate and the lower limit of dietary carbohydrate compatible with life is zero, provided that adequate amounts of protein and fat are consumed.[1] The 2011 Diabetes UK dietary recommendations for diabetes acknowledge that there is currently no ideal percentage of calories from the three macronutrients, carbohydrate, protein and fat.[2] When people with diabetes receive carbohydrate awareness structured education and monitor carbohydrate consumption, they manage to improve glycaemic control and lose weight.[3,4] The standard X-PERT Diabetes Programme implements UK and international guidance that encourages people with diabetes to consume more than 130g of carbohydrate per day and not to exceed 30% of calories from total fat and 10% from saturated fat.[5,6]

Type 2 diabetes is an insulin resistance condition.[7,8] The increase in blood glucose following carbohydrate digestion triggers the pancreas to release the hormone insulin into the blood. Insulin is required to enable the transport of glucose from the blood into the liver, fat and muscles cells where respiration takes place to convert the glucose to energy. When there is an abundance of glucose the excess is either stored as glycogen or converted to fat. A combination of a high carbohydrate diet and insulin resistance results in high circulating levels of insulin which further exacerbates the insulin resistance.[9] Insulin is an anabolic hormone which promotes lipogenesis (fat storage) and prevents lipolysis (fat burning). Insulin resistant individuals with Type 2 diabetes therefore struggle to lose significant weight and obtain normal glycaemia, blood pressure and lipid values, even with large doses of diabetes, hypertension and lipid medication.[10,11]

There is emerging evidence that a very low carb diet reduces the high circulating levels of insulin and is therefore a more effective strategy to improve metabolic health than current nutritional guidelines.[12] However, adoption of a very low carb diet has caused concern amongst healthcare professionals as dietary carbohydrate and fat have an opposing relationship i.e. as energy from carbohydrate reduces, energy from fat increases.[13] There have also been concerns that a diet low in carbohydrate will be nutrient deficient; increase risk of CVD; increase insulin resistance; cause bone mineral loss and kidney, bladder and/or urethra stones; impair the central nervous system; have an adverse impact on wellbeing.[14,15,16,17,18,19,20,21] However, intervention trials have failed to report any such negative findings and have, in fact, reported improvements in many of the conditions that a low carbohydrate was supposed to deteriorate.[22,23,24,25,26]

Moreover, it has now been established that the low fat dietary recommendations were published in the absence of supporting evidence from RCTs.[27] A low fat diet has not been shown to reduce levels of obesity, prevalence of Type 2 diabetes, risk of CVD, or total/CVD mortality.[28,29;30,31,32] Furthermore recent

evidence about associations between fatty acids and coronary disease from RCTs and observational studies do not support cardiovascular guidelines that encourage high consumption of polyunsaturated fatty acids and low consumption of total saturated fats.[33,34,35,36,37]

Cholesterol is essential for life[38] and it is the different lipoproteins that transport cholesterol, not cholesterol itself, that have been shown to either be detrimental or beneficial to health. Many recent studies have concluded the focus on total and LDL cholesterol is erroneous and that LDL-particle size is more important with regard to CVD risk.[39] Indeed the majority of patients admitted to hospital with a heart attack have normal blood cholesterol levels[40] whilst people whose LDL particles are predominantly small and dense have a threefold greater risk of coronary heart disease.[41] Small dense LDL particles are much more likely to become oxidized and lodged in the arteries.[42,43,44] Although a low fat diet has been shown to reduce blood cholesterol levels this tends to be the protective HDL cholesterol rather than small dense LDL particles.[45,46] Dietary carbohydrate has been shown to result in de novo lipogenesis (DNL) [conversion to fat] and increase levels of small dense LDL particles i.e. it has been proposed that carbohydrates are the principal driver of atherogenic dyslipidemia.[47,48,49,50,51,52,53,54] Dietary carbohydrate has also been shown to increase blood levels of triglycerides.[55,56,57] Low HDL cholesterol and high triglycerides are two components of the metabolic syndrome which leads to insulin resistance, Type 2 diabetes and CVD. These conditions are also characterised by high levels of inflammation.[58] Advice to incorporate polyunsaturated fat into the diet through processed vegetable oils such as sunflower, corn, safflower and spreads has led to an unbalanced intake of omega-6 to omega-3 fatty acids. The ratio was previously 1:1 prior to the agriculture revolution but has now increased to 16:1 in westernised populations.[59] Omega-6 fats are pro-inflammatory whereas omega-3 fats are anti-inflammatory and therefore the balance needs to be reinstated to reduce systematic chronic inflammation. Polyunsaturated fat, due to the multiple double bonds, are also less stable and thus more prone to oxidation forming free radicals that can lead to cell damage, CVD and cancer and therefore readdressing the balance between the different types of fat i.e. the promotion of natural fats (omega-3, monounsaturated and saturated) will assist with cell integrity.[60,61,62,63]

Reviews of lower carbohydrate diets have demonstrated reduced insulin resistance, improved glycaemic regulation whilst also having positive effects on reducing risk factors for heart disease, including reducing serum triglyceride, increasing HDL cholesterol, increasing LDL particle size and reducing blood pressure.[64,65,66,67,68,69] A substantial proportion of individuals have been shown to discontinued one or more diabetes medications.[70]

However, until recently there was inconsistency and confusion regarding what constitutes a low carbohydrate diet and systematic reviews have combined heterogeneous studies, which has diluted the

findings.[71] Feinman et al have recently published definitions for very low/low/moderate/high carbohydrate diets.[72] In their critical review they define a low carbohydrate diet as consuming less than 130g carbohydrate per day and a very low carbohydrate as less than 50g per day. The rationale for promoting a very low carbohydrate diet is that the lowered blood glucose levels reduce levels of circulating insulin which then enable lipolysis i.e. fat to be utilised as an alternative fuel to carbohydrate. A metabolic by-product from lipolysis is ketones and nutritional ketosis is a harmless condition that should not be confused with diabetic ketoacidoisis (DKA).[73]

Sweden has become the first western nation to recommend a lower-carbohydrate higher-fat, diet as part of an effort to reduce the national prevalence of obesity, diabetes, and to improve markers of heart health. Swedish advisors recognise that the low-fat diet is failing in the fight to stop or reverse obesity trends that have reached epidemic proportions across the globe. Essentially, the Council suggests that a diet lower in carbohydrate (40% of total calories) would see some of these improvements and a greater increase in good (HDL) cholesterol without having any adverse effects on bad (LDL) cholesterol, while an even lower carbohydrate intake (20% of total calories) would result in more benefits including improved blood glucose levels for individuals with obesity and diabetes and decreased levels of triglycerides.[74]

Although a low carb high fat dietary approach has been shown to improve clinical health, simply prescribing a diet to patients may not enable it to become a sustainable long-term strategy as critical analysis of the evidence base suggests high dropout rates with a reduction of effects over time.[75,76] An explanation for this finding could be that patients may not be receiving sufficient education and support to fully understand and adopt the dietary approach. We aim to provide in-depth information and support through structured education, the adapted X-PERT Diabetes Programme, to ascertain whether a very low carb, high fat lifestyle is acceptable to patients and more effective at improving metabolic health and psychological wellbeing in people with Type 2 Diabetes, in the short and longer-term.

We aim to extend the current evidence base by evaluating whether it is possible for people with Type 2 diabetes to adopt and sustain a very low carbohydrate dietary approach i.e. consume less than 50g of carbohydrate per day to achieve lipolysis demonstrated by nutritional ketosis. All clinical indicators will be monitored and any adverse events documented. If people are able to adopt the LCHF diet as a long-term dietary approach, the benefit to patients may be even greater health benefits compared to the standard education programme along with a better quality of life, a reduced requirement for prescribed medication and a reduced risk of developing the preventable but devastating complications of diabetes. The impact for the NHS could be reduced resource and financial burden due to patients who are better

able to self-manage their condition and less reliant on healthcare professionals, and reduced treatment costs through less prescribed medication, and fewer hospital admissions to treat complications.

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