LA TROBE UNIVERSITY

LEE KONG CHIAN SCHOOL OF MEDICINE

NANYANG TECHNOLOGICAL UNIVERSITY | Imperial College London

Redefining Medicine, Transforming Healthcare

NUTRITION AND RUNNING

Health, Injury and Performance

Professor Peter Brukner
La Trobe Sport and Exercise Medicine Research Centre
Melbourne, Australia

Sugar By Half

The Warwick Agreement on femoroacetabular impingement syndrome (FAI syndrome): an international consensus statement

WARWICK ORTHOPAEDICS SPORTS HIP 18

British Journal of SPORTS MEDICINE

D R Griffin,[1,2] E J Dickenson,[1,2] J O'Donnell,[3,4] R Agricola,[5] T Awan,[6] M Beck,[7] J C Clohisy,[8] H P Dijkstra,[9] E Falvey,[10,11] M Gimpel,[12] R S Hinman,[13] P Hölmich,[9,14] A Kassarjian,[15,16] H D Martin,[17] R Martin,[18,19] R C Mather,[20] M J Philippon,[21] M P Reiman,[20] A Takla,[3,22,23,24] K Thorborg,[14] S Walker,[25] A Weir,[9,26] K L Bennell[23]

Today

- Nutrition and Health
- Nutrition and Musculoskeletal Health
- Nutrition and Performance

Today

- **Nutrition and Health**
- Nutrition and Musculoskeletal Health
- Nutrition and Performance

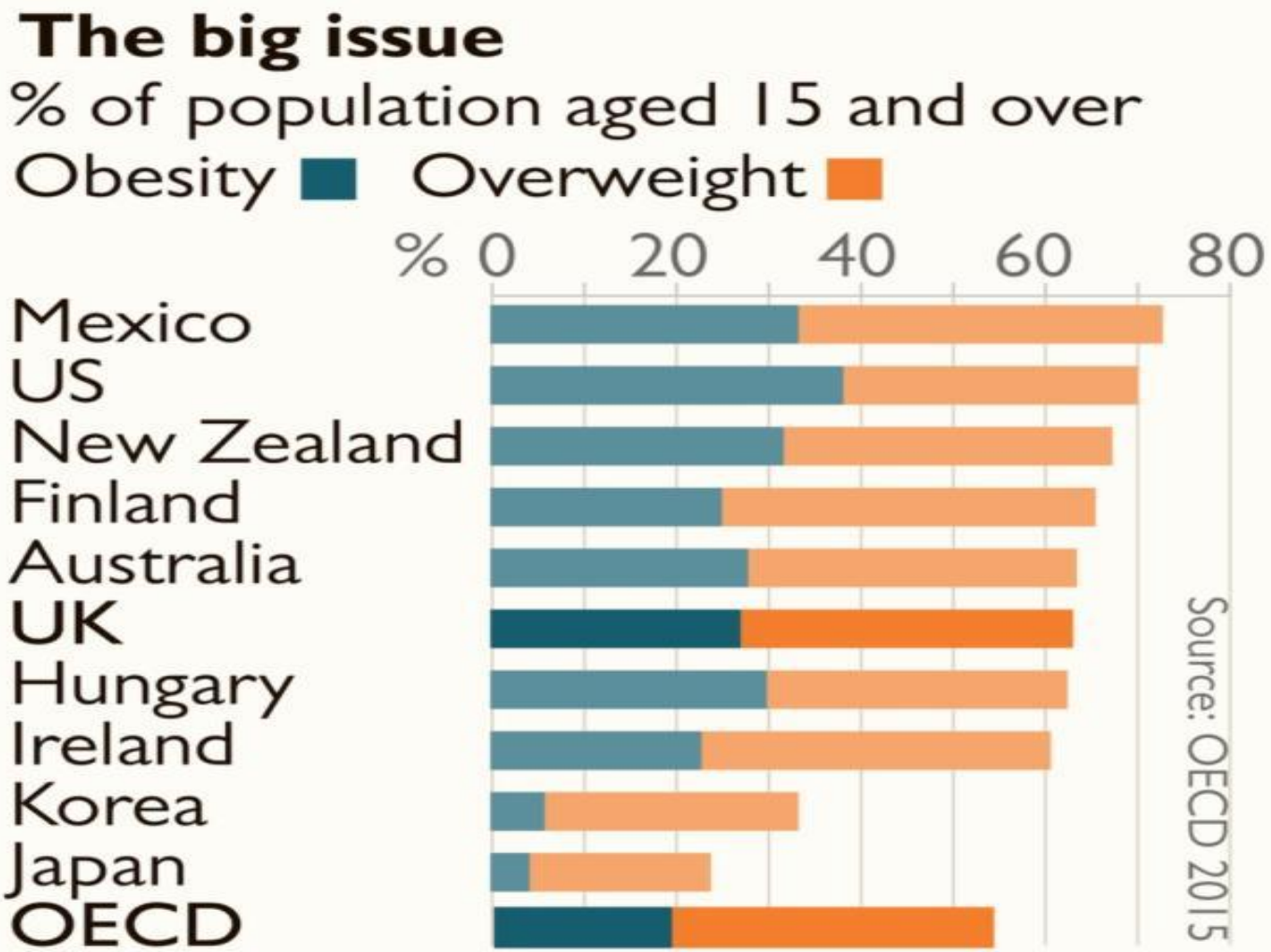
Millennials are fattest generation in history

Kat Lay, Health Correspondent

February 26 2018, 12:01am,
The Times

Health

Millennials are associated with clean eating but have been told to cut down on junk food
MATT CARDY/GETTY IMAGES


The big issue
% of population aged 15 and over
Obesity
Overweight
% 0
20
40
60
80
Mexico
US
New Zealand
Finland
Australia
UK
Hungary
Ireland
Korea
Japan
OECD
Source: OECD 2015

Global obesity rates of World Cup nations

Overweight or obese adults

		Proportion of adults	Global overall rank
1	Saudi Arabia	70%	13
3	Mexico	65%	23
2	Australia	65%	25
4	England	64%	30
5	Egypt	63%	32
6	Uruguay	63%	35
7	Argentina	63%	36
8	Spain	62%	42
9	Iran	62%	43
10	Tunisia	62%	43
11	Costa Rica	61%	46
12	Morocco	60%	50
13	Croatia	60%	53
14	France	60%	55
15	Belgium	60%	56
16	Iceland	59%	59
17	Colombia	59%	61
18	Panama	59%	63
19	Poland	58%	68
20	Portugal	58%	77
21	Peru	58%	78
22	Serbia	57%	79
23	Russia	57%	80
24	Germany	57%	82
25	Brazil	57%	83
26	Sweden	56%	84
27	Denmark	55%	94
28	Switzerland	54%	100
29	South Korea	30%	147
30	Nigeria	29%	150
31	Senegal	28%	152
	Japan	27%	163

Seven in 10

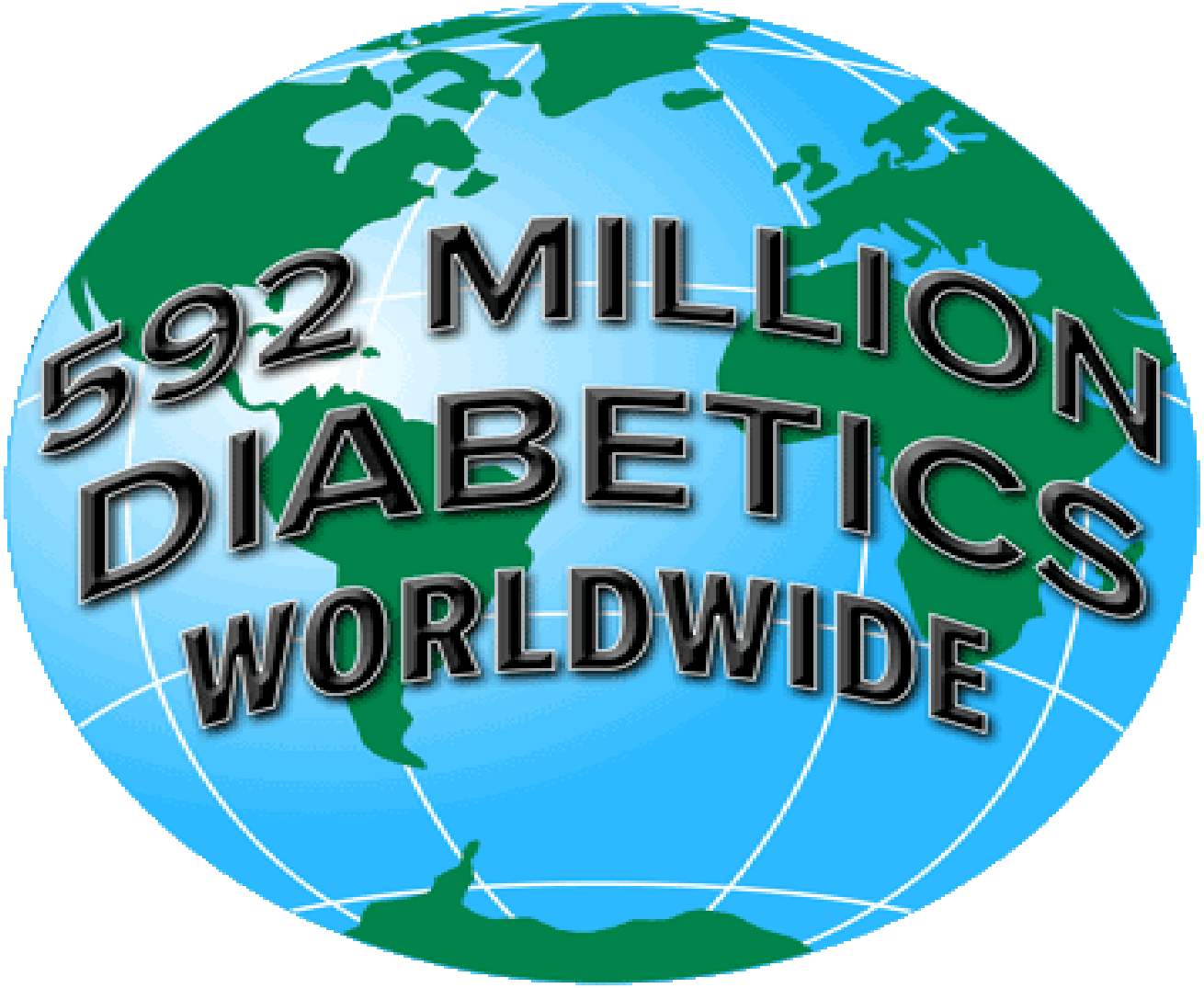
Australian men are overweight or obese

One in two

Women are overweight or obese

One in four

Children are overweight or obese


592 MILLION
DIABETICS
WORLDWIDE

2. Diabetes in Australia

- **280 Australians** develop diabetes every day. *That's one person every 5 minutes*!
- Around **1.7 million Australians** have diabetes. This includes all types of diagnosed diabetes *(1.2 million known and registered)* as well as silent, undiagnosed type 2 diabetes *(up to 500,000 estimated).*
- **100,000+ Australians** developed diabetes in the past year.
- Total annual cost impact of diabetes in Australia estimated at **$14.6 billion**.


Sugar was here.

Zimmet *Clinical Diabetes and Endocrinology* (2017) 3:1
DOI 10.1186/s40842-016-0039-3

Clinical Diabetes and Endocrinology

COMMENTARY Open Access

Diabetes and its drivers: the largest epidemic in human history?

Paul Z. Zimmet

The “Diabesity” epidemic (obesity and type 2 diabetes) is likely to be the biggest epidemic in human history.

Stefan S Fajans Lecture delivered at University of Michigan, Ann Arbor, on May 13, 2016

The modern epidemics

1. Obesity
2. Type 2 diabetes
3. Non-alcoholic fatty liver disease *(NAFLD)*
4. Dental caries
5. Cardiovascular Disease
6. Chronic diseases

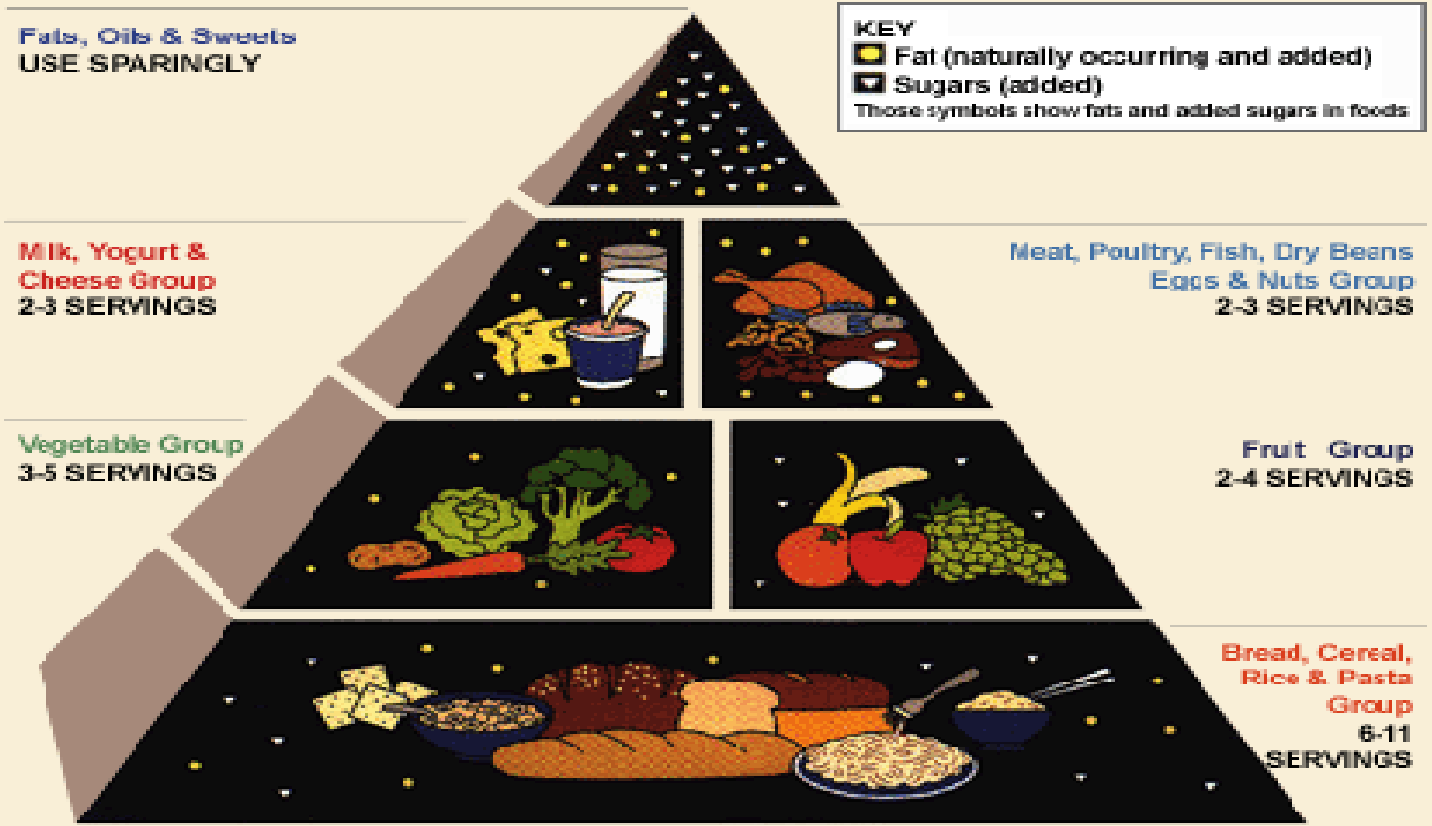
Where did we go wrong?

What makes us fat?

Why ?


Obese
Low-fat Guidelines
45–64 years
30–44 years
18–29 years
65 years and over
50
40
30
20
10
0
1971–1974
1976–1980
1988–1994
1999–2000
2001–2002
2005–2006

Some pyramids were a good idea.



Others, not so good!

The Diet-Heart Hypothesis

"*A generation of citizens have grown up since the diet/heart hypothesis was launched as official dogma. They have been misled by the* ***greatest scientific deception in our times****: The notion that consumption of animal fat causes heart disease.*"

George Mann (1985), Sc.D., M.D., professor, nutritional biochemist, Vanderbilt University, Associate Director of the Framingham Heart Study.

Associations of fats and carbohydrate intake with cardiovascular disease and mortality in 18 countries from five continents (PURE): a prospective cohort study

*Mahshid Dehghan, Andrew Mente, Xiaohe Zhang, Sumathi Swaminathan, Wei Li, Viswanathan Mohan, Romaina Iqbal, Rajesh Kumar, Edelweiss Wentzel-Viljoen, Annika Rosengren, Leela Itty Amma, Alvaro Avezum, Jephat Chifamba, Rafael Diaz, Rasha Khatib, Scott Lear, Patricio Lopez-Jaramillo, Xiaoyun Liu, Rajeev Gupta, Noushin Mohammadifard, Nan Gao, Aytekin Oguz, Anis Safura Ramli, Pamela Seron, Yi Sun, Andrzej Szuba, Lungiswa Tsolekile, Andreas Wielgosz, Rita Yusuf, Afzal Hussein Yusufali, Koon K Teo, Sumathy Rangarajan, Gilles Dagenais, Shrikant I Bangdiwala, Shofiqul Islam, Sonia S Anand, Salim Yusuf, on behalf of the Prospective Urban Rural Epidemiology (PURE) study investigators**

Interpretation High carbohydrate intake was associated with higher risk of total mortality, whereas total fat and individual types of fat were related to lower total mortality. Total fat and types of fat were not associated with cardiovascular disease, myocardial infarction, or cardiovascular disease mortality, whereas saturated fat had an inverse association with stroke. Global dietary guidelines should be reconsidered in light of these findings.

The Lancet, **Published online August 29, 2017 http://dx.doi.org/10.1016/S0140-6736(17)32252-3**

The modern epidemics

1. Obesity
2. Type 2 diabetes
3. Non-alcoholic fatty liver disease *(NAFLD)*
4. Dental caries
5. Cardiovascular disease
6. Chronic diseases

Is there a common denominator?

SUGAR

We are in the midst of a **SUGARDEMIC**

SUGAR CONSUMPTION IN AUSTRALIA

The Bitter Truth

NCD FREE

The World Health Organization recommends reducing sugar intake to

6 TEASPOONS

per day (5% of total energy intake).

Australians consumed an average of

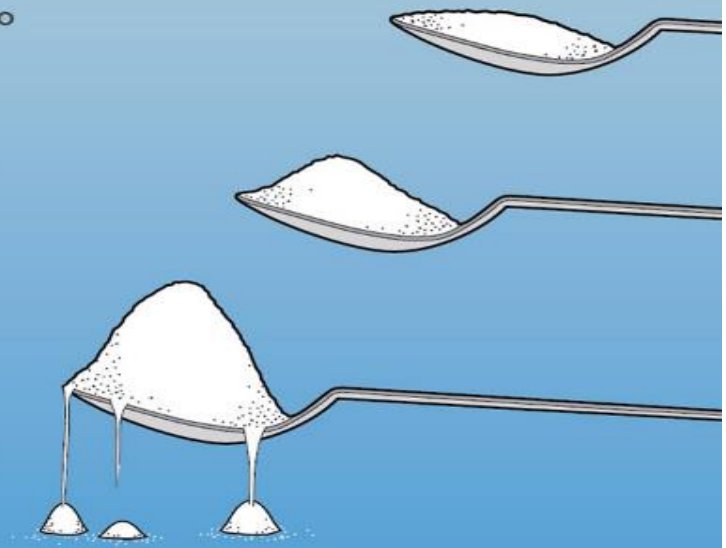
14 TEASPOONS

of sugar per day (in 2011-12).

The problem is worse in teenagers, with the top 10% of 14–18 year old males consuming at least

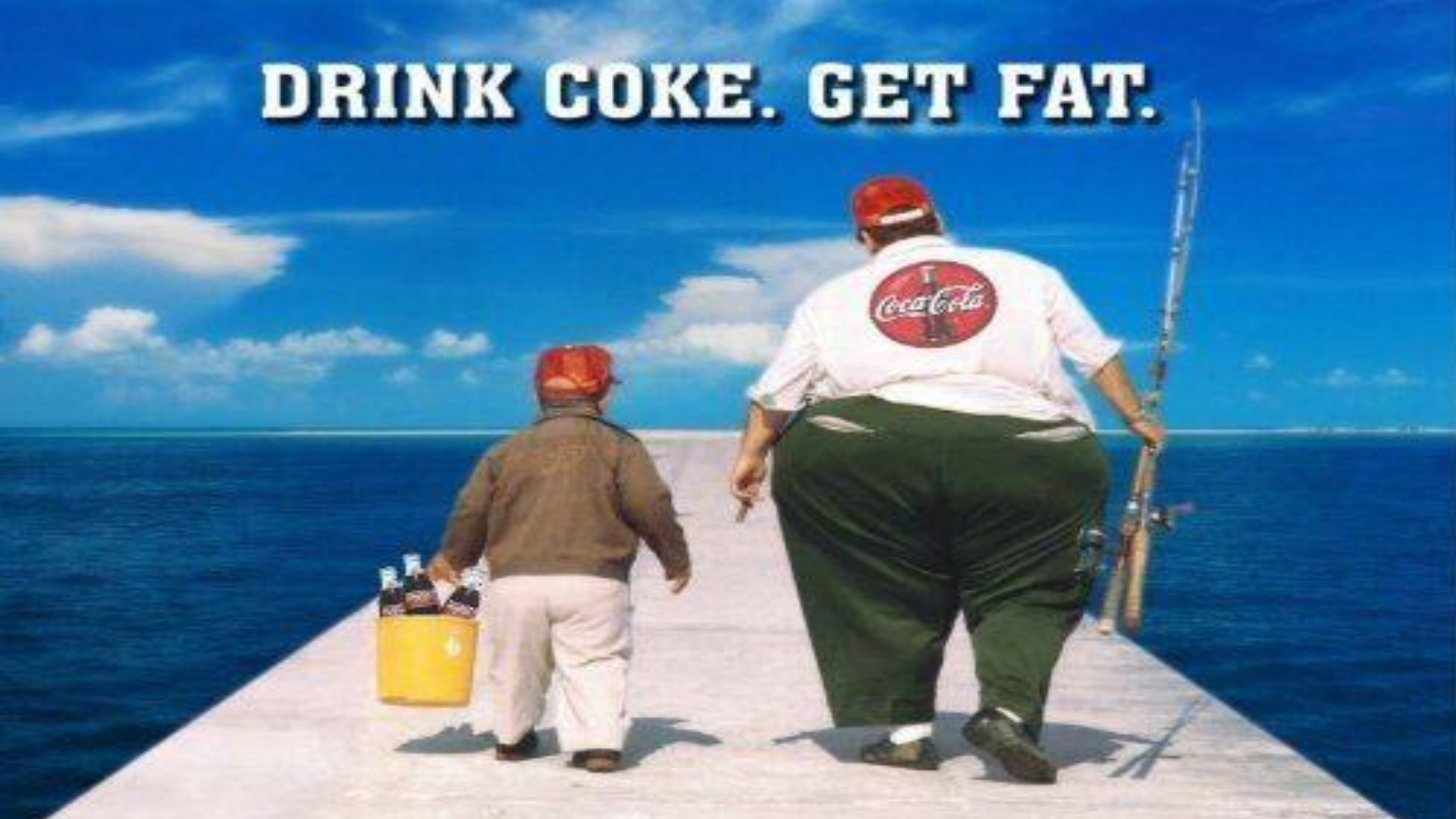
38 TEASPOONS

of sugar per day.



81% of sugar consumed in Australia comes from unhealthy, nutrient-poor foods, drinks and snacks.

Source: Australian Health Survey: Consumption of added sugars, 2011-12


DRINK COKE. GET FAT.
Coca-Cola

SUGAR OVERLOAD

22tsp

BOOST JUICE
BLUEBERRY BLAST
LOW FAT SMOOTHIE
610ML

19tsp

MOUNTAIN
DEW
600ML

16tsp

COCA COLA
600ML

13tsp

RED BULL
473ML

8.5tsp

POWERADE
ISOTONIC
MOUNTAIN BLAST
600ML

7tsp

GOLDEN CIRCLE
SUNSHINE PUNCH
JUICE DRINK
250ML

6.5tsp

LIPTON
PEACH
ICE TEA
500ML

5tsp

JUST
JUICE
APPLE
200ML

1tsp of sugar = 4g
Teaspoons per serve rounded to the nearest half teaspoon


Sugar
By
Half

Today

- Nutrition and Health
- **Nutrition and Musculoskeletal Health**
- Nutrition and Performance

Nutrition and Tendinopathy

Disability and Rehabilitation, 2008; 30(20–22): 1555–1562

Review article

How obesity modifies tendons (implications for athletic activities)

Michele Abate

Department of Medicine and Science of Aging, University "G. d'Annunzio" Chieti, Pescara, Italy

Corresponding author:
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University "G. d'Annunzio"
Via dei Vestini 31
66013 Chieti, Pescara, Italy
E-mail: m.abate@unich.it

Summary

Introduction

Obesity is a world epidemic, and one of the major public health problems in western countries. It is associated to an increased risk for diabetes, hypertension, and other cardiovascular diseases, as well as for musculo-skeletal disorders[1]. Among the latter, hip and knee osteoarthritis are very common, but several studies suggest that individuals with tendon abnormalities, pain, rupture, or failure to respond to conservative management, have significantly higher adiposity levels than controls without damage[2]. Load-bearing tendons (Achilles, patellar, and plantar fascia) are more frequently involved[3-11]. However, adiposity has been also recognized as a risk factor for alterations in non-load bearing tendons (elbow and rotator cuff)[12], and a negative impact on the functional outcomes after arthroscopic rotator cuff repair surgery has been

Adiposity and tendinopathy

J. E. GAIDA, J. L. COOK & S. L. BASS

Deakin University, Melbourne, Victoria, Australia

Review

OPEN ACCESS

Lipids, adiposity and tendinopathy: is there a mechanistic link? Critical review

Alex Scott,[1,2] Johannes Zwerver,[3] Navi Grewal,[1,2] Agnetha de Sa,[1,2] Thuraya Alktebi,[1,2] David J Granville,[4] David A Hart[5]

[1]Department of Physical

ABSTRACT

in active individuals (most of whom have body mass

Obesity as a Risk Factor for Tendinopathy: A Systematic Review

Francesco Franceschi,[1] Rocco Papalia,[1] Michele Paciotti,[1] Edoardo Franceschetti,[1] Alberto Di Martino,[1] Nicola Maffulli,[2,3] and Vincenzo Denaro[1]

[1] *Department of Orthopaedic and Trauma Surgery, Campus Bio-Medico University of Rome, Via Alvaro del Portillo 200, Trigoria, 00128 Rome, Italy*
[2] *Department of Musculoskeletal Disorders, Faculty of Medicine and Surgery, University of Salerno, Baronissi, 84081 Salerno, Italy*
[3] *Centre for Sports and Exercise Medicine, Barts and The London School of Medicine and Dentistry, Mile End Hospital, 275 Bancroft Road, London E1 4DG, UK*

Correspondence should be addressed to Francesco Franceschi; f.franceschi@unicampus.it

"The best evidence available to date indicates that obesity is a risk factor for tendinopathy."

BJSM Online First, published on January 14, 2016 as 10.1136/bjsports-2015-094735

Review

Is there an association between tendinopathy and diabetes mellitus? A systematic review with meta-analysis

Tom A Ranger,[1] Andrea M Y Wong,[2] Jill L Cook,[2,3] Jamie E Gaida[2,4,5]

The Effect of Diabetes, Hyperlipidemia, and Statins on the Development of Rotator Cuff Disease: A Nationwide, 11-Year, Longitudinal, Population-Based Follow-up Study

Tony Tung-Liang Lin, Ching-Heng Lin, Chia-Li Chang, Chun-Han Chi, Shin-Tsu Chang and Wayne Huey-Herng Sheu

Am J Sports Med 2015 43: 2126 originally published online June 17, 2015
DOI: 10.1177/0363546515588173

Review

OPEN ACCESS

Lipids, adiposity and tendinopathy: is there a mechanistic link? Critical review

Alex Scott,[1,2] Johannes Zwerver,[3] Navi Grewal,[1,2] Agnetha de Sa,[1,2] Thuraya Alktebi,[1,2] David J Granville,[4] David A Hart[5]

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ABSTRACT

in active individuals (most of whom have body mass

ELSEVIER

Clinica Chimica Acta 331 (2003) 25–28

www.elsevier.com/locate/clinchim

Is high concentration of serum lipids a risk factor for Achilles tendon rupture?

Taner Ozgurtas[a,*], Cemil Yildiz[b], Muhittin Serdar[a], Sabri Atesalp[b], Turker Kutluay[a]

[a] *Department of Biochemistry, Gülhane Military Medical Academy and Faculty, Etlik, Ankara 06018, Turkey*
[b] *Department of Orthopaedic Surgery, Gülhane Military Medical Academy, 06018 Ankara, Turkey*

BJSM Online First, published on October 15, 2015 as 10.1136/bjsports-2015-095100

OPEN ACCESS

Is higher serum cholesterol associated with altered tendon structure or tendon pain? A systematic review

Benjamin J Tilley,[1] Jill L Cook,[1,2] Sean I Docking,[1,2] James E Gaida[1,3,4]

People with altered tendon structure or tendon pain had significantly **higher**:

- total cholesterol,
- low-density lipoprotein cholesterol (LDL0
- triglycerides,

As well as lower high-density lipoprotein cholesterol (HDL)

CLINICAL SCIENCES

Dyslipidemia in Achilles Tendinopathy Is Characteristic of Insulin Resistance

JAMES EDMUND GAIDA[1], LOTTA ALFREDSON[2], ZOLTAN STEVEN KISS[3], ANDREW MICHAEL WILSON[4], HÅKAN ALFREDSON[2], and JILL LEIGH COOK[5]

[1]School of Exercise and Nutrition Sciences, Deakin University, Burwood, Victoria, AUSTRALIA; [2]Sports Medicine Unit, Department of Surgical and Perioperative Science, University of Umeå, Umeå, SWEDEN; [3]Victoria House Medical Imaging, Prahran, Victoria, AUSTRALIA; [4]Department of Medicine, St Vincent's Hospital, University of Melbourne, Fitzroy, Victoria, AUSTRALIA; and [5]Centre for Physical Activity and Nutrition Research, Deakin University, Burwood, Victoria, AUSTRALIA

ABSTRACT

This pattern of dyslipidemia is characteristic of the dyslipidemia displayed by individuals with **insulin resistance** and is common in the metabolic syndrome.

Nutrition and Joint Disease

Osteoarthritis

Obesity increased the risk of knee and hip OA because of the related **mechanical** impact of overweight on those weight-bearing joints.

Osteoarthritis

Obesity also increased the risk of **hand OA** and, occurrence of metabolic disturbances associated with obesity aggravates the association between **obesity and OA**.

Contents available at ScienceDirect

Diabetes Research and Clinical Practice

journal homepage: www.elsevier.com/locate/diabres

Review

Osteoarthritis and type 2 diabetes mellitus: What are the links?

Alice Courties, Jérémie Sellam *

Rheumatology Department, Saint-Antoine Hospital, Assistance Publique–Hôpitaux de Paris (AP-HP), DHU i2B, Paris, France
Inserm UMR S_938, Sorbonne Universités Univ Paris 06, DHU i2B, Paris, France

RMD Open
Rheumatic & Musculoskeletal Diseases

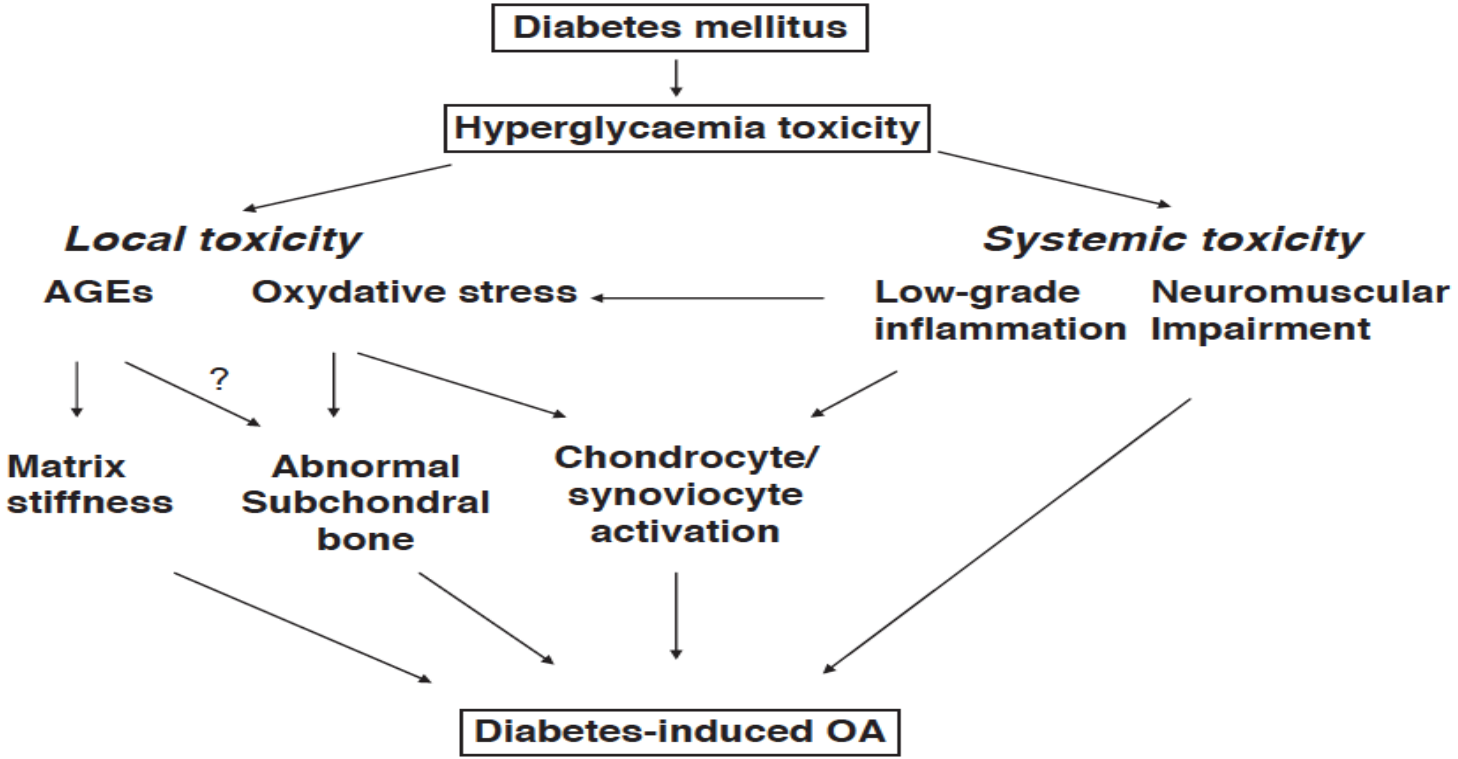
EXTENDED REPORT

Association between diabetes mellitus and osteoarthritis: systematic literature review and meta-analysis

Karine Louati,[1,2,3] Céline Vidal,[1,2] Francis Berenbaum,[1,2,3,4] Jérémie Sellam[1,2,3,4]

This meta-analysis highlights a **high frequency of OA in patients with DM** and an association between both diseases, representing a further step towards the individualisation of DM-related OA within a metabolic OA phenotype.

A general paradigm for a diabetes-induced OA phenotype.



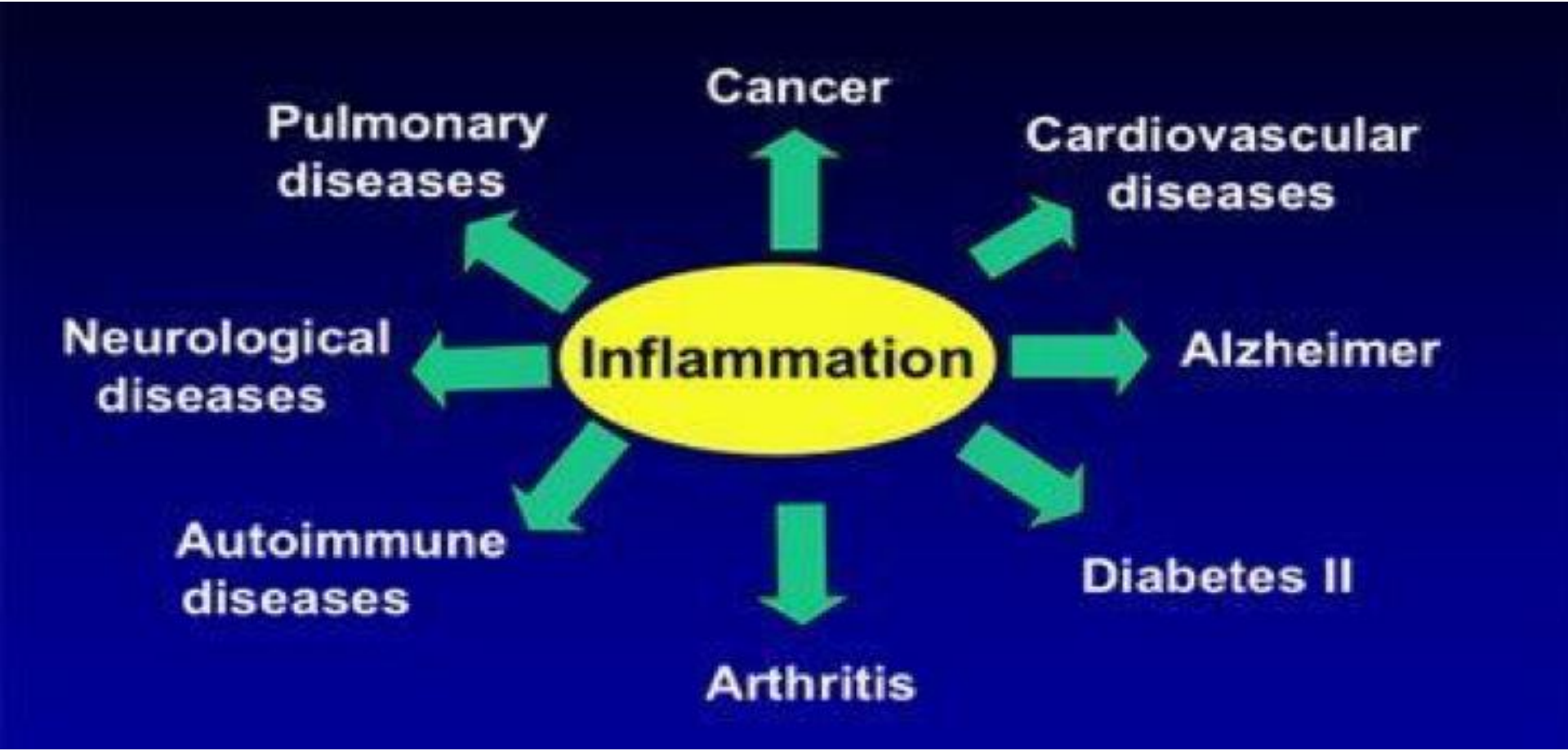
Article

Hyperglycemia and Hyperinsulinemia-Like Conditions Independently Induce Inflammatory Responses in Human Chondrocytes

Ana Teresa Rufino [1,2], Madalena Ribeiro [1,2], João Pinto Ferreira [1], Fernando Judas [3,4] and Alexandrina Ferreira Mendes [1,2,*]

This study shows that **hyperglycemia and hyperinsulinemia** are independently sufficient to induce **inflammatory responses in human chondrocytes**, namely by activating NF- B.

J Funct Morphol Kinesiol 2017;2:15


Cancer
Pulmonary diseases
Cardiovascular diseases
Neurological diseases
Inflammation
Alzheimer
Autoimmune diseases
Diabetes II
Arthritis

What causes inflammation?

- **Poor diet**
  - Sugar
  - Processed foods
  - Vegetable oils
- **Lack of exercise**
- **Poor sleep**
- **Stress**
- **Alcohol**
- **Smoking**
- **Lack of sun**

SUGAR MAKES YOU

HUNGRY

CARBOHYDRATE MAKES YOU

FAT

@thegarysclence

POLYUNSATURATED OILS MAKE YOU

INFLAMED & SICK

Nutrition and Inflammation

Review Article

Dietary Pattern and Macronutrients Profile on the Variation of Inflammatory Biomarkers: Scientific Update

Brenda Kelly Souza Silveira, Thatianne Moreira Silva Oliveira, Patrícia Amaro Andrade, Helen Hermana Miranda Hermsdorff, Carla de Oliveira Barbosa Rosa, and Sylvia do Carmo Castro Franceschini

Journal of the American College of Cardiology
Vol. 51, No. 3, 2008
ISSN 0735-1097/08/$34.00
doi:10.1016/j.jacc.2007.10.016

çosa, MG, Brazil

STATE-OF-THE-ART PAPER

Dietary Strategies for Improving Post-Prandial Glucose, Lipids, Inflammation, and Cardiovascular Health

James H. O'Keefe, MD, Neil M. Gheewala, MS, Joan O. O'Keefe, RD
Kansas City, Missouri

Available online at www.sciencedirect.com
ScienceDirect
www.nrjournal.com

Review Article

Consumption of a healthy dietary pattern results in significant reductions in C-reactive protein levels in adults: a meta-analysis

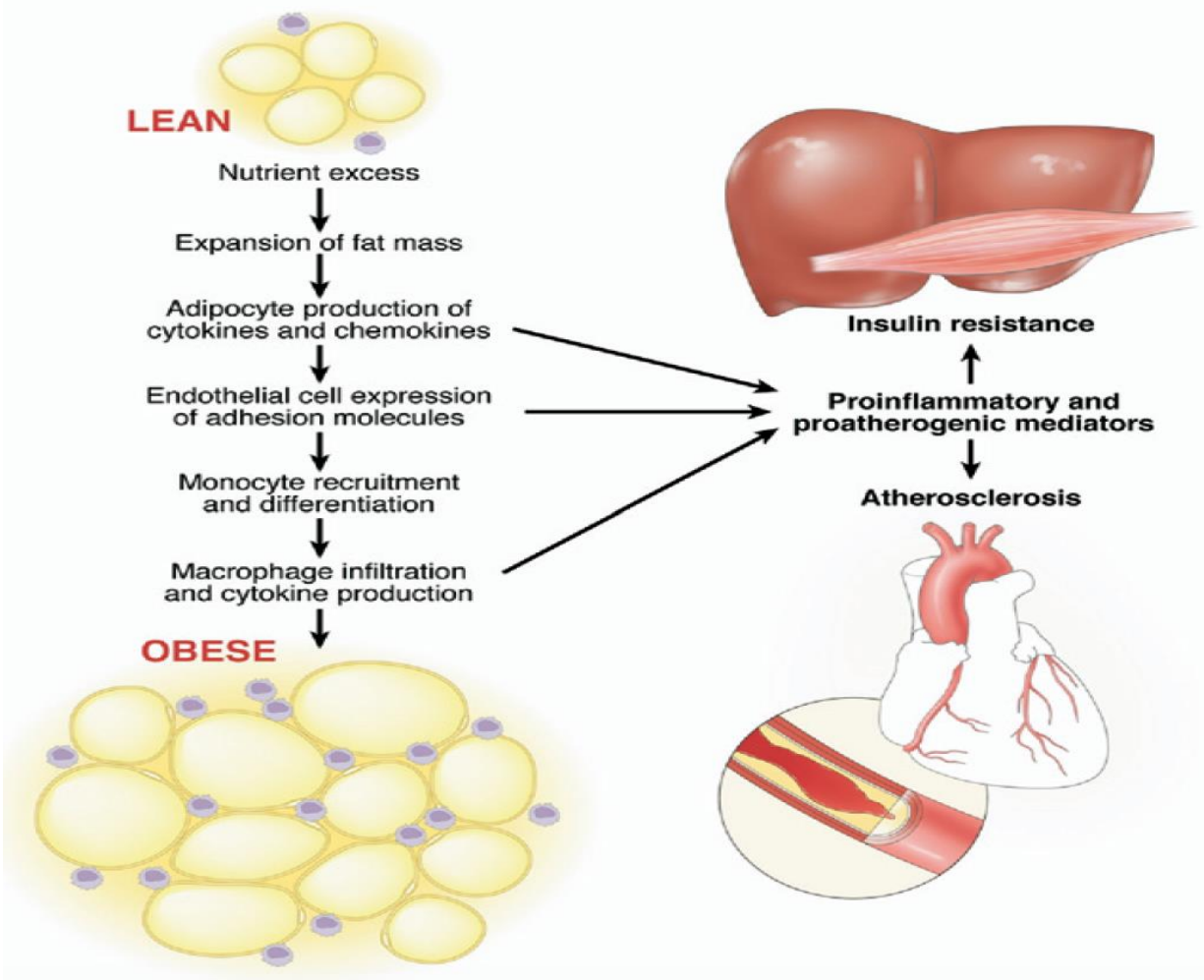
E.P. Neale[a,], M.J. Batterham[b], L.C. Tapsell[a]*
[a] *Smart Foods Centre, School of Medicine, Faculty of Science, Medicine and Health, University of Wollongong, NSW, Austra*
[b] *Statistical Consulting Service, School of Mathematics and Applied Statistics, Faculty of Engineering and Information Scien*
Wollongong, NSW, Australia, 2522

Special Article

Dietary pattern analysis and biomarkers of low-grade inflammation: a systematic literature review

Janett Barbaresko, Manja Koch, Matthias B Schulze, and Ute Nöthlings

Potential mechanisms for obesity-induced inflammation



Review Article

Anti-Inflammatory Nutrition as a Pharmacological Approach to Treat Obesity

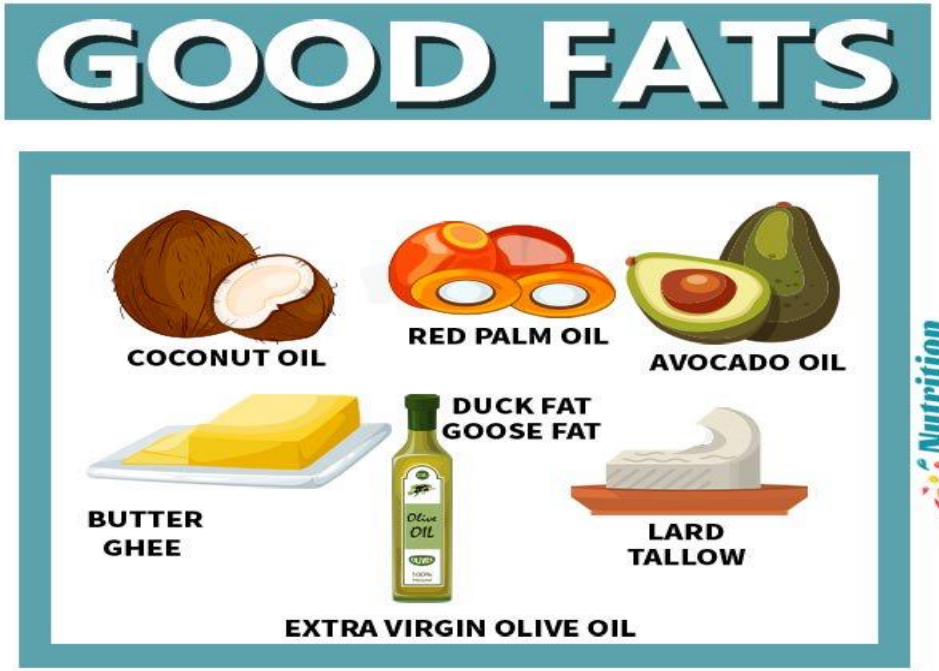
Barry Sears[1] and Camillo Ricordi[2]

[1] *Inflammation Research Foundation, Marblehead, MA 01945, USA*
[2] *Diabetes Research Institute, University of Miami, Miami, FL 33316, USA*

1. **increased** consumption of **refined carbohydrates**
2. **increased** consumption of refined **vegetable oils** rich in omega-6 fatty acids
3. **decreased** consumption of long-chain **omega-3** fatty acids.

Diet

Pro-Inflammatory	Anti-Inflammatory
Sugar	
Omega-6 fats	Omega-3 fats
Wheat & other grains	
Dairy	



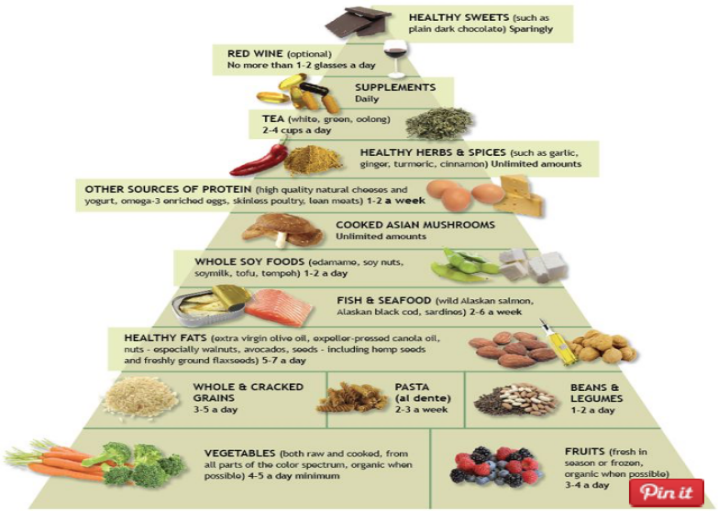
Ratio of Omega-6:Omega-3 should be close to **1:1**

Modern Western diet more like **20:**1 or more

Anti-Inflammatory Diet May Help Arthritis

Foods to Eat and Foods to Avoid

By Carol Eustice | Reviewed by a board-certified physician
Updated August 18, 2016



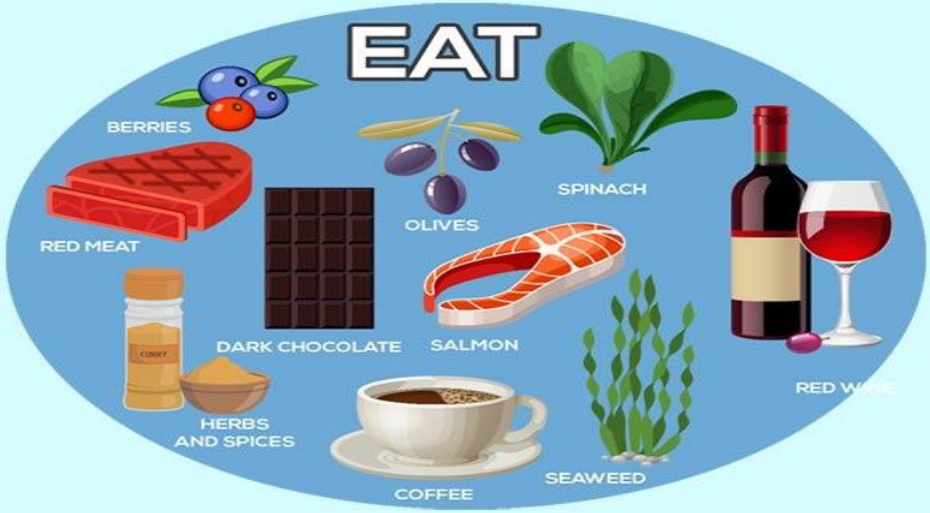
Dr. Weil's Anti-Inflammatory Food Pyramid. Permission: Dr. Weil

Controlling inflammation is essential if you have arthritis or another inflammatory disease. There are several ways to reduce inflammation. A combination of anti-inflammatory treatment and lifestyle change may be necessary. As an example, a combination of medication and diet may be more effective than either alone.

Following an anti-inflammatory diet has become increasingly popular. Basically, an anti-inflammatory diet focuses on foods to avoid that increase inflammation and foods to include in your diet that reduces inflammation.

The term "diet" tends to make us think of short-term weight loss diets, but that is not the purpose of an anti-inflammatory diet

REDUCE INFLAMMATION WITH A LOW CARB DIET



Nutrition ADVANCE

A FAT LOT OF GOOD

RED ZONE: EAT LITTLE

AMBER ZONE: EAT SOME

GREEN ZONE: EAT PLENTY

MEAT
Beef
Lamb
Pork
Chicken
Pancetta
Prosciutto
Bacon
Salami
Liver
Brains
Kidneys
Heart

DRINKS
Water
Coffee
Tea
Bone Broth
Soda water

NUTS
Almonds
Walnuts
Brazil Nuts
Hazelnuts
Macadamias
Pecans

VEGETABLES
Cabbage
Cauliflower
Broccoli
Brussel Sprout
Asparagus
Zucchini
Eggplant
Olives
Spinach
Silverbeet
Mushrooms
Cucumber
Lettuce
Onions
Capsicums
Tomatoes

DAIRY
Eggs
Cream
Butter
Cheese
Cottage Cheese
Greek Yoghurt

NON-DAIRY ALTS
Coconut Milk/Cream
Nut Butters

SEEDS
Flaxseed
Chai
Pumpkin
Sunflower
Sesame

FLOUR
Almond Flour
Coconut Flour

FATS & SAUCES
Olive Oil
Butter
Cocoa Butter
Avocado Oil
Coconut Oil
Lard
Tallow
Ghee
Mayonnaise
Mustard
Pesto

SWEET FOODS
Dark Chocolate
Stevia
Xylitol
Erythritol

FISH
Cod
Crab
Lobster
Halibut
Mackerel
Mussels
Oysters
Plaice
Salmon
Sardines
Scallops
Shrimp
Trout
Tuna

OTHERS
Avocado
Eggs
Spices
Herbs
Lemon Juice
Lime Juice

FERMENTED
Kimchi
Kombucha
True Pickles
Sauerkraut

VEGETABLES
Sweet Potato
Pumpkin
Potatoes
Corn on the cob
Butternut Squash

FRUITS
Apples
Apricots
Peaches
Pears
Lemons
Limes
Oranges

LEGUMES
Kidney beans
Lentils
Tofu

MILK
Full fat milk
Soy milk
Rice milk

NUTS
Cashews
Chestnuts
Pistachios

SAUCES
Tomato sauces
Tomato relishes
Barbeque sauces
Chutney

OTHERS
Diet drinks
Low carb energy bars
Red or White Wine
Beer (low-carb)
Spirits

GRAINS
Cakes
Cereal
Chickpeas
Corn
Couscous
Crumpets
Lentils
Legumes
Noodles
Muffins
Muesli
Muesli bars
Oats
Pasta
Pastries
Peas
Pies
Pizza
Potatoes
Quinoa
Rice
Rice cakes
Flour

DRINKS
Fruit Juices
Cordials
Sports Drinks
Energy Drinks
Flavoured milks
Tonic Water
Colas
Lemonade

ALCOHOL
Dessert wines
Liquors
Sugary mixers

FRUITS
Mango
Pineapple
Banana
Grapes
Dried Fruits

MEATS
Highly processed
Hotdogs
Nuggets
Spam

SUGAR
Soft drink
Confectionery
Chocolate
Cakes
Biscuits
Ice Cream

OTHERS
Margarine
Flavoured yoghurts
Frozen yoghurts
Artificial Sweetener
Anything deep-fried in seed oils

VEGETABLE OILS
Canola oil
Sunflower oil
Safflower oil
Cottonseed oil
Rapeseed oil





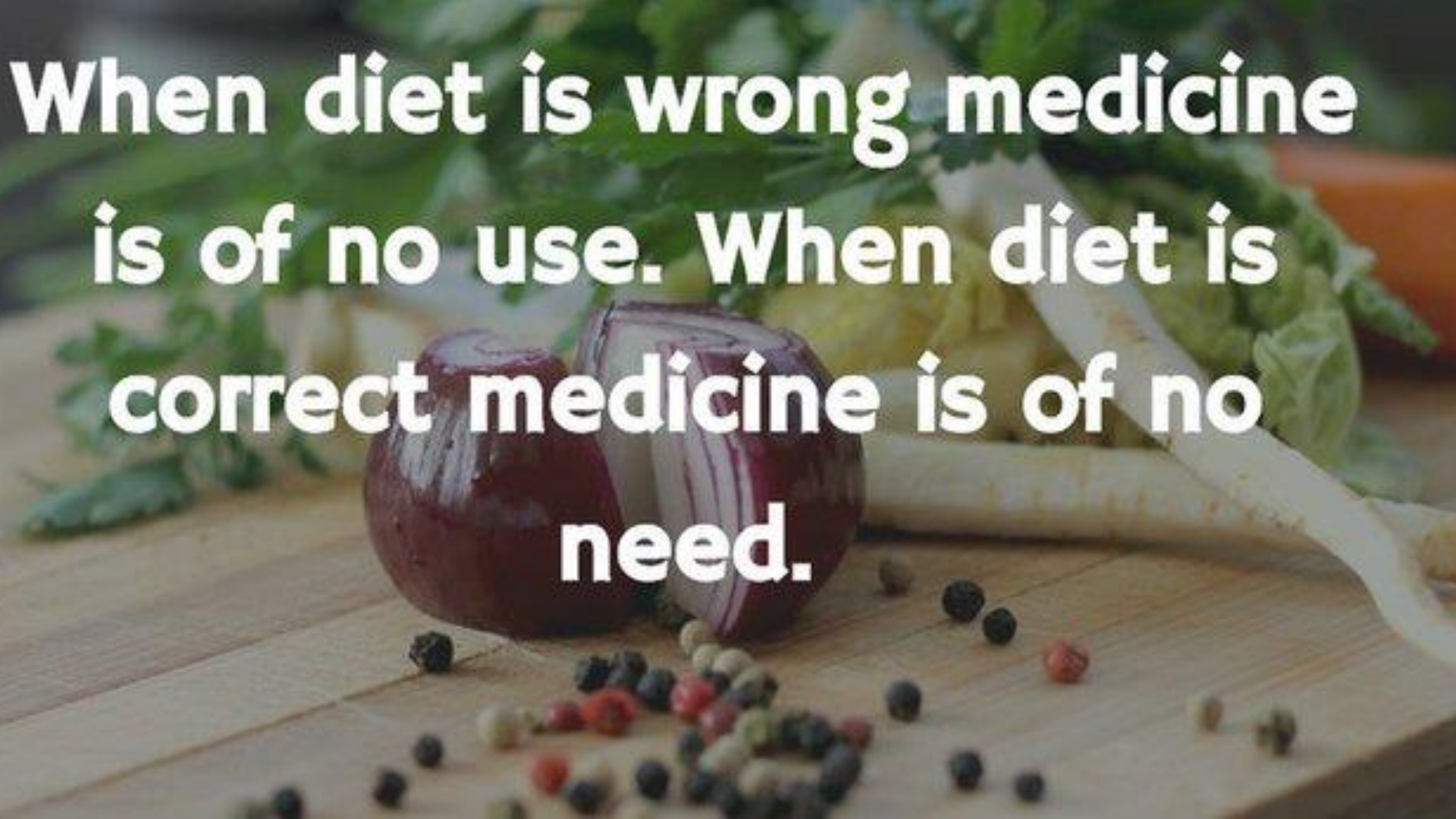




The Anti-Inflammatory Diet

Can the foods you eat beat inflammation?

By Cathy Wong, ND | Reviewed by a board-certified physician
Updated September 15, 2017


When diet is wrong medicine is of no use. When diet is correct medicine is of no need.

Today

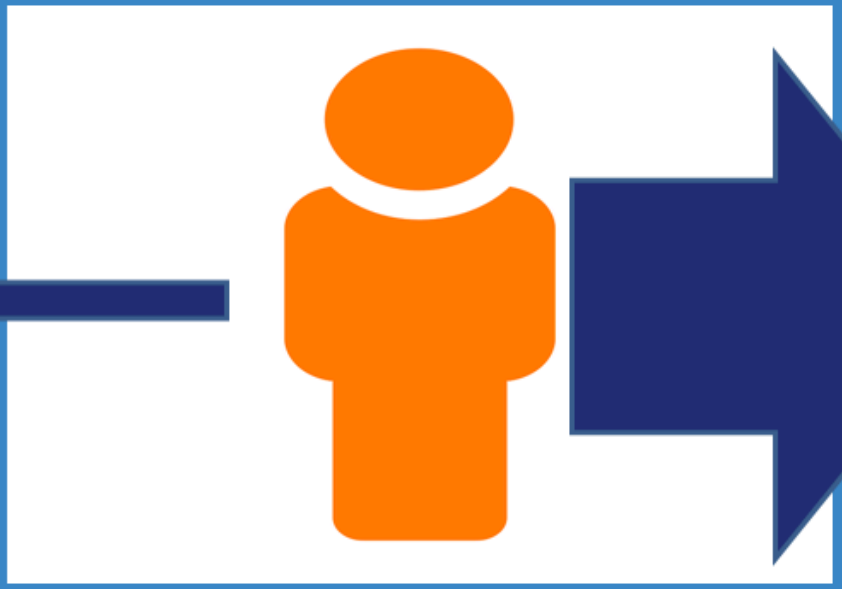
- Nutrition and Health
- Nutrition and Musculoskeletal Health
- **Nutrition and Performance**

The Carb Generation

Available energy

Carbohydrate (kcal)

1,800



Fat (kcal)

40,000+

DOES A DEPENDENCE ON CARBOHYDRATE MAKE SENSE?


BUD LIGHT
BROOKS

Zach Bitter is the 100-mile American record holder. He also eats almost no carbs.

For Zach Bitter, who can travel ultramarathon distances faster than pretty much any other American, carb-cutting is a way of life. Here's how he makes an ultra-low-carb diet work—and how you can do the same.

by Spenser Mestel August 11, 2017 11.33am

Chris Froome Cut Back on Carbs, Lost 20 Pounds and Won the Tour de France – 3 Times!

July 27 by Dr. Andreas Eenfeldt in Exercise, Low Carb High Fat

Kobe Bryant, Los Angeles Lakers Embrace Bacon As Good Food For Training Table

Thursday, July 3, 2014 4:42 pm | Written by: Dan Russo

After Kobe Bryant suffered his Achilles injury in April 2013, the Mamba embarked on an eight-month recovery process. His diet included a food source that provided natural anti-inflammatory products: Bacon.

The sizzling meat played a role in Bryant's paleo-style diet, implemented by the Lakers strength and conditioning coach, Tim DiFrancesco, in the 2012-13 season.

"Contrary to what people might think, we actually want our players to eat as much grass fed butter and bacon as we can get into them," **DiFrancesco told Lakers.com.** "Will that sky-rocket cholesterol? No, just look into the science on it."

The team's nutritionist, Dr. Cate Shanahan, also helped design Bryant's recovery diet. The paleo-style diet focuses on using natural fats as the

EDGE

Inside LeBron James' weight loss and low-carb diet

Photo: Issac Baldizon/NBAE via Getty Images

Gary Ablett's Paleo diet the secret to his success

Jon Pierik

SHARE TWEET MORE

Gary Ablett has embraced a diet that was used by humans more than 10,000 years ago to help him deal with the rigours of modern football.

Ablett is on the Paleolithic diet, said to be used by our hunter-gatherer ancestors before the agricultural age.

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By Tamara Fuentes Feb 28, 2018

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WEIGHT LOSS

'I Lost Weight Eating 2,200 Calories P Day'

HALLE BERRY REVEALS DIET THAT SLOWED 'AGING PROCESS' AND REVERSED DIABETES DIAGNOSIS

So what is the best fuel?

How many carbs?

- Endurance athlete >500gm/day
- Average 200-300gm/day
- Low carb <100-150 gm/day
- Ketosis <30-50 gm/day

Carbs vs Fats

Where is the science?

1983

The Human Metabolic Response to Chronic Ketosis Without Caloric Restriction: Preservation of Submaximal Exercise Capability with Reduced Carbohydrate Oxidation

S. D. Phinney, B. R. Bistrian, W. J. Evans, E. Gervino, and G. L. Blackburn

To study the effect of chronic ketosis on exercise performance in endurance-trained humans, five well-trained cyclists were fed a eucaloric balanced diet (EBD) for one week providing 35–50 kcal/kg/d, 1.75 g protein/kg/d and the remainder of kilocalories as two-thirds carbohydrate (CHO) and one-third fat. This was followed by four weeks of a eucaloric ketogenic diet (EKD), isocaloric and isonitrogenous with the EBD but providing less than 20 g CHO daily. Both diets were appropriately supplemented to meet the recommended daily allowances for vitamins and minerals. Pedal ergometer testing of maximal oxygen uptake ($\dot{V}O_2max$) was unchanged between the control week (EBD-1) and week 3 of the ketogenic diet (EKD-3). The mean ergometer endurance time for continuous exercise to exhaustion (ENDUR) at 62%–64% of $\dot{V}O_2max$ was 147 minutes at EBD-1 and 151 minutes at EKD-4. The ENDUR steady-state RQ dropped from 0.83 to 0.72 ($P < 0.01$) from EBD-1 to EKD-4. In agreement with this were a three-fold drop in glucose oxidation (from 15.1 to 5.1 mg/kg/min, $P < 0.05$) and a four-fold reduction in muscle glycogen use (0.61 to 0.13 mmol/kg/min, $P < 0.01$). Neither clinical nor biochemical evidence of hypoglycemia was observed during ENDUR at EKD-4. These results indicate that aerobic endurance exercise by well-trained cyclists was not compromised by four weeks of ketosis. This was accomplished by a dramatic physiologic adaptation that conserved limited carbohydrate stores (both glucose and muscle glycogen) and made fat the predominant muscle substrate at this submaximal power level.

Jeff S. Volek, PhD, RD
Stephen D. Phinney, MD, PhD

THE ART AND SCIENCE O

LOW CARBOHYDRATE PERFORMANCE

International Journal of Sport Nutrition and Exercise Metabolism, 2003, 13, 466-478

Journal of Physiology (1996), **492.1**, *pp.*293–306

Interaction of training and diet on metabolism and endurance during exercise in man

Jørn Wulff Helge, Erik A. Richter and Bente Kiens*

Copenhagen Muscle Research Centre, August Krogh Institute, University of Copenhagen, DK-2100 Copenhagen, Denmark

Endurance Capacity and High-Intensity Exercise Performance Responses to a High-Fat Diet

Jesse Fleming, Matthew J. Sharman, Neva G. Avery, Dawn M. Love, Ana L. Gómez, Timothy P. Scheett, William J. Kraemer, and Jeff S. Volek

J Appl Physiol 100: 194–202, 2006.
First published September 1, 2005; doi:10.1152/japplphysiol.00813.2005.

Fat adaptation followed by carbohydrate loading compromises high-intensity sprint performance

L. Havemann,[1] S. J. West,[1] J. H. Goedecke,[1] I. A. Macdonald,[2] A. St Clair Gibson,[1] T. D. Noakes,[1] and E. V. Lambert[1]
[1]*University of Cape Town/Medical Research Council Research Unit for Exercise Science and Sports Medicine, Department of Human Biology, University of Cape Town, South Africa; and* [2]*School of Biomedical Sciences, University of Nottingham Medical School, Queen's Medical Centre, Nottingham, United Kingdom*

Sports Med (2015) 45 (Suppl 1):S5–S12
DOI 10.1007/s40279-015-0400-1

REVIEW ARTICLE

Carbohydrate Dependence During Prolonged, Intense Endurance Exercise

John A. Hawley[1,2] · Jill J. Leckey[1]

Effects of ad libitum Low Carbohydrate High-Fat Dieting in Middle-Age Male Runners

Alexander J. Heatherly; Lauren G. Killen; Ashton F. Smith; Hunter S. Waldman; Angela Hollingsworth; Christie L. Seltmann; Eric K. O'Neal

Effects of a low- or a high-carbohydrate diet on performance, energy system contribution, and metabolic responses during supramaximal exercise

Lima-Silva AE, Pires FO, Bertuzzi R, Silva-Cavalcante MD, Oliveira RS, Kiss MA, Bishop D.

Journal of Physiology (1996), **492.1**, *pp.*293–306

Mar 26.

Interaction of training and diet on metabolism and endurance during exercise in man

Jørn Wulff Helge, Erik A. Richter and Bente Kiens*

Copenhagen Muscle Research Centre, August Krogh Institute, University of Copenhagen,

Article

The Effects of a Ketogenic Diet on Exercise Metabolism and Physical Performance in Off-Road Cyclists

Adam Zajac [1], Stanisław Poprzecki [2], Adam Maszczyk [1,*], Miłosz Czuba [1], Małgorzata Michalczyk [3] and Grzegorz Zydek [3]

J Appl Physiol 100: 7–8, 2006;
doi:10.1152/japplphysiol.01238.2005.

Invited Editorial

"Fat adaptation" for athletic performance: the nail in the coffin?

ENDURANCE ATHLETES have a high capacity for the oxidation of fat during exercise as a legacy of their training. Therefore, it is intriguing that this capacity can be easily upregulated by the chronic consumption of a low-carbohydrate (<2.5 g·kg^{-1}·day^{-1}), high-fat ($\sim$65–70% of energy) diet. For example, 2–4 wk of exposure to such a diet in trained individuals has been shown to markedly increase fat oxidation and reduce the utilization of muscle glycogen during subsequent submaximal exercise (10, 11). Despite the promise of an enhanced ability to "tap into your body fat," fat loading per se does not seem to lead to a clear enhancement of exercise capacity or performance (for review, see Ref. 8). In fact, there is at least a short-term increase in the perceived effort of training (2, 3) and an impairment of the response to training when the high-fat, low-carbohydrate eating continues for periods longer than 4 wk, based on data from previously unas "glycogen sparing" after adaptations to a fat-rich diet may be, in fact, a downregulation of carbohydrate metabolism or "glycogen impairment." One study (12) has reported that fat adaptation/carbohydrate restoration strategies are associated with a reduction in the activity of pyruvate dehydrogenase; this change would act to impair rates of glycogenolysis at a time when muscle carbohydrate requirements are high. The present study of Havemann et al. (6) furthers our knowledge by applying the fat adaptation/carbohydrate restoration model to an endurance cycling protocol that involves several features of a real-life race: self-pacing and the interspersing of high-intensity bouts of cycling with more moderate-intensity segments. The results show that the dietary strategy has no effect on overall performance of a 100-km time trial but compromises the ability of well-trained cyclists to performance high-intensity sprints.

"Those at the coal-face of sports nutrition can delete fat loading and high-fat diets from their list of genuine ergogenic aids for conventional endurance and ultra-endurance sports"

Sports Med (2015) 45 (Suppl 1):S33–S49
DOI 10.1007/s40279-015-0393-9

REVIEW ARTICLE

Re-Examining High-Fat Diets for Sports Performance: Did We Call the 'Nail in the Coffin' Too Soon?

Louise M. Burke[1,2]

Sports Med (2015) 45 (Suppl 1):S33–S49
DOI 10.1007/s40279-015-0393-9

REVIEW ARTICLE

Re-Examining High-Fat Diets for Sports Performance: Did We Call the 'Nail in the Coffin' Too Soon?

Louise M. Burke[1,2]

The current guidelines for carbohydrate intake in the athlete's training diet appear to be poorly understood.

Sports nutrition experts do not promote a "high carbohydrate diet" for all athletes.

Sports Med (2015) 45 (Suppl 1):S33–S49
DOI 10.1007/s40279-015-0393-9

REVIEW ARTICLE

Re-Examining High-Fat Diets for Sports Performance: Did We Call the 'Nail in the Coffin' Too Soon?

Louise M. Burke[1,2]

The evolving model is that athletes should follow an **individualized** approach, whereby **carbohydrate intake is periodized** throughout the training cycle according to the fuel needs of each workout, the importance of performing well in the session and/or the potential to amplify the adaptive response to exercise via exposure to low carbohydrate availability.

Sports Med (2015) 45 (Suppl 1):S33–S49
DOI 10.1007/s40279-015-0393-9

REVIEW ARTICLE

Re-Examining High-Fat Diets for Sports Performance: Did We Call the 'Nail in the Coffin' Too Soon?

Louise M. Burke[1,2]

There is a need for **ongoing research** and practice to identify a range of approaches to optimal training and competition diets according to the specific requirements of an event and the experience of the individual athlete.

J Physiol 595.9 (2017) pp 2785–2807

The Journal of Physiology

Low carbohydrate, high fat diet impairs exercise economy and negates the performance benefit from intensified training in elite race walkers

Louise M. Burke[1,2], Megan L. Ross[1,2], Laura A. Garvican-Lewis[1,2], Marijke Welvaert[3,4], Ida A. Heikura[1,2], Sara G. Forbes[1], Joanne G. Mirtschin[1], Louise E. Cato[1], Nicki Strobel[5], Avish P. Sharma[6] and John A. Hawley[2,7]

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[2] *Mary MacKillop Institute for Health Research, Australian Catholic University, Melbourne, Australia 3000*
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[4] *Innovation, Research and Development, Australian Institute of Sport, Canberra, Australia 2616*
[5] *University College Zealand, Ankerhus, Denmark*
[6] *Physiology, Australian Institute of Sport, Canberra, Australia 2616*
[7] *Research Institute for Sport and Exercise Sciences, Liverpool John Moores University, Liverpool, UK*

Key points

- Three weeks of intensified training and mild energy deficit in elite race walkers increases peak aerobic capacity independent of dietary support.
- Adaptation to a ketogenic low carbohydrate, high fat (LCHF) diet markedly increases rates of whole-body fat oxidation during exercise in race walkers over a range of exercise intensities.
- The increased rates of fat oxidation result in reduced economy (increased oxygen demand for a given speed) at velocities that translate to real-life race performance in elite race walkers.
- In contrast to training with diets providing chronic or periodised high carbohydrate availability, adaptation to an LCHF diet impairs performance in elite endurance athletes despite a significant improvement in peak aerobic capacity.

Abstract We investigated the effects of adaptation to a ketogenic low carbohydrate (CHO), high fat diet (LCHF) during 3 weeks of intensified training on metabolism and performance of world-class endurance athletes. We controlled three isoenergetic diets in elite race walkers: high CHO availability (g kg^{-1} day^{-1}: 8.6 CHO, 2.1 protein, 1.2 fat) consumed before, during and after training (HCHO, $n = 9$); identical macronutrient intake, periodised within or between days to alternate between low and high CHO availability (PCHO, $n = 10$); LCHF (< 50 g day^{-1} CHO; 78% energy as fat; 2.1 g kg^{-1} day^{-1} protein; LCHF, $n = 10$). Post-intervention, $\dot{V}_{O_2peak}$ during race walking increased in all groups ($P < 0.001$, 90% CI: 2.55, 5.20%). LCHF was associated with markedly increased rates of whole-body fat oxidation, attaining peak rates of 1.57 ± 0.32 g min^{-1} during 2 h of walking at ~80% $\dot{V}_{O_2peak}$. However, LCHF also increased the oxygen (O_2) cost of race walking at velocities relevant to real-life race performance: O_2 uptake (expressed as a percentage of new $\dot{V}_{O_2peak}$) at a speed approximating 20 km race pace was reduced in HCHO and PCHO (90% CI: −7.047, −2.55 and −5.18, −0.86, respectively), but was maintained at pre-intervention levels in LCHF. HCHO and PCHO groups improved times for 10 km race walk: 6.6% (90% CI: 4.1, 9.1%) and 5.3% (3.4, 7.2%), with no improvement (−1.6% (−8.5, 5.3%)) for the LCHF group. In contrast to training with diets providing chronic or periodised high-CHO availability, and despite a significant improvement in $\dot{V}_{O_2peak}$, adaptation to the topical LCHF diet negated performance benefits in elite endurance athletes, in part due to reduced exercise economy.

(Received 17 August 2016; accepted after revision 23 November 2016; first published online 23 December 2016)
Corresponding author L. M. Burke: AIS Sports Nutrition, Leverrier Crescent, Bruce, ACT, Australia 2616. Email: louise.burke@ausport.gov.au

DOI: 10.1113/JP273230

Available online at www.sciencedirect.com

Metabolism

www.metabolismjournal.com

Keto-adaptation enhances exercise performance and body composition responses to training in endurance athletes

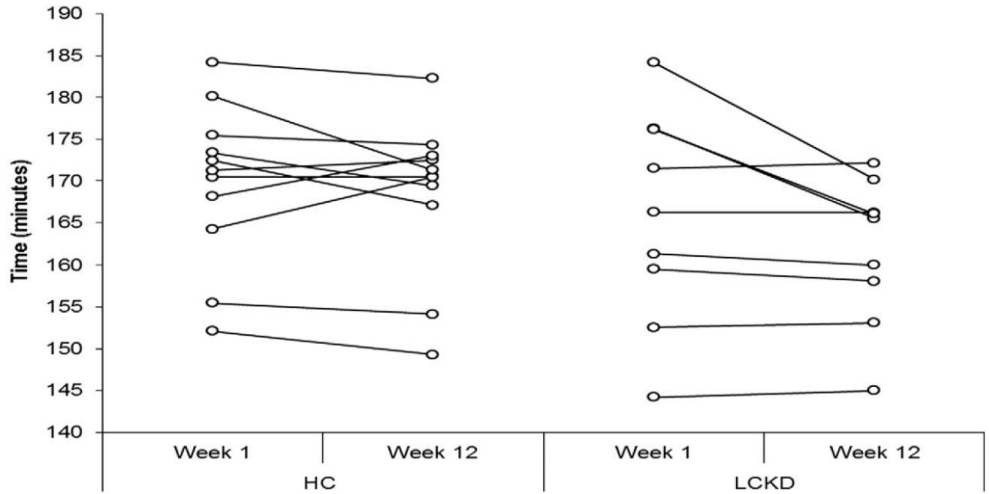
Fionn T. McSwiney[a], *Bruce Wardrop*[a], *Parker N. Hyde*[b], *Richard A. Lafountain*[b], *Jeff S. Volek*[b], *Lorna Doyle*[a,*]

[a] *Department of Sport, and Exercise Science, Waterford Institute of Technology, Waterford, Ireland*
[b] *Kinesiology Program, Department of Human Sciences, The Ohio State University, Columbus, OH, USA*

12 weeks diet and training

LCKD group

- ↓ Body mass (5.9 vs 0.8kg)
- ↓ % body fat (5.2 vs 0.7)
- No change 100km time trial



2 – Individual 100 km TT times for HC, and LCKD groups at pre and post-intervention testing.

Additional advantages of LCHF/keto

- Weight loss, ↑ power/weight ratio
- Metabolic health
  - Long term effects of high carb intake?
- Recovery
- Reduced inflammation
- Reduced need to re-fuel during activity

What we know

- LCHF/keto diets increase fat oxidation
- Anecdotally some athletes esp endurance athletes perform better on LCHF/keto
- High intensity activity appears to be compromised with LCHF/keto
- Research evidence Is not clear – more high quality studies need to be done

What we don’t know

- How long does it take to fully adapt?
- With full adaptation, does endurance performance improve?
- What about other sports?
  - Strength, high intensity intermittent

What I suspect

- There is considerable individual variation
  - Responders and non-responders
- LCHF/keto generally better for ultra-endurance, moderate intensity
- Most need additional carbs for high intensity
- Train low, compete high

Further investigations on LCHF diets are needed regarding:

- performance after weight loss in weight-categorized sports
- repeated high-intensity exercise performance
- development of central fatigue during endurance events
- perceptual-motor performance during prolonged intermittent sports
- ideal dietary fatty acid compositions
- ketone supplemements

What do I tell my athletes

- Your basic diet should be low carb, healthy fat, real food avoiding sugar, processed foods and seed oils
- Give yourself plenty of time to adapt to the change of eating pattern
- You may find that you need to top up with some carbs before and/or during higher intensity activity
- Everyone is different, find what works for you

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DR PETER BRUKNER OAM
Leading sports medicine physician and founder of SugarByHalf


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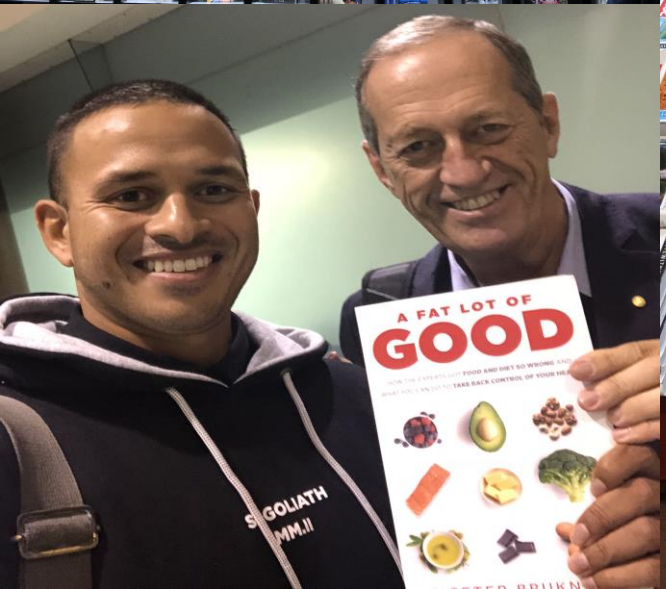
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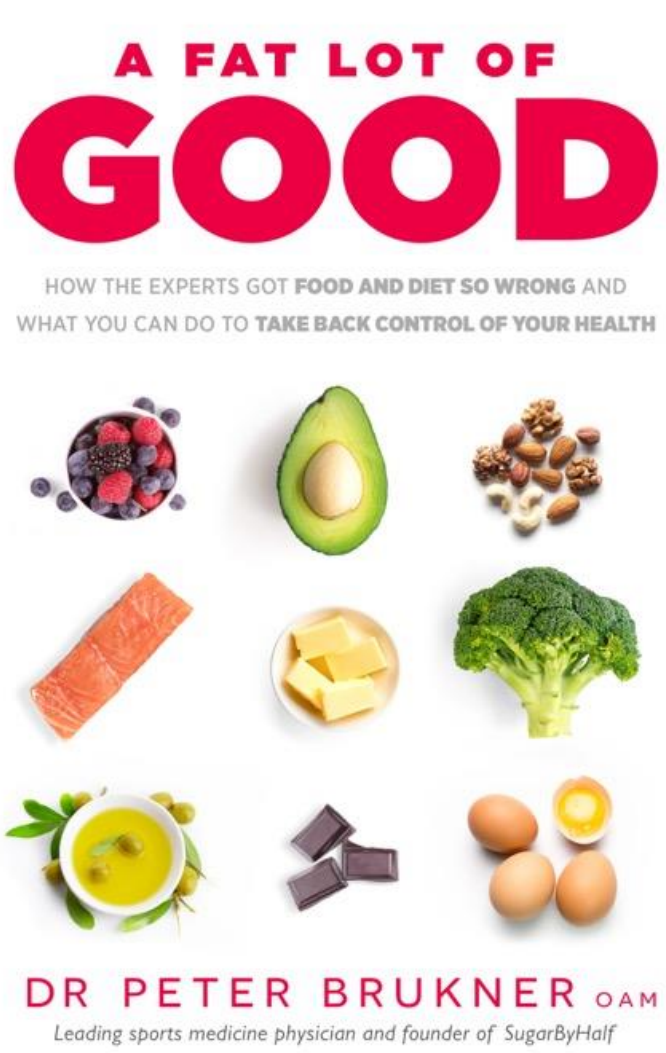
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