

How can you reduce Free Radical damage?

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What will be covered
In this session?

Session 3

How can you reduce Free Radical damage, slow Aging
and reduce risk of developing lifestyle diseases?

Session 1.

Main points *(Revision)*

1. Free radicals cause oxidative stress
2. This oxidative stress causes damage to cells that result in aging and disease.

Main points

Session 2.

(Revision)

1. Early stages of atherosclerosis are initiated by free radical damage of low density cholesterol
2. High cholesterol will not cause atherosclerosis on its own
3. Increased Ox stress in the presence of high cholesterol is the best recipe for development of atherosclerosis
4. Cells of the body are constantly exposed to ROS
5. Free radical damage to DNA represents the first step in carcinogenesis and aging

Session 3.

Main points

1. Impact of calorie restriction on free radical production
2. Effect of high nutrient diet on free radicals
3. Effect of exercise on free radicals

Effect of Calorie restriction on longevity

Rats fed a calorie restricted diet with essential nutrients lived up to twice as long as rats on a normal diet.

McCay and Crowell, 1934

Numerous studies have shown increased lifespan for a variety of animals following calorie restriction from worms to fruit fly to monkeys.

A 20% reduction in calorie intake in a Japanese population produced an ~40% reduction in death rate for heart disease, stroke and cancer.

Nutr Health 1992;8:97-105

A large number of studies have shown improvement in cardiovascular and other health markers in people following a nutritionally balanced calorie restricted diet.

Hungry for life: How the arcuate nucleus and neuropeptide Y may play a critical role in mediating the benefits of calorie restriction.

[Minor RK](#), [Chang JW](#), [de Cabo R](#).

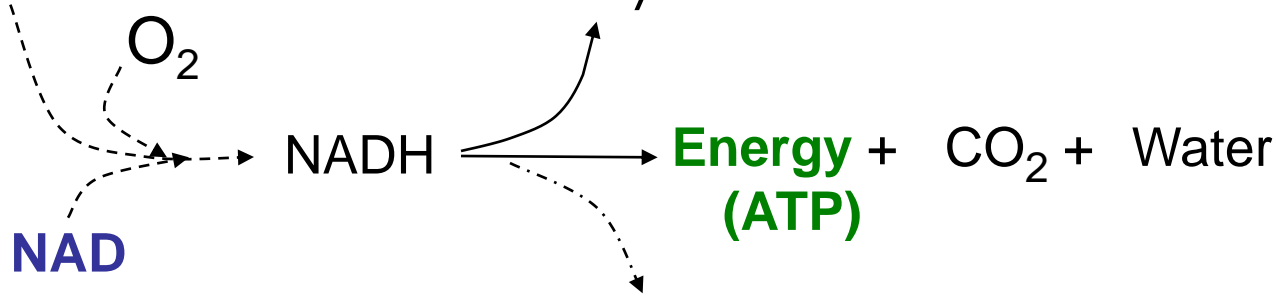
Mol Cell Endocrinol. 2008 Nov 11.

- Laboratory studies consistently demonstrate extended lifespan in animals on calorie restriction (CR), where total caloric intake is reduced by 10-40% but adequate nutrition is otherwise maintained. CR has been further shown to delay the onset and severity of chronic diseases associated with aging such as cancer, and to extend the functional health span of important faculties like cognition.



Why does this happen?

Sugar/Fats



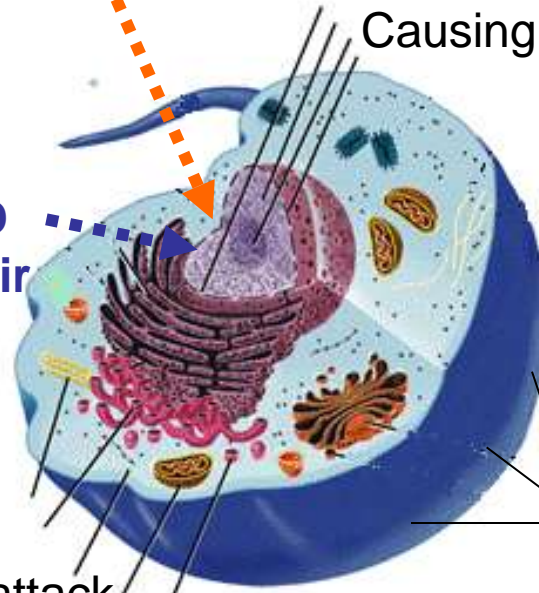
$\uparrow O_2^{\cdot-}$

Free radicals can break the DNA
Causing mistakes in copying

NAD Repair

Free radicals can attack
intracellular machinery

Free radicals can break the
cell wall causing leakage



**EATing less calories
will significantly reduce
free radical production**

Exercise

**increases the body's
capacity to neutralise
Free radicals**

How does the body handle free radicals?

1. Tries to detoxify or nullify the radicals using antioxidants:

Endogenous

- Glutathione
- Catalase (H_2O_2)
- Superoxide dismutase



Exercise increases
activity of Antioxidant
enzymes

Exogenous (from food)

1. Vitamins A, E, C
2. Polyphenols

Exercise

- Reduces the stress response
- Reduces desire for food
- Gives a little endorphin ‘high’
- Promotes mitochondrial activity in fat and muscle cells.
- This increases metabolic rate, decreases circulating triglyceride and insulin resistance
- Increases activity of antioxidant enzymes

How does the body handle free radicals?

1. Tries to detoxify or nullify the radicals using antioxidants:

Endogenous

- Glutathione peroxidase (Glutathione-GSSG)
- Catalase (H_2O_2)
- Superoxide dismutase

Exogenous (from food)

1. Vitamins A, E, C
2. Flavonoids, polyphenols etc

Eating **food** with the right nutrients will help here

How much exercise?

PAPER

Dose – response effect of walking exercise on weight loss. How much is enough?

Brill J et al. *International Journal of Obesity* (2002) 26, 1484–1493

OBJECTIVE: The total volume of exercise needed to both promote weight loss and elicit health benefits has not been sufficiently investigated. The aim of this study was to **examine the effects of two different volumes of walking ‘metabolic fitness’ exercise** prescriptions, in combination with a low-fat, ad libitum diet (LFAL) on weight loss and additional modifiable health-related variables (HRV) in an ethnically diverse sample of overweight premenopausal women.

DESIGN: Clinical **12 week weight loss intervention study** with a low joule diet daily with (a) participants walking 30 min, 5 days per week (DEX1), (b) participants walking 60 min, five times per week (DEX2) or (c) a diet only control group (DO).

RESULTS: All groups showed similar and significant ($P < 0.001$) declines in body weight, percentage body fat, BMI, WHR, fat mass, fat-free mass and diastolic blood pressure following the program. In addition, total cholesterol, triacylglycerol and the TC:HDL ratio displayed a significant time effect ($P < 0.05$).

CONCLUSION: This data suggests that 30 min of walking on most days of the week may be as beneficial as 60 min (in combination with diet) in promoting numerous additional healthful outcomes over diet alone following a 12 week weight loss program

How much exercise?

Interval training

PAPER (Review)

Interval exercise is a path to good health, but how much, how often and for whom?

MacDonald MJ, Currie KD.

Clin Sci (Lond). 2009 Feb;116(4):317-26.

Abstract

Interval exercise training has now been examined in a wide variety of individuals, ranging from elite athletes to patients with severe cardiovascular disease.

The **advantages of interval exercise training** programmes in comparison with constant intensity exercise programmes are that they appear to **deliver superior improvements in several cardiovascular risk factors, fitness and performance**.

Depending on the design, some interval exercise programmes result in a range of benefits, even though the time commitment may be dramatically less than more traditional continuous intensity programmes.

Strategies so far to reduce free radical burden:

1. Eat less calories/kilojoules (reduces free radical production)
2. Exercise (increases antioxidant capacity)

Apart from calories can what we eat affect our free radical exposure?

Free Radicals can also come from what we eat!



- High levels of sugar (glucose) will produce Advanced Glycation End products (**AGE's**)
- **AGEs** also form during the cooking as the result of the application of heat.

Deep-Frying for the brave



Take-home message

- Eating some foods will increase your free radical burden

Are there foods you can eat that will decrease your free radical burden?

Nutrition and Oxidative stress

Association between adherence to the Mediterranean diet and oxidative stress.

Dai J, Jones DP, Goldberg J, et al.

Dept. Medicine, Division of Cardiology, Emory University School of Medicine, Atlanta, GA 30306, USA.

Abstract

BACKGROUND: The cardioprotective property of the Mediterranean diet has been attributed to its antioxidant capacity, but direct investigation of this mechanism has been limited.

OBJECTIVE: We examined the association between the Mediterranean diet and an established plasma marker of oxidative stress, the ratio of reduced to oxidized glutathione (GSH/GSSG), in a well-controlled study of twins.

RESULTS: A one-unit increment in the diet score was associated with a 7% higher GSH/GSSG ratio ($P = 0.03$) after adjustment for energy intake, other nutritional factors, cardiovascular disease risk factors, and medication use. The association persisted within twin pairs: a one-unit within-pair absolute difference in the diet score was associated with a 10% (95% CI: 2.7, 18.0) higher GSH/GSSG ratio in the twin with the higher score than in the co-twin with the lower score ($P = 0.007$). Results were similar in monozygotic and dizygotic twin pairs.

CONCLUSIONS: The association between the Mediterranean diet and plasma oxidative stress is robust and is not confounded by genetic or shared environmental factors. Decreased oxidative stress is a plausible mechanism linking the Mediterranean diet to reduced cardiovascular disease risk.

Am J Clin Nutr. (2008);88(5):1364-70.

Comment on Meat Vs Vegetarian

Michelle Reid, Carol Zeuschner, Angela Saunders, Kate Marsh & Dawn Tan

Meeting the NRV's on a Vegetarian Diet;

Vegetarian Interest Group (2008)

Authors original Objectives:

- 1.To conduct ***dietary modeling*** to determine whether the NRVs can be met on a ***vegetarian diet***.
- 2.Compare the nutritional qualities to a ***traditional meat diet***.

Vegetarian Diet

Breakfast:

2 Weet-Bix™ with strawberries and 1 cup So Good Essential.

1 slice multigrain toast with poached egg.

Snack:

25g cashews and 4 dried apricot-halves.

Lunch:

Wholemeal flat bread with chickpea fefafel, hummus, tabouli and salad.

Snack:

Banana and wheat germ smoothie (fat-free soy milk).

Evening Meal:

Stir-fry greens with tofu served with brown rice.

Snack:

Milo made on So Good Essential™.

Traditional Meat Diet

Breakfast:

2 Weet-Bix™ with strawberries and 1 cup low fat milk.

1 slice multigrain toast with poached egg.

Snack:

1 piece of fruit.

Lunch:

Wholemeal sandwich with ham, cheese, salad and margarine.

Snack:

Banana and honey smoothie (low fat milk).

Evening Meal:

Lean beef and vegetable stir-fry* served with white rice.

Snack:

Milo made on low fat milk.

*www/mla.com.au



Comment on Meat Vs Vegetarian

	Vege meal ¹	Traditional Meat meal ¹
Saturated fat	13 g	25 g
Unsat Fat	22 g	9 g
Omega-3 (ALA)	2.2 g	0.4 g
Cholesterol	213 mg	388 mg
Fibre	43 g	20 g
Polyphenols	<i>Large amounts</i>	<i>minimal</i>

¹ Reid et al. Meeting the NRV's on a Vegetarian Diet; Vegetarian Interest Group (2008)

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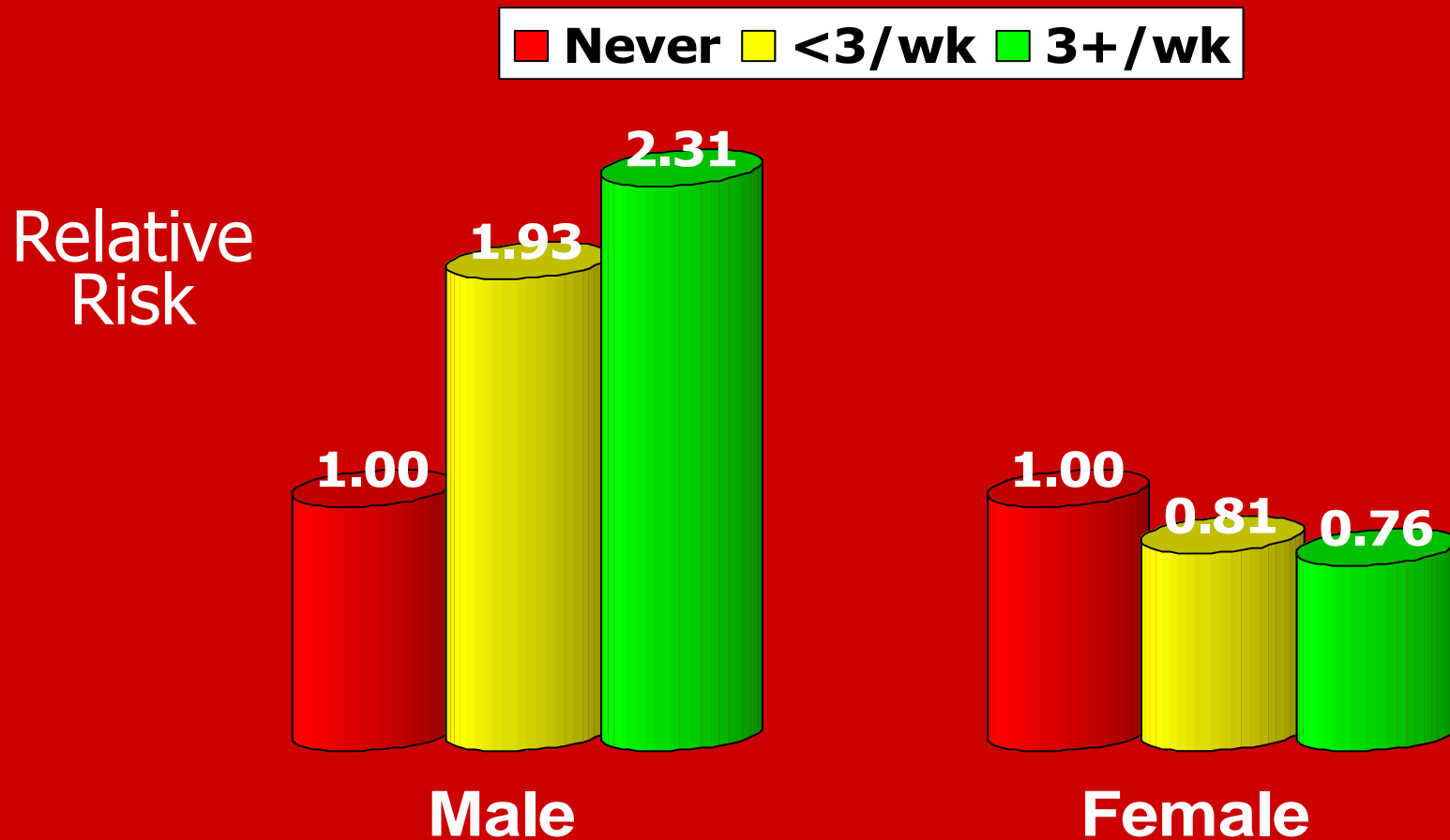
¹ Reid et al. Meeting the NRV's on a Vegetarian Diet; Vegetarian Interest Group (2008)

² Arts, I.C. and P.C. Hollman, "Am J Clin Nut. **81** Suppl: p. 317S-325S (2005)

Research indicates that **polyphenols** may have antioxidant characteristics with potential health benefits and may reduce the risk of cardiovascular disease and cancer².

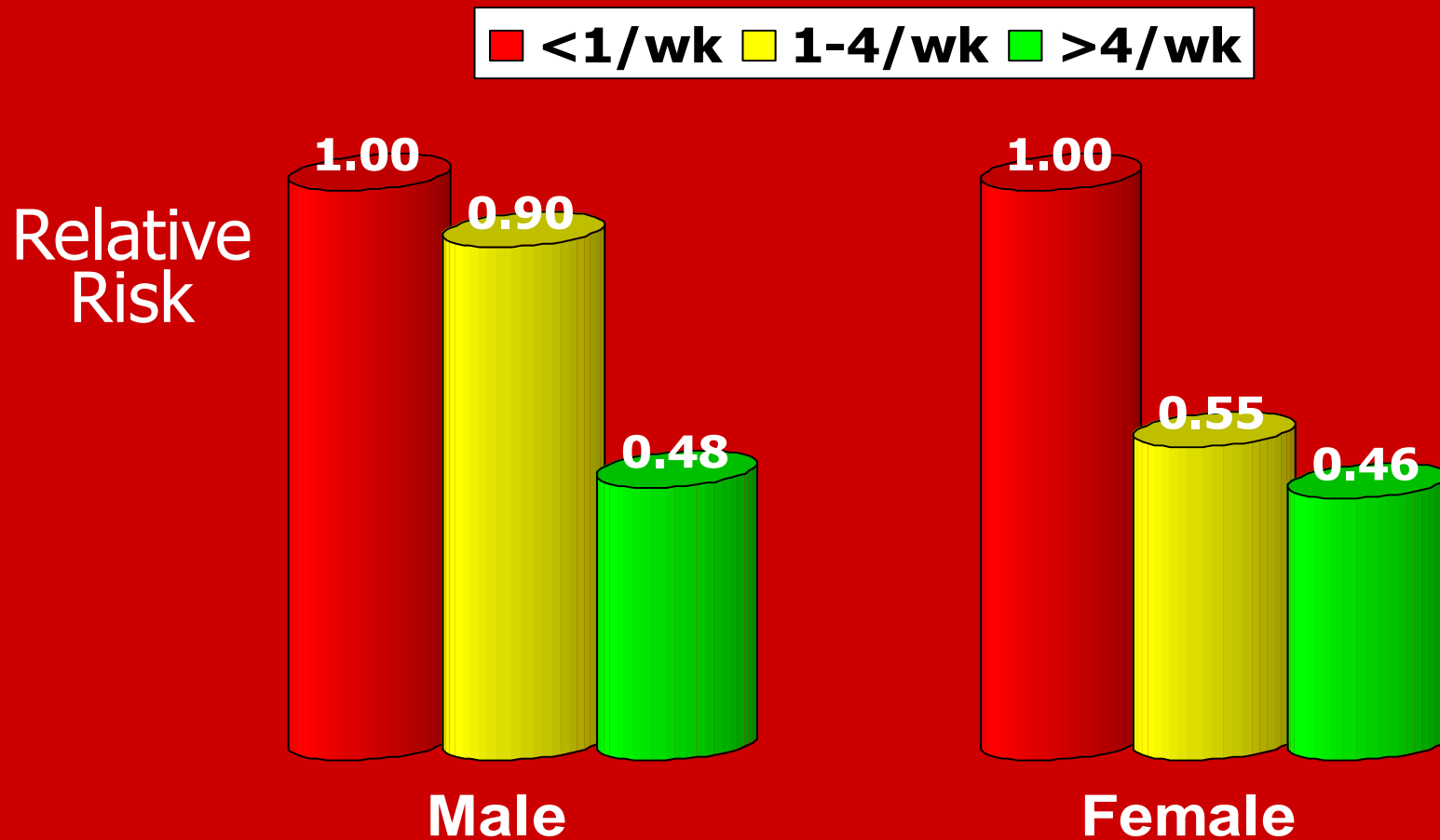
Beef & Fatal CHD Risk

AHS-1 1976-88



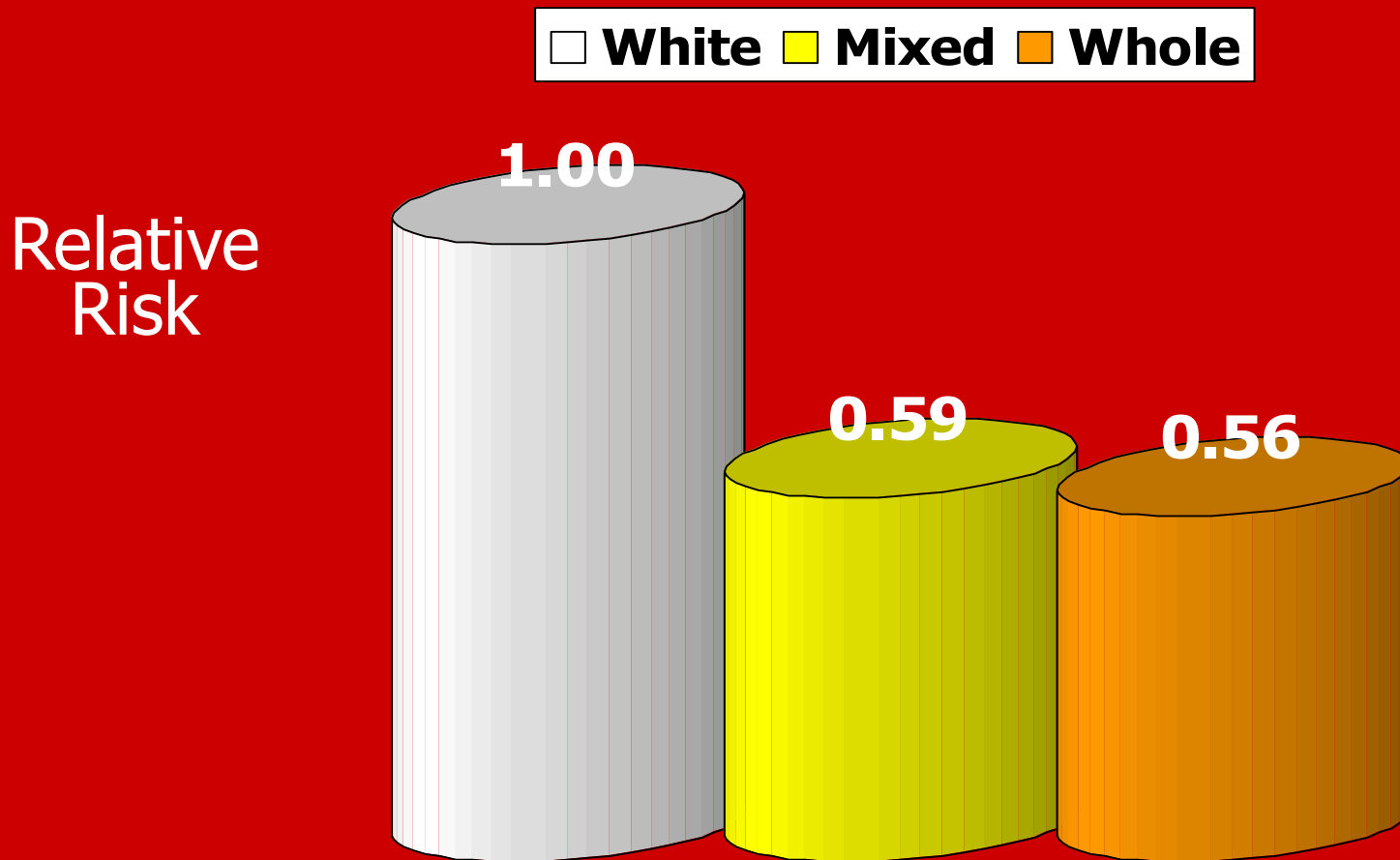
Nuts & CHD Risk

AHS-1 1976-88



Bread & CHD Risk

AHS-1 1976-88



Functional components; Polyphenols *etc*

Flavonoids		
Anthocyanidins	berries, cherries, red grapes	cellular antioxidant defences; may contribute to maintenance of brain function
Flavanols—Catechins, Epicatechins, Procyanidins	tea, cocoa, chocolate, apples, grapes	may contribute to maintenance of heart health
Flavanones	citrus foods	neutralize free radicals which may damage cells; bolster cellular antioxidant defences
Flavonols	onions, apples, tea, broccoli	neutralize free radicals which may damage cells; bolster cellular antioxidant defences
Proanthocyanidins	cranberries, cocoa, apples, strawberries, grapes, wine, peanuts, cinnamon	may contribute to maintenance of urinary tract health and heart health
Isothiocyanates		
Sulforaphane	cauliflower, broccoli, broccoli sprouts, cabbage, kale, horseradish	may enhance detoxification of undesirable compounds and bolster cellular antioxidant defences
Phenols		
Caffeic acid, Ferulic acid	apples, pears, citrus fruits, some vegetables	may bolster cellular antioxidant defences; may contribute to maintenance of healthy vision and heart health

Nutrition and cancer!

Diet and cancer in Mediterranean countries: carbohydrates and fats.

Bosetti C, Pelucchi C, La Vecchia C.

Istituto di Ricerche Farmacologiche Mario Negri, Milano, Italy.

Abstract

OBJECTIVE: Several aspects of the diet characteristic of the Mediterranean countries are considered favourable not only on cardiovascular disease, but also on cancer risk. We considered some aspects of the Mediterranean diet (including, in particular, the consumption of olive oil and carbohydrates) on cancer risk.

DESIGN, SETTING AND SUBJECTS: Data were derived from a series of case-control studies, conducted in Italy since the early 1990s, on over 10,000 cases of thirteen cancer sites and over 17,000 controls.

RESULTS: Olive oil, and other mono- and unsaturated fats, appear to be favourable indicators of breast, ovarian, colorectal, but mostly of upper aero-digestive tract cancers. Whole grain foods are also related to reduced risk of upper aero-digestive tract and various other cancers. In contrast, refined grain intake and, consequently, glycaemic index and glycaemic load were associated to increased risk for several cancer sites. Fish, and hence a diet rich in n-3 polyunsaturated fatty acids, tended to be another favourable diet indicator, while frequent red meat intake was directly related to some common neoplasms. An a priori defined Mediterranean diet score was inversely related to upper digestive and respiratory tract cancers.

CONCLUSIONS: These data provide additional evidence that major characteristics of the Mediterranean diet favourably affect cancer risk.

Inhibitory effects of green tea polyphenols in animal models*

Site	number of studies showing inhibitory effects	number of studies showing no inhibitory effects
Lung	20 (1)	2
Oral cavity	6	0
Oesophagus	4	0
Stomach	9	0
Small intestine	8	1
Colon	11 (3)	6
Skin	27 (1)	0
Prostate	4 (5)	0
Breast	10 (8)	0
Liver	7	1
Bladder	3 (1)	0
Pancreas	2 (2)	0
Thyroid	1	0

*1965 to 2008 of animal carcinogenesis models. The number of xenograft studies is shown in parentheses.

Adapted from

NATURE REVIEWS | **CANCER** (2009):9; p433 |

Studies on tea consumption and the risk of human cancer*

Site	Case-control studies	
	risk reduction	no risk reduction
Breast		
Green	3	0
Black	1	9
Prostate		
Green	2	0
Black	1	3
Ovaries		
Green	1	0
Black	0	6
Other		
Green	5	1
Black	1	3

*These data were obtained by a literature search of Pubmed from 1965 to 2008.
The number of studies showing risk reduction or no risk reduction are shown.

Adapted from

NATURE REVIEWS | **CANCER** (2009):9; p435 |

So what **else** can we do to reduce free radical burden, slow down the aging process and reduce lifestyle diseases?



www.bio-pro.de/en/life/magazin/02104/index.html

EAT MORE nutrient-rich foods

Cancer

Dementia

Diabetes

Heart disease

Summary

Uncontrolled cell growth

cell death

Physiological dysfunction

Irreparable DNA damage

Molecular derangement

Oxidative (free radical) stress

↑ Immune activation - inflammation

Lifestyle choices

- ↓ Exercise/physical activity
- ↑ Exercise/physical activity
- ↓ Nutrition
- ↑ Nutrition
- ↓ Sleep

Environmental

- Mental stress (HPA activation)
- Microbial Infection
- Chemical toxin(s)
- Radiation toxin(s)

Conclusion

What can be done to minimise Free radical damage, aging and the chances of getting lifestyle diseases such as CHD and cancer?

1. Decrease exposure to harmful 'Free Radicals'
 - *Don't eat too much high calorie or crispy foods (AGE's)*
2. Increase the body's ability to neutralise the 'Free radicals'
 - *Exercise (increases body's natural antioxidants)*
 - *Eating foods containing antiox. (fresh fruit and veges)*
3. Increase the body's capacity to repair the DNA
 - *Eat foods with high nutritional value (whole grains, fruit, veges)*

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3. Increase the body's capacity to repair the DNA

- *Eat foods with high nutritional value (whole grains, fruit, veges)*

- Pure air
- Sunlight
- Abstemiousness (no tobacco, coffee, tea or alcohol)
- Rest
- Exercise
- Proper diet (low calorie, vegetable-rich)
- Use of water
- Trust in GOD

E.G. White MH 1905