Il ruolo della tecnologia nella gestione nutrizionale del Diabete Tipo 1

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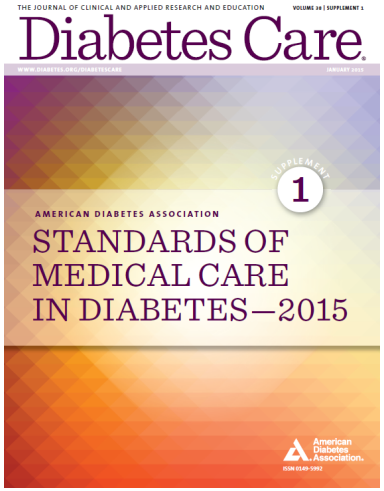
ROMA, 28 NOVEMBRE 2015

“Burden” gestionale

- *Conteggio di carboidrati/ calorie*
- Impostazione boli speciali
- Bolo di correzione
- *Calcolatore di bolo*
- velocita’ basale temporanea
- *Ipoglicemia*
- *Attivita’ sportiva*
- Utilizzazione dati del sensore (RT)
- Allarmi

Supporti decisionali: *Atlanti alimentari* e *Calcolatori di bolo*

Boli Speciali



Recommendations: Pharmacological Therapy For Type 1 Diabetes

Most people with type 1 diabetes should:

- Be treated with MDI injections (3–4 injections per day of basal and prandial insulin) or continuous subcutaneous insulin infusion (CSII) **A**
- Be educated in how to match prandial insulin dose to carbohydrate intake, premeal blood glucose, and anticipated activity **E**
- Use insulin analogs to reduce hypoglycemia risk **A**

ADA. 7. Approaches to Glycemic Treatment. Diabetes Care 2015;38(suppl 1):S41

calcolo del bolo insulinico

Manuale

- molto tempo *(riduzione dell'aderenza*)
- stima empirica
- omissione boli
- rischio di "impilamento" dei boli.

Automatico

- maggiore precisione (migliore controllo glicemico)
- migliore aderenza del paziente al trattamento
- riduzione del rischio di di "impilamento" dei boli

•McDaniel A et al, 2009; Pickup J, 2002; Bode BW et al, 2002; Linkeschova R et al, 2002

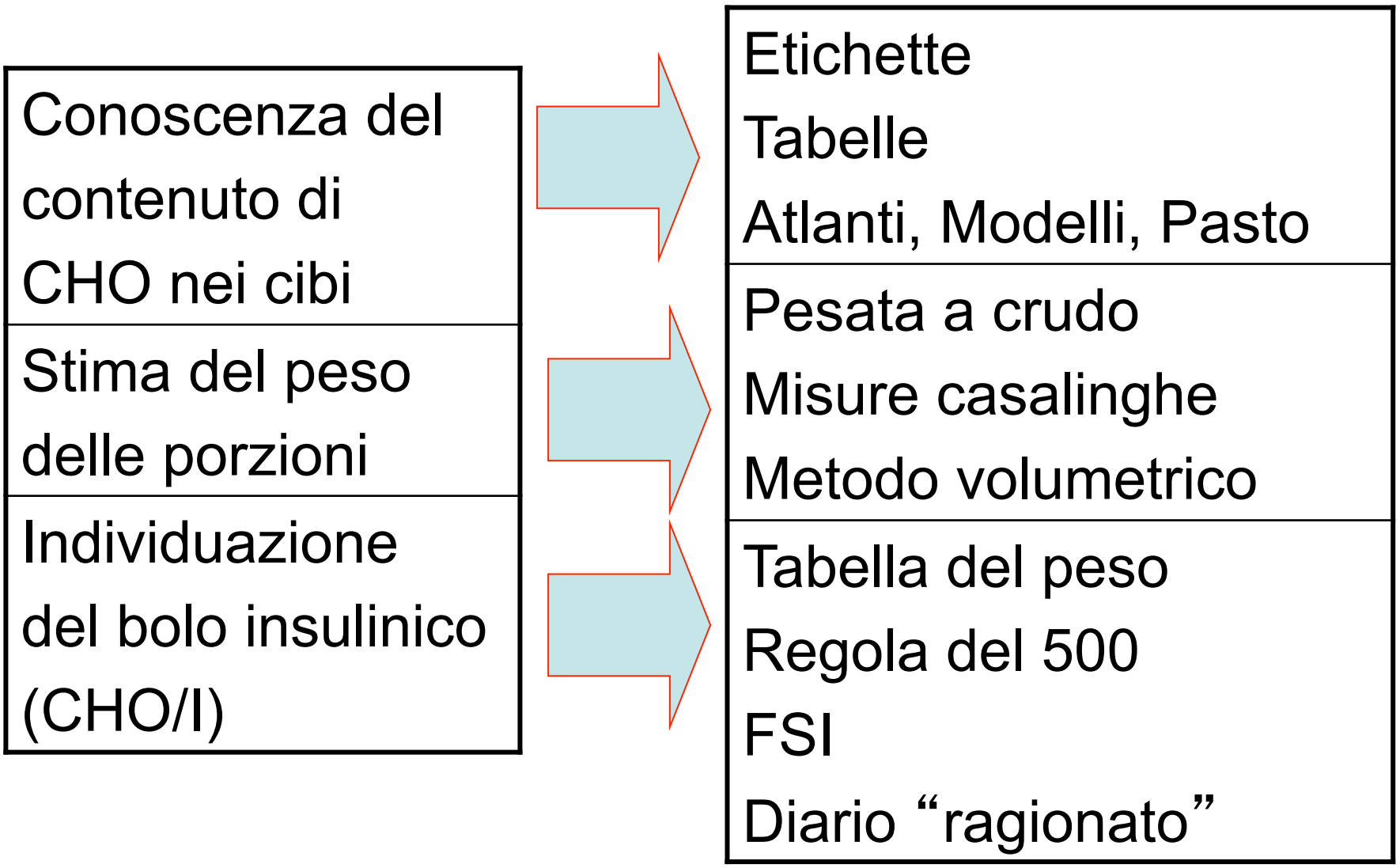
Supporti Decisionali per il confezionamento del bolo insulinico

- Glucometri
- App per smartphone
- Microinfusori

- Carboidrati del pasto (I:CHO; database)
- Glicemia preprandiale
- Obiettivi glicemici
- Insulin on board (insulina residua, IOB)
- Sensibilita’ Insulinica (Fattore di Correzione,FC)
- Stato fisiologico (PS)

$$\text{Bolus insulin} = \frac{\text{CHO}}{\text{ICR}} + \frac{\text{Current BG - Target BG}}{\text{CF}} \times \text{PS - IOB} \quad (3)$$

CHO Counting: fasi e strumenti



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UOS DI DIABETOLOGIA CON DAY HOSPITAL
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Responsabile Dott. Claudio Tubili.

☎ Day Hospital - Diretto e Fax 06/58702607 Ambulatorio 06/58702631

ISTRUZIONI PRELIMINARI PER SEDUTE DI TERAPIA EDUCAZIONALE FINALIZZATE ALLA **CONTA DEI CARBOIDRATI** ("CHO COUNTING")

1. controllare glicemia prima di ogni pasto e 2 ore dopo;

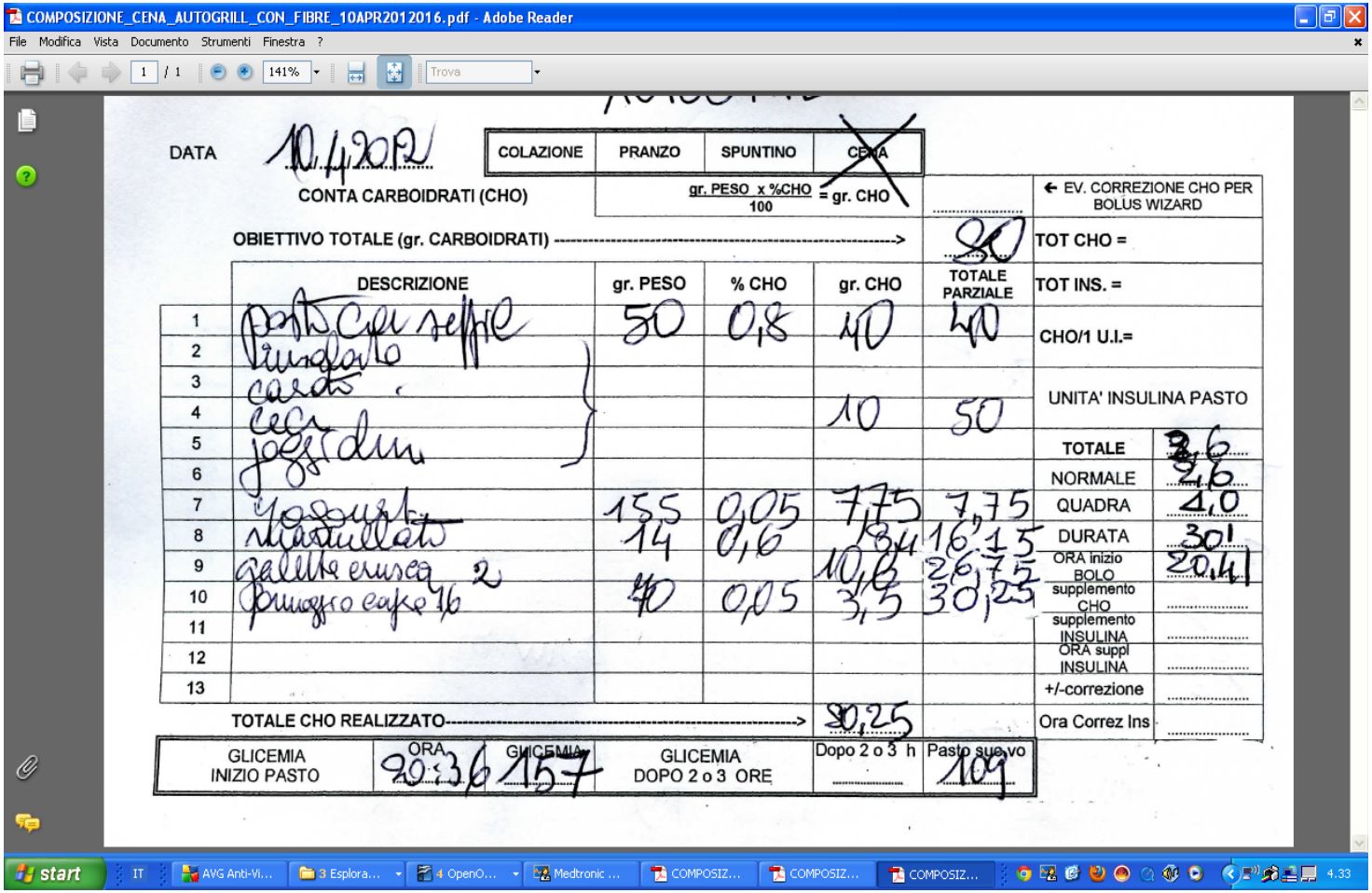
2. quando la glicemia pre-prandiale e' compresa fra **70** e **120** e quella postprandiale fra **100** e **180**:

- registrare tutti gli **alimenti consumati**, possibilmente pesandoli, o almeno indicandoli con misure "domestiche" (un bicchiere, un cucchiaio, ecc.)

- registrare la **dose di insulina** effettuata.

Questi elementi consentiranno di individuare il rapporto individuale ***carboidrati/insulina*** *(ovvero quanti grammi di carboidrati sono coperti efficacemente da una unita' di insulina) che, assieme ad altri fattori stabiliti dal diabetologo (****sensibilita' insulinica*** *e* ***obiettivi glicemici****) permettera' di rendere piu' elastica la terapia, specie se si utilizza un microinfusore.*

DIARIO “RAGIONATO”



COMPOSIZIONE_CENA_AUTOGRILL_CON_FIBRE_10APR2012016.pdf - Adobe Reader

File Modifica Vista Documento Strumenti Finestra ?

DATA 10/4/2012

	COLAZIONE	PRANZO	SPUNTINO	CENA

CONTA CARBOIDRATI (CHO) — gr. PESO x %CHO / 100 = gr. CHO

OBIETTIVO TOTALE (gr. CARBOIDRATI) ----------> 80

	DESCRIZIONE	gr. PESO	% CHO	gr. CHO	TOTALE PARZIALE
1	pasta con zucchine	50	0,8	40	40
2	pangrattato				
3	carote				
4	cena			10	50
5	yogurt drink				
6					
7	yogurt	155	0,05	7,75	7,75
8	muesli	14	0,6	8,4	16,15
9	galletta cruscà 2	40	0,6	10,8	26,75
10	pomodoro ciliegino 16		0,05	3,5	30,25
11					
12					
13					

TOTALE CHO REALIZZATO----------> 30,25

GLICEMIA INIZIO PASTO	ORA 20:36	GLICEMIA 157	GLICEMIA DOPO 2 o 3 ORE	Dopo 2 o 3 h	Pasto successivo 109

← EV. CORREZIONE CHO PER BOLUS WIZARD

TOT CHO =

TOT INS. =

CHO/1 U.I.=

UNITA' INSULINA PASTO

TOTALE	3,6
NORMALE	2,6
QUADRA	4,0
DURATA	30'
ORA inizio BOLO	20.41
supplemento CHO	
supplemento INSULINA	
ORA suppl INSULINA	
+/-correzione	
Ora Correz Ins	

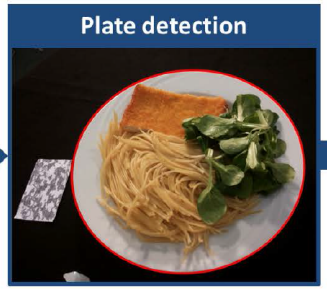
start IT AVG Anti-Vi... 3 Esplora... 4 OpenO... Medtronic ... COMPOSIZ... COMPOSIZ... COMPOSIZ... 4.33

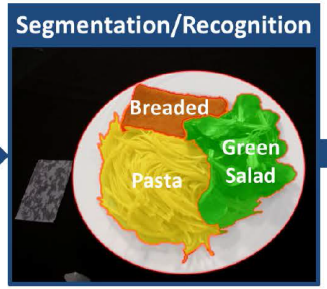

Cena
Pizza/Fast Food
Bigburger
Calzone
Cheeseburger
Crescente
Focaccia
Hamburger
Piadina
Pizza pomodoro e mozzarella
Preferiti
Grandi
Elenco
Dettagli
Cerca
Diario

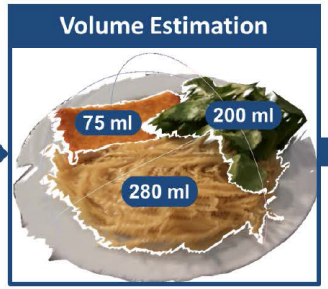

23-2-2010 - Pranzo
Preferiti
Cereali...
Legumi
Verdure...
Frutta
Carni Fr...
Carni Tr...
Fast-Fo...
Prodotti...
Latte e...
Formag...
Uova
Olii, gras...
Dolci
Bevande
Dolcificanti
Cereali
Pane


Tuesday

Computer Vision-Based Carbohydrate Estimation for Type I Patients With Diabetes Using Smartphones







CHO estimation

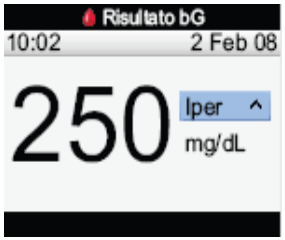
Food type	Volume (ml)	CHO (g)
Breaded	75	5.6
Salad	200	4
Pasta	280	47.6

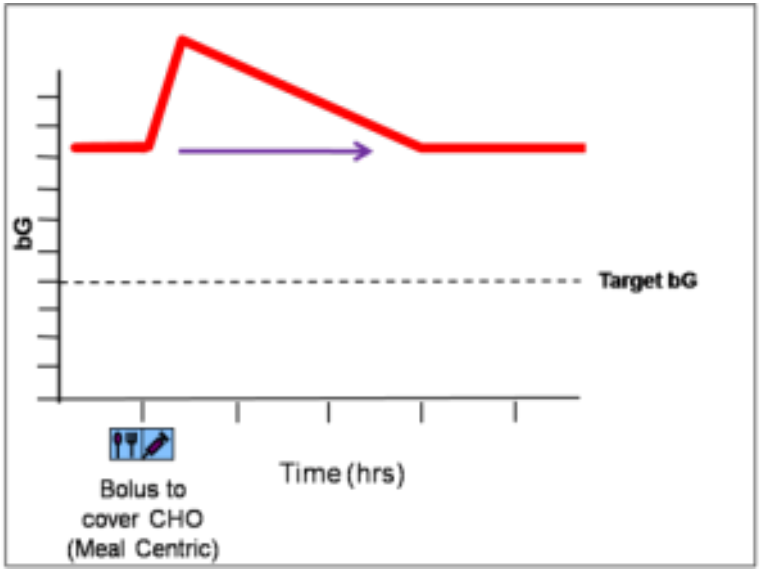
Estimation by	Absolute error (grams)	Relative error (%)	% of absolute errors < 20 grams
Participants with T1D	28.3 ± 38.5	56.1 ± 75.6	58.7
GoCARB	13.3 ± 10.4	28 ± 20.5	80.7

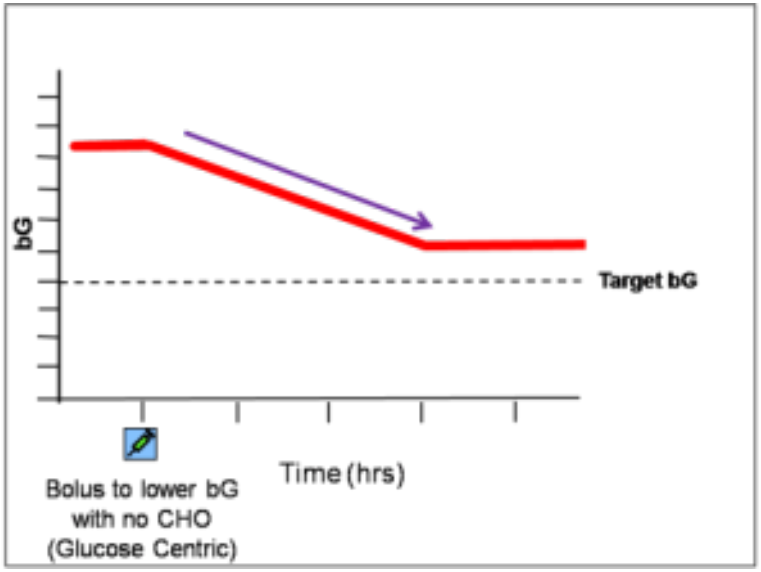
Anthimopoulos M , JDST 2015, 9, 507-515

glicemia preprandiale

Livello bG
Oltre l'allarme di iperglicemia
Tra il limite superiore e l'allarme di iperglicemia
Tra il limite superiore e il limite inferiore
Tra il limite inferiore e l'allarme di ipoglicemia
Al di sotto dell'allarme di ipoglicemia





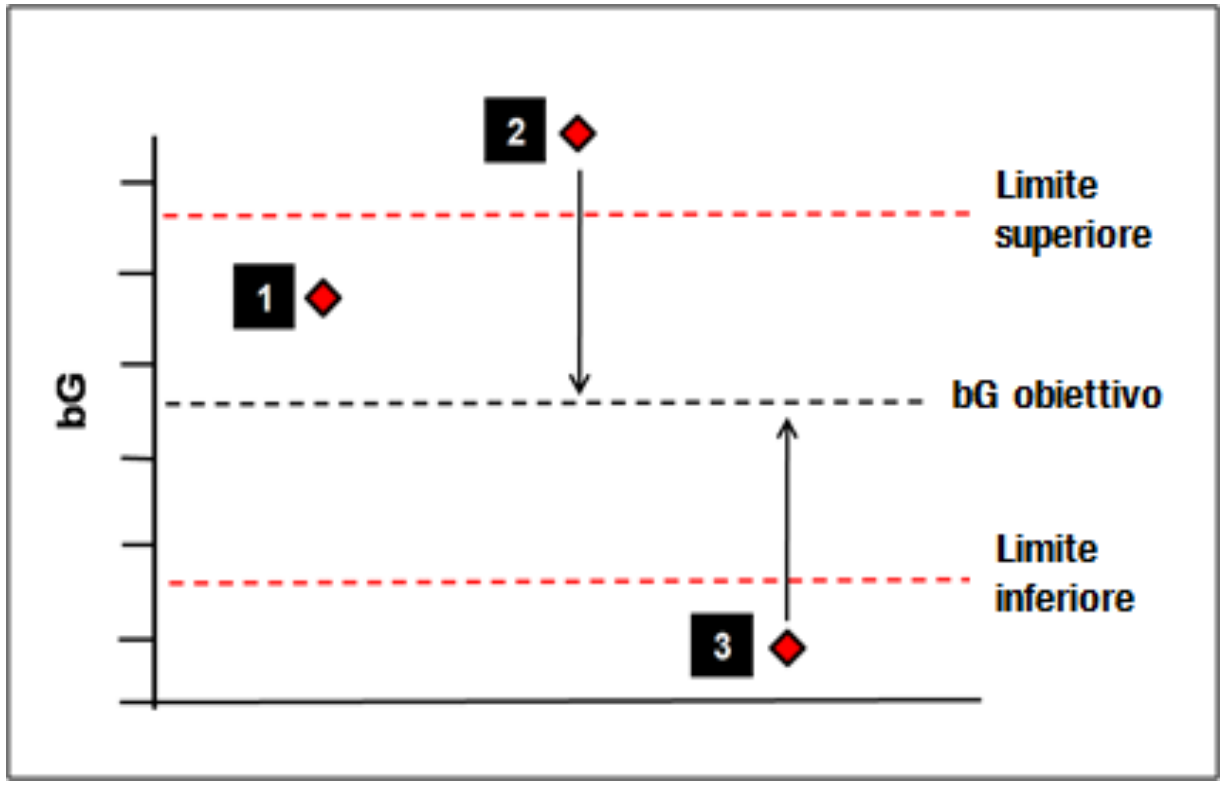


Bolo Insulinico

Nutrienti del pasto (CHO)

Glicemia pre-prandiale
(anche a “CHO 0”)

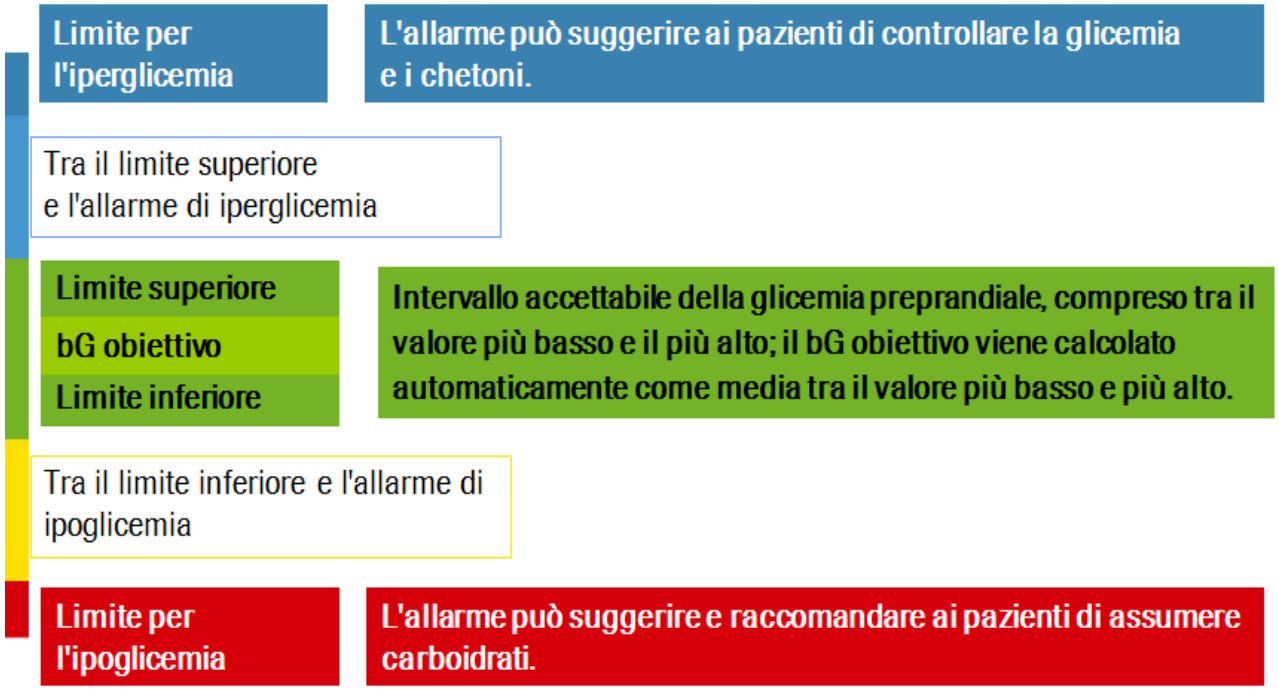
•Correzioni senza assunzione di cibo



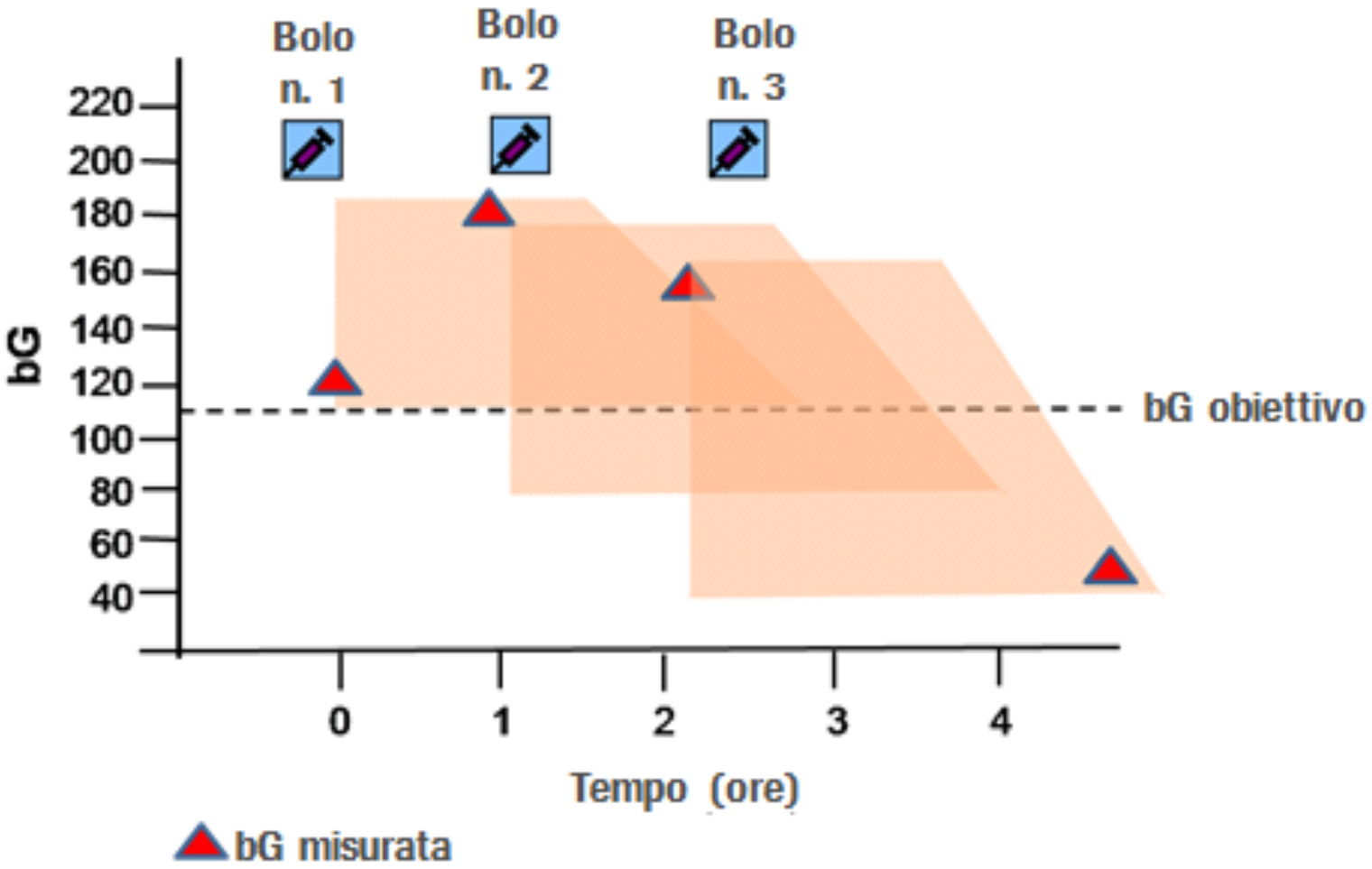
- **Sopra target** – bolo di correzione.
- **Sotto target** – consiglio sui carboidrati da assumere

“Target glicemici“

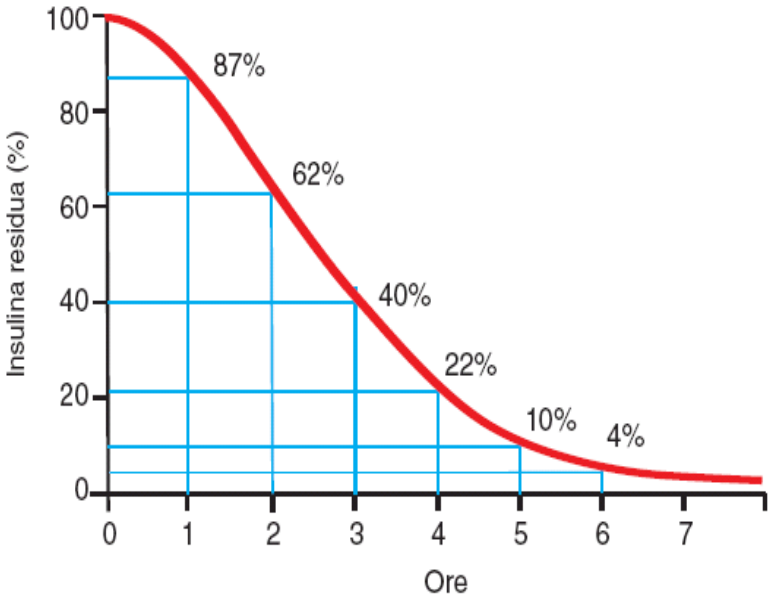
- obiettivo terapeutico
- media tra tra il valore più basso e più alto

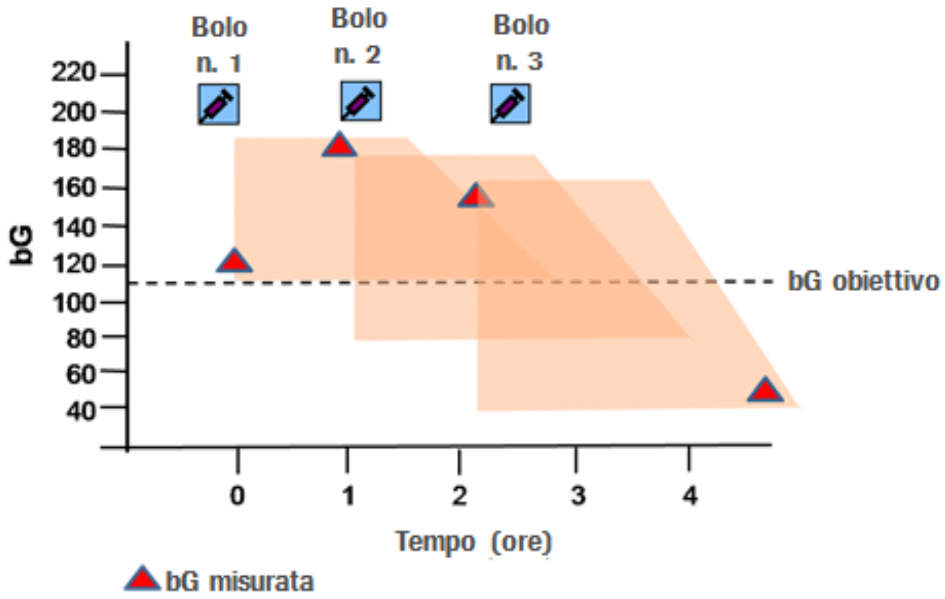


“impilamento” dei boli

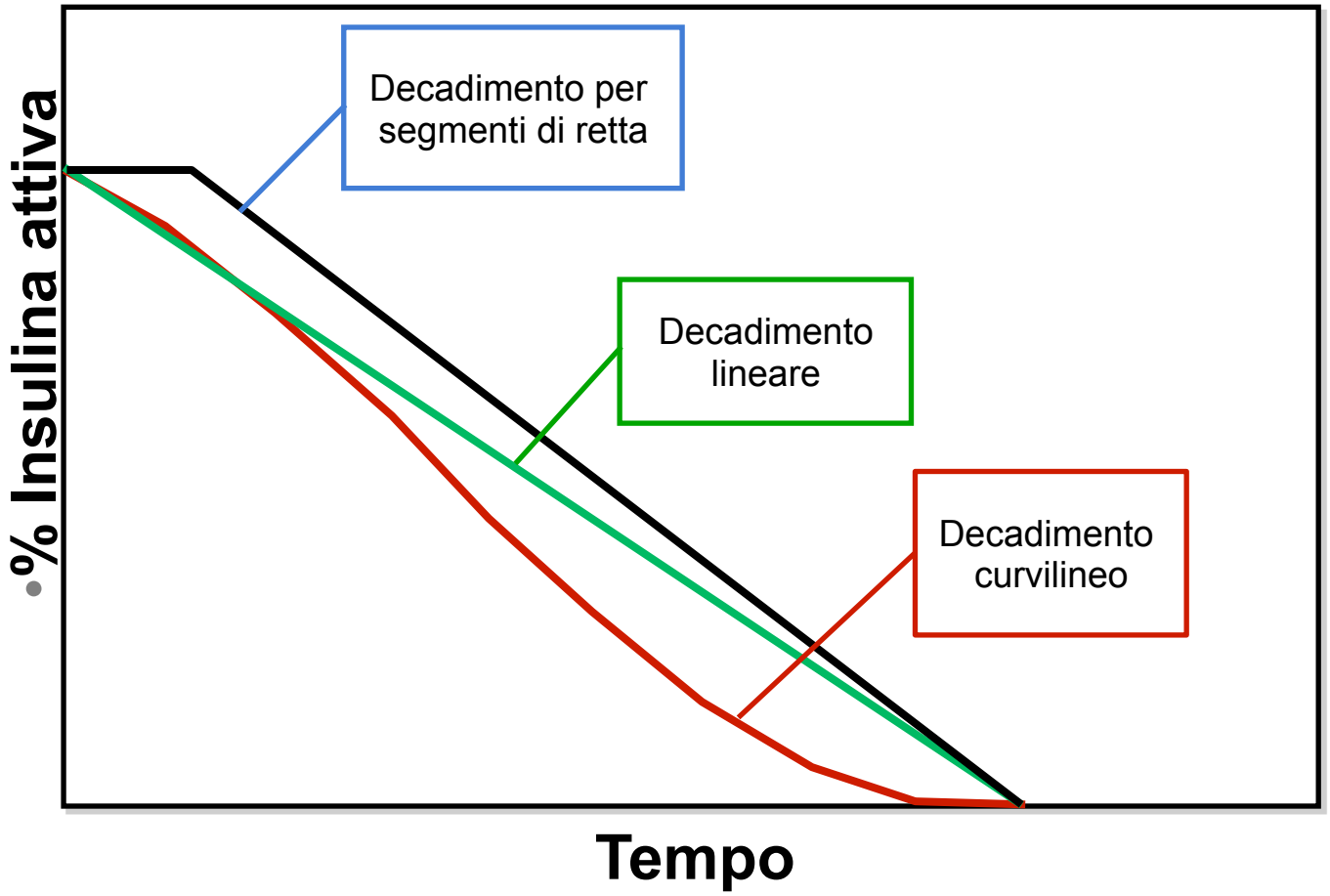


Insulina residua (on board)





algoritmi utilizzati per la valutazione dell'insulina attiva



•*Zisser H et al, Diabetes Technol Ther. 2008*

Sensibilità insulinica (SI)- Fattore di Correzione(FC)

1800/ Fabbisogno Insulinico Giornaliero

(bolo con analogo ultrarapido)

=

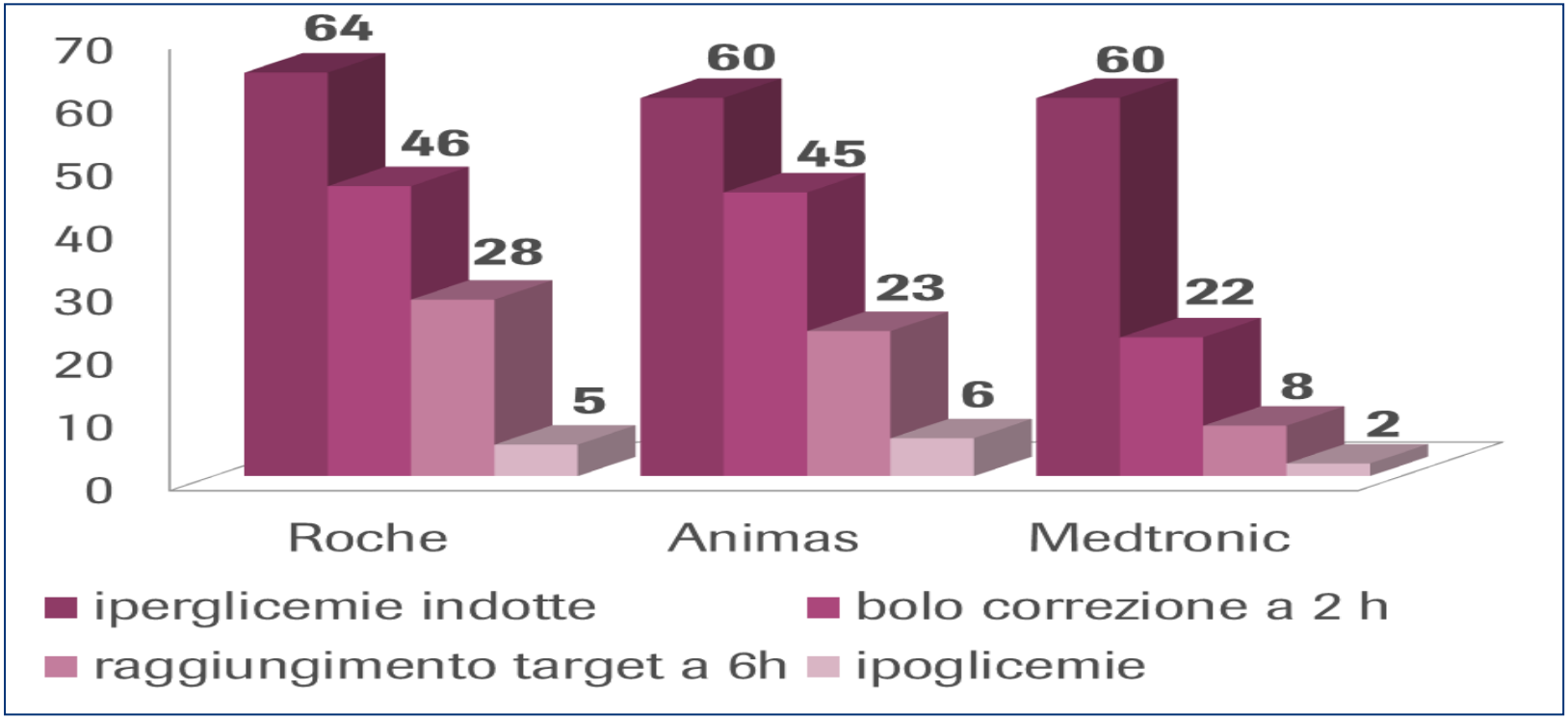
“riduzione della glicemia (mg/dl) con la somministrazione di 1 U di insulina”

Stato Fisiologico (PS)

Esercizio 1	Adeguamento per lo sport (↓ %)
Esercizio 2	Adeguamento per lo sport (↓ %)
Malattia	Adeguamento per la malattia (in genere ↑ %)
Stress	Adeguamento per lo stress (↑ %)
Periodo premestruale	Personalizzato (↑ o ↓ %)

CALCOLATORI DI BOLO	MEDIA DELLE DIFFERENZE DEI VALORI GLICEMICI DAL VALORE TARGET (110 mg/dL) A 6h POST-PRANDIALE (mg/dL)*
Roche	18,8 ± 33,8
Animas	17,3 ± 30,9
Medtronic	47,4 ± 31,8

P = 0,0049



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Zisser H et al. Diab Technol Ther 2010; 12(12): 955-61

Use of an Automated Bolus Calculator in MDI-Treated Type 1 Diabetes

The BolusCal Study, a randomized controlled pilot study

	n	Control	CarbCount	CarbCountABC	Between-group difference *P**
HbA_{1c}					
Baseline	51	9.1 ± 0.7	9.2 ± 0.6	8.8 ± 0.7	0.088
16 weeks	51	8.9 ± 1.1	8.4 ± 0.9	8.1 ± 0.4	0.029
Within-group difference†	51	−0.1 (−1.0 to 0.7)	−0.8 (−1.3 to −0.3)‡	−0.7 (−1.0 to −0.4)§	0.175

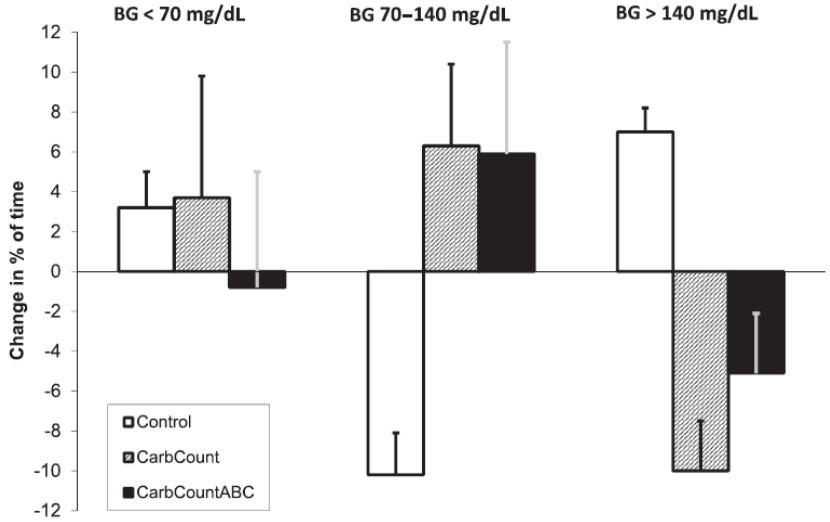


Figure 2—*Change in distribution of glucose values from baseline to 16 weeks measured by blinded CGM.*

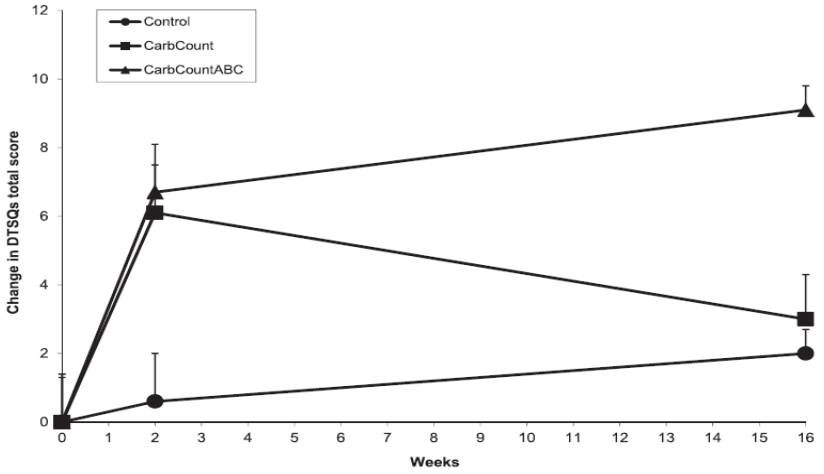
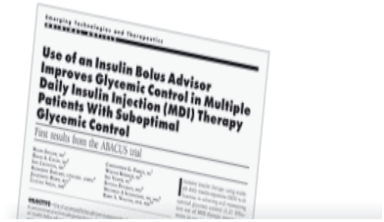


Figure 1—*Changes in DTSQs scores. The change in DTSQs score over time was significantly different between the three study arms (P = 0.008) and between the two intervention arms, CarbCount and CarbCountABC (P = 0.004).*

Schmidt S et al. Diabetes Care 35:984, 2012


Use of an Insulin Bolus Advisor Improves Glycemic Control in Multiple Daily Insulin Injection (MDI) Therapy Patients With Suboptimal Glycemic Control

First results from the ABACUS trial

Studio ABACUS

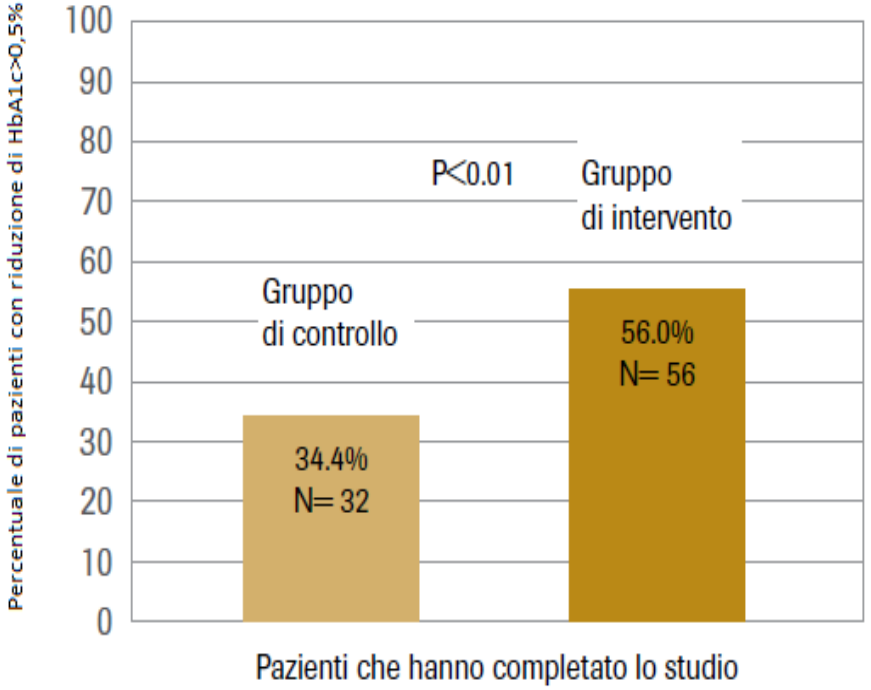
DM1 e **DM2 in Terapia multiniettiva (MDI)**

HbA1c media **8,9%**

glucometro con **calcolatore di bolo** vs. glucometro standard con **calcolo manuale**

- *Studio prospettico, multicentrico, randomizzato, controllato*
- *26 settimane.*

Obiettivo: riduzione della **HbA1c> 0,5%** con il supporto del calcolatore automatico di bolo in pazienti educati al CHO counting



Ziegler R et al. Diabetes Care 2013; 36:3613–9

Use of an Automated Bolus Calculator Reduces Fear of Hypoglycemia and Improves Confidence in Dosage Accuracy in Patients with Type 1 Diabetes Mellitus Treated with Multiple Daily Insulin Injections

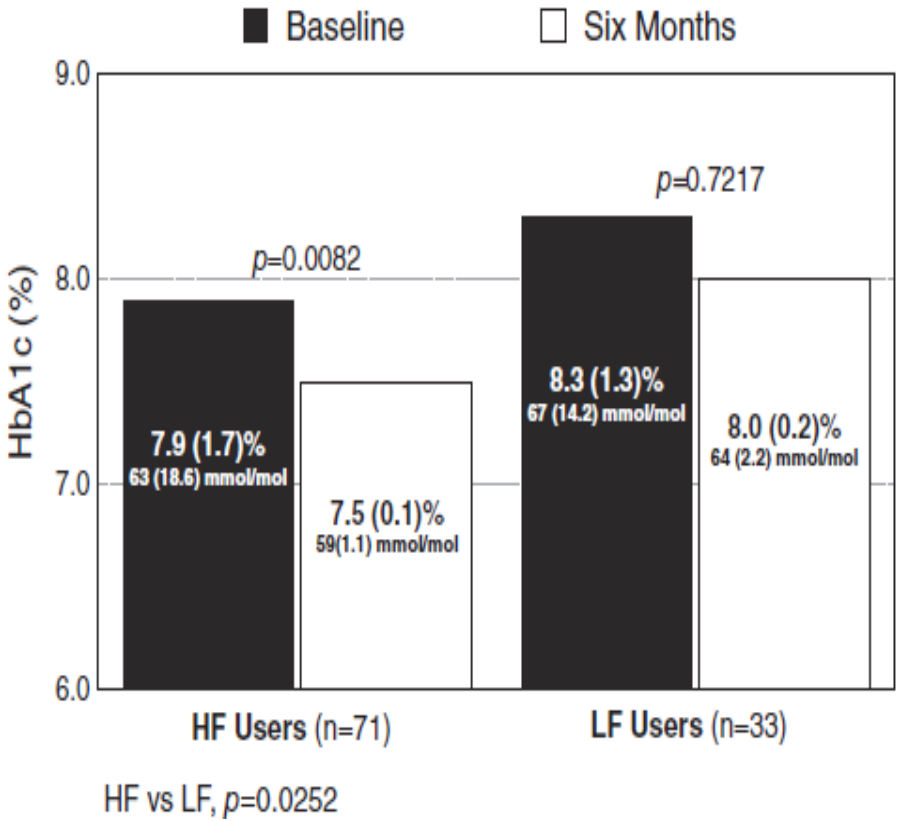
Katharine Barnard, Ph.D., C.Psychol.,[1] Christopher Parkin, M.S.,[2] Amanda Young, M.Sc.,[1] and Mansoor Ashraf, M.B.B.S.[3]

Table 2.
Perceived Improvement in Diabetes Management-Related Factors

	Significantly improved	Improved	No change	Worsened	Significantly worsened
Fear of hypoglycemia	13.0% (73)	39.0% (219)	43.0% (241)	4.8% (27)	0.2% (1)
Confidence in calculation	28.0% (157)	50.8% (285)	16.8% (94)	3.9% (22)	0.5% (3)
Ease of calculating bolus	43.7% (245)	41.2% (231)	13.2% (74)	1.8% (10)	0.2% (1)
Acting on SMBG results	27.1% (152)	54.2% (304)	16.9% (95)	1.8% (10)	0.0% (0)
Control of BG levels	20.1% (113)	53.5% (300)	23.0% (129)	3.2% (18)	0.2% (1)
Ability to achieve BG goals	13.4% (75)	53.7% (301)	30.8% (173)	2.0% (11)	0.2% (1)
Flexibility in lifestyle	20.5% (115)	42.4% (238)	35.3% (198)	1.8% (10)	0.0% (0)
Overall well-being	17.5% (98)	54.4% (305)	26.7% (150)	1.2% (7)	0.2% (1)

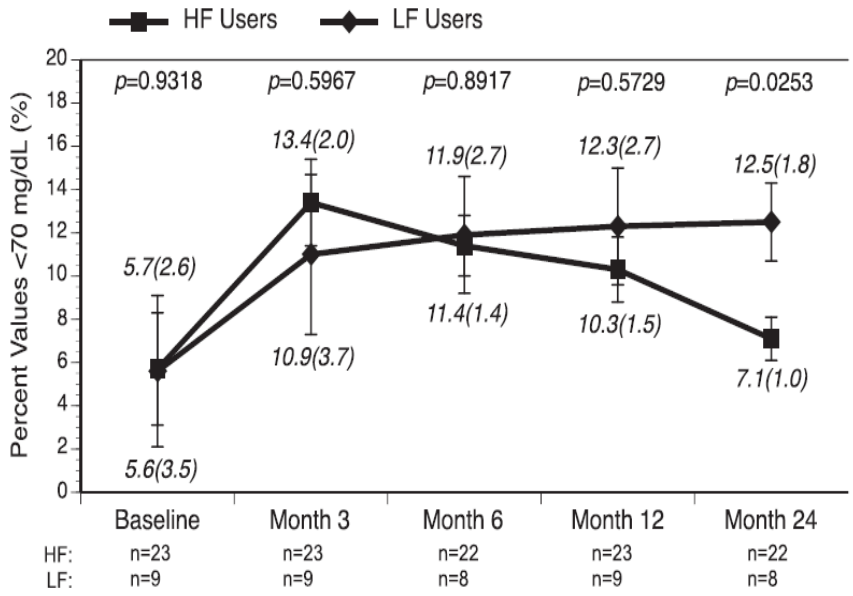
Journal of Diabetes Science and Technology
Volume 6, Issue 1, January 2012

Frequent use of an automated bolus advisor improves glycemic control in pediatric patients treated with insulin pump therapy: results of the Bolus Advisor Benefit Evaluation (BABE) study



HF vs LF, p=0.0252

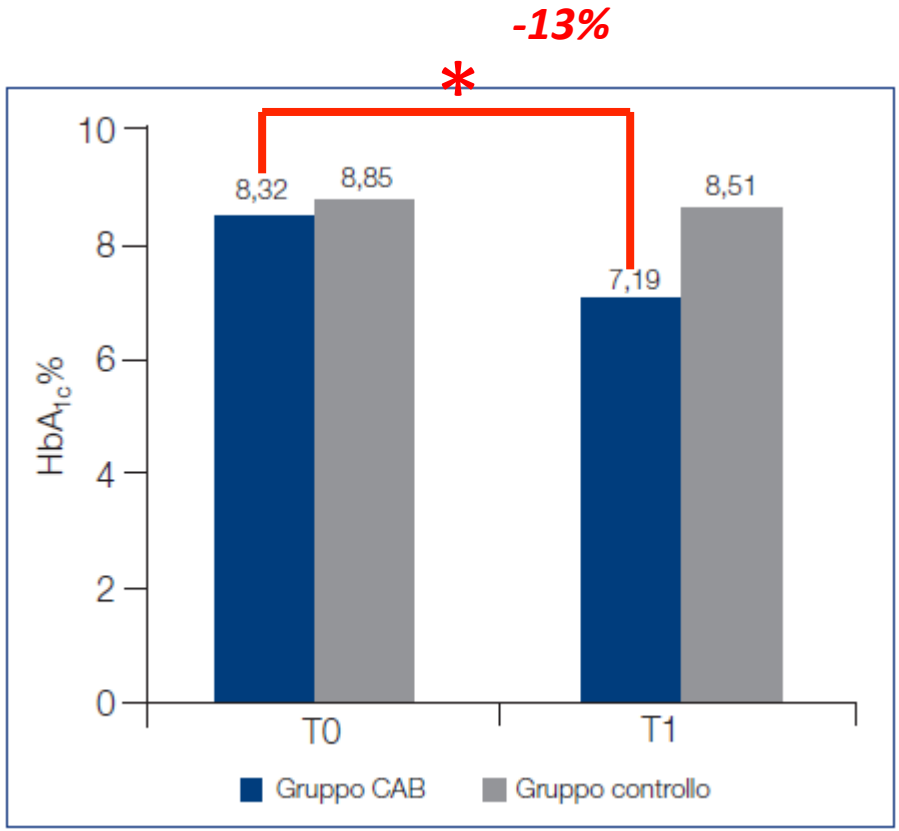
104 bambini in CSII - 6 mesi



Ziegler R , Pediatric Diabetes 2015

Counting dei carboidrati e calcolatore di bolo in pazienti con diabete di tipo 1 in terapia multiniettiva

	Gruppo A (n = 32)	Gruppo B (n = 32)
Età (anni)	19-79	20-78 ns
Sesso (M/F)	9/23	7/25
Durata della malattia (anni)	16 ± 2	14 ± 8 ns
HbA_{1c} % (mmol/mol)	8,32 (67) ± 1,47 (16)	8,85 (73) ± 1,43 (16) ns
BMI (kg/m²)	24,05 ± 3,58	25,32 ± 3,71 ns
Fabbisogno insulinico (U/kg)	0,64 ± 0,18	0,71 ± 0,15 ns
Drop-out	2	3



* p<0.006;

Di Folco U, Tubili C, GIDM 2014; 34, 188 - 193

Bolus Calculators

Journal of Diabetes Science and Technology
2014, Vol. 8(5) 1035–1041

DOI: 10.1177/1932296814532906
dst.sagepub.com
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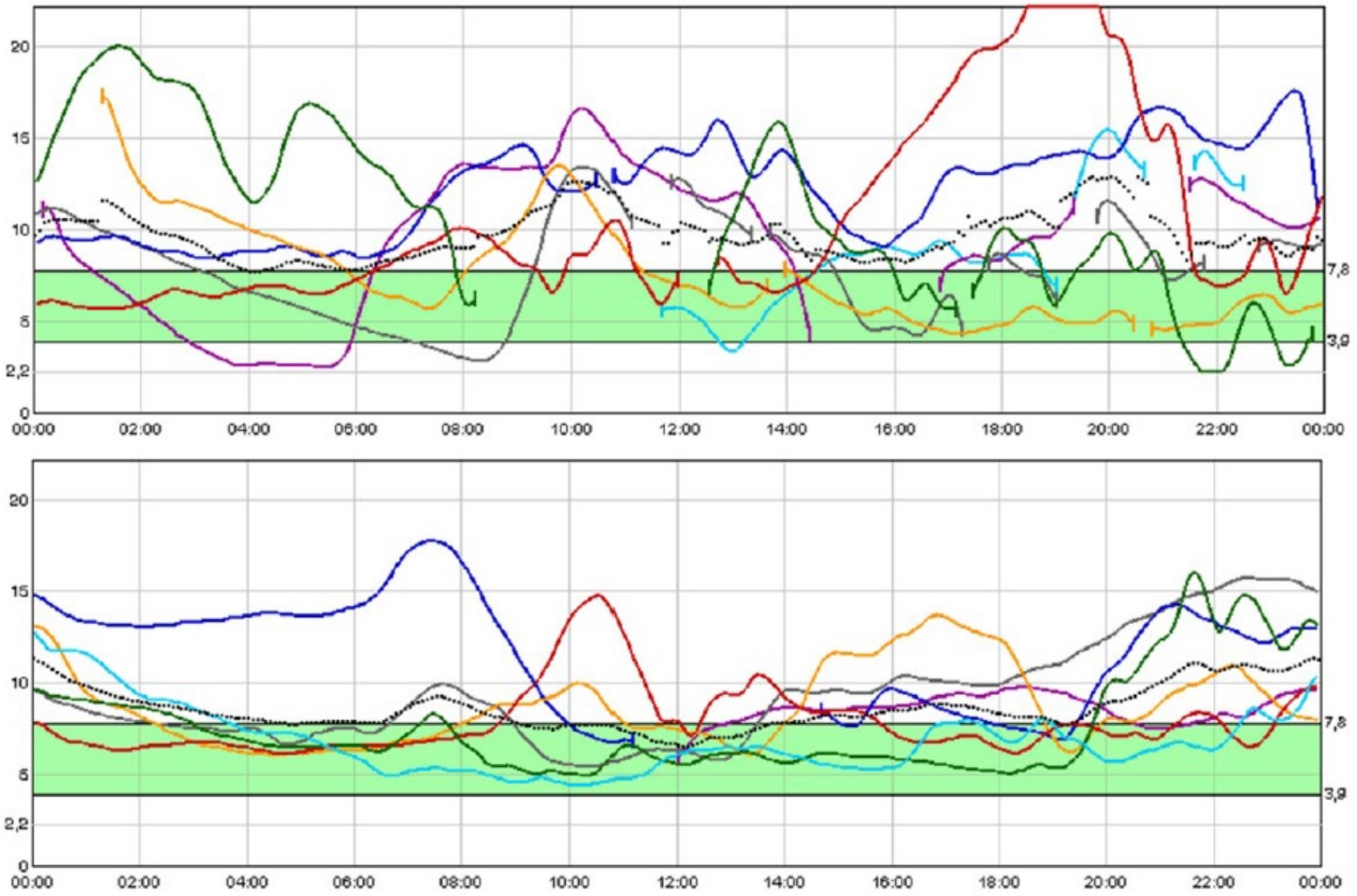
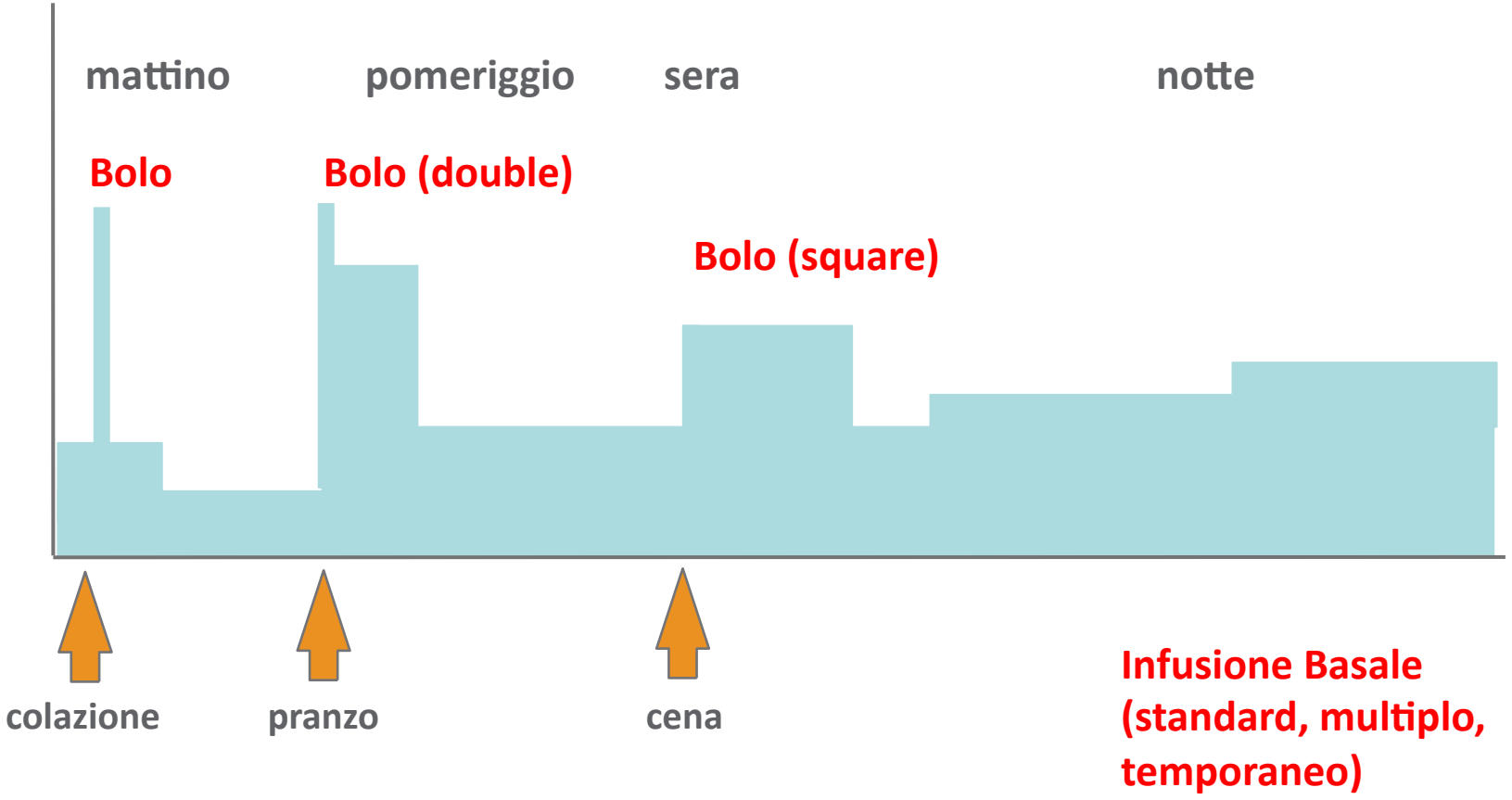
Signe Schmidt, MD, PhD[1,2] and Kirsten Nørgaard, MD, DMSc[1]



SENZA

CON

Supporti decisionali
(Calcolatori di bolo,Atlanti alimentari)
Boli Speciali



ORIGINAL PAPER

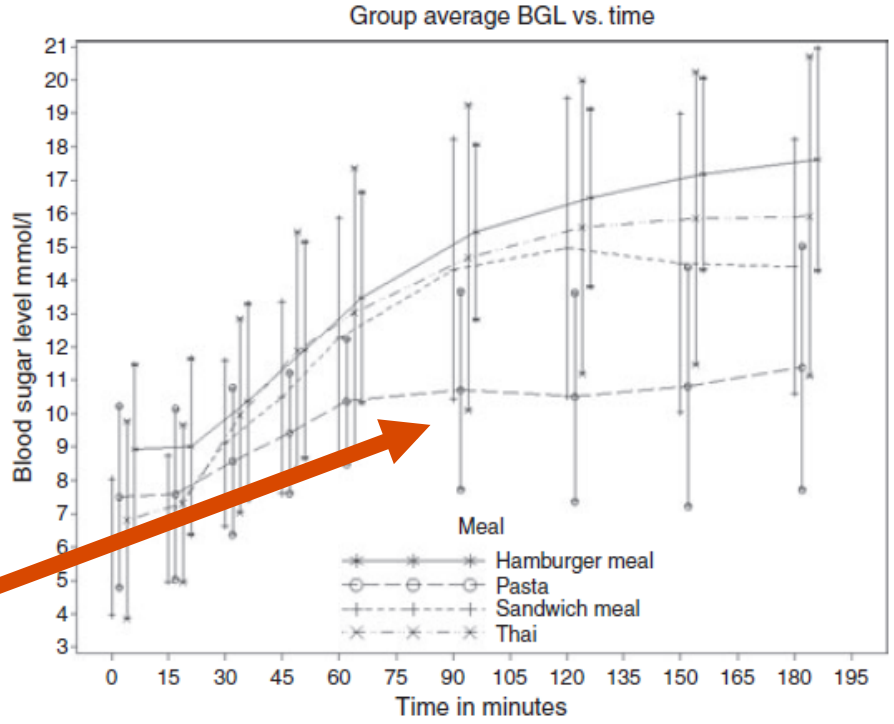
Int J Clin Pract, February 2009, 63, 2, 189–194

Effect of popular takeaway foods on blood glucose levels in type 1 diabetes mellitus patients on intensive insulin therapy

K. MacDonald,[1] J. M. Lowe,[1,2] D. Barker,[1] M. Mensch,[1,2] J. Attia[1]

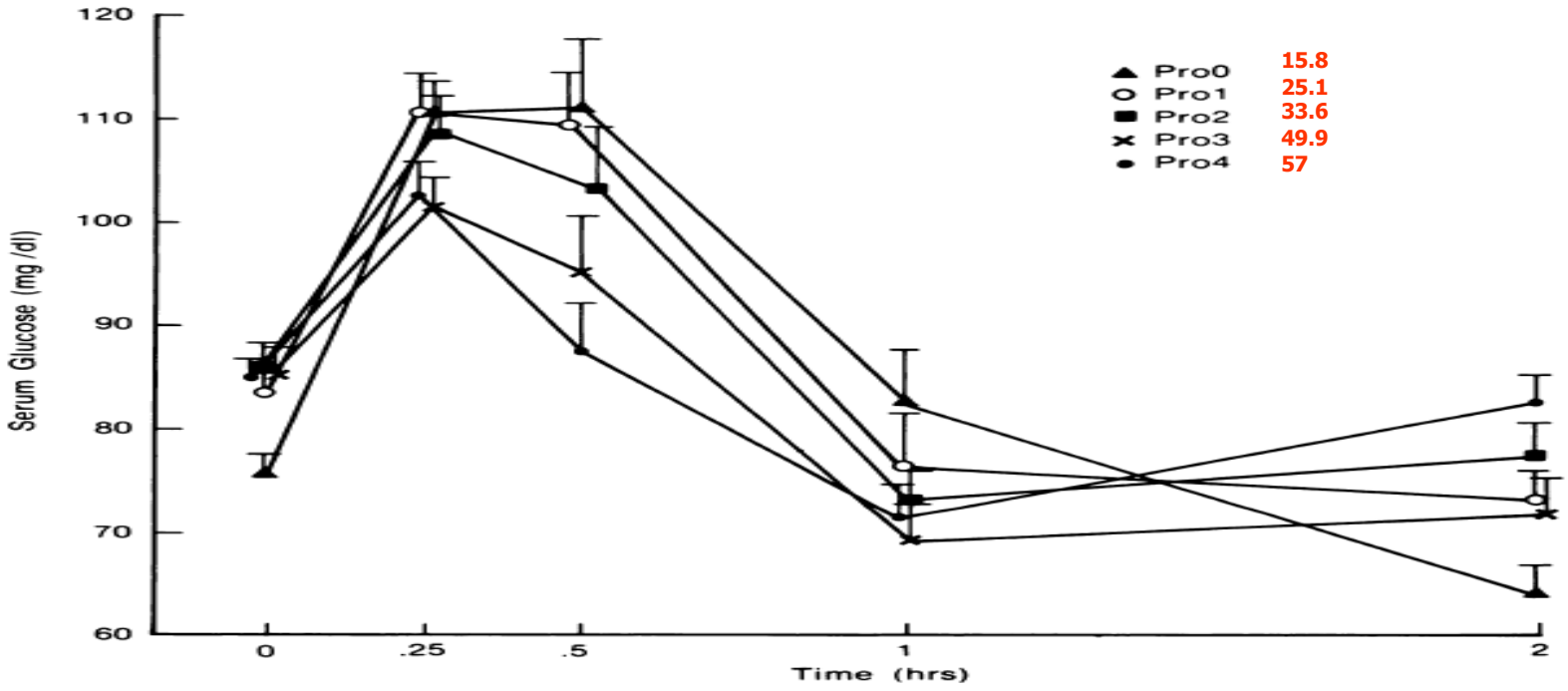
4 pasti – 60 g di CHO

- IG ~ 68, grassi 49%
  Hamburger, formaggio e patate Fritte
- IG 109, grassi 25%
  Pasto Thai – pollo , riso e semi oleosi
- IG ~45, grassi 34%
  Panino (pane bianco), formaggio, prosciutto, pomodoro , mela
- IG ~38, grassi 51%
  Spaghetti alla carbonara



Effect of protein dose on serum glucose and insulin response to sugars[1–3]

Gene A Spiller, PhD; Christopher D Jensen, RD; Thomas S Pattison, MS; Carol S Chuck, RD; James H Whittam, PhD; and James Scala, PhD



Am J Clin Nutr 1987

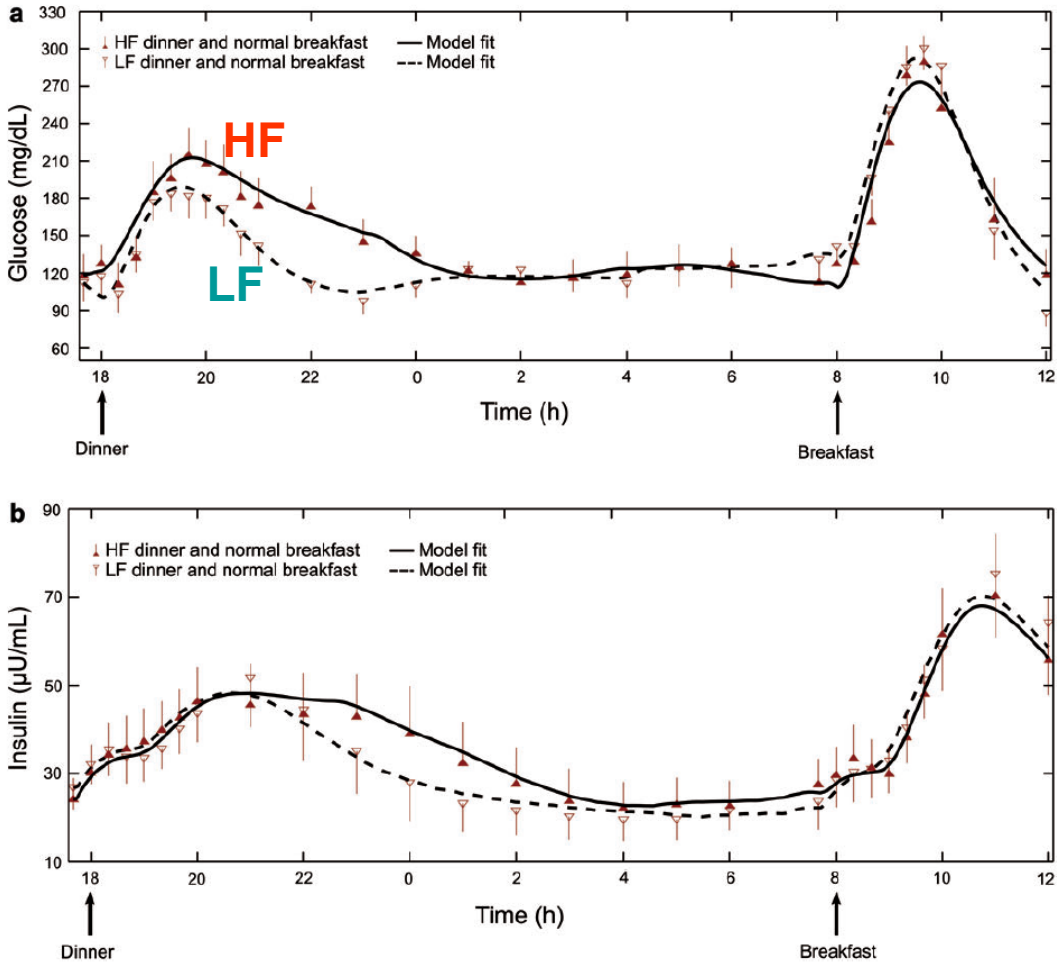
Bolus Estimation—Rethinking the Effect of Meal Fat Content

- 7 DT1
- Pasti *(CHO 96.7 g):*

HF 60 g

LF 10 g

- **τm** 102’ ± 14 vs. 71’ ± 4 *(p=0.02)*
- **S_1** $7.25 \times 10^{-4} \pm 1.29 \times 10^{-4}$ vs. $8.72 \times 10^{-4} \pm 1.08 \times 10^{-4}$ *(p=0.02)*



DIABETES TECHNOLOGY & THERAPEUTICS
Volume 17, Number 11, 2015

• Seven studies (total 103 subjects) (5,7,8,11,15,18,19). • All studies reported significant differences in glycemia with addition of fat. • Fat reduces early glucose response (first 2–3 h) (7,8) and delays peak blood glucose (5,7,15,18) due to delayed gastric emptying. • Fat leads to late postprandial (>3 h) hyperglycemia (18,19). • Addition of 35 g fat can increase blood glucose by 2.3 mmol/L (15), and in some individuals, 50 g of fat can increase insulin requirements by twofold (19). • Marked interindividual differences in the glycemic effect of fat.	• Increase in dose required for coverage of higher-fat meals needs to be individualized. • Delicate balance in calculation and timing of insulin action: needs more insulin to prevent late postprandial hyperglycemia; however, if too much insulin upfront, there is a risk for early postprandial hypoglycemia.
• Seven studies (total 125 subjects) (5,8,11,13,15–17). • All studies reported significant differences in glycemia with addition of protein. • Effect of protein is delayed (effects seen ~100 min postmeal) (11,13,15,17). • Protein has different effects when consumed with and without carbohydrates [e.g., 30 g protein with carbohydrates will affect blood glucose (15,16), whereas at least 75 g protein is needed to see an effect when consumed in isolation (13)].	• Protein-only meals (e.g., ≥230 g lean steak with salad) may require a different insulin dosing strategy than for protein and carbohydrate meals.
• Seven studies (total 98 subjects) (4,6,8–10,12,14). • All studies reported significant differences in glycemia with differing GI (same carbohydrate). • High-GI foods have rapid glucose spike (9,14). • Low-GI foods lower overall glucose response (8–10,12,14), reduce glucose peak (4,9,14), and increase risk of hypoglycemia (when usual CIR is used) (6,9,10)	• Mismatch between insulin action and carbohydrate absorption following high-GI foods can be problematic leading to a rapid glucose spike. • Total carbohydrate content still important: a large carbohydrate serving of low-GI food will still cause large glycemic response. • Low-GI foods with high fructose and/or sucrose content (e.g., fruit juice) will still produce a rapid glucose spike

Food Insulin Index (FII)

classificazione degli alimenti in base alla risposta insulinica, in soggetti sani, in rapporto ad un alimento isocalorico di riferimento

$$RI_{alimento} / R_{alimento\ di\ riferimento}$$

*"…..The FII algorithm may be a **useful tool** for reducing postprandial hyperinsulinemia in **T2DM**, thereby potentially improving insulin resistance and β-cell function."*

Bell K, 2015

Improving the Estimation of Mealtime Insulin Dose in Adults With Type 1 Diabetes:the Normal Insulin Demand for Dose Adjustment (NIDDA) study

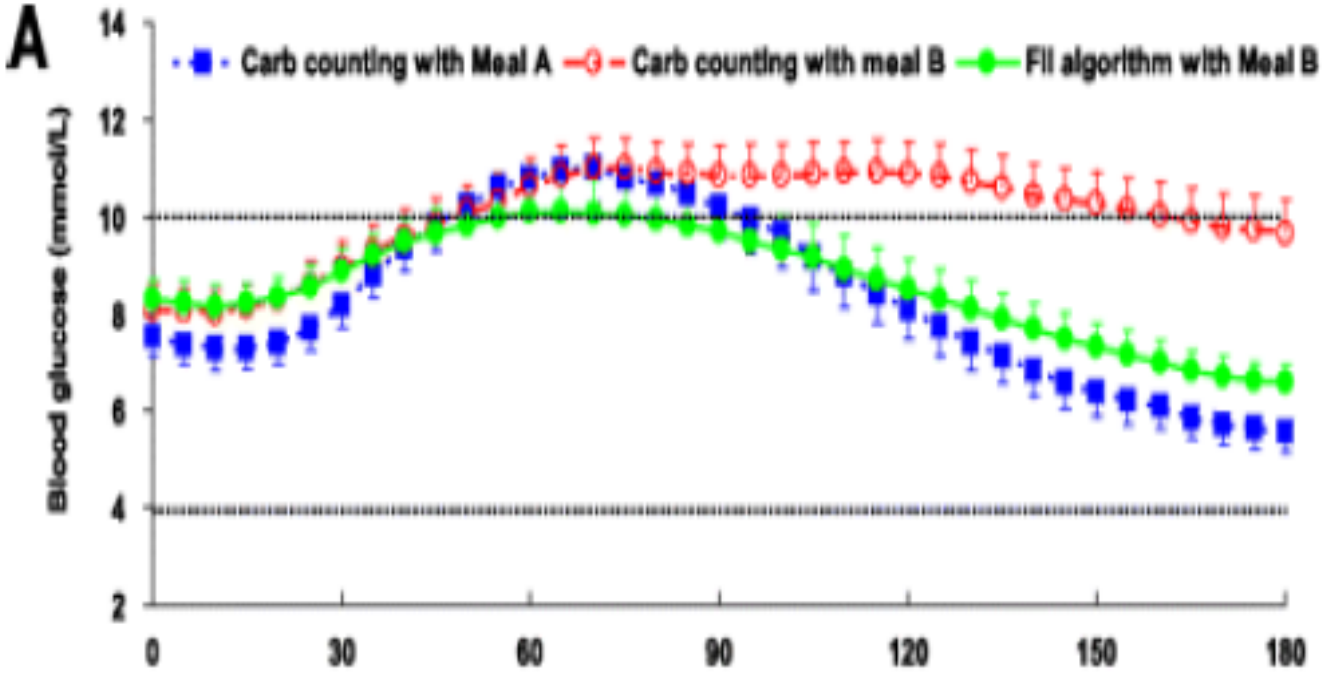
Diabetes care 2011 34:21 46–2151

28 pz. in CSII

Pasto A : CHO g75 - Counting

Pasto B : CHO g41 (+ proteine, grassi) – Counting o FII

- AUC -52% (p=0.013)
- Picco - 41% (p=0.01)
- Non diff. IPO



Bolus Calculator with Nutrition Database Software, a New Concept of Prandial Insulin Programming for Pump Users

Ewa Pańkowska, M.D., Ph.D., and Marlena Błazik, M.D.

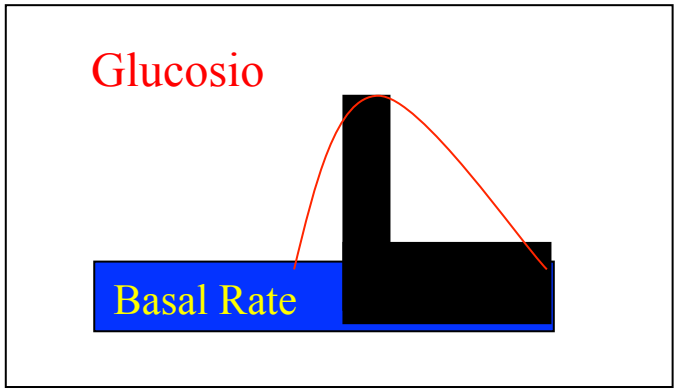
Abstract

Bolus calculators are effective tools in controlling blood glucose levels in patients treated with insulin. Diabetics is a new software devised for patients to facilitate and improve self-managing for prandial insulin dosing and for better controlling food intake. This device contains two integral parts: a nutrition database and a bolus calculator. The algorithm is based on a formula in which carbohydrate (CHO) and either fat and/or protein (FP) products are engulfed in insulin. The insulin dose setting is programmed individually for CHO in a normal bolus (N-W) and for FP in a square-wave bolus (S-W). The device calculates the dose of insulin for N-W or S-W, suggests the optimal kind of bolus, and indicates the timing in hours for an S-W bolus. In addition, this calculator, which contains a nutrition database and insulin dosing software, helps determine the correct type of necessary boluses for selected foods.

J Diabetes Sci Technol 2010;4(3):571-576

FPU (Fat/Protein Unit) = 100 kcal come grassi e/o proteine
1 U /FPU

1 FPU = 3 h
2 FPU = 4 h
3 FPU = 5 h
>3 FPU = 8 h

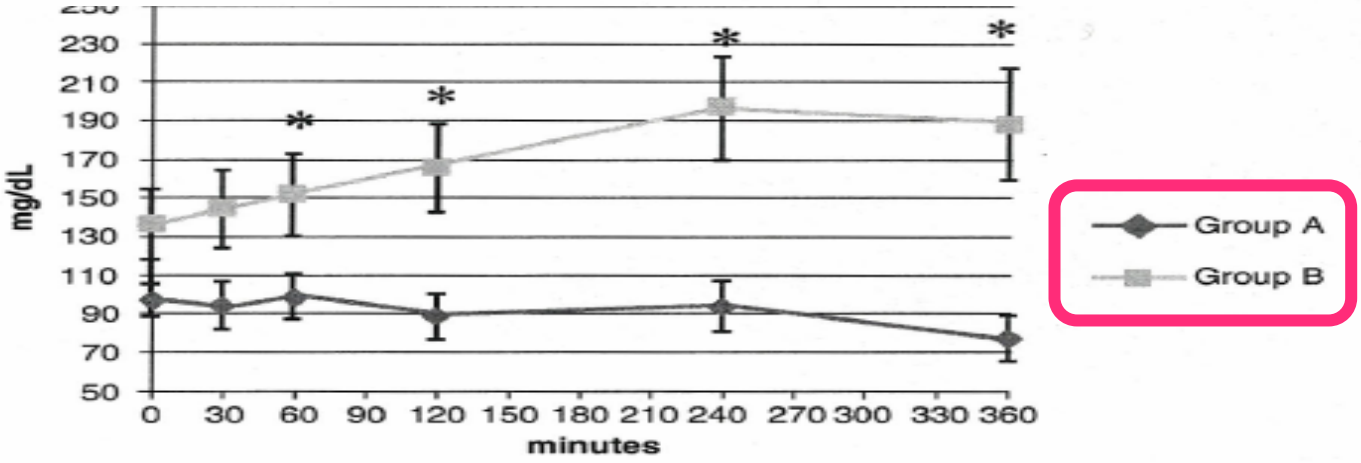


DIABETES TECHNOLOGY & THERAPEUTICS
Volume 14, Number 1, 2012

DOI: 10.1089/dia.2011.0083

Does the Fat-Protein Meal Increase Postprandial Glucose Level in Type 1 Diabetes Patients on Insulin Pump: The Conclusion of a Randomized Study

Ewa Pańkowska, M.D., Ph.D.,[1] Marlena Błazik, M.D.,[1] and Lidia Groele, M.D.[2]



24 pz. DT1 in CSII
Pizza (CHO 45 g -180 kcal ; grassi, proteine - 400kcal)

A) Bolo onda doppia (**nCHOxICR + nFPU x ICR/6 h**)
B) Bolo singolo (nCHOxICR)

The dual-wave bolus feature in type 1 diabetes adult users of insulin pumps

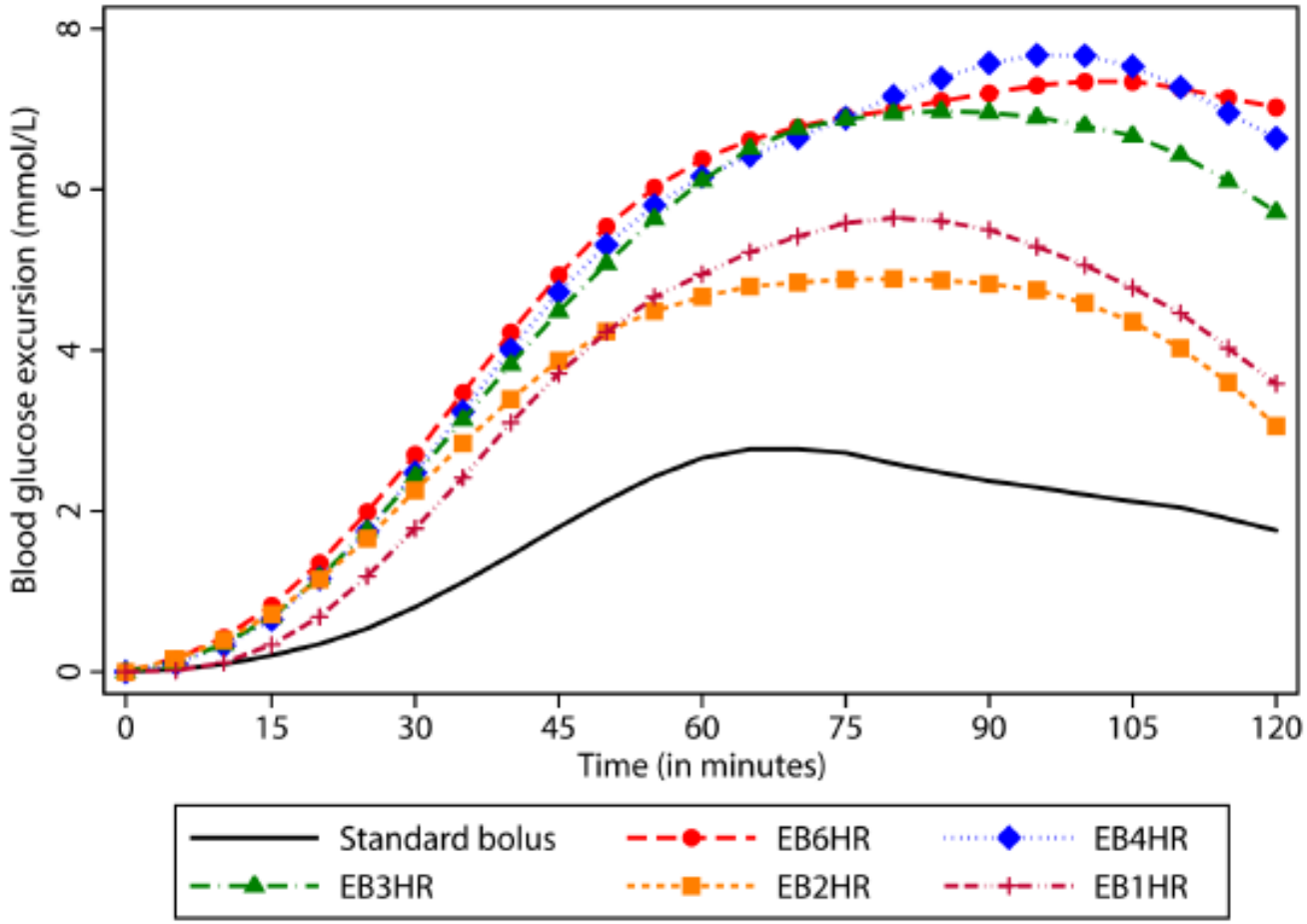
n of women (%)	33 (58.9%)	13 (40.6%)	20 (83.3%)	$P = 0.001$
Age at baseline [years]	26.3 ± 8.5	25.7 ± 8.8	27.0 ± 8.3	NS
Duration of diabetes [years]	6.8 ± 7.2	3.4 ± 4.4	11.3 ± 7.8	$P < 0.0001$
n with background retinopathy (%)	22 (39.3%)	14 (43.7%)	8 (33.3%)	NS
n with microalbuminuria (%)	12 (21.4%)	6 (18.7%)	6 (25.0%)	NS
BMI [kg/m^2]				
Baseline	24.3 ± 1.6	24.7 ± 1.5	23.8 ± 1.6	$P = 0.04$
At 12 months	24.4 ± 1.6	24.8 ± 1.4	24.1 ± 1.8	NS
At 24 months	24.9 ± 1.7	25.0 ± 1.5	24.7 ± 1.9	NS
HbA1c [%]				
Baseline	7.8 ± 0.5	7.6 ± 0.5	7.9 ± 0.6	$P = 0.04$
At 12 months	6.9 ± 0.5	6.6 ± 0.5	7.3 ± 0.3	$P < 0.0001$
At 24 months	6.9 ± 0.5	6.6 ± 0.4	7.3 ± 0.4	$P < 0.0001$
Mean glycemia [mg/dl]				
Baseline	155 ± 14	154 ± 12	156 ± 16	NS
At 1 year	136 ± 8	135 ± 8	139 ± 8	NS
At 2 years	136 ± 8	134 ± 8	139 ± 8	p = 0.05

Klupa T, Acta Diabetol 2011 48:11-14

BMJ Open Diabetes Research & Care

Extended insulin boluses cannot control postprandial glycemia as well as a standard bolus in children and adults using insulin pump therapy

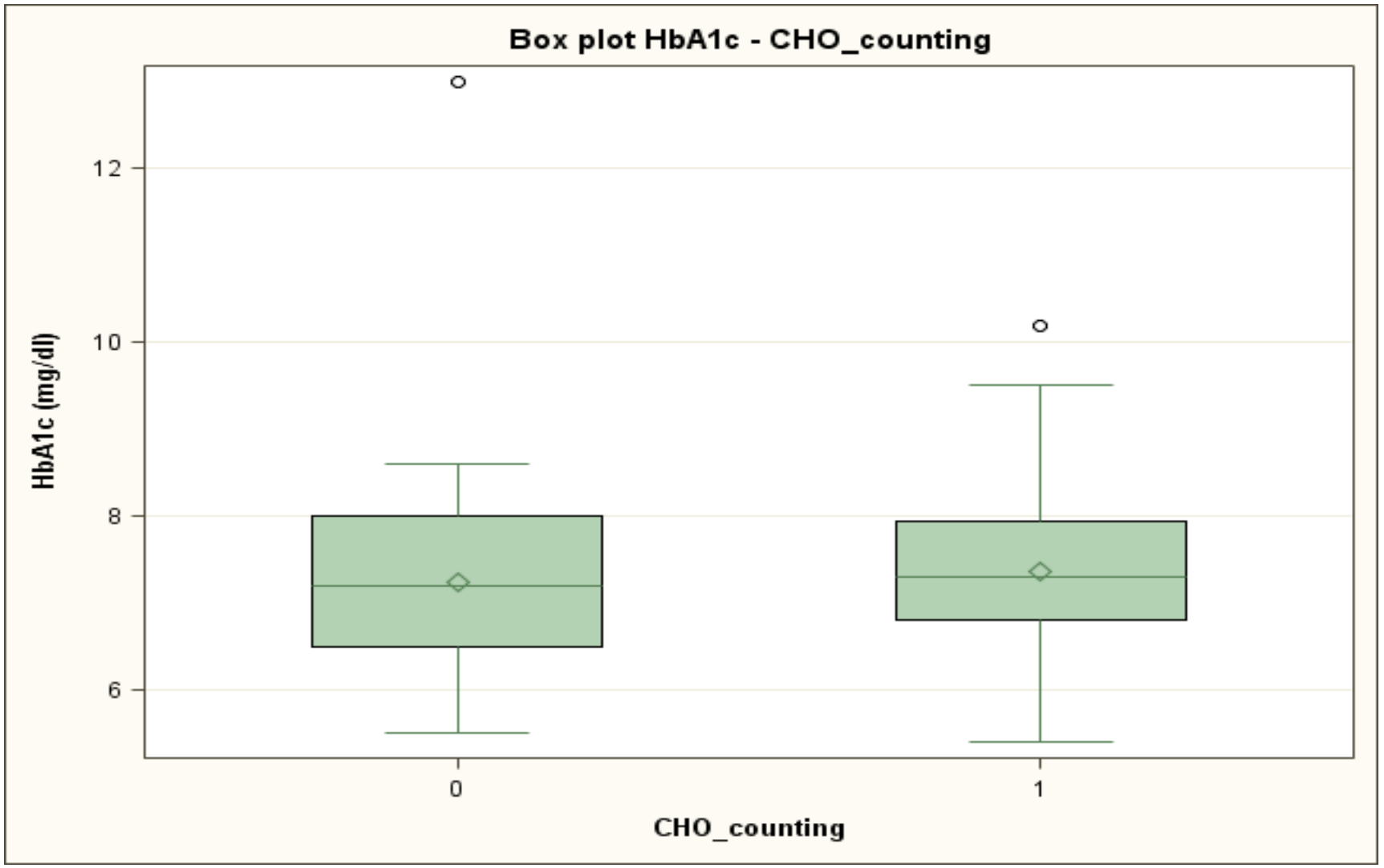
- 20 pz. in CSII
- 7-39 anni
- "Australian Breakfast"



Lopez P, 2014; 2:e000050

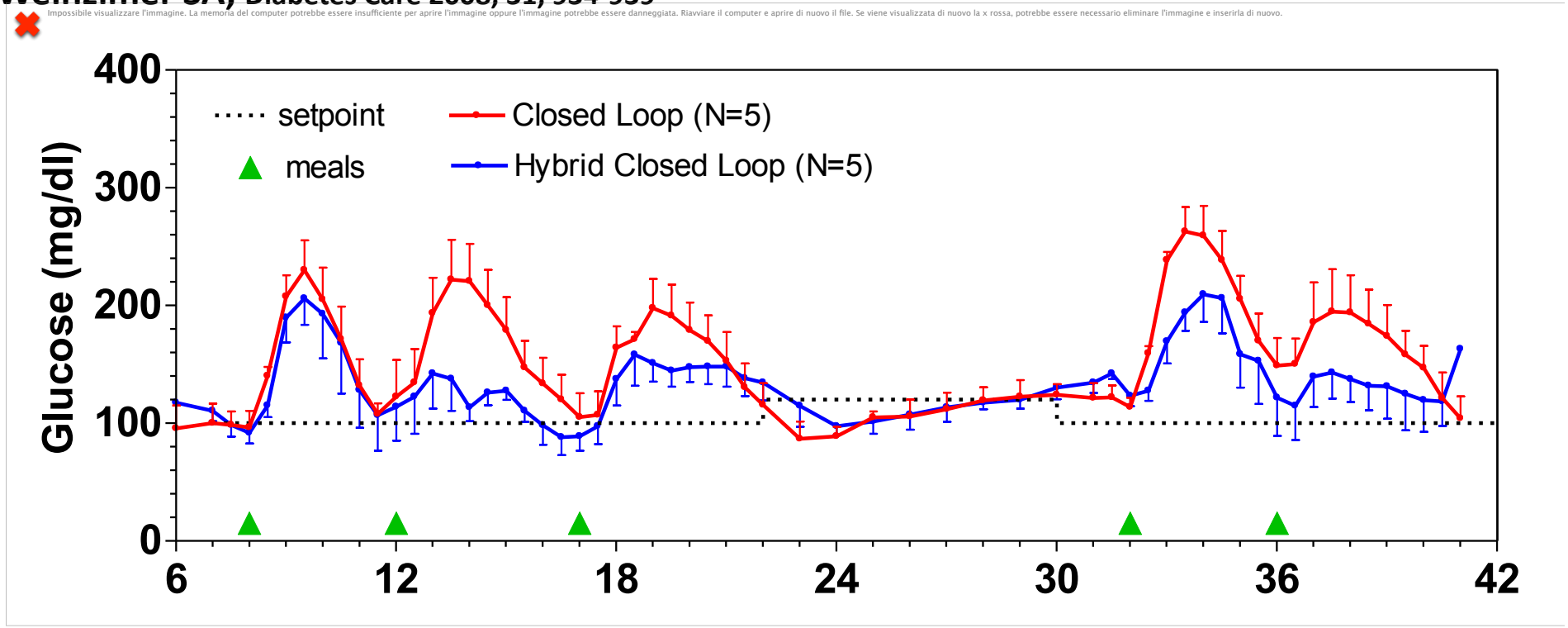
GRAZIE PER L’ATTENZIONE !

Long Term Pump users:
Pratica del CHO Counting e HbA1c



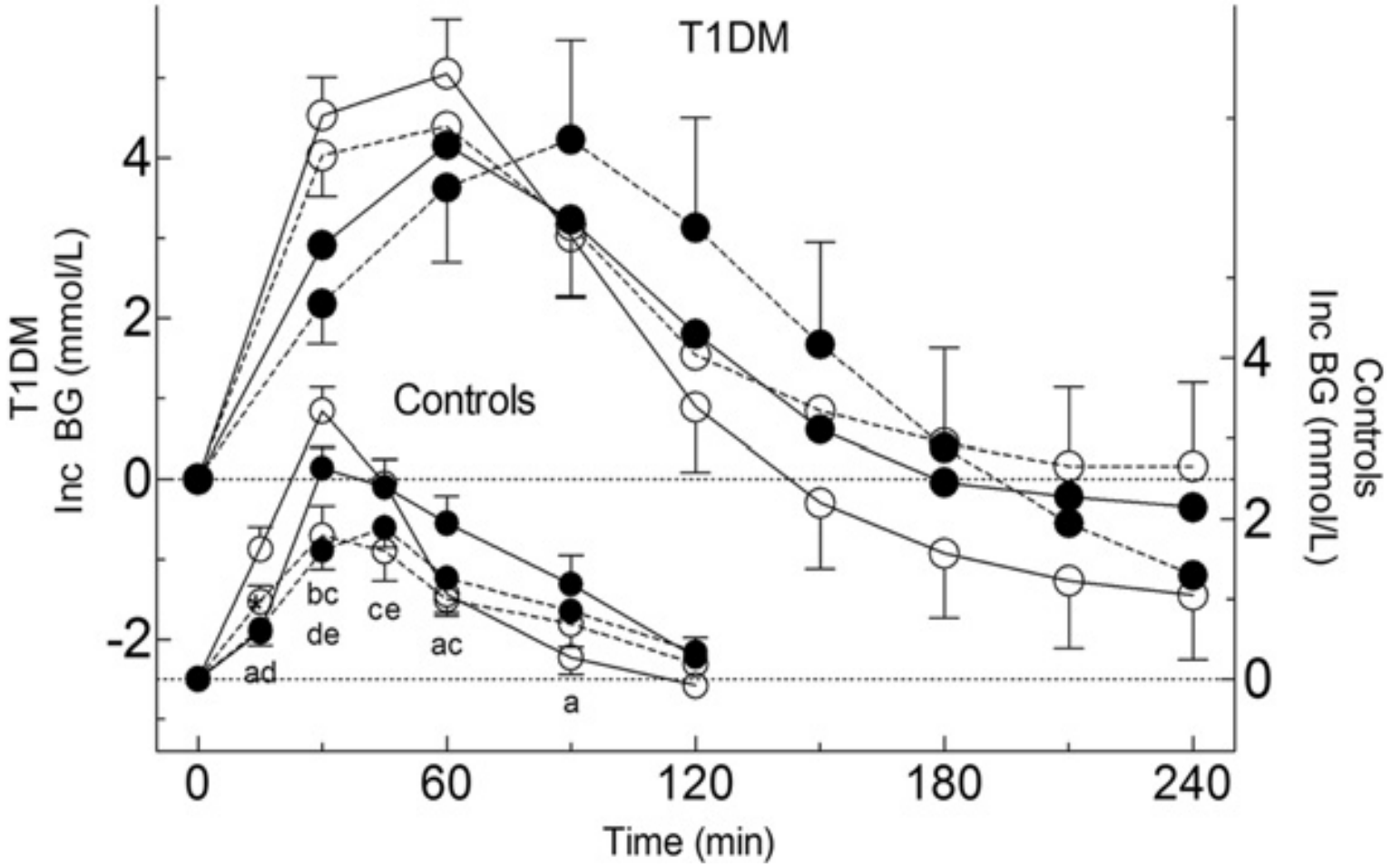
Fully Automated Closed-Loop Insulin Delivery Versus Semiautomated Hybrid Control in Pediatric Patients With Type 1 Diabetes Using an Artificial Pancreas

Weinzimer SA, Diabetes Care 2008, 31, 934-939



	Mean	Nocturnal	Peak PP
Full CL	156 (149-163)	109 (87-131)	232 (208-256)
Hybrid	135 (129-141)	114 (98-131)	191 (168-215)

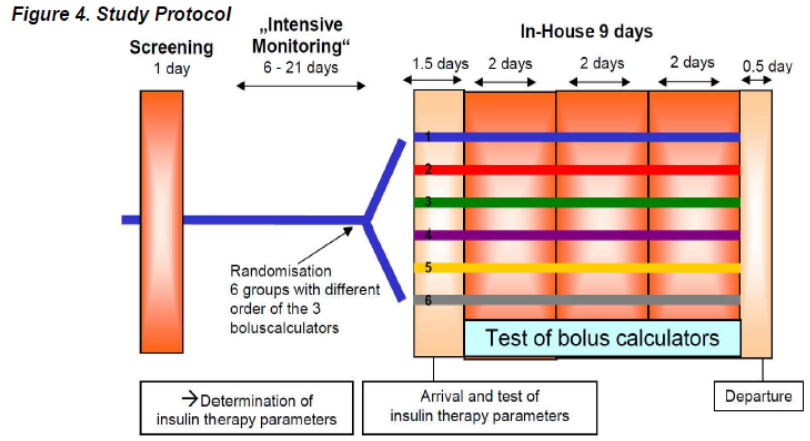
Sugars and fat have different effects on postprandial glucose responses in normal and type 1 diabetic subjects

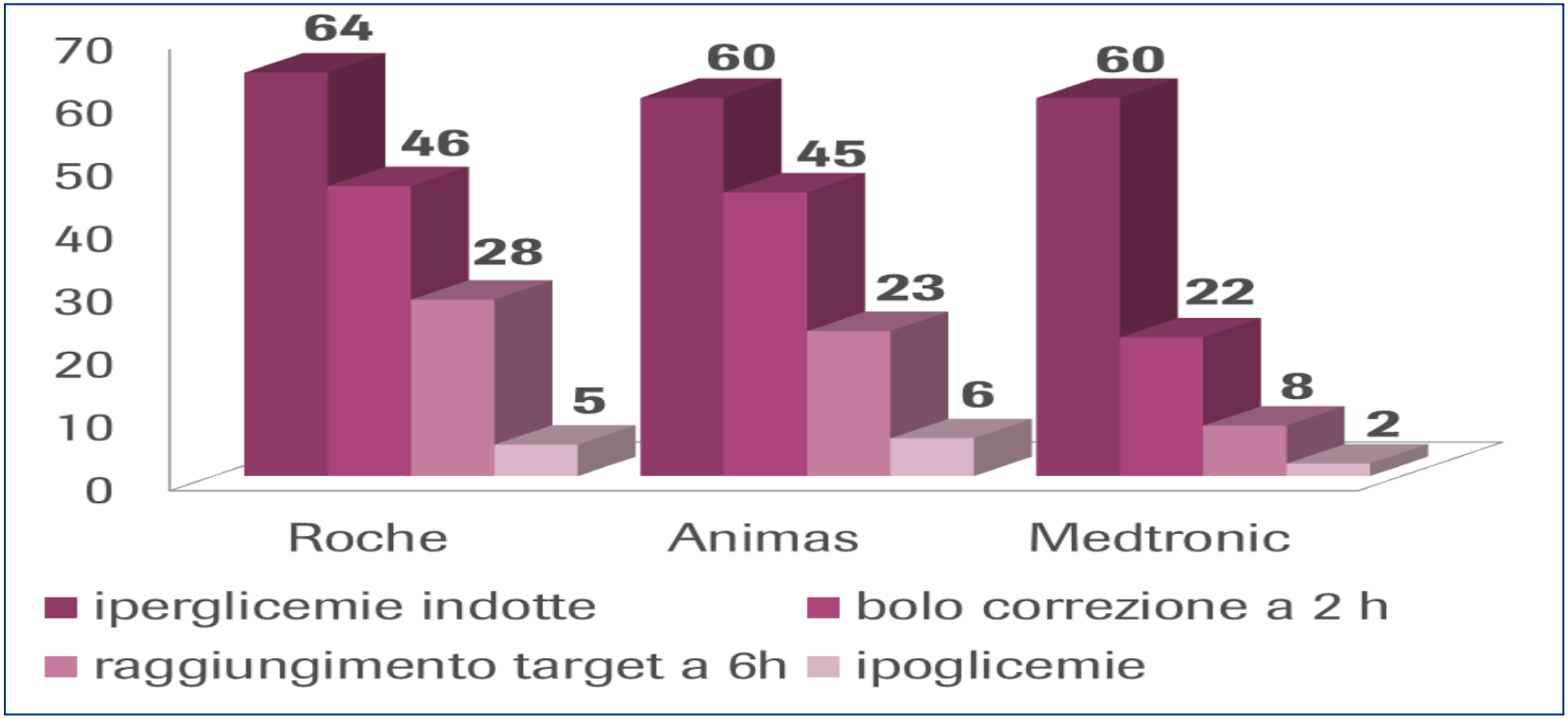


Wolever TMS, Nutr Metab Cardiovasc Dis 2011 21, 719

CALCOLATORI DI BOLO	MEDIA DELLE DIFFERENZE DEI VALORI GLICEMICI DAL VALORE TARGET (110 mg/dL) A 6h POST-PRANDIALE (mg/dL)*
Roche	18,8 ± 33,8
Animas	17,3 ± 30,9
Medtronic	47,4 ± 31,8

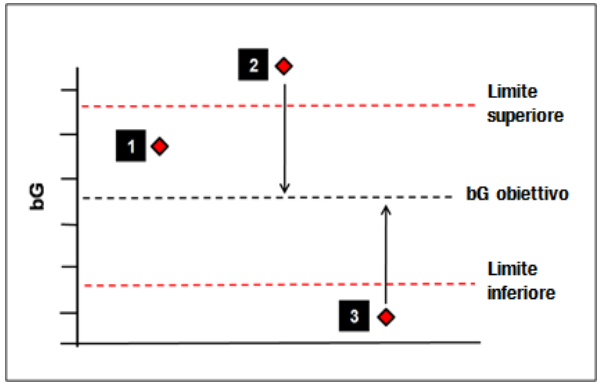
P = 0,0049





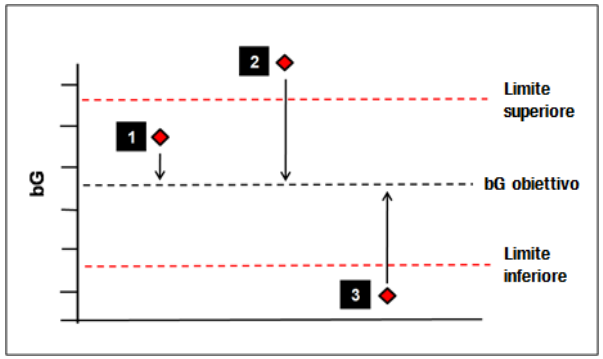
Zisser H et al. Diab Technol Ther 2010; 12(12): 955-61

•Correzioni <u>senza</u> assunzione di cibo



- **Sopra target** – bolo di correzione.
- **Sotto target** –consiglio sulla quantità di carboidrati da assumere

•Correzioni <u>con</u> assunzione di cibo



- **Sotto target** – viene fornito un consiglio sulla quantità di carboidrati da assumere per incrementare il valore glicemico.

Esempio

Se in una giornata vengono somministrate **26 U di basale** e i seguenti boli:

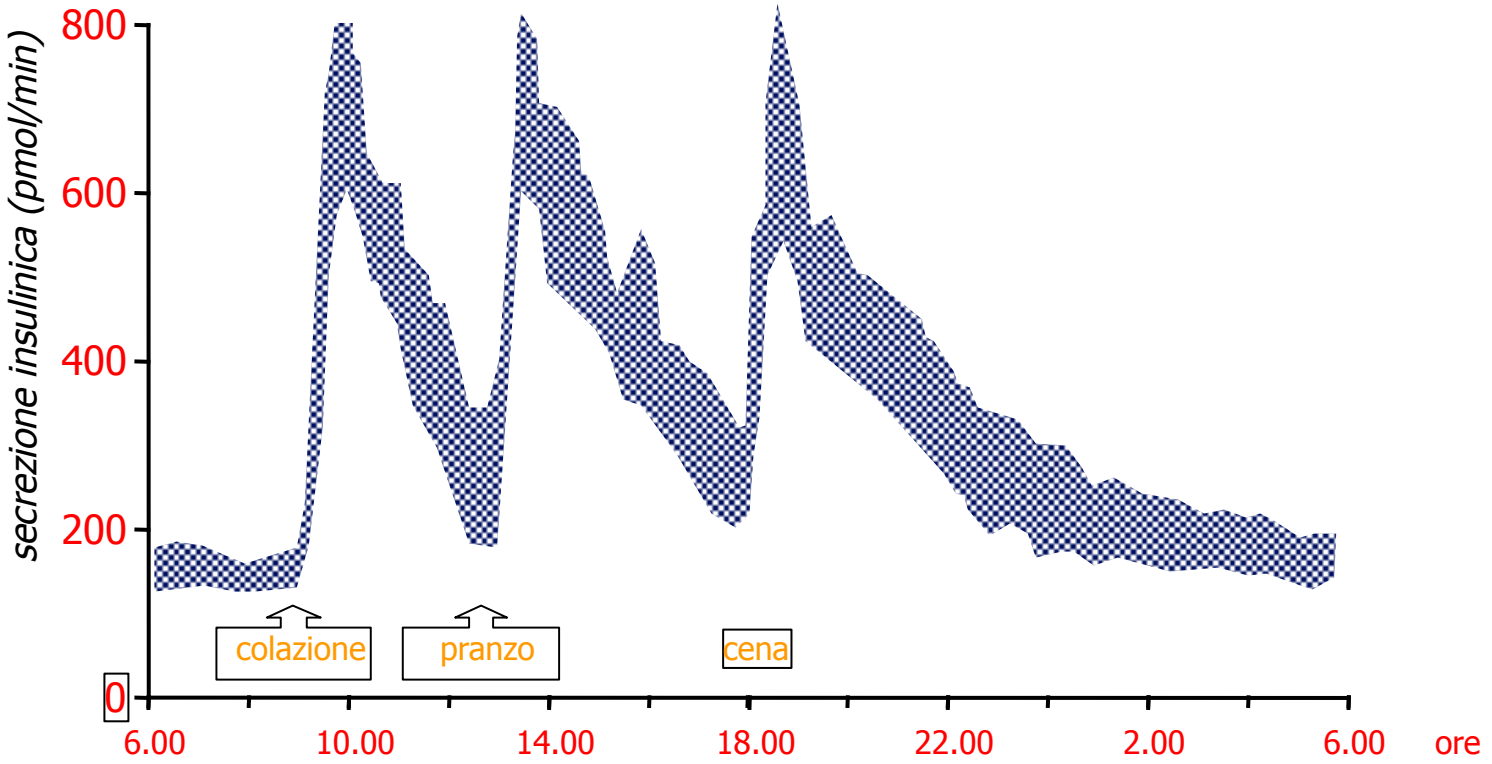
- **6 U a colazione**
- **8 U a pranzo**
- **7 U a cena**
- La somma totale dell'insulina è:
- 6 + 8 + 7 + 26 = **47 UI di insulina al giorno (FIG)**

Per calcolare la sensibilità insulinica:

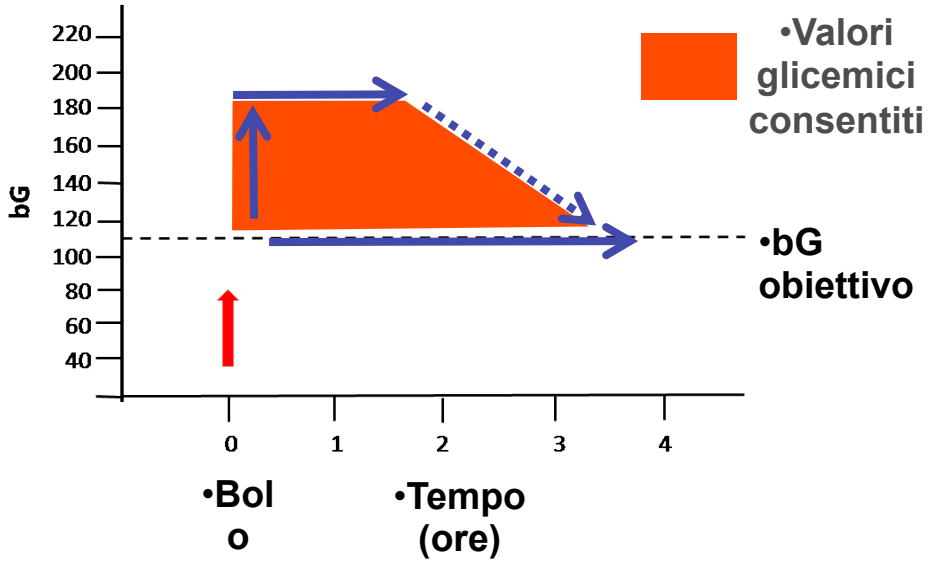
1800/47 unità totali di insulina al giorno = 38.2

1 unità di insulina 'abbassa' la glicemia di 38 mg/dl

PATTERN FISIOLOGICO DI SECREZIONE INSULINICA



Dimensioni e forma del “trapezio”



- **Aumento pasto** – incremento accettabile del livello glicemico dopo un pasto.
- **Tempo attesa** – tempo necessario perché abbia inizio una riduzione significativa della glicemia.
- **Tempo azione** - periodo di tempo complessivo in cui l'insulina esplica la sua attività nel ridurre la glicemia.

Ns.esperienza

Considerazione "intelligente" dell'insulina residua attiva

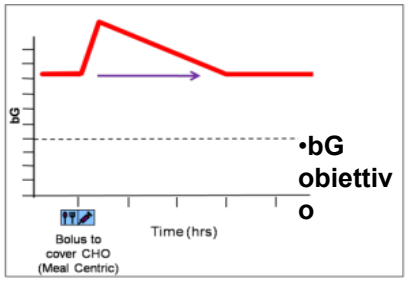
•Attiva

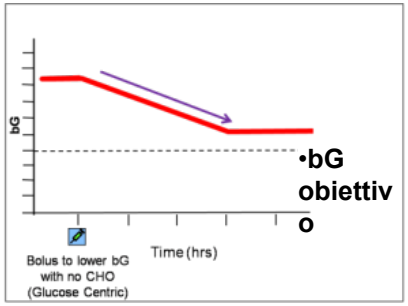
Completa-mente insulinica

Pasto-centrica

Gluco-centrica

•Attiva

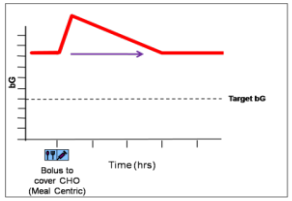




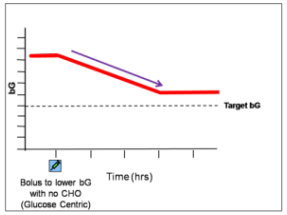
Quando calcola il bolo di correzione viene considerata on-board solo l'insulina “Gluco-centrica”.

Impostazione adeguata del ABC

- Bolo consigliato
- =
- Bolo prandiale
- (solo se si assumono CHO)



- +
- **Bolo di correzione**



- +

- **Rapporto insulina/carboidrati**
- **Sensibilità insulinica**

Eventi salute	Percentuale
Esercizio 1	
Esercizio 2	
Stress	
Malattia	
Periodo premestruale	

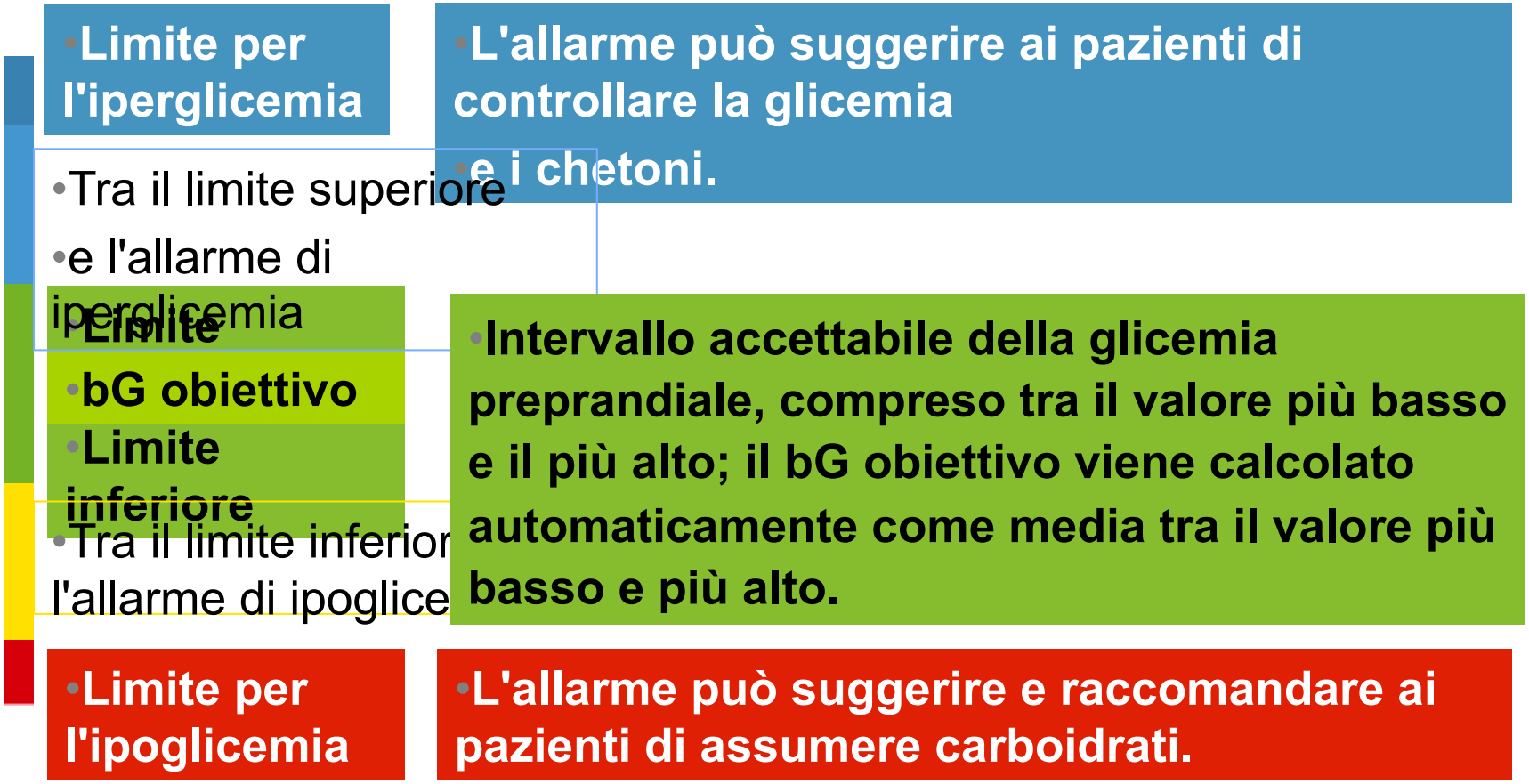
Suggeritori di bolo

- I: CHO (ICR)
- SI
- Target glicemici
- (Data base CHO)

Microinfusori

Glucometri

2. Intervallo obiettivo – livelli glicemici target



- Tali limiti derivano dalle impostazioni del medico…

Esempio

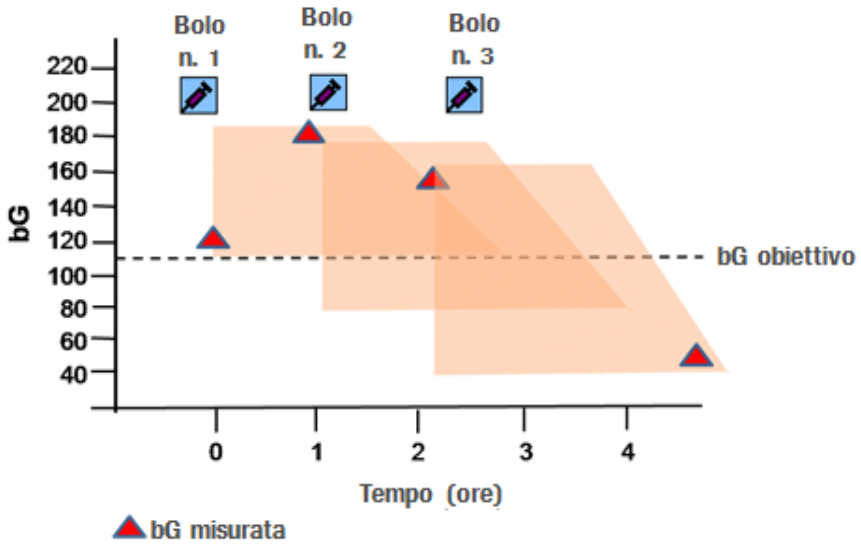
- Se in una giornata vengono somministrate **17,5 UI di basale** e i seguenti boli:
- **6 UI a colazione**
- **8 UI a pranzo**
- **7 UI a cena**
- La somma totale dell'insulina è:
- 6 + 8 + 7 + 17,5 = **38,5 UI di insulina al giorno (FIG)**

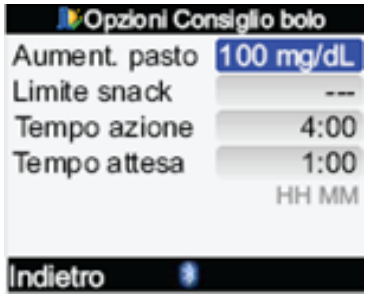
Per calcolare il rapporto I/CHO:

500/38,5 unità totali di insulina al giorno = 13

13 g di CHO vengono 'consumati' da 1unità di insulina

Opzioni della funzione olo"





1. Attenta valutazione dell’insulina on-board

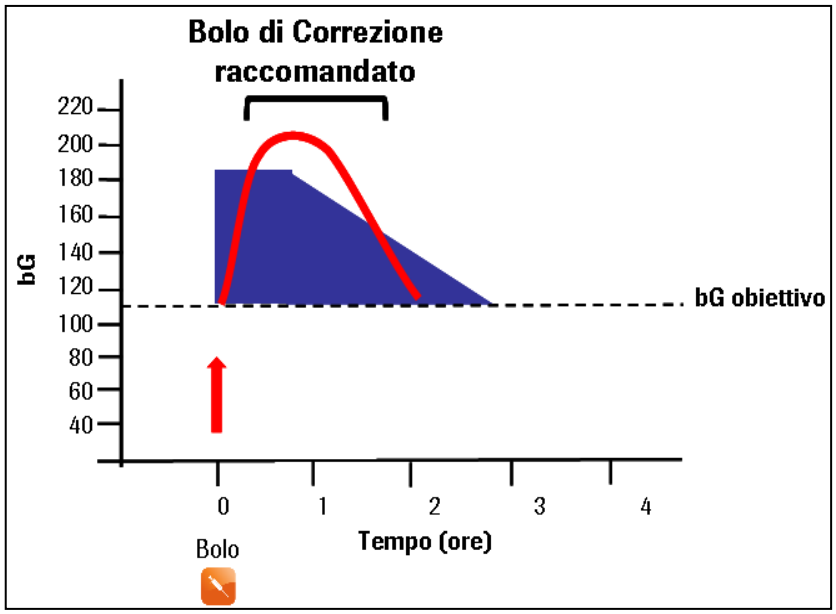
Assicurano che il calcolatore del bolo adegui un secondo bolo per un evento (pasto o correzione dei livelli glicemici) già coperto da un bolo precedente.

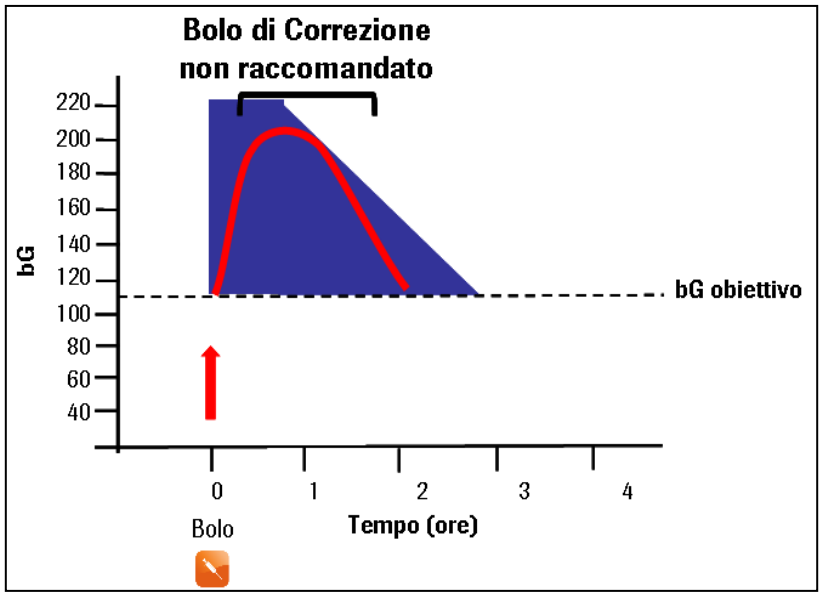
Funzioni programmabili

Una gestione personalizzata del diabete

- **Aumento dopo pasto**
  É l'**incremento accettabile** del livello glicemico postprandiale dopo l'assunzione di un pasto.
- **Tempo di attesa**
  È il tempo necessario perché abbia inizio una **riduzione significativa della glicemia** (riduzione >15%).
- **Tempo di azione**
  Periodo di **tempo complessivo** in cui l'insulina esplica la sua attività nel ridurre la glicemia.

Variazione impostazioni
Aumento pasto

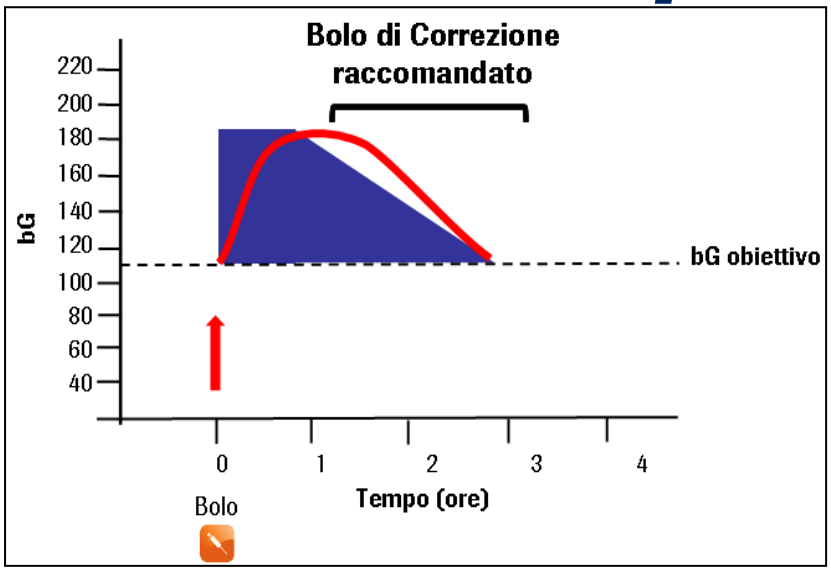


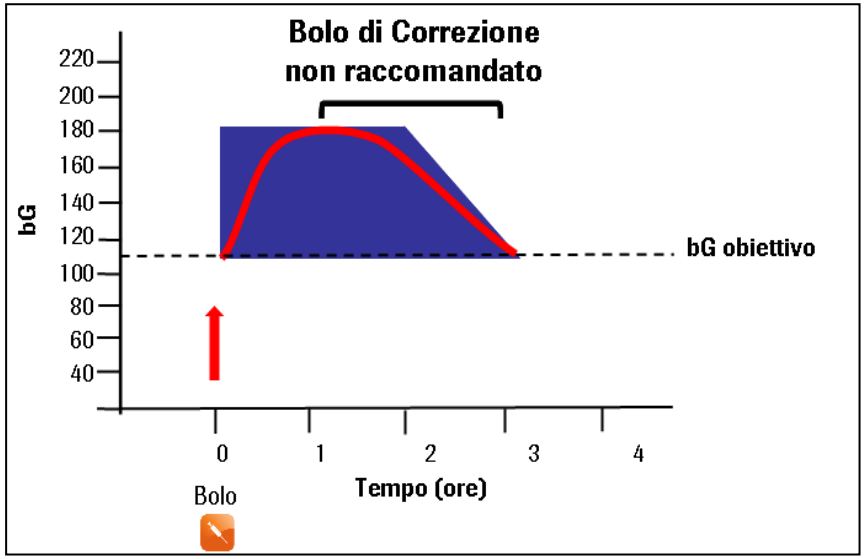


Minore è l'aumento più intensivo è il controllo glicemico

Variazione impostazioni

Tempo attesa

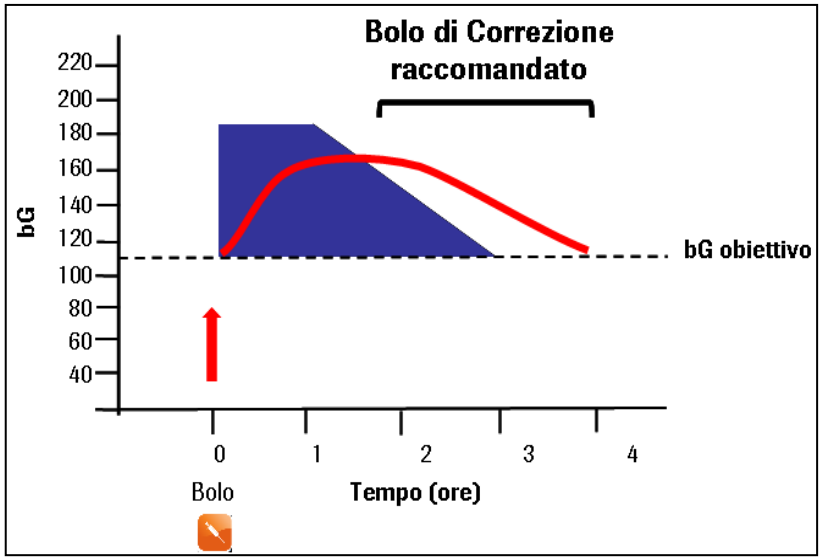


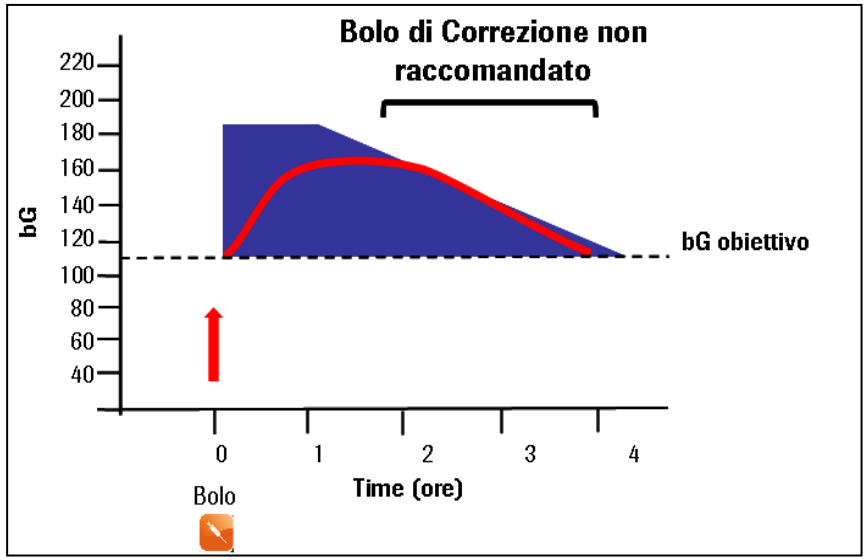


Maggiore è il tempo, meno intensivo è il controllo glicemico.

Variazione impostazioni

Tempo azione

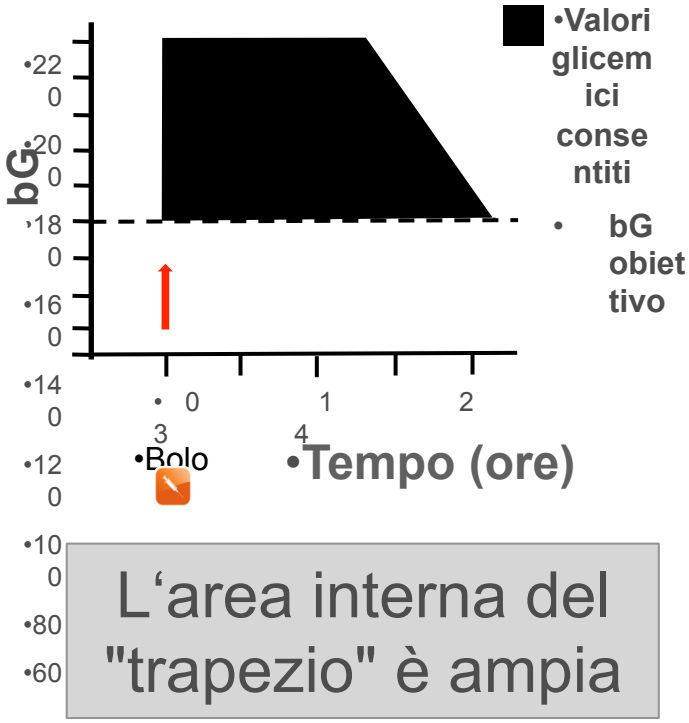




Minore è il tempo, più intensivo è il controllo glicemico.

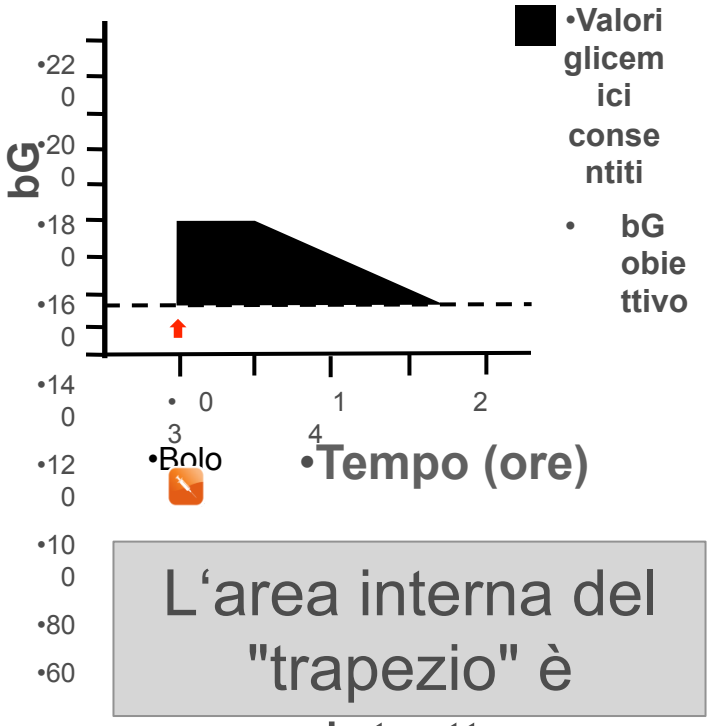
Controllo glicemico conservativo vs intensivo

glicemico



L'area interna del "trapezio" è ampia

glicemico



L'area interna del "trapezio" è ristretta

Esempio di Limite Snack pari a zero

- **Target Range:**

100 -180 mg/dL

- **I/CHO: 1 U : 35 g**
- **FC: 1 U : 80mg/ dL**

- **Aumento Pasto:**

80mg/dL

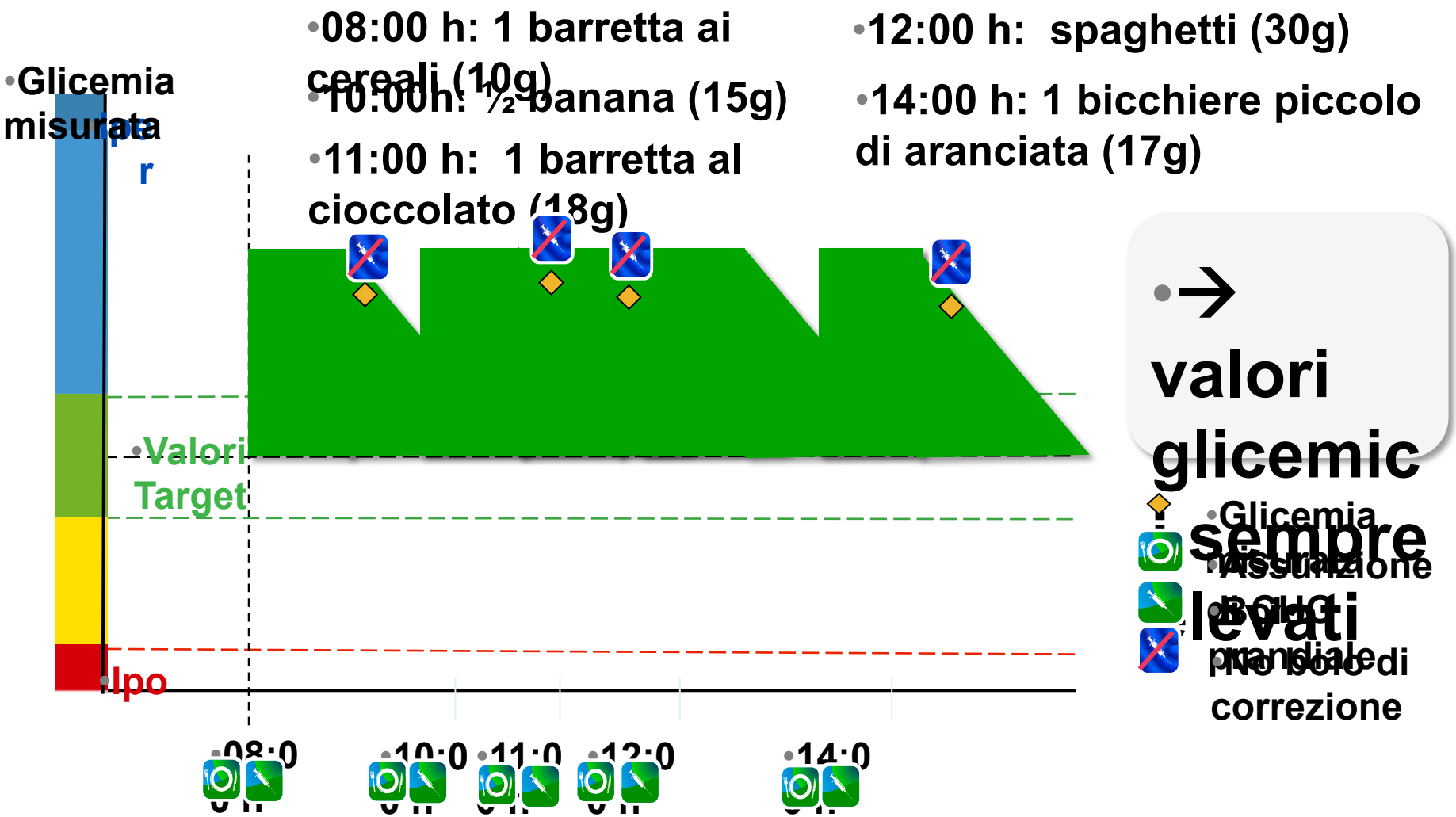
Limite Snack: 0 g

Tempo Azione:

3:00 h

Tempo Attesa:

Cosa accade?



•08:00 h: 1 barretta ai cereali (10g)

•10:00h: ½ banana (15g)

•11:00 h: 1 barretta al cioccolato (18g)

•12:00 h: spaghetti (30g)

•14:00 h: 1 bicchiere piccolo di aranciata (17g)

•→ valori glicemic sempre levati

•Glicemia
•Assunzione
•Bolo
prandiale
•No bolo di correzione

Esempio di Limite Snack diverso da zero

- **Target Range:**

100 -180 mg/dL

- **I/CHO: 1 U : 35 g**
- **FC: 1 U : 80mg/dL**

- **Aumento Pasto:**

80mg/dL

Limite Snack: 20 g

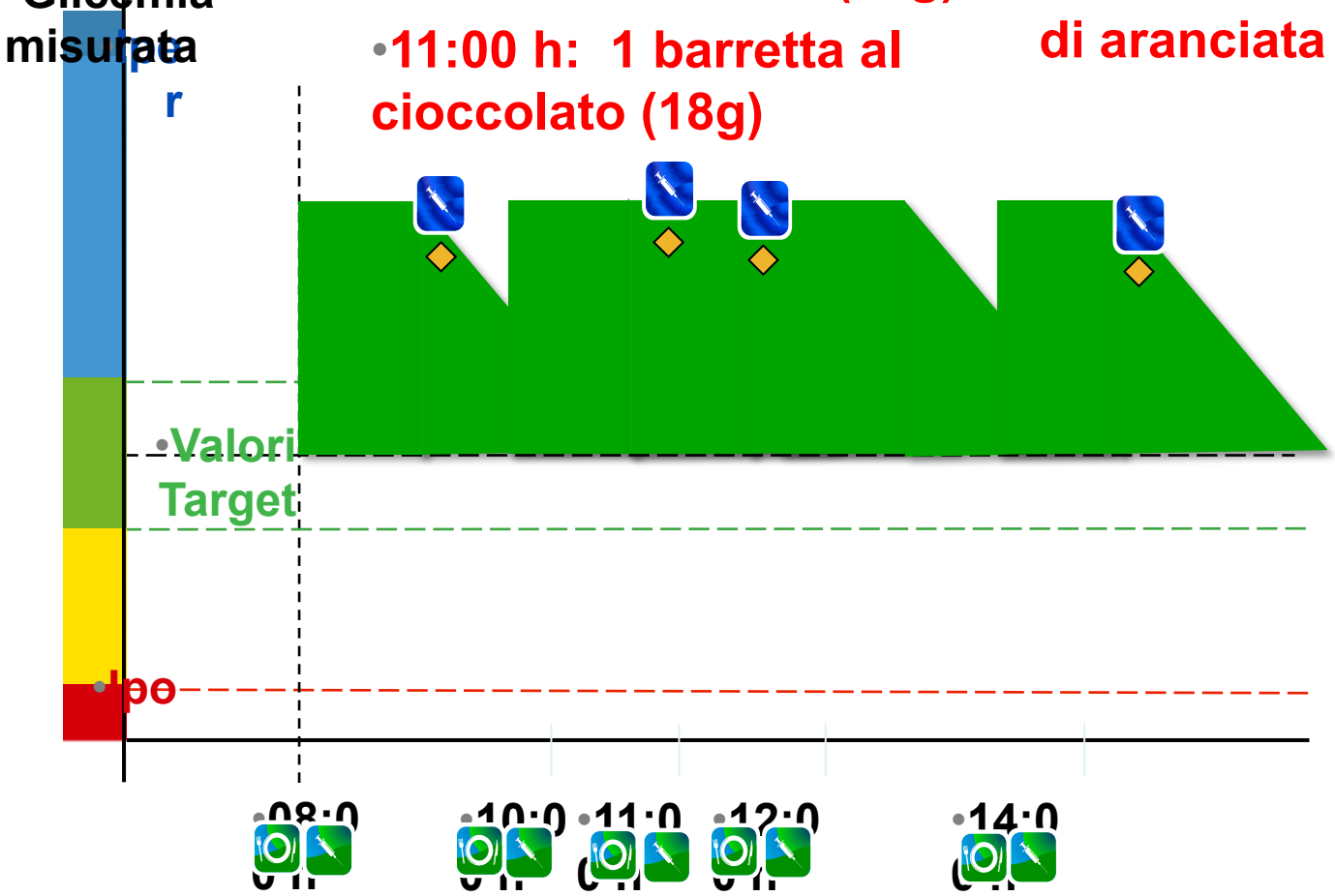
Tempo Azione:

3:00 h

Tempo Attesa:

Cosa accade ora?

- 08:00 h: 1 barretta ai cereali (10g)
- 10:00h: ½ banana (15g)
- 11:00 h: 1 barretta al cioccolato (18g)
- 12:00 h: spaghetti (30g)
- 14:00 h: 1 bicchiere piccolo di aranciata (17g)



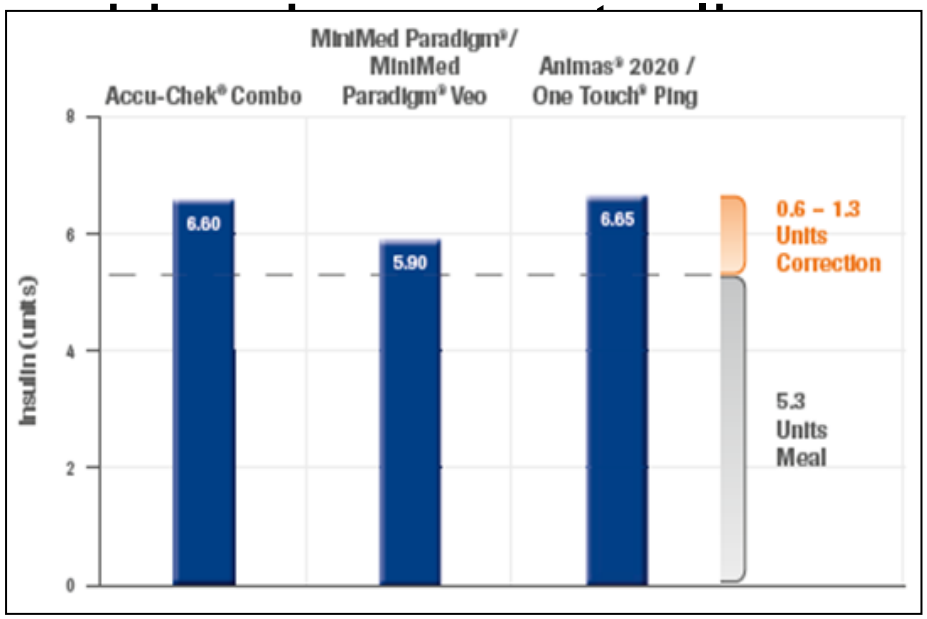
- → valori glicemici elevati erogono corretti

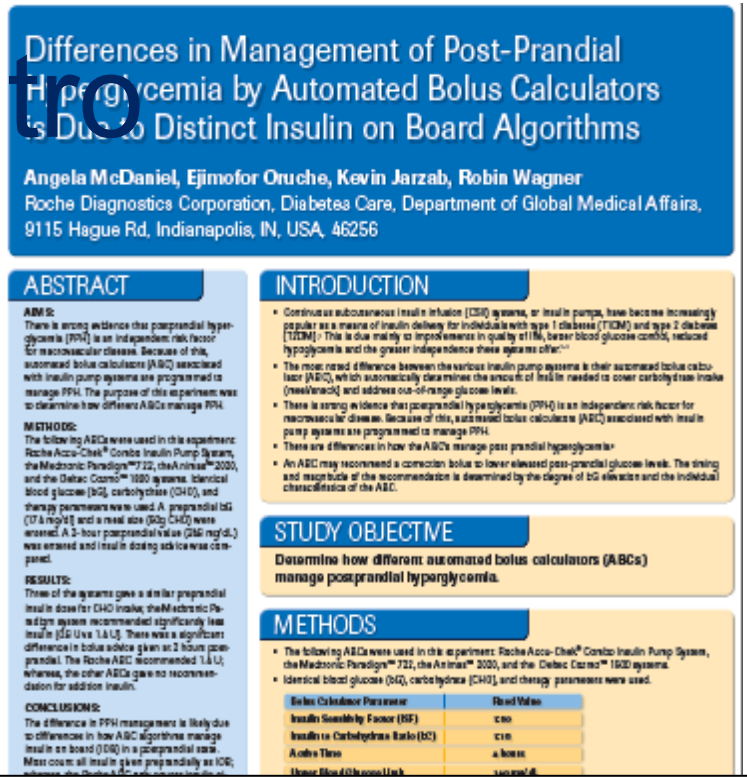
Glicemia misurata
Assunzione pasto
Bolo prandiale
Correzione

I calcolatori automatici di bolo sono tutti uguali?

Studio in vitro

- Obiettivo: confrontare tre calcolatori di bolo per




Differences in Management of Post-Prandial Hyperglycemia by Automated Bolus Calculators is Due to Distinct Insulin on Board Algorithms

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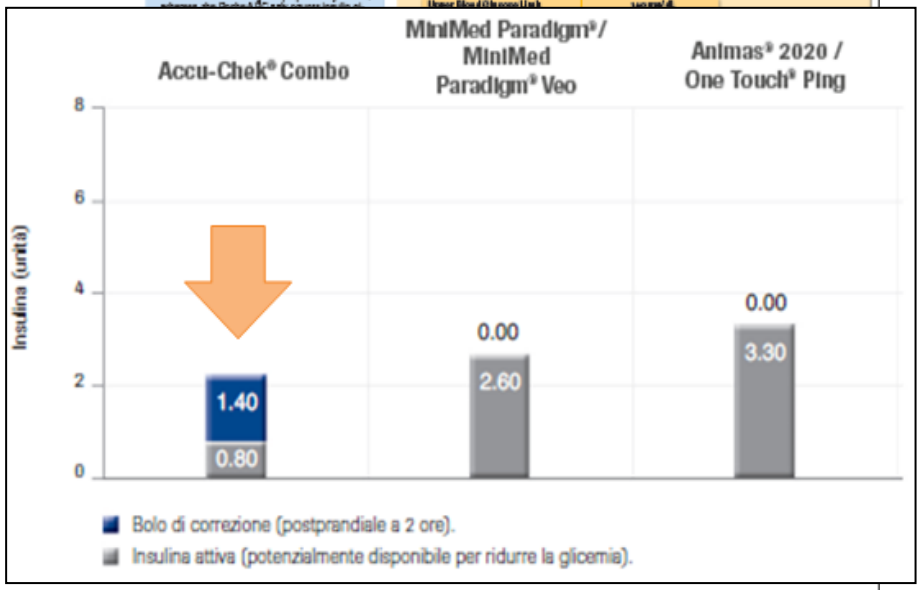
ABSTRACT

INTRODUCTION

STUDY OBJECTIVE

Determine how different automated bolus calculators (ABCs) manage postprandial hyperglycemia.

METHODS



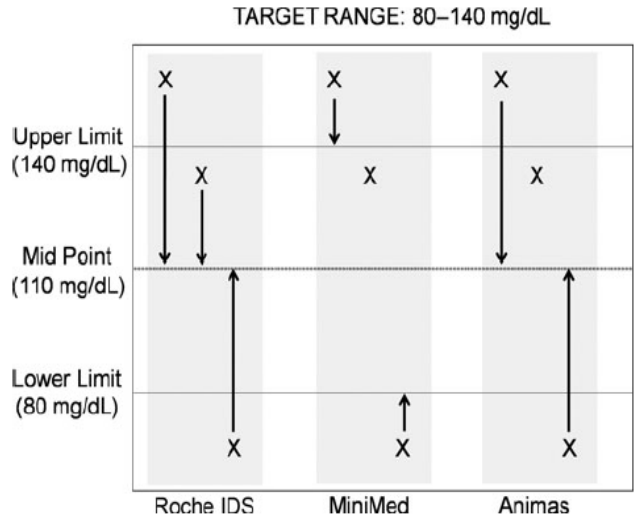
- **La differenza è stata riscontrata nel bolo di correzione consigliato**
- **A 2 ore dal pasto, AC**

McDaniel et al. Poster ATTD 2009

ha considerato una

Come si spiegano queste differenze?

Le **differenze di algoritmo** nei tre calcolatori testati possono spiegare i migliori risultati ottenuti con il calcolatore di bolo Roche:



Maggior raggiungimento del target, senza aumentare l'incidenza di ipoglicemia.

$$\text{Bolus insulin} = \text{Meal insulin} + \text{Correction insulin} \quad (1)$$

$$\text{Bolus insulin} = \frac{\text{CHO}}{\text{ICR}} + \frac{\text{Current BG - Target BG}}{\text{CF}} \quad (2)$$

$$\text{Bolus insulin} = \frac{\text{CHO}}{\text{ICR}} + \frac{\text{Current BG - Target BG}}{\text{CF}} \times \text{PS- IOB} \quad (3)$$