Journal Homepage: - www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/18530
DOI URL: http://dx.doi.org/10.21474/IJAR01/18530

RESEARCH ARTICLE

FLEXIBLE INTENSIVE INSULIN THERAPY: PRACTICAL MODALITIES AND METABOLIC IMPACT

Fatimazahrae Melki[1], Sarrah El Khadir[1], Houda Salhi[1,2] and Hanan El Ouahabi[1,2]

1. Department of Endocrinology, Diabetology and Nutrition, University Hospital Hassan II, Fez, Morocco.
2. University Sidi Mohamed Ben Abdellah, Faculty of Medicine and Pharmacy, Fez, Morocco.

Manuscript Info

Manuscript History
Received: 10 February 2024
Final Accepted: 14 March 2024
Published: April 2024

Key words:
Flexible Insulin Therapy, Glycemic Control, Severe Hypoglycemia, Quality Of Life, Type 1 Diabetes

Abstract

Background: Flexible intensive insulin therapy (FIT) is a therapeutic method aimed at reproducing physiological insulin secretion as rigorously as possible. The purpose of this study was to highlight the practicalities of FIT in our department in order to assess its outcomes on glycated hemoglobin (HbA1c) and severe hypoglycemia (SH) in baseline and after the follow-up of patients with type 1 diabetes.

Methods: Over a period of 6 years, we retrospectively involved patients with type 1 diabetes who participated in an educational program of FIT during a 5-day hospitalization at the Endocrinology, Diabetology, and Nutrition department of the Hassan II University Hospital in Fez. Our study series was followed up at 3-6 and 12months after FIT to determine its effects on metabolic parameters.

Results: The mean HbA1c decreased from 8.82% at baseline to 7.67% at follow-up in 3 months, 7.5% in 6 months to reach 7.16% in one year without increasing the risk of severe hypoglycemia. Indeed, the rate of hypoglycemia decreased significantly from 51.1% at baseline to 8.8% at follow-up ($p = 0.011$).

Conclusion: Our results underscore the value of FIT education in improving glycemic control while decreasing episodes of hypoglycemia and providing patients with a better quality of life.

Introduction:

Flexible intensive therapy (FIT) was historically established in the late of 1970s when Dr. Bernstein published an insulin therapy method adapted to meals and experimented insulin injections based on hyperglycemia [1]. In the early 1980s, the German team in Düsseldorf developed a teaching program called the Düsseldorf Diabetes Treatment and Teaching Program (DTTP) [2]. This program has been successful in the medium-term leading to metabolic improvement and a reduction in the frequency of hospitalizations [2]. Furthermore, in 1990 Howorka proposed the use of personalized algorithms to calculate prandial insulin doses as a supplement to the standard method's algorithms (breakfast: 2 IU/10 g; lunch: 1 IU/10 g; dinner: 1.5IU/10 g).

FIT is an educational method of intensified insulin therapy that aim to enable dietary freedom and provide more autonomy managing prandial insulin doses according to meals and life style for people with type 1 diabetes in order to improve glycemic control and the quality of their lives.

Corresponding Author: Fatimazahrae Melki
Address**:** Department of Endocrinology, Diabetology and Nutrition, University Hospital Hassan II, Fez, Morocco.

A precarious situation can distort the perception of the future. Nevertheless, we must offer intensified insulin treatment wherever possible, especially to these precarious patients, in order to provide them with a flexible life style, characterized by unpredictable and variable feeding conditions and activities. This therapeutic approach should help them to avoid hypoglycemia in case of insufficient nutrition, or conversely hyperglycemic episodes [3].

This study has two purposes: the first is to report on practical modalities FIT used in our department, and the second is to evaluate the metabolic impact of this method on glycated hemoglobin and the incidence of severe hypoglycemia.

Subjects and Methods:

The trial was designed as a descriptive, analytical study of patients with type 1 diabetes retrospectively enrolled over a period of 6 years. We involved patients with type 1 diabetes who were hospitalized and followed up at the Department of Endocrinology, Diabetology and Nutrition at University Hospital Center Hassan II in Fez.

Patients were considered eligible if they were motivated, accountable, had good or moderate glycemic control (HbA1c 5.5-11%) and they were so required self-monitoring blood glucose several times per day. Exclusion criteria included depression, eating behavior disorder and degenerative complications such as diabetic retinopathy, nephropathy and diabetic foot.

The present work was carried out by groups of patients who had participated in a 5-day hospitalization teaching program. This group approach allowed patients to be more motivated, ensured dynamic and personalized teaching, as well as consolidated patients' theoretical knowledge.

FIT's program at our department was based on Howorka's method while respecting his three pre-eminent guidelines: evaluation of basal insulin, prandial insulin and dietetic training. Patients performed experimental sessions to establish their own insulin requirement including, a 24-hour fasting period to illustrate the basic insulin requirement, and ingestion of test meals with varying amounts of carbohydrates to determine the individual carbohydrate-portion/insulin requirement relationship. This also helped to establish an individual correction algorithm to decrease hyperglycemia.

The statistics were collected from the database of type 1 diabetic patients who underwent the FIT program and were followed up during one year with the aim to assess metabolic impact on improving glycemic control and decreasing the risk of severe hypoglycemia (defined as a condition requiring the assistance of another person), while allowing dietary and lifestyle freedom.

Results:

Participants

The present report recruited 45 patients with type 1 diabetes, which consisted of 25 men (57.8%) and 20 women (42.2%). The participants had a mean age of 21±8.5 years, ranging from 16 to 39 years. The average duration of diabetes was 7.8±7.2 years, and their body mass index (BMI) was 21.28±3.8kg/m^2. Additionally, the baseline HbA1c level was 8.82%, as shown in Table 1.

Table 1: Demographic data of patients with type 1 diabetes.

Patients (n) :	45
Gender (n) : Female	 20
Male	25
Age (years): Median±SD Range	 21±8.5 16-39
Diabetes duration: Median ±SD (years) Average	 7.8±7.2 0.5-33
BMI±SD (Kg/m2)	21.28±3.8
Average Waist circumference(cm):	

Female Male	69.6 66.5
HBA1C at baseline (%)	8.82 ±1.95
Insulin total daily dose(u/kg /day)	0.53 ± 0.25
Frequent self monitoring blood glucose	3 to 6 daily

SD: standard deviation; BMI: body mass index; HbA1c: glycated hemoglobin

Outcome measures

The baseline mean HbA1c level was 8.82±1.95% with an average daily total insulin dose of 0.77±0.22 IU/kg. All patients completed the 24-hour fast period without any major incidents and there were no recorded episodes of severe hypoglycemia. The mean basal insulin dose was reduced to 0.27IU/kg/day, with an average insulin sensitivity of 0.43g/l/1IU of insulin. The mean ratios for insulin doses were 1.6±0.39IU/10g at breakfast, 0.95±0.28IU/ 10g at lunch, and 1.24±0.44IU/10g at dinner as reprensented in Table 2.

Table 2: Characteristics of patients with type 1 diabetes at FIT.

Parameters	Results
Insulin total daily dose (iu /kg/day)	0.77±0.22
Basal insulin dose (iu /kg)	0.27± 0.09
Median ratio U/P: Breakfast Lunch Dinner	 1.6±0.39 0.95±0.28 1.24±0.44
Weight loss (kg) : 3 months after FIT: -Median -Average 6 months after FIT: -Median -Average	 3 0-6 2 0-4

U: insulin unit; P: carbohydrate portion

Among all participants, 80% (36 patients) remained adherent to the program. In this group, the HbA1c levels decreased from 8.82% at baseline to 7.67% at follow-up in 3 months, 7.5% in 6 months, and reached 7.16% after one year (Figure1), without increasing the risk of severe hypoglycemia. Indeed, the percentage of hypoglycemia events decreased significantly from 51.1% at baseline to 8.8% at the follow-up (p = 0.011) (Table 3).

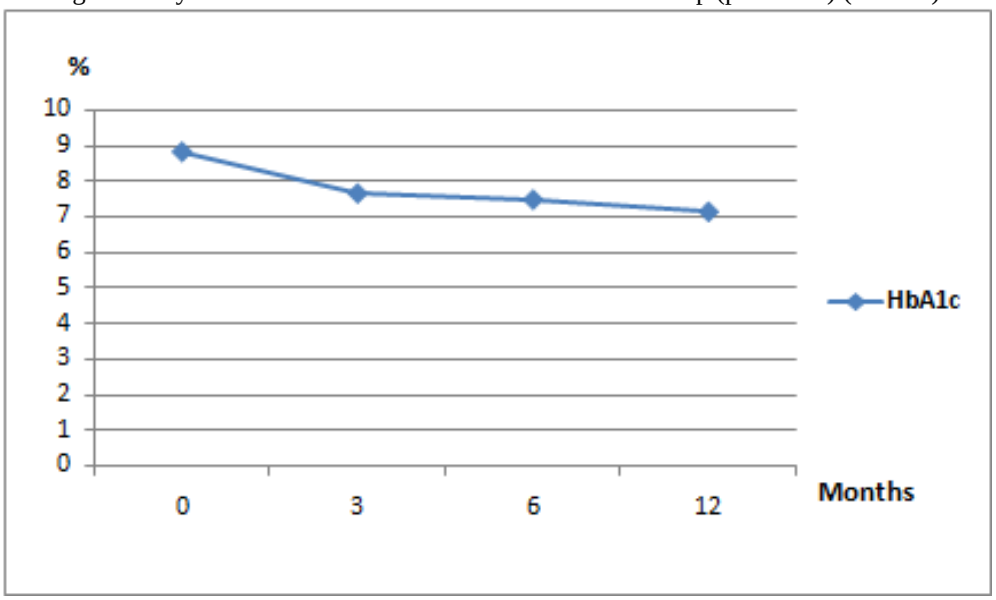

Figure1: Baseline and follow-up HbA1C in 3, 6, and 12 months.

Table 3: Baseline and follow-up data for patients with type 1 diabetes.

	Baseline	Follow-up			P
		3-month	6-month	12-month	
HBA1C (%)	8.82	7.67	7.5	7.16	0.020
Hypoglycemia (%)	51.1	8.8			0.011

The mean HbA1c level decreased by 1.12 percent during the 12-month study (p=0.020), and the rate of severe hypoglycemia episodes fell by 42.3% compared to its previous level (p=0.011).

Discussion:

FIT aims to replicate the physiology of insulin secretion by the pancreatic islets as accurately as possible. According to Grimm [4], its objective is to "transfer the decision-making process and insulin management to the patient, based on different daily activities, especially meals." This insulin therapy is customized to suit the lifestyle of individual patients [5]. It involves separating the basal and prandial insulin requirements through an experimental teaching program [5].

In our study, we observed an improvement in the mean HbA1c level both at baseline and follow-up.This aligns with the findings in the literature, where it is generally reported that HbA1c levels improves after FIT [6-7-8-9-10]. However, only a few teams have specifically studied the impact of the FIT program at 3 months in a hospital setting [11-12]. One such study, conducted at the Hospital Center “Notre Dame et Reine Fabiola” in Belgium [11], evaluated the metabolic impact at 3 months and found a decrease of 0.9% in glycated hemoglobin levels, starting from a baseline value of 8.4%. This baseline value indicates poor glycemic control in patients with diabetes, similar to the patients in our study.

The assessment of DAFNE south group’s study at 6 months [6] showed a 1% decrease in HbA1c level, with a mean of 9.5% at baseline. Other studies [6-11-13-14] obtained similar results to ours at 6 months follow-up, with a decrease of 0.5% in a Swiss study [9], 0.7% [11], and 1.2% [13-14].

In the majority of studies, the improvement in glycemic control is more apparent [7-9] in patients with much higher HbA1c levels before starting FIT. The reduction in HbA1C can reach 2% at 1 year in the "Southern Dusseldorf" cohort with an initial glycated hemoglobin of 12.3% [7]. Most studies evaluate the effect on HbA1c at 1 year [7-8-9-10], or longer [7-9]. It is indeed interesting to assess if glycated hemoglobin continues to decrease beyond 6 months after FIT. However, the changes between 6 and 12 months after FIT do not seem to be significant, and HbA1c levels appear to be sustainable [10-13].

FIT significantly improved glycemic control without increasing the risk of severe hypoglycemia. In a study conducted by Falconnier Bendik et al. at the University Hospital of Basel, it was found that the frequency of severe hypoglycemic events reduced by ten-fold from 0.33 episodes/6 months at baseline to 0.03 episodes/6 months after 18 months ($p < 0.05$) in 45 patients with type 1 diabetes [13]. Our study supports these findings, as we observed a significant decrease in the percentage of hypoglycemia events from 51.1% at baseline to 8.8% at follow-up ($p = 0.011$).

The success of FIT depends on encouraging patients to improve their glycated hemoglobin levels. Motivating patients for change is indeed the main challenge. Furthermore it is crucial to establish a shared goal between the patient and caregiver, which should be negotiated to ensure the success of the program [13].

Our study did not include a multivariat analysis. Hence, larger studies involving type 1 diabetic patients should be conducted to further investigate this topic.

Conclusion:

The results of our study demonstrate that our practical modalities are in line with international recommendations leading to a significant decrease in basal insulin doses and HbA1c levels. This highlights the effectiveness of this approach in enhacing glycemic control, reducing severe hypoglycemia episodes and improving the patient’s quality of life.

Conflict of interest
The authors state that they do not have any conflicts of interest.

References:

[1]. Bernstein RK. Virtually Continuous Euglycemia for 5 Year in a Labile Juvenile-onset Diabetic Patient Under Noninvasive Closed-Loop Control. Diabetes Care1980; 3(1): 140- 143.
[2].Mühlhauser I, Jörgens V, et al. Bicentric evaluation of a teaching and treatment programme for Type 1 (insulindependent) diabetic patients: improvement of metabolic control and other measures of diabetes care for up to 22 months. Diabetologia 1983; 25(6): 470-476
[3].C.Sachon. Functional insulin therapy.Review Practice. 2003 Jun 1; 53(11):1169-1174
[4]. Grimm J, Berger W, et al. Functional insulin therapy: patient education and algorithms
. Diabetes & Metabolism. 2002; 28: 2S15-2S18.
[5]. Sachon C, Heurtier A, Grimaldi A. L'insulinothérapie dite "fonctionnelle" [So-called "functional" insulin therapy]. Diabetes Metabolism. 1998; 23: 556-559.
[6]. DAFNE Study Group. Training in flexible, intensive insulin management to enable dietary freedom in people with Type 1 diabetes: dose adjustment for normal eating (DAFNE) randomized controlled trial. Diabetic Medicine. 2002; 325 :746.
[7].Mühlhauser I, Bruckner I, et al. Evaluation of an intensified insulin treatment and teaching programme as routine management of Type 1 (insulin-dependent) diabetes.The Bucharest Düsseldorf Study. Diabetologia 1987; 30(9): 68 1 -690.
[8].Sämann A, Mühlhauser I, et al. Glycaemic control and severe hypoglycaemia following training in flexible, intensive insulin therapy to enable dietary freedom in people with type 1 diabetes: a prospective implementation study. Diabetologia2005; 48: 1965-1970.
[9]. Speight J, Amiel SA, et al. Long-term biomedical and psychosocial outcomes following DAFNE (Dose Adjustment for Normal Eating) structured education to promote intensive insulin therapy in adults with sub-optimally controlled type 1 diabetes. Diabetes Research and Clinical Practice2010; 89: 22-29.
[10]. Cooke D, Bond R, et al. Structured Type 1 Diabetes Education Delivered within Routine Care: Impact on glycemic control and diabetes-specific quality of life. Diabetes Gare. 2012; 36(2): 270-272.
[11]. P Collin, J Louis. Impact de l'insulinothérapie fonctionnelle sur l'équilibre glycémique et la qualité de vie du diabétique de type 1. Diab-Endocrino Hôpital Notre Dame et Reine Fabiola. Diabetes Metabolism. 2008 ; 35: 692-512.
[12]. M Cordonnier, V Legand. Influence bénéfique de l'insulinothérapie fonctionnelle sur la qualité de vie de diabétique type 1.Endo-Diab-Maladies métaboliques Centre Hospitalier Valencienne.Lille. Diabetes Metabolism. 2009 ; 36:662-51.
[13]. Falconnier Bendik C, Keller U, et al. Training in flexible intensive insulin therapy improves quality of life, decreases the risk of hypoglycaemia and ameliorates poor metabolic control in patients with type 1 diabetes. Diabetes Research and Clinical Practice. 2009; 83(3): 327-333
[14]. Hopkins D, Lawrence I, et al. Improved Biomedical and Psychological Outcomes 1 Year After Structured Education in Flexible Insulin Therapy for People With Type 1 Diabetes: The U.K. DAFNE experience. Diabetes Care. 2012; 35(8): 1638-1642.