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Original Research

Carbohydrate Counting versus Fixed Insulin Doses in Children and adolescents with Type 1 DM

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ABSTRACT:

Diabetes mellitus incidence raising globally. Diet control is one of important aspects in children with type 1 diabetes. We aimed to compare glucose control in type 1 diabetic children and adolescents using the fixed insulin meal doses with those who counted carbohydrates precisely. So we do a across sectional study on diabetic children and adolescents with type I diabetes mellitus visiting Tobruk Diabetic Center in three months period , Data collected by author through questionnaire including demographic data of children, who using carbohydrate counting versus

fixed daily prandial doses and last glycosated hemoglobin and any complications happened. So we divide the patients into two groups :carbohydrate counting and fixed insulin dose groups and compare blood sugar control in both groups. We found no any different in blood sugar control and glycosated hemoglobin in children and adolescent using either carbohydrate counting nor fixed daily insulin doses with poor glycemic control in most studied diabetic patients. Also gender not affecting on glycemic control and no correlation between the disease chronicity, complications and previous hospital admission and carbohydrate counting usage.

KEYWORDS: Type I Diabetes Mellitus, Carbohydrate Counting, Insulin, Children, Nutrition.

INTRODUCTION

The prevalence of type 1 diabetes(T1D) in young people in the US is 1.54 per 1,000.**1**, and the disease's incidence is rising globally**.2**. By 2050, 5 million Americans are predicted to have T1D**.3**. One of the most important aspects of treating diabetes mellitus (D. M.) has always been diet. However, for both the patient and medical staff, it has been and still is one of the most challenging parts of the treatment plan.

Keeping blood glucose levels around normal is the major objective in managing T1D**. 4** and increased glucose levels after eating are factors that make it hard to achieve the best possible management of blood sugar.
.**5** Glycemic response is highly predicted by the total amount of carbohydrates taken; consequently, it is essential to count carbohydrate in meal to closely glycemic control.**6-10**. Counting carbohydrates is not a novel strategy for treating young people with type 1 diabetes.**8**. The American Diabetes Association (ADA) recommended in 2007 that diabetes patients' meals be counted for carbohydrates in order to determine their prandial insulin dosage.**11**. Few studies have been conducted to support the accuracy of carbohydrate counting in children with diabetes.**12,13,14**. Counting carbohydrates increases dietary flexibility and improved glycemic control. **15**. The majority of T1D patients are unaware of the effects of fats and proteins on post prandial blood sugar, which could compromise the precision of carbohydrate counting.

16. Carbohydrate counting is more accurate, simpler to teach, and much more adaptable than the conventional meal plan based on food exchanges. **17**. Our goal was to evaluate the glucose control of children with type 1 diabetes who were given fixed insulin meal doses to those who were using exact carbohydrate counts.

MATERIALS AND METHODS

Across sectional study done on diabetic children and adolescent with type I DM aging from 1-20 years old visiting Tobruk Diabetic center from 1st Aug upto 1st Nov 2024.

Data collected by author through questionnaire including: name, age, sex, onset of DM, weight, last HbA1c, fixed insulin dose or carbohydrate counting, insulin doses, number of meals/day,Insulin Carbohydrate Ratio (ICR).

Also, other questions included Insulin Sensitivity Factor (ISF), previous Diabeteic Ketoacidosis (DKA) and how many times, number of previous hospital admission, cause of admission and any other autoimmune diseases.

This study was authorized by the University of Tobruk's Research Ethics Committee. (approved number NBC: 009.H.24.4).Informed consents was obtained from the children parents according to institutional guidelines.

Statistically we used R Studio version R4.4.1 Categorical data are displayed as counts and percentages, whereas continuous data are represented as medians and ranges. Statistical significance was established as a $p < 0.05$.

RESULTS

The results of this study including 60 child and adolescents with type1 diabetes divided into two groups; group using carbohydrate counting in meals and ICR 31(51.6 %) and group on fixed insulin doses with meals 29 (48.3 %) as showing in figure (1). Most of studied children were females 37 (61.6%), most age group in this study from11-18 Most of studied children were females 37 (61.6%), most age group in this study from11-18 years old. Duration of diabetes ≤5 years in studied patients 45 (75%)

Table 1: Baseline Data of Studied Children.

Variables		Carb. Counting	Fixed	P-value
sex (%)	Female	21 (67.7)	16 (55.2)	0.462
	Male	10 (32.3)	13 (44.8)	
Age Groups (%)	from 1 to 5	4 (12.9)	3 (10.3)	0.435
	from 11 to 18	19 (61.3)	13 (44.8)	
	from 6 to 10	7 (22.6)	10 (34.5)	
	more than 18	1 (3.2)	3 (10.3)	
Age at diabetes onset (%)	from 1 to 5	8 (25.8)	9 (31.0)	0.749
	from 11 to 18	9 (29.0)	6 (20.7)	
	from 6 to 10	12 (38.7)	12 (41.4)	
	less than 1	2 (6.5)	1 (3.4)	
	more than 18	0 (0.0)	1 (3.4)	
Duration of diabetes (%)	from 1 to 5	24 (77.4)	21 (72.4)	0.881
	more than 5	7 (22.6)	8 (27.6)	

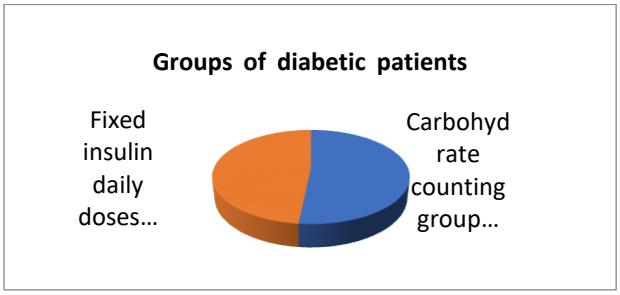

Figure: (1). Groups of diabetic patients

As we noted in table (2) the large percent of our patients with poor blood sugar control and high HbA1c.

Table (3) : HbA1c in both diabetic children using carbohydrate counting versus the fixed daily insulin dose

Variables		Carb. Counting	Fixed	*P*-value
HBA1C (%)	from 7 to 8.8	6 (19.4)	3 (10.3)	0.819
	from 8.6 to 9.5	9 (29.0)	8 (27.6)	
	from 9.6 to 10.5	7 (22.6)	6 (20.7)	
	less than 7	1 (3.2)	1 (3.4)	
	more than 10.5	8 (25.8)	11 (37.9)	

We observe in table (4) the diabetic patients on fixed daily insulin doses with meals have less

Table 2: HbA1c in the Studied Participants.

Variables	
HbA1c	n (%)
from 7 to 8.8	9 (15.0)
from 8.6 to 9.5	17 (28.3)
from 9.6 to 10.5	13 (21.7)
less than 7	2 (3.3)
more than 10.5	19 (31.7)

We noted in table (3) no any significant correlation between group were using carbohydrate counting in calculation of meal doses and group using the fixed insulin dose with meals and HbA1c and blood sugar control with P-value= 0.819

meals per day in comparison with patients were using the carbohydrate counting with P-value= 0.029.

Table 4: The number of daily meals in both carb counting and fixed insulin doses groups

Variables		Carb. Counting	Fixed	*P*-value
Meals numbers (%)	3 or less	6 (19.4)	15 (51.7)	0.029
	4 or 5 meals	22 (71.0)	13 (44.8)	
	6 or more	3 (9.7)	1 (3.4)	

We reported in table (5) no correlation between complications, previous hospital admission and autoimmune diseases in both carbohydrate counting and fixed insulin doses groups with P-value >0.05.

Table 5: The complications and autoimmune diseases in both carb counting and fixed doses groups

Variables		Carb. Counting	Fixed	*P*-value
History of DKA (%)	No	21 (67.7)	25 (86.2)	0.166
	Yes	10 (32.3)	4 (13.8)	
Previous hospital admission (%)	0	4 (12.9)	6 (20.7)	0.635
	1	16 (51.6)	11 (37.9)	
	2	5 (16.1)	7 (24.1)	
	3	0 (0.0)	1 (3.4)	
	4	2 (6.5)	1 (3.4)	
	5	1 (3.2)	1 (3.4)	
	6	1 (3.2)	0 (0.0)	
	7	0 (0.0)	1 (3.4)	
	9	1 (3.2)	0 (0.0)	
	10	0 (0.0)	1 (3.4)	
	14	1 (3.2)	0 (0.0)	
Cause of admission (%)	Another reasons	2 (6.5)	4 (13.8)	0.385
	Hyperglycemia	24 (77.4)	23 (79.3)	
	Hypoglycemia	5 (16.1)	2 (6.9)	
Celiac D (%)	No	29 (93.5)	26 (89.7)	0.938
	Yes	2 (6.5)	3 (10.3)	
Chronic disease (%)	No	25 (80.6)	27 (93.1)	0.299
	Yes	6 (19.4)	2 (6.9)	
Thyroid (%)	No	28 (90.3)	27 (93.1)	1
	Yes	3 (9.7)	2 (6.9)	

DISCUSSION

This is across sectional study done on diabetic children and adolescent with type 1 DM visiting Tobruk diabetic center. This study aimed to study the difference in blood sugar control in both using carbohydrate counting in their life or using fixed daily insulin doses. The primary result of this study was showing no any different in blood sugar control and HbA1c in children and adolescent using either carbohydrate counting nor fixed daily insulin doses. However, a different study demonstrates that providing type 1 diabetic patients with carbohydrate counting enhances their quality of life.**18** and decreasing in HbA1c and **13** That found the using of a carbohydrates counting associated with good blood sugar control. our study was showing poor glycemic control presented by HbA1c in most studied diabetic patients this consistent with **19**. In this study both groups either diagnosed early less than 5 years or more than 5 years near equally using

carbohydrate counting and fixed doses. Other findings indicated a substantial correlation between the HbA1c level and the length of T1DM.**19 &20**. In our study the females were using the carbohydrate counting than males. Showed the gender not affecting on glycemic control **21** . Also this study found no correlation between the disease chronicity and carbohydrate counting usage. In our study we are not focusing on if our patient learned how to calculate the carbohydrate correctly or not. This study's limitation is tiny sample size, we not asses the patient if really understand the carbohydrate counting methods and given the insulin regularly , also many other factors not studied as family habits, social and economic factors , types of foods ,activity and many other factors.

CONCLUSION

The most of children visiting Tobruk Diabetic Center with high HbA1c and poor blood sugar control.

We conclude also no correlation between the using of carbohydrate counting or fixed insulin doses and blood sugar control.

So we recommend further researches on large sample and good training and education for diabetic families.

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ETHICS

The University of Tobruk's Research Ethics Committee gave its approval to this project (approved number NBC: 009.H.24.4).

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الملخص

يرتفع معدل الإصابة بمرض السكري عالميًا. يُعد التحكم في النظام الغذائي أحد الجوانب المهمة لدى الأطفال المصابين بداء السكري من النوع الأول. هدفنا هو مقارنة التحكم في مستوى الجلوكوز لدى الأطفال والمراهقين المصابين بداء السكري من النوع الأول الذين يستخدمون جرعات الأنسولين الثابتة مع أولئك الذين يحسبون الكربوهيدرات بدقة. لذلك

يستخدمون إما حساب الكربوهيدرات أو جرعات الأنسولين اليومية الثابتة مع ضعف التحكم في نسبة السكر في الدم لدى معظم مرضى السكري المدروسين. كما لم يؤثر الجنس على التحكم في نسبة السكر في الدم ولا يوجد ارتباط بين استمرار المرض والمضاعفات والدخول السابق إلى المستشفى واستخدام حساب الكربوهيدرات.

الكلمات المفتاحية: داء السكري من النوع الأول؛ حساب الكربوهيدرات؛ الأنسولين؛ الأطفال؛ التغذية

أجرينا دراسة مقطعية شاملة على الأطفال والمراهقين المصابين بداء السكري من النوع الأول الذين يزورون مركز طبرق للسكري لمدة ثلاثة أشهر. جمع المؤلف البيانات من خلال استبيان يتضمن البيانات الديموغرافية للأطفال الذين يستخدمون حساب الكربوهيدرات مقابل جرعات يومية ثابتة من الوجبات وآخر هيموغلوبين سكري وأي مضاعفات حدثت. لذلك قمنا بتقسيم المرضى إلى مجموعتين: مجموعة حساب الكربوهيدرات ومجموعة جرعة الأنسولين الثابتة وقارنا التحكم في مستوى السكر في الدم في كلتا المجموعتين. لم نجد أي اختلاف في التحكم في مستوى السكر في الدم والهيموغلوبين السكري لدى الأطفال والمراهقين الذين