



بررسی اثر ناشتایی متناوب بر کاهش وزن



اشتباه میکنی همین دیروز ناشتا
بودی کافیه دیگه!

ارائه دهنده:
سامان پورجعفرآبادی



رژیمت رو رعایت کن امروز باید
ناشتا باشی

استاد راهنما:
سرکار خانم زهره حسینی



23 April 2019
Class:235

Effect of Intermittent fasting on weight loss



You made a mistake just yesterday, you were fast enough!

By:
Saman pourjafarabadi



Follow your diet you should be fast today

Supervisor:
Mrs Zohreh Hosseini



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صفحه	عنوان
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علامت اختصاری	معادل انگلیسی	معادل فارسی
IF	Intermittent Fasting	ناشتایی متناوب
ADF	Alternate day fasting	ناشتایی یک روز در میان
BMI	Body mass index	شاخص توده بدنی
DRF	Day Restricted Feeding	محدودیت روزانه غذا خوردن
CR	Moderate Daily Caloric Restriction	محدودیت متوسط کالری دریافتی
SI	Insulin Sensitivity Index	شاخص حساسیت به انسولین
DER	Daily Energy Restriction	محدودیت انرژی روزانه
TRF	Time Restricted Feeding	محدودیت زمان غذا خوردن
LF	Low-Fat	کم چرب
HF	High-Fat	پر چرب
LF	Losing Weight	کاهش وزن

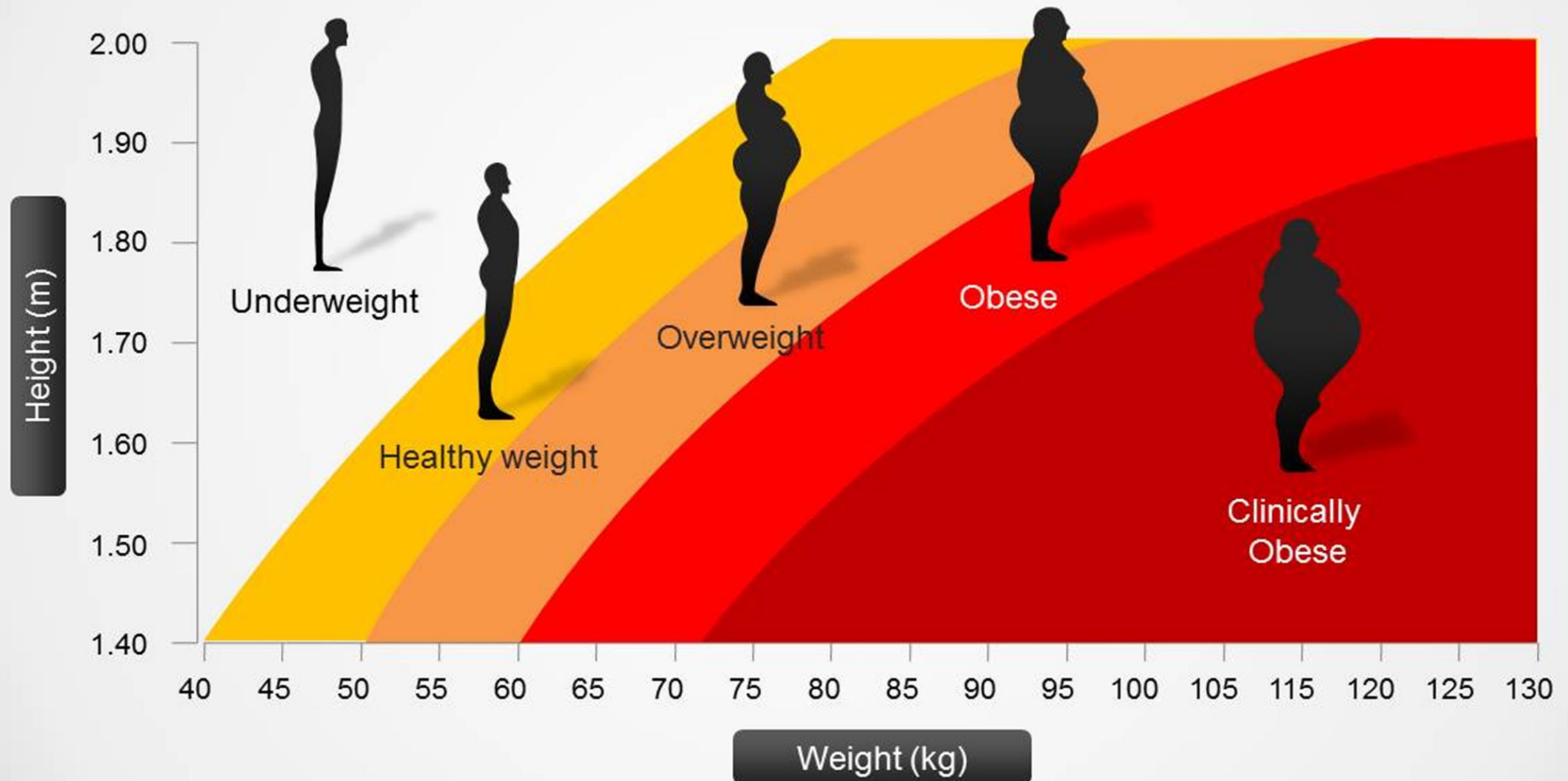
علامت اختصاری	معادل انگلیسی	معادل فارسی
IGF-1	Insulin-like growth factor 1	فاکتور رشد مشابه انسولین
WC	Waist circumference	دور کمر
HDL	High Density Lipoprotein	لیپوپروتئین با چگالی بالا
HOMA-IR	Homeostasis Model Assessment of Insulin Resistance	ارزیابی مدل هومیوستاز از مقاومت به انسولین
HS CRP	High-Sensitivity C-Reactive Protein	پروتئین واکنش پذیر با حساسیت بالا
LDL	Low-Density Lipoprotein	لیپوپروتئین با تراکم کم
CVD	Cardiovascular disease	بیماری قلب و عروقی
BDNF	Brain-Derived Neurotrophic Factor	فاکتور نوروپاتیک مغز استخوان

مقدمه



BMI Chart Template

مقدمه (ادامه)



مقدمه (ادامه)

ژنتیک

رژیم غذایی
ناسالم

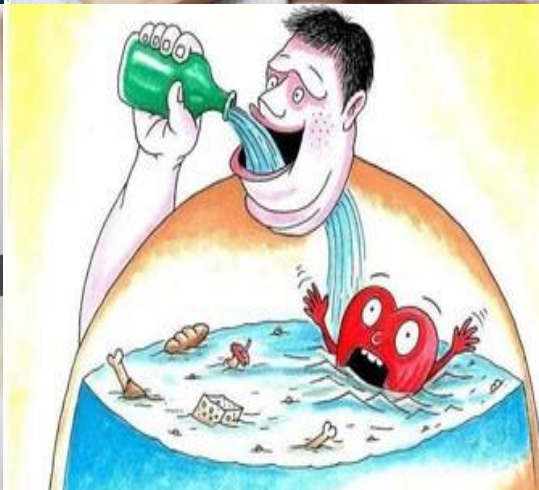
پرخوری

خواب
ناکافی

چاقی

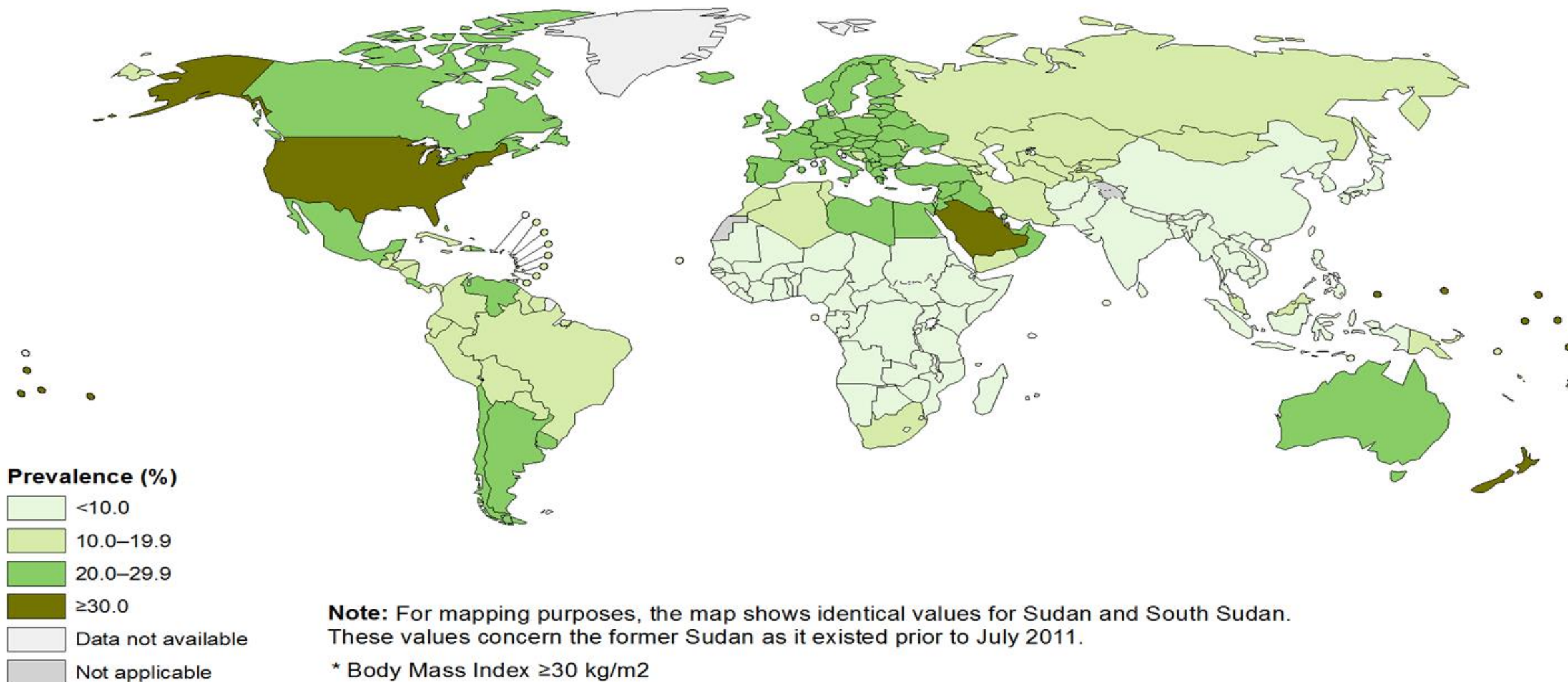
داروها

عدم فعالیت
فیزیکی



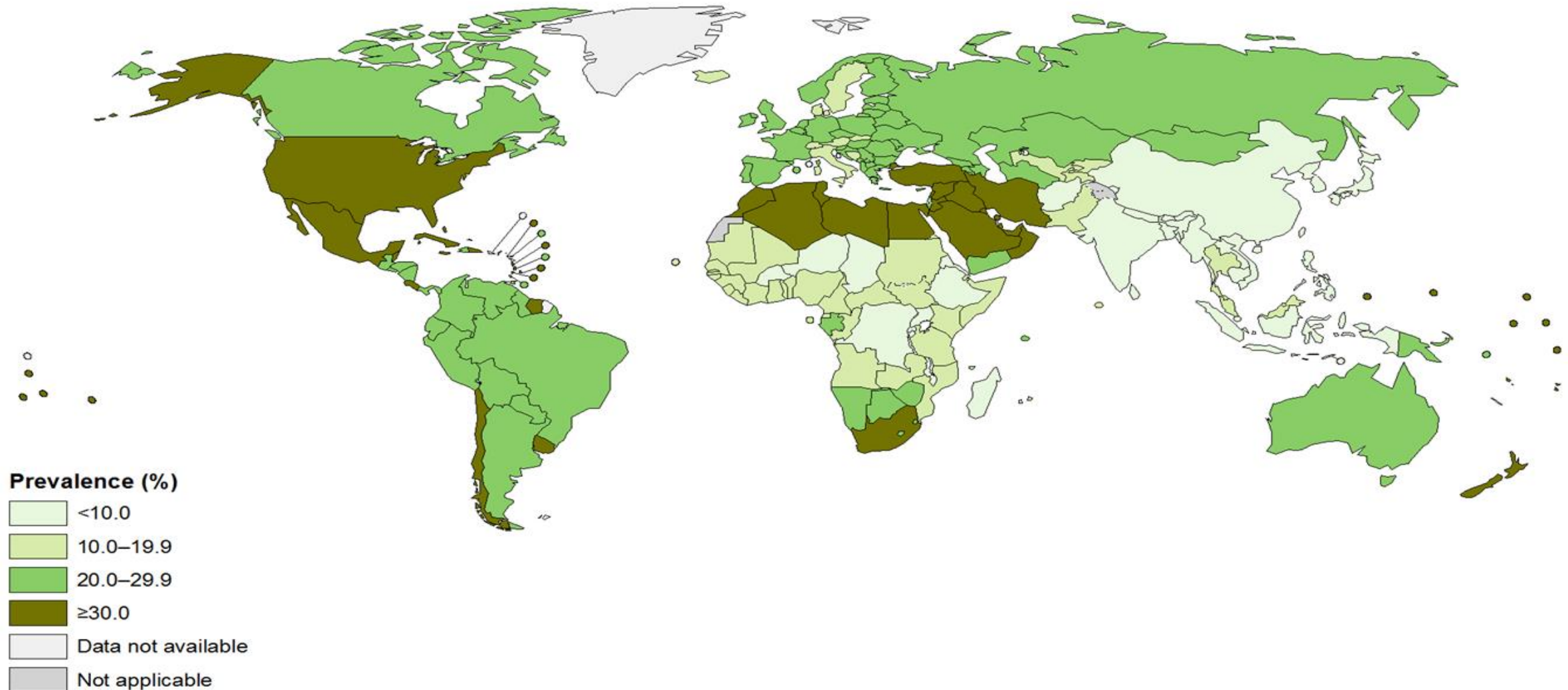
Prevalence of obesity*, ages 18+, 2016 (age standardized estimate)
Male

مقدمه (ادامه)



Prevalence of obesity*, ages 18+, 2016 (age standardized estimate)
Female

مقدمه (ادامه)



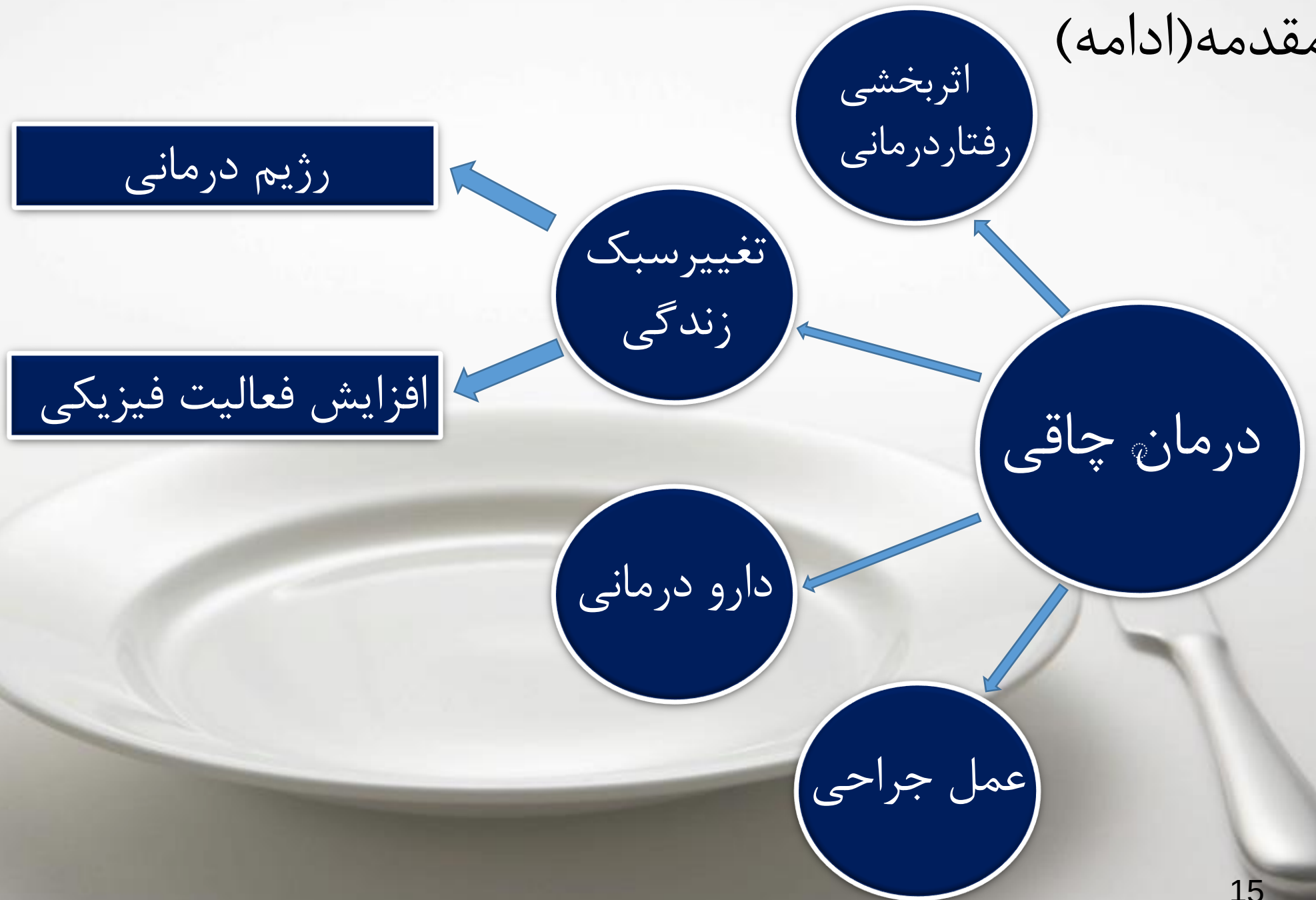


- در سال ۲۰۱۶ بیش از ۱,۹ میلیارد نفر از بزرگسالان ۱۸ ساله و بالاتر دارای اضافه وزن بودند از این تعداد بیش از ۶۵۰ میلیون بزرگسال چاق بودند.
- به طور کلی، در سال ۲۰۱۶ حدود ۱۳٪ از جمعیت بزرگسال جهان (۱۱٪ مردان و ۱۵٪ زنان) چاق بودند.

بیماری های مزمن و چاقی



مقدمه (ادامه)





- بهترین راه برای کاهش میزان کالری دریافتی استفاده از رژیم غذایی مناسب (Diet plan) است.
- رژیم غذایی: به دوره های منظم غذا خوردن و نوشیدن توسط یک شخص یا حیوان با توجه به نیازها و تمایلات او گفته می شود.



Types of MCR Diets

**Low
carbohydrate**

**Low
protein**

**High
protein**

Low fat

Zone Diet

Atkins Diet

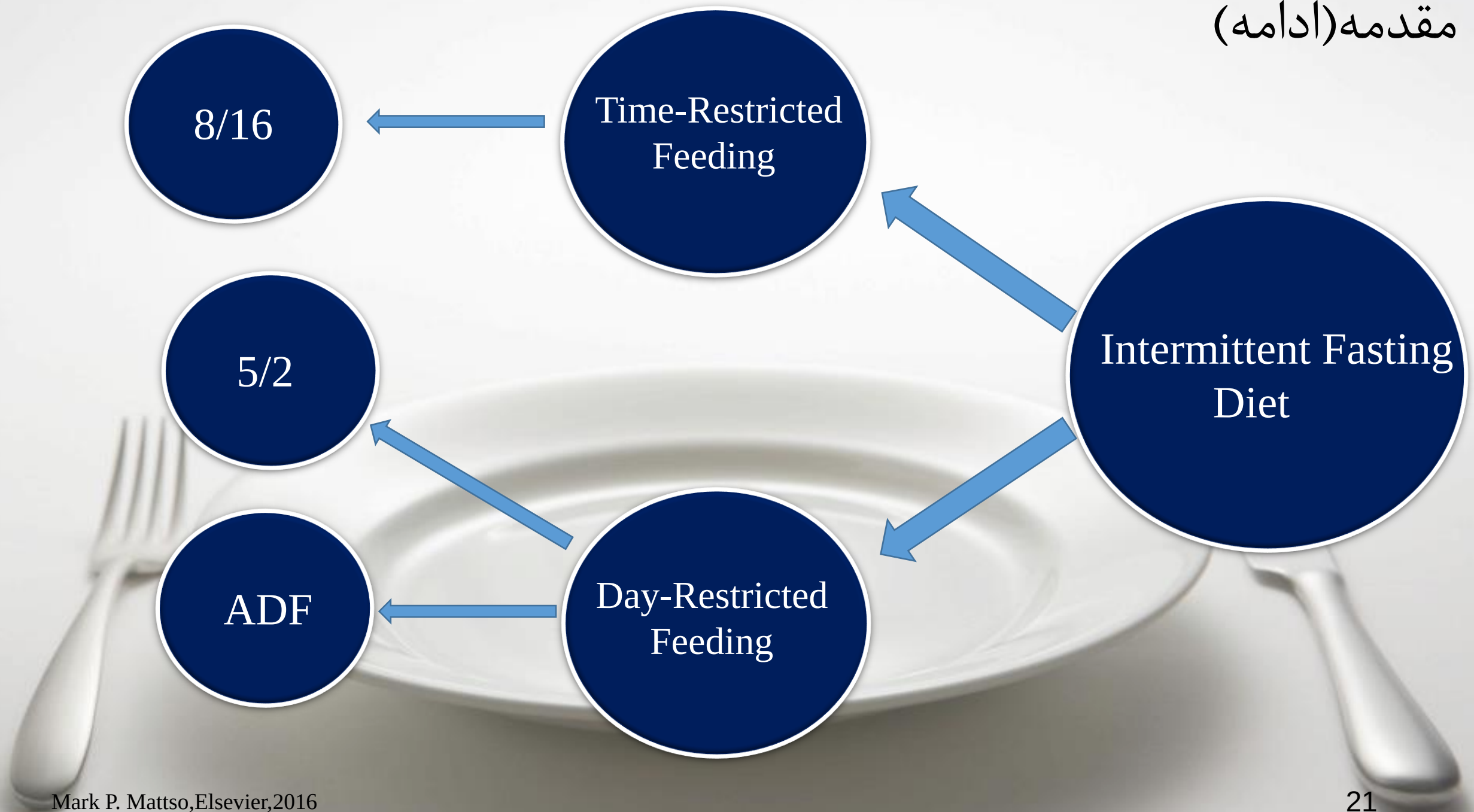
Paleo

Intermittent Fasting



Intermittent fasting

- رژیم گرسنگی متناوب: رژیم گرسنگی متناوب الگوهایی از مصرف غذا را شامل میشود که در آن افراد دوره های زمانی نسبتاً طولانی را (۱۶-۴۸ ساعت) با مصرف کم یا بدون انرژی و دوره های زمانی با دریافت معمول غذایی را به صورت متناوب سپری میکنند.



Diet Only **HALF** the Time!

The **Alternate-** **Day Diet**

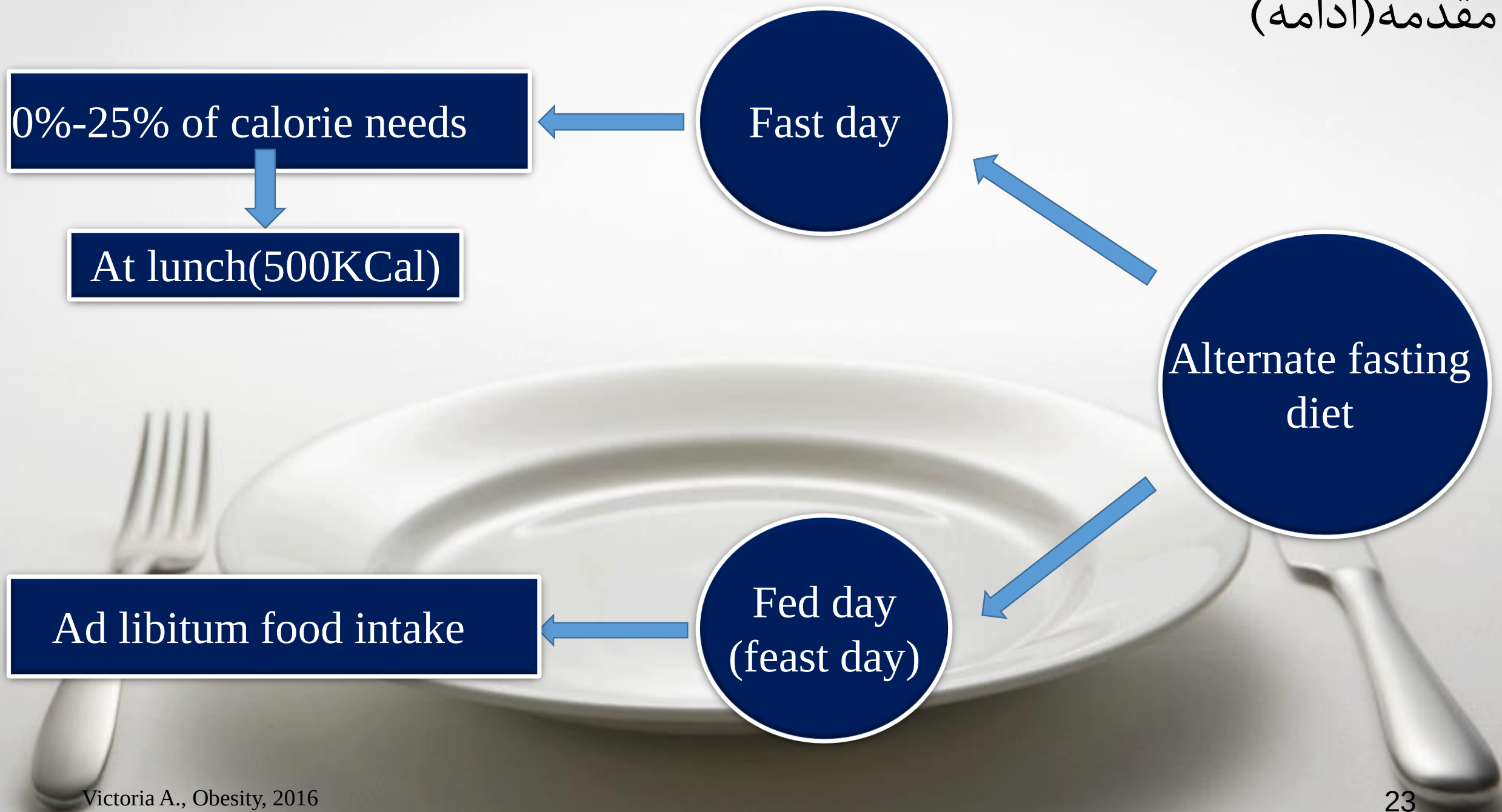


Turn on Your "Skinny Gene,"
Shed the Pounds, and
Live a Longer and Healthier Life

مقدمه (ادامه)

The Every Other Day Diet





طعم دهنده سوپ



آب



قهوه



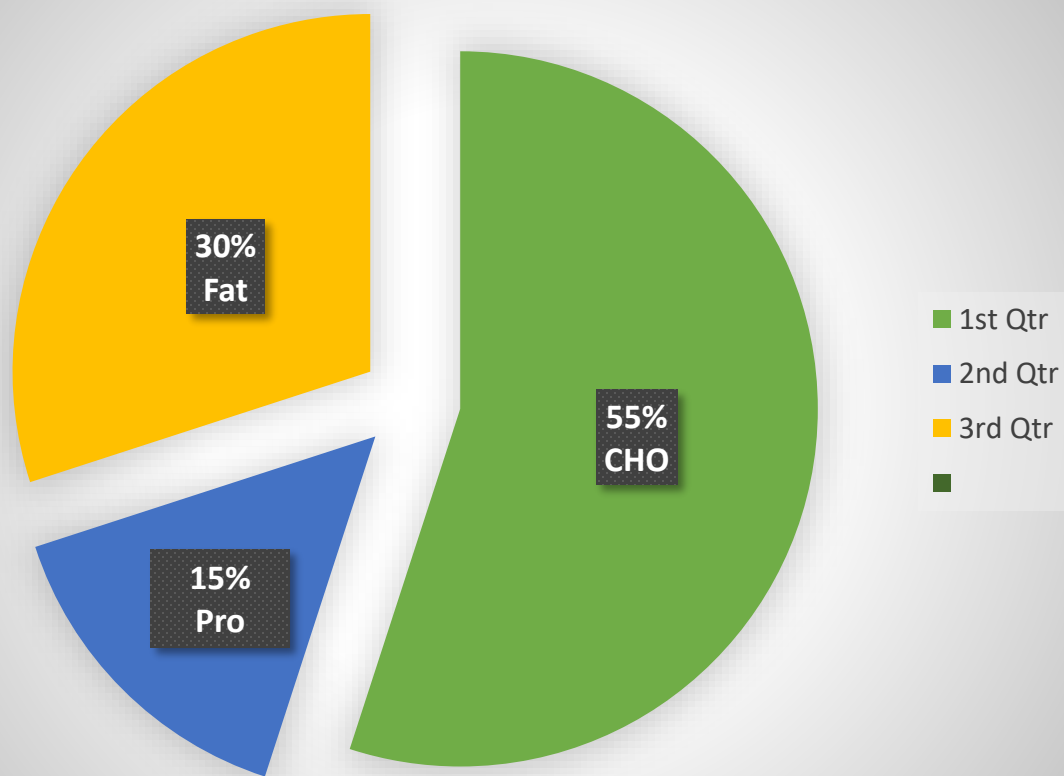
چای



Fast day



Fed day (feast day)



Victoria A., Obesity, 2016

مقدمه (ادامه)



Ad libitum food consumption

از فواید ADF

۱. وزن ↓
۲. سطح لپتین و انسولین (افزایش حساسیت به انسولین و لپتین) ↓
۳. سطح چربی بدن ↓
۴. فشار خون و ضربان قلب ↓
۵. مقاومت بدن در استرس ها (به ویژه قلب و مغز) ↑
۶. التهاب ↓
۷. خطر بیماری های متابولیکی (دیابت و بیماری های قلبی و عروقی) ↓
۸. مقاومت در برابر بیماری های ناشی از افزایش سن و بی تحرکی ↑
۹. سطح کتون بادی ها ↑

آیا رژیم ADF یک راه حل مناسب برای
کاهش وزن هست یا نه؟

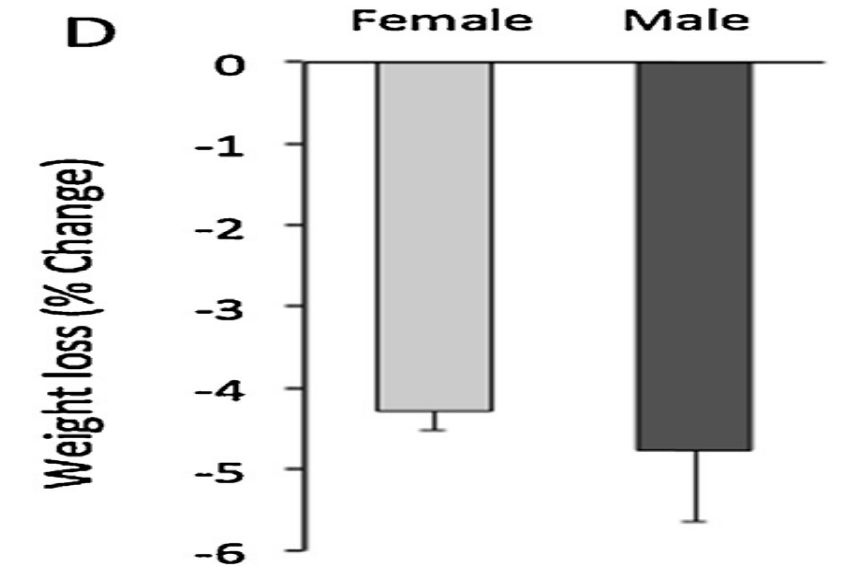
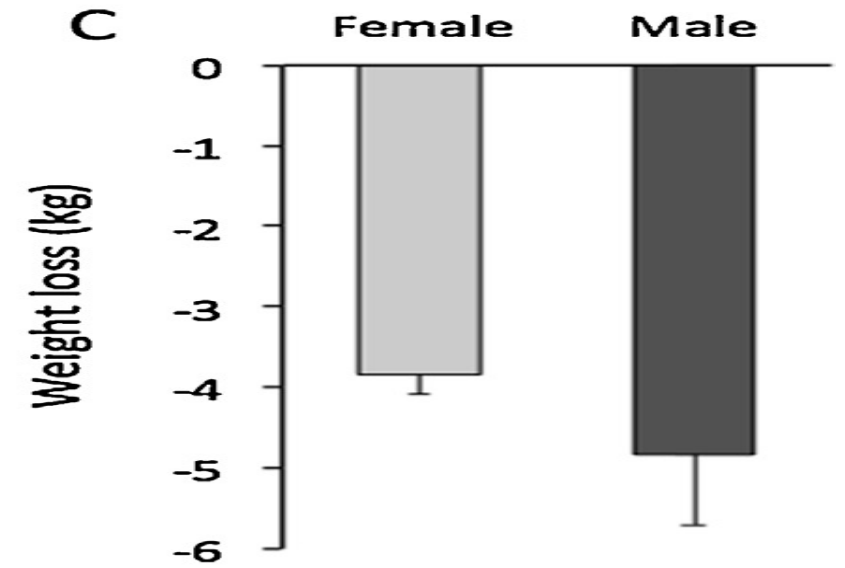
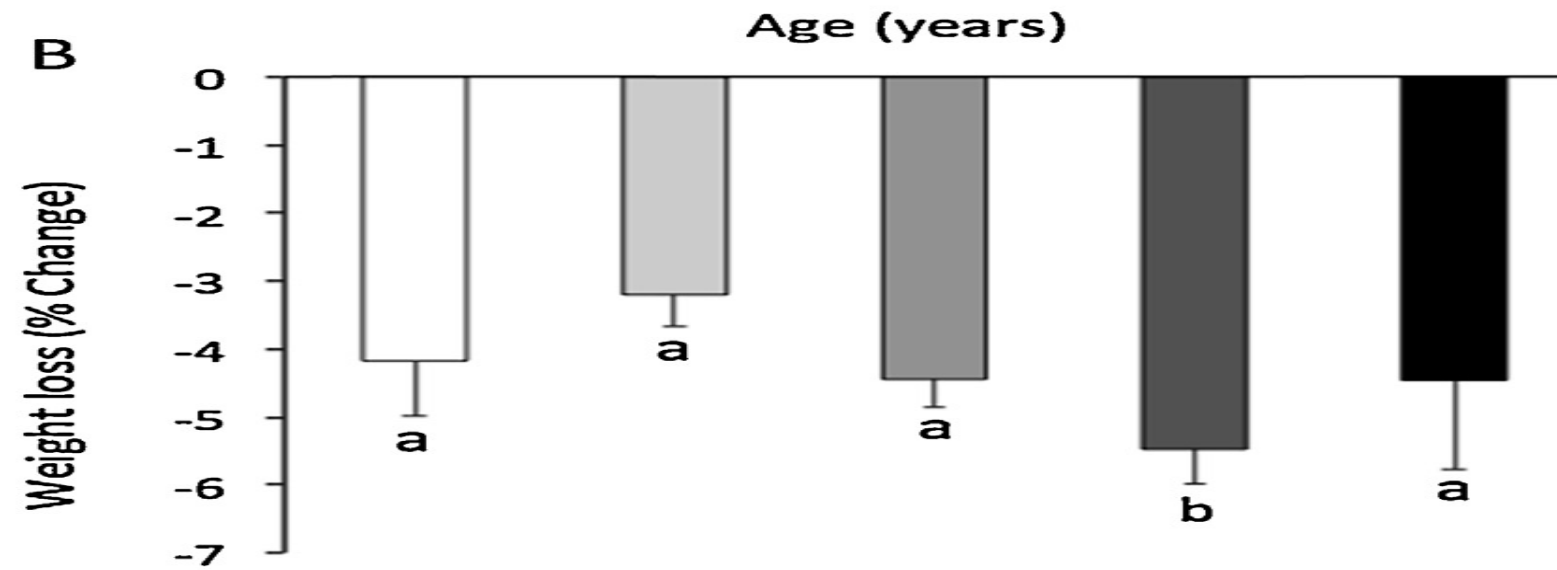
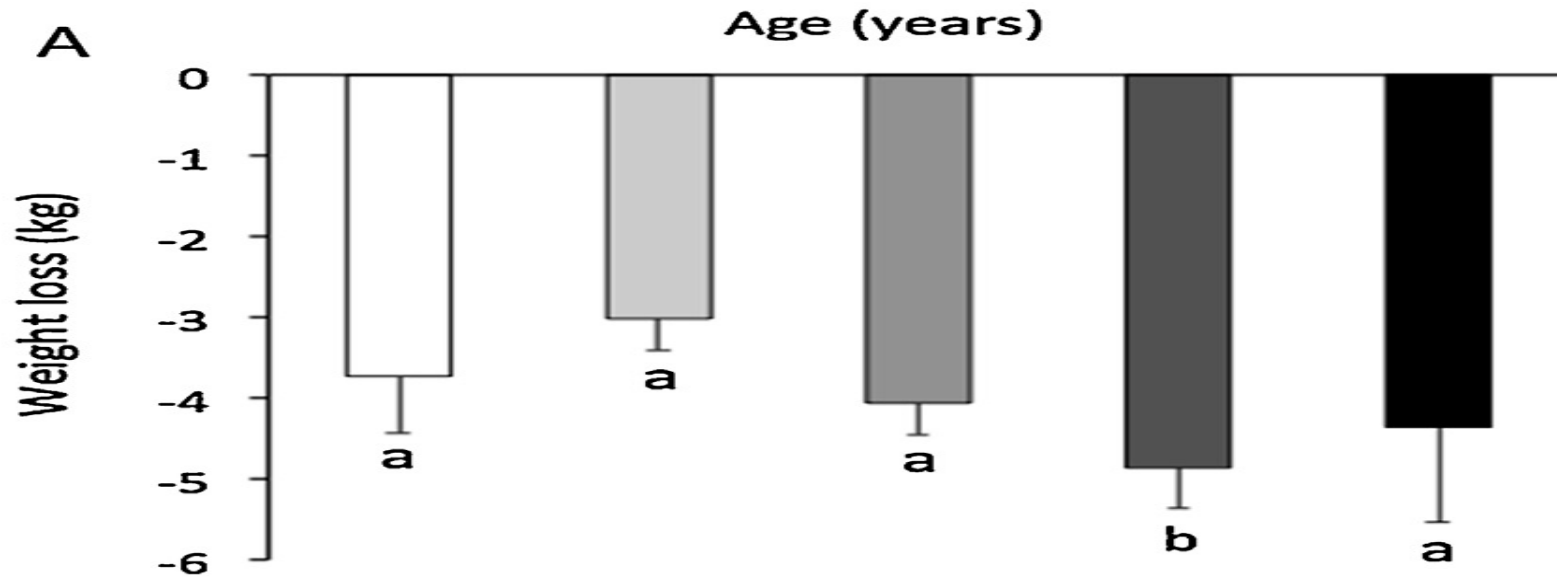


مرور متون



نام نویسنده	سال مطالعه	نوع مطالعه	جمعیت	مداخله	نتایج
Varady.Krista	2015	کارآزمایی بالینی	۱۲۱ نفر مرد: ۱۴ زن: ۱۰۷	❖ ۸ هفته مداخله ADF ❖ Fast day: فقط ۲۵٪ ❖ Ad libitum:Fed day	❖ نژاد اروپایی و افراد بین ۵۰ تا ۵۹ سال کاهش وزن بیشتری نسبت به سایر نژاد ها و گروه های سنی داشتند. ($P = 0.01$) و ($p=0.03$)
Victoria A.	2016	کارآزمایی بالینی	۲۶ نفر ADF: ۱۴ CR: ۱۲	❖ ۸ هفته مداخله مستقیم و ۲۴ هفته پیگیری غیر مستقیم. ❖ دو گروه ADF و CR ❖ CR : ۴۰۰ - kcal درروز ❖ Fast day : بدون کالری ❖ Ad libitum:Fed day	❖ رژیم ADF یک رژیم سالم و قابل تحمل است که تاثیرات مشابهی با CR بر کاهش وزن و پروفایل لیپیدی و حساسیت به انسولین میگذارد. ($p>0.05$)
Trepanowski F.	2017	کارآزمایی بالینی	۹۸ نفر مرد: ۱۴ زن: ۸۴	❖ ۶ ماه مداخله مستقیم و ۶ ماه پیگیری غیرمستقیم ❖ ۳ گروه : کنترل و ADF و CR ❖ CR : کاهش ۲۵٪ انرژی روزانه ❖ Fast day: ۲۵٪ حق دریافت	❖ رژیم CR و ADF هر دو تاثیر نسبتا یکسانی بر کاهش وزن میگذارند. ($p>0.05$) ❖ بین رژیم های ADF و CR تفاوت زیادی از نظر تاثیر بر شاخص های فشارخون، ضربان قلب، تری گلیسرید، انسولین خون و گلوکز

نام نویسنده	سال مطالعه	نوع مطالعه	جمعیت	مداخله	نتایج
Li Zuo	2018	کارآزمایی بالینی	۱۶۲ نفر	❖ ۱۶ هفته مداخله مستقیم و ۸ هفته دنبال کردن غیرمستقیم ❖ دو گروه DER و DER+ADF ❖ DER: هر روز هفته کاهش ۳۰٪ از انرژی دریافتی به همراه رژیم پر پروتئین. ❖ ADF: یک روز (شنبه) Ad libitum و روز های زوج Fasting بودند و فقط دو میان وعده (پر پروتئین) از پیش تهیه شده ، سبزیجات با کالری پایین دریافت میکردند.	این مطالعه ، رژیم با پروتئین بالا را (به همراه ADF یا بدون ADF) راهکار مناسبی برای کاهش وزن می دانند.
Varady.Krista	2015	کارآزمایی بالینی	۲۹ خانم چاق	❖ مطالعه دو فاز داشت که فاز اول ۳ هفته زیر نظر گرفتن بدون مداخله بود و فاز دوم شامل ۸ هفته مداخله بود. ❖ دو گروه ADF-HF(45% fat) و ADF-LF(25% fat) ❖ هر دو گروه در Fast Day مقدار ۲۵٪ از نیازشون را دریافت میکردند و در Fed Day مجاز به دریافت هر مقدار غذایی که میخواستند بودند(Ad libitum)	❖ هر دو رژیم وزن BMI، دور کمر Fat mass، و پروفایل لیپیدی را کاهش میدادند. ❖ تفاوت تغییرات بین دو گروه چندان قابل توجه نبود.



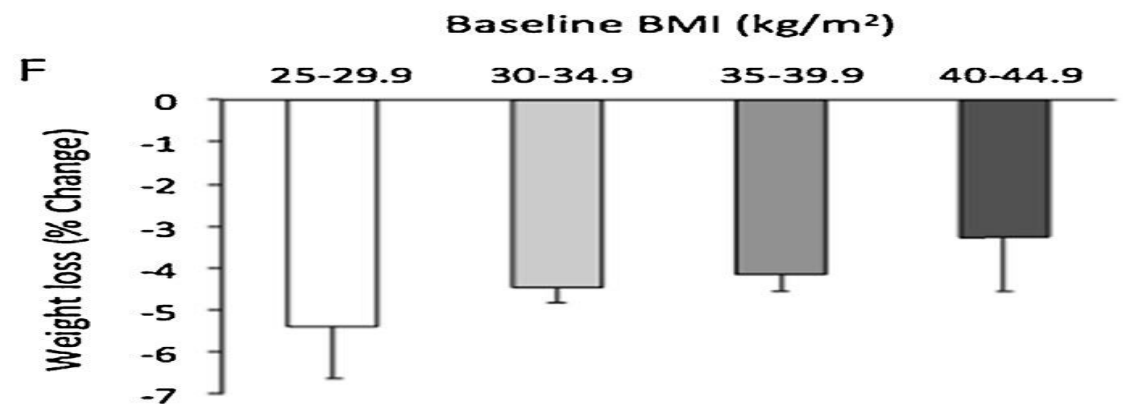
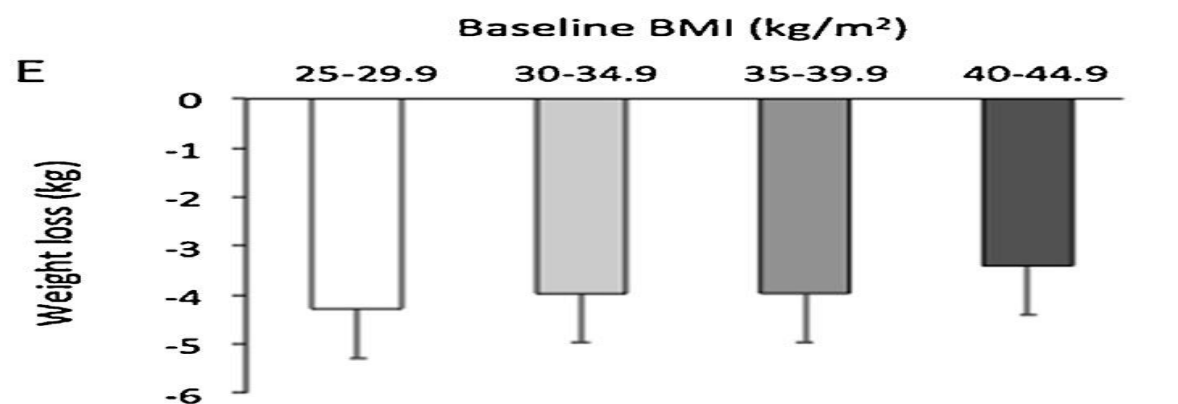
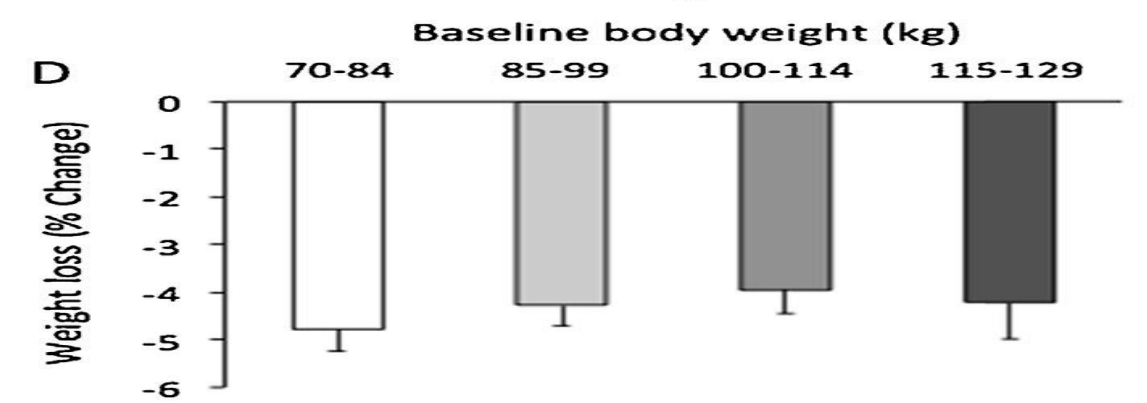
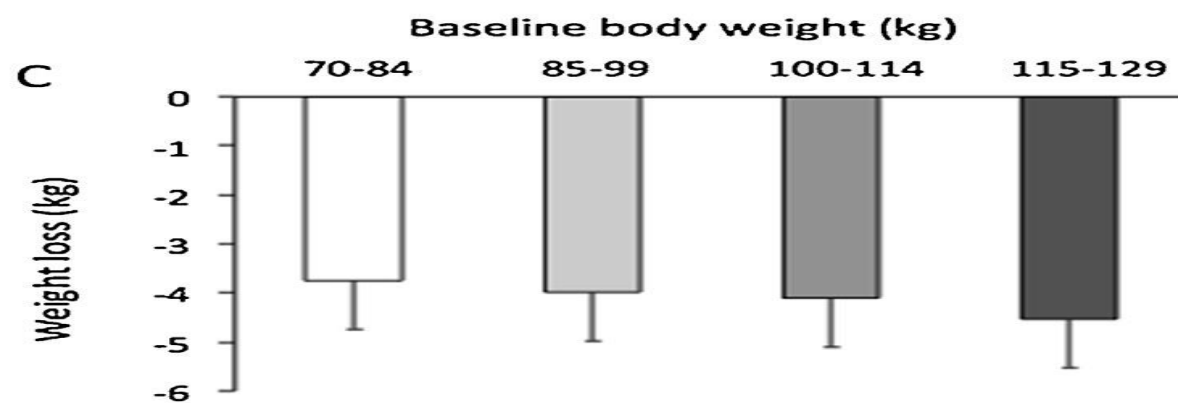
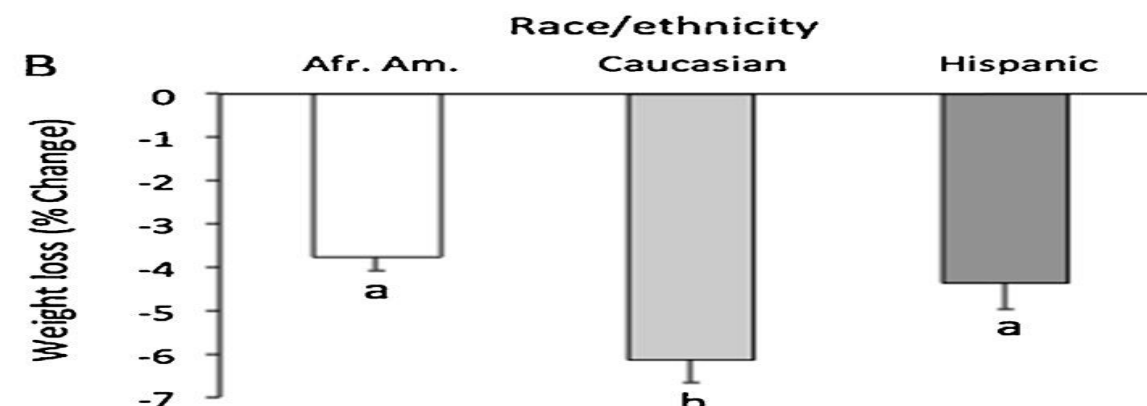
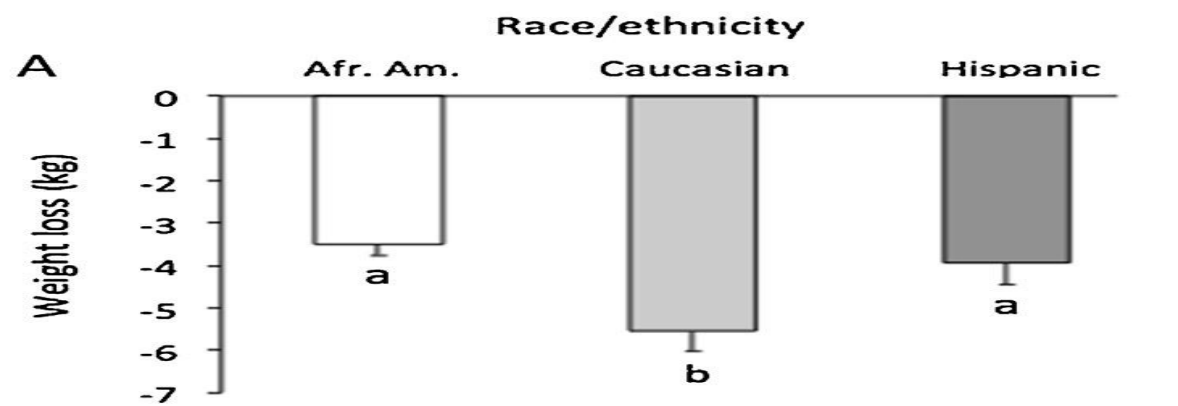


TABLE 4 Changes in anthropometric measures at the end of the 8-week intervention and after 24 weeks of unsupervised follow-up^a

مرور متون (ادامه)

Outcome variable and group	Assessment period			Week 8–baseline			Week 32–baseline			Week 32–week 8			<i>P</i> value for overall interaction
	Baseline	Week 8	Week 32	8–baseline	<i>P</i>	ES	32–baseline	<i>P</i>	ES	32–week 8	<i>P</i>	ES	
Weight (kg)													
CR	114.0 (4.6)	106.9 (4.5)	109.0 (4.7)	−7.1 (1.0)	<0.001		−5.0 (1.6)	0.005		2.1 (1.0)	0.047		
ADF	94.8 (4.4)	86.5 (4.4)	89.1 (4.5)	−8.2 (0.9)	<0.001		−5.7 (1.5)	0.001		2.6 (1.0)	0.013		
CR–ADF	19.3 (6.3)	20.4 (6.3)	19.9 (6.5)	1.1 (1.3)	0.409	−0.35	0.7 (2.2)	0.774	−0.12	−0.5 (1.4)	0.739	0.14	0.559
Weight (%)													
CR				−6.2 (0.9)	<0.001		−4.4 (1.6)	0.011		−1.8 (1.0)	0.082		
ADF				−8.8 (0.9)	<0.001		−5.9 (1.5)	<0.001		−2.9 (1.0)	0.006		
CR–ADF				2.6 (1.3)	0.056	−0.84	1.5 (2.2)	0.496	−0.29	1.1 (1.4)	0.456	−0.32	0.456
BMI (kg/m ²)													
CR	39.5 (1.4)	37.1 (1.5)	37.8 (1.6)	−2.4 (0.3)	<0.001		−1.7 (0.6)	0.007		0.8 (0.4)	0.045		
ADF	35.8 (1.4)	32.6 (1.4)	33.6 (1.5)	−3.2 (0.3)	<0.001		−2.2 (0.5)	<0.001		1.0 (0.4)	0.008		
CR–ADF	3.7 (2.0)	4.5 (2.1)	4.2 (2.2)	0.7 (0.5)	0.136	−0.64	0.5 (0.8)	0.548	−0.25	−0.2 (0.5)	0.65	0.19	0.207
Total fat mass (kg)													
CR	48.8 (2.7)	45.1 (2.6)	46.3 (2.9)	−3.7 (0.5)	<0.001		−2.5 (1.1)	0.028		1.2 (0.8)	0.162		
ADF	37.7 (2.6)	33.9 (2.5)	33.5 (2.8)	−3.7 (0.5)	<0.001		−4.2 (1.0)	<0.001		−0.4 (0.8)	0.605		
CR–ADF	11.1 (3.7)	11.1 (3.6)	12.8 (4.0)	0.0 (0.8)	0.995	0	1.6 (1.5)	0.291	−0.45	1.6 (1.2)	0.173	−0.59	0.371
Total fat mass (%)													
CR	43.4 (1.7)	42.4 (1.7)	42.7 (1.7)	−1.0 (0.3)	0.007		−0.7 (0.5)	0.222		0.3 (0.5)	0.53		
ADF	40.3 (1.6)	39.2 (1.6)	38.0 (1.7)	−1.1 (0.3)	0.002		−2.4 (0.5)	<0.001		−1.3 (0.5)	0.015		
CR–ADF	3.1 (2.3)	3.2 (2.4)	4.7 (2.4)	0.1 (0.5)	0.826	−0.09	1.7 (0.8)	0.035	−0.93	1.6 (0.7)	0.032	−0.95	0.078

TABLE 4 Changes in anthropometric measures at the end of the 8-week intervention and after 24 weeks of unsupervised follow-up^a مرور متون (ادامه)

Outcome variable and group	Assessment period			Week 8			Week 32			Week 48			<i>P</i> value for overall interaction
	Baseline	Week 8	Week 32	8–baseline	<i>P</i>	ES	32–baseline	<i>P</i>	ES	48–week 32	<i>P</i>	ES	
Trunk fat mass (kg)													
CR	26.0 (1.8)	23.9 (1.7)	24.7 (1.8)	−2.1 (0.4)	<0.001		−1.3 (0.7)	0.054		0.8 (0.4)	0.093		
ADF	20.9 (1.7)	18.5 (1.7)	18.2 (1.7)	−2.4 (0.4)	<0.001		−2.7 (0.6)	<0.001		−0.3 (0.4)	0.436		
CR–ADF	5.1 (2.5)	5.4 (2.4)	6.5 (2.5)	0.3 (0.5)	0.637	−0.2	1.4 (0.9)	0.144	−0.63	1.1 (0.6)	0.083	−0.76	0.215
Trunk fat mass (%)													
CR	23.1 (1.1)	22.4 (1.2)	22.7 (1.1)	−0.7 (0.3)	0.017		−0.3 (0.4)	0.34		0.3 (0.3)	0.274		
ADF	22.1 (1.1)	21.2 (1.1)	20.3 (1.1)	−0.9 (0.3)	0.001		−1.8 (0.3)	<0.001		−0.8 (0.3)	0.005		
CR–ADF	1.0 (1.6)	1.3 (1.7)	2.4 (1.5)	0.3 (0.4)	0.484	−0.3	1.4 (0.5)	0.009	−1.19	1.2 (0.4)	0.007	−1.24	0.016
Lean mass (kg)													
CR	60.9 (3.0)	58.2 (2.8)	59.3 (2.8)	−2.6 (0.6)	<0.001		−1.6 (0.6)	0.022		1.1 (0.5)	0.051		
ADF	53.2 (2.8)	50.0 (2.7)	52.1 (2.7)	−3.2 (0.6)	<0.001		−1.2 (0.6)	0.072		2.0 (0.5)	<0.001		
CR–ADF	7.7 (4.1)	8.2 (3.8)	7.2 (3.9)	0.5 (0.9)	0.539	−0.26	−0.4 (0.9)	0.64	0.2	−1.0 (0.7)	0.197	0.55	0.424
Lean mass (%)													
CR	54.2 (1.6)	55.1 (1.6)	54.8 (1.7)	0.9 (0.3)	0.016		0.5 (0.5)	0.309		−0.3 (0.5)	0.509		
ADF	57.1 (1.5)	58.0 (1.6)	59.3 (1.6)	0.9 (0.3)	0.009		2.2 (0.5)	<0.001		1.3 (0.5)	0.012		
CR–ADF	−2.8 (2.2)	−2.9 (2.3)	−4.5 (2.3)	−0.1 (0.5)	0.921	0.04	−1.7 (0.7)	0.026	0.99	−1.6 (0.7)	0.026	0.99	0.061

^aLinear mixed-effects model analysis with unstructured covariance was used to assess the efficacy of intervention on each outcome variable. Test of time by group interaction was used to test the efficacy of intervention (see *P* value for overall interaction). Results are mean (SE). Significant *P* values (*P* < 0.05) are indicated in bold. Effect size (ES) is calculated as $(2 \times t \text{ value})/\sqrt{\text{DF}}$, where degrees of freedom (DF). Hand calculations for between- and within-group differences may not be equal to data shown because all data were rounded to 0.1 decimal place. Weight changes from scale weight (kg) do not match weight changes from sum of DXA fat mass and lean mass due to the different methodologies used to measure these outcomes. For CR: *n* = 12 for baseline and week 8; *n* = 10 for week 32; for ADF: *n* = 13 for baseline and week 8; *n* = 11 for week 32; non-missing observations: *n* = 71. Victoria A., Obesity, 2016

TABLE 5 Changes in resting metabolic rate at the end of the 8-week intervention and after 24 weeks of unsupervised follow-up^a

مرور متون (ادامه)

Outcome variable and group	Assessment period			Week		Week		Week		Week		P value for overall interaction	
	Baseline	Week 8	Week 32	8–baseline	P	ES	32–baseline	P	ES	32–week 8	P	ES	
Unadjusted RMR (kcal/d) ^b													
CR	1,892.5 (67.7)	1,719.3 (69.3)	1,807.3 (72.2)	−173.2 (35.2)	<0.001		−85.2 (39.0)	0.039		88.0 (22.2)	<0.001		
ADF	1,640.1 (65.1)	1,539.7 (66.8)	1,567.2 (69.2)	−100.4 (34.1)	0.007		−72.9 (37.3)	0.063		27.5 (22.0)	0.223		
CR–ADF	252.4 (93.9)	179.6 (96.2)	240.1 (100.0)	−72.8 (49.0)	0.151	0.62	−12.3 (54.0)	0.822	0.09	60.5 (31.3)	0.065	−0.81	0.096
Adjusted RMR (kcal/d) ^{b,c}													
CR	1,757.6 (37.0)	1,646.0 (32.8)	1,681.53 (18.6)	−111.6 (36.9)	0.006		−76.1 (35.9)	0.045		35.6 (22.4)	0.126		
ADF	1,689.0 (34.2)	1,672.8 (33.5)	1,659.8 (20.1)	−16.2 (36.6)	0.662		−29.2 (35.2)	0.416		−13.0 (22.5)	0.569		
CR–ADF	68.6 (51.1)	−26.8 (48.1)	21.7 (29.8)	−95.4 (51.4)	0.076	0.77	−46.9 (49.7)	0.356	0.39	48.5 (31.8)	0.14	−0.64	0.14

^aLinear mixed-effects model analysis with unstructured covariance was used to assess the efficacy of intervention on each outcome variable. Test of time by group interaction was used to test the efficacy of intervention (see *P* value for overall interaction). Results are mean (SE). Significant *P* values (*P* < 0.05) are indicated in bold. Effect size (ES) is calculated as (2 × *t* value)/√DF, where degrees of freedom (DF). Hand calculations for between- and within-group differences may not be equal to data shown because all data were rounded to 0.1 decimal place. For CR: *n* = 12 for baseline and week 8; *n* = 10 for week 32; for ADF: *n* = 13 for baseline and week 8; *n* = 11 for week 32; non-missing observations: *n* = 71.

^bRMR results exclude one observation at week 32 for one subject in ADF because the value was physiologically implausible.

^cRMR results adjusted for fat-free mass (FFM) and fat mass (FM).

Figure 3. Weight Loss by Diet Group Relative to Baseline

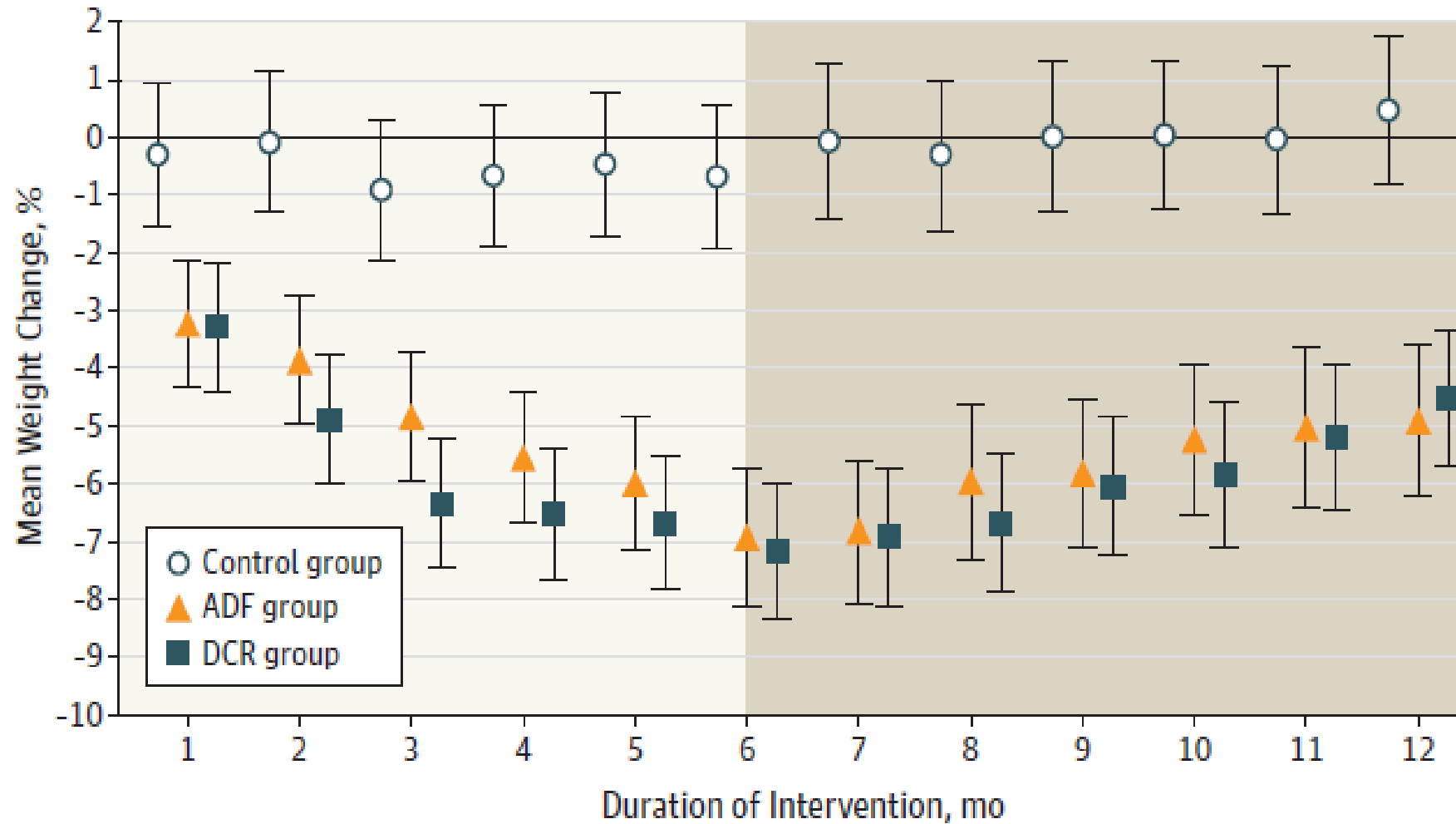


Table 2. Pairwise Effects Estimates of Diet on Mean Changes From Baseline in Body Weight and Risk Indicators for Cardiovascular Disease^a

Outcome Variable	Change in ADF – Change in DCR (95% CI)		Change in ADF – Change in Control (95% CI)		Change in DCR – Change in Control (95% CI)	
	At 6 mo	At 12 mo	At 6 mo	At 12 mo	At 6 mo	At 12 mo
Body weight, % change	0.0 (-2.2 to 2.2)	-0.7 (-3.1 to 1.6)	-6.8 (-9.1 to -4.5)	-6.0 (-8.5 to -3.6)	-6.8 (-9.1 to -4.6)	-5.3 (-7.6 to -3.0)
Fat mass, kg	0.9 (-1.3 to 3.1)	0.0 (-2.4 to 2.4)	-4.2 (-6.6 to -1.8)	-2.0 (-4.4 to 0.5)	-5.1 (-7.5 to -2.7)	-2.0 (-4.4 to 0.4)
Lean mass, kg	0.6 (-1.0 to 2.2)	0.5 (-1.2 to 2.2)	-1.5 (-3.2 to 0.2)	-0.9 (-2.7 to 0.9)	-2.1 (-3.8 to 0.4)	-1.4 (-3.1 to 0.3)
Visceral fat mass, kg	0.2 (-0.1 to 0.5)	0.1 (-0.2 to 0.5)	-0.4 (-0.7 to -0.1)	-0.4 (-0.7 to -0.1)	-0.6 (-0.9 to -0.2)	-0.5 (-0.8 to -0.2)
Blood pressure, mm Hg						
Systolic	0.8 (-7.1 to 8.7)	-1.1 (-9.5 to 7.4)	-3.1 (-11.3 to 5.2)	-2.3 (-11.0 to 6.4)	-3.9 (-12.1 to 4.4)	-1.24 (-9.7 to 7.2)
Diastolic	-0.3 (-5.9 to 5.4)	-3.0 (-9.0 to 3.0)	-1.5 (-7.4 to 4.4)	-0.1 (-6.3 to 6.1)	-1.2 (-7.1 to 4.6)	2.9 (-3.1 to 8.9)
Heart rate, beats/min	-4.9 (-10.1 to 0.4)	-2.0 (-7.7 to 3.8)	-5.8 (-11.3 to -0.3)	-1.2 (-7.1 to 4.7)	-0.9 (-6.4 to 4.5)	0.8 (-4.8 to 6.4)

Table 2. Pairwise Effects Estimates of Diet on Mean Changes From Baseline in Body Weight and Risk Indicators for Cardiovascular Disease^a

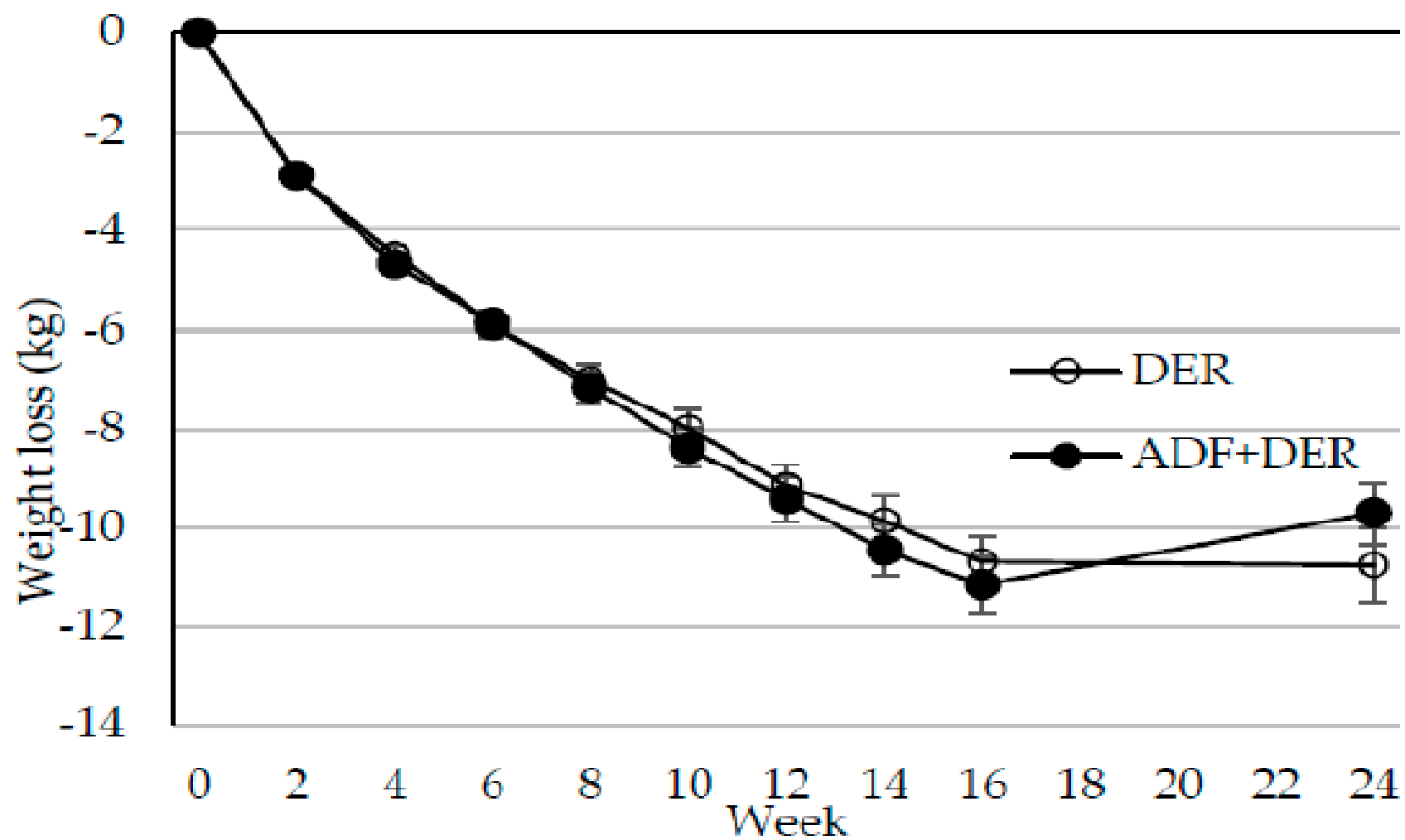
Outcome Variable	Change in ADF – Change in DCR (95% CI)		Change in ADF – Change in Control (95% CI)		Change in DCR – Change in Control (95% CI)	
	At 6 mo	At 12 mo	At 6 mo	At 12 mo	At 6 mo	At 12 mo
Cholesterol, mg/dL						
Total	3.4 (–7.2 to 13.9)	9.7 (–2.2 to 21.7)	–4.3 (–15.4 to 6.9)	4.2 (–8.2 to 16.5)	–7.6 (–18.8 to 3.6)	–5.6 (–17.6 to 6.4)
HDL	6.2 (0.1 to 12.4)	1.0 (–5.9 to 7.8)	8.4 (1.9 to 14.7)	2.9 (–4.2 to 10.0)	2.2 (–4.3 to 8.7)	1.9 (–5.1 to 8.9)
LDL	2.5 (–6.0 to 10.9)	11.5 (1.9 to 21.1)	–2.6 (–11.5 to 6.4)	1.2 (–8.7 to 11.2)	–5.0 (–14.0 to 3.9)	–10.3 (–19.9 to –0.6)
Triglycerides, mg/dL	–10.5 (–26.7 to 5.8)	–9.9 (–28.3 to 8.6)	–19.1 (–36.3 to –1.8)	–24.4 (–43.5 to –5.3)	–8.6 (–25.9 to 8.7)	–14.5 (–33.1 to 4.0)
Glucose, mg/dL	–1.4 (–8.0 to 5.2)	5.7 (–1.6 to 13.0)	–6.3 (–13.3 to 0.7)	–3.9 (–11.5 to 3.6)	–4.9 (–12.0 to 2.1)	–9.6 (–17.1 to –2.2)
Insulin, μ U/mL	–0.4 (–5.5 to 4.7)	–1.3 (–6.9 to 4.3)	–7.5 (–12.9 to –2.0)	–5.9 (–11.7 to –0.1)	–7.0 (–12.5 to –1.6)	–4.6 (–10.4 to 1.2)
HOMA-IR ^a	0.07 (–1.56 to 1.70)	0.02 (–1.78 to 1.81)	–2.49 (–4.22 to –0.76)	–1.86 (–3.73 to 0.01)	–2.56 (–4.30 to –0.82)	–1.88 (–3.72 to –0.03)
HS CRP, mg/dL	–0.04 (–0.19 to 0.11)	0.00 (–0.16 to 0.17)	–0.07 (–0.23 to 0.08)	–0.07 (–0.24 to 0.11)	–0.04 (–0.19 to 0.12)	–0.07 (–0.24 to 0.10)
Homocysteine, mg/L	0.03 (–0.10 to 0.17)	0.03 (–0.12 to 0.18)	0.10 (–0.04 to 0.24)	0.02 (–0.13 to 0.18)	0.06 (–0.08 to 0.20)	–0.01 (–0.16 to 0.14)

Abbreviations: ADF, alternate-day fasting; DCR, daily calorie restriction; HDL, high-density lipoprotein; HOMA-IR, homeostasis model assessment of insulin resistance [calculated as $\text{insulin} \times \text{glucose}/405$, where the unit of measure for insulin is in micro-international units per milliliter and the unit of measure for glucose is milligrams per deciliter]; HS CRP, high-sensitivity C-reactive protein; LDL, low-density lipoprotein.

SI conversion factors: To convert total, HDL, and LDL cholesterol to millimoles

per liter, multiply by 0.0259; to convert triglycerides to millimoles per liter, multiply by 0.0113; to convert glucose to millimoles per liter, multiply by 0.0555; to convert insulin to picomoles per liter, multiply by 6.945; and to convert homocysteine to micromoles per liter, multiply by 7.397.

^a Data were included for 100 participants; mean (SD) values were estimated using an intention-to-treat analysis with a linear mixed model.



	DER		ADF + DER		<i>p</i>
	Baseline (<i>n</i> = 81)	Week 16 (<i>n</i> = 68)	Baseline (<i>n</i> = 82)	Week 16 (<i>n</i> = 67)	
Body weight ² , kg	99.6 ± 15.6	87.1 ± 14.0	100.6 ± 19.6	90.6 ± 18.7	0.803
BMI ² , kg/m ²	35.5 ± 5.5	31.1 ± 5.1	35.7 ± 5.8	31.9 ± 5.5	0.913
Total FFM ² , kg	50.7 ± 7.9	48.8 ± 7.6	51.1 ± 9.1	49.7 ± 9.2	0.842
Total FM ² , kg	45.1 ± 11.2	34.8 ± 10.2	45.7 ± 13.1	37.3 ± 12.8	0.674
TC ² , mmol/L	5.3 ± 1.0	4.7 ± 0.9	5.2 ± 1.0	4.7 ± 1.0	0.754
Triglycerides ² , mmol/L	1.5 ± 0.8	1.1 ± 0.5	1.4 ± 0.6	1.2 ± 0.6	0.029 ³
HDL-C ⁴ , mmol/L	1.3 ± 0.3	1.3 ± 0.3	1.3 ± 0.3	1.2 ± 0.2	0.154
LDL-C ² , mmol/L	3.3 ± 0.9	2.9 ± 0.7	3.3 ± 0.9	2.9 ± 0.8	0.987
hsCRP ^{2,5} , mg/L	3.2 ± 2.6	2.9 ± 2.2	3.7 ± 2.5	3.0 ± 2.2	0.450
Glucose ² , mmol/L	5.5 ± 0.6	5.3 ± 0.4	5.4 ± 0.4	5.3 ± 0.4	0.341
Insulin ² , mU/L	12.4 ± 7.3	8.01 ± 4.2	13.4 ± 8.4	9.1 ± 4.5	0.334
SBP ² , mm Hg	120.6 ± 12.8	112.2 ± 9.7	119.4 ± 12.9	112.2 ± 9.9	0.893
DBP ² , mm Hg	74.7 ± 9.0	71.1 ± 8.7	75.6 ± 9.4	71.5 ± 7.8	0.394

DER, standard meal replacement program; ADF + DER modified meal replacement program; BMI, body mass index; FFM, fat free mass; FM, Fat Mass; TC, Total Cholesterol; HDL-C, high density lipoprotein cholesterol; LDL-C, low density lipoprotein cholesterol; CRP, high sensitivity C Reactive Protein; SBP, Systolic blood pressure; DBP, Diastolic blood pressure. *p*-values are reported for between-group differences over time (time × diet interaction) using linear mixed-effects model analysis. ¹ Values are Means ± SD. Biochemical measures, blood pressure and nutrient status assessed in fasting state. ² significant main effect of time (*p* < 0.001), using linear mixed-effects model analysis. ³ significant effect of time × treatment (*p* < 0.05), using linear mixed-effects model analysis. ⁴ significant main effect of time (*p* < 0.01), using linear mixed-effects model analysis. ⁵ For CRP data, only participants with CRP concentration <10 mg/L were included in analyses; baseline: *n* = 71 DER; *n* = 68 ADF-MRP; week 16 *n* = 61 DER; *n* = 56 ADF + DER.

Table 1 | Participant characteristics before (week 3) and after (week 10) the weight loss period

Group	ADF-LF (n = 15)		ADF-HF (n = 14)	
Time	Week 3	Week 10	Week 3	Week 10
Age (y)	43.2 ± 2.3		42.4 ± 3.0	
Body weight (kg)	88.0 ± 3.0	83.7 ± 2.7 ^a	89.2 ± 2.8	84.5 ± 2.7 ^a
Body mass index (kg/m ²)	34.4 ± 0.8	32.7 ± 0.7 ^a	34.6 ± 0.7	32.8 ± 0.7 ^a
% Fat	41.6 ± 1.1	41.8 ± 1.1	40.4 ± 0.8	39.2 ± 1.0
Fat mass (kg)	36.9 ± 1.9	35.4 ± 1.9 ^a	36.1 ± 1.4	33.2 ± 1.5 ^a
Waist circumference	98.4 ± 1.9	90.4 ± 2.3 ^a	98.0 ± 1.9	90.8 ± 1.9 ^a
Total cholesterol (mmol/L)	5.0 ± 0.2	4.2 ± 0.2 ^a	5.0 ± 0.3	4.3 ± 0.2 ^a
LDL cholesterol (mmol/L)	3.0 ± 0.2	2.3 ± 0.2 ^a	2.8 ± 0.2	2.3 ± 0.2 ^a
HDL cholesterol (mmol/L)	1.5 ± 0.1	1.5 ± 0.1	1.6 ± 0.1	1.6 ± 0.1
Triglycerides (mmol/L)	1.1 ± 0.1	0.9 ± 0.1 ^a	1.4 ± 0.2	1.3 ± 0.2 ^a
Glucose (mg/dL)	107.4 ± 2.9	105.1 ± 2.0	108.4 ± 3.0	105.7 ± 2.2

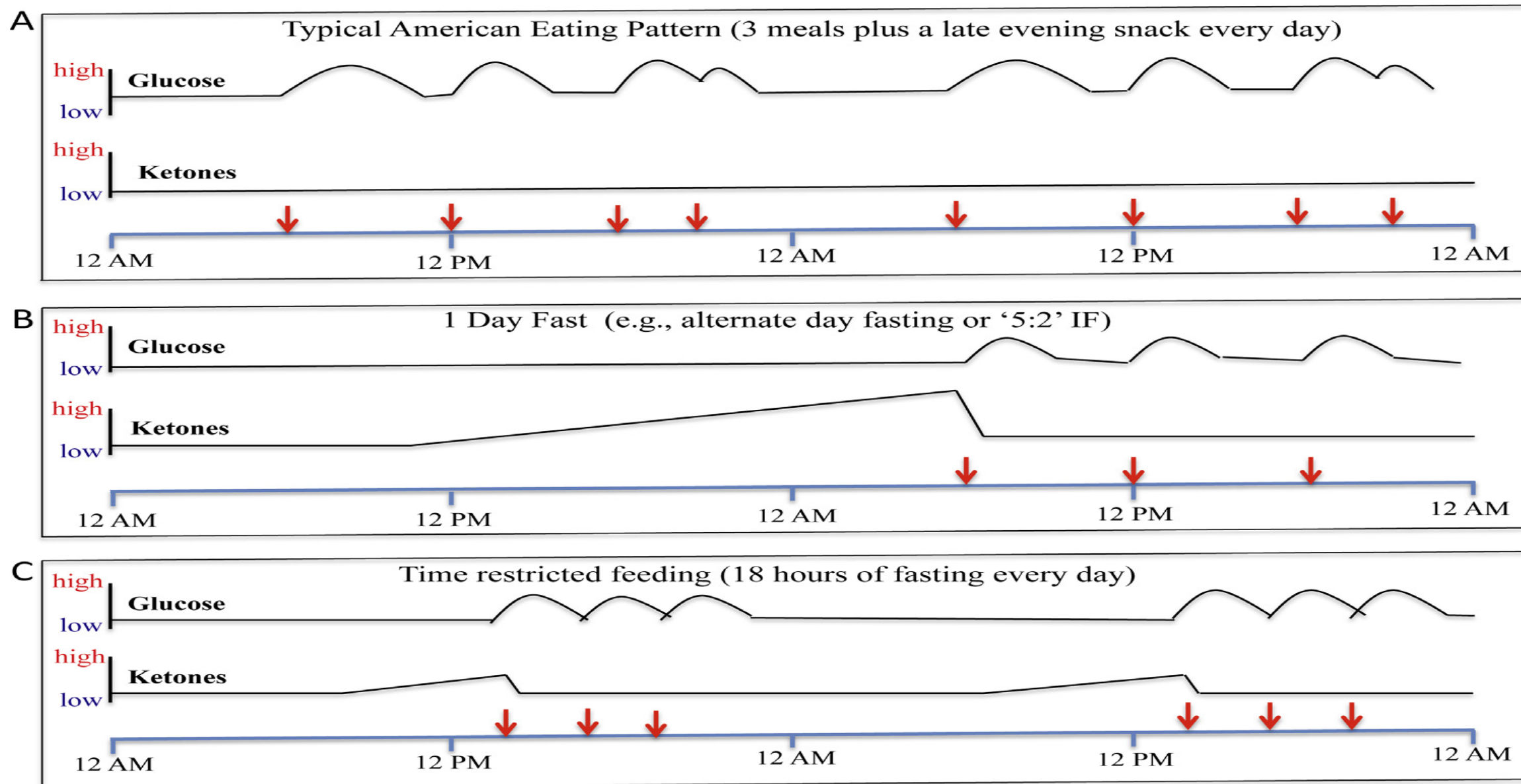
Values reported as mean ± SEM. Alternate day fasting high fat diet (ADF-HF); alternate day fasting low fat diet (ADF-LF).

^aP < 0.05 within group difference (from week 3 to week 10).

بحث



تغییرات سطح گلوکز و کتون بادی ها در رژیم های ناشتایی متناوب

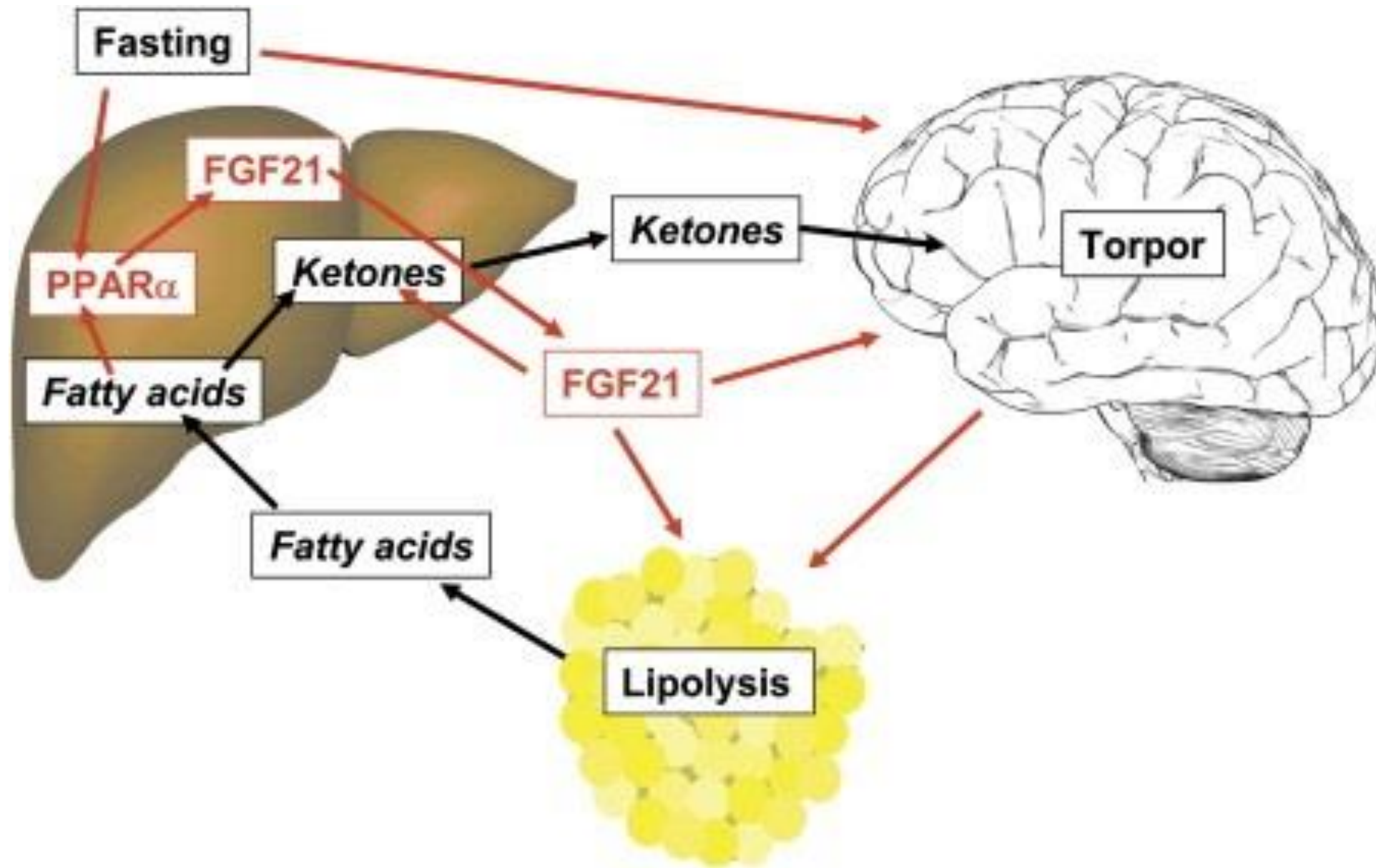


(a) Fed state: insulin dominates



(b) Fasted state: glucagon dominates







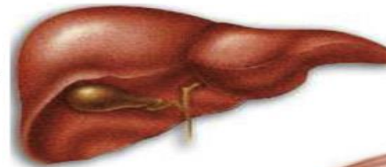
Reduced: glucose, insulin, leptin, total cholesterol, CRP, $\text{TNF}\alpha$, IL-6, markers of oxidative stress, IGF-1

Increased: 3OHB, adiponectin

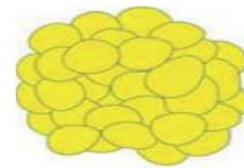
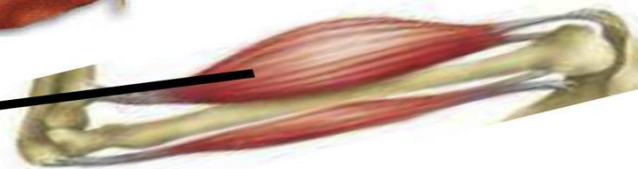


Decreased resting heart rate
Increased heart rate variability
Decreased blood pressure

Increased insulin sensitivity
Ketone body production



Increased insulin sensitivity
Enhanced autophagy



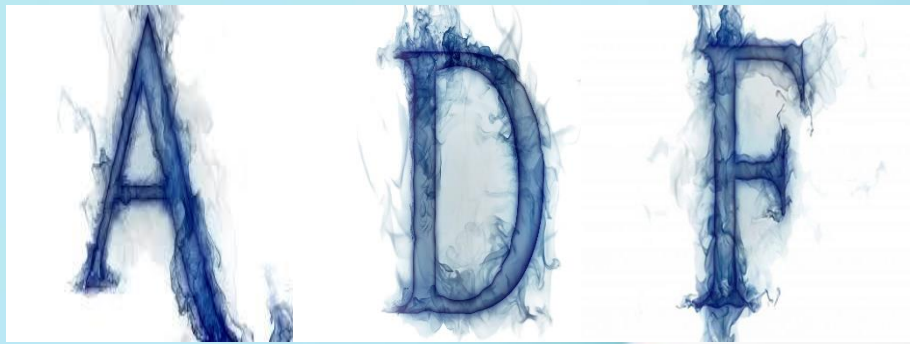
Fatty acid mobilization
Reduced inflammation



RESULTS

نتیجه گیری





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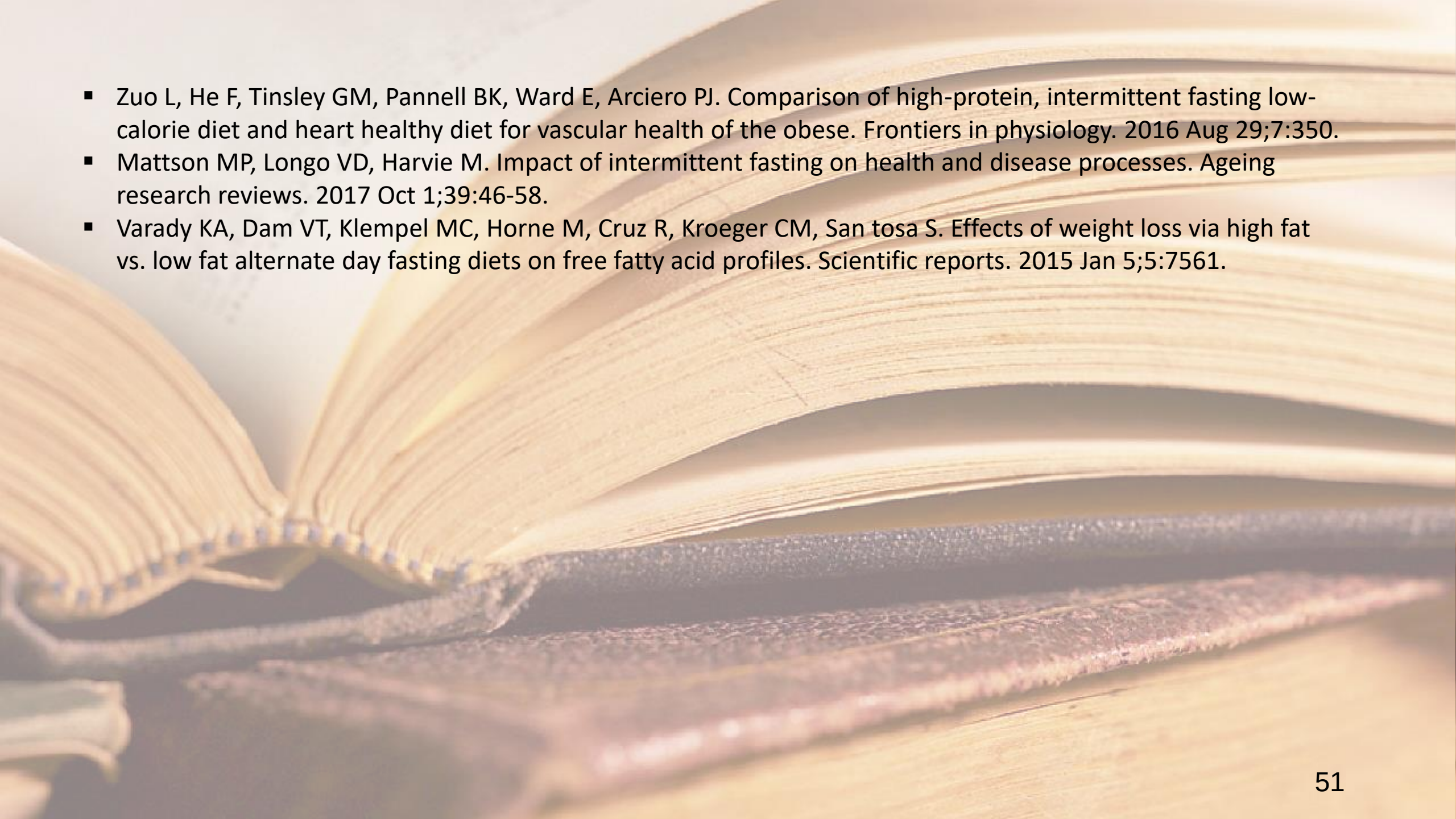


همانطور که دیدیم رژیم ADF تاثیر مشابه رژیم CR بر کاهش وزن و سایر شاخص های سلامتی میگذارد



در نتیجه میتوان در کنار رژیم CR از رژیم ADF نیز برای کاهش وزن در افراد چاق یا دارای اضافه وزن استفاده کرد.

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thank you!

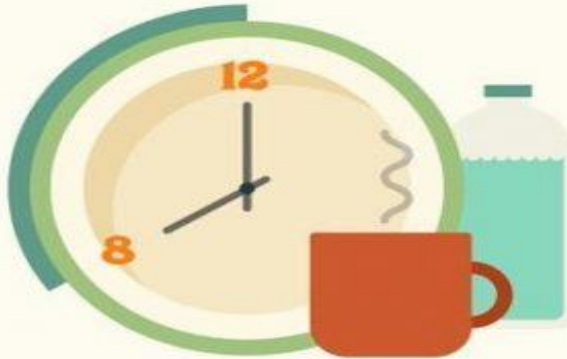
The 16:8 Approach to Intermittent Fasting



What is 16:8 fasting?

Every day, you fast for 16 hours, then eat within an 8-hour window.

For example...



Fast between 8 pm and 12 noon

You can have water,
or coffee and tea
(with no milk or
sugar).



Eat between 12 noon and 8 pm

You can have anything
you want (though
healthy foods are
encouraged) without
counting calories or
macros.



مقدمه (ادامه)

یک هفته



دو روز غیر متوالی



مجاز به دریافت حداکثر ۲۵٪ نیاز
انرژی



۵۰۰ کالری



TABLE 6 Changes in metabolic measures at the end of the 8-week intervention and after 24 weeks of unsupervised follow-up^a

Outcome variable and group	Assessment period			Week 8–baseline	P	ES	Week 32–baseline	P	ES	Week 32–week 8	P	ES	P value for overall interaction
	Baseline	Week 8	Week 32										
Cholesterol (mg/dL) ^b													
CR	171.3 (10.0)	149.7 (10.6)		−21.7 (6.8)	0.004								
ADF	166.9 (9.6)	135.1 (10.1)		−31.8 (6.5)	<0.001								
CR–ADF	4.5 (13.9)	14.6 (14.6)		10.1 (9.4)	0.295	−0.45							
HDL (mg/dL) ^b													
CR	38.9 (2.2)	34.8 (2.0)		−4.2 (1.9)	0.043								
ADF	38.2 (2.1)	34.1 (1.9)		−4.2 (1.9)	0.036								
CR–ADF	0.7 (3.1)	0.7 (2.7)		0.0 (2.7)	0.996	0							
LDL (mg/dL) ^b													
CR	104.5 (8.6)	87.6 (8.9)		−16.9 (4.9)	0.002								
ADF	100.0 (8.3)	77.4 (8.6)		−22.6 (4.7)	<0.001								
CR–ADF	4.5 (11.9)	10.2 (12.4)		5.7 (6.8)	0.412	−0.35							
Triglycerides (mg/dL)													
CR	139.6 (14.6)	136.8 (11.5)	151.6 (23.4)	−2.8 (11.3)	0.804		12.0 (17.1)	0.489		14.9 (18.2)	0.422		
ADF	142.9 (14.0)	117.9 (11.1)	148.1 (24.2)	−25.0 (10.9)	0.031		5.1 (18.8)	0.787		30.1 (19.7)	0.139		
CR–ADF	−3.3 (20.2)	18.8 (16.0)	3.6 (33.6)	22.2 (15.7)	0.17	−0.59	6.9 (25.4)	0.789	−0.11	−15.3 (26.8)	0.574	0.24	0.382
Glucose (mg/dL)													
CR	91.6 (2.1)	94.9 (1.8)	93.3 (2.2)	3.3 (2.3)	0.166		1.7 (1.9)	0.389		−1.6 (2.1)	0.472		
ADF	88.4 (2.0)	94.4 (1.7)	91.0 (2.3)	6.0 (2.1)	0.01		2.6 (2.1)	0.228		−3.4 (2.2)	0.14		
CR–ADF	3.2 (2.9)	0.5 (2.5)	2.4 (3.2)	−2.7 (3.1)	0.389	0.37	−0.9 (2.8)	0.76	0.13	1.9 (3.1)	0.553	−0.25	0.68
Insulin (μU/mL)													
CR	19.3 (1.7)	19.1 (2.1)	17.2 (2.1)	−0.2 (2.4)	0.945		−2.0 (2.2)	0.359		−1.9 (1.3)	0.157		
ADF	13.3 (1.6)	16.3 (2.0)	13.7 (2.1)	3.0 (2.3)	0.207		0.4 (2.2)	0.855		−2.6 (1.4)	0.075		
CR–ADF	5.9 (2.4)	2.8 (2.9)	3.5 (3.0)	−3.1 (3.3)	0.352	0.4	−2.4 (3.1)	0.437	0.33	0.7 (1.9)	0.703	−0.16	0.642

TABLE 6 Changes in metabolic measures at the end of the 8-week intervention and after 24 weeks of unsupervised follow-up^a

Outcome variable and group	Assessment period			Week 8–baseline	<i>P</i>	ES	Week 32–baseline	<i>P</i>	ES	Week 32–week 8	<i>P</i>	ES	<i>P</i> value for overall interaction
	Baseline	Week 8	Week 32										
Insulin (μU/mL)													
CR	19.3 (1.7)	19.1 (2.1)	17.2 (2.1)	−0.2 (2.4)	0.945		−2.0 (2.2)	0.359		−1.9 (1.3)	0.157		
ADF	13.3 (1.6)	16.3 (2.0)	13.7 (2.1)	3.0 (2.3)	0.207		0.4 (2.2)	0.855		−2.6 (1.4)	0.075		
CR–ADF	5.9 (2.4)	2.8 (2.9)	3.5 (3.0)	−3.1 (3.3)	0.352	0.4	−2.4 (3.1)	0.437	0.33	0.7 (1.9)	0.703	−0.16	0.642
Si [$\times 10^4$ μU/(mL min)]													
CR	2.6 (0.9)	2.6 (0.8)	3.2 (1.7)	0.0 (0.2)	0.967		0.7 (0.8)	0.421		0.7 (0.9)	0.461		
ADF	1.9 (0.9)	2.0 (0.8)	3.0 (1.7)	0.1 (0.2)	0.676		1.1 (0.8)	0.218		1.0 (0.9)	0.295		
CR–ADF	0.6 (1.3)	0.6 (1.2)	0.3 (2.4)	−0.1 (0.3)	0.799	0.11	−0.4 (1.2)	0.735	0.15	−0.3 (1.2)	0.803	0.11	0.898
Leptin (ng/mL)													
CR	30.5 (3.4)	19.2 (2.9)	31.4 (4.7)	−11.3 (2.3)	<0.001		0.9 (3.0)	0.761		12.2 (3.0)	<0.001		
ADF	29.2 (3.3)	15.2 (2.8)	26.1 (4.8)	−13.9 (2.4)	<0.001		−3.1 (3.3)	0.363		10.8 (3.3)	0.003		
CR–ADF	1.3 (4.7)	4.0 (4.0)	5.3 (6.7)	2.7 (3.3)	0.432	−0.33	4.0 (4.5)	0.379	−0.37	1.4 (4.5)	0.761	−0.13	0.599
Ghrelin (pg/mL)													
CR	810.3 (53.0)	894.3 (79.4)	881.6 (56.8)	84.0 (45.6)	0.079		71.4 (34.2)	0.048		−12.7 (48.1)	0.795		
ADF	775.8 (51.4)	900.2 (77.2)	792.4 (57.5)	124.4 (46.2)	0.013		16.6 (38.7)	0.673		−107.8 (50.2)	0.043		
CR–ADF	34.5 (73.8)	−5.9 (110.8)	89.3 (80.8)	−40.4 (64.9)	0.54	0.26	54.8 (51.6)	0.3	−0.44	95.2 (69.6)	0.184	−0.57	0.364
BDNF (pg/mL)													
CR	22,552.1 (1,934.4)	18,510.0 (2,070.6)	18,317.8 (1,849.0)	−4,042.1 (2,124.3)	0.07		4,234.3 (2,453.1)	0.098		−192.2 (2,380.7)	0.936		
ADF	20,934.6 (1,858.5)	20,165.4 (1,989.4)	25,738.0 (1,936.9)	−769.2 (2,041.0)	0.71		−4,803.4 (2,480.0)	0.065		5,572.6 (2,414.0)	0.03		
CR–ADF	1,617.5 (2,682.5)	−1,655.4 (2,871.5)	−7,420.2 (2,677.8)	−3,272.9 (2,945.9)	0.278	0.46	9,037.7 (3,488.3)	0.016	1.08	−5,764.8 (3,390.5)	0.103	0.71	0.053

^aLinear mixed-effects model analysis with unstructured covariance was used to assess the efficacy of intervention on each outcome variable. Test of time by group interaction was used to test the efficacy of intervention (see *P* value for overall interaction). Results are mean (SE). Significant *P* values (*P* < 0.05) are indicated in bold. Effect size (ES) is calculated as $(2 \times t \text{ value})/\sqrt{\text{DF}}$, where degrees of freedom (DF). Hand calculations for between- and within-group differences may not be equal to data shown because all data were rounded to 0.1 decimal place. For CR: *n* = 12 for baseline and week 8; *n* = 10 for week 32; for ADF: *n* = 13 for baseline and week 8; *n* = 11 for week 32; non-missing observations: *n* = 71.

^bNo available data for week 32.

HDL, high-density lipoprotein; LDL, low-density lipoprotein; Si, insulin sensitivity index; BDNF, brain-derived neurotrophic factor.