Diyette şeker, yağ içeriği ve glisemik indeksin diyabet ve regülasyonu üzerine etkisi

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Diyabette beslenme tedavisi

- Besin değeri yüksek yiyeceklerin uygun porsiyonlarından oluşan sağlıklı yeme alışkanlıkları kazandırmak ve sürdürülmesini sağlamak

- Kan glukozu
- Lipid
- Kan basıncı
- Vücut ağırlığı

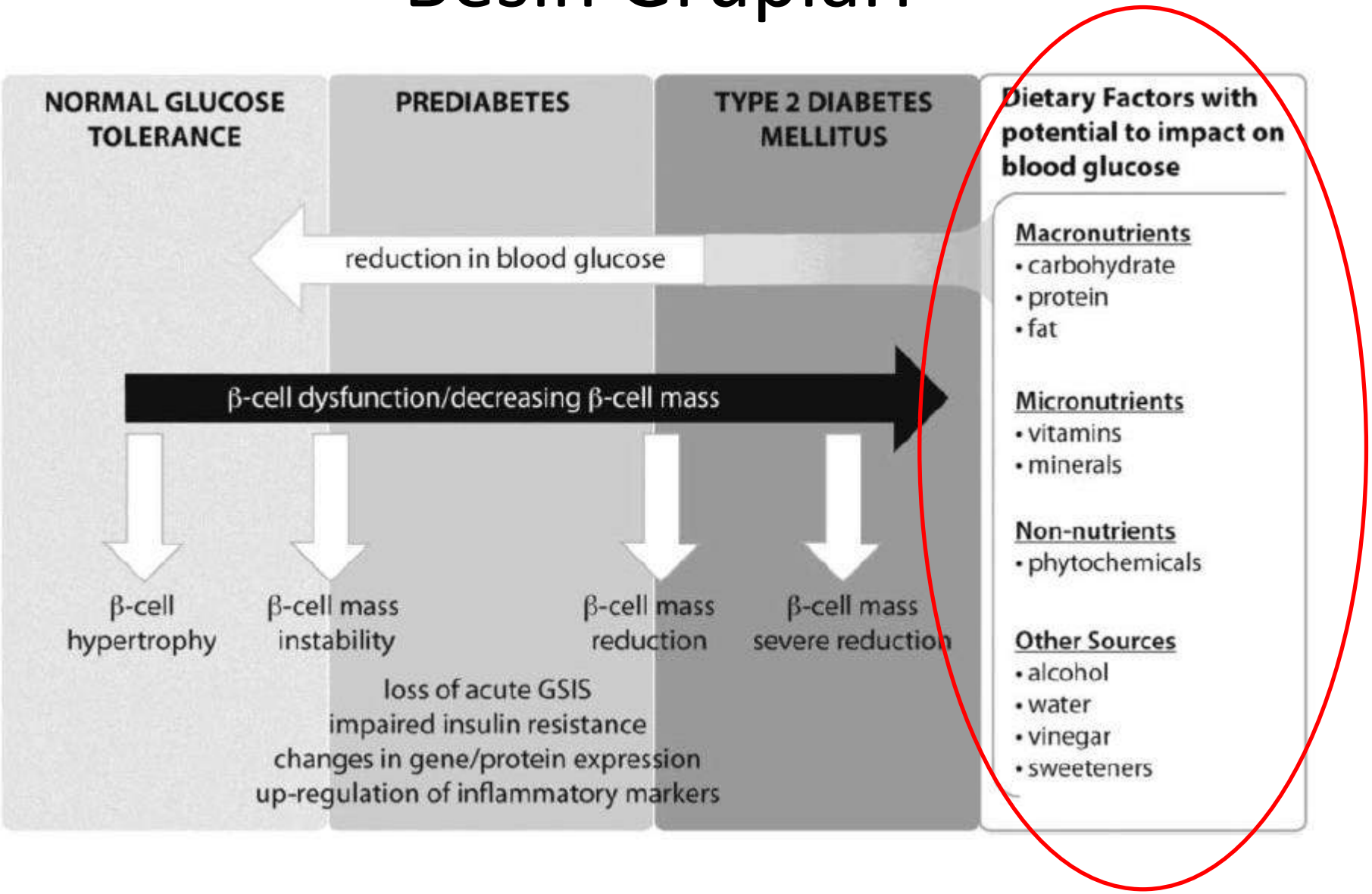
kontrolü

- Diyabetin kronik komplikasyonlarını önlemek veya geciktirmek

Diyabette beslenme tedavisi

- Kişisel besin ihtiyaçlarını belirlemek
  - Metabolik durum
  - kişisel ve kültürel tercihler
  - sadece bilimsel olarak kanıtlanmış besinlerde kısıtlama yaparak yemek yemenin zevki korunur

Besin Grupları



Makrobesinler

	karbonhidrat	protein	yağ
% total enerji	%45-60	%15-20	%20-35
Gram başı kalori	4	4	9
2000 kalori/gün diyet için miktar	225-300gr	75-100gr	44-78gr

Makrobesinlerin oranları

- Karbonhidrat, protein ve yağ için ideal yüzdeler
  - kişisel tercihleri
  - yeme alışkanlıkları
  - vücut ağırlığı hedefi: kalori kısıtlaması
  - metabolik hedefler: besin grupları önemli
- Örn: Karbonhidrat alımı direkt olarak postprandial glukoz düzeyini etkiler ve glisemik kontrolde önemlidir.
  - tip 1 DM de
    - Karbonhidrat sayımına göre insülin dozu
    - Sabit doz insülin alanlarda karbonhidrat miktarı ve zamanı sabit olmalı

Diyabette makrobesinler

- Düşük karbonhidratlı diyetlerde karbonhidratların diğer makrobesinlerle yer değiştirmesi gerekir
  - Bu durumda sıklıkla yağ: düşük KH/yüksek yağ
  - Bazı durumlarda ise protein:düşük KH/yüksek pr

- Düşük yağlı diyetlerde yağın yerini karbonhidratlar alır: Düşük yağ/yüksek KH diyet

Curr Atheroscler Rep 2012

Yüksek protein diyetleri

- Protein termogenezi arttırdığı ve iştahı baskıladığı için erken dönemde kilo kaybı ve insülin direncinde azalmaya neden olabiliyor fakat uzun dönemde yüksek KH lı diyetlerle benzer kilo kaybı ve glukoz regülasyonu sağlıyor
  - Renal fonksiyonlarda azalma,
  - idrar Ca atılımında artma,
  - nefrolithiasis
  - OP a neden olabilmekte.
  - Drop-out daha fazla

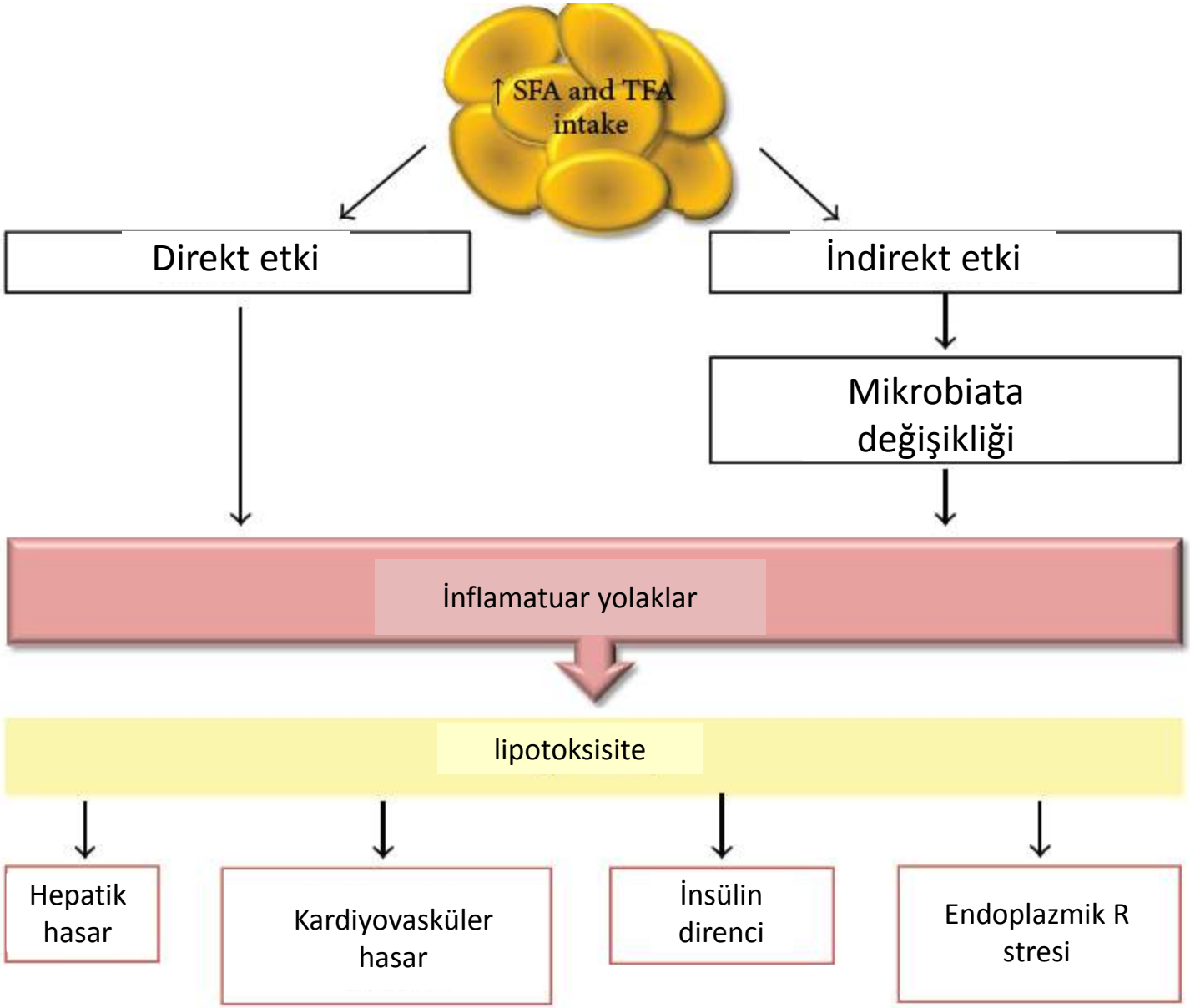
- Düşük karbonhidrat/yüksek yağ içeren diyetler
- Düşük yağ/yüksek KH diyetler

- Düşük karbonhidrat/yüksek yağ içeren diyetler
- Düşük yağ/yüksek KH diyetler

- Karbonhidrat türü
- Yağ türü

Yağ türü

- Doymuş yağ
- Trans yağ
- Kolesterol
- Tekli doymamış yağ (MUFA)
  - Akdeniz diyeti MUFA içeren diyet.
- Çoklu doymamış yağ (PUFA)
  - Omega 3-6
  - supp önerilmiyor. Omega içeren besinler alınmalı


↑ SFA and TFA intake
Direkt etki
İndirekt etki
Mikrobiata değişikliği
İnflamatuar yolaklar
lipotoksisite
Hepatik hasar
Kardiyovasküler hasar
İnsülin direnci
Endoplazmik R stresi

Karbonhidrat türü

- Glisemik indeks
- Glisemik yük
- Lif oranı

Glisemik indeks

- 50 gram karbonhidrat içeren test yiyeceğinin, 2 saat içerisinde oluşturduğu kan glukozunu arttırma alanının, aynı miktarda karbonhidrat içeren referans yiyeceğin oluşturduğu arttırma alanına kıyaslanmasıdır.
- Besinin kan şekerini referans besine göre ne kadar yükselttiği
  - Düşük 0 – 55
  - Orta 56 – 69
  - Yüksek >70

Glisemik yük

- Glisemik yükün hesaplamasında ise tüketilen karbonhidratın miktarı da önemlidir.
- GY = GI x karbonhidrat miktarı / 100
- Glisemik yük :
  - 20 ve üzerinde ise yüksek
  - 11-19 arası orta
  - <10 ise GY düşük

Glisemik indeks

Bazı besinlerin glisemik indeksleri

	Glisemik İndeks	Glisemik Yük
Kahvaltılıklar		
Mısır gevreği	92	24
Buğday gevreği	59	12
Tahıllar		
Pirinç-beyaz	98	21
Bulgur	48	12
Makarnalar		
Spagetti	38	18
Şehriye	35	16
Ekmek, bisküvi vb.		
Baget (beyaz, yuvarlak ekmek)	72	25
Tam buğday ekmeği	77	9
Çavdar ekmeği	58	9
Kraker	78	14
Yulaflı bisküvi	55	12
Kurubaklagiller		
Nohut	28	8
Mercimek	25	5
Barbunya	28	7
Patates		
Haşlanmış	88	16
Kızartılmış	75	22
Sebzeler		
Pancar	64	5
Havuç	47	3
Taze bezelye	48	3
Balkabağı	75	3
Meyveler		
Elma	38	6
Kayısı-kuru	31	9
Muz	51	13
Portakal	48	5
Üzüm	46	8
Süt ve türevleri		
Süt- normal	27	3
Yoğurt-düşük yağlı	33	10
İçecekler		
Kola	63	16
Meyveli gazlı içecek	68	23
Portakal suyu	52	12
Tatlılar		
Şeker- sükroz	68	7
Fruktoz	19	2
Bal	55	10
Çikolata	44	13
Bar	68	27

Glisemik indeks

Bazı besinlerin glisemik indeksleri

Tam taneli tahıl ürünleri tercih edilmeli.
Pirinç yerine bulgur tercih edilmeli.
Günde 5 porsiyon sebze ve meyve tüketilmeli.
Kurubaklagiller sıklıkla tüketilmeli (haftada 2-3 kez)

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Glisemik indeks

Bazı besinlerin glisemik indeksleri

Glisemik indeks ile ilgili tartışmalar +
Etkileyen faktör çok

Çalışmalarda glisemik indeks tanımı:

- Düşük: %39-77
- Yüksek: %56-84 arasında olup görüş birliği veya kesinlik yoktur.

Standart olarak da beyaz ekmek veya glukoz kullanılmış

	Glisemik İndeks	Glisemik Yük
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Glisemik indeks ile ilgili tartışmalar +
Etkileyen faktör çok

Glisemik indeksi etkileyen faktörler:

1. Nişastanın yapısındaki farklılık: amiloz -amilopektin oranları.
2. Diyet lif miktarı
3. Besin öğesi olmayan maddeler: enzim inhibitörleri, fitatlar, lektin vs.
4. Beraber yenen yiyecekler: protein, yağ vs
6. Yiyeceğin yapısı ve yiyeceklere uygulanan işlemler:
   - Taneli-sıvı: meyve-meyve suyu
   - İyi pişmiş-az pişmiş besinler
7. Yavaş yemek yeme: Sindirim ve emilim daha yavaş olacağından GI düşebilir.

Glycemic index, glycemic load and glycemic response: An International Scientific Consensus Summit from the International Carbohydrate Quality Consortium (ICQC)☆

- Düşük Gİ ve GY yiyecekler KH emilimini yavaşlatarak postprandial glisemiyi azaltabilir
- GI metodolojisi geçerli ve tekrar edilebilir bir yöntemdir
- Glisemik yük glisemik cevabı gösterebilen en etkin yöntemdir
- Vücut ağırlığı
- Tip 2 DM
- KAH üzerinde olumlu etki
- Kanıt ise alfaglukozidaz inhibitörlerinin KH emilimini azaltarak tip 2 DM ve KAH riskini azaltması
- Düşük Gİ besinler sağlıklı diyet olarak önerilmeli ve yiyeceklerin üzerinde Gİ ve GY yazılmalı

Table 3 Consensus: scientific statements [1–14] and future recommendations [15–20].

1. Carbohydrates present in different foods have distinct physiological effects, including effects on postprandial glycemia, also known as the glycemic response (GR), with different implications for health.
2. Reducing postprandial glycemia is recognized as a beneficial physiological effect [52,53,202,203].
3. Ways to reduce postprandial glycemia include slowing carbohydrate absorption by consuming low glycemic index (GI) and low glycemic load (GL) foods to reduce the dietary GI and GL [15,18].
4. The GI methodology is a sufficiently valid and reproducible method for differentiating foods based on their GR [49,204].
5. The GI quantifies specific physiological properties of carbohydrate-containing foods as influenced by the food matrix. These characteristics extend beyond the chemical composition of the foods and include delaying gastric emptying and reducing the rate of digestion and small intestinal absorption.
6. When considering the macronutrient composition, the GL/1000 kJ (the product of GI and available carbohydrate content) is the single best predictor of the GR of foods [154].
7. There is convincing evidence from meta-analyses of controlled dietary trials that diets low in GI improve glycemic control in people with type 2 and type 1 diabetes [12,13,77,87,194].
8. There is convincing evidence from meta-analyses of prospective cohort studies that low GI/GL diets reduce the risk of type 2 diabetes [11,19].
9. There is convincing evidence from a large body of prospective cohort studies that low GI/GL diets reduce the risk of coronary heart disease [6,38,205].
10. The proof of principle for the concept of slowing carbohydrate absorption is the use of alpha-glucosidase inhibitors (acarbose etc.) to reduce progression to type 2 diabetes and coronary heart disease [31,32].
11. The quality of carbohydrate rich foods as defined by GI/GL is particularly important for individuals who are sedentary, overweight and at increased risk of type 2 diabetes [3,18].
12. Potential mechanisms for reduction of type 2 diabetes include evidence that low GI/GL diets improve insulin sensitivity and beta-cell function in people with type 2 diabetes and those at risk for type 2 diabetes [206,207].
13. Potential mechanisms for reduction of coronary heart disease include evidence that low GI/GL diets improve blood lipids and inflammatory markers including C-reactive protein [24,27–29,193,208,209].
14. Probable evidence exists for low GI/GL diets in reducing total body fat mass and in weight management [37,78,131,134,210].
15. The GI complements other ways of characterizing carbohydrate-foods, such as fiber and whole grain content [201,211].
16. Low GI and low GL should be considered in the context of a healthy diet.
17. Given the rapid rise in diabetes and obesity there is a need to communicate information on GI/GL to the general public and health professionals.
18. This should be supported by inclusion of GI/GL in dietary guidelines and in food composition tables.
19. In addition package labels and low GI/GL symbols on healthy foods should be considered.
20. More comprehensive high-quality food composition tables need to be developed for GI/GL at the national level.

Nutrition, Metabolism & Cardiovascular Diseases, 25: 2015

Diyette Lif

- Diyet lifi, ince bağırsakta sindirilemeyen fakat kalın bağırsakta fermente olan başlıca tahıl, meyve ve sebzelerde bulunan bir grup gıda bileşenidir.

Diyette Lif

- Diyet lifleri, çözünür ve çözünmeyen lifler olmak üzere iki grupta değerlendirilmektedir.
- Çözünür diyet lifi, suyu bağlayarak jel ve sıkı yapı oluşturmaktadır, metabolik etkileri ön planda
- Çözünmeyen diyet lifi ise ağırlığının 20 katı kadar suyu absorbe eder; sindirim sistemi etkisi ön planda
- Genellikle diyet lifi bakımından zengin olan gıdalar her iki lif bileşenini de farklı oranlarda içermektedir.
- Meyve, sebze ve yulaf kepeğinde çözünür lif miktarı; buğday kepeğinde ise çözünmeyen lif içeriğinin daha fazla

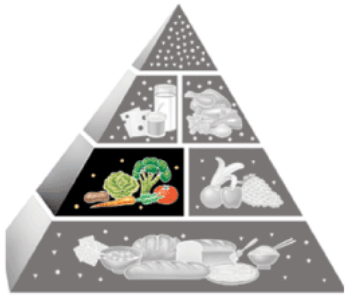
TABLE 4-3 Fiber in Selected Foods

Bread, Cereal, Rice, and Pasta Group

Whole-grain products provide about 1 to 2 grams (or more) of fiber per serving:

- 1 slice whole-wheat, pumpernickel, rye bread.
- 1 oz ready-to-eat cereal (100% bran cereals contain 10 grams or more).
- ½ c cooked barley, bulgur, grits, oatmeal.

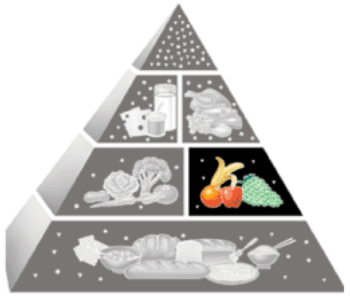
Vegetable Group



Most vegetables contain about 2 to 3 grams of fiber per serving:

- 1 c raw bean sprouts.
- ½ c cooked broccoli, brussels sprouts, cabbage, carrots, cauliflower, collards, corn, eggplant, green beans, green peas, kale, mushrooms, okra, parsnips, potatoes, pumpkin, spinach, sweet potatoes, swiss chard, winter squash.
- ½ c chopped raw carrots, peppers.

Fruit Group



Fresh, frozen, and dried fruits have about 2 grams of fiber per serving:

- 1 medium apple, banana, kiwi, nectarine, orange, pear.
- ½ c applesauce, blackberries, blueberries, raspberries, strawberries.
- Fruit juices contain very little fiber.

Legumes

Many legumes provide about 6 to 8 grams of fiber per serving:

- ½ c cooked baked beans, black beans, black-eyed peas, kidney beans, navy beans, pinto beans.

Some legumes provide about 5 grams of fiber per serving:

- ½ c cooked garbanzo beans, great northern beans, lentils, lima beans, split peas.

NOTE: Appendix H provides fiber grams for over 2000 foods.

Günde ortalama 25-40gr lif alınması öneriliyor.

Bread, Cereal, Rice, and Pasta Group

Whole-grain products provide about 1 to 2 grams (or more) of fiber per serving:

- 1 slice whole-wheat, pumpernickel, rye bread
- 1 [illegible] 0 grams or more).
- ½ c cooked barley, bulgur, grits, oatmeal.

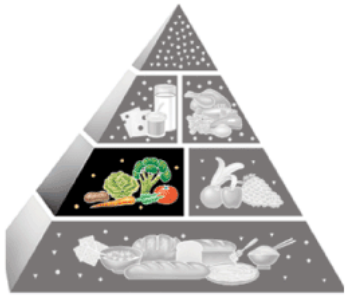
1 dilim tam tahıllı ekmekte 1-2 gr

Vegetable Group

Most vegetables contain about 2 to 3 grams of fiber per serving:

- 1 c raw bean sprouts.
- [illegible] liflower, collards, corn, eggplant, potatoes, pumpkin, spinach, sweet potatoes, swiss chard, winter squash.
- ½ c chopped raw carrots, peppers.

Birçok sebze porsiyonda 2-3gr lif içerir

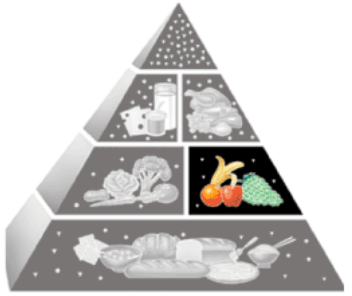


Fruit Group

Fresh, frozen, and dried fruits have about 2 grams of fiber per serving:

- [illegible] e, orange, pear.
- [illegible], raspberries, strawberries.
- Fruit juices contain very little fiber.

Meyvelerde yaklaşık 2 gr



Legumes

Many legumes provide about 6 to 8 grams of fiber per serving:

- ½ [illegible] idney beans, navy beans, pinto beans.

Some legumes provide about 3 grams of fiber per serving.

- ½ c cooked garbanzo beans, great northern beans, lentils, lima beans, split peas.

Kurubaklagillerde porsiyonda 6-8gr

NOTE: Appendix H provides fiber grams for over 2000 foods.

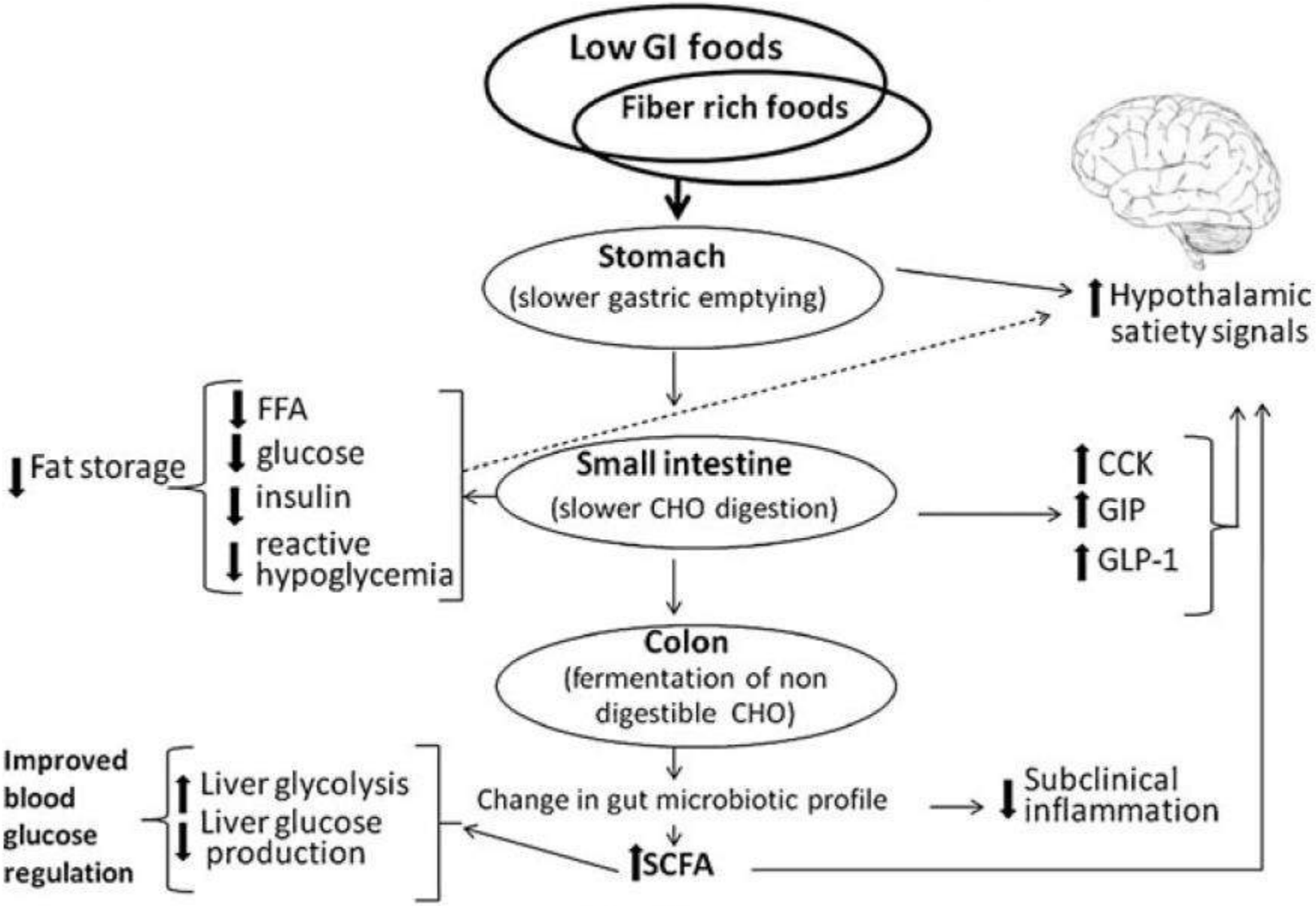
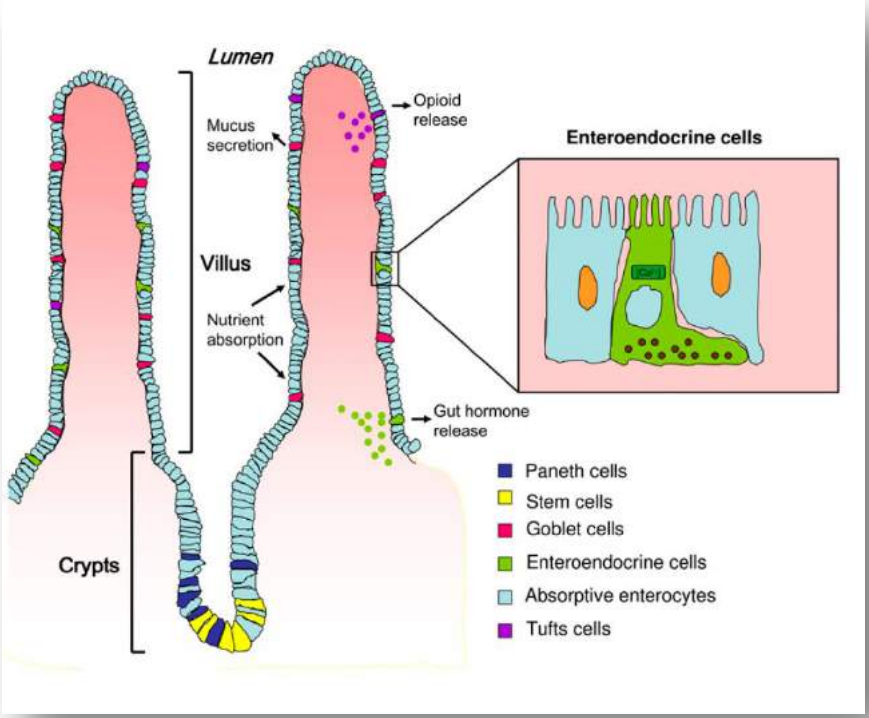

Possible mechanisms of action of dietary fiber and low glycemic index foods
Low GI foods
Fiber rich foods
Stomach
(slower gastric emptying)
Hypothalamic satiety signals
Fat storage
FFA
glucose
insulin
reactive hypoglycemia
Small intestine
(slower CHO digestion)
CCK
GIP
GLP-1
Colon
(fermentation of non digestible CHO)
Improved blood glucose regulation
Liver glycolysis
Liver glucose production
Change in gut microbiotic profile
Subclinical inflammation
SCFA

Figure 1

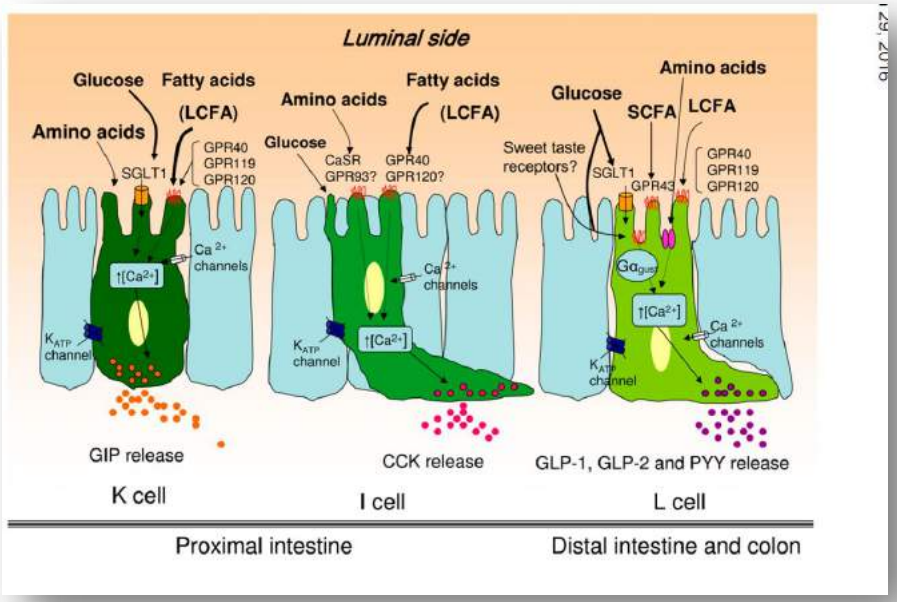
Enteroendokrin hücreler

- Gastrointestinal sistemin yiyeceklere cevabını organize eder
- Luminal içerikle temas kurabilen açık hücrelerdir
  - Tat resp
  - SGLT-1
  - GPR (G pr coupled rsp)
- Luminal içeriğe karşı sensör görevi



Enteroendokrin hücreler

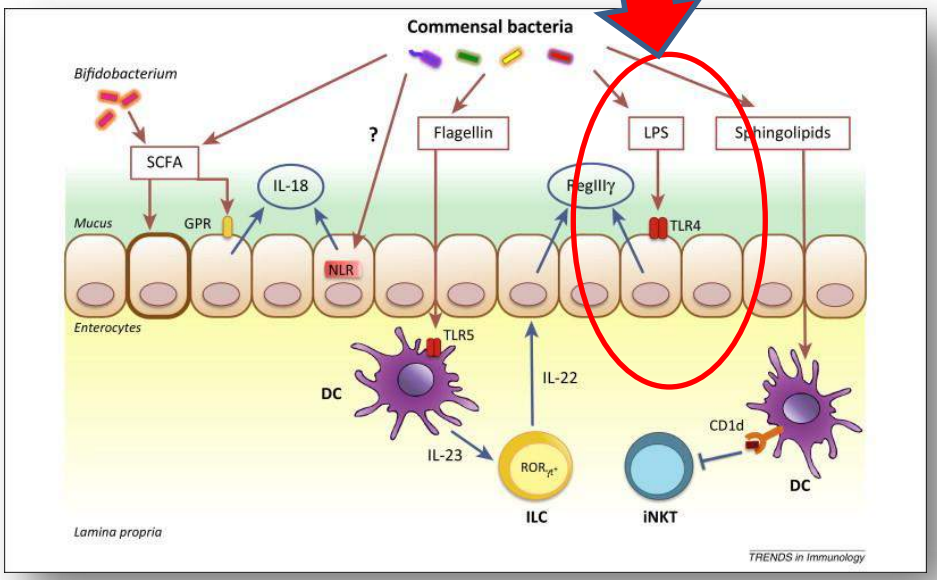
- Yağ: GIP ce CCK
- Karbonhidrat:GLP
- Yağ ve protein: PYY
- GIP:insülin sekresyonu artar, yağ depolanması artar
- CCK: pankreatik enzim sekresyonu uyarır, mide boşalma zamanını uzatır



Mikrobiata

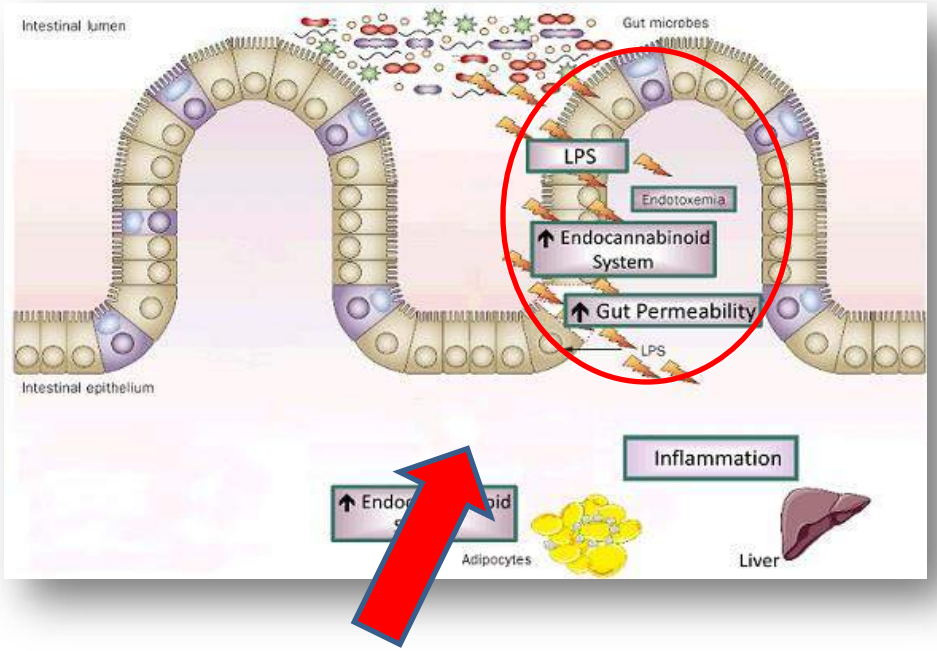
LPS: gram (-) bakteri duvarı komponenti TLR4 kompleksine bağlanarak inflamasyonu uyarır

- İnsanlarda **yüksek yağ+yüksek KH diyeti** sonrası LPS düzeylerinde artış. Mononükleer hücre TLR4, nuclear factor-κB (NF-κB) ve (SOCS-3) ekspresyonunda artış olduğu gösterilmiş.
- TLR4 delesyonu yüksek yağ alımına bağlı İR önlemiştir
- Lif ve meyveden zengin diyet alımında bu artış gözlenmemiş



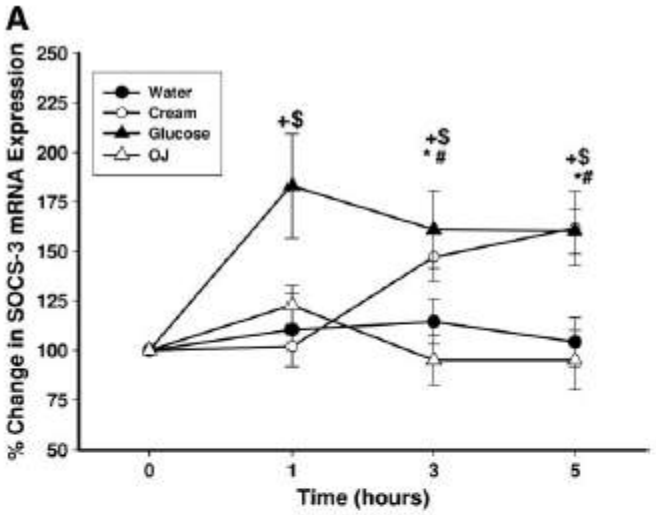
Mikrobiata

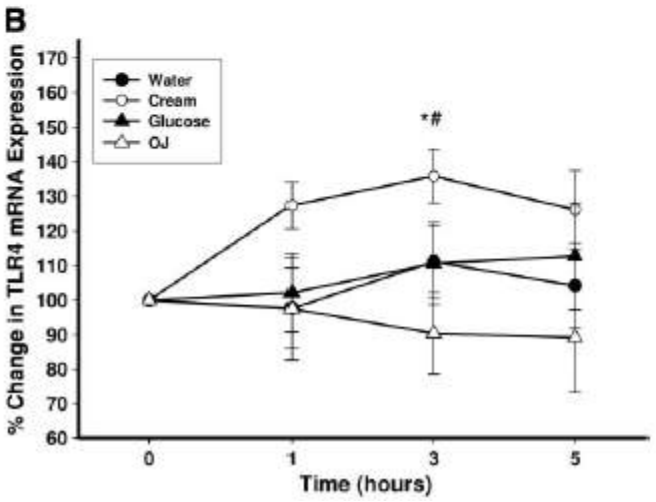
- Ratlarda **yüksek yağ içeren diyet** yüksek KH içeren diyete göre daha fazla LPS düzeylerini yükseltmiştir.
- Yağ alımının intestinal permeabiliteyi arttırarak LPS nin portal sisteme girişinde etkili olabilir.
- İnsanlarda da 3 günlük yağ alımının diğer besinlere göre LPS düzeylerini belirgin olarak arttırdığı gösterilmiş.

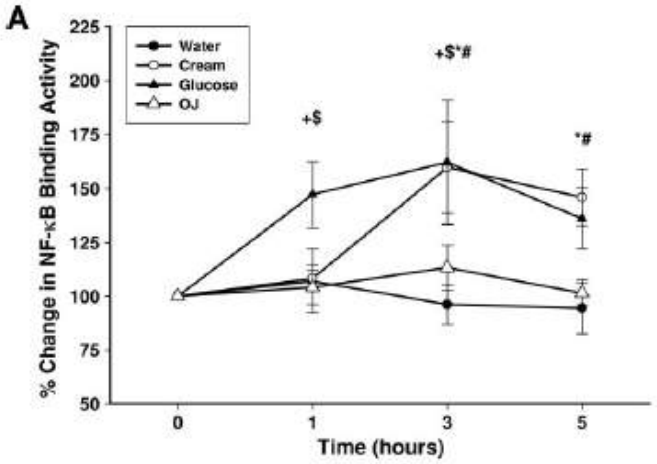


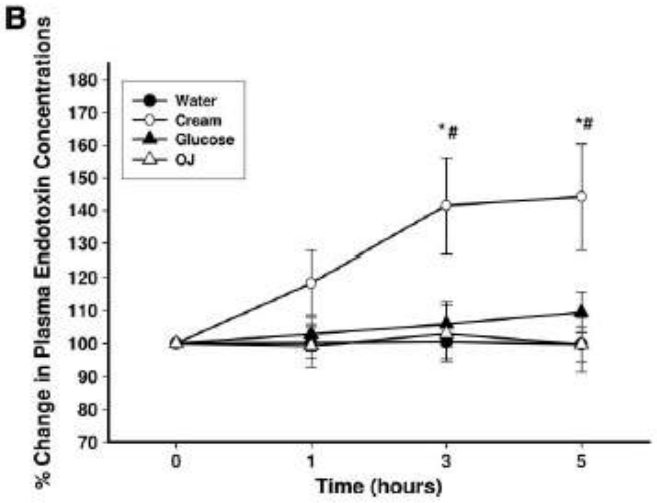
LPS: ib geçirgenliğini arttırır ve endotoksemiye neden olur.

Deopurkar et al.









300 kalori
33gr krema
75 gr glukoz
Portakal suyu
su

Doymuş yağ ve glukoz:
NF-κB,
SOCS3,
TNF-α,
IL-1β düzeylerini arttırmış

doymuş yağ:
LPS
TLR4 düzeyleri artmış

Diabetes Care 2010;33:991–997

Fruktoz ve mikrobiata

- Fazla miktarda fruktoz alımında da endotoksemi gösterilmiş.
- 8 hafta yüksek doz fruktoz alan ratlarda portal endotoksin düzeyleri 27 kat artmış
  - Plazma inflamasyon belirteçleri
  - Hepatosteatoz
  - IR kontrole göre artmış.
- TLR4 mutasyonu olan ratlarda fruktozun bu olumsuz etkileri gözlenmemiş
- Bu da LPS-TLR4 aksının fruktozun metabolik etkilerine neden olduğunu gösteriyor.

Spruss et al. Hepatology 2009

- Düşük yağ-yüksek karbonhidrat
- Düşük karbonhidrat-yüksek yağ
- Diyetler kilo kaybı ve diyabet regülasyonu üzerine etkisi açısından karşılaştırılmışlar.

Düşük Karbonhidrat-düşük yağ diyetleri karşılaştırılması

Comparative Study of the Effects of a 1-Year Dietary Intervention of a Low-Carbohydrate Diet Versus a Low-Fat Diet on Weight and Glycemic Control in Type 2 Diabetes

Table 1—*Baseline characteristics of participants*

	Low-carbohydrate diet	Low-fat diet
n	55	50
Age (years)	54 ± 6	53 ± 7
Female sex	45 (82)	37 (74)
Race		
Black	34 (62)	33 (66)
Hispanic	8 (15)	9 (18)
White	8 (15)	7 (14)
Asian	2 (4)	1 (2)
Other	2 (4)	0
Physical measures		
Weight (kg)	93.6 ± 18	101 ± 19
BMI (kg/m^2)	35 ± 6	37 ± 6
Systolic blood pressure (mmHg)	125 ± 18	130 ± 17
Diastolic blood pressure (mmHg)	73 ± 9	77 ± 10
Clinical		
A1C (%)	7.5 ± 1.5	7.4 ± 1.4
Total cholesterol (mmol/l)	4.4 ± 0.83	4.3 ± 0.86
LDL (mmol/l)	2.5 ± 0.69	2.4 ± 0.74
HDL (mmol/l)	1.3 ± 0.24	1.2 ± 0.29
Triglycerides (mmol/l)	1.4 ± 0.84	1.4 ± 0.67
Medications		
Metformin	43 (78)	43 (86)
Sulfonylurea	24 (44)	26 (52)
Insulin	19 (35)	12 (24)
Cholesterol-lowering medication	34 (62)	28 (56)

Data are means ± SD or *n* (%) unless otherwise noted.

Düşük Karbonhidrat-düşük yağ diyetleri karşılaştırılması

Low-carbohydrate and low-fat diets in diabetes

Table 2—*Change in anthropometric and metabolic outcomes at 3, 6, and 12 months after diet initiation*

	3 months	6 months	12 months	*P*
A1C				
Low-carbohydrate diet	−0.64 ± 1.4	−0.29 ± 0.92	−0.02 ± 0.89	0.71
Low-fat diet	−0.26 ± 1.1	−0.15 ± 1.1	0.24 ± 1.4	
Weight (kg)*				
Low-carbohydrate diet	−5.2 ± 2.8	−4.8 ± 3.5	−3.1 ± 4.8	0.005
Low-fat diet	−3.2 ± 3.7	−4.4 ± 5.3	−3.1 ± 5.8	
Systolic blood pressure (mmHg)				
Low-carbohydrate diet	−5.8 ± 19.2	−0.78 ± 17.7	2.0 ± 15.6	0.15
Low-fat diet	−0.98 ± 21.0	−37 ± 19.8	−1.8 ± 22.6	
Diastolic blood pressure (mmHg)				
Low-carbohydrate diet	−2.2 ± 12.5	−0.93 ± 12.4	−2.9 ± 9.4	0.62
Low-fat diet	−0.40 ± 12.6	0.95 ± 9.8	−2.2 ± 11.6	
Total cholesterol (mmol/l)†				
Low-carbohydrate diet		0.05 ± 0.79	0.10 ± 0.76	0.37
Low-fat diet		−0.27 ± 0.74	−0.13 ± 0.70	
LDL (mmol/l)				
Low-carbohydrate diet		−0.10 ± 0.52	−0.04 ± 0.63	0.23
Low-fat diet		−0.25 ± 0.56	−0.18 ± 0.66	
HDL (mmol/l)				
Low-carbohydrate diet		0.16 ± 0.28	0.16 ± 0.27	0.002
Low-fat diet		−0.01 ± 0.22	0.06 ± 0.21	
Triglycerides (mmol/l)				
Low-carbohydrate diet		−0.02 ± 0.85	−0.15 ± 0.88	0.53
Low-fat diet		0.04 ± 0.56	−0.01 ± 0.86	

Data are means ± SD. **P* values for diet difference over all time points. †Lipid values were not collected at 3 months.

Düşük Karbonhidrat-düşük yağ diyetleri karşılaştırılması

Low-carbohydrate and low-fat diets in diabetes

Table 2—*Change in anthropometric and metabolic outcomes at 3, 6, and 12 months after diet in*

İlaçlarda düzenleme yapılmış

	3 months	6 months	12 months	*P*
A1C				
Low-carbohydrate diet	−0.64 ± 1.4	−0.29 ± 0.92	−0.02 ± 0.89	0.71
Low-fat diet	−0.26 ± 1.1	−0.15 ± 1.1	0.24 ± 1.4	
Weight (kg)*				
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Düşük Karbonhidrat-düşük yağ diyetleri karşılaştırılması

Table 2—*Change in anthropometric and metabolic outcomes at 3, 6, and 12 months after diet initiation*

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Data are means ± SD. *P values for diet difference over all time points. †Lipid values were not collected at 3 months.

Düşük KH grubu ilk 3 ayda ayda 1,7kg vermiş. Sonraki aylarda ayda 0,23kg almış

Düşük yağ grubu ilk 3 ayda 1,2kg vermiş. 3-12 ay arası plato

Düşük Karbonhidrat-düşük yağ diyetleri karşılaştırılması

Low-carbohydrate and low-fat diets in diabetes

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Düşük Karbonhidrat-düşük yağ diyetleri karşılaştırılması

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Yağ ve karbonhidrat oranları metaanaliz

Influence of Fat and Carbohydrate Proportions on the Metabolic Profile in Patients With Type 2 Diabetes: A Meta-Analysis

Table 1—*Descriptive statistics of studies included in the meta-analysis*

	Intervention period (weeks)	Dropout (%)	LFHC		HFLC		Age (years)	Men (%)	BMI	Using antihyperglycemia agents (%)	Diabetes duration (years)
			n	C/F/P (%)	*n*	C/F/P (%)					
Campbell et al. (1994; ref. 13)	2	N/A	10	55/22/23	10	40/37/23	55	100	26.5	10	5
Chen et al. (1995; ref. 14)	6	N/A	9	55/30/15	9	40/45/15	49	67	27.5	N/A	N/A
Coulston et al. (1989; ref. 15)	6	0	8	60/20/20	8	40/40/20	66	63	25.5	75	N/A
Fuh et al. (1990; ref. 16)	2	N/A	11	60/20/20	11	40/40/20	58	100	25.8	100	N/A
Garg et al. (1992; ref. 17)	3	N/A	8	60/25/15	8	35/50/15	63	100	30	0	N/A
Garg et al. (1994; ref. 18)	6	0	42	55/30/15	42	40/45/15	58	79	28.1	100	N/A
Heilbronn et al. (1999a; ref. 19)	12	17	12	73/10/17	10	50/32/18	58	27	32.9	58	5
Heilbronn et al. (1999b; ref. 19)	12	15	12	73/10/17	13	50/32/18	58	20	33.1	52	6
Lovejoy et al. (2002a; ref. 20)	4	12	30	58/27/15	30	46/39/15	54	43	33	47	N/A
Lovejoy et al. (2002b; ref. 20)	4	12	30	58/27/15	30	46/39/15	54	43	33	47	N/A
Luscombe et al. (1999; ref. 21)	4	25	21	53/21/26	21	42/35/23	57	67	30.4	76	6
Miyashita et al. (2004; ref. 22)	4	N/A	11	63/10/27	11	40/35/25	52	73	27	0	N/A
Parillo et al. (1992; ref. 23)	2	0	10	60/20/20	10	40/40/20	53	70	26.7	50	8
Parillo et al. (1996a; ref. 24)	2	0	9	60/20/20	9	40/40/20	48	N/A	24.7	0	6
Parillo et al. (1996b; ref. 24)	2	0	9	60/20/20	9	40/40/20	50	N/A	24.6	100	8
Rodriguez-Villar et al. (2000; ref. 25)	6	25	12	55/30/15	12	45/40/15	N/A	N/A	27.9	N/A	6
Rodriguez-Villar et al. (2004; ref. 26)	6	15	22	55/30/15	22	45/40/15	61	54	28.3	N/A	N/A
Rusmussen et al. (1994; refs. 27, 28)	3	N/A	15	50/30/20	15	30/50/20	57	67	27	47	6
Sestoft et al. (1985; ref. 29)	1.4	N/A	8	50/30/20	8	42/36/22	48	50	22.7	0	5
Simpson et al. (1982; ref. 30)	4	N/A	10	60/22/18	10	35/47/18	58	N/A	26.2	80	6
Storm et al. (1997a; ref. 31)	3	0	15	50/30/20	15	40/45/15	53	53	29.7	73	6
Storm et al. (1997b; ref. 31)	3	0	15	50/30/20	15	40/45/15	53	53	29.7	73	6
Median	4	6	12	58/24/20	12	40/40/20	55	65	27.7	52	6
Minimum	1.4	0	8		8		48	20	22.7	0	5
Maximum	12	25	42		42		66	100	33.1	100	8

C/F/P, proportion of carbohydrate/fat/protein to total energy of the prescribed diet; N/A, not assessed.

Yağ ve karbonhidrat oranları metaanaliz

Sadece karbonhidrat/yağ oranındaki değişikliklerin etkisini görmek için lif veya tam tahıl gibi KH içeriğinde ve kalitesinde değişiklikler içeren çalışmalar dışlanmış.

Table 1—*Descriptive statistics of studies included in the meta-analysis*

	Intervention period (weeks)	Dropout (%)	LFHC		HFLC		Age (years)	Men (%)	BMI	Using antihyperglycemia agents (%)	Diabetes duration (years)
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Coulston et al. (1989; ref. 15)	6	0	8	60/20/20	8	40/40/20	66	63	25.5	75	N/A
Fuh et al. (1990; ref. 16)	2	N/A	11	60/20/20	11	40/40/20	58	100	25.8	100	N/A
Garg et al. (1992; ref. 17)	3	N/A	8	60/25/15	8	35/50/15	63	100	30	0	N/A
		0	42	55/30/15	42	40/45/15	58	79	28.1	100	N/A
		17	12	73/10/17	10	50/32/18	58	27	32.9	58	5
		15	12	73/10/17	13	50/32/18	58	20	33.1	52	6
		12	30	58/27/15	30	46/39/15	54	43	33	47	N/A
		12	30	58/27/15	30	46/39/15	54	43	33	47	N/A
		25	21	53/21/26	21	42/35/23	57	67	30.4	76	6
		N/A	11	63/10/27	11	40/35/25	52	73	27	0	N/A
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Median	4	6	12	58/24/20	12	40/40/20	55	65	27.7	52	6
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Yağ ve karbonhidrat oranları metaanaliz

Reviews/Commentaries/ADA Statements
META-ANALYSIS

Influence of Fat and Carbohydrate Proportions on the Metabolic Profile in Patients With Type 2 Diabetes: A Meta-Analysis

Düşük yağ/yüksek KH içeren diyet

- HbA1c ve AKŞ üzerindeki etkileri benzer
- Açlık insülin düzeyinde %8 artış
- TG düzeylerinde %13 artış
- HDL düzeyinde %6 azalma

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					13	50/32/18	58	20	33.1	52	6
					30	46/39/15	54	43	33	47	N/A
					30	46/39/15	54	43	33	47	N/A
					21	42/35/23	57	67	30.4	76	6
					11	40/35/25	52	73	27	0	N/A
					10	40/40/20	53	70	26.7	50	8
					9	40/40/20	48	N/A	24.7	0	6
Parillo et al. (1996b; ref. 24)	2	0	9	60/20/20	9	40/40/20	50	N/A	24.6	100	8
Rodriguez-Villar et al. (2000; ref. 25)	6	25	12	55/30/15	12	45/40/15	N/A	N/A	27.9	N/A	6
Rodriguez-Villar et al. (2004; ref. 26)	6	15	22	55/30/15	22	45/40/15	61	54	28.3	N/A	N/A
Rusmussen et al. (1994; refs. 27, 28)	3	N/A	15	50/30/20	15	30/50/20	57	67	27	47	6
Sestoft et al. (1985; ref. 29)	1.4	N/A	8	50/30/20	8	42/36/22	48	50	22.7	0	5
Simpson et al. (1982; ref. 30)	4	N/A	10	60/22/18	10	35/47/18	58	N/A	26.2	80	6
Storm et al. (1997a; ref. 31)	3	0	15	50/30/20	15	40/45/15	53	53	29.7	73	6
Storm et al. (1997b; ref. 31)	3	0	15	50/30/20	15	40/45/15	53	53	29.7	73	6
Median	4	6	12	58/24/20	12	40/40/20	55	65	27.7	52	6
Minimum	1.4	0	8		8		48	20	22.7	0	5
Maximum	12	25	42		42		66	100	33.1	100	8

C/F/P, proportion of carbohydrate/fat/protein to total energy of the prescribed diet; N/A, not assessed.

Yağ ve karbonhidrat oranları metaanaliz

- Düşük yağ/yüksek KH diyetinde KH/yağ oranı ve TG düzeyi arasında doz ilişkisi gösterilememiş.
- MUFA içeren Yüksek yağ/düşük KH diyeti ile karşılaştırıldığında TG düzeyleri daha fazla yükselmiş.
- Düşük kalorili diyetlerde TG düzeyinde yükselmeye neden olmamış.
- Total kalori alımı ve yağ kalitesi KH/yağ oranından daha önemli

Düşük KH diyetler

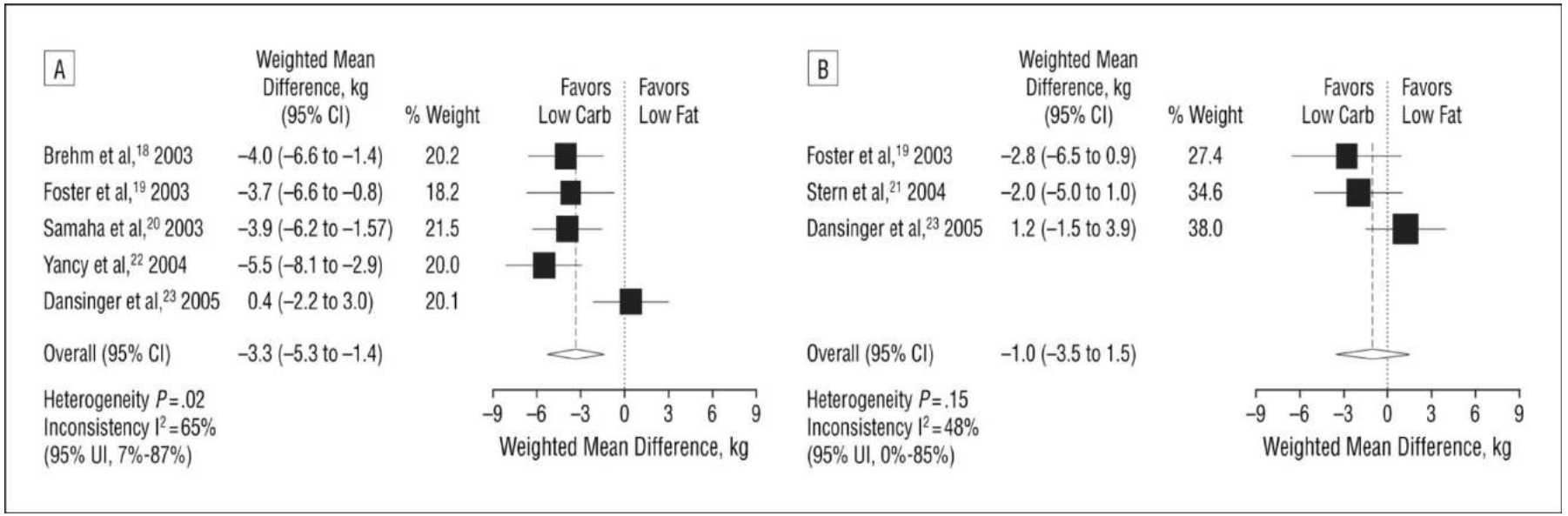
- Düşük KH içeren diyet <%30-40 KH
  - Glisemik kontrol olumlu: ilaç dozlarında azalma
  - HDL de artış
  - TG de azalma
- Orta KH içeren diyet %40-65
  - Glisemik kontrol nötr
  - KVH çelişkili sonuçlar

Reviews/Consensus Reports/ADA Statements
SYSTEMATIC REVIEW

Macronutrients, Food Groups, and Eating Patterns in the Management of Diabetes

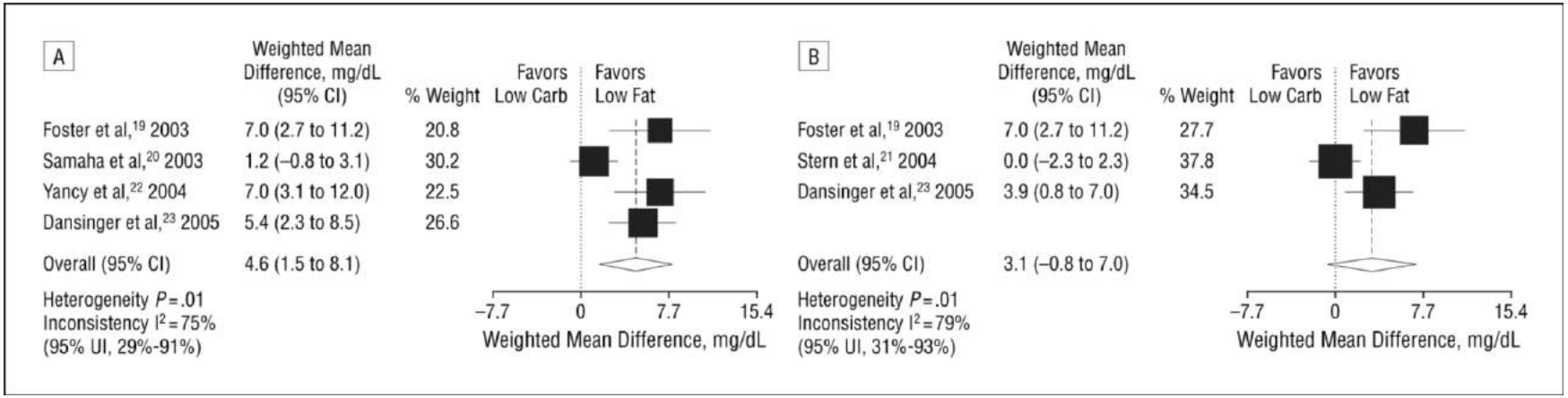
A systematic review of the literature, 2010

Düşük KH ve düşük yağ diyetleri vücut ağırlığı üzerine etkisi



Arch Intern Med. 2006;166(3):285-293.

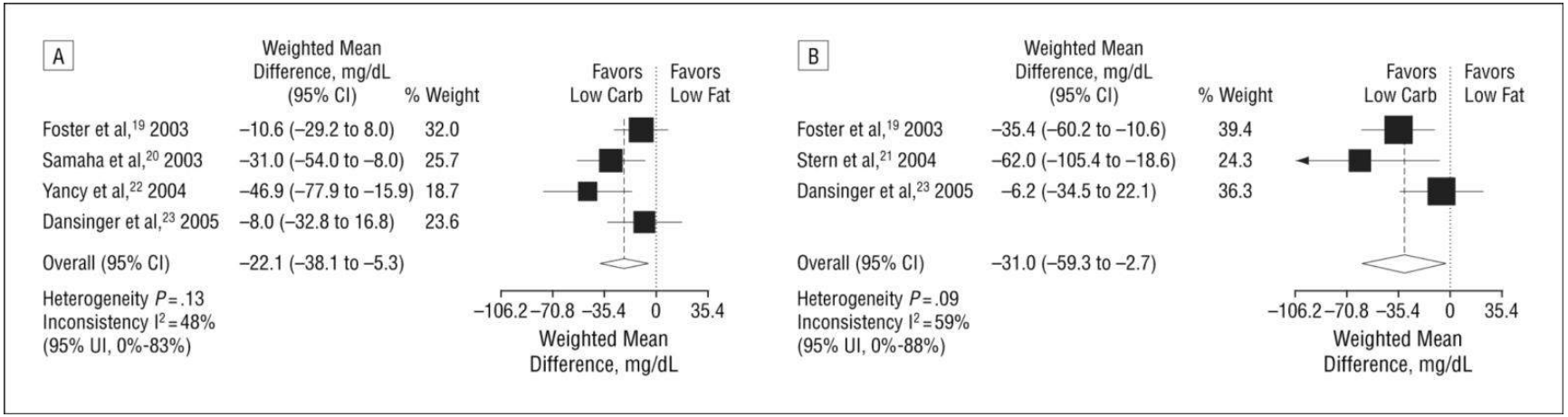
Düşük KH ve düşük yağ diyetleri HDL üzerine etkisi



Diğer metaanalizden farklı olarak düşük yağ-yüksek KH olumlu

Arch Intern Med. 2006;166(3):285-293.

Düşük KH ve düşük yağ diyetleri TG üzerine etkisi



TG sonuçları diğer metaanalize benzer

Arch Intern Med. 2006;166(3):285-293.

Düşük ve yüksek glisemik indeksli diyetlerin karşılaştırıldığı Cochrane metanalizi

Table 1. Glycaemic index (GI) of intervention and control diets in the included studies

Study	GI of low-GI diet	*n*	SE/SD	GI of control diet	*n*	SE/SD	*P**
Collier *et al.*[23]	68	7	3 SE	82	7	3 SE	<0·005
Brand *et al.*[22]	77	16	3 SE	91	16	3 SE	<0·01
Fontvieille *et al.*[24]	38	18	5 SD	64	18	2 SD	<0·001
Wolever *et al.*[32]	58	6	nr	86	6	nr	nr
Frost *et al.*[25]	77	30	1 SE	82	30	1 SE	<0·01
Luscombe *et al.*[29]	43	28	nr	63	28	nr	nr
Giacco *et al.*[26]	70	29	nr	90	25	nr	nr
Komindr *et al.*[30]	70	10	nr	100	10	nr	nr
Gilbertson *et al.*[27]	55	55	5 SD	CHO exchange diet	49		
Jimenez-Cruz *et al.*[28]	44	36	1 SE	56	36	1 SE	<0·0001
Rizkalla *et al.*[31]	39	12	1	719	12	1	<0·0001
Jenkins *et al.*[33]	70	106	nr	84 (high-cereal fibre diet)	104	nr	<0·001

1-12 ay süren çalışmalar

Cochrane Database of Systematic Reviews
21 JAN 2009 DOI: 10.1002/14651858.CD006296.pub2

Düşük ve yüksek glisemik indeksli diyetlerin karşılaştırıldığı Cochrane metanalizi

Primer sonlanım noktaları:

- Glisemik kontrol: HbA1c, fruktozamin vs.
- yan etki

Sekonder sonlanım noktaları:

- insülin etkisi (açlık plazma insülin, insülin duyarlılığı vs)
- morbidite
- yaşam kalitesi
- fiyat
- mortalite

Cochrane Database of Systematic Reviews
21 JAN 2009 DOI: 10.1002/14651858.CD006296.pub2

Düşük ve yüksek glisemik indeksli diyetlerin karşılaştırıldığı Cochrane metanalizi

Primer sonlanım noktaları:

- Glisemik kontrol: **Düşük Gİ ile HbA1c de%0.5 azalma**
- yan etki: **hipoglisemi oranı düşük Gİ de daha az.**

Sekonder sonlanım noktaları:

- insulin etkisi (açlık plasma insulin, insulin duyarlılığı vs)
- morbidite
- yaşam kalitesi
- fiyat
- mortalite

Cochrane Database of Systematic Reviews
21 JAN 2009 DOI: 10.1002/14651858.CD006296.pub2

Düşük ve yüksek glisemik indeksli diyetlerin karşılaştırıldığı Cochrane metanalizi

Primer sonlanım noktaları:

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Düşük Gİ ile HbA1c de%0.5 azalma

• yan etki: hipoglisemi oranı düşük Gİ de daha az.

Sekonder sonlanım noktaları:

• insulin etkisi (açlık plasma insulin, insulin duyarlılığı vs):**benzer**

• morbidite: **çalışma yok**

• yaşam kalitesi: **1 çalışmada düşük Gİ grubunda yaşam kalitesi daha iyi**

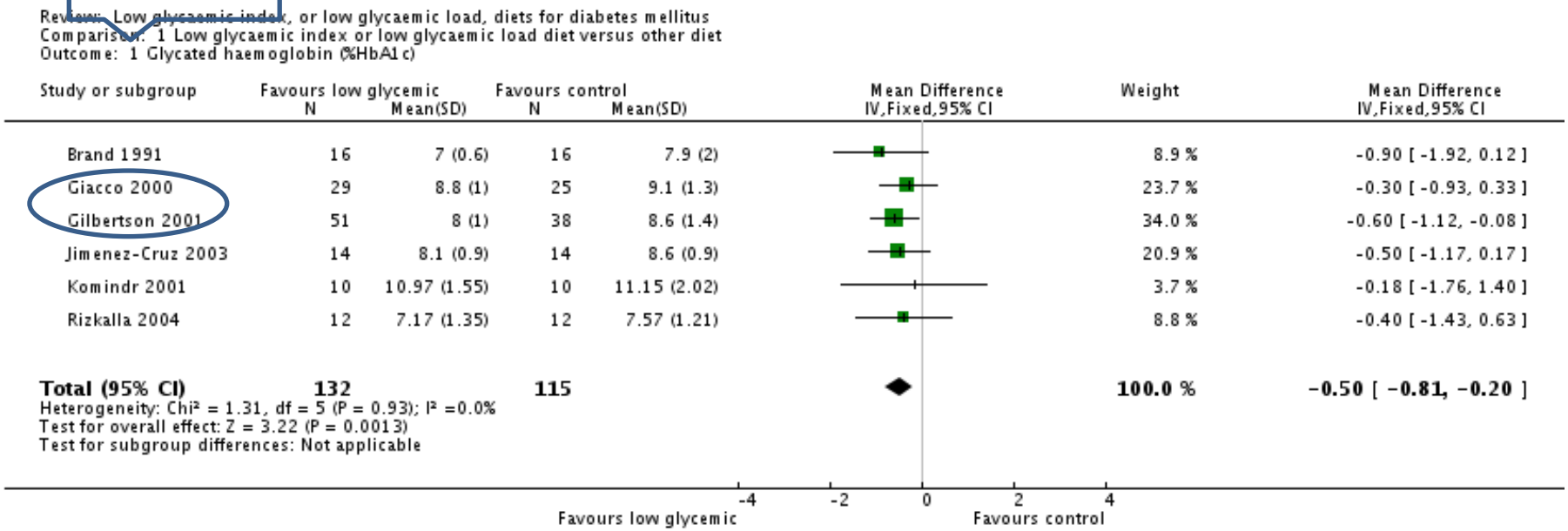
• fiyat:**çalışma yok**

• mortalite: **çalışma yok**

Cochrane Database of Systematic Reviews
21 JAN 2009 DOI: 10.1002/14651858.CD006296.pub2

Düşük ve yüksek glisemik indeksli diyetlerin karşılaştırıldığı Cochrane metanalizi

TİP 1 DM çalışmaları



HbA1c de %0.5 düşüş

Cochrane Database of Systematic Reviews
21 JAN 2009 DOI: 10.1002/14651858.CD006296.pub2

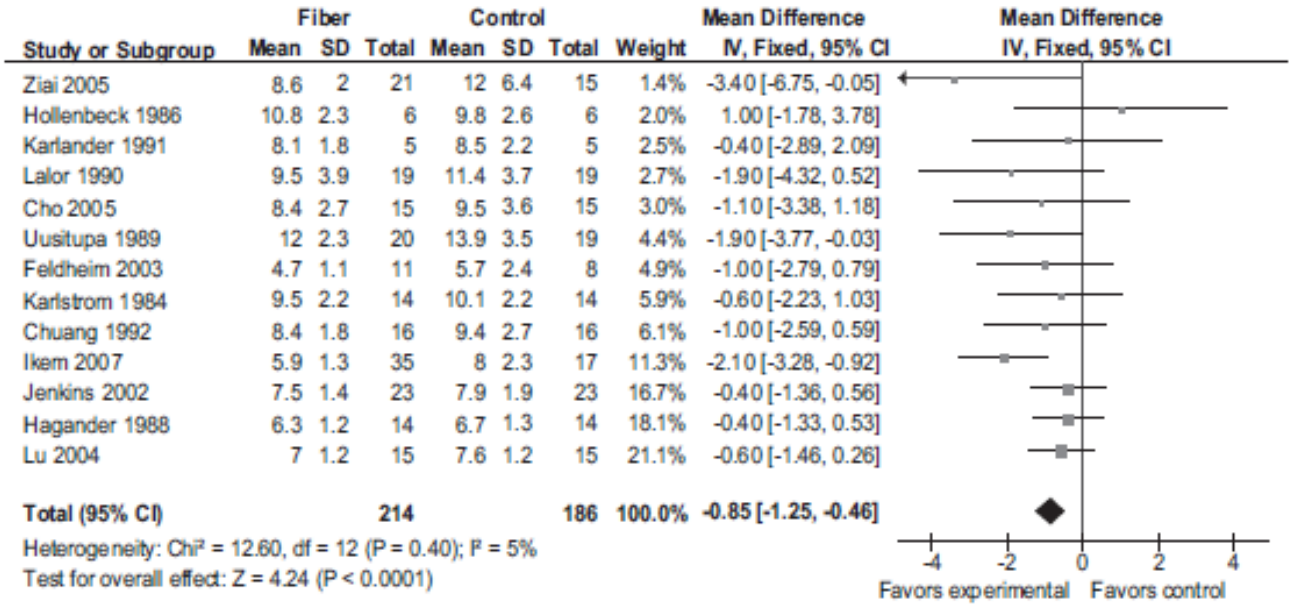
Lif içeriği

Table 1. Intervention Details of Included Studies

Study	Specific Fiber Type	Soluble Fiber	Intervention
Karlsrom 1984	Cereal and unknown	Soluble and insoluble	A high-fiber diet (42.4 g) versus a control diet (18.9 g fiber). Diets were identical in the proportion of carbohydrate, fat, protein, and cholesterol.
Hollenbeck 1986	Unknown	Unknown	A high-fiber diet (27 g/1000 kcal) versus a control diet (11 g fiber/1000 kcal). Diets were identical in the proportion of carbohydrate, fat, protein, and cholesterol.
Holman 1987	Guar gum	Soluble	Guar minitablets (5 g), taken 3 times a day taken immediately before the first mouthful of each meal and washed down with water. Of note, all patienes had achieved near-normal fasting plasma glucose levels before study began.
Hagander 1988	Cereal, beet, and leguminous	Soluble and insoluble	High-fiber versus low-fiber diets without changing energy intake or proportions of protein, fat, and carbohydrates.
Uusitupa 1989	Guar gum	Soluble	Guar gum granules (5 g), premixed with juice, milk, or water (1–2 dL), 3 times a day before main meals.
Lalor 1990	Guar gum	Soluble	Guar gum granules (5 g) at meal times 3 times daily.
Karlander 1991 (diet only arm)	Beet fiber	Soluble	Beet fiber (16 g) mixed into meals divided over 3 meals a day.
Chuang 1992	Guar gum	Soluble	Guar gum (5 g) taken before or with meals in a liquid form 3 times a day.
Chandalia 2000	Unfortified foods (e.g. cantaloupe, sweet potato, oatmeal)	Soluble and insoluble	A high-fiber diet (50 g) versus a control diet (24 g fiber). Diets were identical in the proportion of carbohydrate, fat, protein, and cholesterol.
Jenkins 2002	Cereal fiber	Soluble and insoluble	Bread and breakfast cereals high in cereal fiber were provided to add 19 g/day of additional cereal fiber compared with an additional 4 g/day of additional cereal fiber in the control group.
Feldheim 2003	Wheat fiber	Soluble and insoluble	Consumption of bread and crescents enriched with a dietary fiber concentrate.
Lu 2004	Arabinoxylan-rich fiber	Soluble and insoluble	Usual diet supplemented with arabinoxylane fiber-enriched bread and muffins compared with non–fiber-enriched bread and muffins in the control group.
Cho 2005	*Cassia tora* fiber	Soluble	Two 2-g packets per day ingested after meals, i.e., one packet each after morning and evening meal.
Ziai 2005	*Plantago ovata* Forsk (Psyllium)	Soluble and insoluble	Fiber supplement (5.1 g) in 250 mL of water twice a day, 20–30 minutes before the morning and evening meals.
Ikem 2007	Unknown	Unknown	A high-fiber diet (40 g of fiber added) versus a control diet. Diets were similar in the proportion of carbohydrate, fat, and protein.

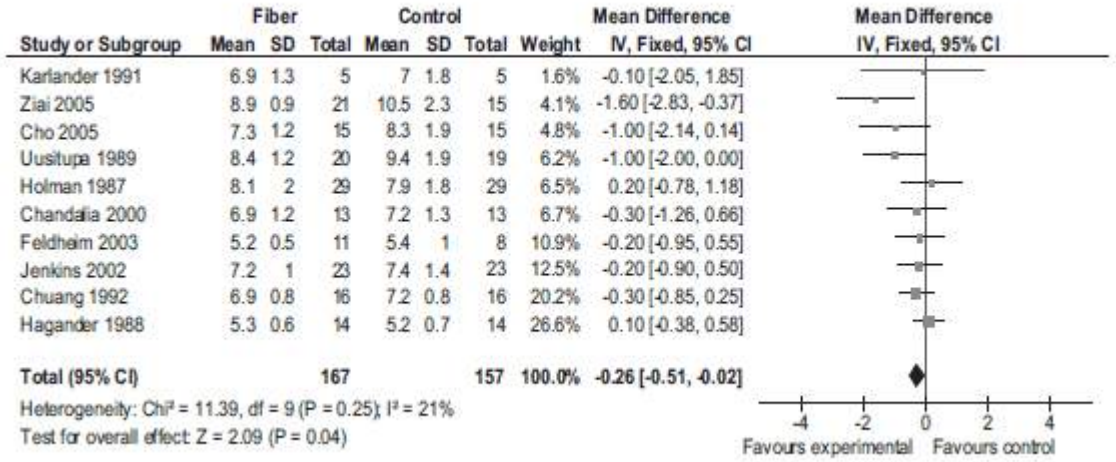
Yüksek lifli diyetler
Çözünebilir lif supp
Çözünmez lif supp

Figure 2. Forest plot for fasting blood glucose. Mean, SD, and mean difference are shown in units of mmol/L.



Lif içeren diyet açlık kan şekerinde 15.32mg/dl azalma

Figure 3. Forest plot for glycosylated hemoglobin.



Study or Subgroup	Fiber Mean	Fiber SD	Fiber Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
Karlander 1991	6.9	1.3	5	7	1.8	5	1.6%	-0.10 [-2.05, 1.85]
Ziai 2005	8.9	0.9	21	10.5	2.3	15	4.1%	-1.60 [-2.83, -0.37]
Cho 2005	7.3	1.2	15	8.3	1.9	15	4.8%	-1.00 [-2.14, 0.14]
Uusitupa 1989	8.4	1.2	20	9.4	1.9	19	6.2%	-1.00 [-2.00, 0.00]
Holman 1987	8.1	2	29	7.9	1.8	29	6.5%	0.20 [-0.78, 1.18]
Chandalia 2000	6.9	1.2	13	7.2	1.3	13	6.7%	-0.30 [-1.26, 0.66]
Feldheim 2003	5.2	0.5	11	5.4	1	8	10.9%	-0.20 [-0.95, 0.55]
Jenkins 2002	7.2	1	23	7.4	1.4	23	12.5%	-0.20 [-0.90, 0.50]
Chuang 1992	6.9	0.8	16	7.2	0.8	16	20.2%	-0.30 [-0.85, 0.25]
Hagander 1988	5.3	0.6	14	5.2	0.7	14	26.6%	0.10 [-0.38, 0.58]
Total (95% CI)			**167**			**157**	**100.0%**	**-0.26 [-0.51, -0.02]**

Heterogeneity: $Chi^2 = 11.39$, df = 9 (P = 0.25); $I^2 = 21\%$
Test for overall effect: Z = 2.09 (P = 0.04)

Lif içeren diyet açlık HbA1c de %0.26 azalma

- Bu çalışmalarda ortalama lif oranı artışı 18g/gün.
- Bunun için bir tabak yüksek lifli tahıl ve diğer öğünlerde biraz sebze eklenmesiyle elde edilebilir.

EURODİAB
2108 tip 1 diyabetik
Takip 7.4 yıl
148 KVH
46 tüm nedenlere bağlı ölüm
Ortalama yaş:31 yıl
Diyabet yaşı: 13 yıl

Table 1 Baseline characteristics of type 1 diabetic patients in the EURODIAB PCS according to tertiles of dietary fibre intake (n=2,108)

Characteristic	Tertiles of fibre intake[a]			p value for trend
	1	2	3	
n	702	703	703	
Mean follow-up, years	7.3±0.9	7.3±1.1	7.2±1.0	0.03
Age, years	31.0±9.1	32.3±9.8	32.9±10.1	0.0003
Sex, n (%) male	393 (65.0)	330 (46.9)	358 (50.9)	0.06
Diabetes duration, years	13.1 (7.8–18.7)	13.0 (7.3–19.7)	12.8 (6.7–20.3)	0.41
HbA_{1c}, % (mmol/mol)	8.3±2.0 (67.2)	8.0±1.8 (63.9)	8.0±1.9 (63.9)	0.003
Daily insulin dose, units/kg	0.7 (0.6–0.8)	0.7 (0.5–0.8)	0.6 (0.5–0.8)	0.002
Daily insulin frequency, injections/day	2.0 (2.0–3.0)	3.0 (2.0–3.0)	3.0 (2.0–3.0)	0.03
Systolic blood pressure, mmHg	119.1±16.4	120.2±16.8	120.8±17.1	0.06
Diastolic blood pressure, mmHg	75.1±11.2	75.0±11.2	75.1±11.2	0.9
Antihypertensive use, n (%)	42 (6.0)	54 (7.8)	63 (9.0)	0.03
BMI, kg/m^2	23.6±2.8	23.4±2.6	23.4±2.9	0.16
Triacylglycerol, mmol/l	0.9 (0.7–1.3)	0.9 (0.7–1.3)	0.8 (0.7–1.1)	0.02
Total cholesterol, mmol/l	5.4±1.1	5.3±1.1	5.3±1.2	0.05
HDL-cholesterol, mmol/l	1.5±0.4	1.5±0.4	1.5±0.4	0.51
LDL-cholesterol, mmol/l	3.4±1.0	3.3±1.0	3.3±1.0	0.15
Total/HDL-cholesterol ratio, mmol/l	3.4±1.4	3.4±1.1	3.4±1.2	0.28
Physical inactivity, n (%)	15 (2.2)	18 (2.6)	27 (3.9)	<0.0001
Mild physical activity ≥1 time/week, n (%)	230 (33.2)	241 (34.7)	195 (28.2)	<0.0001
Moderate physical activity ≥1 time/week, n (%)	237 (34.3)	214 (30.8)	241 (34.8)	0.24
Vigorous physical activity ≥1 time/week, n (%)	210 (30.4)	222 (31.9)	229 (33.1)	<0.0001
Ever-smoker, n (%)	382 (54.4)	332 (47.2)	304 (43.2)	<0.0001
Alcohol intake, g/day	2.4 (0.0–13.0)	1.0 (0.0–8.8)	0.0 (0.0–5.3)	<0.0001
None, n (%)	293 (41.7)	338 (48.1)	392 (55.8)	<0.0001
≤20 g/day, n (%)	290 (41.3)	275 (39.1)	264 (37.6)	<0.0001
>20 g/day, n (%)	119 (17.0)	90 (12.8)	47 (6.7)	<0.0001
Total energy intake, kJ/day	9,824.3 (8,177.4–12,170.6)	9,279.0 (7,722.2–11,155.8)	9,905.0 (8,254.4–11,951.4)	0.84
Total fat, g/day[a]	106.1 (93.8–118.5)	98.3 (88.2–108.9)	98.8 (79.7–100.2)	<0.0001
SFA, g/day[a]	40.2 (34.8–46.4)	37.0 (32.2–42.6)	32.3 (27.6–38.2)	<0.0001
SFA, en%	15.1 (12.9–17.4)	13.8 (11.7–16.3)	12.1 (10.0–14.2)	<0.0001
MUFA, g/day[a]	40.8 (35.3–48.2)	38.6 (33.6–45.7)	34.7 (29.5–41.8)	<0.0001
PUFA, g/day[a]	14.7 (11.3–19.8)	14.5 (11.3–18.8)	14.0 (10.5–18.6)	0.004
Total fibre, g/day[a]	13.4 (11.3–14.7)	18.6 (17.2–19.8)	25.2 (22.8–28.3)	<0.0001
Total fibre, g/1000 kcal	5.6 (4.9–6.2)	7.9 (7.3–8.4)	10.7 (9.8–12.2)	<0.0001
Soluble fibre, g/day[a]	4.2 (3.5–4.7)	5.8 (5.3–6.4)	7.9 (7.1–9.2)	<0.0001
Insoluble fibre, g/day[a]	8.9 (7.6–9.9)	12.5 (11.7–13.5)	17.3 (15.6–19.5)	<0.0001

Diabetologia (2012) 55:2132–2141

EURODIAB lif alımı

- Diyet lif oranındaki artış ile KVH riski ve tüm nedenlere bağlı mortalitede azalma
- Çözünebilir lif ile ilişki çözünemeyene göre daha kuvvetli
- Doymuş yağ ile KVH ve tüm nedenlere bağlı mortalite arasında ilişki gösterilememiş
- Doymuş yağ; PUFA, MUFA veya KH ile yer değiştirdiğinde de anlamlı ilişki yok.

Diabetologia (2012) 55:2132–2141

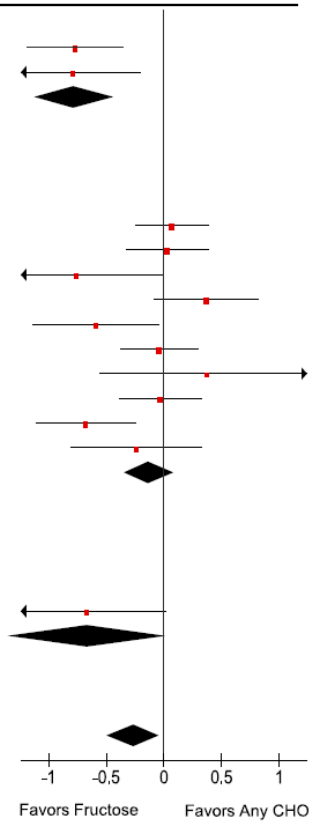
Fruktozun glisemik kontrol üzerindeki etkisi

Karışık ve sıvı fruktoz nişasta ve sukroz ile karşılaştırılmış.

Glukoz ve insülinde değişiklik yok

A Glycated Blood Proteins

Study or Subgroup	Year	Participants	% Weight	Mean Difference (95% CI) in HbA1c (%)
Type 1 Diabetes Mellitus				
Bantle et al. [15]	1986	12	8,8%	-0 77 [-1,18, -0,36]
Bantle et al. [20]	1992	6	6,7%	-0,79 [-1,38, -0,20]
Subtotal			15.5%	-0.78 [-1.11, -0.44]
Heterogeneity: Tau² = 0,00; Chi² = 0,00, df = 1 (P = 0,96); I² = 0%				
Test for overall effect: Z = 4.51 (P < 0.00001)				
Type 2 Diabetes Mellitus				
Malerbi et al. [9]	1996	16	10.0%	0.07 [-0.24, 0.38]
Bantle et al. [15]	1986	12	9,5%	0,03 [-0,32, 0,38]
Osei et al. [11]	1987	18	5,2%	-0,76 [-1,50, -0,02]
Grigoresco et al. [21]	1988	8	8.3%	0.37 [-0.08, 0.82]
Osei et al. [10]	1989	13	7.1%	-0.59 [-1.14, -0.04]
Anderson et al. [12]	1989	14	9.8%	-0.04 [-0.37, 0.29]
Thorburn et al. [22]	1990	6	4,0%	0,37 [-0.55, 1,29]
Bantle et al. [20]	1992	12	9,5%	-0,03 [-0,38, 0,32]
Koivisto et al. [13]	1993	10	8.5%	-0.68 [-1.11, -0.25]
Vaisman et al. [23]	2006	25	6.9%	-0.24 [-0.81, 0.33]
Subtotal			78,8%	-0,13 [-0,34, 0,09]
Heterogeneity: Tau² = 0,06; Chi² = 20,35, df = 9 (P = 0,02); I² = 56%				
Test for overall effect: Z = 1.18 (P = 0.24)				
Undifferentiated Diabetes				
Blayo et al. [14]	1990	20	5,7%	-0,67 [-1,36, 0,02]
Subtotal			5,7%	-0,67 [-1,36, 0,02]
Heterogeneity: Tau² = 0,01; Chi² = 13,00, df = 12 (P = 0,37); I² = 8%				
Test for overall effect: Z = 1.12 (P = 0.26)				
Total		172	100.0%	-0.27 [-0.49, -0.04]
Heterogeneity: Tau² = 0,10; Chi² = 35,80, df = 12 (P = 0,0003); I² = 66%				
Test for overall effect: Z = **2.33 (P = 0.02)**				
Test for subgroup differences: Chi² = 11.06, df = 2 (P = 0.004), I² = 81.9%				

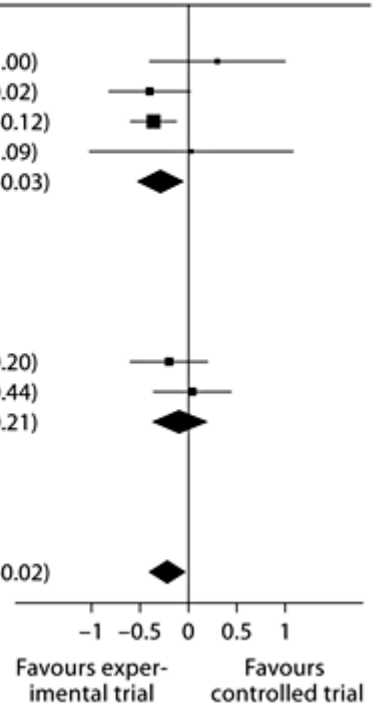


DIABETES CARE, VOLUME 35, JULY 2012

Düşük ve yüksek MUFA diyet karşılaştırılması

Yüksek MUFA diyet ile:
Glukoz ve insülin değerlerinde değişiklik yok.
HbA1c de %0.21 lik düşüş +

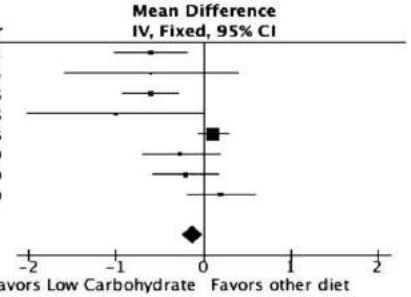
Study or sub-group	High MUFA mean	SD	total	Low MUFA mean	SD	total	Weight %	Mean difference IV, random (95% CI)
1.7.1 High MUFA vs. LF								
Brehm et al., 2009	7.5	1.95	43	7.2	1.44	52	6.6	0.30 (−0.40 to 1.00)
Elhayany et al., 2010	6.3	1.4	61	6.7	0.9	55	16.4	−0.40 (−0.82 to 0.02)
Esposito et al., 2009	6.85	0.9	108	7.21	0.9	107	38.4	−0.36 (−0.60 to −0.12)
Shai et al., 2008	7.31	1.03	8	7.28	1.19	9	3.0	0.03 (−1.03 to 1.09)
Subtotal			220			223	64.4	−0.28 (−0.52 to −0.03)
Heterogeneity: $\tau^2 = 0.01$, $\chi^2 = 3.63$, d.f. = 3 (p = 0.30), $I^2 = 17\%$								
Test for overall effect: Z = 2.19 (p = 0.03)								
1.7.2 High MUFA vs. LGI								
Elhayany et al., 2010	6.3	1.4	61	6.5	0.8	63	17.8	−0.20 (−0.60 to 0.20)
Wolever et al., 2008	6.62	0.938	50	6.58	1.117	50	17.7	0.04 (−0.36 to 0.44)
Subtotal			111			113	35.6	−0.08 (−0.37 to 0.21)
Heterogeneity: $\tau^2 = 0.00$, $\chi^2 = 0.68$, d.f. = 1 (p = 0.41), $I^2 = 0\%$								
Test for overall effect: Z = 0.55 (p = 0.58)								
Total (95% CI)			331			336	100.0	−0.21 (−0.40 to −0.02)
Heterogeneity: $\tau^2 = 0.01$, $\chi^2 = 5.89$, d.f. = 5 (p = 0.32), $I^2 = 15\%$								
Test for overall effect: Z = 2.22 (p = 0.03)								
Test for subgroup differences: $\chi^2 = 1.03$, d.f. = 1 (p = 0.31), $I^2 = 2.9\%$								



A Difference in Hb A_{1c} low-carbohydrate versus other diets

Study or Subgroup	Mean Difference	SE	Weight	Mean Difference IV, Fixed, 95% CI	Year
Samaha 2003 [32]	-0.6	0.2133	8.1%	-0.60 [-1.02, -0.18]	2003
Stern 2004 [33]	-0.6	0.5102	1.4%	-0.60 [-1.60, 0.40]	2004
Haimoto 2008 [8]	-0.6	0.1611	14.1%	-0.60 [-0.92, -0.28]	2008
Westman 2008 [42]	-1	0.5173	1.4%	-1.00 [-2.01, 0.01]	2008
Wolever-1 2008 [38]	0.11	0.0868	48.6%	0.11 [-0.06, 0.28]	2008
Davis 2009 [7]	-0.26	0.2254	7.2%	-0.26 [-0.70, 0.18]	2009
Elhayany-1 2010 [37]	-0.2	0.191	10.0%	-0.20 [-0.57, 0.17]	2010
Iqbal 2010 [43]	0.2	0.2	9.2%	0.20 [-0.19, 0.59]	2010
Total (95% CI)			**100.0%**	**-0.12 [-0.24, -0.00]**	

Heterogeneity: $Chi^2 = 27.86$, $df = 7$ ($P = 0.0002$); $I^2 = 75\%$
Test for overall effect: $Z = 2.02$ ($P = 0.04$)



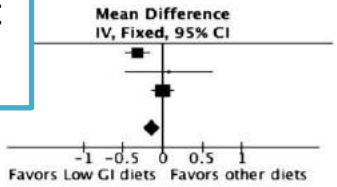
Difference in low carbohydrate vs. 'other' diets. 'Other' diets compared were low fat (Samaha [32], Haimoto [8], Davis [7] and Iqbal [43]), Low GI (Westman [42] and Wolever-1[38]), Mediterranean (Elhayany-1[37]) and conventional high CHO (Stern [33])
Wolever-1 [38] is the c
Elhayany-1 [37] is the c the study.

Akdeniz diyeti ADA ve benzeri diyetlere göre daha fazla HbA1c düşürmüş

B Difference

Study or Subgroup						
Jenkins 2008 [34]						
Ma 2008 [39]						
Wolever-2 2008 [38]						
Total (95% CI)			**181**	**172**	**100.0%**	**-0.14 [-0.24, -0.03]**

Heterogeneity: $Chi^2 = 9.80$, $df = 2$ ($P = 0.007$); $I^2 = 80\%$
Test for overall effect: $Z = 2.63$ ($P = 0.008$)



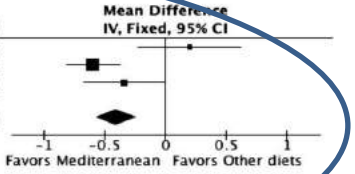
Difference in low-GI vs. 'other' diets. 'Other' diets compared were high fiber (Jenkins [35]), high GI (Wolever-2 [38]), ADA (Ma [39]).
Wolever-2 [38] is the comparison between the low-GI and high-GI arms of the study.

C Difference in Hb A_{1c} Mediterranean versus other diets

Study or Subgroup	Mean Difference	SE	Mediterranean Total	Other diets Total	Weight	Mean Difference IV, Fixed, 95% CI
Elhayany-2 2010 [37]	0.2	0.2164	63	65	15.8%	0.20 [-0.22, 0.62]
Esposito 2008 [36] (1)	-0.6	0.1124	108	107	58.5%	-0.60 [-0.82, -0.38]
Toobert 2003 [35]	-0.34	0.1693	137	108	25.8%	-0.34 [-0.67, -0.01]
Total (95% CI)			**308**	**280**	**100.0%**	**-0.41 [-0.58, -0.24]**

Heterogeneity: $Chi^2 = 10.97$, $df = 2$ ($P = 0.004$); $I^2 = 82\%$
Test for overall effect: $Z = 4.73$ ($P < 0.00001$)

(1) For Esposito 2008, data for outcome at 1 year

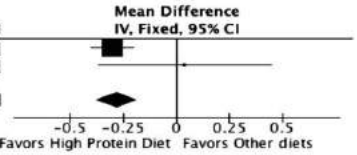


Difference in Mediterranean vs. 'other' diets. 'Other' diets were 'usual care' (Toobert [36]), ADA (Esposito [36] and Elhayany-2 [37]).
Elhayany-2 [37] is the comparison between the traditional Mediterranean and ADA arms of the study.

D Difference in Hb A_{1c} high-protein versus other diets

Study or Subgroup	Mean Difference	SE	High Protein Total	Other diets Total	Weight	Mean Difference IV, Fixed, 95% CI
Brinkworth 2004 [44]	-0.3	0.051	19	19	94.4%	-0.30 [-0.40, -0.20]
Larsen 2011 [40]	0.04	0.2092	53	46	5.6%	0.04 [-0.37, 0.45]
Total (95% CI)			**72**	**65**	**100.0%**	**-0.28 [-0.38, -0.18]**

Heterogeneity: $Chi^2 = 2.49$, $df = 1$ ($P = 0.11$); $I^2 = 60\%$
Test for overall effect: $Z = 5.67$ ($P < 0.00001$)

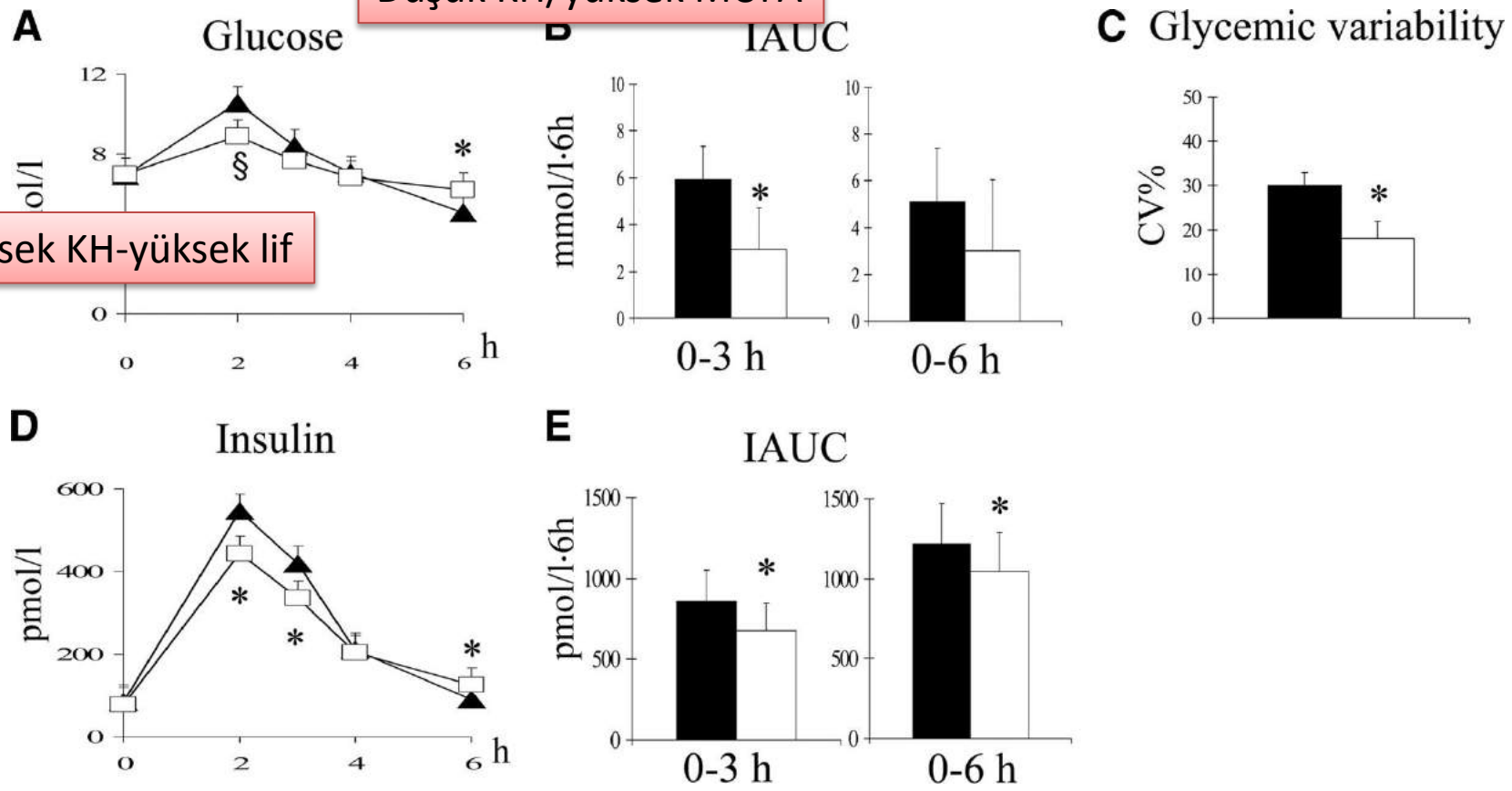


Difference in high protein vs. 'other' diets. 'Other' diets compared were low protein (Brinkworth [44]) and high carbohydrate (Larsen [40]).

Olubukola Ajala et al. Am J Clin Nutr 2013;97:505-516

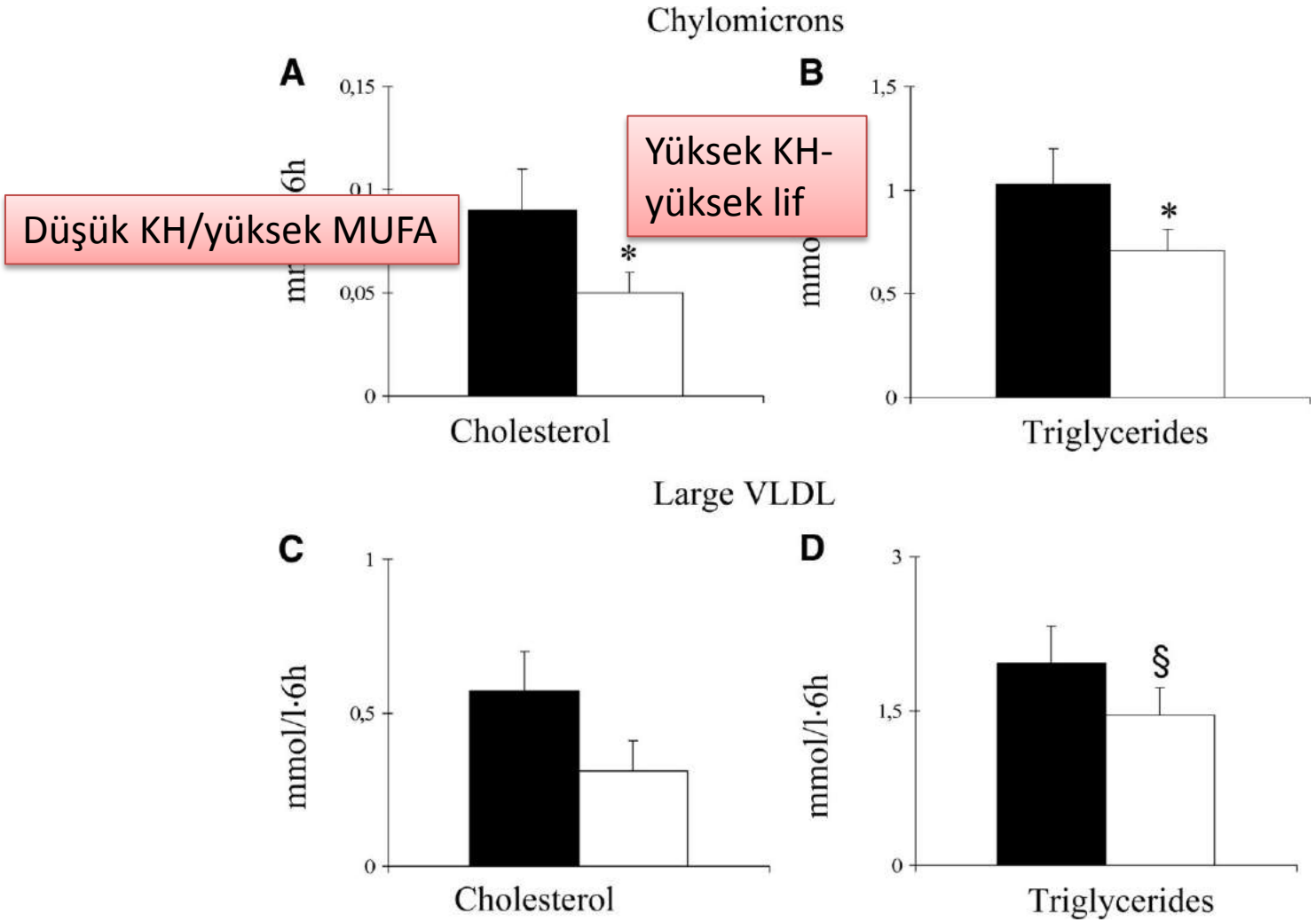
Düşük KH/yüksek MUFA

Yüksek KH-yüksek lif



Yüksek KH-lif diyeti ile glisemik cevap daha düşük

Claudia De Natale et al. Dia Care 2009;32:2168-2173



Düşük KH/yüksek MUFA

Yüksek KH-yüksek lif

Claudia De Natale et al. Dia Care 2009;32:2168-2173

Food Order Has a Significant Impact on Postprandial Glucose and Insulin Levels

Diabetes Care 2015;38:e98–e99 | DOI: 10.2337/dc15-0429

Metformin ile tdv edilen 11 T2DM
12-saat açlık sonrası isokalorik yemek(628 kcal: 55 g protein, 68 g karbonhidrat, 16 g yağ) :
İlk vizitte KH ve 15 dakika sonra pr veyağ 1 hafta sonra tam tersi
Sebze ve protein önce yenilirse kan glukozu ve insülin düzeyleri düşmüş.

Table 1—Glucose and insulin levels/iAUC for various time points/intervals during the two visits

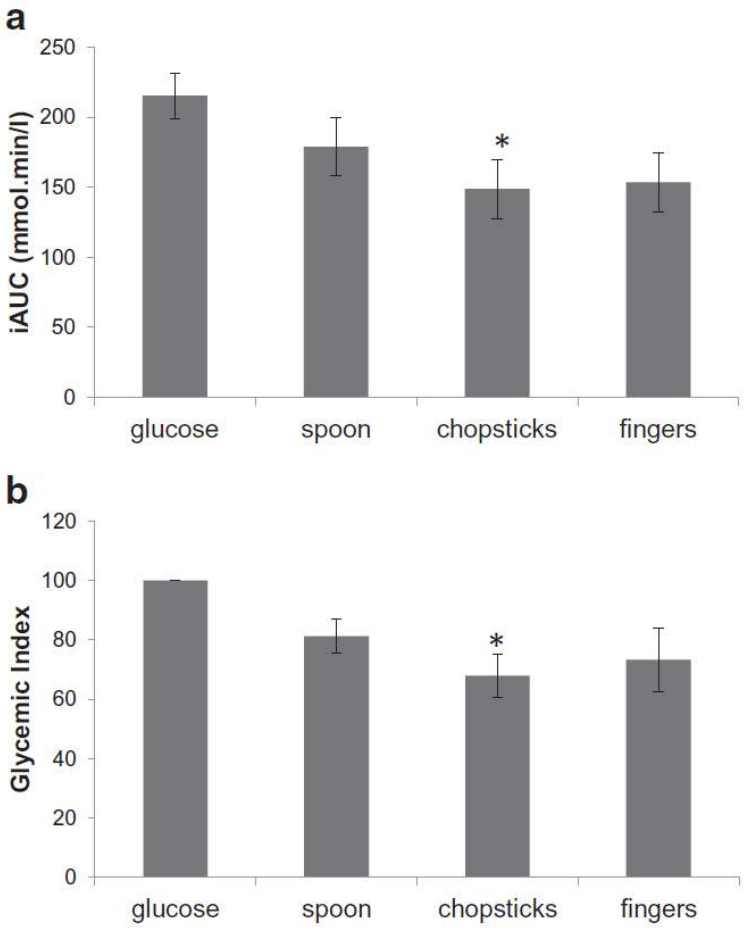
	Time (min)	Carbohydrates first	Carbohydrates last	P^c	Change (%)
Blood glucose (mg/dL)[a]	0	106.7 ± 5.3	107.3 ± 6.3	0.752	0.5
	30	156.8 ± 8.2	112.0 ± 5.8	0.001	−28.6
	60	199.4 ± 12.2	125.6 ± 6.9	0.001	−37.0
	120	169.2 ± 13.8	140.8 ± 7.7	0.030	−16.8
Serum insulin (μIU/mL)[a]	0	18.8 ± 2.4	16.3 ± 1.4	0.154	−13.6
	30	62.4 ± 8.6	42.9 ± 9.7	0.083	−31.2
	60	125.4 ± 20.1	63.2 ± 11.0	0.002	−49.6
	120	152.0 ± 31.7	90.9 ± 16.6	0.014	−40.2
Glucose iAUC (mg/dL × min)[b]	0–30	751.4 ± 71.0	90.0 ± 26.8	0.001	−88.0
	0–60	3,396.8 ± 606.9	444.2 ± 103.8	0.001	−86.9
	0–120	7,545.0 ± 804.4	2,001.5 ± 376.9	0.001	−73.5
Insulin iAUC (μIU/mL × min)[b]	0–30	657.5 ± 131.8	399.5 ± 132.6	0.102	−39.2
	0–60	2,908.5 ± 432.0	1,510.5 ± 407.4	0.002	−48.1
	0–120	10,097.9 ± 1,646.9	5,202.8 ± 1,061.6	0.002	−48.5

Data are means ± SEM, $n = 11$. [a]Blood samples were collected immediately before the meal ($t = 0$ min) and at 30, 60, and 120 min after the start of the meal. [b]Intervals were measured in minutes from the start of the meal. [c]*P* values were calculated using the Wilcoxon matched-pairs signed rank test.

The impact of eating methods on eating rate and glycemic response in healthy adults

Pirincin yeme yöntemi ve glisemik indeksi

Çubukla daha yavaş yeniyor ve daha fazla çiğneniyor
GLP-1 in etkisini arttırıyor



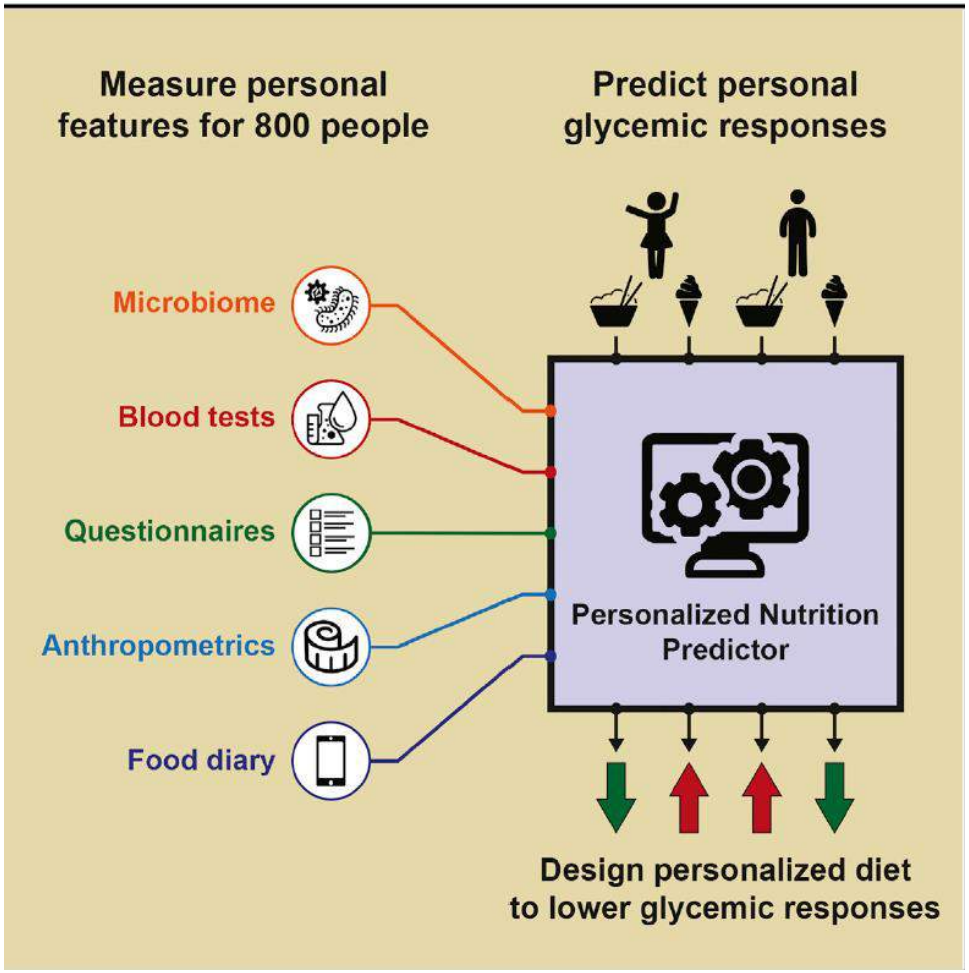
L. Sun et al. / Physiology & Behavior 139 (2015) 505–510

Beslenme-yenilikler

Cell

Personalized Nutrition by Prediction of Glycemic Responses

- Kişiye özel beslenme algoritması



Cell *163*, 1079–1094, November 19, 2015

Little Change in Diet After Onset of Type Diabetes, Metabolic Syndrome, and Obesity in Middle-Aged Adults: 11-Year Follow-up Study

Diabetes Care 2016;39:e29–e30 | DOI: 10.2337/dc15-2094

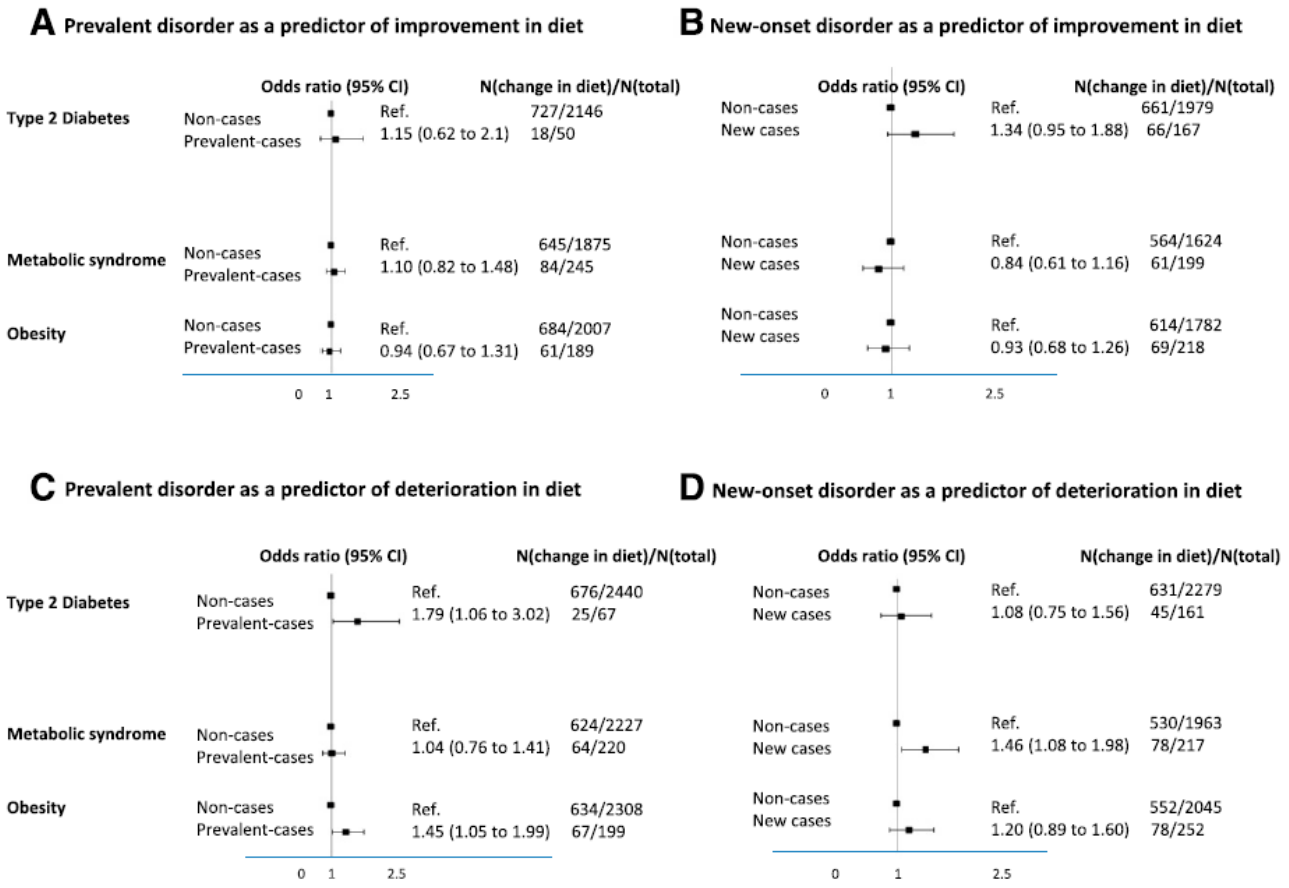


Figure 1—Prevalent (*A* and *C*) and new-onset (*B* and *D*) metabolic disorders as predictors of an improved diet in participants with an unhealthy diet (*A* and *B*) and predictors of deterioration in diet in participants with a healthy diet (*C* and *D*). Odds ratio (95% CI) are adjusted for age, sex, ethnicity, socioeconomic status, marital status, total energy intake, smoking, alcohol consumption, and physical activity.

Sonuç: Yağ

- Yağ türü miktarından daha önemli
- Kilo verme isteniyorsa yağ kısıtlanabilir
- MUFA içeren diyetler (Akdeniz diyeti): glisemik kontrol, klio kontrolü ve KVH açısından olumlu tercih edilmeli
- PUFA için balık, çerez vs omega içeren diyetler
- Omega supp alınmamalı: etkinlik yok.
- Doymuş yağ <%10 olmalı
- Kolesterol <300mg altında
- Trans yağ mümkün olduğunca alınmamalı.

Sonuç: Karbonhidrat

- Miktarı kişisel olarak belirlenmeli
- Glisemik indeks: tartışmalar çok.
  - Pratik?
  - mümkün olduğunca glisemik indeks düşük besinler tercih edilmeli
- Lif:kadınlar günde 25gr erkekler 38gr/gün
- Fruktoz: serbest fruktoz (meyve) olarak toplam enerjinin %12 sini geçmeyecek şekilde alınmalı