The effect of modified pulse-carbohydrate diet on weight and HbA_{1C} in type 2 diabetic patients

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AIM: To find the effect of modified pulse carbohydrate diet on weight and HBA_{1C} in type 2 diabetic patients (DM).

METHODOLOGY: Retrospective analysis was done on 20 patients who have taken the modified pulse carbohydrate diet (75% pulses and 25% cereals) Adai dosai vs normal diet (75% cereals and 25% pulses) at home for 3 months at least 4 days in a week for breakfast and dinner. Randomized selection was done in stable type 2 DM patients who were on OHA. No adjustments were made in the drugs during the trial. There were 5 drop outs. These were compared to 15 who have not taken modified carbohydrate diet food, Statistical analysis was done using SPSSPC (11.5 version). Data were expressed as mean ± standard error. Differences were compared using independent t test $P<0.05$ was considered statistically significant.

RESULTS: The average decrease in weight (kg) on the modified pulse-carbohydrate diet is 0.30 (0.56) and the similar value for the control group is 0.10 (0.35). However the difference is not statistically significant. Regarding the HBA_{1C} (Mean ± SEM) there is a significant reduction with the modified carbohydrate diet (0.68 ± 0.37 compared to control group 0.66 ± 0.18) and the difference is statistically significant ($P<0.01$).There was no gross elevation in the renal parameters for the modified pulse carbohydrate diet group.

KEY WORDS: Type 2 DM, modified pulse-carbohydrate diet, instant mixes, glycemic control, HBA_{1C}, protein.

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Introduction

The incidence of diabetes mellitus, a chronic disease is increasing world wide. The same is true of India. Recent surveys have established that by the year 2025 India will have maximum number of diabetics in the world.[1] Hence diabetes and its complications pose a major threat to future public health resource through out the World.[2] Life long treatment for maintaining glycemic control is necessary to prevent the onset of complications.[3]

Diet has been a main stay in the management of diabetes. But it is often classed as the most difficult aspect of treatment.[4] In India cereals and pluses form the staple diet.[5] Carbohydrate plays as a major culprit for the rise in blood sugar. The source of carbohydrate is more important than the total amount of carbohydrate because the source and the quality of dietary carbohydrate may differentially optimize insulin action and there by affect the degree of insulin resistance.[6]

The current Joslin recommendation says that different carbohydrate foods affects blood glucose levels to varying degree as measured by glycemic index. Foods such as legumes have slow release carbohydrate and cause slower rise in blood glucose levels.

A number of studies in healthy subjects and in person with controlled Type 2 DM have demonstrated that glucose from ingested protein does not appear in the general circulation and therefore protein does not increase plasma glucose concentration. However, the long term effect of consuming >20% of energy as protein on the development of neuropathy has not been determined.Therefore it may be prudent to avoid protein intakes > 20% of total

daily energy.[7] Hence, diabetes patients require special foods. We developed modified carbohydrate foods and evaluated them in diabetics with regard to change in weight and HbA_{1C}.

Methodology

Modified pulse carbohydrate diet (75% pulses and 25% cereals) were used for testing against the normal diet (75% cereals and 25% pluses) Instant mixes were formulated. The nutritive values were calculated based on NIN, ICMR for both the diet [Tables 1 and 2].[8]

Twenty stable type 2DM who were on OHA free of significant cardiovascular, renal or neurological complications were selected as the subjects for the study. The subjects willing to participate in the study were asked to take the instant mixes (75% pulses and 25% cereals) in the form of idli/dosa for a period of three months at least for four days in a week for breakfast and dinner at home. There were five drop outs among the selected subjects. No adjustment was made in the drug during the study period. Fasting, post prandial blood glucose and weight were recorded for the selected subjects every visit. During the initial and at the end of the study HbA_{1C} was done to all the subjects. All the above criteria were compared to fifteen subjects who had only normal diet (75% cereals and 25% pluses).

Statistical analysis was done using SPSSPC (11.5 version). Data were expressed as mean ± standard error. Differences were compared using independent t test. $P<0.05$ was considered statistically significant.

Table 1: Food values of modified pulse carbohydrate diet and normal idli[8]

Name of food stuff	Total calories	CHO g	PRO g	FAT g	FIBER g
Dhal idli pulse based	348.5	62.5	18.9	1.79	2.63
Normal idli cereal based	345	74	10.8	0.65	0.375

Table 2: Mineral and vitamin content of modified pulse carbohydrate diet and idli[8]

Name of the food stuff	Minerals	Vitamins mg	
Dhal idli, (pulse based)	Na, K, Selenium, Zn, Cl, Cr	Vit-C,	0.15
		Thiamine	0.26
		Carotene	57.89
		Niacin	1.75
Normal idli, (cereal based)	Zn	Vit-C	0
		Thiamine	0.15
		Carotene	9.5
		Niacin	0.21

Results

The average decrease in weight (kg ± SEM) on the modified pulse carbohydrate diet is 0.30 ± 0.56 and the similar value for the control group is 0.10 ± 0.35. However the difference is not statistically significant. Regarding the HbA_{1C} (Mean ± SEM) there is a significant reduction ($P<0.0.1$) on the modified carbohydrate diet (0.68 ± 0.37) compared to control group (0.66 ± 0.18). There was no gross elevation in the renal parameters for the modified pulse carbohydrate diet group.

Discussion

Data suggests that protein aids in the sensation of fullness and that low protein meals are associated with increased hunger. Thus protein may serve to reduce appetite and assist one in achieving and maintaining the desired lower calorie level.[9] The conversion of protein to glucose is infact 50-60% but this glucose does not enter the general circulation. Gluconeogenesis occur over 24 hours and glucose is disposed over this long period.[9] Around 1-1.5 g of protein per kg of ideal body weight is suggested for a diabetic who does not have any renal problem.[10]

Based on the above, modified pulse carbohydrate diet (75% pulses and 25% cereals) was planned for the study. Instant mixes was provided for the subjects willing to participate in the study to ensure standardization. Since it was difficult to adhere for patients who were traveling often, five drop outs were there during the study.

Pulses are rich in soluble fiber, protein and 20% low in carbohydrate. Lentils and pulses have low glycemic index. Table 1 presents the nutritive value of the modified pulse carbohydrate diet (75% pulses and 25% cereals) and the normal diet (75% cereals and 25% pluses).

Table 2 presents vitamins and minerals present in modified diet which is rich in carotene, niacin and vitamin - C. The pulses stimulates insulin secretion because of its amino acid content, which is different from cereals. The cereals have a low content of lysine, which is present in good concentration in pulses.[11] It is interesting to note that foods like gram flour can significantly stimulate insulin secretion to the extent that it may be used therapeutically.[12]

To conclude, from this study, though limited, it is clear that a therapeutic role of pulse based diets is possible in type 2 diabetes, but it is a matter of conjecture whether the therapeutic effects of modified pulse carbohydrate diet on type 2 diabetes of differing severity will be elicited.

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References

1. Hillary K, Ronald EA, William HH. Global Burden of diabetes, 1995-2025. Prevalance, Numerical estimates and projections. Diabetes Care 1998;21:1414-31.
2. Ramachandran AC, Snehalatha A, Kapur V, Vijayan V, Mohan AK, Dass PV, *et al.* High prevalence of diabetes & IGT in India: National urban Diabetes survey. Diabetologia 2001;44:1094-101.
3. Sato E, Suzukamo Y, Miyashita M, Kazuma K. Development of a Diabetes Diet related Quality of life scale. Diabetes Care 2004;27:1271-5.
4. Gilbertson HR, Brand-Miller JC, Thorburn AW, Evans S, Chondros P, Werther GA. The effect of flexible low GI dietary advice Vs measured Carbohydrate exchange diet on glycemic control in children with T1DM. Diabetes Care 2001;24:1137-43.
5. Jenkins DJ, Wolever TM, Taylor RH, Ghafari H, Jenkins AL, Barker H, *et al.* Rate of digestion of foods & post prandial glycemia in normal & diabetic subjects. Br Med J 1980:281:14-7.
6. Pereira MA, Jacob DR, Slatlery ML, Ruth KJ, Van Horn L, Hiler JE, *et al.* The association of Whole grain intake & fasting insulin in a biracial cohort of young adults. The CARDIA study CVD prevention 1998;1:231-42.
7. ADA Nutrition on principles & recommendation in diabetes. Diabetes Care 2004;27:536-46.
8. Gopalan C, Sastri R. Nutritive value of Indian Foods. NINICMR 2004:47-95.
9. Ronald KC, Weir GC. Editors Joslin's Diabetes Mellitus, 4th ed. Boston; 2005.
10. Joslin EP. Diabetes Manual for doctor and patient, 9th ed. Lea & Febiger: Philadelphia; 1953.
11. Coulston AM, Hollenbeck CB, Swisslocki AL, Reaven G. Effect of source of dietary carbohydrate on plasma glucose and insulin response to mixed meals in subjects with NIDDM. Diabetes Care 1987;10:395-400.
12. Chandalia H, Ranjita N, Mehta S. Mechanism of Low Glycemic Index of pulses and pulse Incorporated Cereal Foods. Int J Diab Dev Count 1992:12;9-11.