بسم الله الرحمن الرحيم

دانشگاه علوم پزشکی و خدمات بهداشتی درمانی شهید بهشتی

تغذیه و رژیم درمانی در سندروم متابولیک و مقاومت به انسولین

سمیه حسین پور نیازی

استادیار مرکزتحقیقات تغذیه و غدد درون ریز

پژوهشکده علوم غدد درون ریز و متابولیسم

دانشگاه علوم پزشکی شهید بهشتی

Historical aspect of MetS

دهه ۱۹۲۰ kylin، پزشک سوئدی:

سندرم متابولیک ترکیبی از پرفشاری خون، افزایش قند خون و نقرس می باشد

سال ۱۹۷۴، Vague :

تاکید بر چاقی بالاتنه (آندروئید یا چاقی شکمی) به عنوان عامل خطر مرتبط با اختلالات متابولیکی

(چاقی بالاتنه نوعی از فنوتیپ چاقی است که با اختلالات متابولیکی مانند دیابت نوع ۲ و بیماری قلبی عروقی ارتباط دارد.)

سال ۱۹۸۸، Reavan:

تعریف این سندرم به صورت توصیفی از چندین اختلال متابولیکی همراه با مقاومت به انسولین (به عنوان هسته مرکزی پاتوفیزیولوژی اختلالات متابولیکی)

Kylin E. Zentralblatt fur innere Medizin; 1923: 44: 105-27
Vague J. Presse Med 1947; 30: 339–40.
Reaven GM. Diabetes 1988; 37: 1595–607.

Historical aspect of MetS (cont')

بیان واژه **سندرم X** برای تعریف آن

عدم گنجاندن چاقی در تعریف این سندرم

سال ۱۹۸۹، Kaplan :

اضافه کردن چاقی شکمی به تعریف Reaven و حذف غلظت پایین HDL کلسترول

استفاده از واژه "**چهارگانه ی کشنده**" Deadly Quartet

سایر اسامی مربوط به این اختلال متابولیکی که در اسلایدهای بعدی به آن اشاره خواهد شد:

"**سندرم مقاومت به انسولین**"

"**سندرم متابولیک**"

سندرم متابولیک معمول ترین واژه ای است که برای پیش بینی خطرات بیماری های مزمن مانند بیماری های قلبی عروقی و دیابت استفاده می شود

Kaplan NM. Arch Intern Med 1989; 149: 1514–20

Definitions of MetS

The precise definition of the metabolic syndrome remains undecided

***Various definitions** have proposed for Mets:*

- WHO (world health organization)
- EGIR (European Group for the Study of Insulin Resistance)
- NCEP ATP III (National Cholesterol Education Program Adult Treatment Panel III)
- IDF (International diabetes Federation)
- AACE (Association of Clinical Endocrinologists)

Grundy et al, Circulation 2005;112;2735-52

Previous criteria for clinical diagnosis of metabolic syndrome

Clinical Measure	WHO (1998)	EGIR	ATP III (2001)	AACE (2003)	IDF (2005)
Insulin **resistance**	IGT, IFG, T2DM, or lowered insulin sensitivity* plus any 2 of the following	Plasma insulin **>75th** percentile plus any 2 of the following	None, but any **3 of** the following **5** features	IGT or IFG plus any of the following based on clinical judgment	None
Body weight	Men: waist-to-hip ratio **>0.90**; women: waist-to-hip ratio **>0.85** and/or BMI >30 kg/m2	WC **≥94** cm in men or **≥80** cm in women	WC **≥102** cm in men or **≥88** cm in women†	BMI **≥25** kg/m2	Increased WC (population specific) plus any 2 of the following
Lipid	TG **≥150** mg/dL and/or HDL-C **<35** mg/dL in men or **<39** mg/dL in women	TG **≥150** mg/dL and/or HDL-C **<39** mg/dL in men or women	TG **≥150** mg/dL HDL-C **<40** mg/dL in men or **<50** mg/dL in women	TG **≥150** mg/dL and HDL-C **<40** mg/dL in men or **<50** mg/dL in women	TG **≥150** mg/dL or on TG Rx HDL-C **<40** mg/dL in men or **<50** mg/dL in women or on HDL-C Rx

Grundy et al, Circulation 2005;112;2735-52

Previous criteria for clinical diagnosis of metabolic syndrome (cont')

Clinical Measure	WHO (1998)	EGIR	ATP III (2001)	AACE (2003)	IDF (2005)
Blood pressure	≥140/90 mm Hg	≥140/90 mm Hg or on hypertension Rx	≥130/85 mm Hg	≥130/85 mm Hg	≥130 mm Hg systolic or ≥85 mm Hg diastolic or on hypertension Rx
Glucose	IGT, IFG, or T2DM	IGT or IFG (but not diabetes)	>110 mg/dL (includes diabetes)	IGT or IFG (but not diabetes)	≥100 mg/dL (includes diabetes
Other	Microalbuminuria			Other features of insulin resistance§	

Grundy et al, Circulation 2005;112;2735-52

Definition of MetS

Harmonizing the metabolic syndrome

- ✓International diabetes federation task force on epidemiology and prevention
- ✓ national heart, lung, and blood institute
- ✓ American heart association
- ✓world heart federation
- ✓international atherosclerosis society
- ✓international association for the study of obesity.

Harmonizing the metabolic syndrome: a joint interim statement of the international diabetes federation task force on epidemiology and prevention; national heart, lung, and blood institute; American heart association; world heart federation; international atherosclerosis society; and international association for the study of obesity.Circulation. 2009; 120: 1640-5

New definition of MetS by a Joint Interim Statement of the International Diabetes Federation Task Force on Epidemiology and Prevention

measure	*Categorical cut points*
Elevated waist circumference	Population and country specific definition
Elevated TG	≥ **150** mg/dl or drug treatment for elevated TG
Reduced HDL-C	**<40** mg/dl in men **<50** mg/dl in women Or drug treatment for reduced HDL-C

Harmonizing the metabolic syndrome: a joint interim statement of the international diabetes federation task force on epidemiology and prevention; national heart, lung, and blood institute; American heart association; world heart federation; international atherosclerosis society; and international association for the study of obesity.Circulation. 2009; 120: 1640-5

New definition of MetS by a Joint Interim Statement of the International Diabetes Federation Task Force on Epidemiology and Prevention

measure	*Categorical cutpoints*
Elevated blood pressure	**≥ 130** mmHg systolic blood pressure Or **≥85** mmHg diastolic blood pressure Or On antihypertensive drug treatment in a patients with history of hypertension
Elevated fasting glucose	**≥ 100** mg/dl of in drug treatment for elevated glucose

MetS was defined as the presence of **three or more** of five components as recommended

Alberti KG, Circulation. 2009; 120: 1640-5

> Arch Iran Med. 2010 Sep;13(5):426-8.

Appropriate definition of metabolic syndrome among Iranian adults: report of the Iranian National Committee of Obesity

Fereidoun Azizi [1], Farzad Hadaegh, Davood Khalili, Alireza Esteghamati, Farhad Hosseinpanah, Alireza Delavari, Bagher Larijani, Parvin Mirmiran, Azadeh Zabetian, Yadollah Mehrabi, Roya Kelishadi, Hassan Aghajani

Affiliations + expand

PMID: 20804311

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Table 1. Criteria for clinical diagnosis of metabolic syndrome in Iranian adults

Measure	Categorical cut-off points
Elevated waist circumference	95 cm (men and women)
Elevated triglycerides or drug treatment for elevated triglycerides	150 mg/dL (1.7 mmol/L)
Reduced HDL-C or drug treatment for reduced HDL-C	40 mg/dL (1.0 mmol/L) in males; 50 mg/dL (1.3 mmol/L) in females
Elevated blood pressure or antihypertensive drug treatment in a patient with a history of hypertension	Systolic 130 and/or diastolic 85 mm Hg
Elevated fasting glucose or drug treatment of elevated glucose	100 mg/dL

Prevalence of MetS (cont'd)

Ansarimoghadam A. Diabetes & metabolic syndrome: Clinical Research & Reviews; 2018:12:2: 195-201

Prevalence of MetS

In Middle-East countries:

fluctuated by **country** and **time** of study

- Turkish: 2.2–44%
- Saudi-Arabia: 16–41%
- Pakistan: 14–63%
- Qatar: 26–33%
- Kuwait : 9–36%
- Emirate : 22–50%
- Yemen: 23 %
- **Iran: 6–42%**

Ansarimoghadam A. Diabetes & metabolic syndrome: Clinical Research & Reviews; 2018:12:2: 195-201

Comparative Study > PLoS One. 2021 Mar 3;16(3):e0241926. doi: 10.1371/journal.pone.0241926. eCollection 2021.

A nationwide study of metabolic syndrome prevalence in Iran; a comparative analysis of six definitions

Ozra Tabatabaei-Malazy [1 2], Sahar Saeedi Moghaddam [1], Nazila Rezaei [1], Ali Sheidaei [1 3], Mohammad Javad Hajipour [1 4], Negar Mahmoudi [1], Zohreh Mahmoudi [1], Arezou Dilmaghani-Marand [1], Kamyar Rezaee [1], Mahdi Sabooni [1 5], Farideh Razi [6], Farzad Kompani [7], Alireza Delavari [8], Bagher Larijani [2], Farshad Farzadfar [1 2]

Affiliations + expand

Results: National prevalence rate of MetS based on ATP III, IDF, AHA/NHLBI, JIS, RIDF and RJIS criteria were 38.3% (95% CI 37.4-39.1), 43.5% (42.7-44.4), 40.9% (40.1-41.8), 47.6% (46.8-48.5), 32.0% (31.2-32.9), and 40.8% (40.0-41.7), respectively. The prevalence was higher among females, in urban residents, and those aged 65-69 years. MetS was expected to affect about 18.7, 21.3, 20.0, 23.3, 15.7, and 20.0 million Iranians, respectively, based on ATP III, IDF, AHA/NHLBI, JIS, RIDF and RJIS. The two most common components noted in this population were reduced high-density lipoprotein cholesterol (HDL-C) levels and central obesity.

Conclusion: High prevalence rate of MetS among Iranian adults is alarming, especially among females, urban residents, and the elderly. The JIS definition criteria is more appropriate to determine higher number of Iranians at risk of NCDs. Proper management and prevention of MetS is required to adopt multiple national plans including lifestyle modifications, medical interventions, and public education on NCDs risk factors.

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> Int J Endocrinol. 2021 Mar 29:2021:8862456. doi: 10.1155/2021/8862456. eCollection 2021.

High Prevalence of Metabolic Syndrome and Its Related Demographic Factors in North of Iran: Results from the PERSIAN Guilan Cohort Study

Mohammadreza Naghipour [1], Farahnaz Joukar [1 2], Hossein-Ali Nikbakht [3], Soheil Hassanipour [2], Mehrnaz Asgharnezhad [4], Morteza Arab-Zozani [5], Fariborz Mansour-Ghanaei [1 4]

Affiliations + expand

PMID: 33859688 PMCID: PMC8024063 DOI: 10.1155/2021/8862456

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Abstract

Results: The prevalence of the syndrome according to IDF and ATP definition was 42.87% (95% CI: 41.92-41.81) and 40.68% (95% CI: 39.74-41.62), respectively. The prevalence of components for central obesity, high triglyceride, HDL cholesterol, blood glucose, and hypertension components was 75.8%, 43.1%, 40.6%, 39.2% and 37.9%, respectively. All demographic variables were related to the syndrome, and among them age, gender, and residence were identified as independent and strong predictive variables in the regression model. More than 92% of the population had at least one component of the syndrome.

Conclusion: The results of the study show a high prevalence of metabolic syndrome risk factors. It is essential to educate healthy lifestyle behaviors and further health education in the high-risk groups identified in this study, especially the elderly, women, and rural residents.

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Review > Iran J Public Health. 2018 Apr;47(4):473-480.

The Prevalence of Metabolic Syndrome in Iran: A Systematic Review and Meta-analysis

Saeideh Mazloomzadeh [1], Zahra Rashidi Khazaghi [1], Nouraddin Mousavinasab [1]

Affiliations + expand

PMID: 29900131 PMCID: PMC5996331

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Methods: In this systematic review and meta-analysis, the Medline, ISI, IranMedex, and SID were searched using "metabolic syndrome", "syndrome X", "prevalence", and "Iran" keywords from 2002 to 2012. A total of 223 articles were found in which 14 studies were considered for meta-analysis. Data were analyzed using fixed and random model and meta-regression in STATA.

Results: The prevalence of MS for those who were 20 yr and older was 23.8% (95%CI: 18.99-28.67) and in under 20 was 10.98% (95%CI: 7.75-14.2). Metabolic syndrome was more frequent in women (25.5%) than in men (17.16%) and was increased with increasing age. The most frequent component of metabolic syndrome was low HDL cholesterol (59.7%) followed by hypertriglyceridemia (39.5%).

Conclusion: Regarding a high prevalence of metabolic syndrome and some of its components such as low HDL and high triglyceride in our country, implementation of programs for metabolic syndrome prevention is necessary.

Keywords: Meta-analysis; Metabolic syndrome; Prevalence; Systematic review.

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اصول کلی تغذیه در مدیریت سندرم متابولیک و مقاومت به انسولین

levels of evidence (*grades*) are used to summarize the available *scientific evidence* and *guide recommendations* for the *prevention and treatment of MetS*

A: Evidence from meta-analyses that incorporated quality ratings in the analysis or well-conducted randomized controlled trials (RCTs)

B: Evidence from prospective cohort studies or case–control studies

C: Expert consensus/opinion or clinical experience.

Pablo Pérez-Martínez. Nutr Rev. 2017 May; 75(5): 307–326.

levels of evidence (*grades*) are used to summarize the available *scientific evidence* and *guide recommendations* for the *prevention and treatment of MetS*

Daily consumption of ***legumes*** is recommended to improve ***cardio-metabolic risk factors***	A
Legumes can be recommended for ***people with metabolic syndrome*** as an effective component in ***prevention and management of diabetes and cardiovascular disease***	A

Pablo Pérez-Martínez. Nutr Rev. 2017 May; 75(5): 307–326.

levels of evidence (*grades*) are used to summarize the available *scientific evidence* and *guide recommendations* for the *prevention and treatment of MetS*

There is an added cardio-metabolic benefit from incorporating ***nuts*** into a *Mediterranean-type dietary pattern*	A
Consume ***1 to 1.5*** servings of ***nuts*** daily to reduce low-density lipoprotein cholesterol and ***cardiometabolic risk***	A

Pablo Pérez-Martínez. Nutr Rev. 2017 May; 75(5): 307–326.

levels of evidence (*grades*) are used to summarize the available *scientific evidence* and *guide recommendations* for the *prevention and treatment of MetS*

Although the association between intake of ***fruits and vegetables*** and *features of metabolic syndrome remains unclear*, consumption of fruits and vegetables should be an integral part of a healthy and balanced diet	A

Pablo Pérez-Martínez. Nutr Rev. 2017 May; 75(5): 307–326.

levels of evidence (*grades*) are used to summarize the available *scientific evidence* and *guide recommendations* for the *prevention and treatment of MetS*

Daily consumption of ***cereals*** (whole grains) is recommended for ***cardiometabolic health***	A
Cereals can be recommended for ***people with metabolic syndrome***	B

Pablo Pérez-Martínez. Nutr Rev. 2017 May; 75(5): 307–326.

levels of evidence (*grades*) are used to summarize the available *scientific evidence* and *guide recommendations* for the *prevention and treatment of MetS*

Dairy products and *particularly* ***yogurt*** consumption may be useful in ***preventing metabolic syndrome***	B
Reduce intake of *sugar-sweetened beverage* in ***preventing metabolic syndrome***	B

Pablo Pérez-Martínez. Nutr Rev. 2017 May; 75(5): 307–326.

levels of evidence (*grades*) are used to summarize the available *scientific evidence* and *guide recommendations* for the *prevention and treatment of MetS*

Eating a variety of *fish* *at least twice a week*, especially fish containing n-3, may be useful in *preventing metabolic syndrome*	B
There is no evidence to limit **eggs** intake to *prevent metabolic syndrome*	C

Pablo Pérez-Martínez. Nutr Rev. 2017 May; 75(5): 307–326.

Food groups and intermediate disease markers: a systematic review and network meta-analysis of randomized trials

Lukas Schwingshackl,[1,2] Georg Hoffmann,[3] Khalid Iqbal,[1] Carolina Schwedhelm,[1,2] and Heiner Boeing[1,2]

[1]Department of Epidemiology, German Institute of Human Nutrition Potsdam-Rehbruecke (DIfE), Nuthetal, Germany; [2]NutriAct – Competence Cluster Nutrition Research Berlin-Potsdam, Germany; and [3]Department of Nutritional Sciences, University of Vienna, Vienna, Austria

Results: A total of 66 randomized trials (86 reports) comparing 10 food groups and enrolling 3595 participants was identified. Nuts were ranked as the best food group at reducing LDL cholesterol (SUCRA: 93%), followed by legumes (85%) and whole grains (70%). For reducing TG, fish (97%) was ranked best, followed by nuts (78%) and red meat (72%). However, these findings are limited by the low quality of the evidence. When combining all 10 outcomes, the highest SUCRA values were found for nuts (66%), legumes (62%), and whole grains (62%), whereas SSBs performed worst (29%).

Conclusion: The present NMA provides evidence that increased intake of nuts, legumes, and whole grains is more effective at improving metabolic health than other food groups. For the credibility of diet-disease relations, high-quality randomized trials focusing on well-established intermediate-disease markers could play an important role. This systematic review was registered at PROSPERO (www.crd.york.ac.uk/PROSPERO) as CRD42018086753. *Am J Clin Nutr* 2018;108:576–586.

CRITICAL REVIEWS IN FOOD SCIENCE AND NUTRITION
2021, VOL. 61, NO. 1, 85–96
https://doi.org/10.1080/10408398.2020.1716680

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REVIEW

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Benefits of pulse consumption on metabolism and health: A systematic review of randomized controlled trials

Helena Ferreira[a], Marta Vasconcelos[a], Ana M. Gil[b], and Elisabete Pinto[a,c]

[a]CBQF - Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Universidade Católica Portuguesa, Porto, Portugal; [b]Department of Chemistry and, CICECO-Aveiro Institute of Materials, University of Aveiro, Aveiro, Portugal; [c]EPIUnit - Instituto de Saúde Pública, Universidade do Porto, Porto, Portugal

ABSTRACT

Pulses are nutrient-dense foods that have for a long time been empirically known to have beneficial effects in human health. In the last decade, several studies have gathered evidence of the metabolic benefits of pulse intake. However, it remains unclear at what amounts these effects may be attained. This study aimed to systematically review the scientific outputs of the last two decades regarding health benefits of pulse consumption and the amounts necessary for positive outcomes to be achieved. A PubMed search including keywords [("dietary pulses", "pulses", "legumes", "grain legumes", "bean", "chickpea", "pea", "lentil", "cowpea", "faba bean", "lupin") and ("inflammation", "inflammatory markers", "C-reactive protein", "blood lipids", "cholesterol", "cardiometabolic health", "cardiovascular disease", "diabetes", "glycaemia", "insulin", "HOMA-IR", "body weight", "body fat", "obesity", "overweight", "metabolome", "metabolic profile", "metabolomics", "biomarkers", "microbiome", "microbiota", "gut")] was performed. Only English written papers referring to human dietary interventions, longer than one day, focusing on whole pulses intake, were included. Most of the twenty eligible publications reported improvements in blood lipid profile, blood pressure, inflammation biomarkers, as well as, in body composition, resulting from pulse daily amounts of 150 g (minimum-maximum: 54-360 g/day; cooked). Concerns regarding methodological approaches are evident and the biochemical mechanisms underlying such effects require further investigation.

KEYWORDS

Biomarkers; cardiovascular risk factors; ingestion; legume grains; well-being

Assessment

جدول تلفیق واحدهای توصیه شده دریافتی (serving size) با واحدهای سیاهه جانشینی

	تعداد واحد توصیه شده به علی	CHO (g)	Pro (g)	Fat (g)	Energy (Kcal)
Low fat dairy	3	3×12=36	3×8 =24	3×5 = 15	3×120 =360
Vegetables	5	5×5 =25	5×2 =10	-	5×25=125
Fruits	4	4×15 =60	-	-	4×60 =120
Simple sugar	5	5×5=25	-	-	5×20=100
Legumes	1	1×15=15	1×7=10	1×2=2	1×125=125
Grains	6	250 –161= 89÷15= 6	6×3 =18	-	6×80 =480
Meat	4 { 2 2	-	90-62= 28÷7=4	2×3=6 2×5=10	2×45=90 2×75=150
Fat and oil (1 serving nuts)	7.5	-	-	71-33= 38÷5 = 7.5	7.5×45=337.5
Total		260	67	90	1917

Planning

نمونه ای از یک برنامه غذایی سالم برای علی:

تزریق انسولین ساعت ۶

صبحانه : (ساعت ۶:۳۰)

نان سنگک ۲ کف دست، یک قوطی کبریت پنیر کم چرب و کم نمک
مغز گردو ۲ عدد، چای کمرنگ ۱ لیوان + ۲ قاشق مرباخوری عسل

میان وعده صبح:(ساعت ۱۰)

یک لیوان شیر کم چرب(۱/۵٪چربی)، دو عدد نارنگی

ناهار :(ساعت ۱۲:۳۰)

برنج – ۱۲ قاشق غذاخوری سر صاف
خورش کرفس (گوشت خورشتی دو قوطی کبریت، نصف لیوان کرفس پخته شده)
یک لیوان کاهوی و کلم خردشده به همراه نصف عدد گوجه فرنگی و نصف عدد خیار + ۱ قاشق مرباخوری روغن زیتون
یک لیوان ماست کم چرب و پروبیوتیک (۱/۵ درصد چربی)
روغن کلزا – ۲ ق م
ژله : یک قاشق غذاخوری

Planning

ادامه نمونه ای از یک برنامه غذایی سالم برای علی:

عصرانه :(ساعت ۴)

یک عدد انار متوسط + یک عدد سیب

یک قاشق مرباخوری مغز خام تخمه کدو

تزریق انسولین ۶ شب

شام : (ساعت ۶:۳۰)

سه چهارم لیوان خوراک لوبیای چیتی

نان سنگک سنتی سبوس دار – ۱/۵ کف دست

ماست کم چرب پروبیوتیک – یک لیوان

سبزی خوردن: ۲ لیوان

۲ قاشق مربا خوری روغن زیتون

ژله یک قاشق غذاخوری

قبل از خواب : (ساعت ۱۰ شب)

یک عدد سیب

نصف کف دست نان سنگک، یک عدد تخم مرغ، یک قاشق مرباخوری ژله

ATP III recommendation for Management of the MetS (cont')

Reduction of underlying causes:

1) Weight reduction (7-10%)

2) Diet therapy

3) Increase physical activity

3) Stop cigarette smoking

The metabolic syndrome – What is it and how should it be managed? European Journal of Preventive Cardiology 2019, Vol. 26(2S) 33–46

ATP III recommendation for Management of the MetS (cont')

1) Weight reduction:

High weight loss (10% of baseline weight in 6 months)

- ✓ In obese subjects
- ✓ Improvement in sensitivity to insulin between **30** and **60**%, an effect greater than that seen with insulin-sensitizing drugs
- ✓ An risk reduction in CVD

Hoyas I. J Clin Med. 2019 Sep; 8(9): 1301.

ATP III recommendation for Management of the MetS (cont')

2) Diet therapy

Carbohydrate

ADA statement:

There is *no "first-line" approach* with respect to the optimal carbohydrate quantity in the diet plan, because evidence remains inconclusive

Hoyas I. J Clin Med. 2019 Sep; 8(9): 1301.

ATP III recommendation for Management of the MetS (cont')

2) Diet therapy

Carbohydrate

Elevated intake of carbohydrates of high GI

Insulin resistance directly

Development of T2DM in persons with MetS

Hoyas I. J Clin Med. 2019 Sep; 8(9): 1301.

ATP III recommendation for Management of the MetS (cont')

2) Diet therapy

Whole grains

A diet rich in whole grains (**6-10** servings/d)

A reduction in insulinemia by 10%

Insulin resistance by 13%

Hoyas I. J Clin Med. 2019 Sep; 8(9): 1301.

ATP III recommendation for Management of the MetS (cont')

2) Diet therapy

Dietary fat:

The amount of ***fat*** can influence ***insulin sensitivity*** and the ***risk of developing type 2 diabetes:***

only with intakes greater than ***35–40%*** of total energy intake

Hoyas I. J Clin Med. 2019 Sep; 8(9): 1301.

ATP III recommendation for Management of the MetS (cont')

2) Diet therapy

Dietary fat (evidence base)

Daily consumption of ***olive oil*** at doses of ***20–40 g/d*** in ***replacement for other fats*** is useful in the *prevention* and *treatment* of metabolic syndrome

Pablo Pérez-Martínez. Nutr Rev. 2017 May; 75(5): 307–326.

Influence of diet on insulin sensitivity

Total fatty acids (>40%)	-
trans Fatty acids	-
Monounsaturated fatty acids	+
Fiber cereal	+
Low glycemic index	+
Salt	-
Simple sugars (>20% energy)	-
Conjugated linoleic acid	-
(+): Increases insulin sensitivity (-): Decreases insulin sensitivity	

Hoyas I. J Clin Med. 2019 Sep; 8(9): 1301.

ATP III recommendation for Management of the MetS (cont')

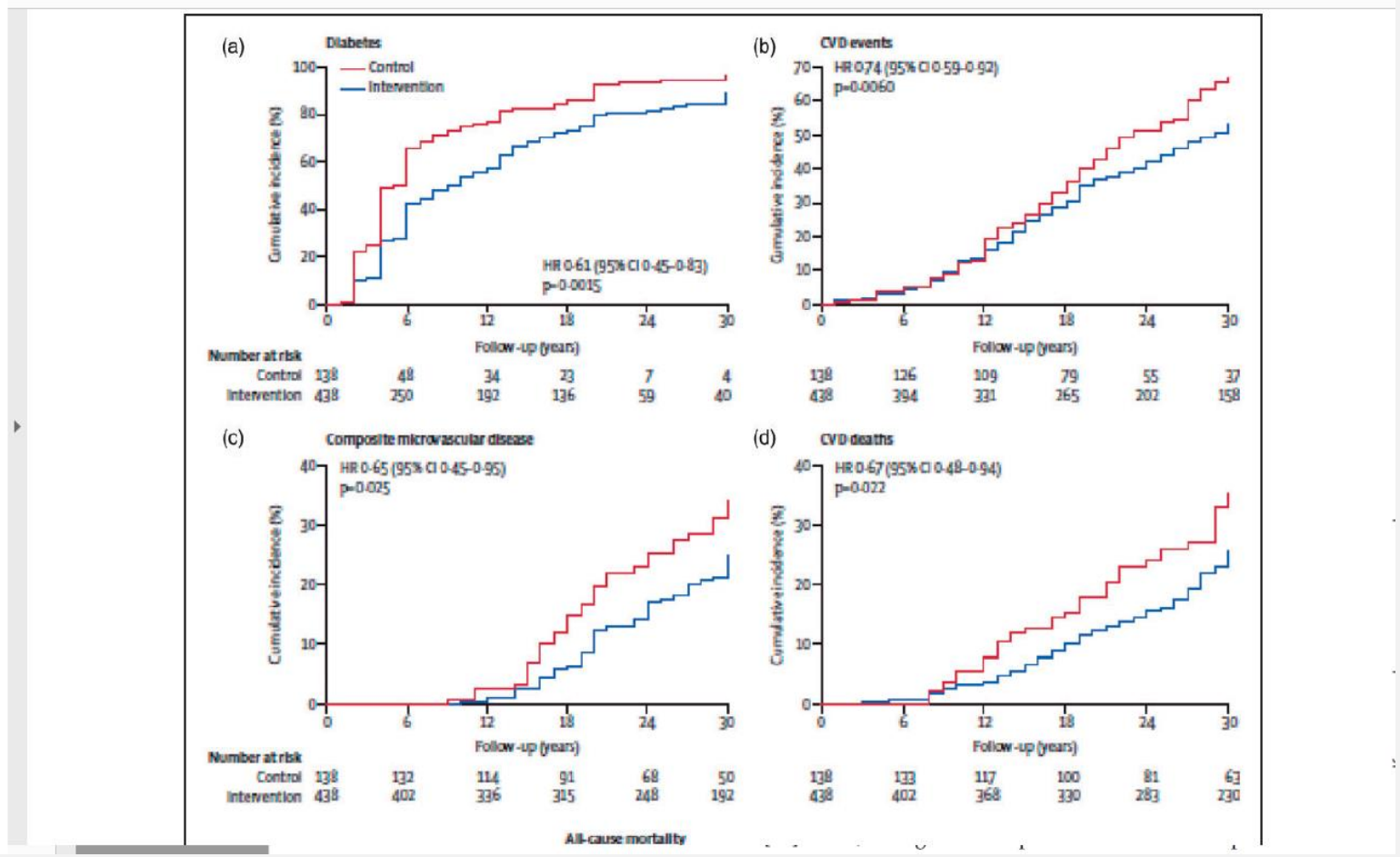
3) Increase physical activity

Summary of available evidence on physical activity

- *30–60 min* of daily physical activity is recommended, including *aerobic exercise*, *work-related activity*, and *muscle strengthening*
- Physical activity can be accumulated throughout the day in blocks as short as *10 minutes*

Pablo Pérez-Martínez. Nutr Rev. 2017 May; 75(5): 307–326.

Development of diabetes (a), cardiovascular events (b), microvascular events (c), cardiovascular mortality (d) during 30 years of follow-up in the Da Qing trial.



The metabolic syndrome – What is it and how should it be managed? European Journal of Preventive Cardiology 2019, Vol. 26(2S) 33–46

رویکرد های رژیم درمانی در مدیریت سندرم متابولیک و مقاومت به انسولین

Dietary strategies and potential health benefits for Metabolic Syndrome

Table 1. Dietary strategies and potential health benefits for Metabolic Syndrome (MetS).

Dietary Pattern	Nutritional Distribution	Improvements in MetS Criteria	Ref.
Mediterranean diet	▪ 35–45% kcal/d from total fat (mainly MUFA [1], EVOO and nuts being the principal source) ▪ 35–45% kcal/d from CH ▪ 15–18% kcal/d from protein	Reduction of CVD incidence and outcomes	[22,23,24,25,26,27,28,29]
		Decreased BP (systolic and diastolic)	[15,26]
		Inverse association with mortality	[24,30]
		Improvements in dyslipemia	[26]
		Decreased incidence of T2DM	[12,22,23,29,31]
DASH diet	▪ Total fats 27% kcal/d ▪ Saturated fats 6% kcal/d ▪ Dietary cholesterol ▪ CH 55% kcal/d ▪ Proteins 18% kcal/d	Reduction of BP (systolic and diastolic)	[32,33]
		Reduction in BMI and waist circumference	[34,35]
		Improvement in cardiometabolic profile	[36,37,38,39]
		Reduction in T2DM incidence	[40]
Plant-based diets	▪ Reduction or restriction of animal-derived foods ▪ High intake of plant-source foods ▪ Fat profile rich in UFAs	Reduction of BP (systolic and diastolic)	[41,42]
		Decreased body weight and risk of obesity	[43,44,45]
		Reduction of the risk of CVD	[46]
		Decreased all-cause mortality	[43,47,48]
		Decreased risk of T2DM	[43,47,48]

Dietary Strategies for Metabolic Syndrome: A Comprehensive Review. Nutrients 2020, 12, 2983

Dietary strategies and potential health benefits for Metabolic Syndrome

		Decreased risk of T2DM	[43,47,48]
Low CH diets and very low CH diets (ketogenic diets)	▪ <50% kcal/d from carbohydrates and <10% kcal/d from CH in ketogenic diets ▪ High protein (20–30% kcal/d) ▪ High fat intake (30–70% kcal/d)	Weight-loss and weight-loss maintenance	[49,50,51,52]
		Reduction of DBP	[52]
		Reduction of LDL-c and triglycerides levels	[49,50,51]
		Increase of HDL-c levels	[49,50,51]
		Improvements in insulin resistance	[53,54]
		Reduction of HbA1c levels	[49,51]
Low-fat diet	▪ <30% kcal/d from total fat (<10% of saturated fat) ▪ 15–17% kcal/d from protein ▪ 50–60% kcal/d from CH	Reduction of BP (systolic and diastolic)	[33,55]
		Short-term improvement of cholesterol profile	[33,55]
		Short-term weight loss	[55]
		Reduced risk of all-cause mortality	[56]
High protein diet	▪ High protein (20–30% kcal/d) or 1.34–1.50 g/Kg body weight/d from protein ▪ Low CH (40–50% kcal/d)	Reduction of triglycerides levels	[57,58]

Dietary Strategies for Metabolic Syndrome: A Comprehensive Review. Nutrients 2020, 12, 2983

Dietary strategies and potential health benefits for Metabolic Syndrome

Low-fat diet		▪ <30% kcal/d from total fat (<10% of saturated fat) ▪ 15–17% kcal/d from protein ▪ 50–60% kcal/d from CH	Reduction of BP (systolic and diastolic)	[33,55]
			Short-term improvement of cholesterol profile	[33,55]
			Short-term weight loss	[55]
			Reduced risk of all-cause mortality	[56]
High protein diet		▪ High protein (20–30% kcal/d) or 1.34–1.50 g/Kg body weight/d from protein ▪ Low CH (40–50% kcal/d)	Reduction of triglycerides levels	[57,58]
Other dietary patterns and strategies	Nordic diet	▪ High content of whole-grain high-fibre products ▪ Low in meat and processed foods	Reduction of BP (systolic and diastolic)	[59]
			Increase of HDL-c levels	[59]
	Intermittent fasting	▪ Fasting for a long period of time	Weight loss	[60,61,62]
			Improvements in insulin resistance	[60,61,62]
			Improvements in dyslipidaemia	[60,61,62]
			Reduction of BP (systolic and diastolic)	[60,61,62]
			Decreased risk of T2DM	[63]
			Decreased risk of CVD	[63]

[1] Monounsaturated fatty acids, MUFA; extra virgin olive oil, EVOO; carbohydrates, CH; cardiovascular disease, CVD; blood pressure, BP; type 2 diabetes mellitus, T2DM; Dietary Approaches to Stop Hypertension, DASH; unsaturated fatty acids, UFAs; body mass index, BMI; diastolic blood pressure, DBP; low-density lipoprotein cholesterol, nsaturated fatty acids, MUFA.

Dietary Strategies for Metabolic Syndrome: A Comprehensive Review. Nutrients 2020, 12, 2983

Dietary strategies and potential health benefits for Metabolic Syndrome

sistent access to enough food for an active, healthy life (135). Food insecurity affects 16% of adults with diabetes compared with 9% of adults without diabetes (136). There is a complex bidirectional association between food insecurity and cooccurring diabetes. Food security screening should happen at all levels of the health care system. Any member of the health care team can screen for food insecurity using The Hunger Vital Sign. Households are considered at risk if they answer either or both of the following statements as "often true" or "sometimes true" (compared with "never true") (137):

- "Within the past 12 months, we worried whether our food would run out before we got money to buy more."
- "Within the past 12 months, the food we bought just didn't last, and we didn't have money to get more."

If screening is positive for food insecurity, efforts should be made to make referrals to appropriate programs and resources. For more information on efforts and policy recommendations, see "The Biden-Harris Administration National Strategy on Hunger, Nutrition, and Health" (138).

egy or method to direct some of the choices. Eating plans are based on the individual's usual eating style.

- **Dietary approach.** Method or strategy to individualize a desired eating pattern and provide a practical tool(s) for developing healthy eating patterns. Examples of dietary approaches include the plate method, carbohydrate choice, carbohydrate counting, and highly individualized behavioral approaches (140).

Evidence suggests that there is not an ideal percentage of calories from carbohydrate, protein, and fat for people with diabetes. Therefore, macronutrient distribution should be based on an individualized assessment of current eating patterns, preferences, and metabolic goals. Members of the health care team should complement MNT by providing evidence-based guidance that helps people with diabetes make healthy food choices that meet their individualized needs and improve overall health.

ing patterns are acceptable for the management of diabetes (73,104,141,142). Until the evidence around benefits of different eating patterns is strengthened, health care professionals should focus on

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Nutrition, and Health" (138).

Eating Patterns and Meal Planning

For an understanding of nutrition and diabetes, it is important to clarify the differences between food patterns, eating plans, and approaches. These are terms that are often used interchangeably, but they are different and relevant in individualizing nutrition care plans (139).

- **Eating pattern(s) or food pattern(s).** The totality of all foods and beverages consumed over a given period of time. An eating pattern can be ascribed to an individual, but it is also the term used in prospective cohort and observational nutrition studies to classify and study nutrition patterns. Examples of eating patterns include Mediterranean style, Dietary Approaches to Stop Hypertension (DASH), low-carbohydrate vegetarian, and plant based (139).
- **Eating/meal plan (historically referred to as a diet).** An individualized guide to help plan when, what, and how much to eat on a daily basis, completed by the person with diabetes and the RDN.

ferent eating patterns is strengthened, health care professionals should focus on the core dimensions common among patterns: inclusion of nonstarchy vegetables, whole fruits, legumes, whole grains, nuts, seeds, and low-fat dairy products and minimizing consumption of meat, sugar-sweetened beverages, sweets, refined grains, and ultraprocessed foods (143,144).

Evidence for eating patterns has been informed by RCTs, prospective cohort studies, systematic reviews, and network meta-analysis. Those most frequently referenced include Mediterranean, DASH, low-fat, carbohydrate-restricted, vegetarian, and vegan eating patterns. As stated previously, there is insufficient evidence to select one over the other (137,141,142,145–154). Ultimately, ongoing diabetes and nutrition education paired with appropriate support to implement and sustain health behaviors is recommended (103).

Meal Planning

Referral to and ongoing support from an RDN is essential to assess the overall nutrition status of, and to work collaboratively with, the person with diabetes to create a personalized meal plan that

Diabetes care; 2024

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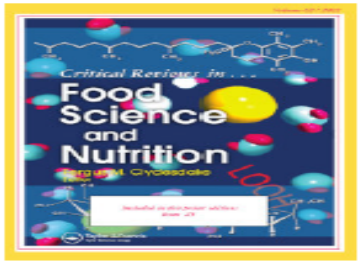

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Critical Reviews in Food Science and Nutrition

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Nutritional guidelines for the management of insulin resistance

Giovanna Muscogiuri, Luigi Barrea, Massimiliano Caprio, Florencia Ceriani, Alberto O. Chavez, Marwan El Ghoch, Evelyn Frias-Toral, Rucha J Mehta, Verna Mendez, Stavroula A. Paschou, Agnieszka Pazderska, Silvia Savastano & Annamaria Colao

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Guideline for the Management of Insulin Resistance

Govers E[1], Slof EM[2], Verkoelen H[3], Ten Hoor-Aukema NM[4] and Knowledge Centre for Dietitians for Prevention and Management of Overweight and Obesity (KDOO)

[1]Chair to ESDN Obesity of the European Federation of Associations of Dietitians (EFAD), Primary Care Dietitian to Amstelrin, Institution for Primary Care, The Netherlands
[2]Primary care dietitian to EetOké, Member of KDOO board, Scientific Advisor for Atkins Netherlands, The Netherlands
[3]Dietitian to Prima-Vita, Member of KDOO, The Netherlands
[4]Primary Care Dietitian to Bon Appetit Dietitians, The Netherlands

***Corresponding author:** Elisabeth Govers, Cornelis van Alkemadestraat 16, 1065 AC Amsterdam, The Netherlands, **E-mail:** e.govers112@upcmail.nl

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Abstract

The successes of interventions to obtain weight loss and prevent relapse are limited. Moreover, comorbidities like type 2 diabetes mellitus, hypertension, hypercholesterolemia, hypertriglyceridemia and gout, have so far been treated as separate diseases, although mounting evidence shows that these morbidities are consequences of the failing metabolism due to insulin resistance. Weight loss, in other words treating obesity, improves comorbidities and improves quality of life. Treatment of obesity and its comorbidities is a multidisciplinary matter. It can be done in primary care. It should be widely recognized that a low carbohydrate diet and exercise are the two main aspects of treatment that lead to the desired result: considerable weight loss and diminishment of comorbidities, visible through improvement of blood parameters and improved quality of life. Because of the complexity of the diet a large role in management is fit for dietitians, supported by psychologists, physiotherapists and exercise trainers. Family physicians and nurse practioners need to be aware of the important role diet and lifestyle play. In insulin resistance medication is not the preferred treatment; it should be avoided as much as possible. By accepting this challenge in primary care, health professionals can change the prevalence and consequences of obesity and its comorbidities, thus reducing health care costs considerably. Persons that are insulin

Dietary management in insulin resistance

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Dietary Management

Explanation about the physiological changes in the patient's body through visceral fat and IR gives an insight in the causes of overweight, and the reasons why weight loss in the past has not been successful in the long term. It forms the basis for lifestyle changes and self-management by the patient. It is important to formulate the patient's own objectives as well as the objectives of the dietary treatment, because these may be different. Patients have their own thoughts about their health and what they want to achieve, which are sometimes not realistic, e.g. the wish to lose 30 kilos in six months; and sometimes show a lack of commitment, e.g. when a patient does not want to lose weight when he is developing type 2 diabetes. The challenge for the dietitian is to motivate the patient to feel responsible for his own health; to feel confident that he can make a few changes that mean a big difference, and to keep him interested whilst he has a busy work environment and social life. It is very important to keep focus on weight loss, because weight loss is the key to improvement of comorbidities, and long-term quality of life. Dietary management aimed at minor weight loss may lead to patient satisfaction short term but may not lead to improved physiological and metabolic health [39].

Dietary treatment aims at improving and normalizing metabolic and vascular health and implies:

- Improving physical and mental health, in regard of economic, social and financial aspects.
- Stimulating self-management of the patient.
- Improving physical activity. Physical activity leads to diminishing of IR [40-44].

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Under Dutch law a diet is a nutritional treatment that differs from general dietary guidelines for a medical reason. Insulin resistance is a medical condition that requires a different proposition of the macro-nutrients. A diet with the normal advice to obtain 50 energy percent from carbohydrates, as general guidelines worldwide do, is not fit for the patient with insulin resistance, because these patients will not lose weight. Such a diet will not be effective and sometimes even counter-productive [45,46]. Self-help diets and commercial or internet based diets do not meet the requirements for diets on medical indication needed for patients with insulin resistance.

The explanation why patients with IR do no lose weight on normally composed diets is that the insulin level at fasting state already is too high (Table 2). Large quantities of carbohydrates stimulate the release of insulin even more; insulin promotes lipogenesis. Through the high insulin levels the release of growth hormone is inhibited. Growth hormone promotes lipolysis. High insulin levels thus prevent lipolysis, and therefore prevent weight loss. This is why the diet is aimed at reducing the secretion of insulin through diet to a minimum, to promote lipolysis and consequently weight loss.

Dependent on the grade of insulin resistance and based on the dietary history the carbohydrate content of the diet is decreased. A low carbohydrate diet is high in protein and fat and contains optimal micronutrients and fibre [46].

Dietary management in insulin resistance

- As already remarked, excessive circulating insulin is strongly associated with obesity and plays a causal role in adipocyte hypertrophy and hyperplasia, ultimately leading to adipose tissue remodeling and subsequent expansion

- Importantly, early normalization of insulin production and secretion has been shown as a *valuable therapeutic approach* to both *prevent and treat obesity and IR states*

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The objectives of the *dietary management for insulin resistance*

- Improvement of the insulin sensitivity by *restriction of the carbohydrate content of the diet*

  Weight loss of 10-15% (20% in case of obesity stage 3) and weight maintenance of 2-5 years

  Sustaining or improving of muscle mass

  Maximum satiation through protein, fat and fiber

  Optimal ***supply of vitamins and minerals***

  Improvement of ***quality of life***

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Dietary management in insulin resistance

Energy Expenditure

- Both *body weight and fat free mass* (FFM) are important determinants of the *basal metabolism*
- *Organs and muscle* have high energy expenditure and *fat mass* uses less energy
- The percentage muscle or body fat influences basal metabolism: individuals with a high fat percentage have a lower basal metabolism than those with a lower fat percentage

Dietary management in insulin resistance

Fat%	65kg	70kg	75kg	80kg	85kg	90kg	95kg	100kg	105kg
<10%	1795	1930	2065	2200	2335	2470	2605	2740	2875
10-20%	1715	1850	1980	2110	2245	2380	2515	2650	2785
20-30%	1560	1680	1800	1920	2040	2160	2280	2300	2420
>30%	1405	1510	1620	1730	1840	1950	2060	2170	2280

Table 5: Average basal metabolism per 24 hours in persons aged 20-40 according to body fat percentage

This difference needs to be taken into account when *calculating energy expenditure* for a patient.
The difference in basal metabolism between men and women can also be explained by differences in fat percentage: women have averagely *10 per cent more fat mass* than men with the same length, weight and age
In insulin resistance the energy expenditure must also be taken into account: *weight loss never occurs when there is no energy deficit.*
Generally a deficit of *600 calories* forces the body to metabolize fatty tissue.
As mentioned before in insulin resistance the *low carbohydrate approach* is necessary to *start lipolysis*.

درصد کاهش وزن و انرژی دریافتی بر اساس نمایه توده بدن

BMI (kg/m2)	weight loss %	Energy deficit
25-27	5%	500 Kcal
27-35	7%	700 kcal
>35	10-15%	1000 kcal
>40	20%	1000 kcal

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Dietary management in insulin resistance; carbohydrate

Carbohydrates

A carbohydrate restriction has a greater effect on lowering serum glucose values than a caloric restriction and should be the first choice in treatment of type 2 diabetes [50]. Table 6 gives an outline of the carbohydrate restrictions for patients with different profiles.

- Restrict carbohydrates to products with a low glykemic index (less than 55) or with a low glykemic load (less than 10). Advise carbohydrates only in combination with fibre.
- The severity of insulin resistance is leading in the level of the carbohydrate restriction.

15) Guideline for the Management of Insulin Resistance. Int J Endocrinol Metab

- A low carbohydrate diet is effective in improving the glykemic and lipid profile in insulin resistance [51].
- Replacing carbohydrates by protein and fat leads to more satiety and satiation.
- These recommendations are guidelines which will be adjusted per patient, dependent on dietary diagnosis, including anthropometric measurements, and dietary history [52].
- Low carbohydrate diets can lead to a mild form of ketosis. The liver switches to ketosis when the carbohydrate intake is low, and starts to metabolize fat. This is not the same condition as keto-acidosis, when ketones are formed because there is no glucose available in the cells at all, as in non-regulated type 1 diabetes, when there is no insulin production. The amount of ketones in this case will increase to high levels. In a low carbohydrate diet these levels are never met [53].
- Snacks in between meals with a low GI index are only necessary if the compliance of the diet is a problem [54].

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Dietary Inflammatory Index (DII) *cont'd*

2. EAT A LOW GLYCEMIC DIET

	GI	GL
Vegetables		
Beets, canned	64	5
Carrots (avg)	47	3
Parsnip	97	12
Peas (green, avg)	48	3
Potato		
Baked (avg)	85	26
Boiled	88	16
French fries	75	22
Microwaved	82	27
Pumpkin	75	3
Sweet corn	60	11
Sweet potato (avg)	61	17
Rutabaga	72	7
Yam (avg)	37	13

Dietary Inflammatory Index (DII) *cont'd*

2. EAT A LOW GLYCEMIC DIET

Legumes		
Baked beans (avg)	48	7
Broad beans	79	9
Butter beans	31	6
Chickpeas (avg)	28	8
Cannellini beans (avg)	38	12
Kidney beans (avg)	28	7
Lentils (avg)	29	5
Soy beans (avg)	18	1

Dietary Inflammatory Index (DII) *cont'd*

2. EAT A LOW GLYCEMIC DIET

Fruit		
Apple (avg)	38	6
Apricot (dried)	31	9
Banana (avg)	51	13
Cherries	22	3
Grapefruit	25	3
Grapes (avg)	46	8
Kiwi fruit (avg)	53	6
Mango	51	8
Orange (avg)	48	5
Papaya	59	10
Peach (avg)		
Canned (natural juice)	38	4
Fresh (avg)	42	5
Pear (avg)	38	4
Pineapple	59	7
Plum	39	5
Raisins	64	28
Cantaloupe	65	4
Watermelon	72	4

Dietary management in insulin resistance; carbohydrate

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Glycemic Index (GI) Values for Major Sources of Dietary Carbohydrates in Iran

Fatemeh Kazemi [1,2], Goodarz Danaei [3,4], Farshad Farzadfar [2,5], Vasanti Malik [6], Mahboubeh Parsaeian [7], Hamed Pouraram [1], Negar Zamaninour [8], Jamal Rahmani [9], Ahmad Reza Dorosty Motlagh [1,*]

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Food	N	GI[a], Mean ± SE	GI Classification	Serving Size (g)	Available Carbohydrate[b] (g/serving)	GL (per serving)
Bread						
Lavash	12	72 ± 7	High GI	30	18	13
Taftoon	12	79 ± 9	High GI	30	17.67	14
Barbari	12	99 ± 8	High GI	30	17.19	17
Sangak[c]	12	82 ± 6	High GI	30	16	13
Rye	11[d]	84 ± 7	High GI	30	13	11
Barley	11[d]	66 ± 6	Moderate GI	30	14.16	9
Rice						
White rice (Tarom)	11[e]	71 ± 10	High GI	30	24	17
Brown rice (Tarom)	12	65 ± 6	Moderate GI	30	22	14
Lentils:White rice, 1:2	11[e]	79 ± 7	High GI	30	19.5	15.4
Lentils:Brown rice,1:2	11[d]	55 ± 4	Low GI	30	18	10

ON THIS PAGE

Abstract
1. Background
2. Objectives
3. Methods
4. Results
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Dietary management in insulin resistance; fat

- Fat in the diet plays an important role in both taste and satiation, thus leading to more compliance
- One of the main advantages of a low carbohydrate diet is that there is no fat restriction
- Dependent of the carbohydrate restriction fat can contribute *35-50 energy % to the diet*
- However, one needs to consider total energy intake to make weight loss possible
- Therefore, fat cannot be added to the diet unlimitedly
- If *weight loss in a low carbohydrate diet is not achieved*, it is advised to *reconsider* the *fat intake* in the diet

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ATP III recommendation for Management of the MetS and insulin resistance (cont'd)

2) Diet therapy

Dietary fat:

The amount of ***fat*** can influence ***insulin sensitivity*** and the ***risk of developing type 2 diabetes:***

only with intakes greater than ***35–40%*** of total energy intake

Hoyas I. J Clin Med. 2019 Sep; 8(9): 1301.

Dietary management in insulin resistance; fat

- The intake of saturated fats from dairy may not be so harmful as thought previously [58].
- The consumption of mono unsaturated fatty acids like olive oil and rapeseed oil, avocado and poly unsaturated fatty acids in fish and nuts is preferred.
- Replace saturated fat by omega-3 (fish) fatty acids or alpha-linoleic acid in nuts, seeds and pits [59].
- A lower-carbohydrate, higher-fat diet reduces abdominal and intramuscular fat and increases insulin sensitivity in adults at risk of type 2 diabetes. It leads to better weight loss, larger decrease of intra-muscular and intra-abdominal fat and decrease of the insulin secretion [60].

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Dietary management in insulin resistance; protein

- The diet should have *1-1,5 grams protein per kg* present body weight
- A *high protein diet* leads to *more satiation and sustains muscle mass*
- A *high protein diet* leads to significantly *higher decrease of fat mass* after a year
- *Protein* should be evenly spread *over three meals*
- Give per meal 3 grams of the essential amino acid *leucine*. Leucine is present in *animal protein, dairy products, nuts, seeds and pulses*
- Wey protein and casein are in combination with leucine essential for building and maintaining muscle tissue. Leucine prevents decrease of muscle and liver tissue. Leucine is also part of hemoglobin.
- Protein rich foods enhance *thermogenesis*. This effect is *bigger in animal protein* than in proteins from plants. ***Pulses however have a beneficial effect on fasting glucose values in type 2 diabetes mellitus***.

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Dietary management in insulin resistance; protein

Food product	Leucine/g per 100 grams
Sojbeans	2.97
Lentils	2.03
Black eyed peas	1.83
Beef	1.76
Peanuts	1.67
Salami	1.63
Salmon	1.62
Shrimps	1.61
Chicken	1.48
Almonds	1.47
Eggyolk	1.40
Chick peas, garbanzos	1.37
Sesame seed	1.36
Cheese	1.35
Linicseed	1.24
Walnuts	1.17
Egg	1.09
Eggwhite	1.02
Porcsausage	0.96
Sheepmilk	0.59
Porc	0.40
Hummus	0.35
Goatmilk	0.31
Cowmilk, 3.25% fat	0.27
Sojmilk	0.24
Asparagus	0.13
Sugar snaps	0.11
Human milk	0.10

Table 7: Leucine in uncooked and unprocessed food

High protein meals give more satiation

Because appetite is postponed for hours after a protein-rich meal, it is easier not to eat in between meals and uphold the diet

If the patient is able to control his appetite this is a remedy against relapse

A diet rich in protein and low in carbohydrates is good for long-term weight maintenance

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Dietary management in insulin resistance; protein

Maintenance of Muscle Mass

- Up to a few years ago the dominant approach in weight loss management was that calorie restriction was most effective
- The result was, besides the fact that patients were hungry part of the time, that muscle mass declined
- A protein intake of ***1 to 1,5 grams per kilo body weight,*** reducing carbohydrate intake at the same time has a beneficial effect on body composition
- Patients ***lose body fat***, whereas ***fat free mass (muscle, bones, organs) will be preserved***

A high protein diet with a firmly reduced carbohydrate intake has proven most effective to maintain muscle mass and lose fat mass

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Dietary management in insulin resistance; fiber

These are inulin, pectin, gums, and fructooligosaccharides, mainly present in legumes, cereals (oats and barley), and certain fruits.

- Giving volume to the stool
- Used by intestinal microorganisms, especially the colon's flora, and is also known as fermentable fiber
- Link this fiber type with IR is the GI
- Soluble fiber, given its gelling properties, is associated with the concept of GI

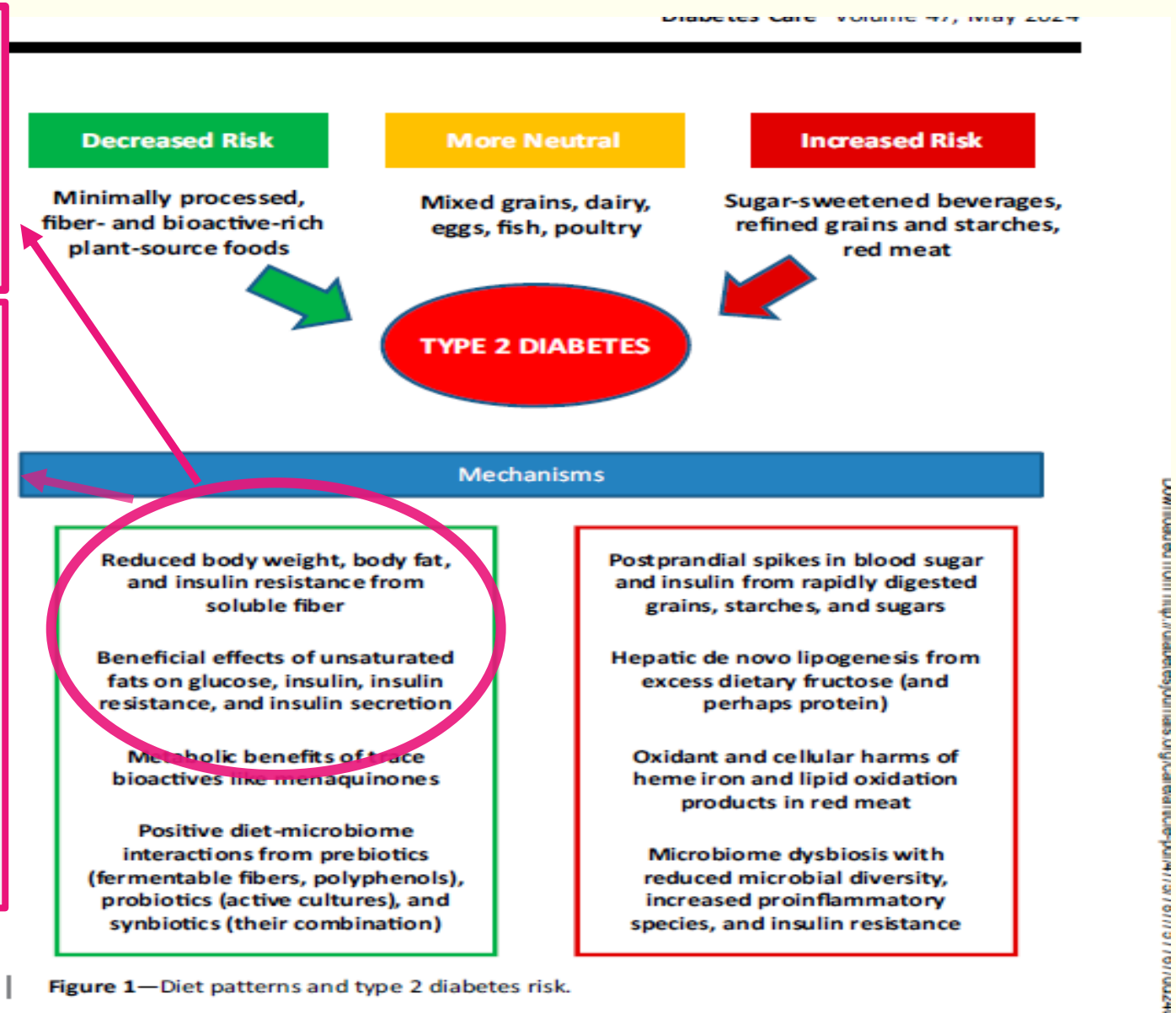

Figure 1—Diet patterns and type 2 diabetes risk.

Mozzafarian. Diabetes care. May 2024; voulume 47: 787-789

Assessment

درصد درشت مغذی ها از کل کالری آقای علی

کالری مورد نیاز:کیلوکالری ۲۰۰۰=۳۵۰+۱۶۵۱

Pro=20% × 2000=400 ÷ 4 = 100g

Fat = 35 % ×2000=700 ÷ 9 = 77 g

CHO = 45% × 2000=900 ÷ 4 = 225 g

Assessment

با توجه به تزریق انسولین به علی، توزیع کربوهیدرات در وعده های غذایی به شکل ذیل محاسبه می شود:

صبحانه	225 ×15% = 34 g
نیم چاشت	225× 10% = 22.5 g
ناهار	225× 25% = 56 g
عصرانه	225× 10% = 22.5 g
شام	225× 30% = 67.5 g
قبل خواب	225× 10% = 22.5 g

Assessment

جدول تلفیق واحدهای توصیه شده دریافتی (serving size) با واحدهای سیاهه جانشینی

	تعداد واحد توصیه شده به علی	CHO (g)	Pro (g)	Fat (g)	Energy (Kcal)
Low fat dairy	3	3×12=36	3×8 =24	3×5 = 15	3×120 =360
Vegetables	4	4×5 =20	4×2 =8	-	4×25=100
Fruits	3	3×15 =45	-	-	3×60 =180
Simple sugar	3	3×5=15	-	-	3×20=60
Legumes	1	1×15=15	1×10=10	1×2=2	1×125=125
Grains	6	225 –131= 94÷15= 6	6×3 =18	-	6×80 =480
Meat	5.5	-	100-60= 40÷7=5.5	2.5×3=7.5 3×5=15	2.5×45=112.5 3×75=225
Fat and oil	7.5	-	-	77-39.5= 37.5÷5 = 7.5	7.5×45=337.5
Total		260	67	90	1917

Assessment

توزیع عادلانه واحدهای توصیه شده دریافتی در وعده ها و میان وعده ها علی ط.

گروههای غذایی	تعداد واحد توصیه شده	صبحانه	نیم چاشت	نهار	عصرانه	شام	قبل از خواب
لبنیات کم چرب	۳		۱	۱		۱	
سبزی	٤			۲	۱	۱	
میوه	۳		۱		۱		۱
غلات		۲				۲	
حبوبات						۱	
قند ساده		۱			۱		۱
گوشت	۵.۵	۱.۵		۲	۱		۱
چربی	۷.۵	۱		۳	۱	۲.۵	
شمارش کربوهیدرات (گرم)		۳۵	۲۷	۵۲	۲۵	٦۵	
		۳٤	۲۲.۵	۵٦	۲۲.۵	٦۷.۵	۲۲.۵

پنیر یا تخم مرغ

آجیل سویا

Planning

نمونه ای از یک برنامه غذایی سالم برای علی:

تزریق انسولین ساعت ۶

صبحانه : (ساعت ۶:۳۰)

نان سنگک ۲ کف دست، یک قوطی کبریت پنیر کم چرب و کم نمک
مغز گردو ۲ عدد، چای کمرنگ ۱ لیوان + ۲ قاشق مرباخوری عسل

میان وعده صبح:(ساعت ۱۰)

یک لیوان شیر کم چرب(۱/۵٪چربی)، دو عدد نارنگی

ناهار :(ساعت ۱۲:۳۰)

برنج – ۱۲ قاشق غذاخوری سر صاف
خورش کرفس (گوشت خورشتی دو قوطی کبریت، نصف لیوان کرفس پخته شده)
یک لیوان کاهوی خردشده به همراه نصف عدد گوجه فرنگی و نصف عدد خیار + ۱ قاشق مرباخوری روغن زیتون
یک لیوان ماست کم چرب و پروبیوتیک (۱/۵ درصد چربی)
روغن کلزا – ۲ ق م
ژله : یک قاشق غذاخوری

Planning

ادامه نمونه ای از یک برنامه غذایی سالم برای علی:

عصرانه :(ساعت ۴)

یک عدد انار متوسط+ یک عدد سیب

یک قاشق مرباخوری سویا

تزریق انسولین ۶ شب

شام : (ساعت ۶:۳۰)

سه چهارم لیوان خوراک لوبیای چیتی

نان سنگک سنتی سبوس دار – ۱/۵ کف دست

ماست کم چرب پروبیوتیک – یک لیوان

سبزی خوردن: ۲ لیوان

۲ قاشق مربا خوری روغن زیتون

ژله یک قاشق غذاخوری

قبل از خواب : (ساعت ۱۰ شب)

یک عدد سیب

نصف کف دست نان سنگک، یک عدد تخم مرغ، یک قاشق مرباخوری ژله

Lifestyle recommendations for dyslipidemia

Table 9 Summary of nutrition and lifestyle interventions to lower circulating levels of LDL-C and TG*

Interventions for Lowering LDL-C	Intervention for Lowering TG**
↓ SFAs, TFAs, and dietary cholesterol	↓ Added sugars and refined starches
↑ UFAs intake (5% TDE replacement for SFAs)	↓ Alcohol
↓ Body weight (5-10%), if overweight/obese	↓ Body weight (5-10%), if overweight/obese
↑ Protein, especially plant protein (3-5% TDE)	↑ Protein, especially plant protein (3-5% TDE)
↑ Viscous fiber intake (5-10 g/day)	↑ EPA+DHA intake (2-4 g/day)
↑ Plant stanols/sterols (2 g/day)	↑ Physical activity (≥150 minutes/week)†

*The dietary strategies summarized are within the context of an overall healthy lifestyle that includes a recommended dietary pattern, adequate physical activity, avoidance of tobacco products, adequate sleep quantity and quality, and psychosocial stress management.

**In addition to the interventions listed, individualize the macronutrient composition of the dietary pattern. Many patients will achieve TG reduction with dietary fat intake in the range of 20-40% TDE, whereas a lower fat diet (<20% TDE) may be needed in a small number of patients to maintain TG <750 mg/dL.

†≥150 min/week of moderate-intensity activity (e.g., brisk walking), ≥75 min/week of vigorous-intensity activity (e.g., jogging or running), or the equivalent combination, plus 2-3 days/week of muscle strengthening exercises.[4,5,7,8,143]

Abbreviations: DHA=docosahexaenoic acid; EPA=eicosapentaenoic acid; LDL-C=low-density lipoprotein cholesterol; SFAs=saturated fatty acids; TDE=total daily energy; TG=triglyceride; TFAs=*trans* fatty acids; UFAs=unsaturated fatty acids.

Please cite this article as: Kirkpatrick et al, Nutrition interventions for adults with dyslipidemia: A clinical perspective from the national lipid association, Journal of Clinical Lipidology, https://doi.org/10.1016/j.jacl.2023.05.099

Lifestyle recommendations for hypertriglyceridemia *(cont'd)*

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Journal of Clinical Lipidology (2023) 000, 1–24

[mNS;June 2, 2023;16:4]

Journal of Clinical Lipidology

Clinical Perspective

Nutrition interventions for adults with dyslipidemia: A Clinical Perspective from the National Lipid Association☆

Carol F. Kirkpatrick, PhD, RDN, CLS, FNLA[1], Geeta Sikand, MA, RDN, CDE, CLS, FAND, FNLA[1], Kristina S. Petersen, PhD, APD, FAHA, Cheryl A.M. Anderson, PhD, MPH, FAHA, Karen E. Aspry, MD, MS, FNLA, Julie P. Bolick, MS, RDN, CD, CLS, FNLA, Penny M. Kris-Etherton, PhD, RDN, CLS, FAHA, FASN, FNLA[#], Kevin C. Maki, PhD, CLS, FACN, FNLA, FTOS[#,*]

Midwest Biomedical Research, Addison, IL, USA; Kasiska Division of Health Sciences, Idaho State University, Pocatello, ID, USA; University of California Irvine Heart Disease Prevention Program, Irvine, CA, USA; Department of Nutritional Sciences, Texas Tech University, Lubbock, TX, USA; Herbert Wertheim School of Public Health and Human Longevity

Lifestyle recommendations for hypertriglyceridemia *(cont'd)*

k et al

Adults with fasting TG ≥150 mg/dL or nonfasting TG ≥175 mg/dL

↓

- Assess nonlifestyle secondary causes
- Assess lifestyle factors and practices (adiposity; dietary habits, including types and quantities of dietary carbohydrates, fats, proteins, and alcohol; physical activity)

↓

Emphasize a healthy dietary pattern* and increased physical activity

↓

Implement shared decision-making intervention	TG <500 mg/dL†	TG 500-749 mg/dL†	TG≥750 mg/dL‡
Added sugars (foods and beverages)	Reduce	Markedly reduce	Eliminate
Total fat (% TDE)	25-35%	Refer to text	Refer to text and Figure 4
Alcohol	Restrict	Abstain completely	Abstain completely
Aerobic activity	At least 150 min/week of accumulated moderate-intensity or 75 min/week of vigorous-intensity aerobic physical activity (or equivalent of both)§		
Reduce adiposity	Recommended weight loss goal is 5-10% for patients with increased adiposity		

↓

- Monitor response to interventions
- Consider referral to RDN, exercise specialist, or other supportive services
- Continue interventions or adjust as indicated

Lifestyle recommendations for hypertriglyceridemia

1) A practical first step of lifestyle modification: Alcohol restriction

Mild to moderate: 2 drinks/day for men, 1 drinks/day for women

High or TG-induced pancreatitis: Complete abstinence

Implement shared decision-making intervention	TG <500 mg/dL†	TG 500-749 mg/dL†	TG≥750 mg/dL‡
Added sugars (foods and beverages)	Reduce	Markedly reduce	Eliminate
Total fat (% TDE)	25-35%	Refer to text	Refer to text and Figure 4
Alcohol	Restrict	Abstain completely	Abstain completely
Aerobic activity	At least 150 min/week of accumulated moderate-intensity or 75 min/week of vigorous-intensity aerobic physical activity (or equivalent of both)§		
Reduce adiposity	Recommended weight loss goal is 5-10% for patients with increased adiposity		

- Jacobson TA et al. J Clin Lipidol. 2015;9(6 Suppl):S1-122.e1.
- Subramanian S. The journal of clinical endocrinology and metablsim; 2022: 107: 1686-1697

Lifestyle recommendations for hypertriglyceridemia

A practical second step of lifestyle modification: Weight loss

Implement shared decision-making intervention	TG <500 mg/dL†	TG 500-749 mg/dL†	TG≥750 mg/dL‡
Added sugars (foods and beverages)	Reduce	Markedly reduce	Eliminate
Total fat (% TDE)	25-35%	Refer to text	Refer to text and Figure 4
Alcohol	Restrict	Abstain completely	Abstain completely
Aerobic activity	At least 150 min/week of accumulated moderate-intensity or 75 min/week of vigorous-intensity aerobic physical activity (or equivalent of both)§		
Reduce adiposity	Recommended weight loss goal is 5-10% for patients with increased adiposity		

- Jellinger PS et al. Endocr Prac 2017 Apr;23(Suppl 2):1-87
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Lifestyle recommendations for hypertriglyceridemia

Table 8 Features of healthy dietary patterns that meet nutrition recommendations for hypertriglyceridemia based on triglyceride elevation and presence of chylomicronemia*[53,161]

Food Groups	Mild-to-Moderate TG Elevation (≥150 to <500 mg/dL)**†	Severe TG Elevation (≥500 to 749 mg/dL)**†	Severe TG Elevation (≥750 mg/dL) – presumed MCS**‡	Severe TG Elevation (≥750 mg/dL) – FCS**‡
Calories	Meet daily needs with minimally processed nutrient-dense foods	Meet daily needs with minimally processed nutrient-dense foods	Meet daily needs with minimally processed nutrient-dense foods	Meet daily needs with minimally processed nutrient-dense foods; gradually add MCT oil, as needed
Alcohol	Restrict; if choosing to drink: Men ≤2 drinks/day*** Women ≤1 drink/day***	Abstain completely	Abstain completely	Abstain completely
Sugar-sweetened beverages	Restrict	Abstain completely	Abstain completely	Abstain completely
Fruits#	Mostly whole fruits, 2 servings/day[a]	Mostly whole fruits, 2 servings/day[a]	Mostly whole fruits, 2 servings/day[a]	Mostly whole fruits, limit to 1 serving/day[a]
Vegetables#	2 ½ cups/day[b]	2 ½ cups/day[b]	2 ½ cups/day[b]	2 ½ cups/day[b]
Grains#	Mostly fiber-rich whole grains, 4-6 servings/day[c]	Mostly fiber-rich whole grains, 4-6 servings/day[c]	Mostly fiber-rich whole grains, 4-6 servings/day[c]	Individualize[c]
Dairy#	Limit full-fat dairy	Limit full-fat dairy	Limit full-fat dairy	Eliminate full-fat dairy

Lifestyle recommendations for hypertriglyceridemia

Table 8 Features of healthy dietary patterns that meet nutrition recommendations for hypertriglyceridemia based on triglyceride elevation and presence of chylomicronemia*[53,161]

Food Groups	Mild-to-Moderate TG Elevation (≥150 to <500 mg/dL)**†	Severe TG Elevation (≥500 to 749 mg/dL)**†	Severe TG Elevation (≥750 mg/dL) – presumed MCS**‡	Severe TG Elevation (≥750 mg/dL) – FCS**‡
Calories	Meet daily needs with minimally processed nutrient-dense foods	Meet daily needs with minimally processed nutrient-dense foods	Meet daily needs with minimally processed nutrient-dense foods	Meet daily needs with minimally processed nutrient-dense foods; gradually add MCT oil, as needed
Alcohol	Restrict; if choosing to drink: Men ≤2 drinks/day*** Women ≤1 drink/day***	Abstain completely	Abstain completely	Abstain completely
Sugar-sweetened beverages	Restrict	Abstain completely	Abstain completely	Abstain completely
Fruits#	Mostly whole fruits, 2 servings/day[a]	Mostly whole fruits, 2 servings/day[a]	Mostly whole fruits, 2 servings/day[a]	Mostly whole fruits, limit to 1 serving/day[a]
Vegetables#	2 ½ cups/day[b]	2 ½ cups/day[b]	2 ½ cups/day[b]	2 ½ cups/day[b]
Grains#	Mostly fiber-rich whole grains, 4-6 servings/day[c]	Mostly fiber-rich whole grains, 4-6 servings/day[c]	Mostly fiber-rich whole grains, 4-6 servings/day[c]	Individualize[c]
Dairy#	Limit full-fat dairy	Limit full-fat dairy	Limit full-fat dairy	Eliminate full-fat dairy

Lifestyle recommendations for hypertriglyceridemia

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Alcohol	Restrict; if choosing to drink: Men ≤2 drinks/day[***] Women ≤1 drink/day[***]	Abstain completely	Abstain completely	Abstain completely
Sugar-sweetened beverages	Restrict	Abstain completely	Abstain completely	Abstain completely
Fruits[#]	Mostly whole fruits, 2 servings/day[a]	Mostly whole fruits, 2 servings/day[a]	Mostly whole fruits, 2 servings/day[a]	Mostly whole fruits, limit to 1 serving/day[a]
Vegetables[#]	2 ½ cups/day[b]	2 ½ cups/day[b]	2 ½ cups/day[b]	2 ½ cups/day[b]
Grains[#]	Mostly fiber-rich whole grains, 4-6 servings/day[c]	Mostly fiber-rich whole grains, 4-6 servings/day[c]	Mostly fiber-rich whole grains, 4-6 servings/day[c]	Individualize[c]

Lifestyle recommendations for hypertriglyceridemia

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Dairy#	Limit full-fat dairy and/or sugar-sweetened dairy; choose low-fat or fat-free unsweetened dairy or unsweetened dairy alternatives, 3 servings/day[d]	Limit full-fat dairy and/or sugar-sweetened dairy; choose low-fat or fat-free unsweetened dairy or unsweetened dairy alternatives, 3 servings/day[d]	Limit full-fat dairy and/or sugar-sweetened dairy; choose low-fat or fat-free unsweetened dairy or unsweetened dairy alternatives, 3 servings/day[d]	Eliminate full-fat dairy and/or sugar-sweetened dairy; choose fat-free unsweetened dairy or unsweetened dairy alternatives, 3 servings/day[d]
Protein sources#	5 ½ oz equivalents/day[e]	5 ½ oz equivalents/day[e]	5 ½ oz equivalents/day[e]	Individualize servings/day

Lifestyle recommendations for hypertriglyceridemia

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Food Groups	Mild-to-Moderate TG Elevation (≥150 to <500 mg/dL)**†	Severe TG Elevation (≥500 to 749 mg/dL)**†	Severe TG Elevation (≥750 mg/dL) – presumed MCS**‡	Severe TG Elevation (≥750 mg/dL) – FCS**‡
Legumes (beans, soy), nuts, and seeds	Choose mostly plant protein sources	Choose mostly plant protein sources	Choose mostly plant protein sources; cautiously include nuts and seeds	Choose mostly plant protein sources; eliminate nuts and seeds due to fat content
Fish and seafood	Emphasize fatty fish, ≥2 servings/week (8 oz/week)	Emphasize fatty or lean fish, ≥2 servings/week (8 oz/week)	Emphasize fatty or lean fish, ≥2 servings/week (8 oz/week)	Emphasize lean fish, ≥2 servings/week (8 oz/week)
Poultry/meats	Choose lean cuts and avoid processed meats	Choose lean cuts and avoid processed meats	Choose lean cuts and avoid processed meats	Choose very lean cuts without skin and avoid processed meats

Lifestyle recommendations for hypertriglyceridemia

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↑ Protein, especially plant protein (3-5% TDE)	↑ Protein, especially plant protein (3-5% TDE)
↑ Viscous fiber intake (5-10 g/day)	↑ EPA+DHA intake (2-4 g/day)
↑ Plant stanols/sterols (2 g/day)	↑ Physical activity (≥150 minutes/week)†

*The dietary strategies summarized are within the context of an overall healthy lifestyle that includes a recommended dietary pattern, adequate physical activity, avoidance of tobacco products, adequate sleep quantity and quality, and psychosocial stress management.

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Abbreviations: DHA=docosahexaenoic acid; EPA=eicosapentaenoic acid; LDL-C=low-density lipoprotein cholesterol; SFAs=saturated fatty acids; TDE=total daily energy; TG=triglyceride; TFAs=*trans* fatty acids; UFAs=unsaturated fatty acids.

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Alcohol	Restrict	Abstain completely	Abstain completely
Aerobic activity	At least 150 min/week of accumulated moderate-intensity or 75 min/week of vigorous-intensity aerobic physical activity (or equivalent of both)§		
Reduce adiposity	Recommended weight loss goal is 5-10% for patients with increased adiposity		

- Jacobson TA et al. J Clin Lipidol. 2015;9(6 Suppl):S1-122.e1.
- Subramanian S. The journal of clinical endocrinology and metablsim; 2022: 107: 1686-1697

Physical activity in insulin resistance

- Physical exercise: reduce IR, achieve weight loss
- Constant exercise: strong anti-inflammatory effects, probably because of the influence of exercise on the immune system, and through the reduction of visceral fat
- Exercise also causes a reduced release of pro-inflammatory cytokines and chemokines from the adipocytes
- Endurance exercise leads to reduce induction of pro-inflammatory signaling and obesity
- It also diminishes the infiltration of macrophages in the fatty tissue and promotes anti-inflammatory immune cellphenotype
- During training muscle cells probably release many anti-inflammatory cytokines.

Physical activity in insulin resistance

- *Walking*, *swimming* and *cycling* are advised, *one hour per day*.
- In the starting phase every other day to prevent over-training, good results were seen in patients that exercised 150 minutes moderately intensive per week
- Patients with very little muscle mass, measured with a four-point impedance meter see their muscle mass improve with power lifting.

Sleep

- Sleep plays a key role in homeostasis of the glucose metabolism
- Normally glucose metabolism has a daily pattern with intra-individual variations in glucose tolerance: *glucose expenditure is highest in waking state* and *lowest during NON-REM sleep*
- Short night rest caused as well an elevated plasma level of non-estherized fatty acids
- *Sleep deprivation* leads to *increase of the glucose production with 22%,* suggesting *hepatic insulin resistance*

هرم راهنمای غذایی ایرانی

یک واحد نان و غلات: یک کف دست بدون انگشت(معادل ۳۰گرم)، انواع نان ها یا نان لواش ۴ کف دست یا نصف لیوان برنج یا ماکارانی پخته

یک واحد سبزی: یک لیوان سبزی برگی یا نصف لیوان سبزی پخته یا سبزی خام خرد شده یا یک عدد سیب زمینی یا گوجه فرنگی یا پیاز یا خیار متوسط

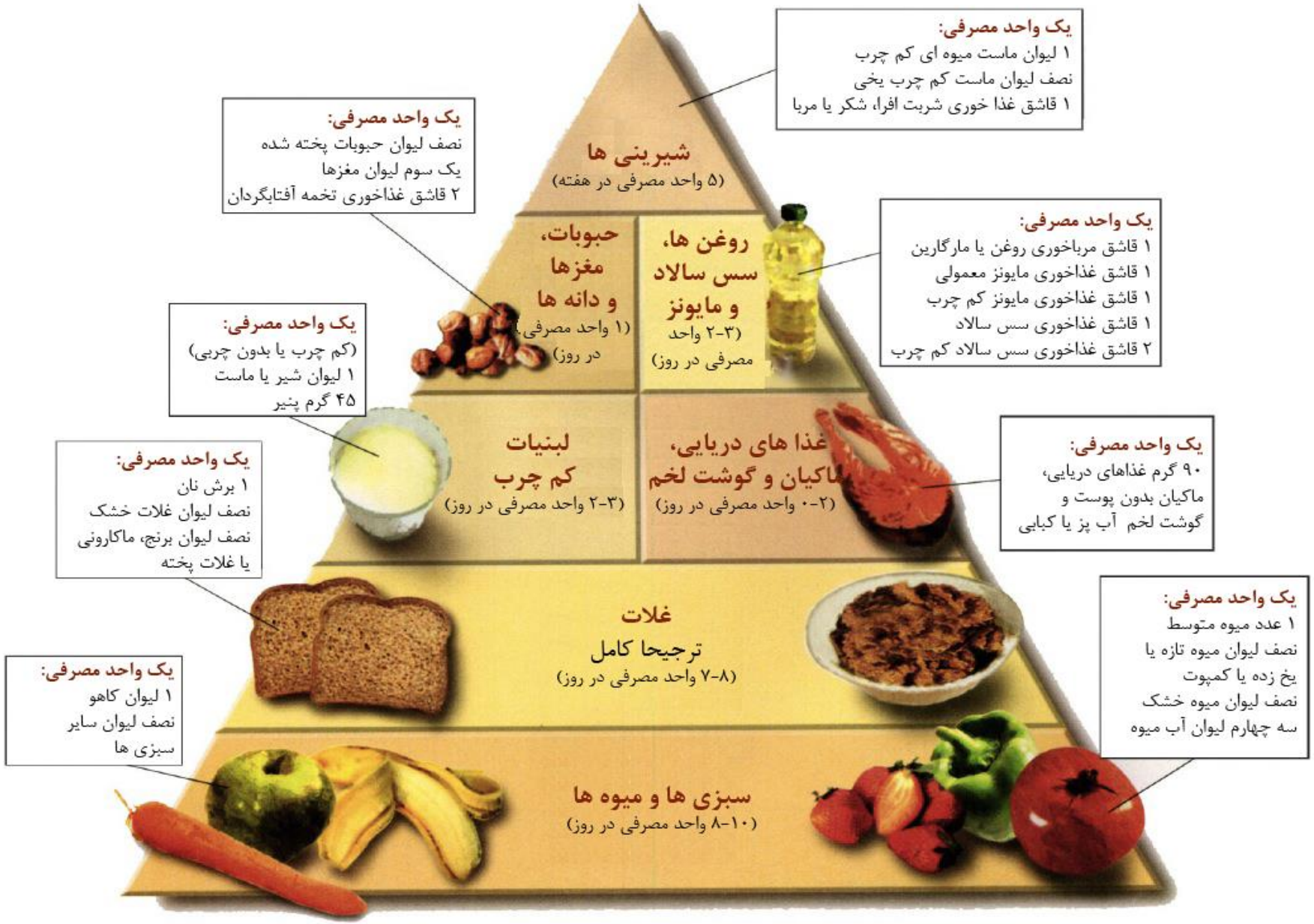
یک واحد میوه: یک عدد میوه متوسط مانند سیب، پرتقال و .... یا نصف لیوان آب میوه تازه و طبیعی یا نصف لیوان میوه های ریز مثل توت یا یک چهارم لیوان میوه خشک

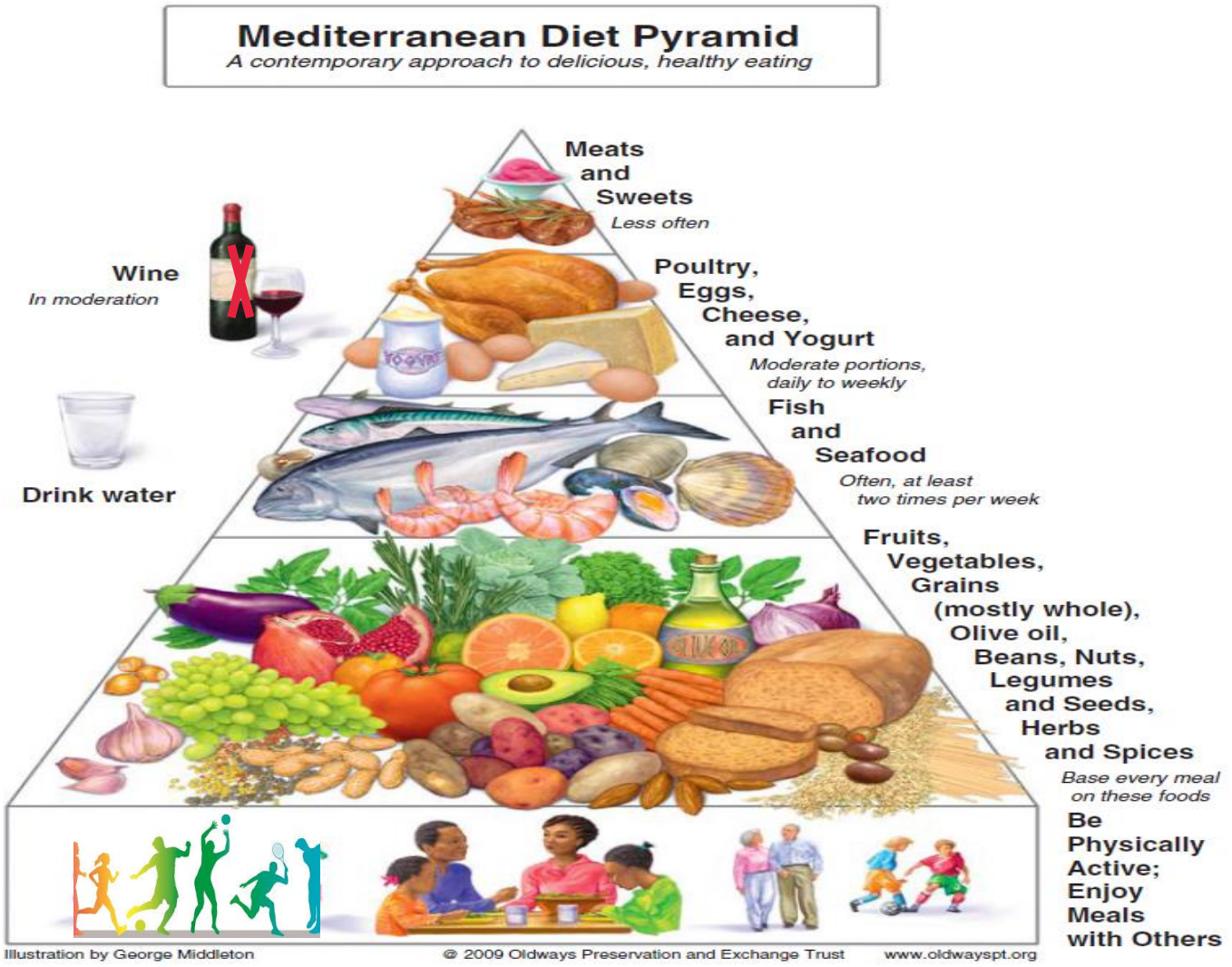
یک واحد شیر و فرآورده ها: یک لیوان شیر یا یک لیوان ماست کم چرب یا ۶۰-۴۵ پنیر(۲ قوطی کبریت پنیر) یا ۲ لیوان دوغ

یک واحد گوشت: ۶۰گرم گوشت لخم پخته شده یا دو قطعه خورشتی یا نصف ران متوسط یا نصف سینه متوسط مرغ یا دو عدد تخم مرغ

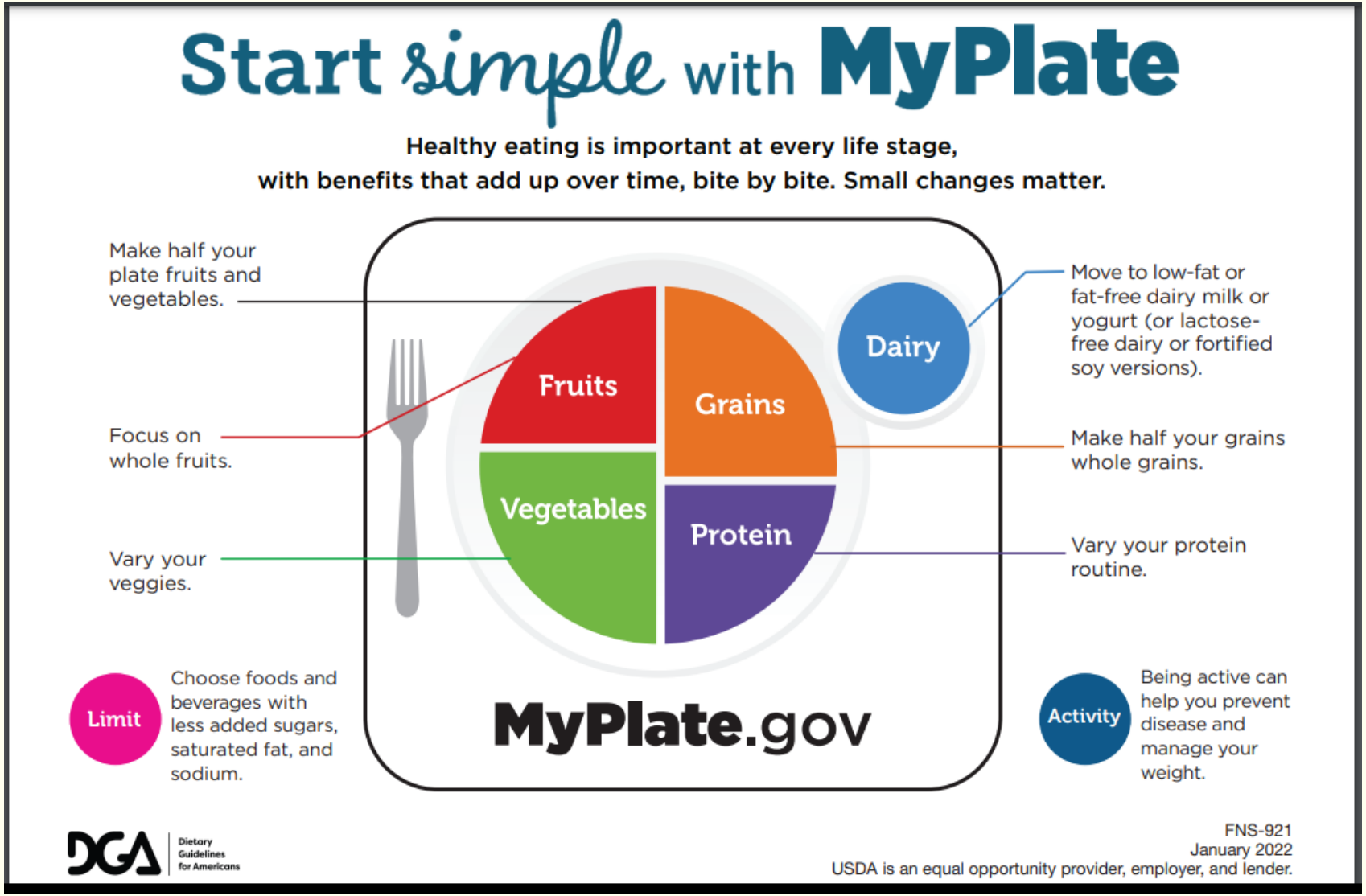
یک واحد حبوبات: نصف لیوان حبوبات پخته یا یک سوم لیوان انواع مغزها(گردو، فندق، بادام، پسته و تخمه

http://www.fao.org/nutrition/education/food-based-dietary-guidelines/regions/countries/iran/en/


یک واحد مصرفی:
۱ لیوان ماست میوه ای کم چرب
نصف لیوان ماست کم چرب یخی
۱ قاشق غذا خوری شربت افرا، شکر یا مربا
شیرینی ها
(۵ واحد مصرفی در هفته)
یک واحد مصرفی:
نصف لیوان حبوبات پخته شده
یک سوم لیوان مغزها
۲ قاشق غذاخوری تخمه آفتابگردان
حبوبات،
مغزها
و دانه ها
(۱ واحد مصرفی
در روز)
روغن ها،
سس سالاد
و مایونز
(۳-۲ واحد
مصرفی در روز)
یک واحد مصرفی:
۱ قاشق مرباخوری روغن یا مارگارین
۱ قاشق غذاخوری مایونز معمولی
۱ قاشق غذاخوری مایونز کم چرب
۱ قاشق غذاخوری سس سالاد
۲ قاشق غذاخوری سس سالاد کم چرب
یک واحد مصرفی:
(کم چرب یا بدون چربی)
۱ لیوان شیر یا ماست
۴۵ گرم پنیر
لبنیات
کم چرب
(۳-۲ واحد مصرفی در روز)
غذا های دریایی،
ماکیان و گوشت لخم
(۲-۰ واحد مصرفی در روز)
یک واحد مصرفی:
۹۰ گرم غذاهای دریایی،
ماکیان بدون پوست و
گوشت لخم آب پز یا کبابی
یک واحد مصرفی:
۱ برش نان
نصف لیوان غلات خشک
نصف لیوان برنج، ماکارونی
یا غلات پخته
غلات
ترجیحا کامل
(۸-۷ واحد مصرفی در روز)
یک واحد مصرفی:
۱ عدد میوه متوسط
نصف لیوان میوه تازه یا
یخ زده یا کمپوت
نصف لیوان میوه خشک
سه چهارم لیوان آب میوه
یک واحد مصرفی:
۱ لیوان کاهو
نصف لیوان سایر
سبزی ها
سبزی ها و میوه ها
(۱۰-۸ واحد مصرفی در روز)



- Krause's food & nutrition care process,14th edition; 2017, p 657-9


Start simple with MyPlate
Healthy eating is important at every life stage,
with benefits that add up over time, bite by bite. Small changes matter.
Make half your plate fruits and vegetables.
Focus on whole fruits.
Vary your veggies.
Fruits
Grains
Vegetables
Protein
Dairy
Move to low-fat or fat-free dairy milk or yogurt (or lactose-free dairy or fortified soy versions).
Make half your grains whole grains.
Vary your protein routine.
MyPlate.gov
Limit
Choose foods and beverages with less added sugars, saturated fat, and sodium.
Activity
Being active can help you prevent disease and manage your weight.
DGA
Dietary Guidelines for Americans
FNS-921
January 2022
USDA is an equal opportunity provider, employer, and lender.

Focus on whole fruits like fresh, frozen, canned, or dried.

Buy fruits to have them available to add to your meal or eat as a snack. If you buy juice, select 100% fruit juice.

Eat a variety of vegetables and add them to mixed dishes like casseroles, sandwiches, and wraps.

Fresh, frozen, and canned count, too. Look for "reduced sodium" or "no-salt-added" on the label.

Choose whole-grain versions of common foods such as bread, pasta, and tortillas.

Not sure if it's whole grain? Check the ingredients list for the words "whole" or "whole grain."

Eat a variety of protein foods such as beans, soy, seafood, lean meats, poultry, and unsalted nuts and seeds.

Select seafood twice a week. Choose lean cuts of meat and ground beef that is at least 93% lean.

Choose low-fat (1%) or fat-free (skim) dairy. Get the same amount of calcium and other nutrients as whole milk, but with less saturated fat and calories.

Lactose intolerant? Try lactose-free milk or a fortified soy beverage.

Daily Food Group Targets — Based on a 2,000 Calorie Plan

Visit MyPlate.gov/MyPlatePlan for a personalized plan.

2 cups

1 cup counts as:

1 small apple
1 large banana
1 cup grapes
1 cup sliced mango
½ cup raisins
1 cup 100% fruit juice

2½ cups

1 cup counts as:

2 cups raw spinach
1 cup cooked collard, kale, or turnip greens
1 small avocado
1 large sweet potato
1 cup cooked beans, peas, or lentils
1 cup cut cauliflower

6 ounces

1 ounce counts as:

1 slice of bread
½ cup cooked oatmeal
1 small tortilla
½ cup cooked brown rice
½ cup cooked couscous
½ cup cooked grits

5½ ounces

1 ounce counts as:

1 ounce cooked lean chicken, pork, or beef
1 ounce tuna fish
¼ cup cooked beans, peas, or lentils
1 Tbsp peanut butter
2 Tbsp hummus
1 egg

3 cups

1 cup counts as:

1 cup dairy milk or yogurt
1 cup lactose-free dairy milk or yogurt
1 cup fortified soy milk or yogurt
1½ ounces hard cheese
1 cup kefir

Choose foods and beverages with less added

سبک زندگی در افراد مبتلا به دیابت نوع ۲

- مصرف ۳ وعده غذایی اصلی و ۲ تا ۴ میان وعده در طول روز در حجم کم
- مشخص نمودن **ساعات مشخص** در روز جهت مصرف وعده های غذایی و میان وعده‌ها و عدم حذف هر کدام از وعده ها و میان وعده ها
- مصرف میان وعده آخر شب (مانند مصرف یک لیوان شیر در هنگام خواب)
- استفاده از مواد غذایی حاوی کربوهیدرات حاوی مواد مغذی و فیبر بیشتر مانند استفاده از نان‌های سنگگ و تافتون به جای نان لواش یا استفاده از برنج قهوه‌ای به جای برنج سفید، یا استفاده روزانه نصف لیوان حبوبات پخته شده
- مصرف روزانه حداقل ۵ واحد از میوه ها و سبزی های تازه در برنامه غذایی (بخشی از این سبزیجات از سبزی‌های برگ سبز مانند سبزی‌خوردن، کاهو، کلم، کرفس و نیز سبزیجات ریشه‌ای مانند هویج، ترب، شلغم باشد. همچنین به جای آب میوه از میوه استفاده نمایید)

سبک زندگی در افراد مبتلا به دیابت نوع ۲

- مصرف روزانه نصف لیوان از حبوبات پخته شده در برنامه غذایی (مانند عدسی را در وعده صبحانه یا خوراک لوبیا را در وعده ناهار یا شام یا استفاده از غذاهای حاوی حبوبات مانند آش)
- مصرف منابع غذایی غنی از امگا ۳ مانند ماهی، دانه‌ها و مغزدانه‌ها مانند گردو نیز ارده در برنامه غذایی
- استفاده از روغن‌های مفید مانند روغن زیتون و روغن کنجد برای سالاد و روغن‌های کانولا و گلزا برای پخت و پز
- حذف یا کاهش مصرف منابع غذایی حاوی اسیدهای چرب اشباع و ترانس مانند مصرف کره، چربی گوشت قرمز، پوست مرغ، لبنیات پرچرب، بستنی، شکلات، نارگیل، شیر نارگیل، روغن نارگیل و روغن پالم و روغن جامد و نیمه جامد هیدروژنه، غذاهای سرخ شده، غذاهای آماده مانند پیتزا و ساندویچ، کراکر، اسنک‌ها، نان‌های فانتزی و انواع شیرینی، کره گیاهی

سبک زندگی در افراد مبتلا به دیابت نوع ۲

- توصیه به کاهش وزن ۷ تا ۱۰ از وزن بدن در طی ۶ ماه از طریق رعایت یک رژیم غذایی کاهش وزن توام با افزایش فعایت بدنی در صورت ابتلا بودن به اضافه وزن و چاقی
- استفاده از مواد غذایی تخمیرشده مانند کفیر و ماست و مواد غذای پره‌بیوتیک مانند موز، پیاز، سیر، کاسنی و آرتیشو در برنامه غذایی
- کاهش مصرف نمک (مصرف روزانه ۱ قاشق چای‌خوری نمک در برنامه غذایی) و کاهش مصرف مواد غذایی با محتوای سدیم بالا نظیر غذاهای شور، کالباس و سوسیس، پنیر پیتزا، چیپس، پفک و غذاهای کنسروی
- استفاده از چاشنی‌ها و طعم‌دهنده‌ها مانند آبلیمو و سرکه به جای نمک

سبک زندگی در افراد مبتلا به دیابت نوع ۲

- کاهش مصرف نوشیدنی‌های شیرین شده مانند نوشابه و آب میوه، غذاهای پروسه شده با مقادیر زیاد غلات تصفیه شده و قند و شکر، عسل و مربا و نیز مواد غذایی حاوی قند و شکر مانند انواع کیک و شیرینی‌ها و سایر تنقلات شیرین
- عدم مصرف مکمل‌ها (مانند ویتامین D یا کروم) یا داروهای گیاهی و ادویه‌ها (مانند دارچین)، یا مکمل‌های آنتی‌اکسیدان مانند ویتامین E و C جهت کنترل قند خون
- عدم تهیه شیرین کننده‌های مصنوعی مانند آسپارتام، ساخارین، اسه‌سولفام کا، و سوکرالوز را برای کنترل قند خون و وزن

از توجه شما سپاسگزارم