Glycemic Indices of Caribbean foods and application in dietary lifestyle intervention for management of Type 2 Diabetes Mellitus

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SUMMARY

Glycemic Index (GI) values for some commonly eaten Caribbean carbohydrate-rich foods processed by various traditional methods were determined using 10 healthy subjects. The foods studied were Round Leaf yellow Yam (*Dioscorea cayenensis)*, Negro and Lucea Yams (*Dioscorea rotundata)*, White and Sweet Yams (*Dioscorea alata*), Sweet Potato (*Solanum tuberosum*), Irish Potato (*Ipomoea batatas*), Coco Yam (*Xanthosoma spp.*), Dasheen (*Colocasia esculenta*), Pumpkin (*Cucurbita moschata*), Breadfruit (*Artocarpus altilis*), green Banana (*Musa sapientum*) and green and ripe Plantain (*Musa paradisiaca*). The foods were processed by boiling, frying, baking and roasting where applicable. Pure glucose was used as the standard with a GI value of 100. Prior to GI determination the proximate compositions of the foods were carried out. Foods found to have a low and intermediate GI were assessed in a randomized control parallel, dietary lifestyle intervention study, with adult type 2 diabetics over six months. The minimum sample size calculated per dietary treatment group was 22 subjects. The experimental treatment group (n =32) emphasized the consumption of low and intermediate Glycemic Index foods while subjects in the control treatment group (n = 33) consumed a conventional diet. Attempts were made to ensure that both groups were iso-caloric so as to avoid the confounding effect of the intervention group being relatively hypo-caloric with 45-50 % of energy from carbohydrates. Biochemical markers for glycemia, inflammation, urological function as well as for cardiovascular risks were assessed.

Of all the foods, the fiber content for Breadfruit was highest while the lowest level was recorded for ripe Plantain (48.80 ± 0.3 and 3.0 ± 0.3 g/kg dry weight respectively). The

lowest level of protein was observed in Pumpkin (9.7 ± 0.4 g/kg dry weight) while the highest was recorded in Irish potato and Coco yam (25.70 ± 0.5 g/kg dry weight). The fat content of the foods were negligible ranging between 0.80 ± 0.1 g/kg and 3.30 ± 0.3 g/kg (dry weight), while the ash content of the foods ranged from 2.20 ± 0.2 g/kg to 17.90 ± 0.3 g/kg (dry weight). Available carbohydrate content was lowest for Pumpkin (135.90 g/kg dry weight) and highest for Coco yam and Sweet potato (307.80 g/kg and 298.0 g/kg respectively dry weight). While the moisture content ranged between 60 % and 80 % wet weight of the total mass of the different foods analyzed.

The results revealed marked differences in GI among the different foods studied ranging from 35 ± 3 to 94 ± 8. The area under the glucose-response curve and GI value of some of the roasted and baked foods were significantly higher than foods boiled or fried ($p < 0.05$). For foods processed by boiling, green Banana had the lowest GI while Sweet yam had the highest GI (37 ± 5 and 79 ± 4 respectively). All foods processed by roasting had high GI values ranging between 72 ± 8 and 82 ± 7. Similarly, baked Sweet potato and Irish potato were found to have high GI values (94 ± 8 and 83 ± 6 respectively). Of the foods processed by frying, green banana was found to have the lowest GI and ripe plantain had the highest (35 ± 3 and 90 ± 6 respectively).

After the 6 months dietary intervention trial, consumption of low and intermediate GI foods by subjects in the intervention group resulted in a significant decrease in glycosylated haemoglobin (A_{1C}) concentration, compared to subjects in the control group on the conventional diet (-9.03 % and -4.03 % respectively). The experimental diet group showed

a significantly greater decline in plasma triglycerides than the conventional diet group (-16.13 % and -5.93 % respectively; $p<0.05$). Mean homocysteine levels decreased in both groups but more significantly in the intervention group than that of the control group (-17.53 % and -6.98 % respectively). It was also observed that C-reactive protein concentration decrease significantly in subjects who consumed the low-intermediate GI diet than those in the control group (-38.24 % and -15.18 %, respectively). It was observed that high density lipoproteins (HDL) concentration increased in both dietary groups, however, the percentage increase recorded in the intervention group was significantly greater than the control group (25.5 % and 10.11 % respectively). Assessment of the low density lipoproteins (LDL) levels revealed a decrease of 4.10 % in subjects who consumed the low-intermediate diet and 2.89 % decrease in subjects on the conventional diet. Changes in total cholesterol concentrations, blood pressure and body mass index (BMI) did not differ significantly between the groups over the after the 24 weeks period. In analyzing the biochemical markers for urological function, it was found that serum creatinine and serum urea decreased in subjects in the intervention group while increased in those in the control group.

Data from the assessment of the effects of different processing methods on the Glycemic Index of the foods revealed that boiling resulted in lower GI for most of the foods studied. This may indicate to diabetics that this method of processing may represent the healthiest way to keep blood glucose level at a clinically safe minimum. Conversely, even though foods processed by frying may result in a lower GI, this method of food processing should not be promoted due to health risks associated with increased fats in the diet.

The results of the biochemical markers studied indicate that consumption of some indigenous Caribbean foods with low and intermediate Glycemic Indices may have a positive effect in glycemic control and may reduce the risk of cardiovascular diseases. These results should prove valuable and promote the use of low and intermediate GI Caribbean foods by health care professionals, nutritionists and in diabetes education programmes, which may possibly reduce the incidence of post-prandial spikes in blood glucose levels and may be therefore useful for the management of type 2 diabetes.