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RESEARCH PAPER OPEN ACCESS

COMPARISON OF DIETARY CARBOHYDRATE INTAKE, BODY WEIGHT AND INSULIN DOSING IN CHILDREN WITH TYPE 1 DIABETES MELLITUS

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ABSTRACT

Day to day management of type 1 diabetes mellitus in children and adolescents is a burdensome task for their parents. The present study is to see whether the dose of insulin intake is based on the body weight and carbohydrate (CHO) content of the daily diet consumed by the subjects and to compare the same aspect between the subjects from a corporate hospital (Sagar Hospitals) and Government hospital (Indira Gandhi Institute of Child Health) respectively. The subjects (n = 118) for the study were selected from the outpatient department of diabetic clinic from both the hospitals by purposive sampling. The results indicated that majority of the subjects (83%) were taking higher dosage of insulin when compared with their weight and CHO intake. Higher dose of insulin was taken by the subjects who are in above 10 years age group and lower doses were taken by the subjects in the age group of 6-10 years. The study indicates that imparting the proper diabetic education pertaining to the concept of CHO counting and proper insulin intake will help type 1 diabetics to manage the balance between their diet and insulin intake to maintain near normal blood glucose levels.

KEY WORDS:
Type 1 Diabetes, Food Intake, Carbohydrate, Insulin, Body Weight, Age.

INTRODUCTION

Type 1 diabetes is usually caused by autoimmune destruction of the pancreatic beta cells that produce insulin that 'unlocks' the cells of the body, allowing glucose to enter into blood and fuel them. Therefore, people with type 1 diabetes have to inject insulin every day for the rest of their lives and this is one of the most challenging metabolic disorders because of the demands it imposes on day-to-day life (Ramesh Goyal, 2010). Globally, there are close to 500,000 children under

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the age of 15 with type 1 diabetes. Every day 200 children develop type 1 diabetes (International Diabetes Federation (IDF), 2008). Recent recommendations by the American Diabetes Association suggest that children with type 1 diabetes should follow the nutrition recommendations for age, sex and body size of the general population. In case of being overweight or obese, weight-control strategies should be applied (Bantle JP et al, 2010). Adherence to recommendations should be pursued by continuous nutritional education that should start at the onset of diabetes and maintained by means of nutritional counselling to the family. The second main target of nutritional intervention is to encourage to plan a reproducible daily meal plan that can be adhered by acquiring good habits and making nutritional choices. A good balance between eating for pleasure and maintaining one's health is a challenge for anyone, more so in case of children with diabetes (Claudio Maffeis et al, 2008).

METHODOLOGY

This study was undertaken to assess the adequacy of control of diabetes comparing dietary carbohydrate intake, body weight and insulin dosing in children with type 1 diabetes mellitus from poor socioeconomic background as compared to those from middle class family background. Other family relevant factors were also analysed. A pretested interview schedule was administered personally on the subjects who were above 10 years of age and administered on the parents/care takers of the subjects who belonged to the age group of 1 to 10 years and obtained the relevant information needed for the study. The statistical software SPSS versions 15 was used for the analysis of the data and MS word and excel was used to generate graphs and tables etc. The level of significance was used at 0.05 and 0.01 level.

RESULTS & DISCUSSION

Out of total number of subjects selected (n =118) 67% were from IGICH and 33% were from Sagar hospitals belonging to the age group of 1 to 18 years. The sample represents both urban (65.3 %) and rural (34.7%) children containing 45% male and 55% female subjects. Nuclear family was the predominant norm among the subjects with around 45% of them falling in the income bracket of Rs.3000 -10,000/per month (*Table 1*).

According to Roberta L (2000), the optimum quantity of insulin is calculated based on the formula one unit of insulin is required per 15 gms of CHO (The total CHO intake per day is divided by 15). Based on these findings the children were classified in to 3 groups as depicted in *Table 2*. It was found that 91% of the subjects from IGICH and 66.7% of subjects from Sagar hospitals were taking more of insulin than required when compared with their daily intake of CHO. 33.3 % and 6.3% were found to be taking less than required amount of insulin from Sagar and IGICH respectively. But only 2% of the subjects from IGICH were taking right amount of insulin based on their daily CHO intake clearly shown in the *Figure 1*.

According to the American Diabetes Association and the American Dietetic Association (2010), there is no singular diet or meal plan that works for everyone with diabetes. Overall, research studies indicate

that the total amount of carbohydrate consumed is the strongest predictor of blood glucose response and this is typically the first tool used in managing the blood glucose levels. For individuals needing greater blood sugar control, choosing low-glycemic carbohydrates along with a carbohydrate-controlled diet plan may produce modest results (Bloomgarden ZT, 2004; Scott R Votey et al, 2010; Garg SK, et al, 2007 and Mercola, 2009).

There was positive relationship between CHO intake and insulin indicating that higher the CHO intake, higher will be the insulin dose. Statistically significant correlation coefficient between insulin and CHO intake was found among sagar hospitals subjects with linear relationship which clearly shows in *Table 3*. However it was not significant in the whole group (*Figure 2*).

The optimum quantity of insulin is calculated based on the concept 1 unit of insulin is required per kg of body weight. Based on these findings the children were classified in to 3 groups as depicted in *Table 4*. It was found that 55.7% of the subjects from IGICH and 28.2% of subjects from Sagar hospitals were taking more of insulin than required when compared with their body weight. 71.8 % and 41.8% were found to be taking less than required amount of insulin from Sagar and IGICH respectively. But only 2% of the subjects in IGICH were taking right amount of insulin based on their body weight. (*Figure 3*).

Table 5 shows there was a significant correlation coefficient at 0.01 level between weight and insulin dosage in both the groups. A positive linear relationship between weight and insulin intake was found in all the subjects unlike incase of CHO and insulin intake found only in subjects from Sagar hospitals but not in IGICH (*Figure 4*).

Table 6 depicts the relationship between insulin dose and other variables viz: age, gender and residence. A significant relationship was found between insulin dose and age with 98% of children above the age of 10 years falling under the category of taking an insulin dose of more than required. Even though all age groups have the subjects taking lesser quantity of insulin than required, majority were found in the age group of 6 – 10 years. A statistically significant relationship was also found between the residence and insulin intake with 49% of rural subjects taking more than required insulin as against 21% who are taking lower dose of insulin.

The scenario is quite opposite in case of urbanites with 79% of them taking less dose than required compared to 21% who were taking more than required dose of insulin. The relationship between proper insulin dose and different variables namely age, gender and residence are interesting. Insulin according to the CHO intake and body weight was not followed in majority of the subjects.

CONCLUSION

Based on body weight and CHO intake insulin dosage was higher in the subjects from IGICH compared to subjects from Sagar hospitals. A significant relationship between insulin dose and variables like age, residence

was also found in all the subjects irrespective of their background. However the study indicates that the number of units of insulin taken by the subjects was neither based on the CHO count nor their body weight which is very much essential. Therefore Proper diabetic nutrition education becomes the need for the day since this helps the type 1 diabetics to find a balance between eating for pleasure and maintain one`s health (Franz MJ et al,2010). This balance indeed helps them to enjoy a better quality of life with ultimate goal of prevention or delaying the long term complications arising from uncontrolled diabetes mellitus.

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Table 1. Demographic profile of the Subjects

	Variables	Number	Percent
Hospital	SAGAR	39	33.1
	IGICH	79	66.9
AGE (Yrs)	Up to 5	13	11
	6 – 10	29	24.6
	> 10	76	64.6
Gender	Male	53	44.9
	Female	65	55.1
Residence	Rural	41	34.7
	Urban	77	65.3
Type of family	Nuclear	92	78
	Joint	26	22
Family Size	1 to 4	64	55
	> 4	52	45
Family income/ month	<3000	15	13
	3000 – 10,000	53	45
	10,000 – 25,000	22	19
	>25,000	27	23

Table 2. Insulin and Carbohydrate Ratio

Insulin intake	*Hospital*		*Total*	*p-value*
	Sagar (n=39)	*IGICH (N=79)*		
More than required	*26 (66.7)*	*72 (91.1)*	*98 (83.1)*	*0.001*
Right Amount	-	*2 (2.5)*	*2 (1.7)*	
Less than required	*13 (33.3)*	*5 (6.3)*	*18 (15.3)*	

Table 3. Correlation between CHO and insulin

Variables	Correlations Coefficient	P value
Whole group	0.178	0.053
Sagar group	0.332*	0.039*
IGICH	0.206	0.069

*Significant 0.05 level

Table 4. Insulin intake according to Body weight

Insulin intake	Hospital		Total	p-value
	Sagar (n=39)	IGICH (n= 79)		
More than required	11 (28.2%)	44 (55.7)	55 (46.6%)	0.008
Right amount	-	2 (2.5%	2 (1.7%)	
Less than required	28 (71.8%)	33 (41.8%)	61 (51.7%)	

Table 5. Correlation between Wt and insulin

Variables	Correlations Coefficient	P value
Whole group	0.662*	0.001
Sagar group	0.638*	0.001
IGICH	0.678*	0.001

*Significant 0.01 level

Table 6. Insulin dose with respect to socio demographic variables

Variables		More than required - No (%)	Less than required - No (%)	P value
Age in years	<5	1 (2)	12 (20)	0.001*
	6 -10	-	29 (48)	
	> 10	54 (98)	20 (32)	
Gender				
	Male	19 (34.5)	34 (56)	0.220
	Female	36 (65.5)	27 (44)	
Resi-dence				
	Rural	27 (49)	13 (21)	0.002*
	Urban	28 (51)	48 (79)	

*Significant

Figure 1. Insulin and Carbohydrate Ratio

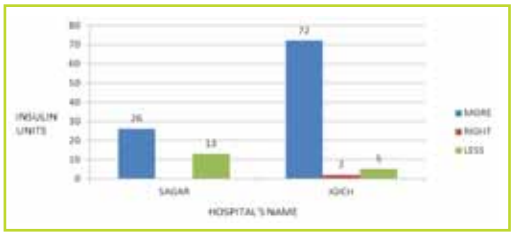

Figure 2. Relationship between CHO and Insulin intake

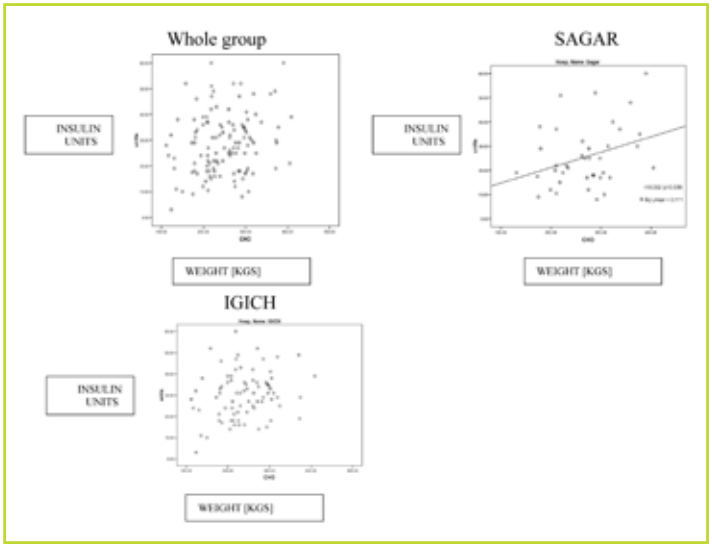

Figure 3. Insulin intake and body weight

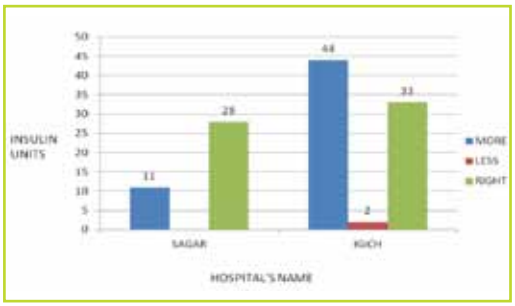

Figure 4. Relationship between Weight and Insulin