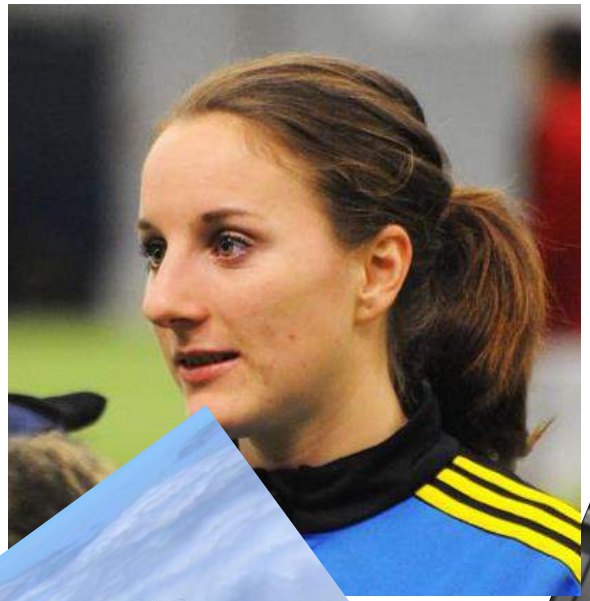
Zorlu/Profesyonel sporlarda diyabet yönetimi

Prof. Dr. Taner DAMCI

İUC Cerrahpaşa Tıp Fakültesi Endokrinoloji Metabolizma ve Diyabet Bilim Dalı

Team1 Koordinatörü

Alper Saruhan



Antonia Göransson

Billy Jean King

Borja Mayoral

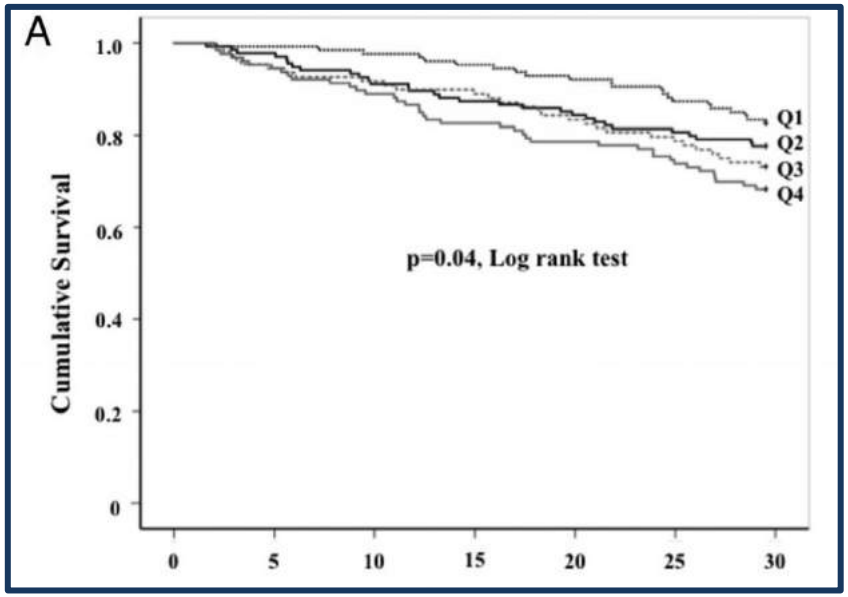
Will Cross

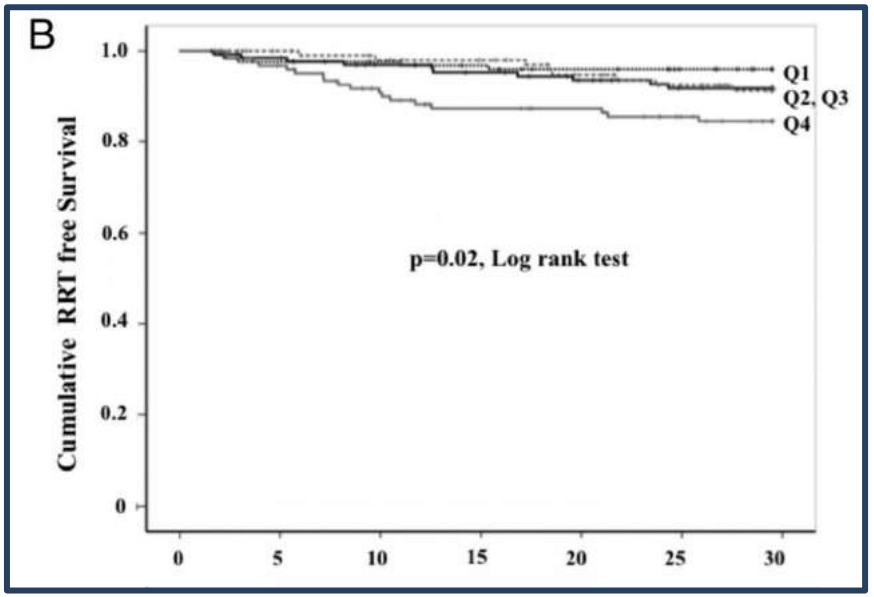
Team Novo Nordisk

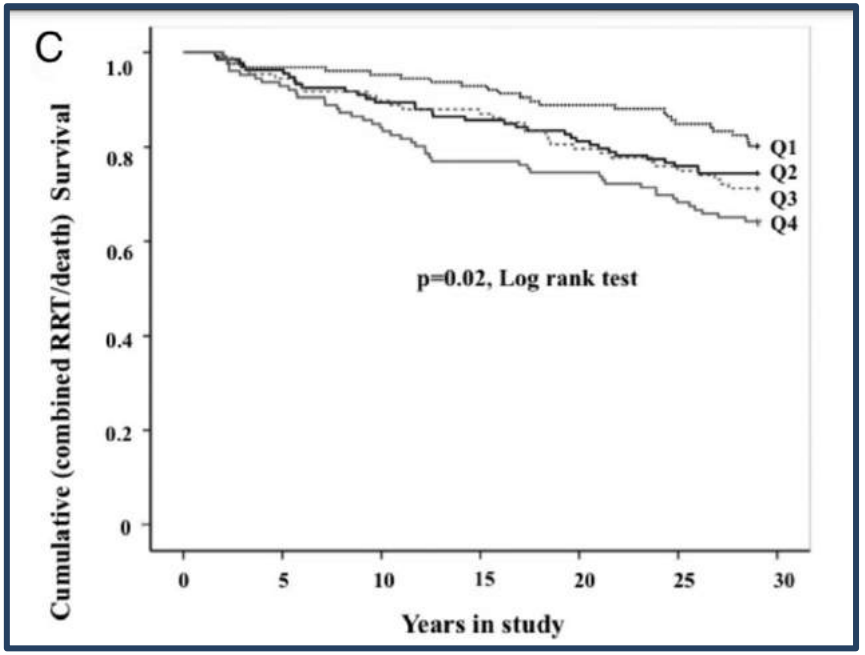
Wasim Akram

TÜRK DİYABET CEMİYETİ
T.D.C.
AYAR HAYAT SAĞLAR
1955

TEAM



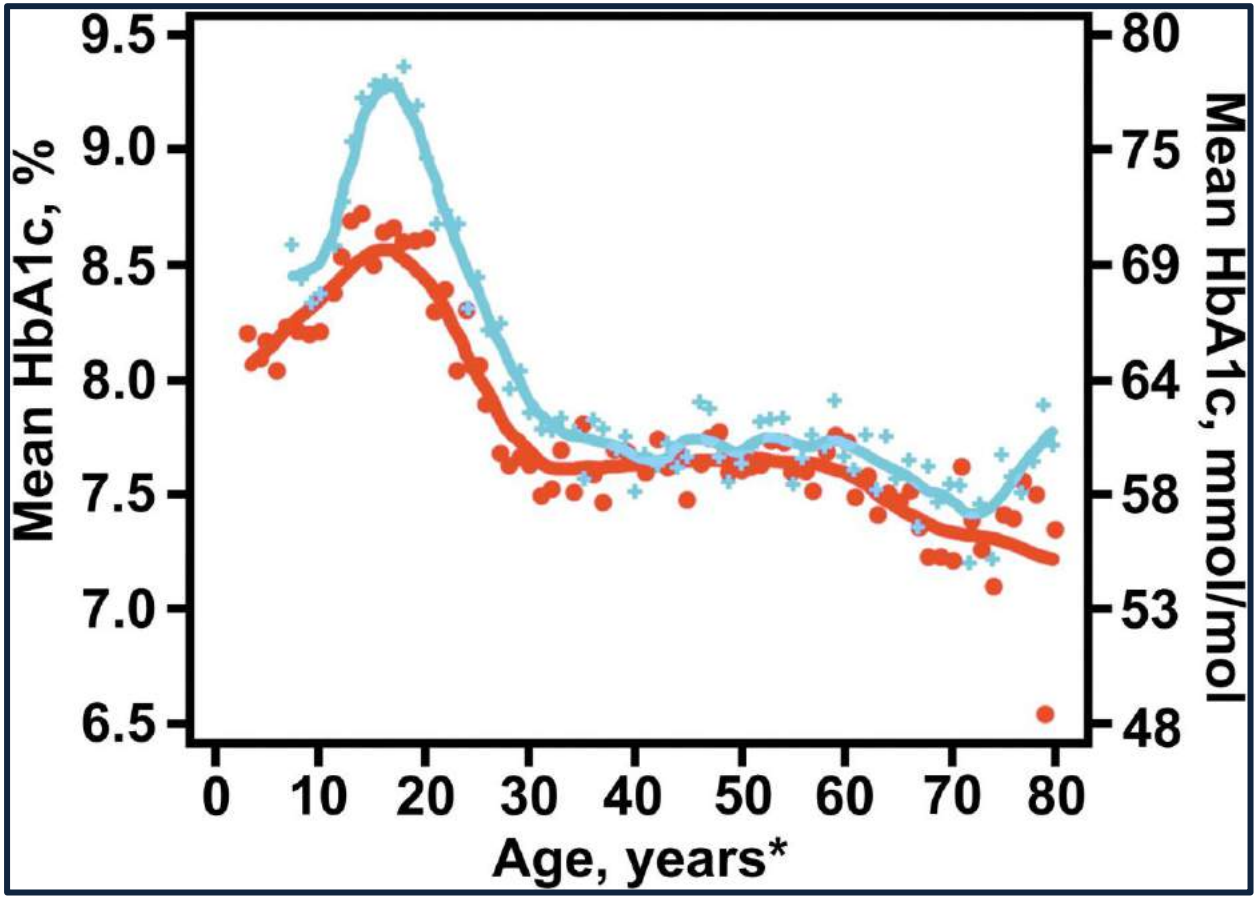




Survival (A), RRT free survival (B) and cumulative survival to the combined endpoint (RRT or death). (C) From the baseline examination to the end of the study are analyzed with Kaplan-Meier curves for baseline HbA1c quartiles [HbA1c quartiles 1 (Q1, black squares), 2 (Q2, white triangles), 3 (Q3, black triangles), and 4 (Q4, white squares)]

İyi glisemik ve kardiyovasküler risk faktörü kontrolü ile tip 1 diyabetliler toplum ortalamasına yakın uzunlukta bir yaşam sürebilirler

J Clin Endocrinol Metab, Volume 99, Issue 12, December 2014, Pages 4523–4530,

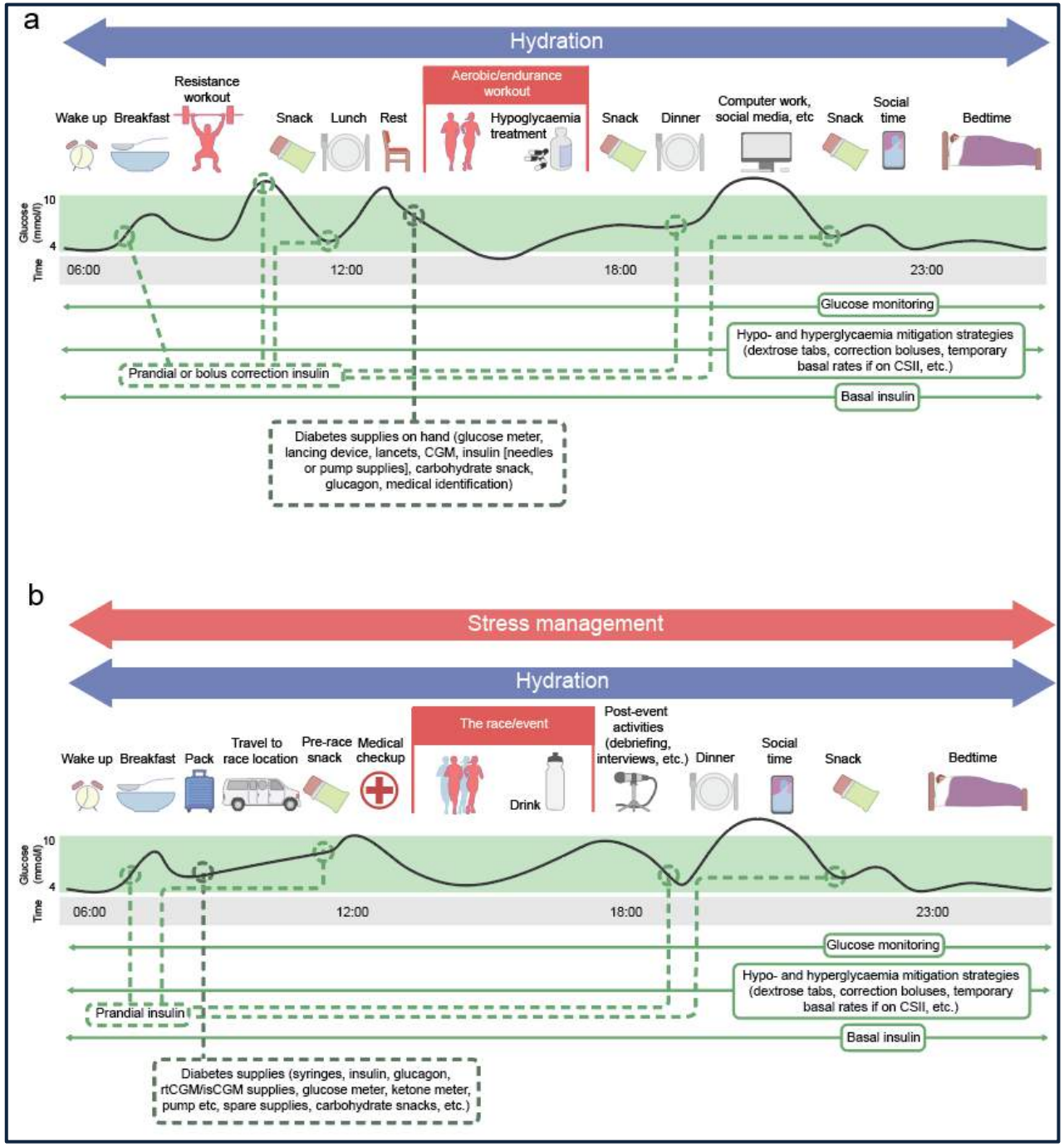


Average HbA1c by year of age: 2010–2012 versus 2016–2018. Orange line represents 2010–2012 cohort, and blue line represents 2016–2018 cohort.

Tip 1 diyabette yaşa göre diyabet kontrolü durumu.
Profesyonel spor yaşlarında kontrol daha zordur.

Diabetes Technology & TherapeuticsVol. 21, No. 2

Profesyonel veya yarı profesyonel spor zordur

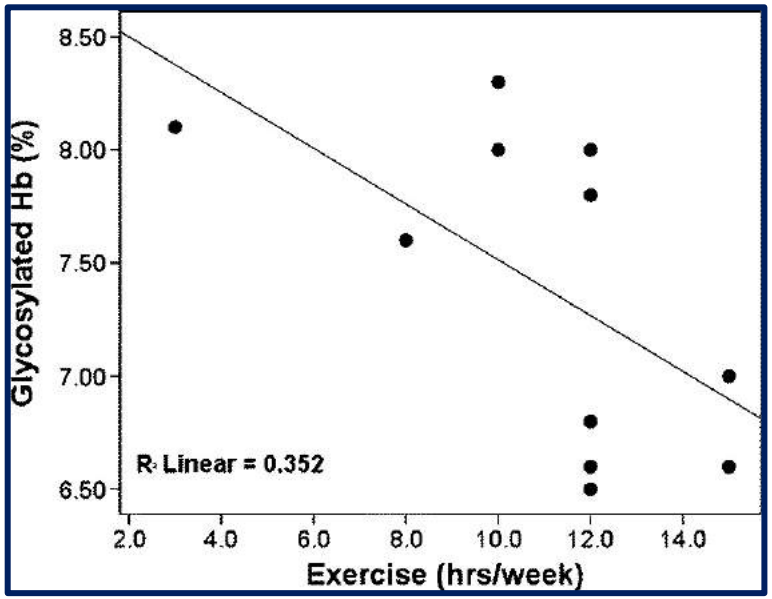


Tip 1 diyabetli bir sporcunun tipik bir günü

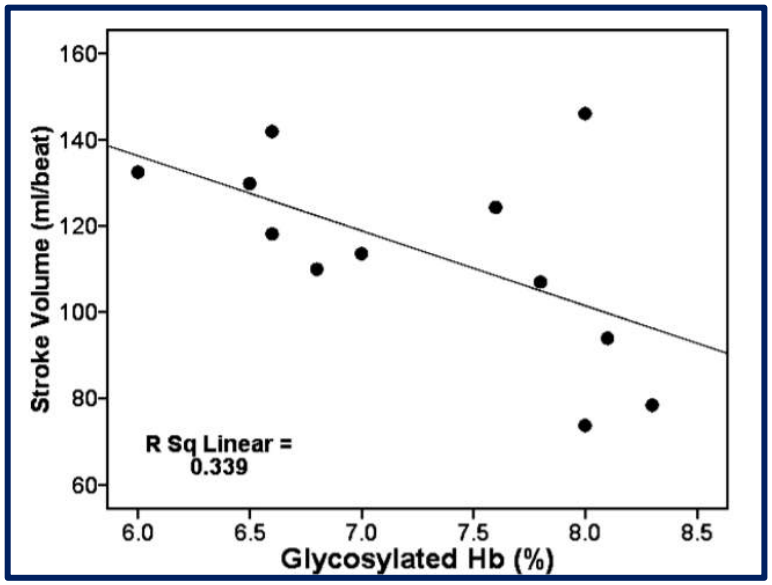
a. Antrenman
b. Yarış (Maç)

Diabetologia DOI 10.1007/s00125-020-05183-8

Diyabetli olmak performansı etkiler mi?



Relationship between training volume and HbA1c in subjects with type I diabetes. The x-axis represents training volume, and the y-axis represents HbA1c



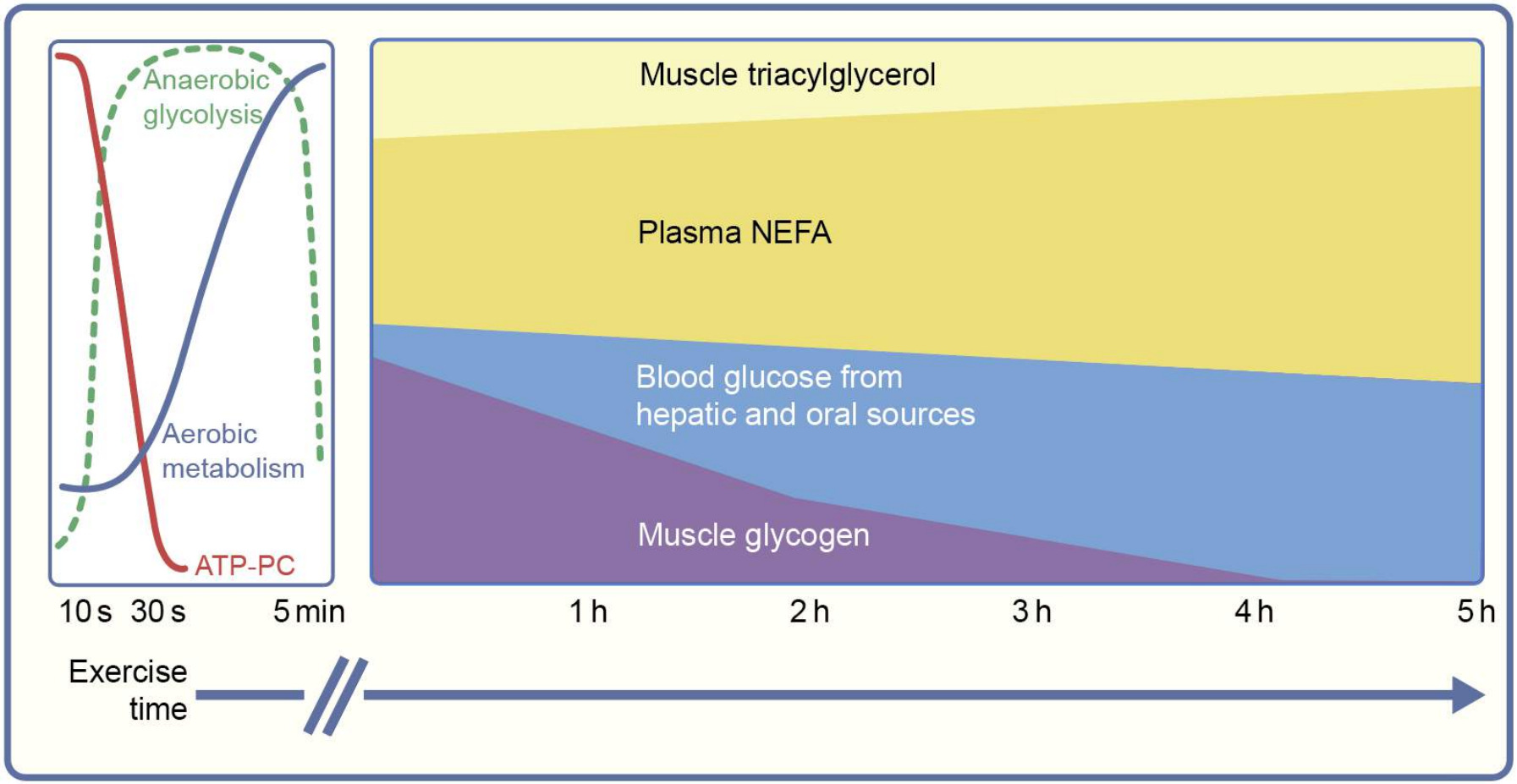
Relationship between HbA1c and peak stroke volume in patients with type I diabetes. The x-axis represents HbA1c, and the y-axis represents peak stroke volume.

Performansla glisemik kontrol arasında yakın bir ilişki vardır

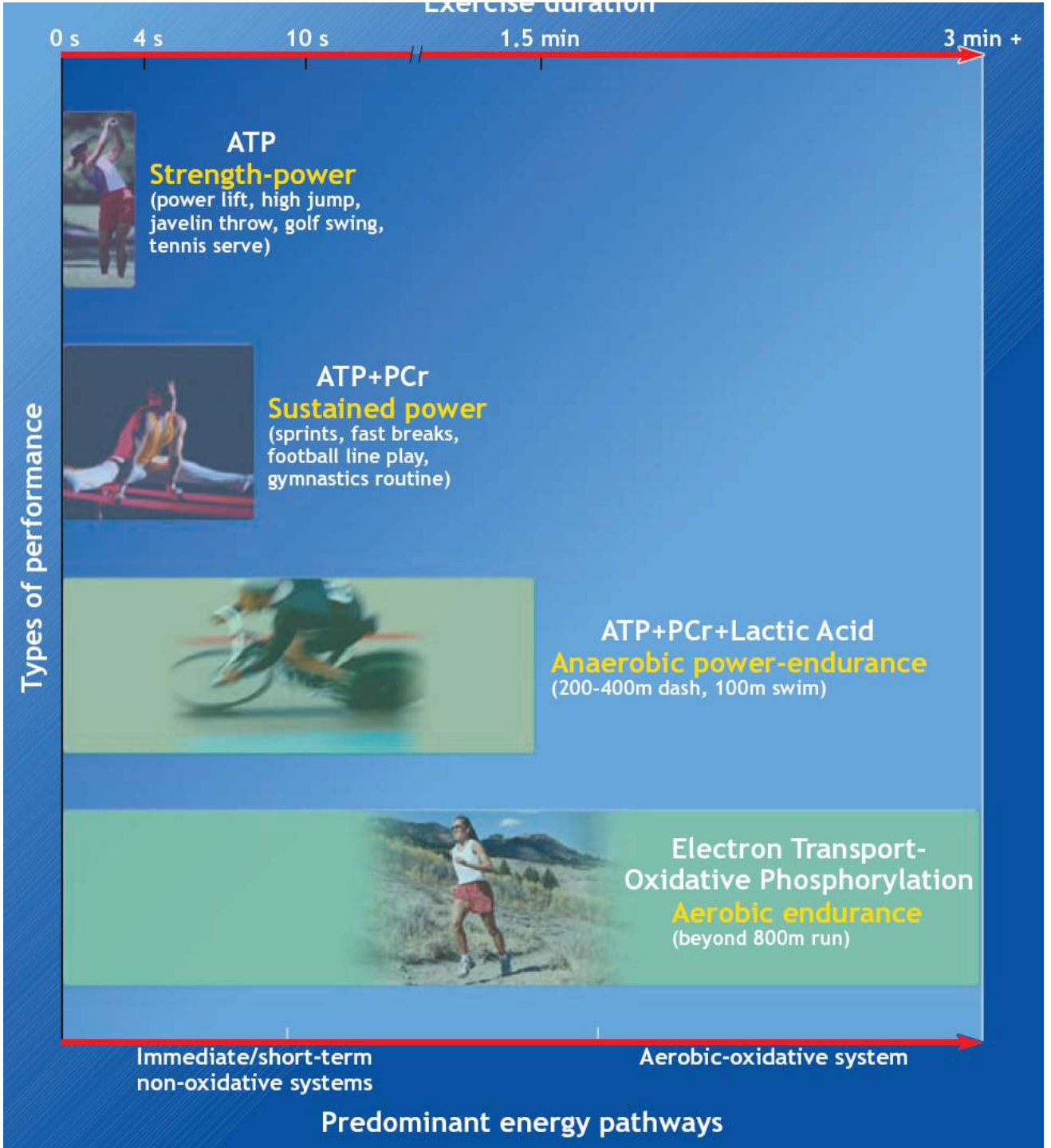
Medicine & Science in Sports & Exercise: August 2010 - Volume 42 - Issue 8 - p 1454-1459

Egzersizdeki yakıt tüketimi ve bunun insülinle ilgisi

Hareket sırasında kasların zamana göre yakıt kullanımı



Diabetologia DOI 10.1007/s00125-020-05183-8


Exercise duration
0 s
4 s
10 s
1.5 min
3 min +
ATP
Strength-power
(power lift, high jump, javelin throw, golf swing, tennis serve)
ATP+PCr
Sustained power
(sprints, fast breaks, football line play, gymnastics routine)
ATP+PCr+Lactic Acid
Anaerobic power-endurance
(200-400m dash, 100m swim)
Electron Transport-
Oxidative Phosphorylation
Aerobic endurance
(beyond 800m run)
Types of performance
Immediate/short-term
non-oxidative systems
Aerobic-oxidative system
Predominant energy pathways

Aerobic (Kardio) egzersizleri tekrarlayıcı ve sürekli hareketten oluşan ve daha çok aerobik enerji üretim sistemlerine dayalı büyük kas gruplarını içeren hareket (örn yürüme, koşma, bisiklet ve yüzme)

Güç (Ağırlık, direnç) egzersizleri serbest ağırlıklar ağırlık makineleri, vücut ağırlığı veya elastik direnç bantları kullanılarak yapılan tekrarlayıcı ve kısa süreli, daha çok anaerobik enerji üretim sistemlerini kullanan hareketler.

HIIT (Interval) kısa süreli maximum hız veya şiddette ve aralarda daha düşük şideette veya durarak dinlenilen aralıklı değişken egzersiz aerobik egzersiz (Mesela 20 sn ile 4 dakika arasında değişen yüklenme ve dinlenme periyodları)

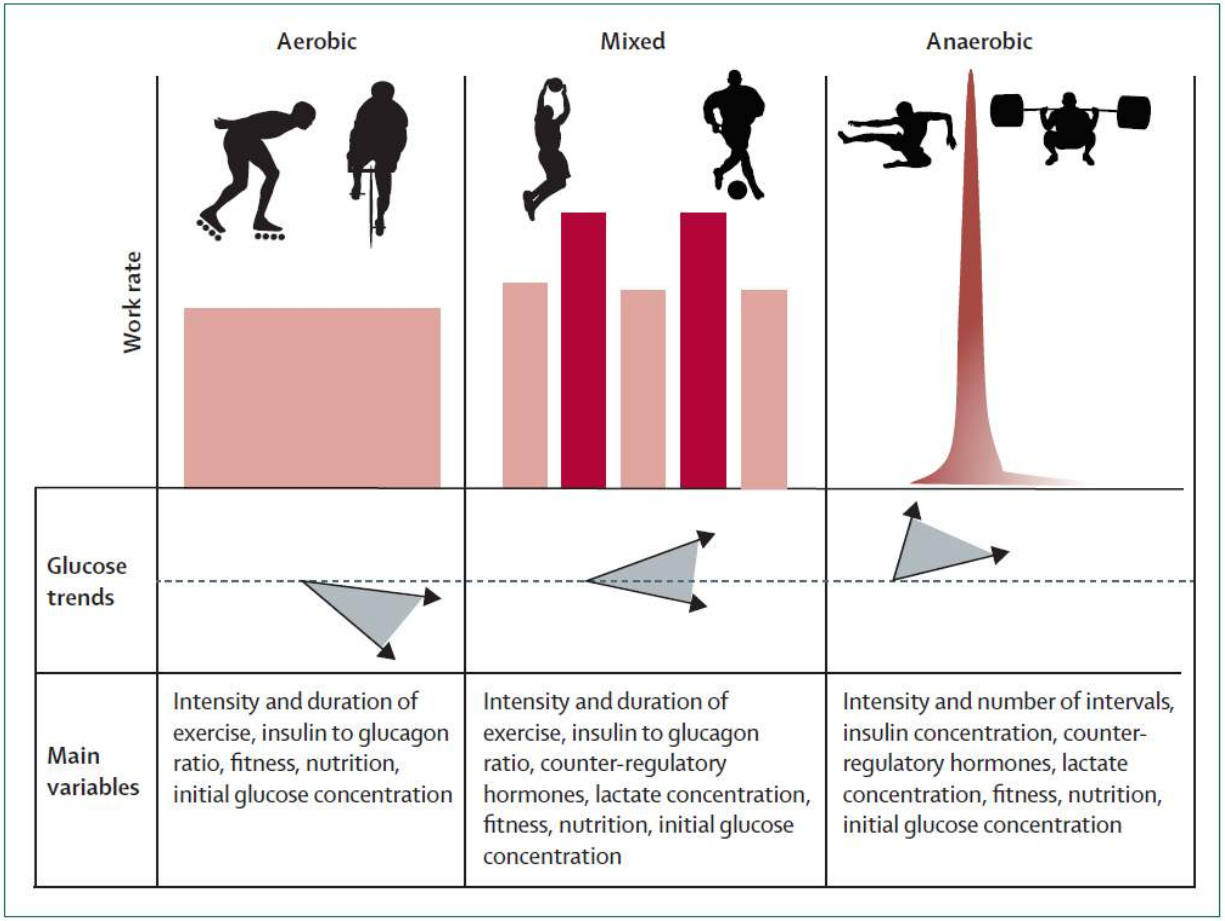
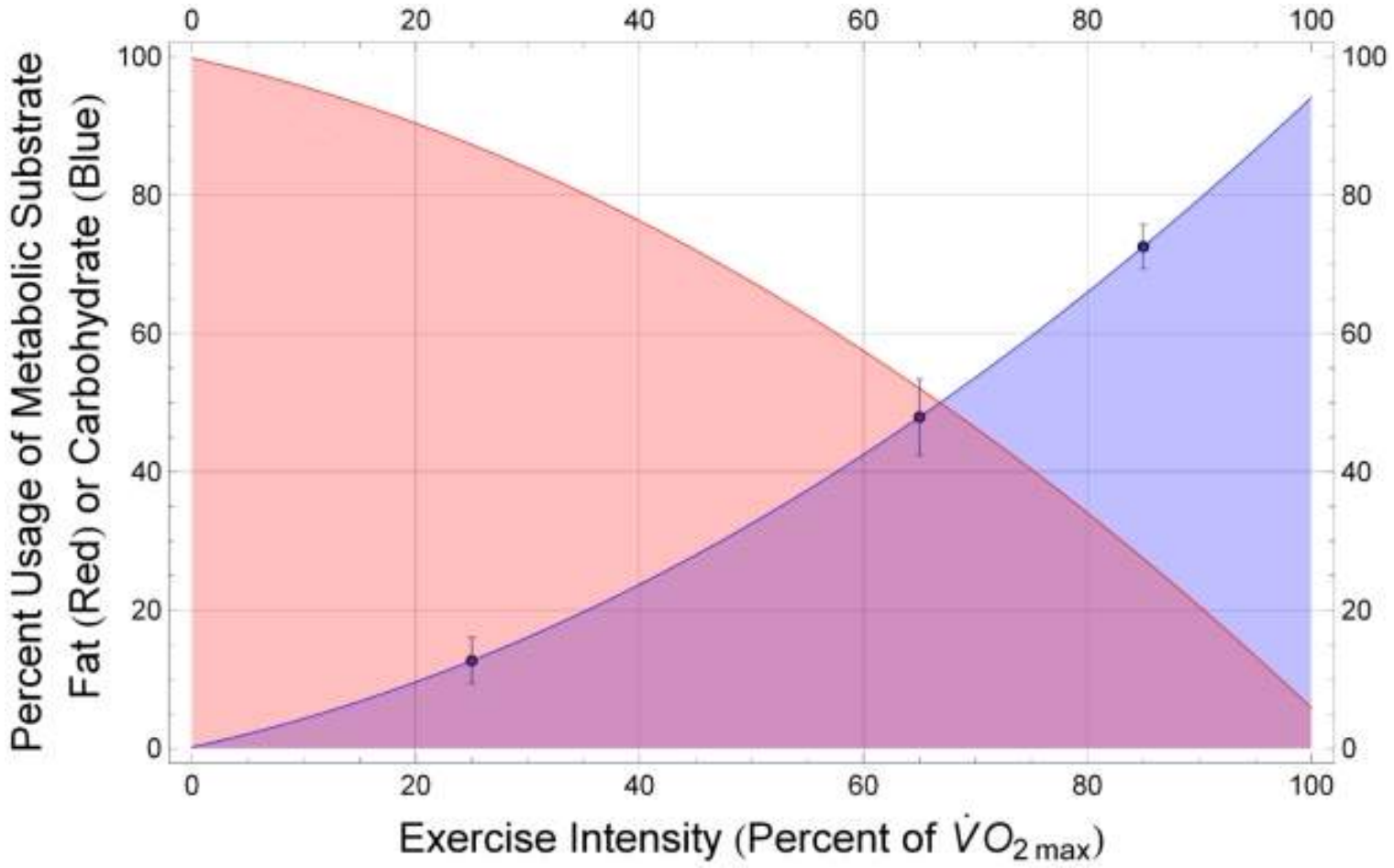


***Figure 1*: Variability in blood glucose responses to different forms of exercise in people with type 1 diabetes**
High individual variability exists in the blood glucose responses to different form of exercise, as denoted by the arrows and grey shading. In general, aerobic exercise decreases glycaemia, anaerobic exercise increases glycaemia, and mixed activities are associated with glucose stability. Individual responses are dependent on various additional factors, including the duration and intensity of the activity, initial blood glucose concentrations, individual fitness, concentrations of insulin, glucagon, and other counter-regulatory hormones in the circulation, and the nutritional status of the individual.



Egzersiz şiddetine göre yakıt olarak karbonhidrat ve yağ kullanımı oranları değişir

PLoS Comput Biol. 2010 Oct; 6(10)

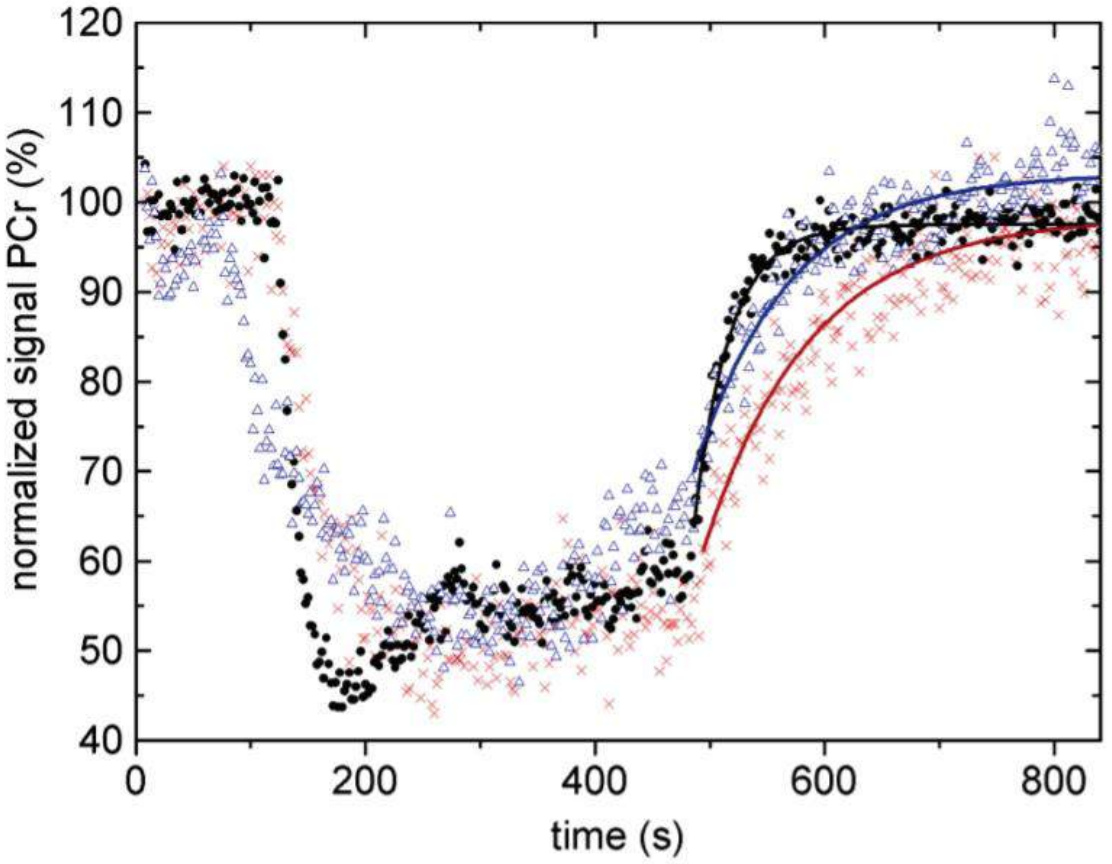
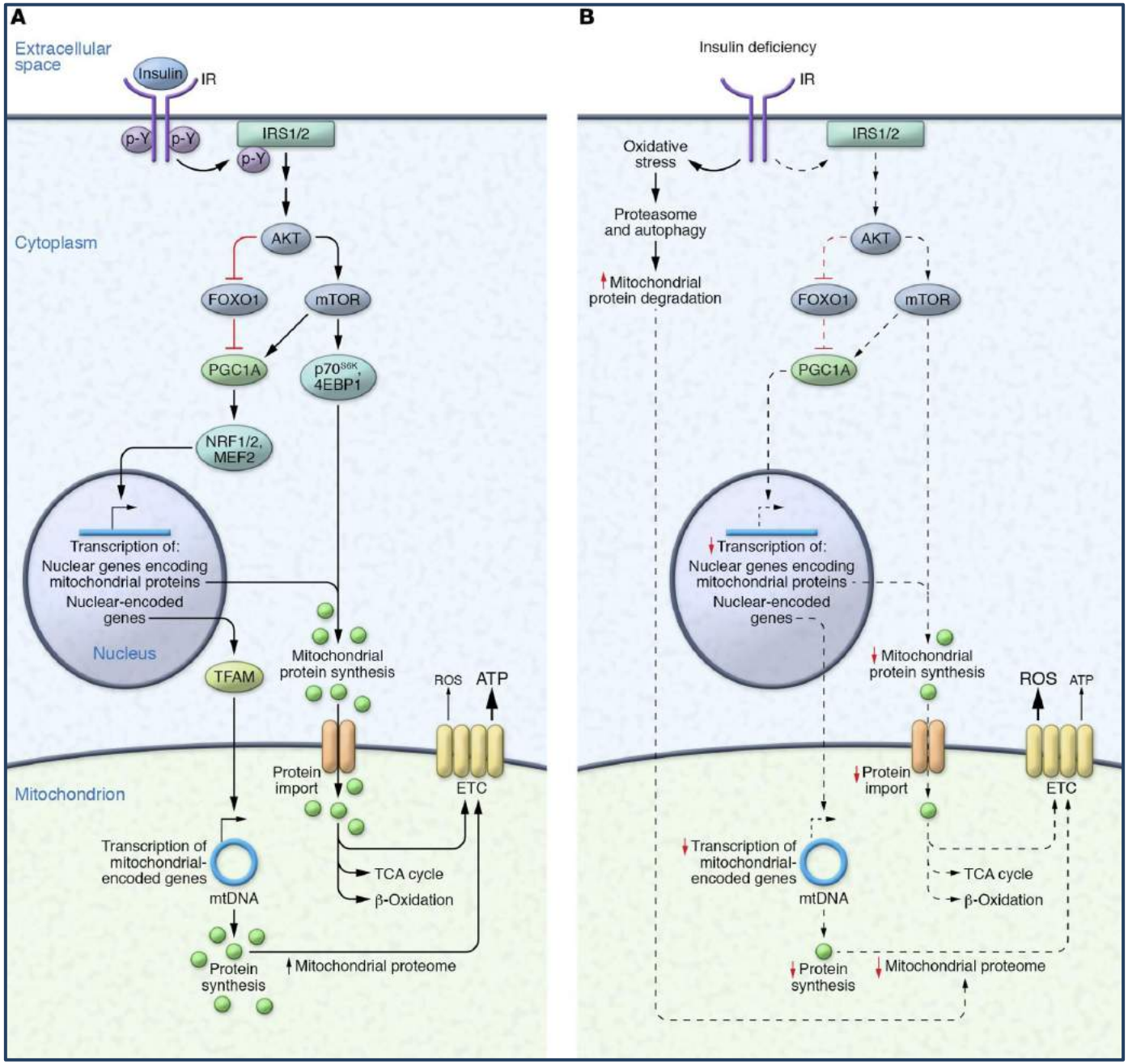


Fig. 1. Typical changes in phosphocreatine (PCr) during the rest – exercise – recovery periods during the examination of a female control (black), DM1 patient without (blue) and with (red) nephropathy.

Nefropatisi olmayan tip 1 diyabetlilerde fosfokreatinin yenilenmesi etkilenmemiştir

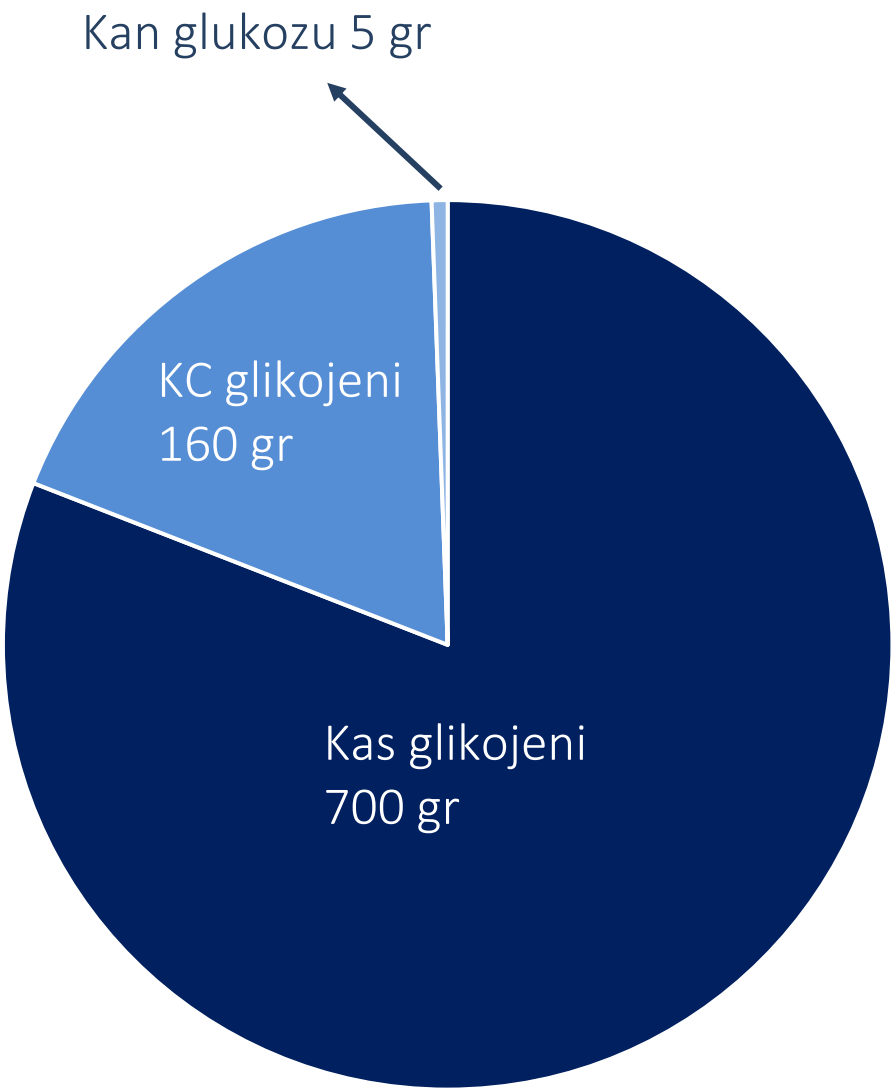
Physiol. Res. 67: 433-441, 2018



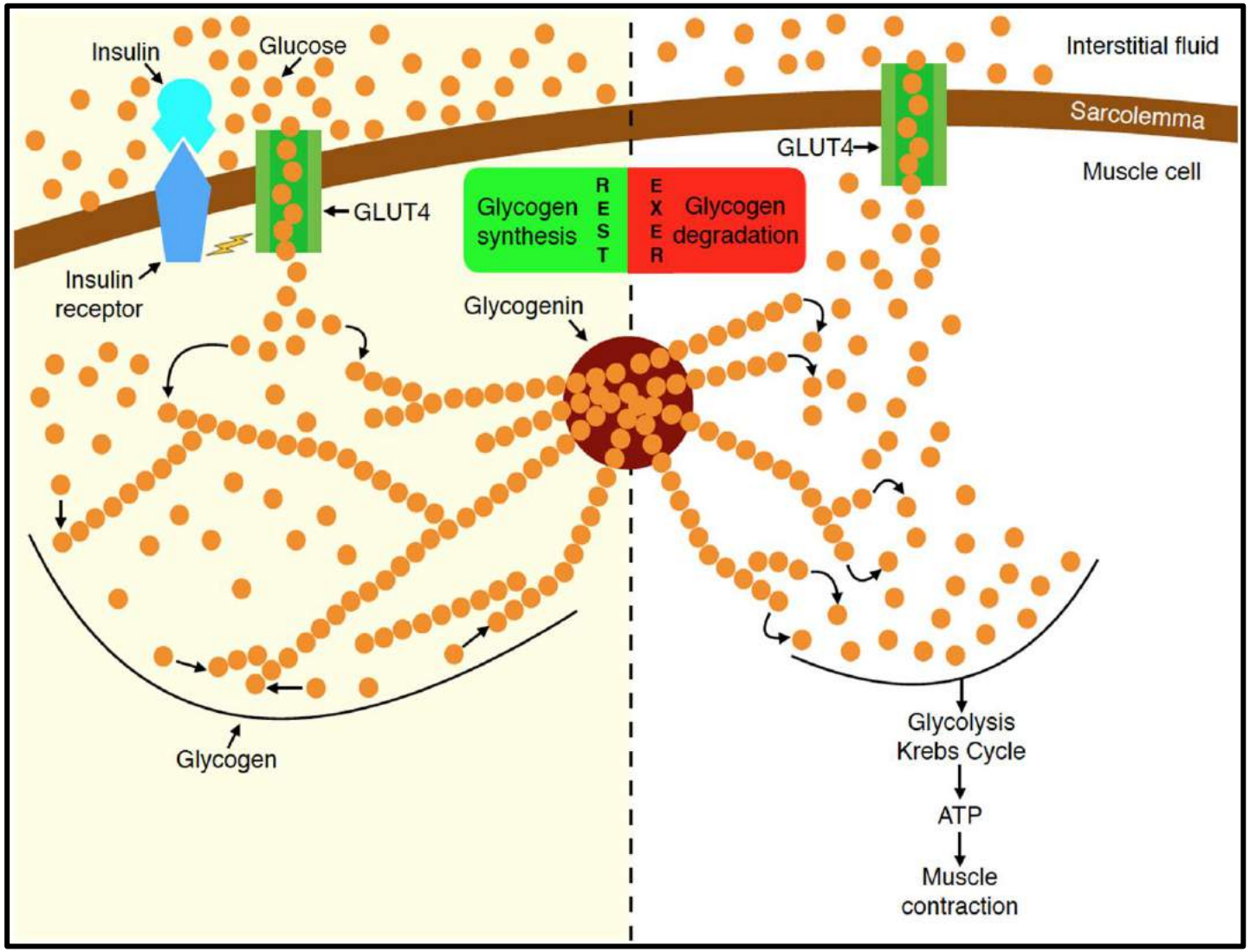
İnsülin eksikliği mitokondri fonksiyonunu etkiler

J Clin Invest. 2018;128(9):3671-3681

Yakıt olarak karbonhidratlar

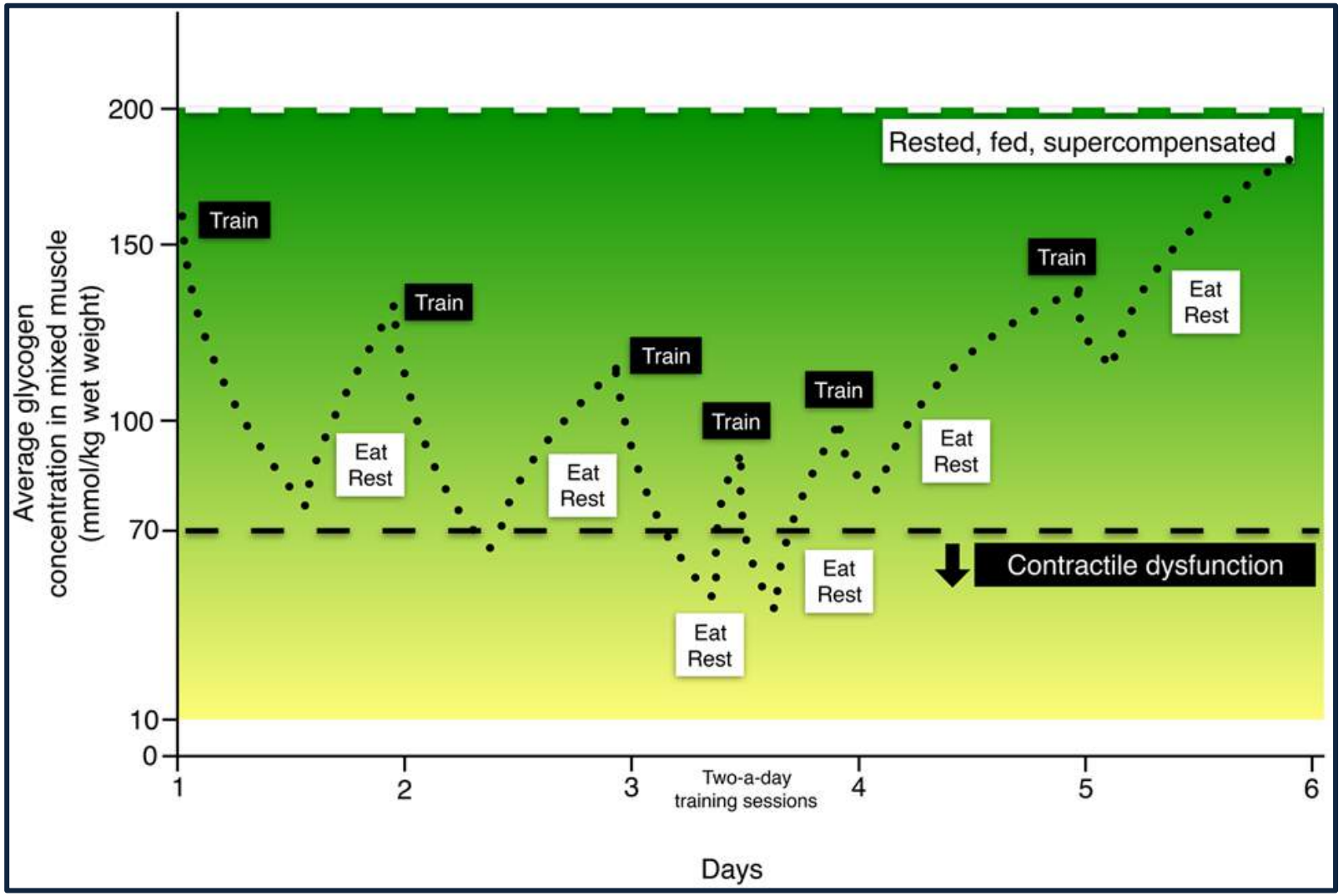


İnsan vücudunda karbonhidrat depoları



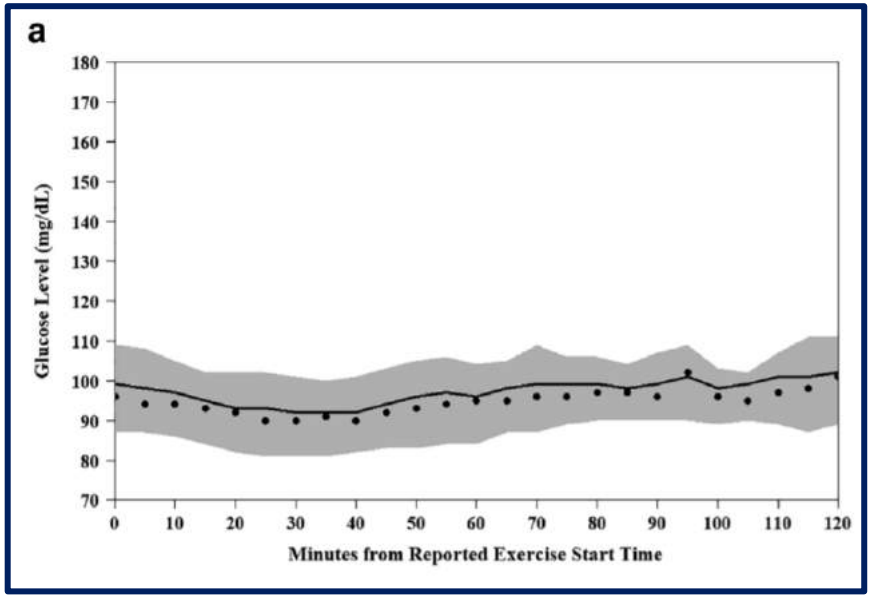
Dinlenme ve harekette kas glikojen döngüsü

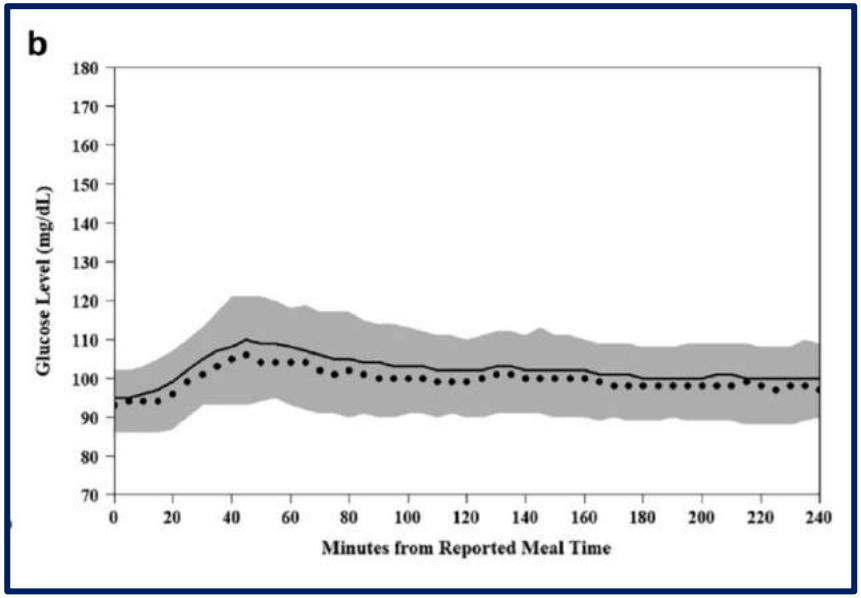
Nutr Rev, Volume 76, Issue 4, April 2018, Pages 243–259,



Dinlenme, antrenman ve karbonhidrat alımının kas glikojenine etkisi

Nutr Rev, Volume 76, Issue 4, April 2018, Pages 243–259,

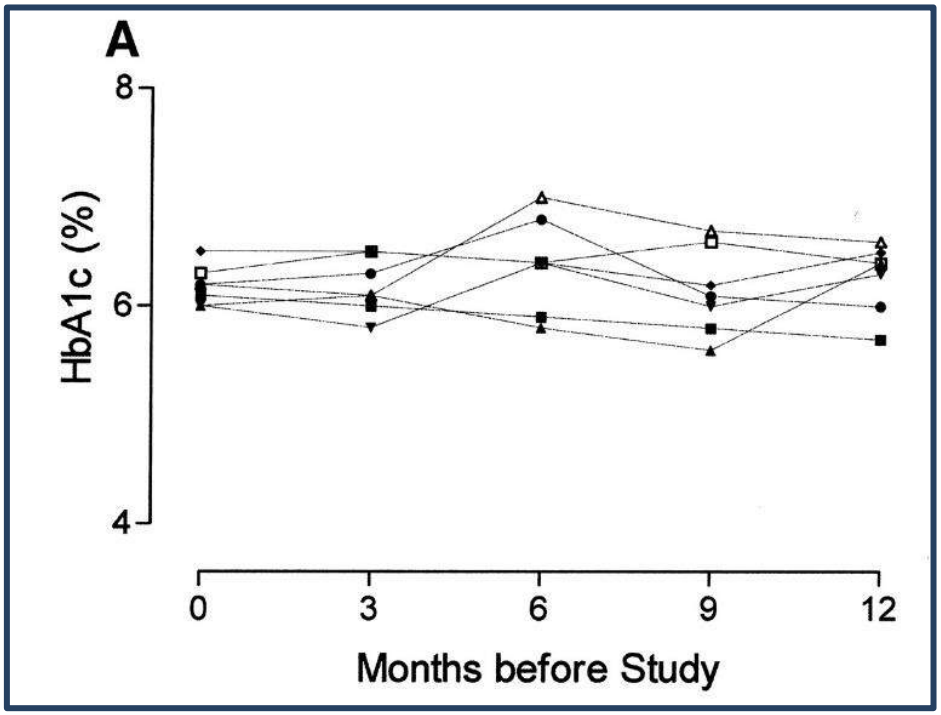




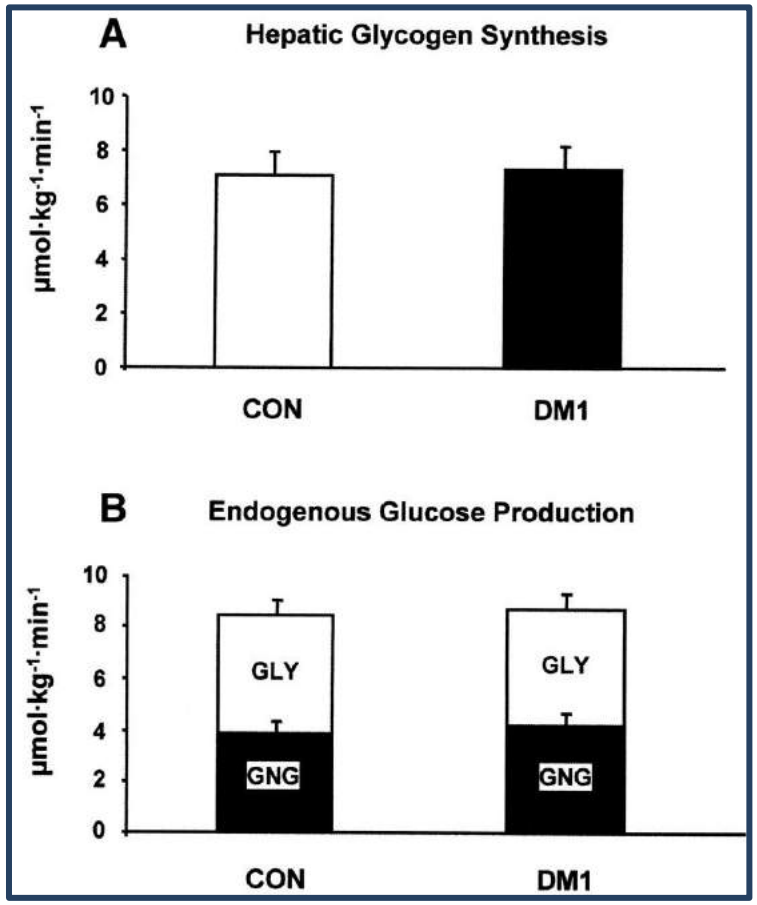
(a) Tracing of exercise glucose (exercise instances where a snack was consumed 30minutes prior to the start of exercise were excluded [N = 451 exercise sessions]). (b) Tracing of postprandial glucose (analysis was limited to only days in which all three main meals—breakfast, lunch, and dinner—were logged, each of the three meals were separated by at least four hours between the current and the next meal [or alcoholic drink], and a minimum of one hour of postprandial continuous glucose monitoring data existed [N = 306 meals]). Black dots represent median glucose level; solid black line represents mean glucose level; and gray band represents the interquartile range of glucose levels.

Egzersiz ve yemenin diyabetli olmayan sağlıklı kişilerde CGM üzerindeki etkileri

Journal of Diabetes Science and Technology 2021, Vol. 15(3) 593–599



Rates of net glycogen synthesis (A) and EGP (B), including net glycogen breakdown (GLY, ☐) and gluconeogenesis (GNG, ▪) of nondiabetic (CON, n = 7) and type 1 diabetic subjects with long- and short-term normoglycemia (DM1, n = 7). Rates of hepatic glycogen synthesis and breakdown were calculated from linear regression of the glycogen concentration time curves obtained after ingestion of a 800-kcal liquid meal. All data are corrected for liver volume as well as body weight and are given as µmol · kg−1 · min−1 and presented as means ± SE



İyi kontrollü tip 1 diyabetlilerde karaciğer glikojen sentezi ve glukoz üretimi bozulmamıştır

Martin G. Bischof et al. Diabetes 2002;51:49-54

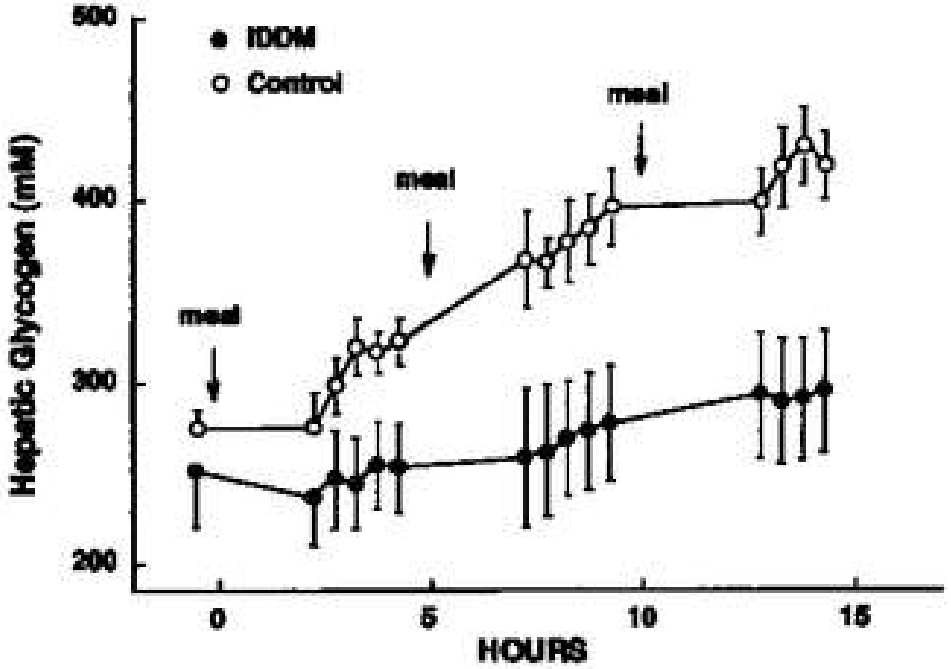
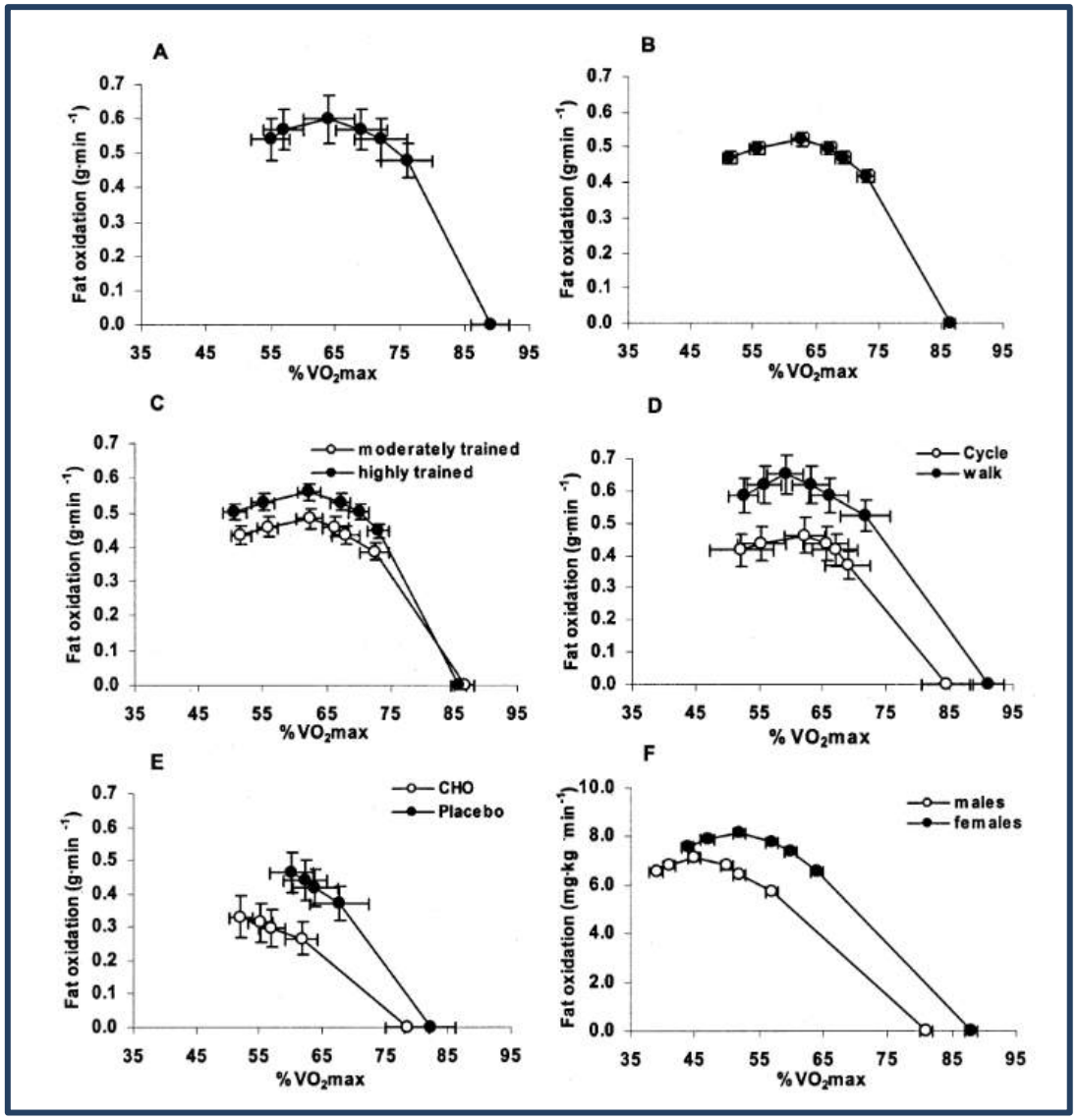


Figure 2. Time course for hepatic glycogen concentration (mM) in both normal and IDDM subjects during a day in which three isocaloric mixed meals were ingested 5 h apart.

Kötü kontrollü tip 1 diyabetiklerde karaciğer glikojen yenilenmesi bozulmuştur

J Clin Invest. 1995;95(2):783-787

Yakıt olarak lipid oksidasyonu



Fat oxidation rates versus exercise intensity expressed as percentage of VO2maxdetermined in (A) moderately trained men (n11)18(B) a large groupof trained male cyclists with wide range of VO2maxvalues (n53)19(C) moderately (n26) and highly (n27) trained male cyclists (VO2max, 59 versus72 mL·kg1·min1)19(D) cycle-ergometer-based and treadmill-based tests in moderately trained triathletes (n12),85(E) moderately trained cyclistsafter overnight fast and 45 min after ingestion of 75 g of glucose (n11),108and (F) large group of individuals on the treadmill-based test (157 men and143 women).20CHO, carbohydrate; VO2max, maximum oxygen consumption.

Maximum yağ oksidasyonu VO2Max %60-65 düzeyinde gerçekleşir

Nutrition 20:716 –727, 2004

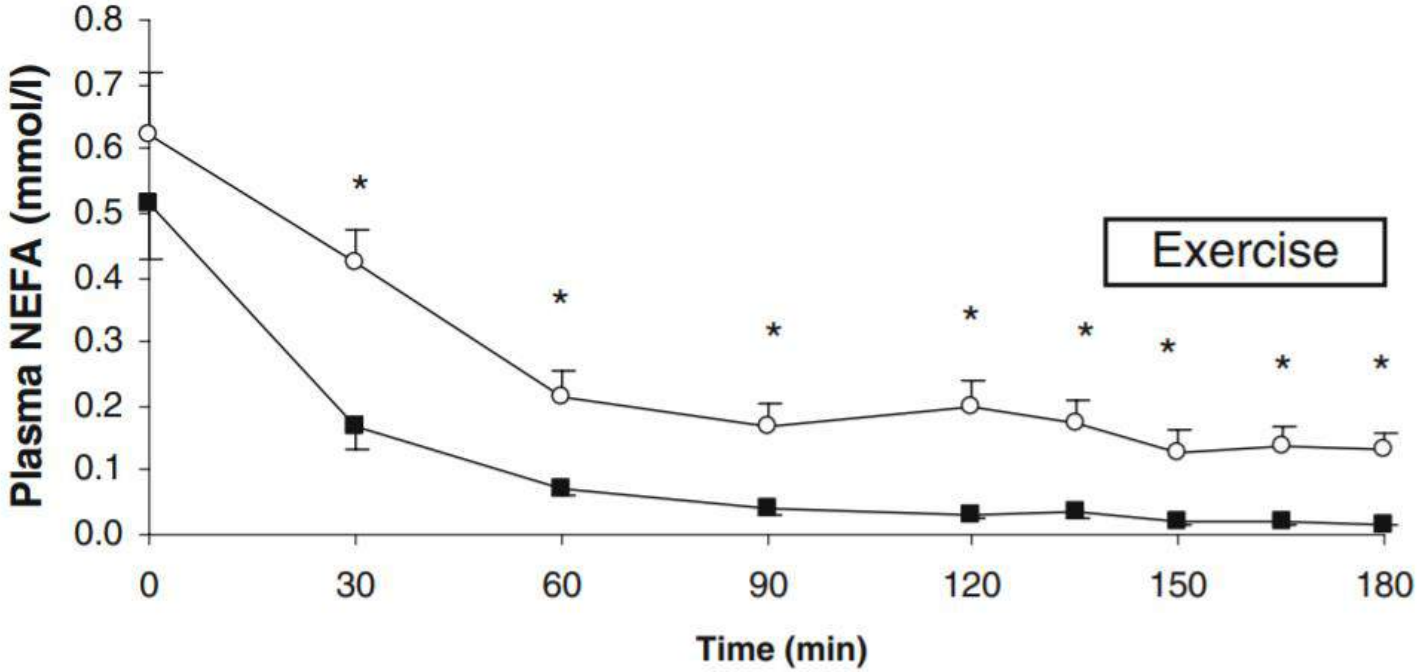
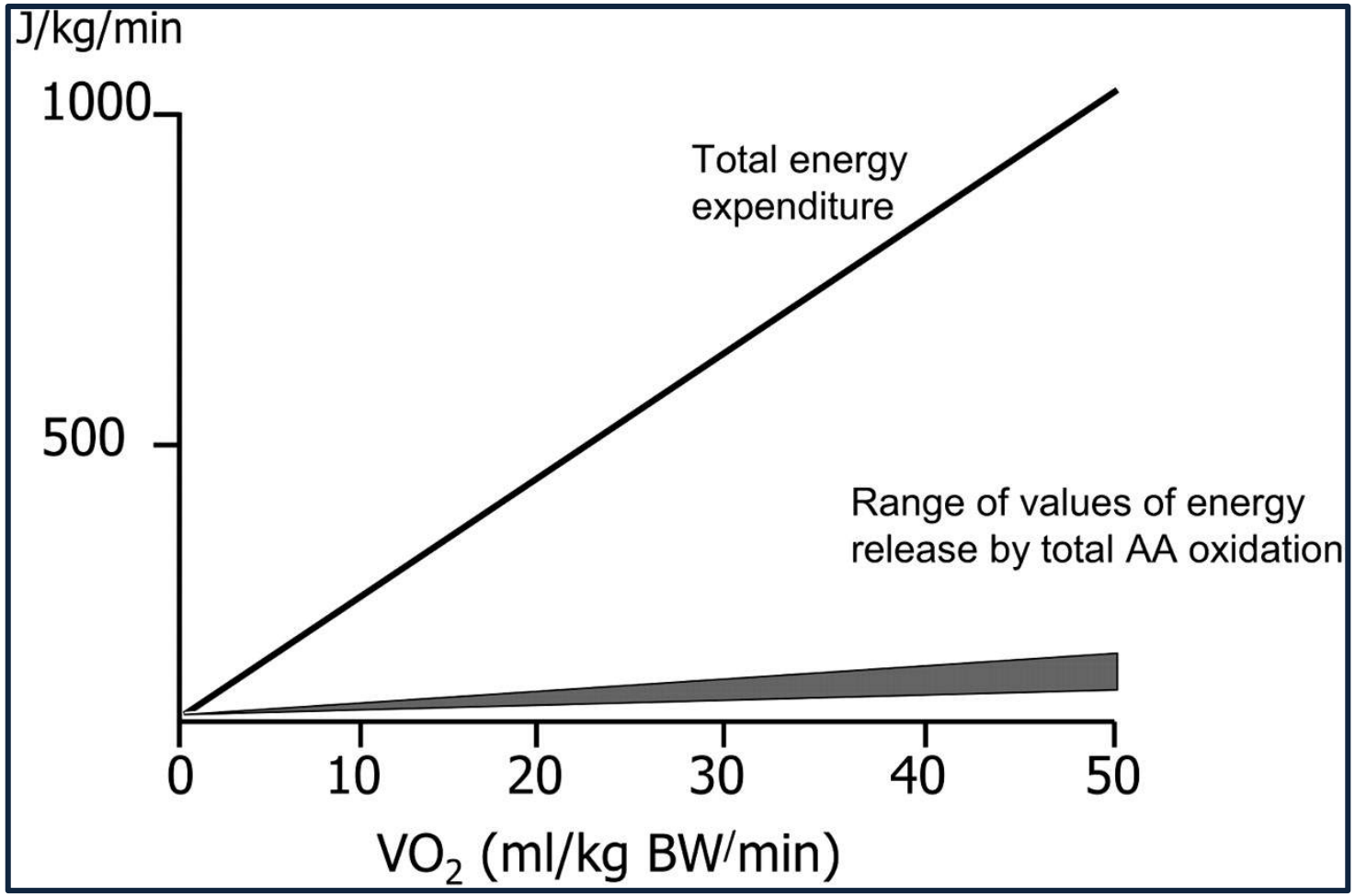


Fig. 2 Plasma NEFA concentrations during the resting part of the clamp and during exercise in the HI (*closed squares*) and LO (*open circles*) trials. Data are mean±SEM; $n=8$ for resting period and $n=7$ for exercise period. The value immediately before exercise denotes measurements made in the sitting position. *$p<0.01$ for differences between trials

Hiperinsülinemi egzersiz sırasında yağ asidi mobilizasyonunu ve oksidasyonunu azaltır

Diabetologia (2007) 50:414–421

Yakıt olarak protein

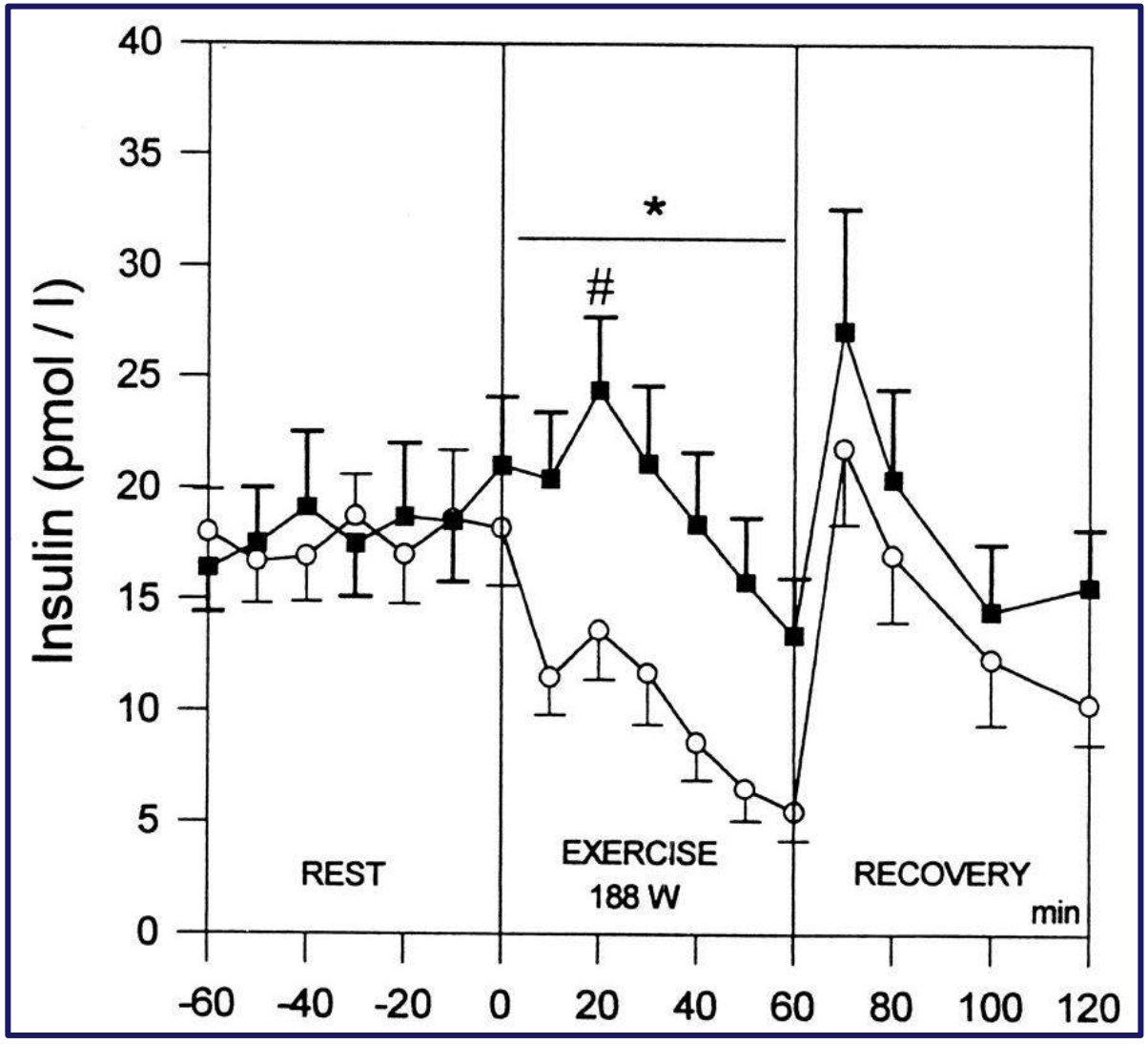


Calculated total amount of energy released during steady-state exercise and contribution of AA oxidation

Egzersizde proteinlerin enerji sağlanmasına katkısı minimaldir

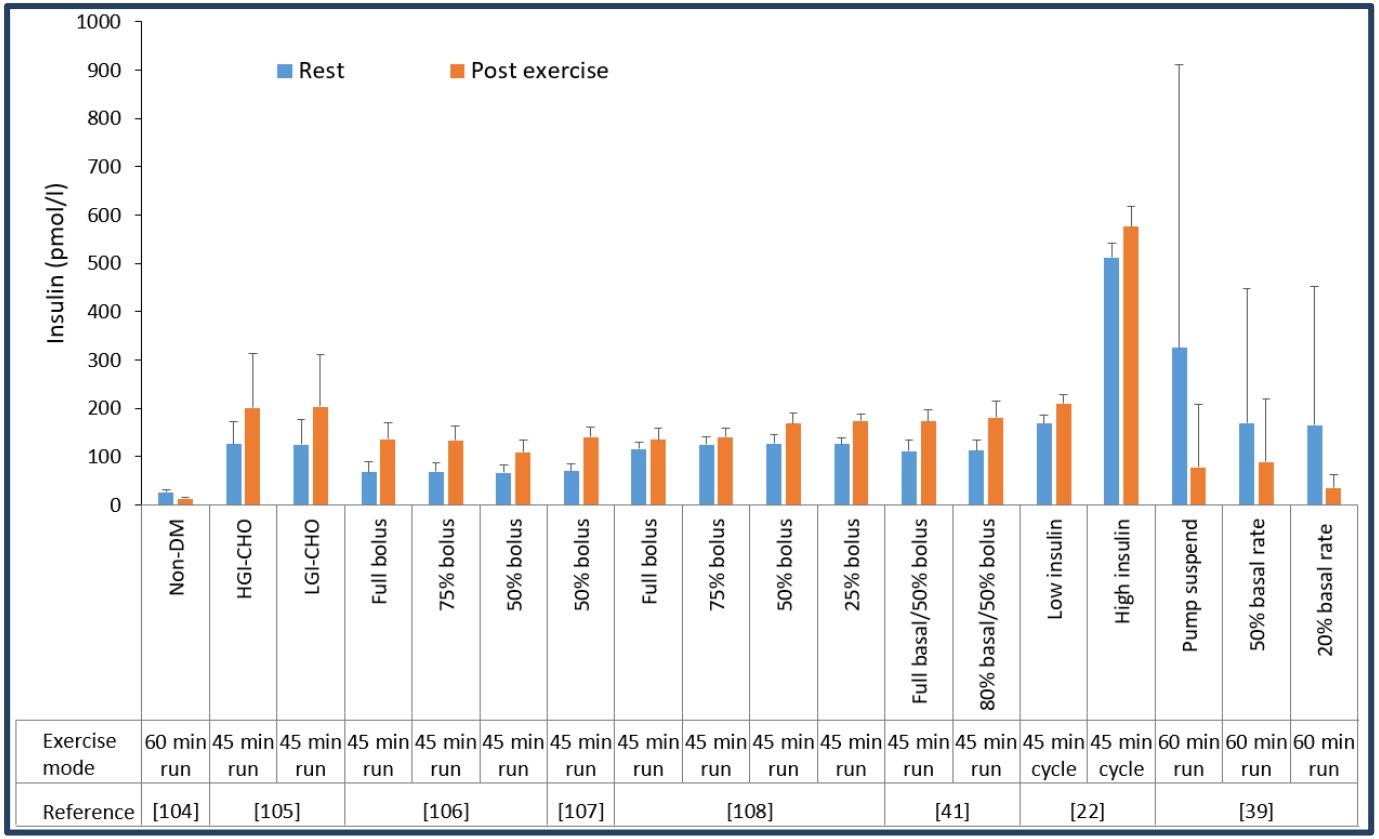
Journal of Nutrition, Volume 136, Issue 1, January 2006

Diyabette egzersiz sırasında insülin (dis)regülasyonu



Diyabetli olmayan bireylerde egzersizin başlamasıyla insülin düzeyleri düşer. Düşüş egzersiz şiddeti ve süresiyle orantılıdır.

Diabetes 2001;50:1834-1843



Circulating insulin levels in athletes with type 1 diabetes

Tip 1 diyabette endojen insülin sekresyonu olmadığı egzersiz sırasında ve sonrasında sporcular çoğu kez hiperinsülinemiktir. Bu lipid oksidasyonunu azaltır ve hipoglisemi riskini artırır

Diabetologia DOI 10.1007/s00125-020-05183-8

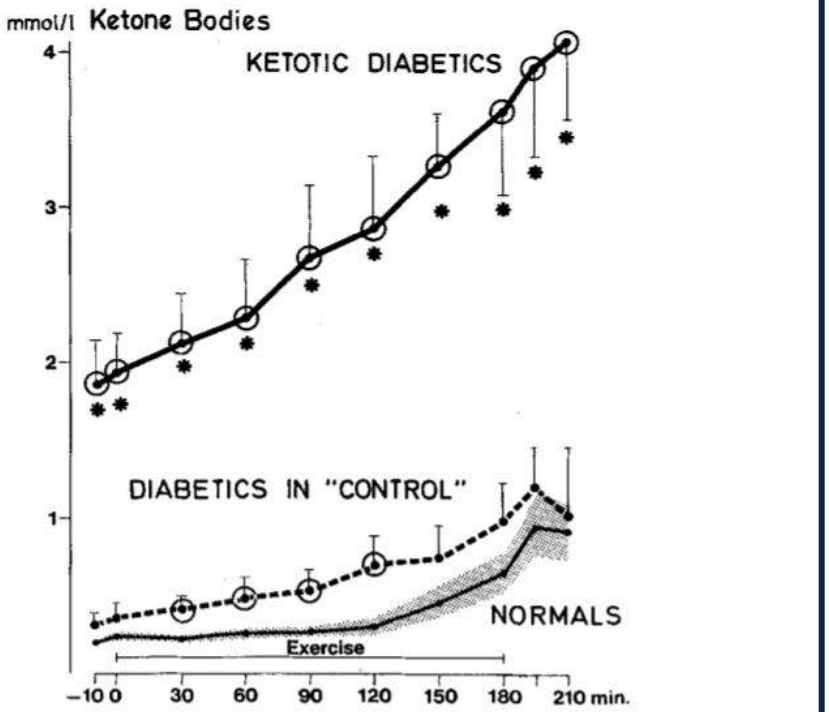


Fig. 3. Effect of prolonged exercise on blood levels of ketone bodies. Symbols as in Figures 1 and 2

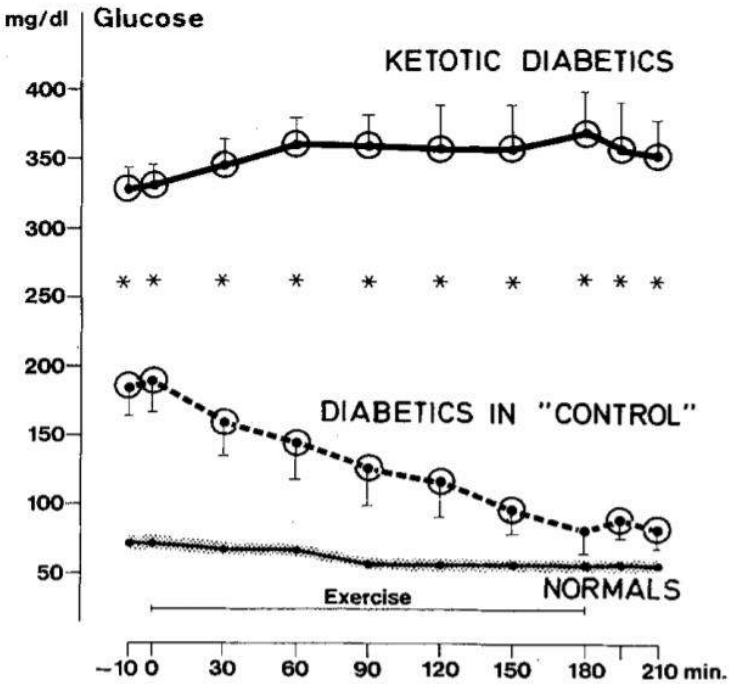


Fig. 4. Effect of prolonged exercise on blood glucose levels. Symbols as in Figures 1 and 2

Egzersiz öncesi insülin dozunu atlamak ise ketoz ve hiperglisemi ile sonlanabilir

Diabetologia 1977 13(4):355–365

Tip 1 diyabetli atlette amaç hem normoglisemiyi sağlamak hem de bunu fizyolojik insülin düzeylerine yakın insülinle başarmaktır.

İnsülin verilme şekli fark yaratabilir mi?

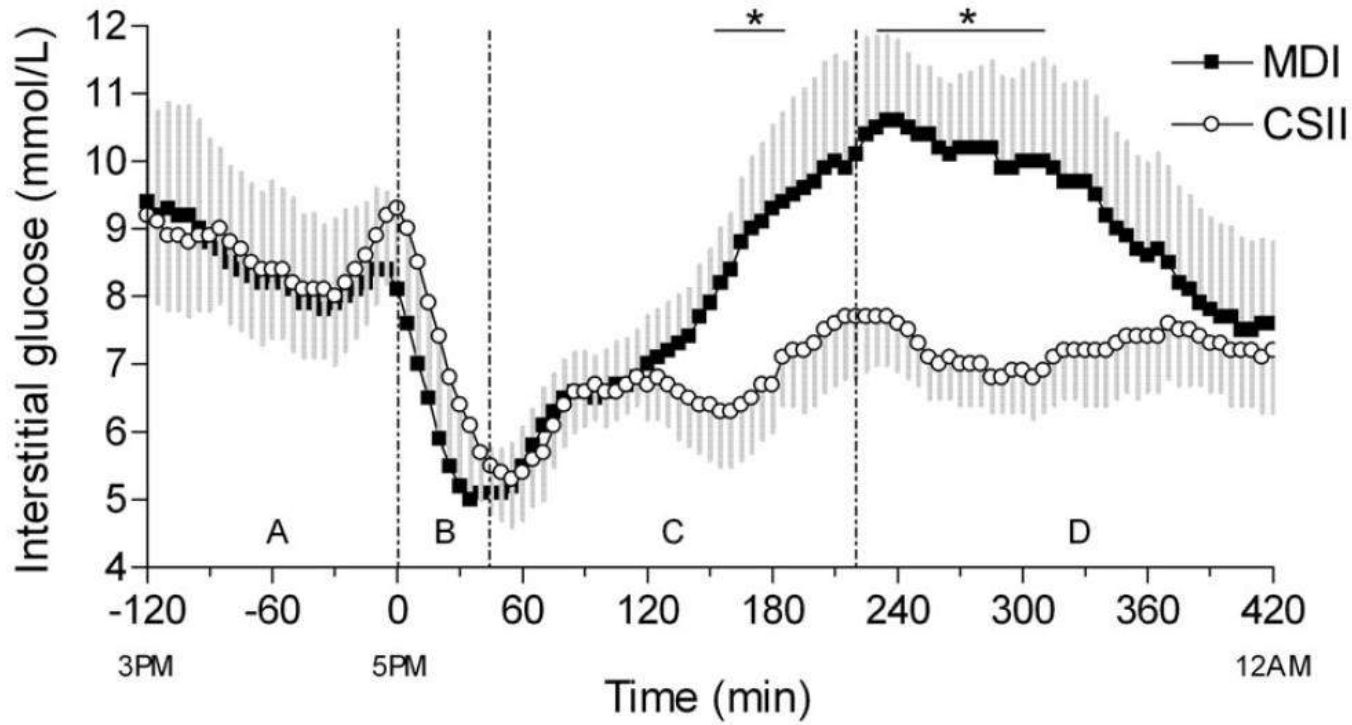


FIG. 1. Changes in glucose levels **(A)** before exercise, **(B)** during aerobic exercise, **(C)** in early (0–3 h) post-exercise recovery, and **(D)** in late (3–6 h) post-exercise recovery in individuals with type 1 diabetes receiving insulin via continuous subcutaneous insulin infusion (CSII) (open circles) or multiple daily insulin injections (MDI) (solid squares). Significant group × time interactions were found in **(C)** early and **(D)** late recovery (both $^*P < 0.05$) with MDI patients experiencing more post-exercise hyperglycemia.

CSII postegzersiz hiperglisemisinde basal bolustan daha iyi sonuçlar verebilir

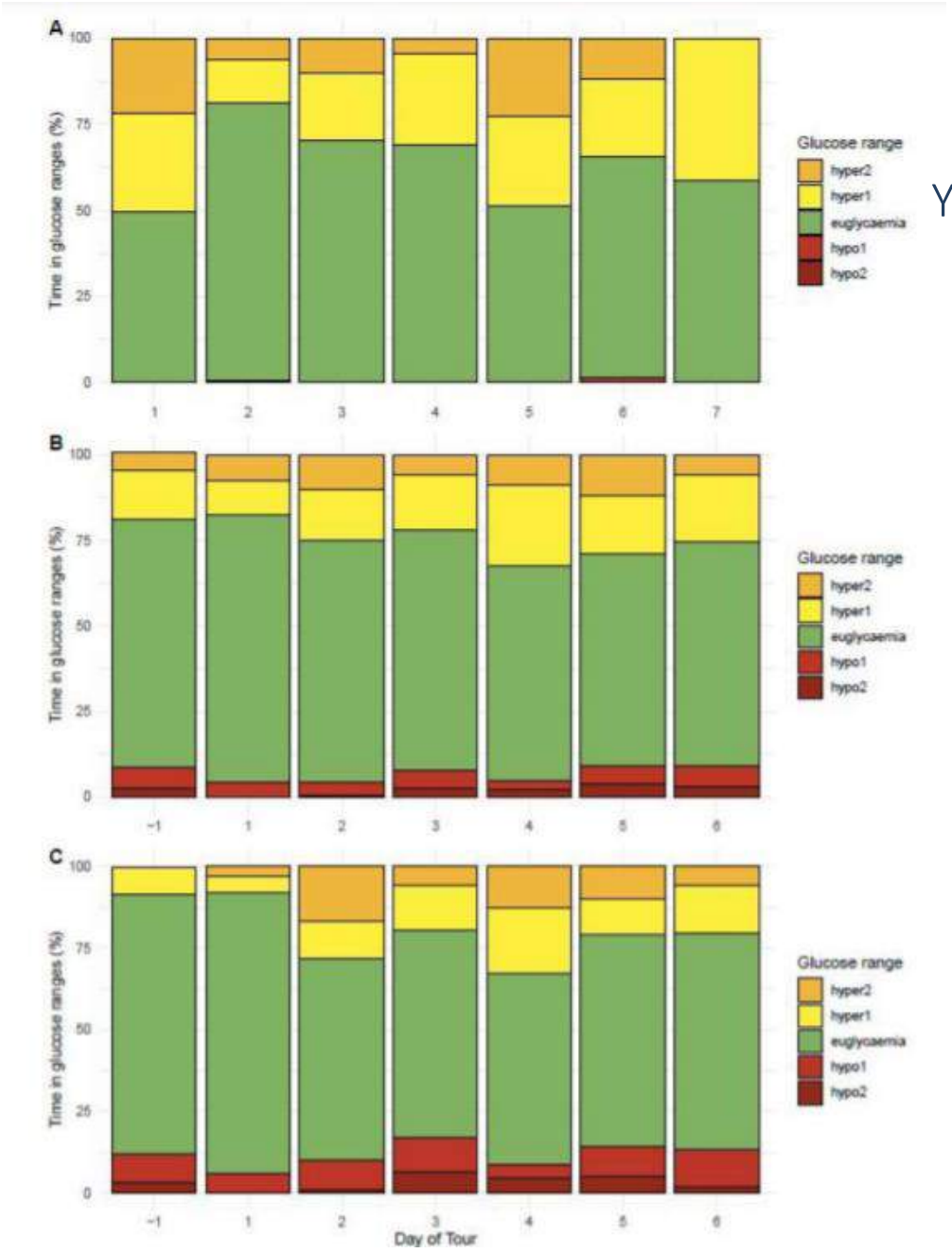
Altı Tip 1 Diyabetli profesyonel bisikletçinin basal bolus (MDI) ile yarış deneyimi

Table 1—Rider and race characteristics over the 7-day Tour of California

	Stage of the tour							
	1	2	3	4	5	6	7	7-Day mean
Ride duration (min)	194 ± 0	396 ± 15	360 ± 9	353 ± 0	298 ± 2	248 ± 9	174 ± 2	289 ± 86
Distance (km)	143	195	207	213	219	128	141	196 ± 44
Total stage elevation (m)	61	4,426	2,947	3,583	2,951	4,279	2,593	2,977 ± 1,461
Ambient temperature (°C)	25	20	21	21	18	12	11	18 ± 5
Humidity (%)	50	49	74	65	58	83	42	60 ± 15
Energy expenditure (kcal)	2,265 ± 499	4,955 ± 342*	4,564 ± 284*	4,334 ± 694*	4,268 ± 283*£	3,691 ± 279*°§£	2,717 ± 300°§#	3,828 ± 996
In-ride energy intake (kcal)	1,034 ± 324	2,138 ± 347*	1,883 ± 406*	2,075 ± 253*	1,528 ± 390	1,704 ± 287	1,050 ± 545°§#	1,630 ± 452
In-ride energy change (kcal)	−1,230 ± 217	−2,817 ± 499*	−2,681 ± 581*	−2,259 ± 684*	−2,740 ± 488*	−1,987 ± 541	−1,666 ± 776°ˆ	−2,197 ± 602
Power (W)								
Peak	1,077 ± 183	939 ± 98	1,043 ± 100	981 ± 124	995 ± 106	897 ± 123*§	944 ± 106	982 ± 62
Mean	175 ± 41	219 ± 17*	214 ± 13*	205 ± 30*	244 ± 17*°§#	248 ± 14*°§#	256 ± 17*°§#	223 ± 2
Normalized	226 ± 28	246 ± 20*	261 ± 12*	247 ± 24*	289 ± 18*°§#	280 ± 16*°§#	297 ± 17*°§#	264 ± 19
HR (bpm)								
Peak	187 ± 3	189 ± 22	179 ± 3*°	174 ± 6*°	179 ± 15*°	170 ± 2*°§ˆ	175 ± 7*°$	179 ± 7
Mean	134 ± 8	144 ± 5*	134 ± 5°	127 ± 12°	138 ± 3#	138 ± 1#	141 ± 5*§#	137 ± 6

Data are presented as the mean ± SD or *n*. *Significant difference ($P < 0.05$) with respect to stage 1. °Significant difference ($P < 0.05$) with respect to stage 2. §Significant difference ($P < 0.05$) with respect to stage 3. #significant difference ($P < 0.05$) with respect to stage 4. ˆSignificant difference ($P < 0.05$) with respect to stage 5. $Significant difference ($P < 0.05$) with respect to stage 6. £Significant difference ($P < 0.05$) with respect to stage 7.

Diabetes Care 2020 May; 43(5): 1142-1145.



Yarış sırasında

24 saat

Gece

Diabetes Care 2020 May; 43(5): 1142-1145.

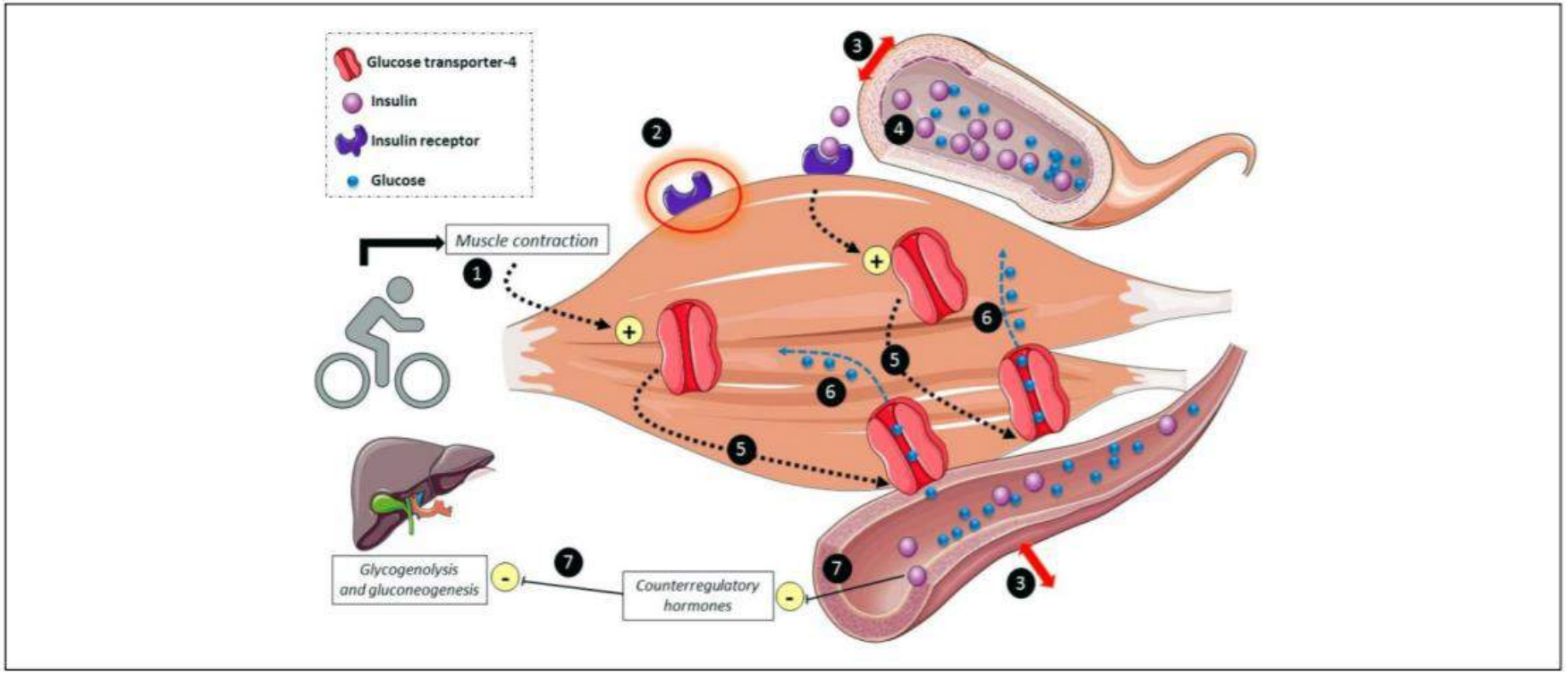


Figure 1. Underlying mechanisms inducing hypoglycemia in individuals with type 1 diabetes during low-to-moderate intensity exercise level exercise.

(1) Exercise increases insulin-stimulated glucose uptake in skeletal muscle, (2) increase of insulin sensitivity, (3) increased capillary blood flow and local vasodilation increase glucose delivery to active tissues, (4) possibility of high level exogenous insulin, (5) glucose is transported from blood into muscle fibers by the glucose transporter-4 which is progressively translocated to the plasma membrane and transverse tubules by muscle contractions and insulin, (6) increase of the replenishment of muscle glycogen stores, and (7) defective response by counter-regulatory hormones and hepatic glucose production due to high circulating levels of insulin.

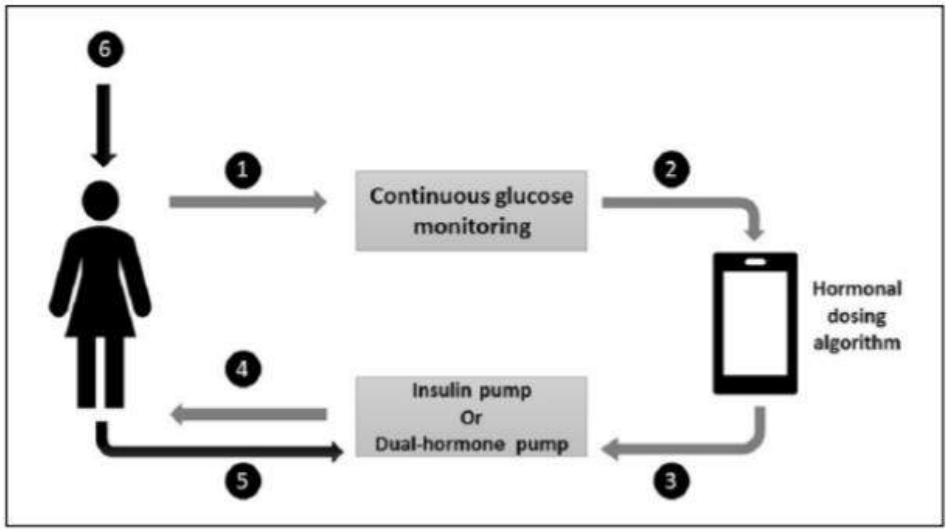


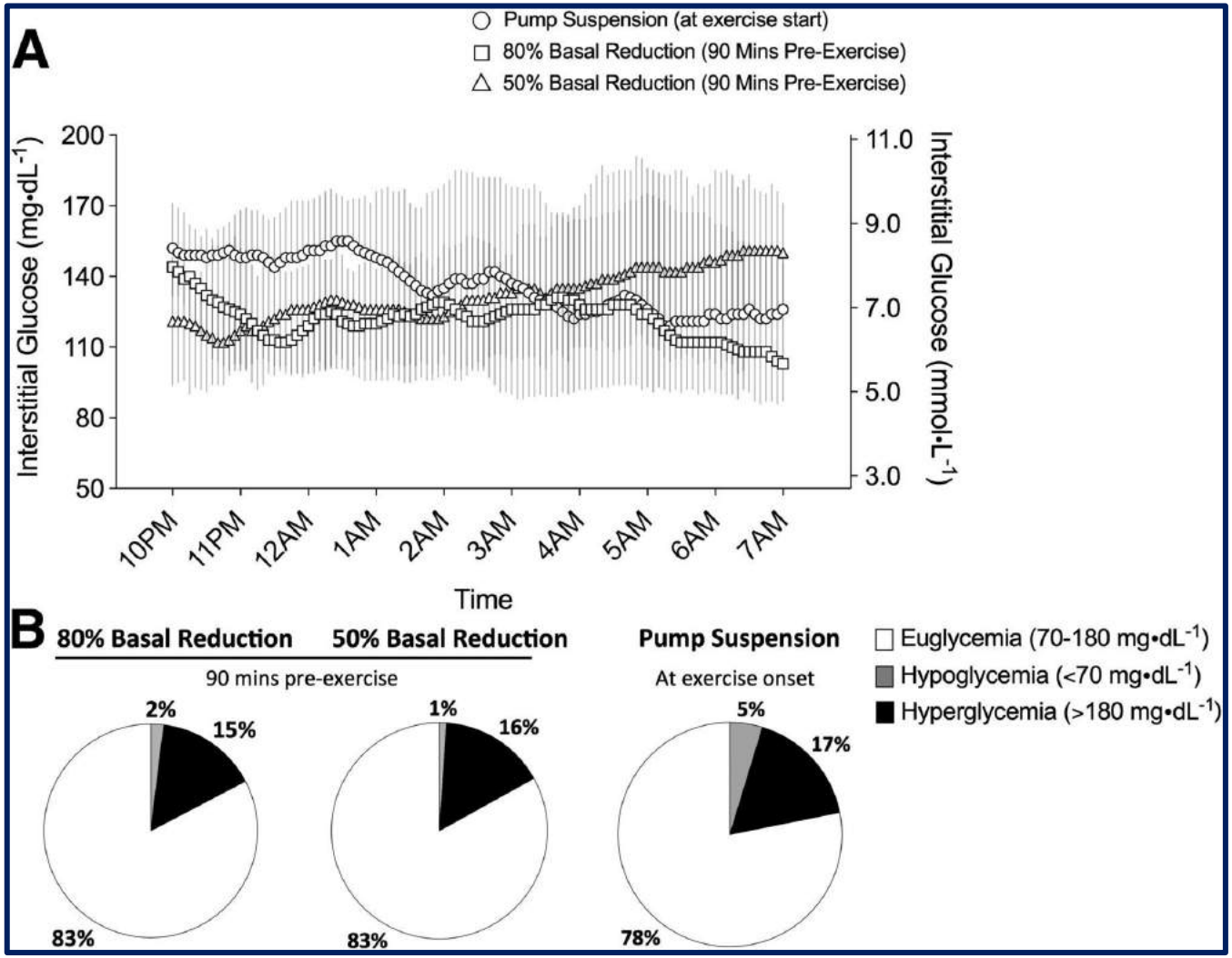
Figure 2. The three components of an artificial pancreas: glucose sensor, control system, and insulin pump.
(1) The continuous glucose monitoring constantly detects interstitial glucose levels. (2) Continuous glucose monitoring then transmits wirelessly these levels to hormonal dosing algorithm (usually installed on a smart phone). (3) Accordingly, the hormonal dosing algorithm calculates the optimal hormone dose and transmits wirelessly guides dosing changes to pump. (4) The single-insulin pump or dual-hormone pump (insulin and glucagon) then delivers the required hormonal dosage (basal rate changes ± boluses) to the patient. (5) Note that the patient may be able to manually intervene when needed and self-adjust hormonal delivery by the pump. (6) Patient's glucose levels vary widely due to external factors, such as meals, levels of activity, stressors, as well as internally due to endogenous hormonal and metabolic changes.

Yapay pankreas egzersiz sonrası ve sırasındaki hipoglisemileri azaltabilir

Journal of Diabetes Science and Technology 2019, Vol. 13(6) 1077–1090

Pek çok atlet spor yaparken terleme, pompaların hortumları, görsel kaygılar ve harekete engel olma gibi sebeplerden dolayı üzerlerinde bir cihaz olmasından hoşlanmaz.

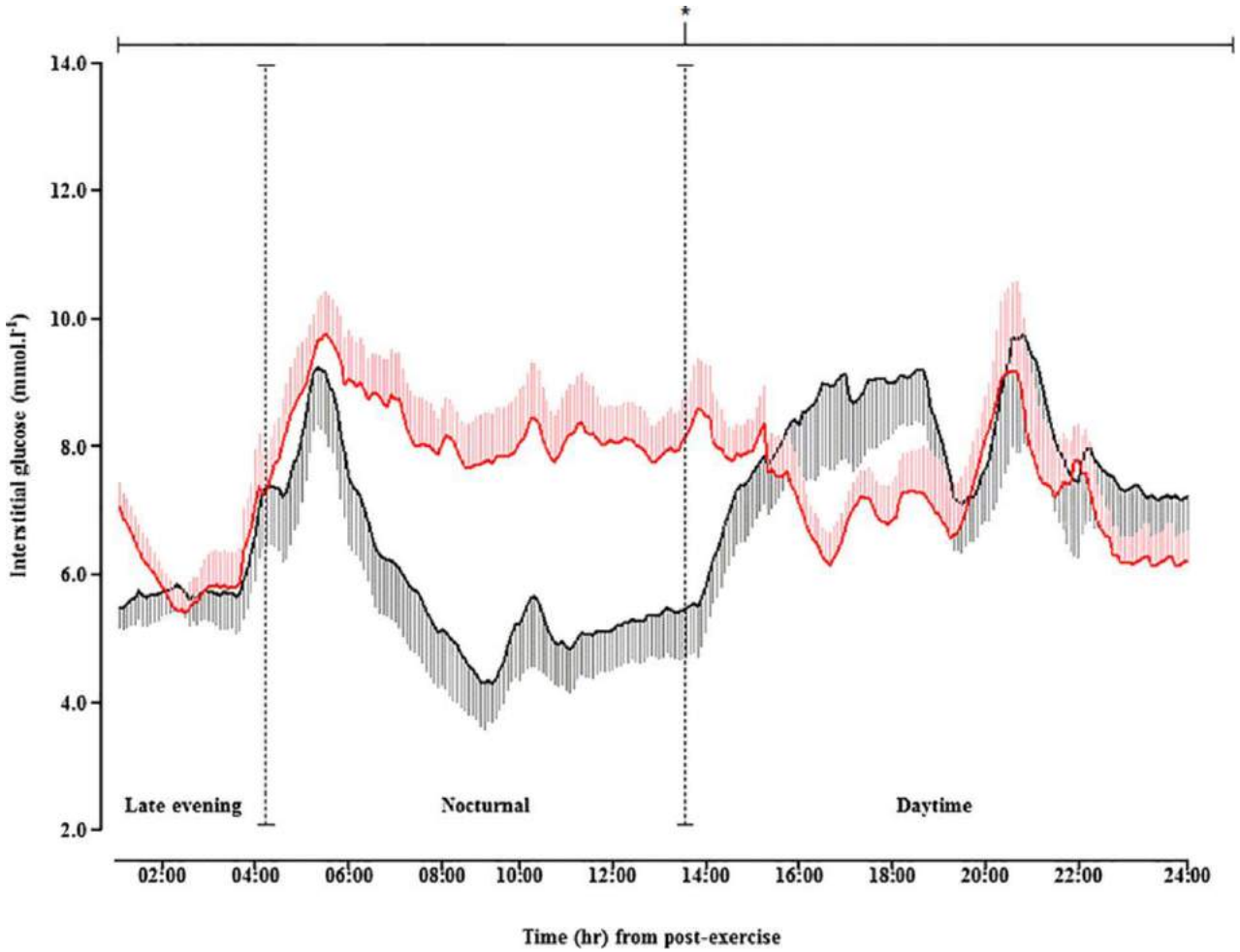
Uzun egzersizde relatif hiperinsülinemiyi önleme taktikleri



A: Overnight recovery CGM glucose data from 10:00 p.m. to 7:00 a.m. across all treatment arms. Data represent median and IQR. B: Percent time spent in euglycemia, hyperglycemia, and hypoglycemia (n = 15).

Basal insülin dozu azaltılması veya pompanın kapatılması benzer sonuçlar verir.

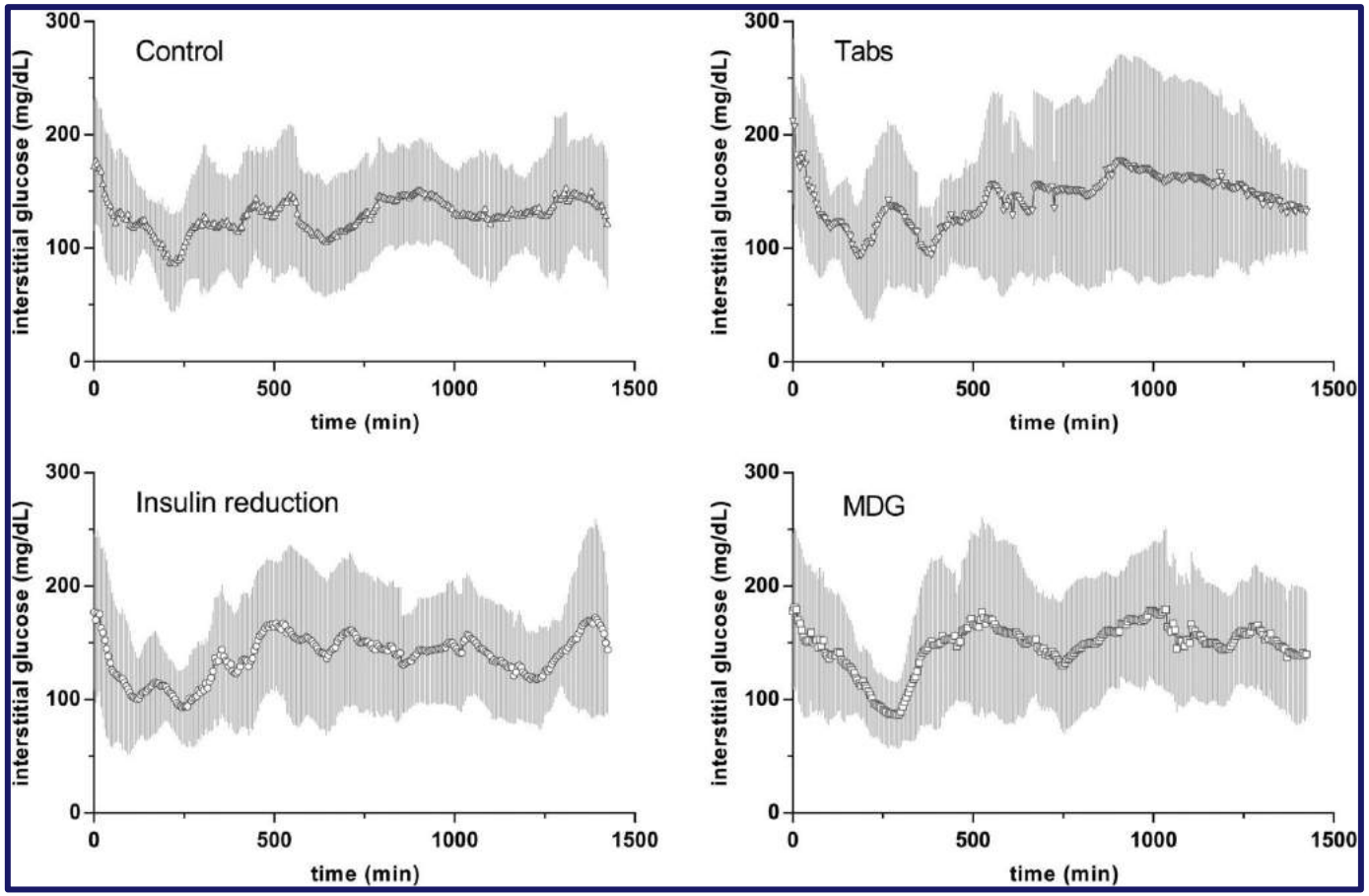
Dessi P. Zaharieva et al. Dia Care 2019;42:824-831



MDI kullanan hastalarda basal insülin dozunu % 20 azaltmak noktürnal hipoglisemiyi önler

Time-course changes in interstitial glucose concentrations throughout the postlaboratory period. Data presented as mean±SEM. Black trace=100%, red trace=80%. *Indicates a significant difference in interstitial glucose area under the curve between 100% and 80% (p≤0.05).

Matthew D Campbell et al. BMJ Open Diab Res Care 2015;3:e000085



Interstitial glucose from CGM during late recovery, shown relative to the time elapsed since the start of the late recovery period (90 min after the standardized meal)

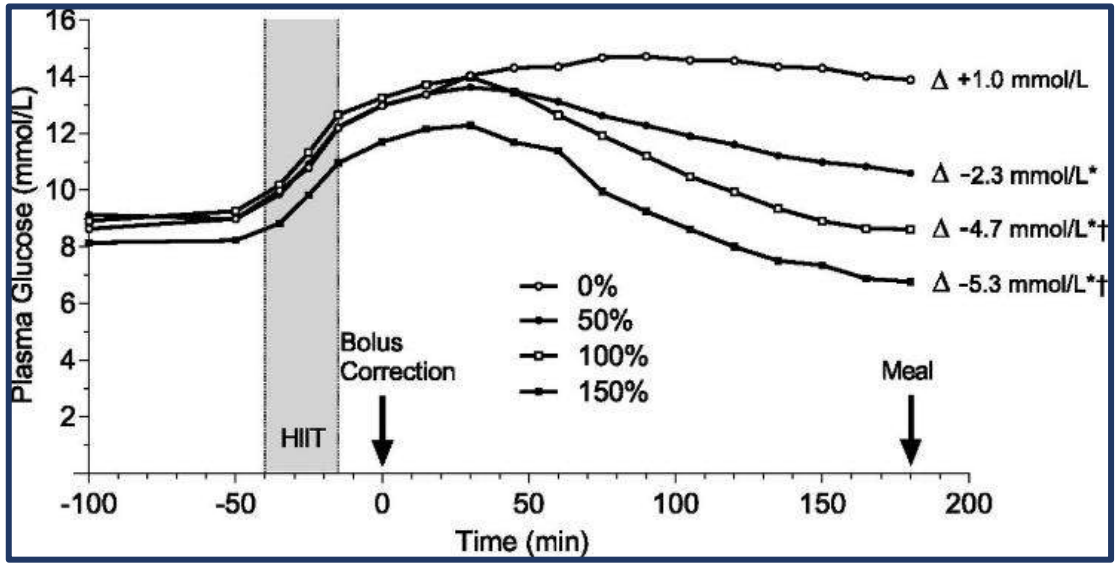
Egzersiz öncesi mini doz glukagon (MDG uygulaması karbonhidrat alımı ve insülin doz azaltılmasına benzer hipoglisemi azalması sağlayabilir. Ama bu etki özellikle uzamış egzersizde glikojen depolarının azalması sebebiyle yetersiz kalabilir

Michael R. Rickels et al. Dia Care 2018;41:1909-1916

Egzersiz sonrası rölatif hipoinsülinemiyi önleme taktikleri

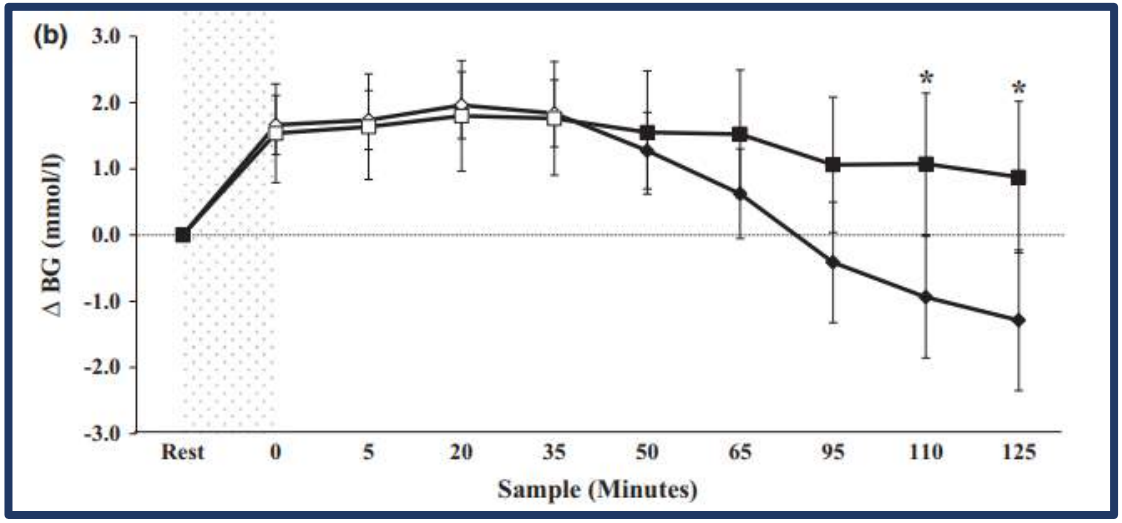
Yarış (maç) öncesi stres, kısa süreli intensif egzersiz (HIIT veya patlayıcı egzersizler) ve ağırlık (rezistans) egzersizleri, post egzersiz hiperglisemisine yol açabilir.

Uzun endurans egzersizleri daha çok hipoglisemi yapar.



PG during exercise and 3-h postbolus insulin correction in the four interventions. *Significantly different compared with the 0% arm ($P < 0.05$); †significantly different compared with the 50% arm ($P < 0.05$)

Diabetes Care 2019 Jan; 42(1): 10-16.



Responses to insulin group (diamonds) and no-insulin group (squares) experimental sessions

Diabet. Med. 33, 506–510 (2016)

HIIT (a) ve Ağırlık (b) egzersizleri sonrasında küçük doz bolus insülin postegzersiz hiperglisemisini azaltabilir

Karbonhidrat alımıyla uygulanabilecek taktikler

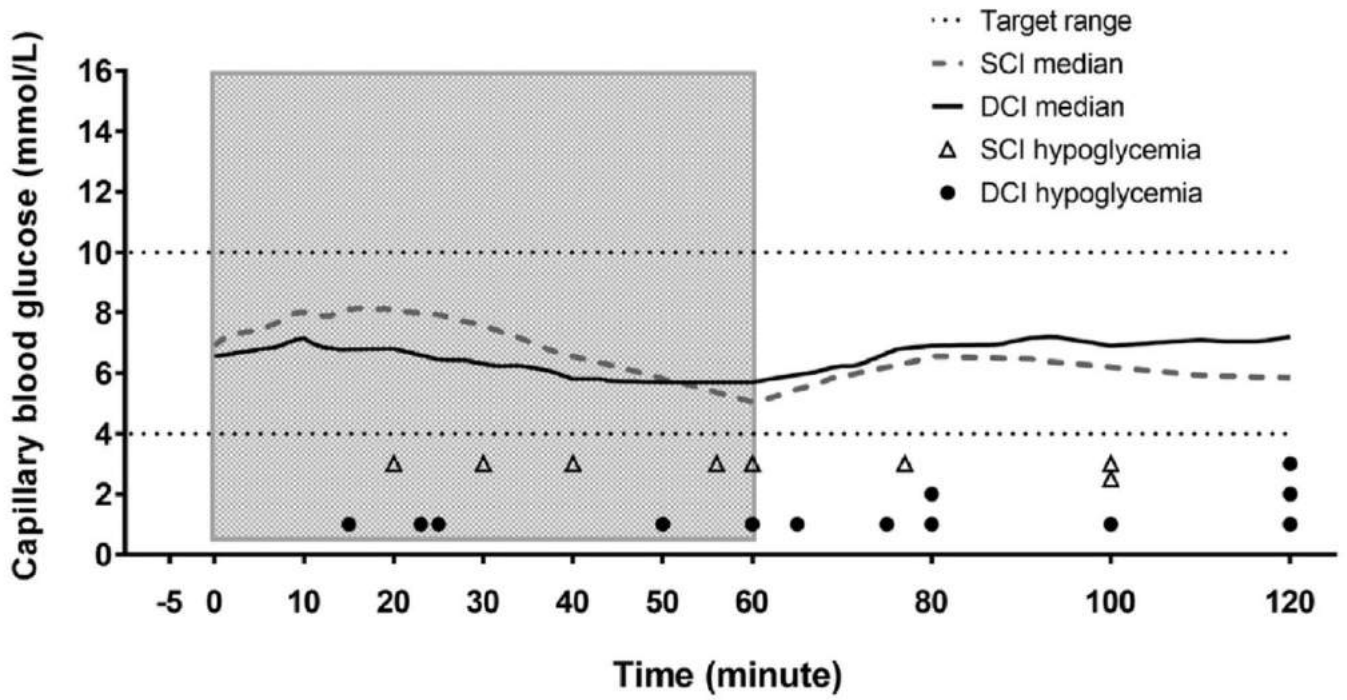
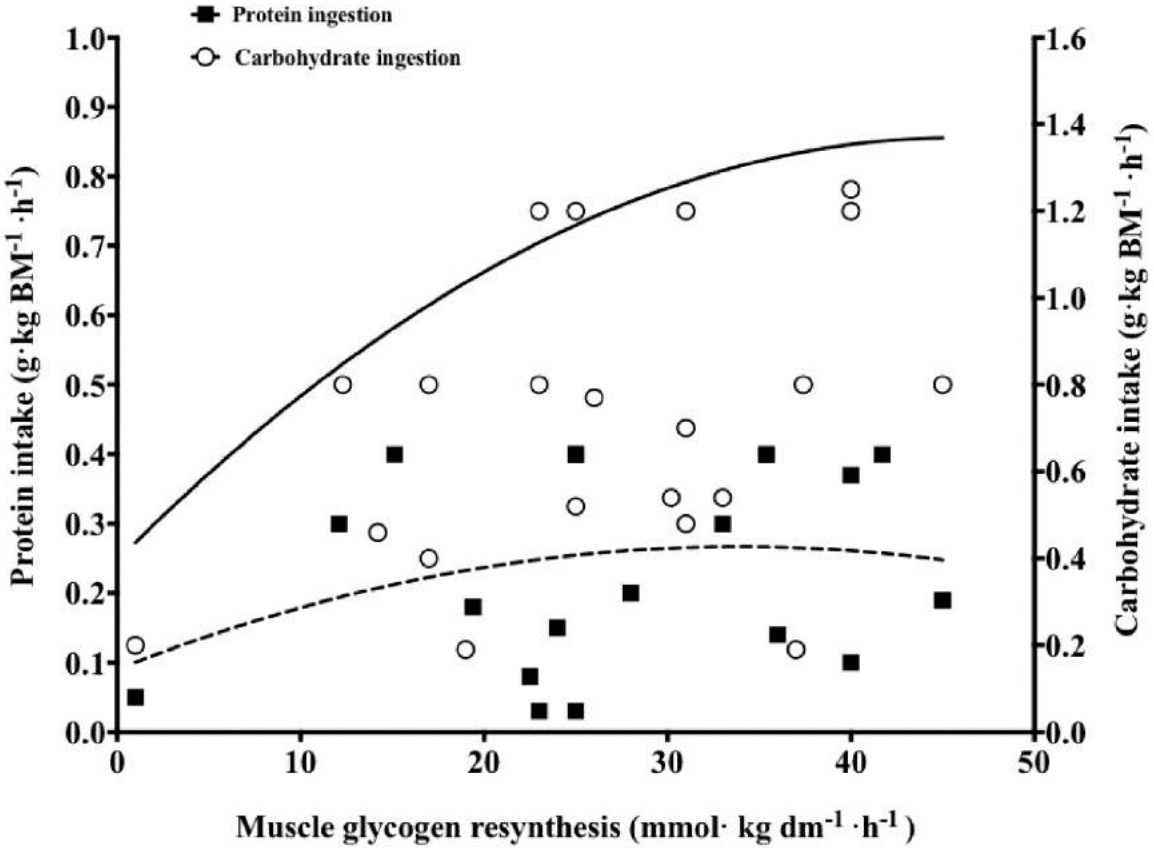


Figure 1 CBGC median profile of the two strategies during PA combined with the recovery period. The grey zone box represents the PA period. The triangles and circles are the total number of hypoglycemic events requiring treatment.

SCI, Single carbohydrate intake; DCI, Distributed carbohydrate intake

Egzersiz öncesinde tek doz veya yayılmış karbonhidrat alımı normoglisemiyi sağlamada benzer etkilidir

Nutr Metab Cardiovasc Dis. 2021 Apr 9;31(4):1238-1246



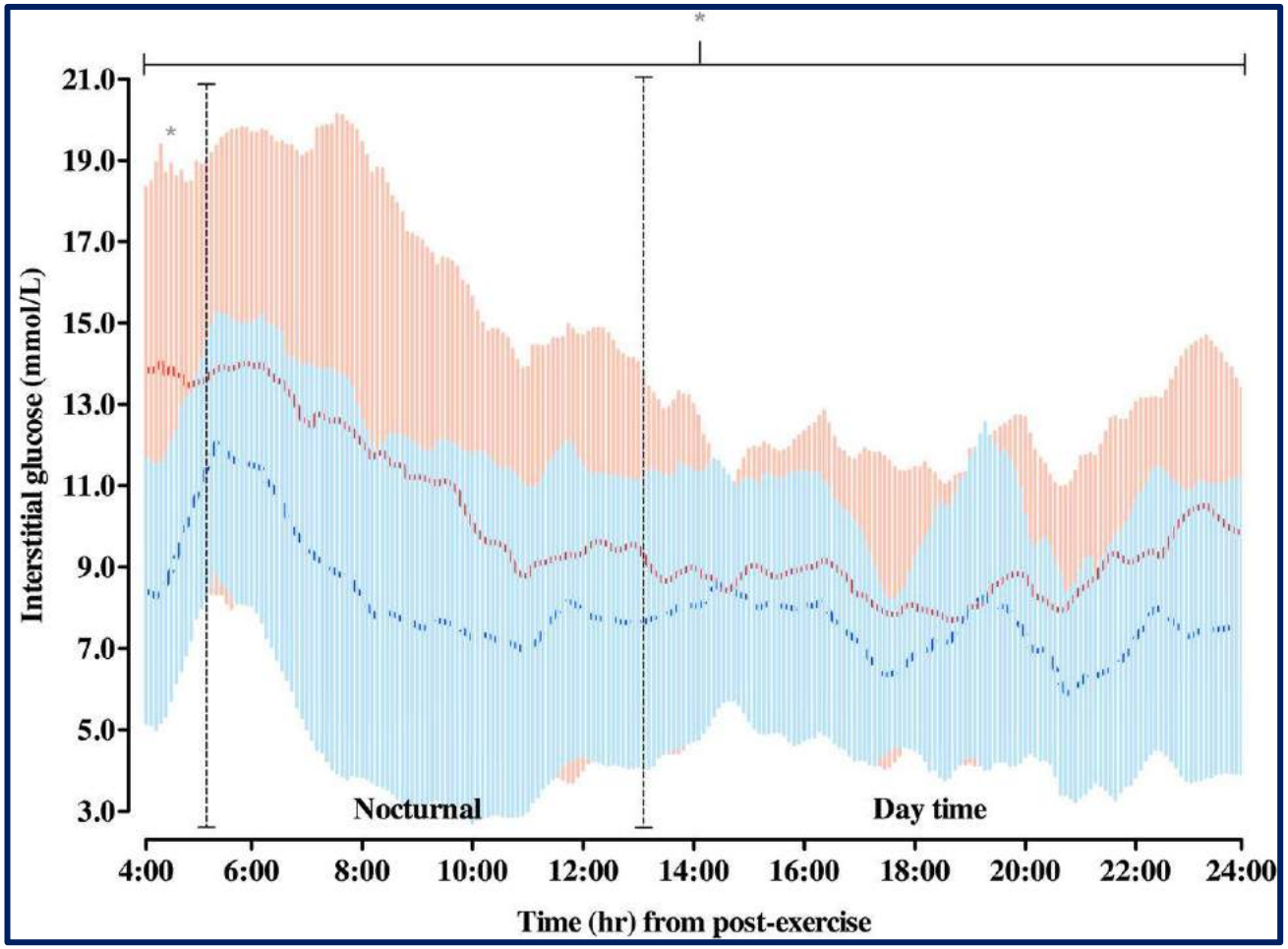
Karbonhidrat alımı ile glikojen yenilenmesi arasındaki ilişki

Reported rates of muscle glycogen resynthesis across 18 different investigations that have measured muscle glycogen concentrations during short-term (2–6 h) recovery with varied amounts of protein added to carbohydrates in humans

Nutrients 2018, 10(2), 253

HIIT ve rezistans egzersizi öncesinde ve sırasında genellikle ek karbonhidrat alımı gerekmez.

KH alımı 30 dakikanın üzerindeki egzersizlerde gereklidir.



Egzersiz sonrası düşük glisemik indeksli karbonhidratlarla replasman yapılması hiperglisemiye yol açmaz.

Time-course changes in interstitial glucose throughout the postlaboratory period. Data are presented as mean ± SD. Red trace, HGI; blue trace, LGI. *Interstitial glucose area under the curve is significantly different between conditions ($P \leq 0.05$). Vertical lines indicate nocturnal or daytime periods. End of nocturnal period indicates when patients awoke.

Dia Care 2014;37:1845-1853

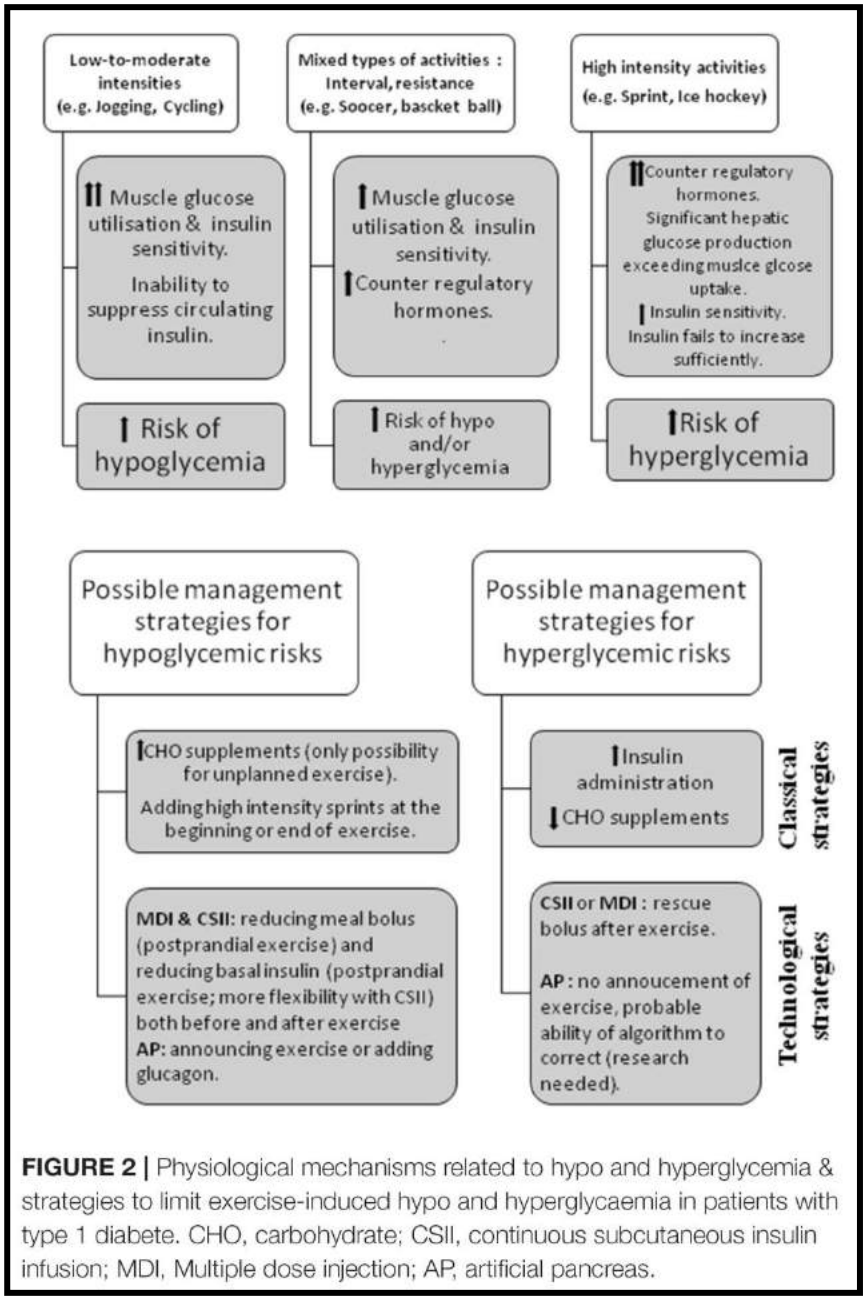


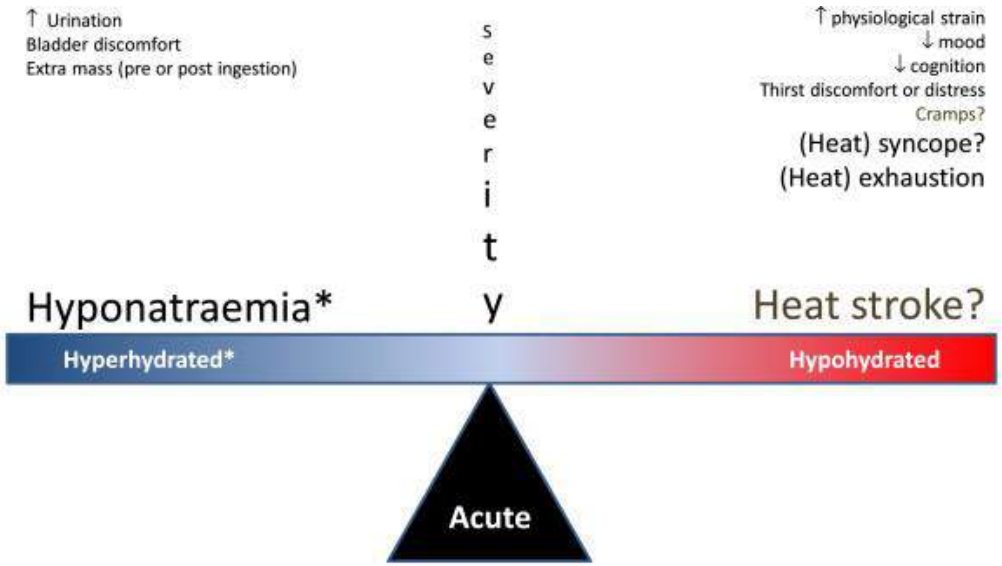
FIGURE 2 | Physiological mechanisms related to hypo and hyperglycemia & strategies to limit exercise-induced hypo and hyperglycaemia in patients with type 1 diabete. CHO, carbohydrate; CSII, continuous subcutaneous insulin infusion; MDI, Multiple dose injection; AP, artificial pancreas.

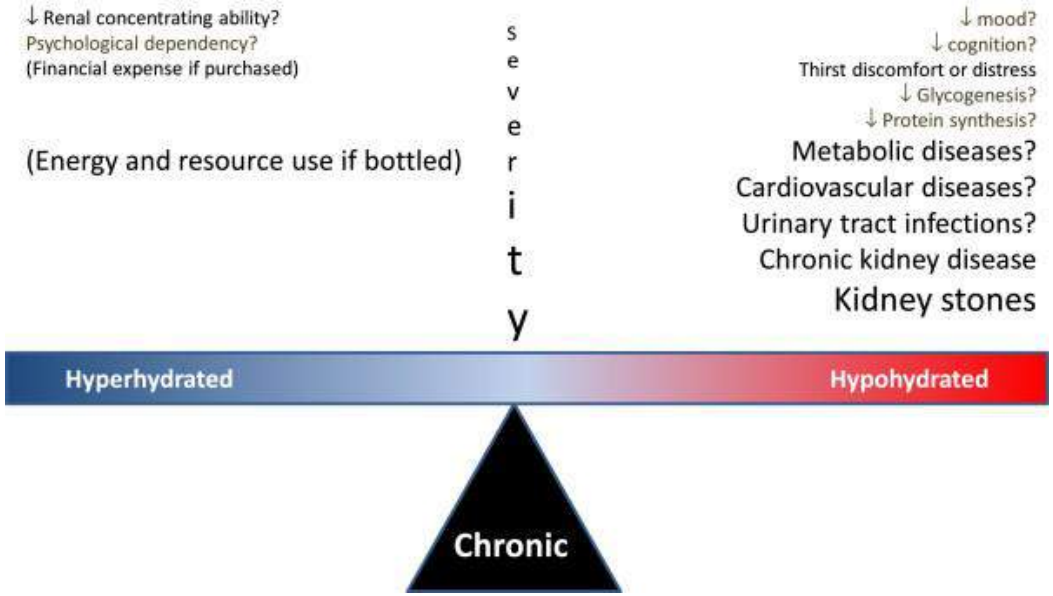
Tip 1 diyabetli atlette hiper/hipoglisemik sorunlar ve teknolojik çözümler

Front Endocrinol). 2019 Jan 18;9:818

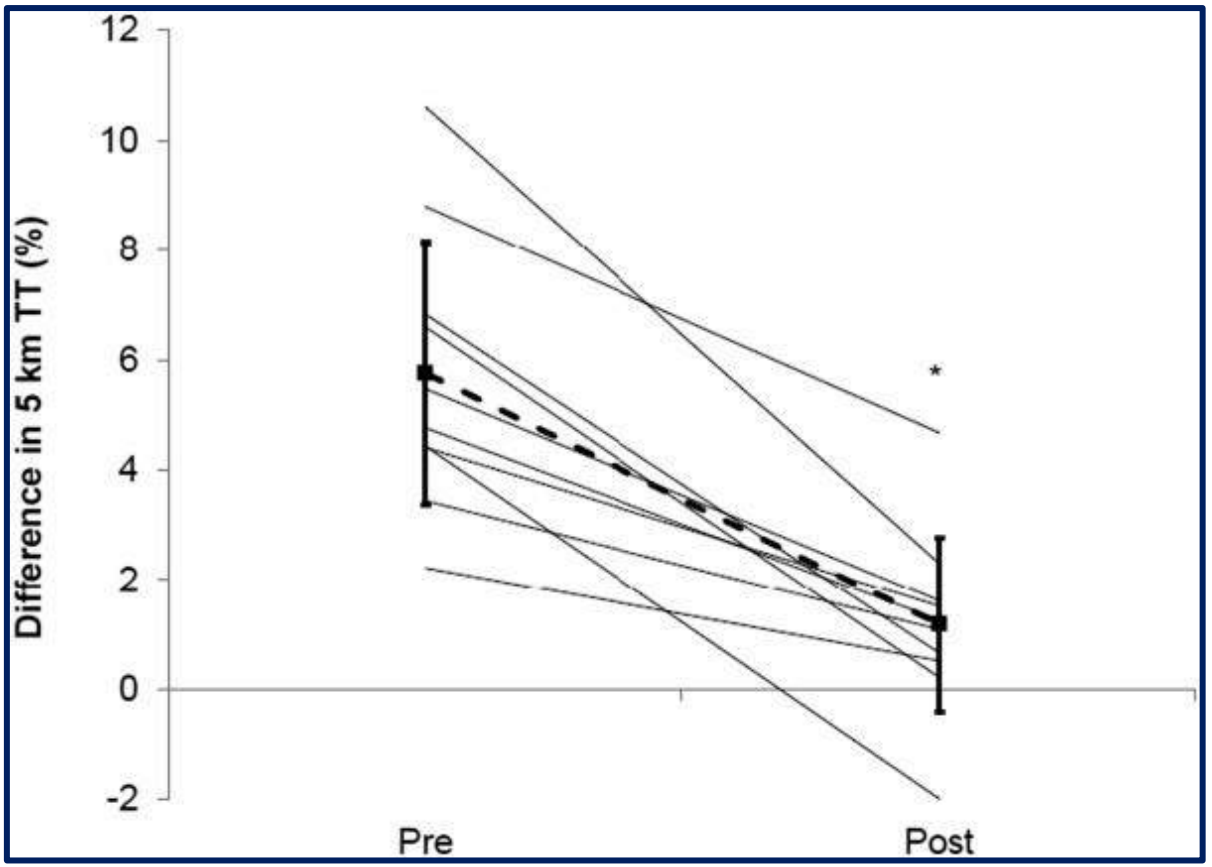
Hidrasyon

Sporda hidrasyon kritiktir. Diyabetli sporcular eğer hiperglisemik iseler daha çok su tüketmek zorundadırlar.


↑ Urination
Bladder discomfort
Extra mass (pre or post ingestion)
severity
↑ physiological strain
↓ mood
↓ cognition
Thirst discomfort or distress
Cramps?
(Heat) syncope?
(Heat) exhaustion
Hyponatraemia*
Heat stroke?
Hyperhydrated*
Hypohydrated
Acute


↓ Renal concentrating ability?
Psychological dependency?
(Financial expense if purchased)
(Energy and resource use if bottled)
severity
↓ mood?
↓ cognition?
Thirst discomfort or distress
↓ Glycogenesis?
↓ Protein synthesis?
Metabolic diseases?
Cardiovascular diseases?
Urinary tract infections?
Chronic kidney disease
Kidney stones
Hyperhydrated
Hypohydrated
Chronic

Dehidrasyon performansı etkiler



Effect of hypohydration on exercise performance before and after familiarisation to the hypohydration.

Extrem Physiol Med. 2014; 3: 18

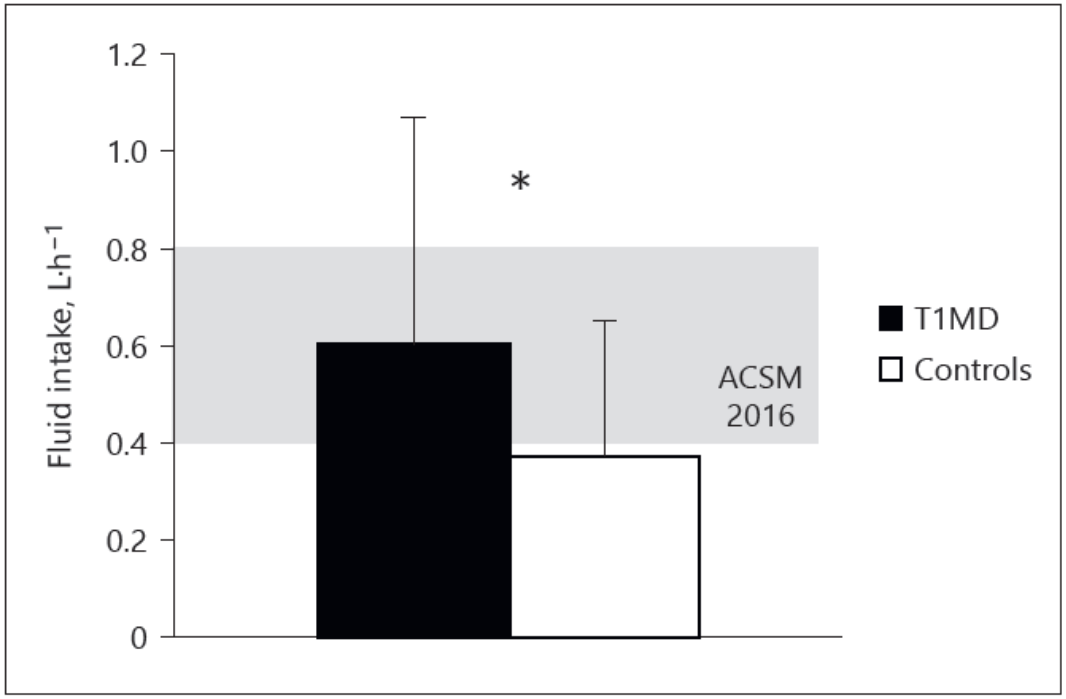


Fig. 1. Fluid intake during exercise in type 1 diabetes mellitus (T1DM) and control (CON). Mean and SD of self-reported fluid intake during exercise ($L \cdot h^{-1}$) in individuals with T1DM (black; $n = 45$) and the matched sample of non-diabetic individuals (CON, white; $n = 45$). Grey box indicates the range of fluid intake for exercise suggested by American College of Sports Medicine (ACSM) guidelines (from 0.4 to 0.8 $L \cdot h^{-1}$; Thomas et al. [17]). * Significant difference between T1DM individuals and CON subjects for $p < 0.05$.

Tip 1 diyabetli sporcular egzersiz sırasında daha fazla su tüketme eğilimindedirler

Ann Nutr Metab 2018;73:10–18

Hipoglisemiyi fark edememe sendromu

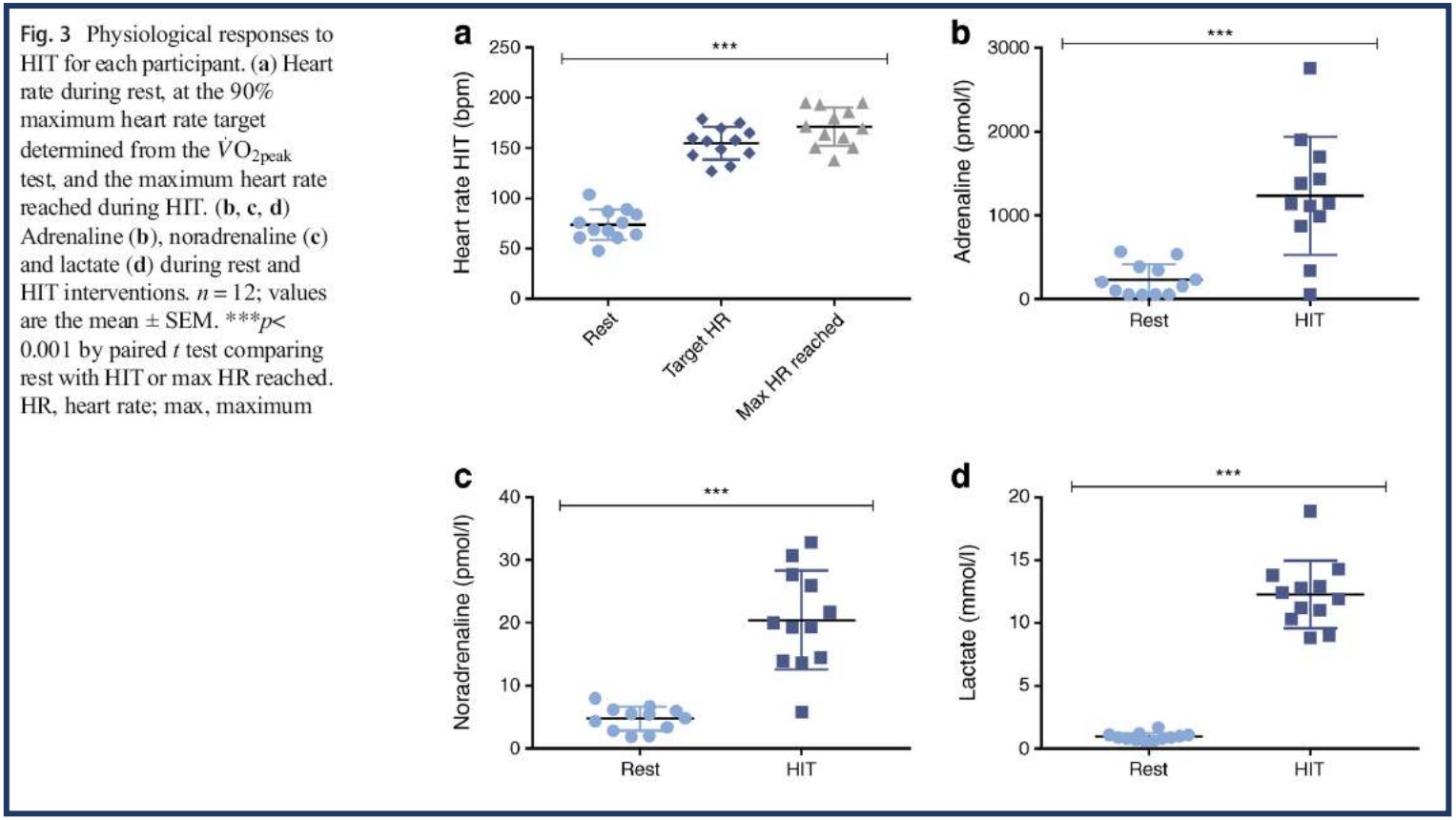


Fig. 3 Physiological responses to HIT for each participant. (**a**) Heart rate during rest, at the 90% maximum heart rate target determined from the $\dot{V}O_{2peak}$ test, and the maximum heart rate reached during HIT. (**b**, **c**, **d**) Adrenaline (**b**), noradrenaline (**c**) and lactate (**d**) during rest and HIT interventions. $n = 12$; values are the mean ± SEM. ***$p <$ 0.001 by paired t test comparing rest with HIT or max HR reached. HR, heart rate; max, maximum

HIT ile kalp hızı adrenalin, noradrenalin ve laktat yanıtları

Diabetologia (2020) 63:853–863

HIIT ile kontrinsüliner sistem restorasyonu

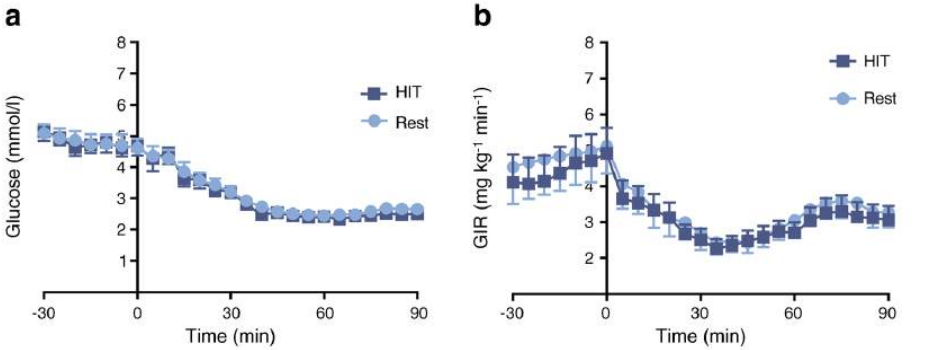


Fig. 4 Hyperinsulinaemic–hypoglycaemic clamp profiles following HIT and rest (control). (**a**) Plasma glucose level. (**b**) Glucose infusion rate. $n = 12$; values are the mean ± SEM. GIR, glucose infusion rate

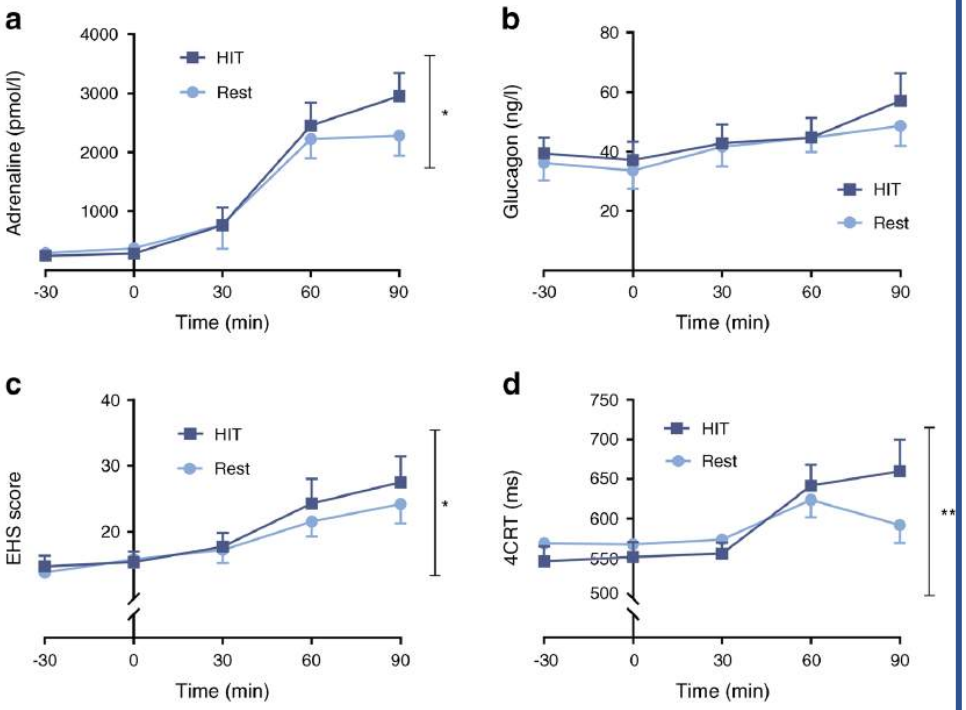


Fig. 5 Acute exposure to HIT improves defective counterregulatory response. Plasma adrenaline (**a**), glucagon (**b**), total EHS score (**c**) and 4CRT (**d**) during the hyperinsulinaemic–hypoglycaemic clamp study. $n = 12$; values are the mean ± SEM. *$p<0.05$, **$p<0.01$ using the generalised estimate equation

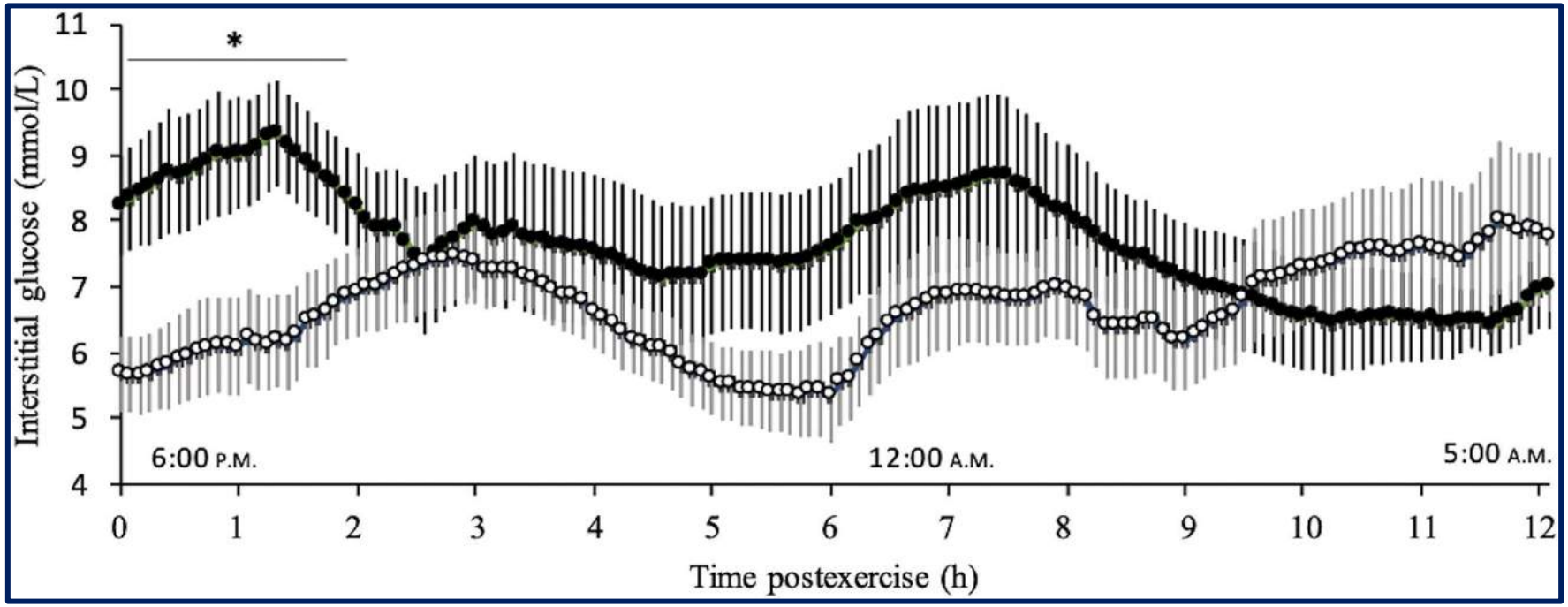
EHS Edinburgh Hypoglycaemia Symptom Scale

4CRT Four-choice reaction time

Diabetologia (2020) 63:853–863

Tip 1 diyabetli kadın atletler

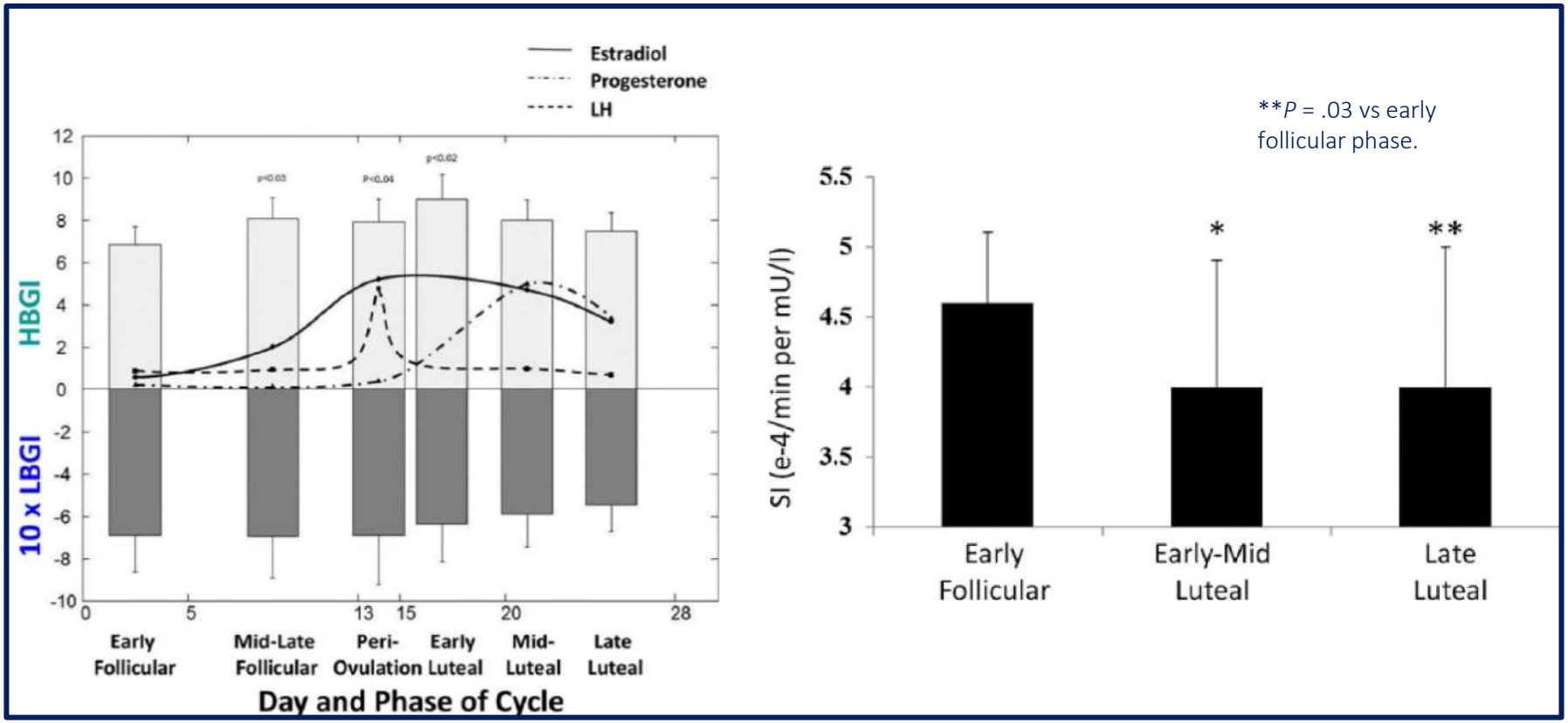
Ann Trason



Mean (±standard error) interstitial glucose measured by continuous glucose monitoring from 0 to 12 h postexercise in males (open circles) and females (filled circles) with type 1 diabetes. Asterisk represents the period of time where mean interstitial glucose was significantly higher in females than males ($p<0.05$).

Kadın atletler egzersiz sırasında hipoglisemiye daha dirençlidir

Can J Diabetes 2019 44(3):267–273.

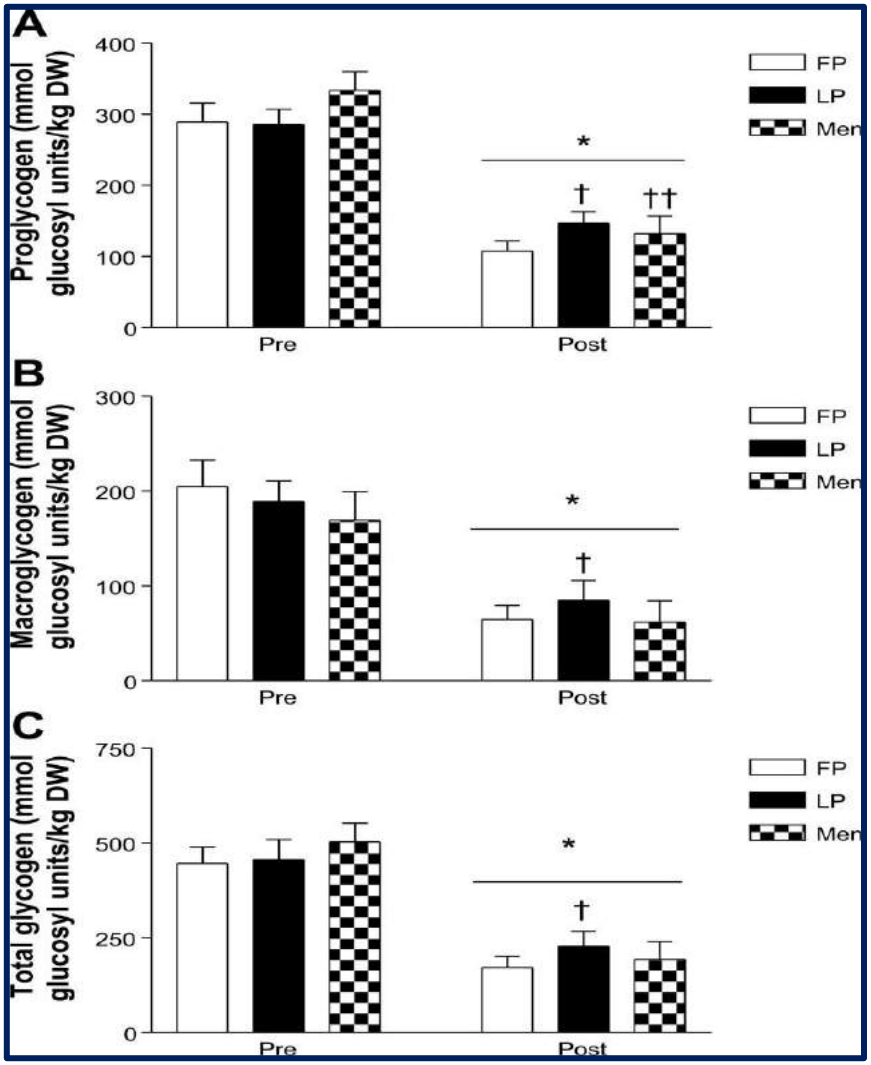


HBGI (high blood glucose indices) , LBGI, and hormone profiles by cycle phase. *P* values are compared to early follicular phase.

Insulin sensitivity index

Kadınlarda lutel fazda insülin duyarlılığı azalıp hiperglisemiye eğilim olur

J Diabetes Sci Technol 2015 9(6):1192–1199

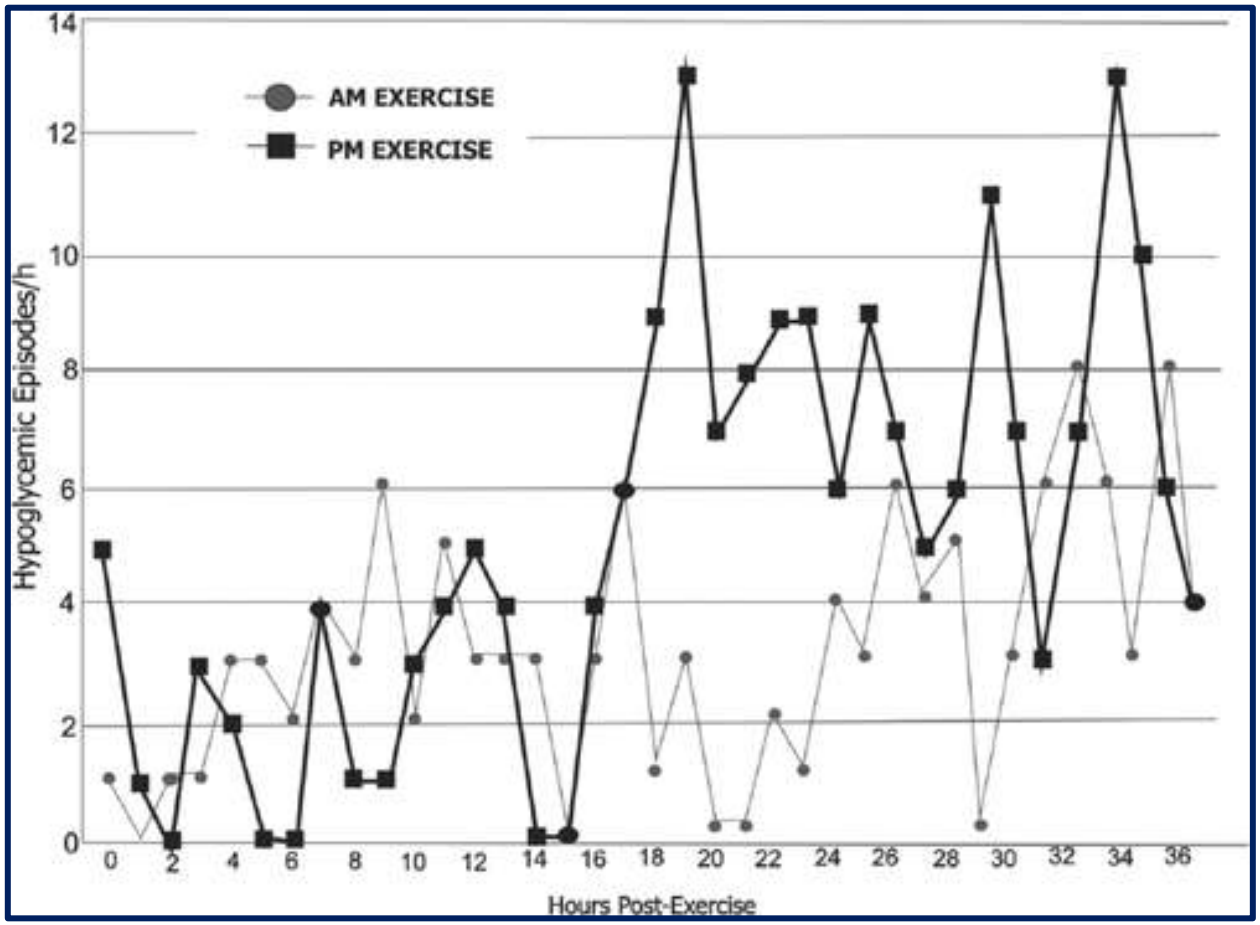


Proglycogen (*A*), macroglycogen (*B*), and total glycogen (*C*) concentrations for 12 women in the FP (open bars) and LP (filled bars) of the menstrual cycle and 11 men (cross-hatched bars) at rest (Pre) and after 90 min of cycling (Post) at an intensity of 65% V̇o2 peak. Data are means ± SE. DW, dry wt. *Exercise decreased glycogen concentration ($P < 0.001$). †LP used less than FP ($P < 0.05$). ††LP used less than men, $P < 0.05$.

Luteal fazda egzersiz sırasında yakıt tüketimi değişir, karbonhidrat kullanımı azalır.

Am J Physiol Regul Integr Comp Physiol 2006 291(4): R1120–R1128

Antrenman zamanlaması



Gece hipoglisemileri açısından sabah egzersiz öğleden sonraya göre daha avantajlıdır

Hourly hypoglycemic episodes following morning (circles) or afternoon (squares) exercise.

J Diabetes Sci 2015: 6 19–624

Sonuçlar

- Diyabetli insanlar gittikçe artan sıklıkta zorlu/profesyonel sporlara yönelmektedirler
- Diyabet yönetiminin spora sporun diyabet yönetimine büyük etkileri vardır
- Uzun süreli iyi diyabet kontrolü performansı artırır, sporun sağlığa yararlarını yükseltir.
- İnsülin tedavisi, karbonhidrat alımı, teknoloji kullanımı, bilgi, bilgiyi uygulama önemli sonuçlar yaratır
- Diyabeti tedavi eden hekimler bu konuda bilgilerini artırmalıdırlar. Sporu kısıtlamak veya hastaları demotive etmek yoluna gitmemelidirler.