Factors Affecting the Preservation of C-Peptide Secretion in Egyptian Children with Type 1 Diabetes Mellitus

Amany Kamal El-Hawary, Hadil Mohamad Aboelenin , Rania Mostafa Abd El-Latif El-Helaly , Ahmed Abd El-Gwad Fotouh Abd El-Gwad

Mansoura University Children Hospital, Mansoura, Egypt

Introduction

At the time of clinical onset of type 1 diabetes mellitus (T1DM) only ~ 10% of normal b-cell mass remains functioning. Levels of plasma C-peptide drop to ~20% of the maximal mean of healthy people. Measurement of stimulated C-peptide levels is currently believed to be the best method to evaluate endogenous insulin secretion, especially in insulin-treated patients in whom the diabetes subtype is uncertain. The Diabetes Control and Complications Trial found that the use of aggressive treatment at diagnosis, with rapid and strict control of hyperglycemia, may result in improved beta-cell function and could help sustain endogenous insulin secretion. Understanding the modifiers and predictors of beta-cell function would allow targeting immunological approaches to those individuals most likely to benefit from therapy.
Factors that modulate this residual pancreatic function are still questionable. So the aim of this study is to evaluate the effect of different factors associated with preserved pancreatic beta cell function at one year follow up of children with new-onset type I DM.

Patients and method

Study Design: (non-concurrent cohort study).
Subjects: Total 93 children (46 females and 47 males), aged more than 2 years, were diagnosed with T1DM. The included children were divided into two groups according to the preservation of pancreatic β-cell function (stimulated c-peptide s-cp ≥0.6ng/mL): group A with preserved s-CP at follow up and group B with non preserved s-CP.
Methods: Insulin regimen was divided into 4 groups:
group 1, bolus insulin; 3 injections before meal; (4 patients),
group 2, premixed insulin; 3 injections before meal; (9 patients),
group 3, MDI-NPH; (27 patients),
group 4, MDI-long; (53 patients).
All patients were received insulin infusion for three consecutive days before shifting to any of the previous regimens.
The children were investigated at the time of diagnosis and after 12 months follow up for baseline C-peptide, mixed meal stimulated C-peptide level (s-CP) and HbA1c.
In this study, a cut-point at the C-peptide level ≥0.6 ng/ml at follow up was used to define **preserved** C-peptide. residual pancreatic function is needed to decrease long term complications.
Change in C-peptide over the one year of the study (delta C-peptide) was calculated as (C-peptide $_{at\ follow\ up}$ − C-peptide $_{at\ diagnosis}$).
Improvement in pancreatic function was expressed as **improved** C-peptide which indicate C-peptide value at follow up more than or equals C-peptide at diagnosis.

conclusion

Older age, colder seasons and initially higher HbA1c at diagnosis remains significantly associated with preserved C-peptide after 12 months follow up.

Results

Of the 93 children, 50.5% were male and 49.5% were female with the mean age at diagnosis of 9.05±3.34 years. Patients were distributed in 3 age groups: nearly 60% were from late childhood group (6 -12 years), 21% in adolescence (12-18 years) and 19 % in early childhood (2-6 years).
Seventy two percent of patients were from rural areas.
Nearly 74 % of patients had no family history of type I DM, the least percentage of patients ~ 19 % were diagnosed in autumn months and ~ 65 % of patients had no signs of diabetic ketoacidosis at diagnosis. Fifty seven percent of patients were maintained on multiple daily injections plus basal long acting insulin.
Mean total dose of insulin per kg was 1.05 ± 0.36 at diagnosis.
Mean Stimulated C-peptide at diagnosis was 0.92 ± 0.58 and mean HbA1c was 8.79 ± 2.15

Distribution of patients according to pancreatic function

Fasting C-peptide		n (%)	Stimulated C-peptide		n (%)
Improved	Yes	39 (41.9)	Improved	Yes	41 (44.1)
	No	54 (58.1)		No	52 (55.9)
Preserved	Yes	21 (22.6)	Preserved	Yes	44 (47.3)
	No	72 (77.4)		No	49 (52.7)
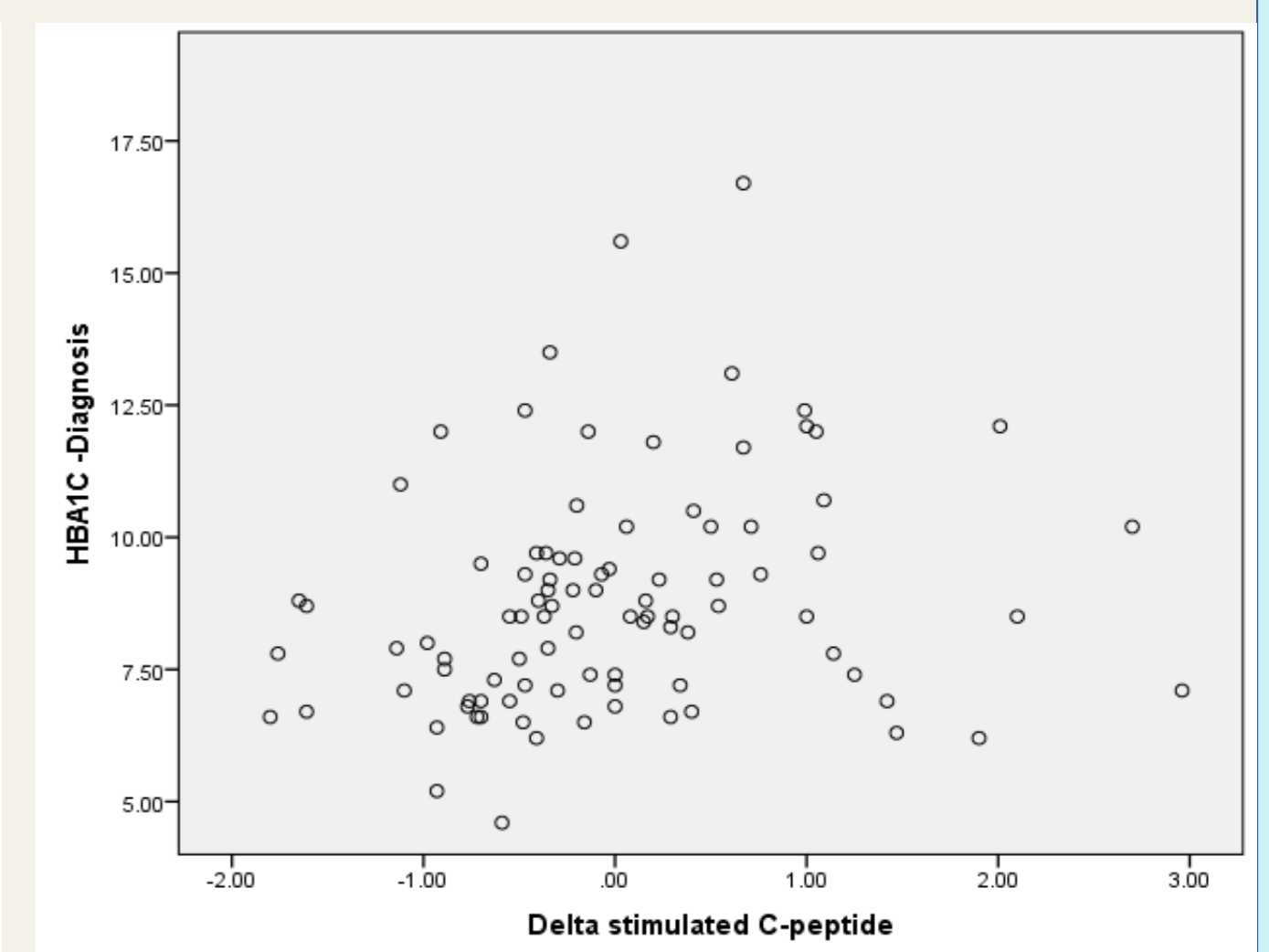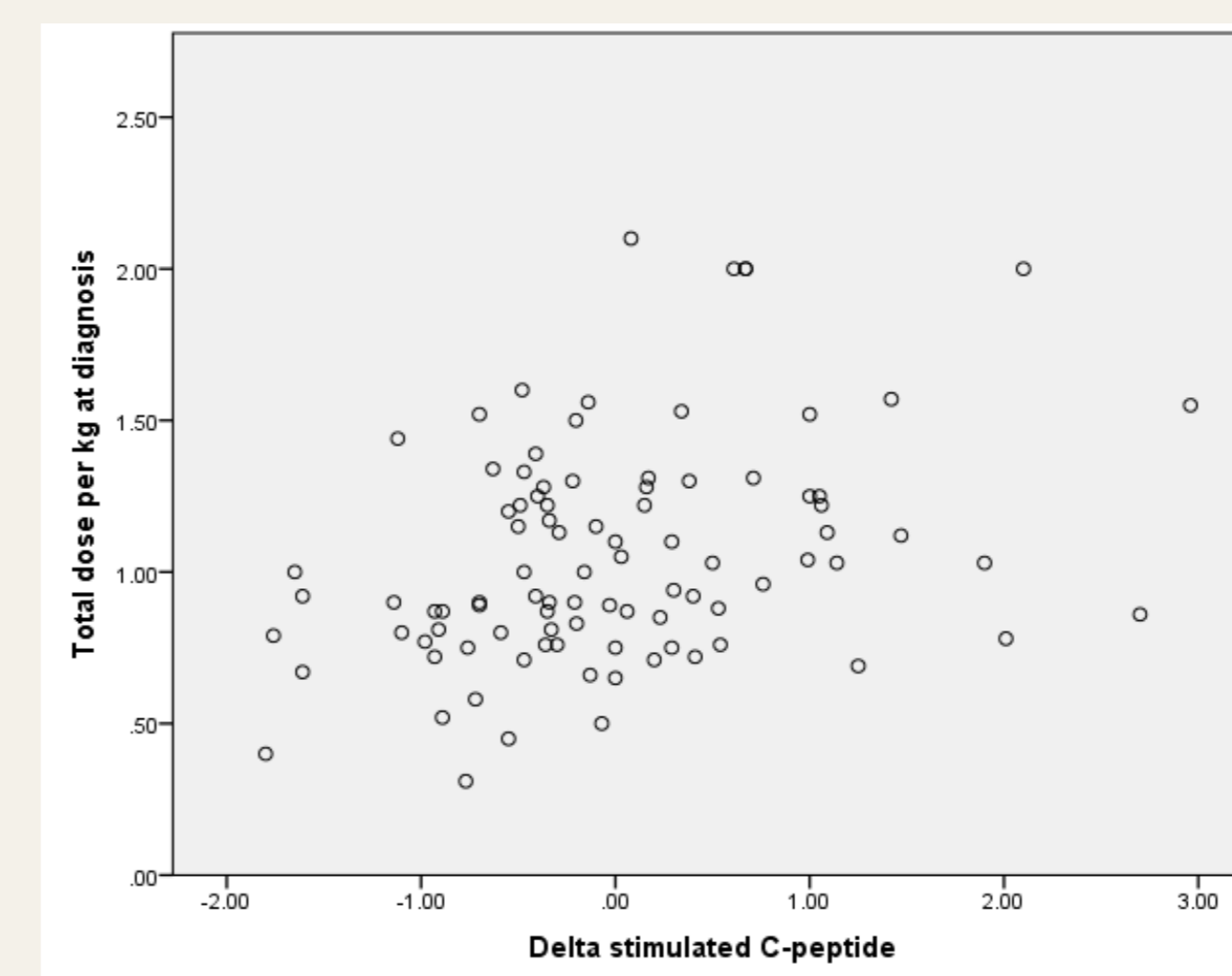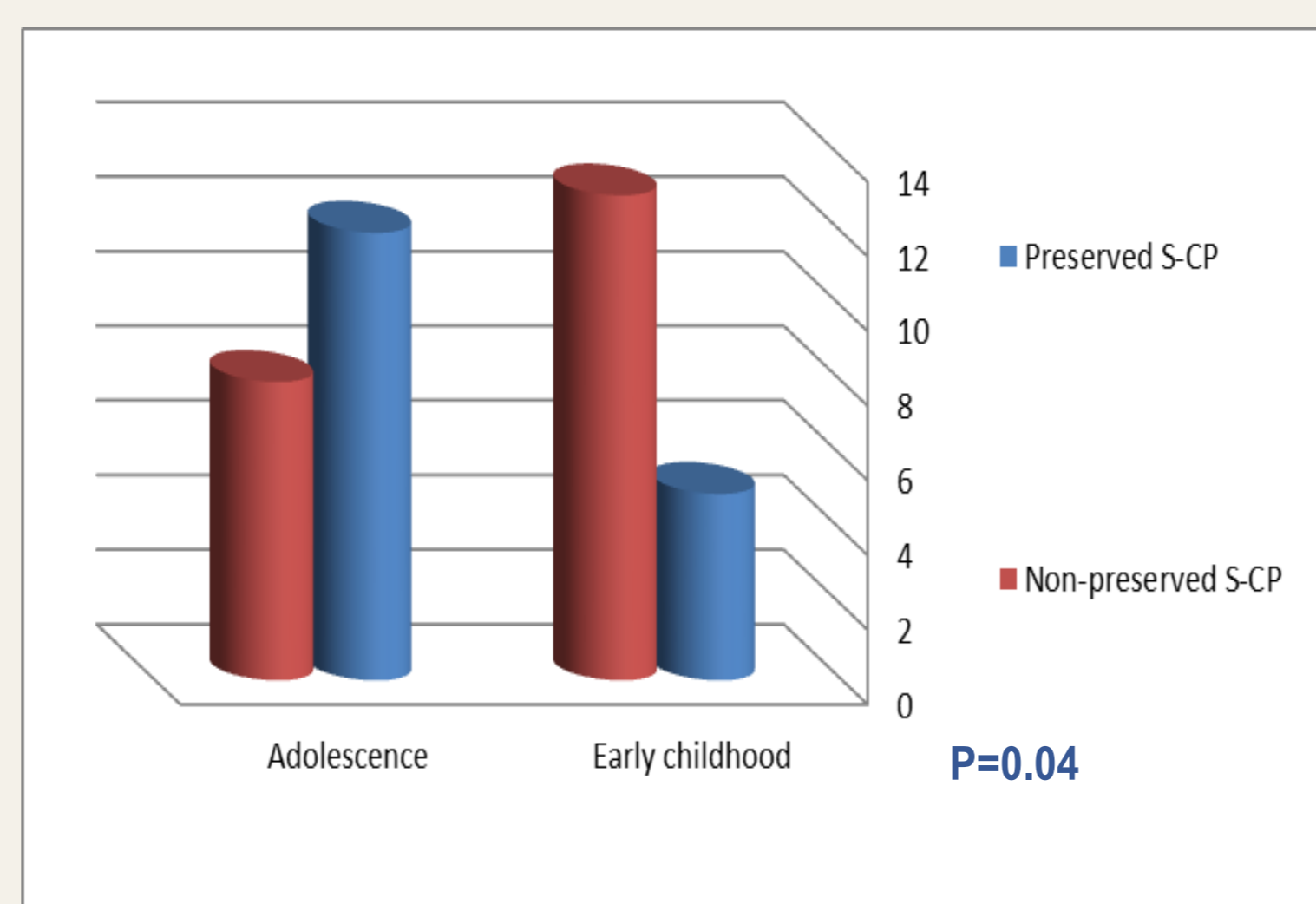
Comparison between preserved and non-preserved pancreatic function in different age groups

Scatter diagrams showing significant positive correlation between delta stimulated c-peptide and total insulin dose per kg at diagnosis and HbA1c at diagnosis

Comparison between preserved and non-preserved pancreatic function according to diabetes related criteria

		Preserved S-CP n = 44 n (%)	Non-preserved S-CP n = 49 n (%)	Pearson Chi-Square	
Family history of type I DM	No	37 (84.1)	32 (65.3)	P = 0.03*	X^2 = 4.27
	Yes	7 (15.9)	17 (34.7)		
Season at diagnosis	Summer and spring	18 (41)	31 (63.2)	P = 0.03*	X^2 = 4.64
	Winter and autumn	26 (59)	18 (36.8)		
Insulin regimen	Bolus (group 1)	2 (4.5)	2 (4.1)	P_1 = 0.58	X^2 = 0.32
	Premixed (group 2)	3 (6.8)	6 (12.2)	P_2 = 0.73	X^2 = 0.12
	MDI –intermediate (group 3)	11 (25)	16 (32.7)	P_3 = 0.91 P_4 = 0.70	X^2 = 0.01 X^2 = 0.15
	MDI – long (group 4)	28 (63.7)	25 (51)	P_5 = 0.28 P_6 = 0.31	X^2 = 1.16 X^2 = 1.04

P_1 group 1&2, P_2 group 1&3, P_3 group 1&4, P_4 group 2&3, P_5 group 2&4, P_6 group 3&4

Comparison of C-peptide and HbA1c between groups of preserved and non-preserved pancreatic function

		Mean ± SD at diagnosis	Mean ± SD at follow up	Student t test	
				t	P-value
Group A Preserved S-CP	Fasting C-peptide	0.65 ± 0.42	0.76 ± 0.50	1.11	0.26
	Stimulated C-peptide	1.03 ± 0.63	1.56 ± 0.85	3.32	0.001*
	HbA1c	9.27 ± 2.40	7.37 ± 1.30	4.61	< 0.0001*
Group B Non-preserved S-CP	Fasting C-peptide	0.51 ± 0.34	0.23 ± 0.14	5.33	< 0.0001*
	Stimulated C-peptide	0.82 ± 0.51	0.32 ± 0.14	6.61	< 0.0001*
	HbA1c	8.36 ± 1.80	7.57 ± 1.56	2.32	0.02*

Poster presented at: