Introduction to Food as Medicine

McMaster Medical School
Jan 31st 2019

SC Ganguli MD, FRCPC
Gastroenterology Division
McMaster University

St. Joseph's Healthcare Hamilton

McMaster University

Subhas Ganguli – Conflict of Interest Slide

Last 2 years: None

Prior to 2 years ago:
Clinical trials conducted for: Novartis, Abbott, Janssen, Dynogen, Proctor & Gamble, Ferring, Glaxo Smith Klein, Boeringer Ingelheim

Speakers bureau: Abbott, Astra-Zeneca, Medical Futures (Iberogast), Novartis, Nycomed, Pharmascience, Janssen, Takeda

Advisory Board: Schering, UCB Pharma, Forest Laboratories, Janssen, Ferring
Research Grant: Glaaxo

Grants/Research Support: GSK

Updated 3/27/17

Top 10 Causes of Death, USA, 2013

Parenthetical data indicate percentage of total deaths

Causes of Death

Male		Female
Ischemic heart disease (20.3%)	1	Ischemic heart disease (20.3%)
Alzheimer disease (8.3%)	2	Alzheimer disease (12.7%)
Lung cancer (7.4%)	3	Cerebrovascular disease (7.3%)
COPD* (5.8%)	4	Lung cancer (5.7%)
Cerebrovascular disease (5.0%)	5	COPD* (5.6%)
Lower respiratory infections (3.0%)	6	Lower respiratory infections (3.4%)
Diabetes (2.8%)	7	Breast cancer (3.4%)
Prostate cancer (2.8%)	8	Diabetes (2.8%)
Chronic kidney disease (2.7%)	9	Chronic kidney disease (2.6%)
Colorectal cancer (2.6%)	10	Colorectal cancer (2.5%)

*Chronic obstructive pulmonary disease

SCG 2018

L Marczak JAMA 2016:315(3):241

Risk Factors for Top 10 Causes of Death,

USA, 2013

	Risk Factors	
	Male	**Female**
1	Dietary	Dietary
2	Smoking	Blood Pressure
3	Blood Pressure	Smoking
4	Body Mass Index	Body Mass Index
5	Blood Glucose	Blood Glucose
6	Total Cholesterol	Total Cholesterol
7	Physical Activity	Physical Activity
8	Kidney Function	Kidney Function
9	Air Pollution	Air Pollution
10	Occupational Risks	EtOH / Drugs

L Marczak JAMA 2016:315(3):241

How Important is Lifestyle ?

Healthy Lifestyle Factors & US Life Expectancy

Aim: Assess impact of lifestyle factors on US mortality & life expectancy.

Design: prospective cohort study of:
- 78,865 women from NHS followed for 34 yrs (1980-2014)
- 44,354 men from HPFUS followed for 27 yrs (1986-2014)

Low risk lifestyle factors:
1) Never smoking
2) BMI 18.5-24.9
3) >= 30 min/d moderate/vigorous physical activity
4) Moderate alcohol intake (5-15 g women, 5-30 g men)
5) High diet quality score (upper 40%)

Total lifestyle score: 0-5 scale

SCG 2018

Y Li Circulation 2018 in press
DOI: 10.1161/CIRCULATIONAHA.117.032047

Healthy Lifestyle Factors & US Life Expectancy
Alternate Healthy Eating Index Score

Assigned points (0 to10) for intake of each of 10 components:

High intake of:

1) Vegetables
2) Fruits
3) Nuts
4) Whole grains
5) Polyunsaturated fats
6) Omega 3 fatty acids

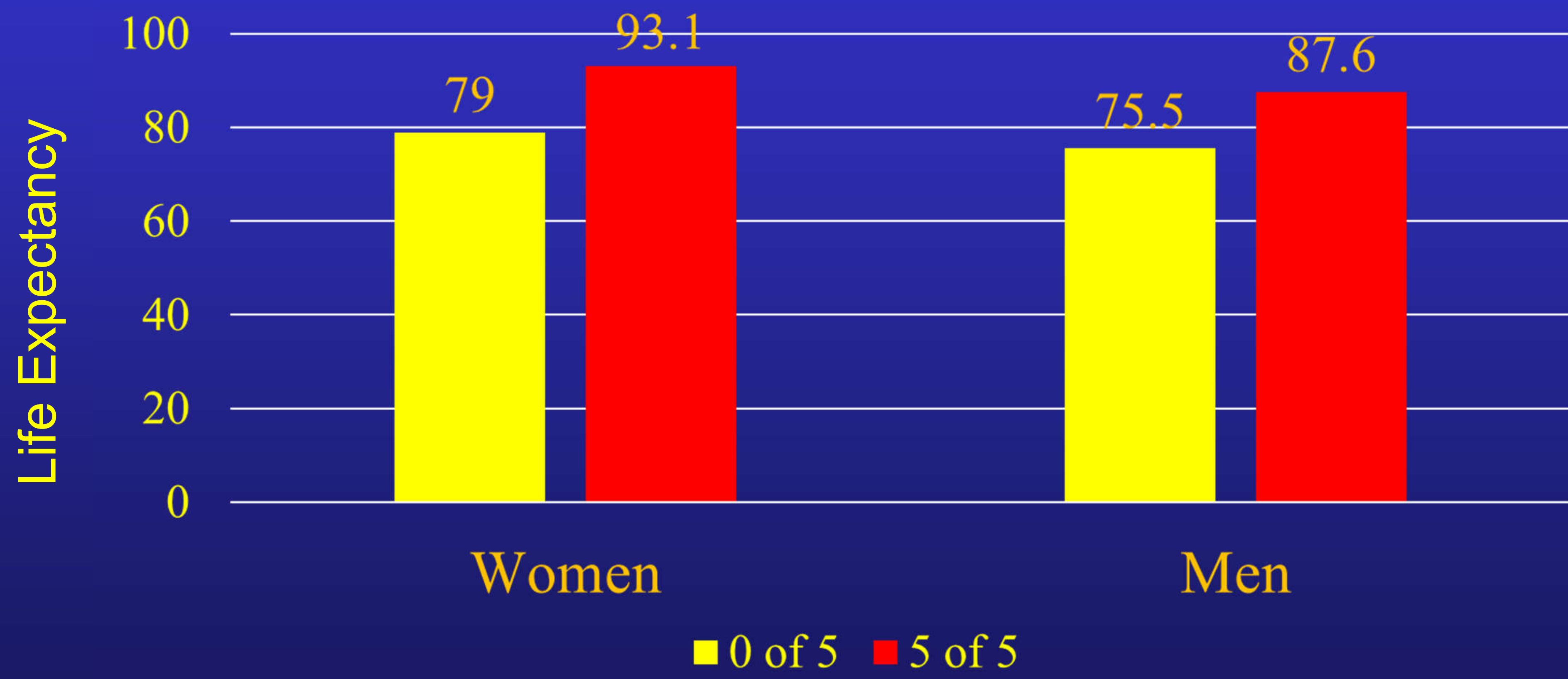
Low intake of:

7) Red meats
8) Processed meats
9) Sugar sweetened beverages

SCG 2018

Y Li Circulation 2018 in press
DOI: 10.1161/CIRCULATIONAHA.117.032047

Healthy Lifestyle Factors & US Life Expectancy
Life Expectancy at 50 Yrs of Age



Y Li Circulation 2018 in press
DOI: 10.1161/CIRCULATIONAHA.117.032047

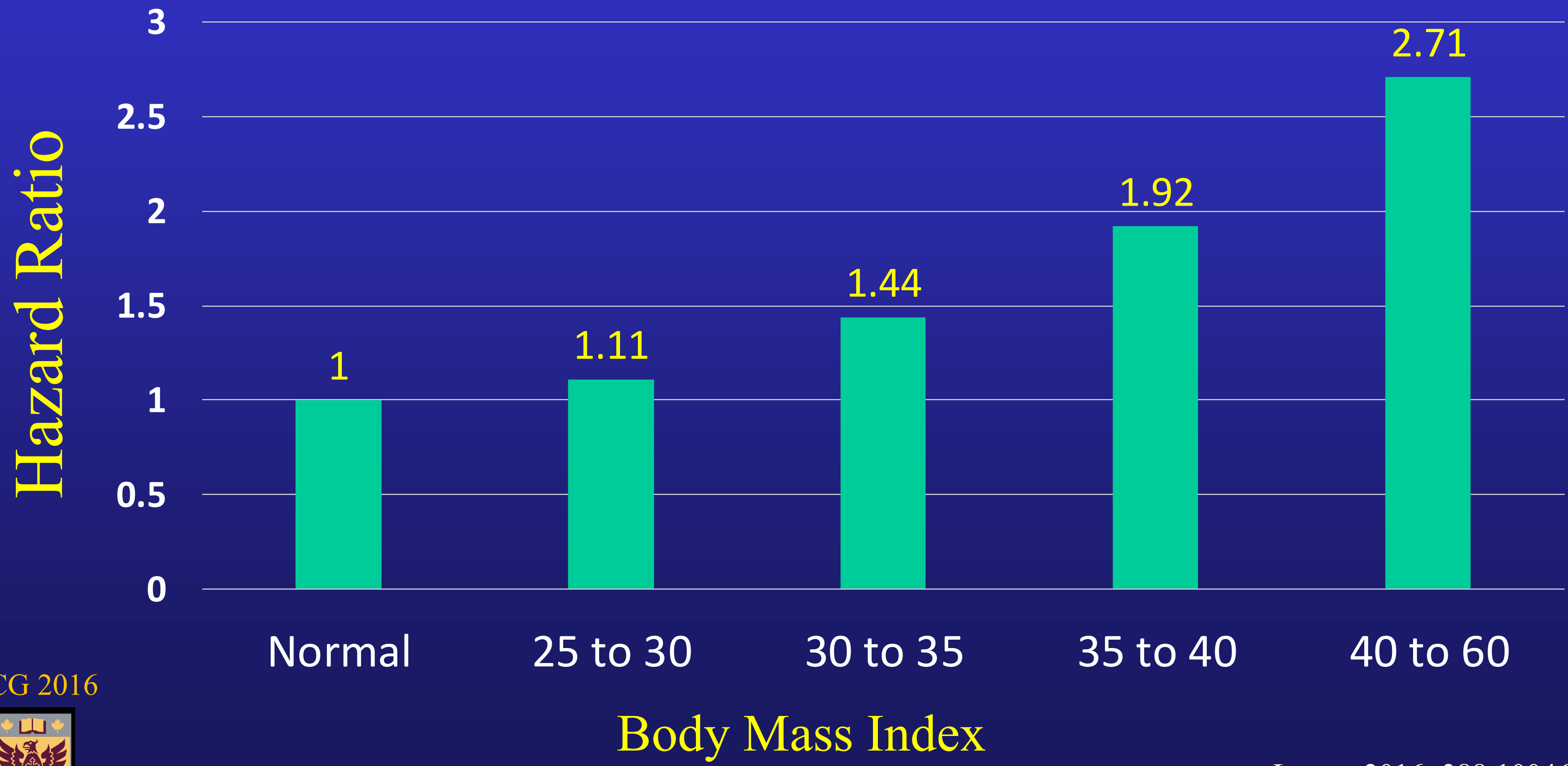
Obesity

Obesity in Canada

BMI and all-cause mortality

27423262

(Global, Non-smokers, healthy, after 5 yrs)
(198 prospective studies; 3.9 million participants)



SCG 2016

Lancet 2016::388:10046:776-786

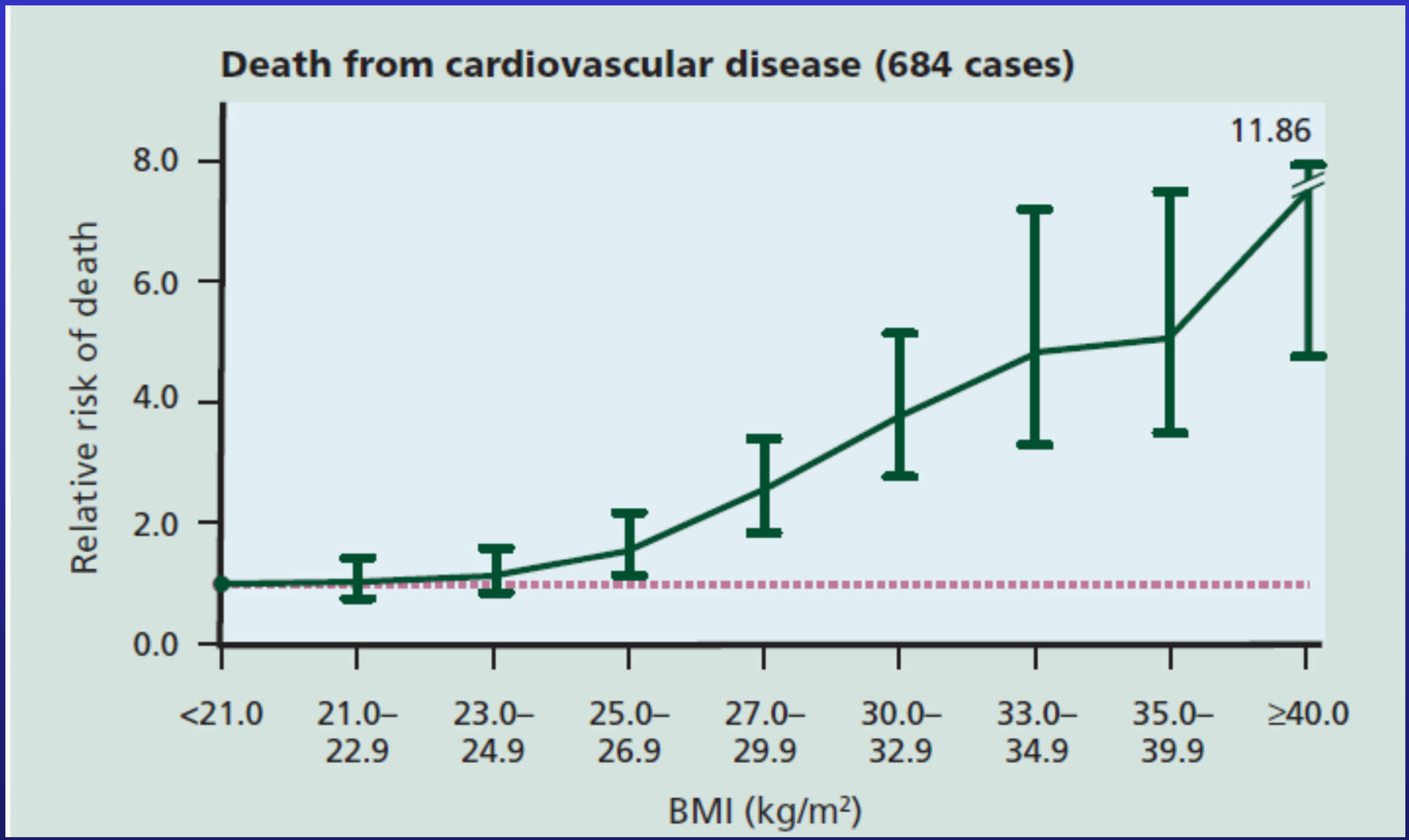
Health Problems Associated with Obesity

Relative risk greater than 3	Relative risk 2–3	Relative risk 1–2
Type 2 diabetes	Coronary heart disease	Cancer
Gallbladder disease	Hypertension	Reproductive hormone abnormalities
Dyslipidaemia	Osteoarthritis (knees)	Polycystic ovary syndrome
Insulin resistance	Hyperuricaemia and gout	Impaired fertility
Breathlessness		Low back pain
Sleep apnoea		Increased risk of anaesthesia complications
		Fetal defects (associated with maternal obesity)

Adapted with permission from WHO[1]

Food Nutrition Physical Activity and the Prevention of Cancer
AICR 2007, Washington DC

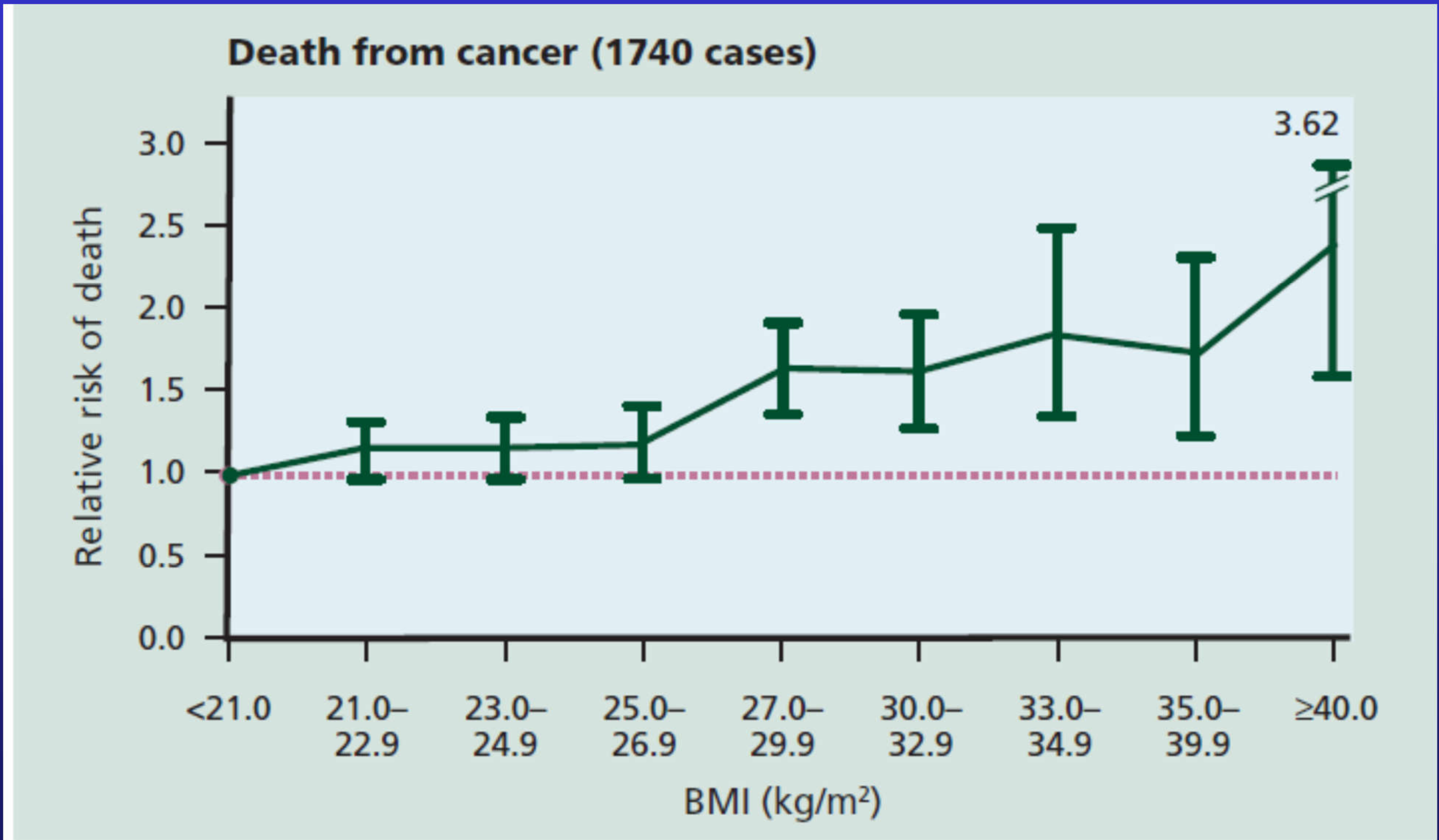
BMI and Death from CVD



SCG 2017

Food Nutrition Physical Activity and the Prevention of Cancer
AICR 2007, Washington DC

BMI and Death from Cancer

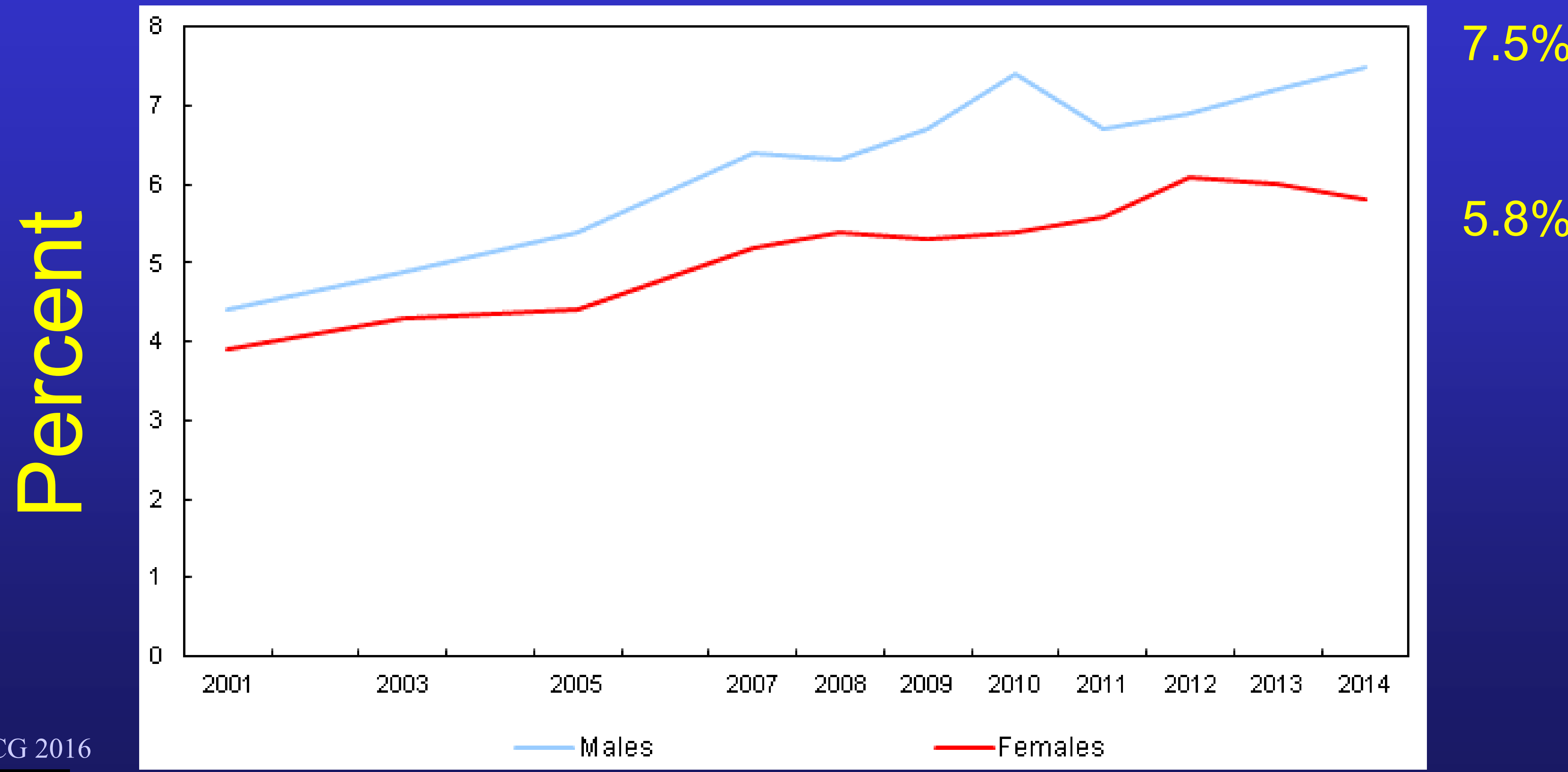


SCG 2012

Food Nutrition Physical Activity and the Prevention of Cancer
AICR 2007, Washington DC

Self-Reported Diabetes in Canada

(2001 to 2014, 12 and older)



SCG 2016

http://www.statcan.gc.ca/pub/82-625-x/2015001/article/14180-eng.htm

Can a Conventional

Approach

Stop Diabetes ?

RCT of lifestyle vs metformin in Prediabetics: DPP

Aim

Does a lifestyle intervention or treatment with metformin prevent or delay the onset of diabetes ?

Design

Multicenter RCT, Placebo controlled, double blind. ITT analysis

Population

(n=3234 in 27 US centers) meeting all the below criteria:

1) BMI ≥ 24
2) Fasting [Glu] = 5.3 – 6.9 mmol/L
3) 2 hr [Glu] = 7.8 – 11.0 mmol/L after 75g oral glucose load

Knowler WC, NEJM 2002;346:393-403

RCT of lifestyle vs metformin in Prediabetics: DPP

Interventions

1) Standard lifestyle recommendations + placebo
2) Standard lifestyle recommendations + Metformin 850 mg BID
3) Intensive lifestyle modification

    Goal: achieve/maintain 7% weight reduction

    Rx: 16 sessions in 24 wks then monthly

    1) Moderate physical activity for ≥ 150 minutes per week
    2) Diet: 'healthy low calorie, low fat diet'

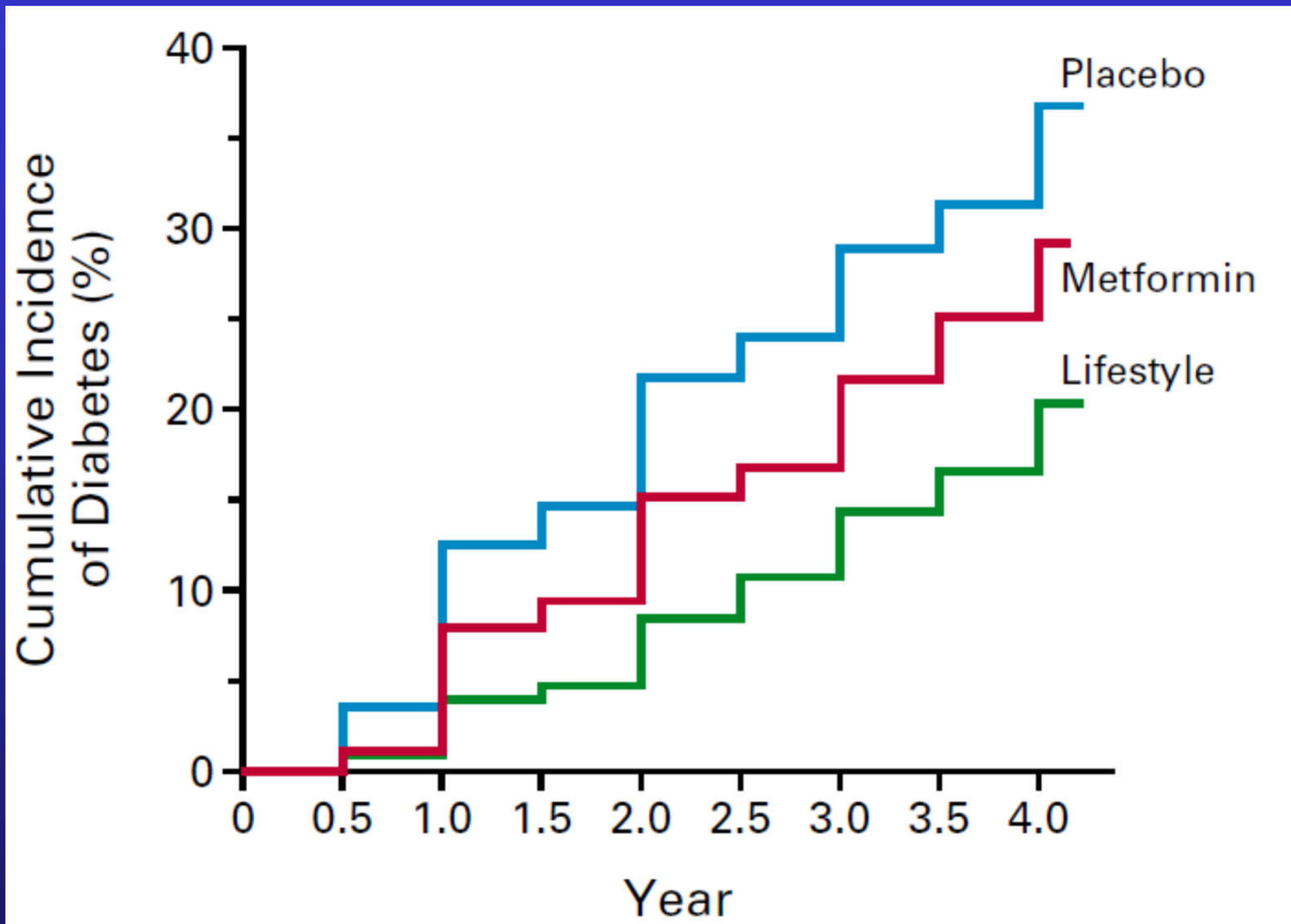
Outcomes – Dx of diabetes (retested at 6 weeks):

1) Annual oral glucose tolerance test
2) Semi-annual fasting glucose

Knowler WC, NEJM 2002;346:393-403

DPP: Incidence of Diabetes

11832527



NNT (3 yrs)

MF = 13.9

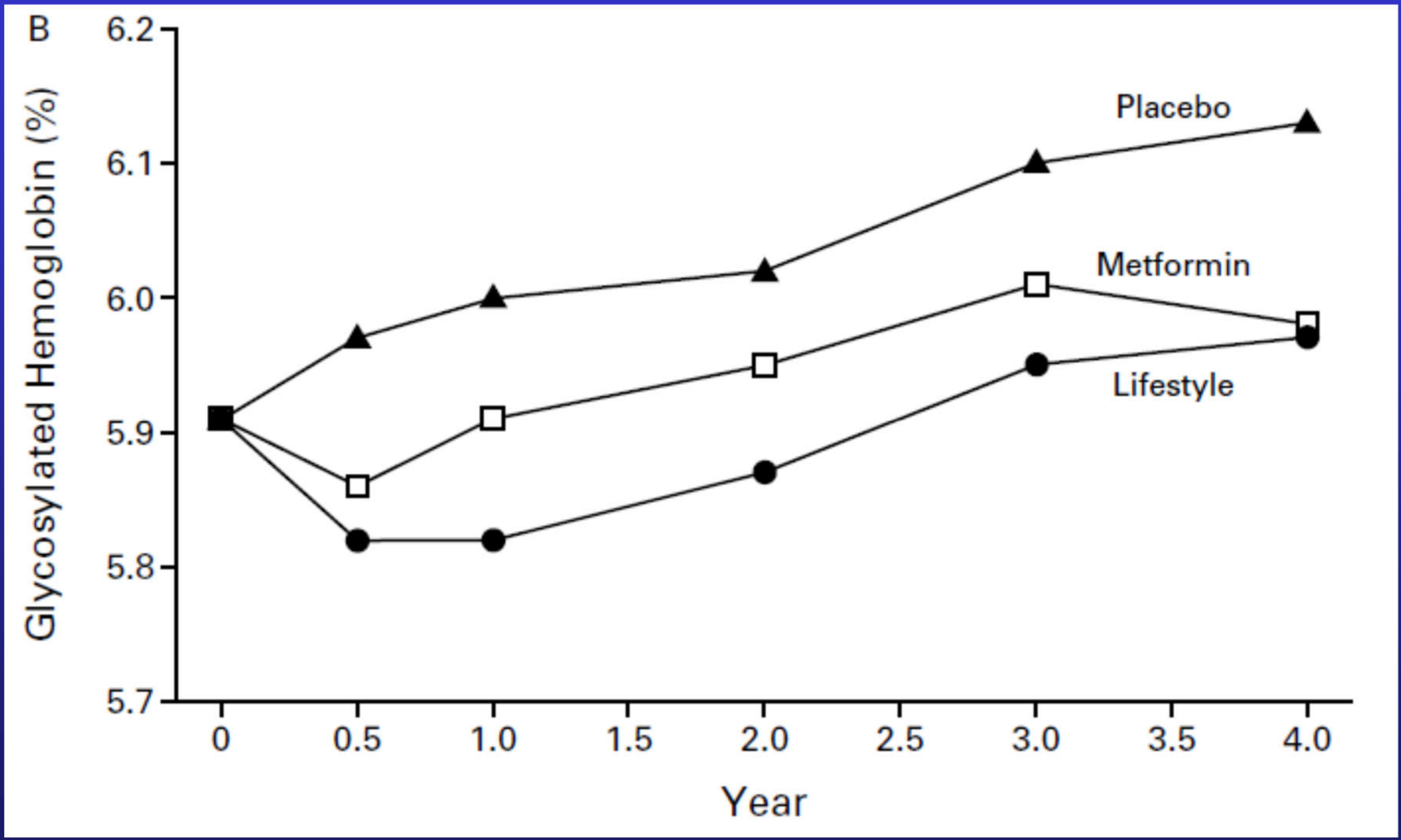
Lifestyle = 6.9

P < 0.001 for each comparison

SCG 2016

Knowler WC, NEJM 2002;346:393-403

DPP: Glycosylated Hemoglobin



$P < 0.001$

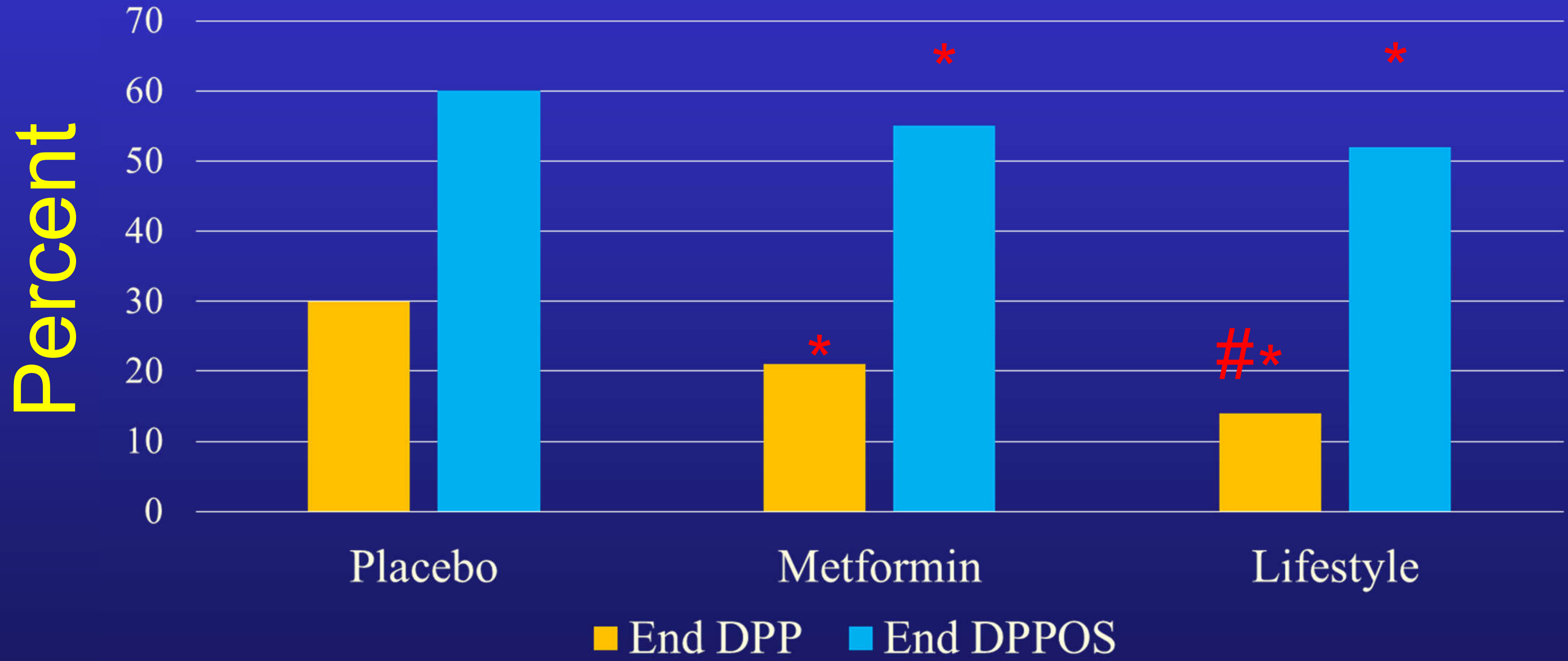
SCG 2012

Knowler WC, NEJM 2002;346:393-403

Long Term Results

26377054

DPPOS & DPP Outcomes at end Rate of Developing Diabetes at 15 yrs



SCG 2017

* P < 0.05 vs Placebo

\# P < 0.05 vs Metformin

DM Nathan Lancet Diabetes Endocrinol 2015:3:866-75

What to do ?

21831992

Red Meat Consumption & NIDDM

Prospectively followed 37,083 men (Health Professionals follow-up study, 1986-2008) & 79,570 women (Nurses Health Study I 1976-) plus 87,504 (NHS-II, 1989-) who were free of CV disease and cancer at baseline. Diet assessed by validated questionnaire & updated every 4 years. Excluded baseline IDDM & NIDDM, CVD, cancer

Aims

1) Assess effect of meat consumption on NIDDM in large cohorts
2) Updated meta-analysis
3) Estimate effect of substituting low fat dairy, nuts, whole grains for red meat on NIDDM risk

Used data from present study to update previous meta-analyses

Multivariate adjustments for major lifestyle & dietary risk factors.

A Pan Am J Clin Nutr 2011;94:1088-96

Red Meat Consumption & NIDDM

Multivariate analysis to adjust for:

1) Intakes of : total energy (in quintiles)
2) Age, BMI
3) Race (white, nonwhite)
4) Smoking status (never, past, current [3 ranges])
5) EtOH intake (0 plus 3 levels)
6) Physical activity (5 levels)
7) Family Hx: DM
8) Baseline history of Htn, hypercholestrolemia
9) Women: postmenopausal status, menopausal hormone & OCP use

A Pan Archives IM 2012 epub

21831992

Red Meat & NIDDM: Results

Incident cases of NIDDM:

- 2438 during max 20 y followup in HPFS = 1.9%
  - 8253 during max 28 y followup in NHS-I = 2.0%
  - 3068 during max 16 y followup in NHS-II = 1.1%

Overall 13,759 cases in 4.03 million person-years = 1.7%

Definitions of a meat portion:

Unprocessed red meat = 85g = 3 oz

Hot dog = 45 g

Bacon = 28g (2 slices)

Other processed red meat = 45 g

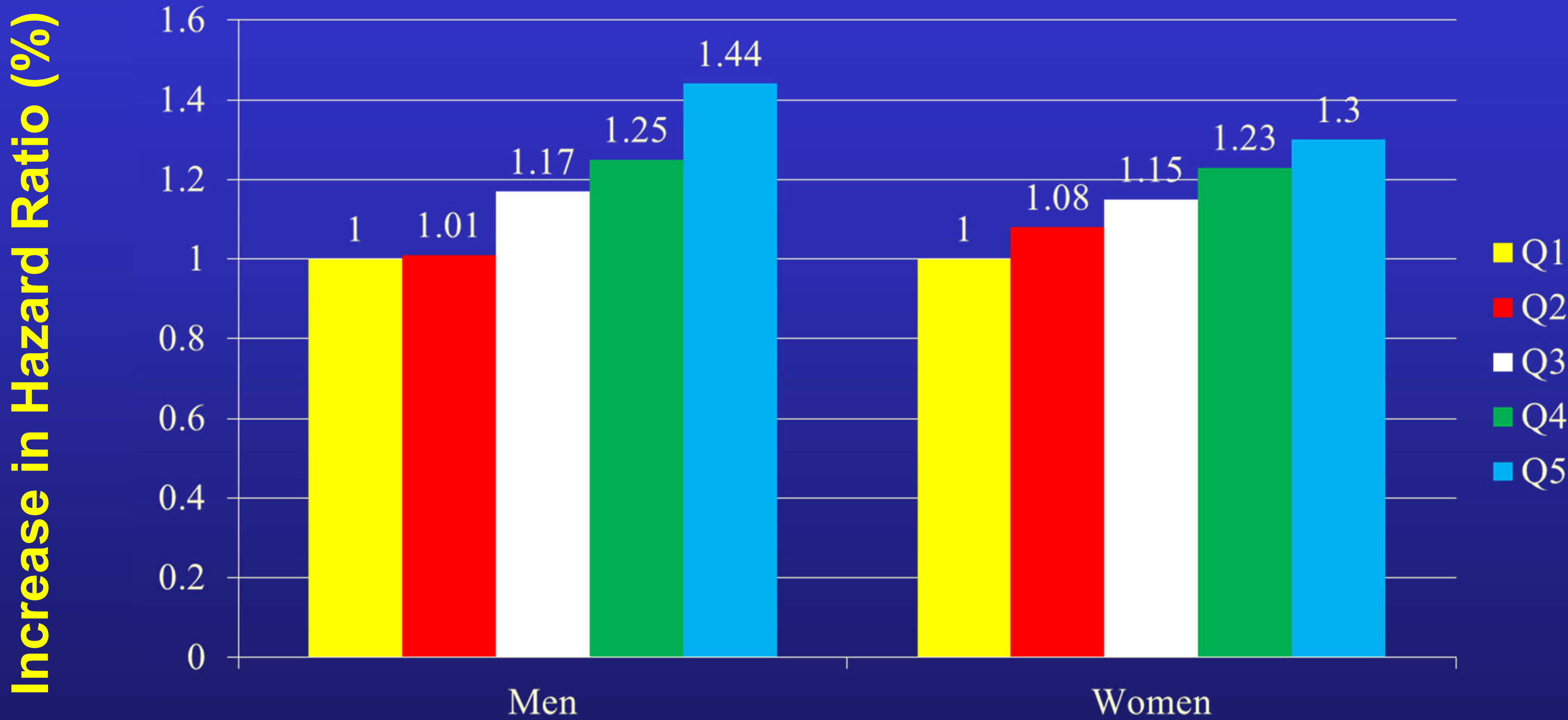
SCG 2016

A Pan Am J Clin Nutr 2011;94:1088-96

Total Red Meat & NIDDM

21831992

Adjusted for: BMI, Age, Calorie intake Physical activity, smoking, EtOH, race



SCG 2012

	Q1	Q2	Q3	Q4	Q5
Men	0.25	0.60	0.94	1.34	2.02
Women	0.50	0.83	1.12	1.44	2.07

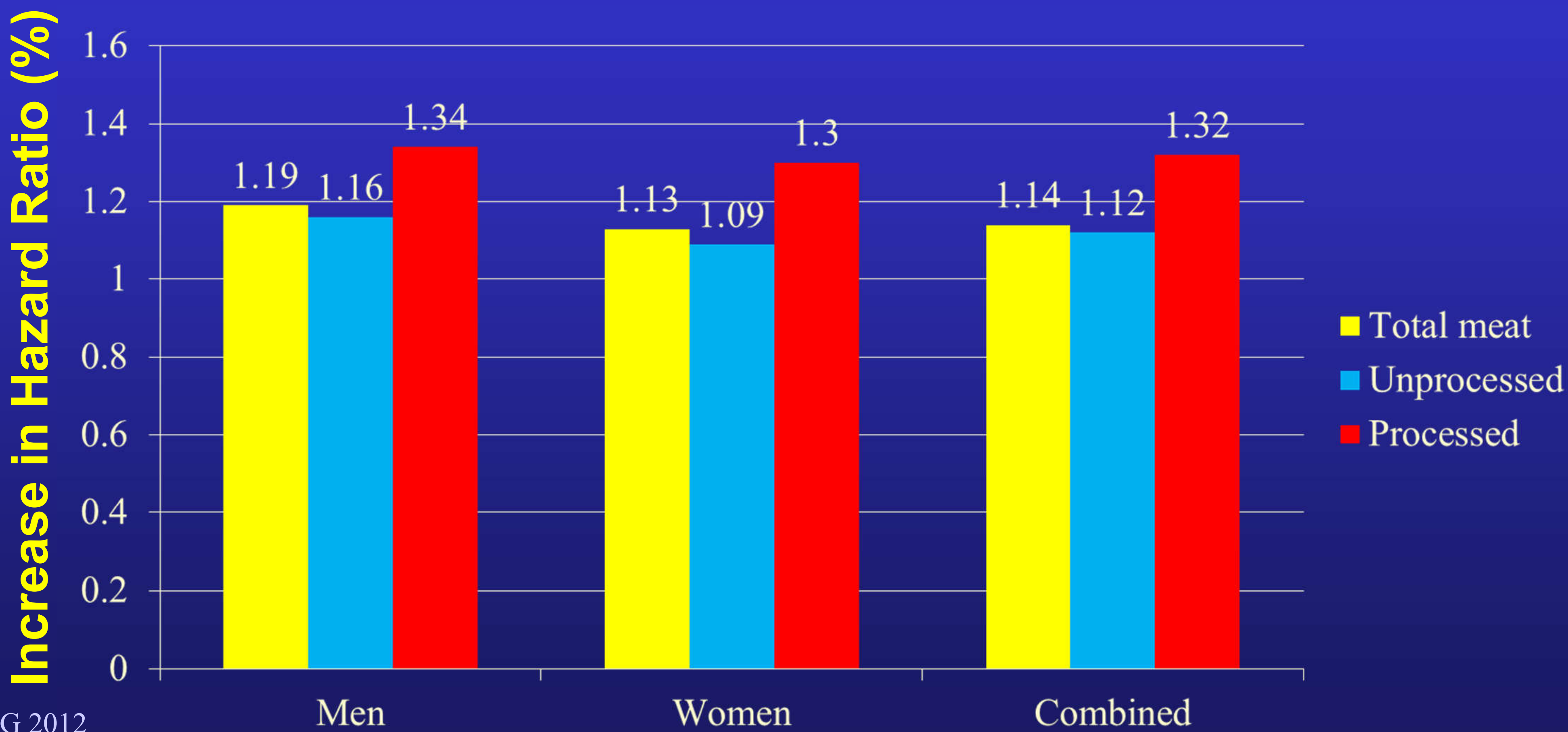
Portions per day

A Pan Am J Clin Nutr 2011;94:1088-96

21831992

Red Meat Consumption & NIDDM

Effect of a 1 serving per day increase

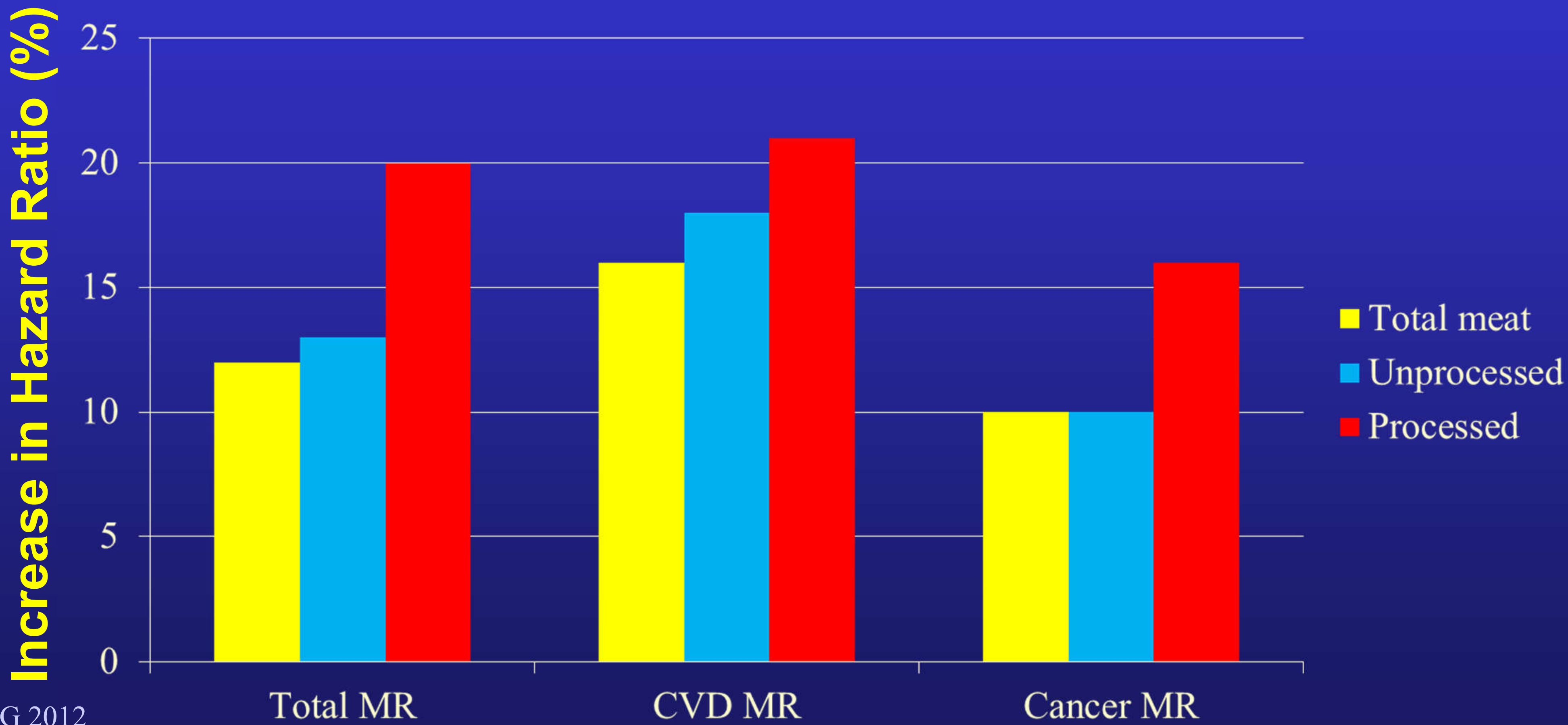


SCG 2012

A Pan Am J Clin Nutr 2011;94:1088-96

Red Meat Consumption & Outcomes

Effect of a 1 serving per day increase



SCG 2012

CVD = cardiovascular disease

A Pan Archives IM 2012 172(7):555-63

3985239

Adventist Study 1960-1981

Meat & Diabetes (Logistic regression)

Outcome	Meat Consumption	Multivariate-Adjusted Relative Risk (95% CL)[b] Male	Female
Self-Reported Diabetes Prevalence (1960)	<1 day/wk (vegetarian)	1.0	1.0
	1+ days/wk (non-vegetarian)	1.7(1.2,2.4)	1.4(1.1,1.8)
	<1 day/wk	1.0	1.0
	1–2 days/wk	1.4(0.9,2.3)	1.1(0.8,1.6)
	3–5 days/wk	1.5(0.9,2.5)	1.2(0.9,1.8)
	6+ days/wk	2.7(1.6,4.6)	2.3(1.6,3.3)
Diabetes on the Death Certificate (1960–1980)	<1 day/wk (vegetarian)	1.0	1.0
	1+ days/wk (non-vegetarian)	1.9(1.2,3.1)	1.1(0.8,1.6)
	1 day/wk	1.0	1.0
	1–2 days/wk	1.6(0.9,2.9)	1.3(0.9,2.0)
	3–5 days/wk	1.6(0.8,3.0)	1.2(0.7,1.8)
	6+ days/wk	3.6(1.9,7.1)	0.6(0.3,1.2)

SCG 2014

N = 25,698 adults followed for 21 yrs

DA Snowdon Am J Public Health 1985:75:507-12

What can be done about obesity ?

RCT Weight Loss with a Vegan vs a Moderate Low Fat Diet

Aim: Assess extent to which weight loss achieved thru a 14 week low-fat vegan or more moderate low fat diet were maintained at 1 and 2 years after the intervention.

Population: 62 postmenopausal, overweight (BMI 26-44) women

Vegan diet: Encouraged use of unrefined foods.

Control: NCEP step II diet

No restriction on energy intake for either diet group; encouraged to eat to satiety.

Weekly group meetings for first 14 weeks with MD and dietician

Part 1 (14 + 14 subjects):No support meetings after 14 weeks

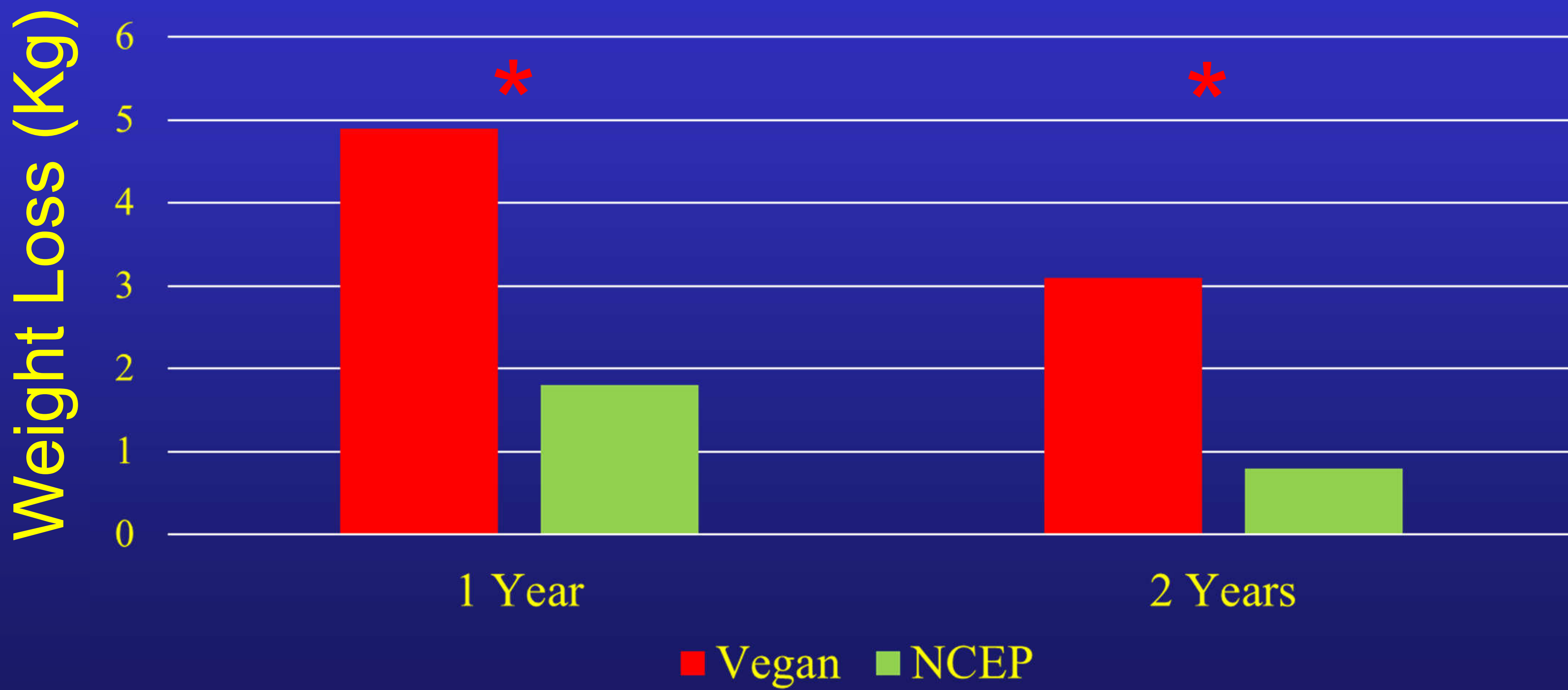
Part 2 (17 + 17 subjects): Support meetings 1 hr/2 weeks x 1 yr

Followed for a total of 2 years.

GM Turner-McGrievy Obesity 2007:15(9):2276-2281

RCT Vegan vs Low Fat Diet

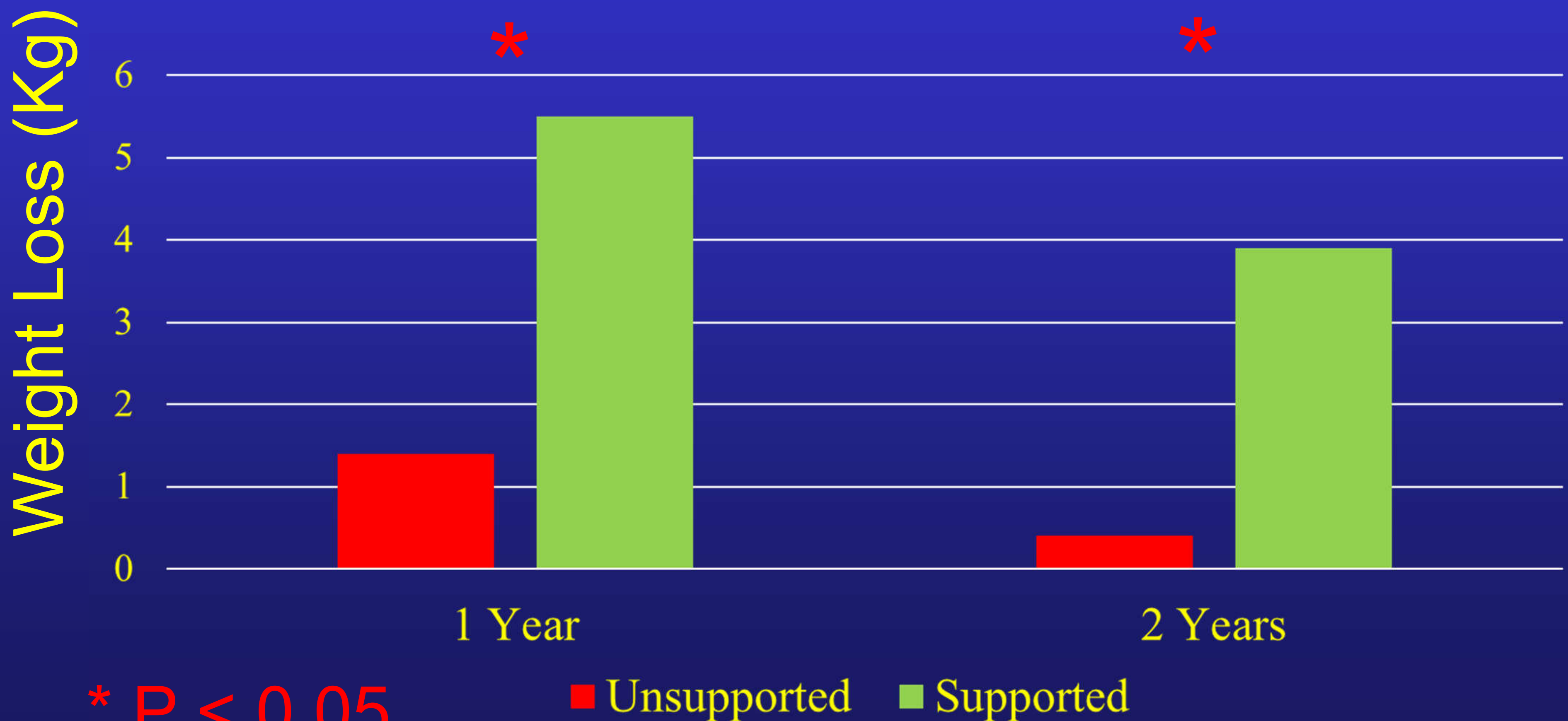
Weight Loss(Parts 1 & 2)



* P < 0.05

GM Turner-McGrievy Obesity 2007:15(9):2276-2281

RCT Vegan vs Low Fat Diet
Role of Support



* P < 0.05

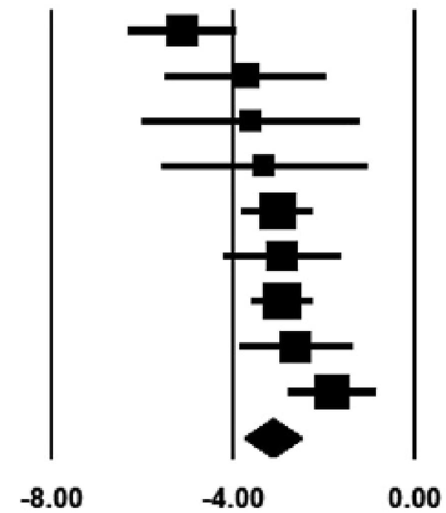
GM Turner-McGrievy Obesity 2007:15(9):2276-2281

Meta:Vegetarian Diets & Weight Loss

Study name	Subgroup within study	Mean	Lower limit	Upper limit	p-value
Ferdowsian 2010[26]	Vegan	-5.1	-6.3	-3.9	<0.0001
Barnard 2009[24]	Vegan	-3.7	-5.5	-1.9	<0.0001
Turner-McGrievy 2007[22]	Vegan	-3.6	-6.0	-1.2	0.003
Dansinger 2005[21]	Vegetarian	-3.3	-5.6	-1.0	0.004
Mishra 2013b[27]	Vegan	-3.0	-3.8	-2.2	<0.0001
Kjeldsen-Kragh 1991[14]	Vegetarian	-2.9	-4.2	-1.6	<0.0001
Mishra 2013a[27]	Vegan	-2.9	-3.6	-2.2	<0.0001
Gardner 2007[23]	Vegetarian	-2.6	-3.8	-1.4	<0.0001
Nenonen 1998[17]	Vegan	-1.8	-2.8	-0.8	0.0002
Total		-3.1	-3.7	-2.5	<0.0001

Statistics for each study

Mean and 95% CI



Numbers represent weight in kilograms

ND Barnard J Acad Nutrition & Dietetics 2015:115:954-969

What about individuals who already have diabetes ?

RCT Vegan vs ADA diet in NIDDM

Population (n=99)

NIDDM, using hypoglycemic medications at least 6 mos.

- had to have HBA1c between 6.5% and 10.5%
- if on insulin had to be using it < 5 yrs

Intervention (22 weeks then to 74 weeks)

Vegan: 10% of energy from fat. Encouraged to favor low GI foods. No restrictions on portion size, energy or CHO intake. B12 pill given.

ADA diet: Individualised based on body weight, lipid concentrations. If BMI > 25 also prescribed energy intake deficit of 500-1000 cal/day

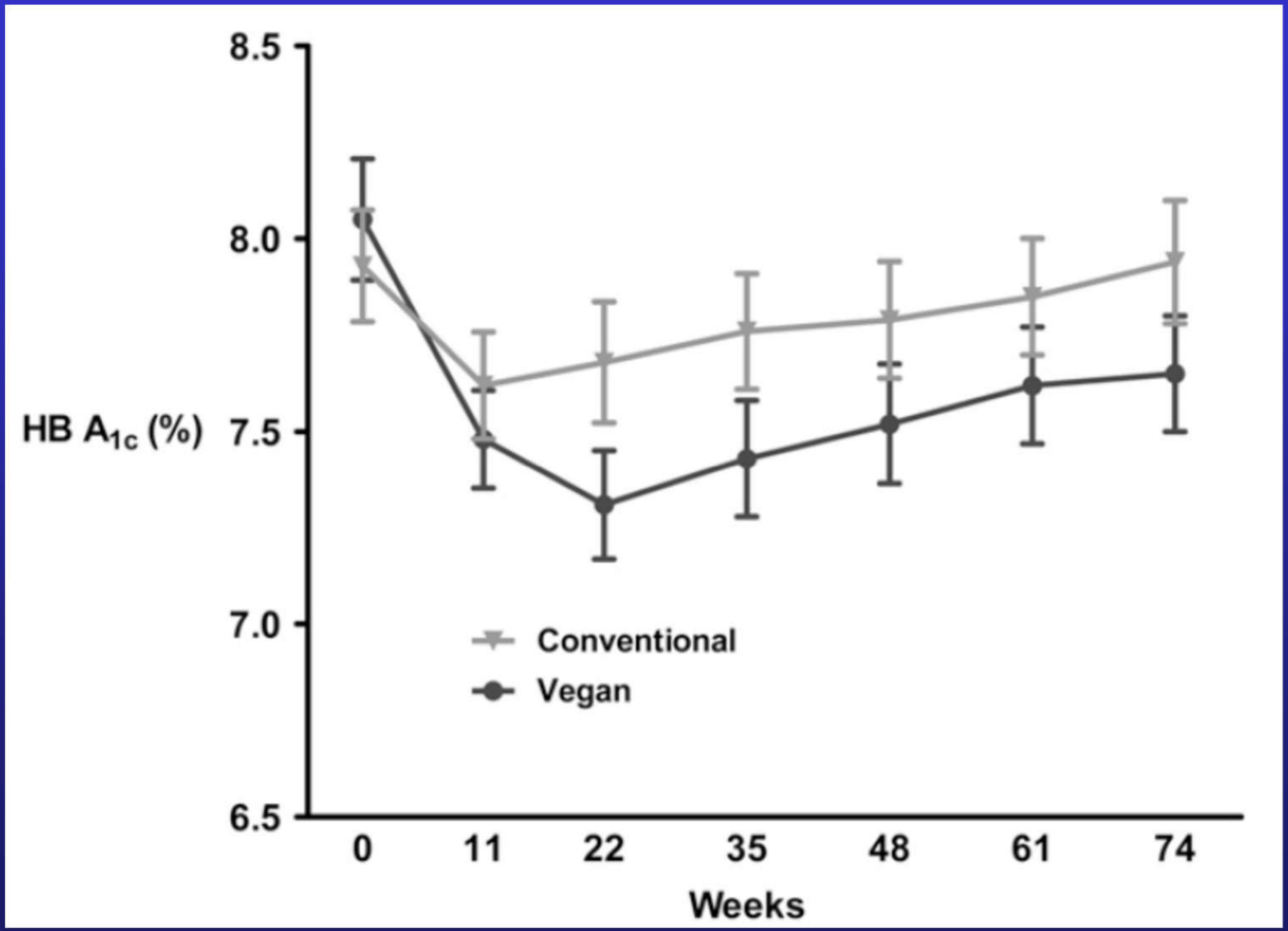
All participants asked NOT to alter their exercise habits during the intervention period

Both groups started with 1 h with dietician then weekly 1 hr meetings for nutrition/cooking instruction.

Did unannounced 24 hr diet recalls at weeks 4, 8, 13, 20

Barnard ND Diabetes Care 2006:29:1777-83 PMID 1683779
Barnard ND Am J Clin Nutrition 2009:89 sup: 1588S-96S PMID 19334901

RCT Vegan vs Std Diabetic Diet in NIDDM

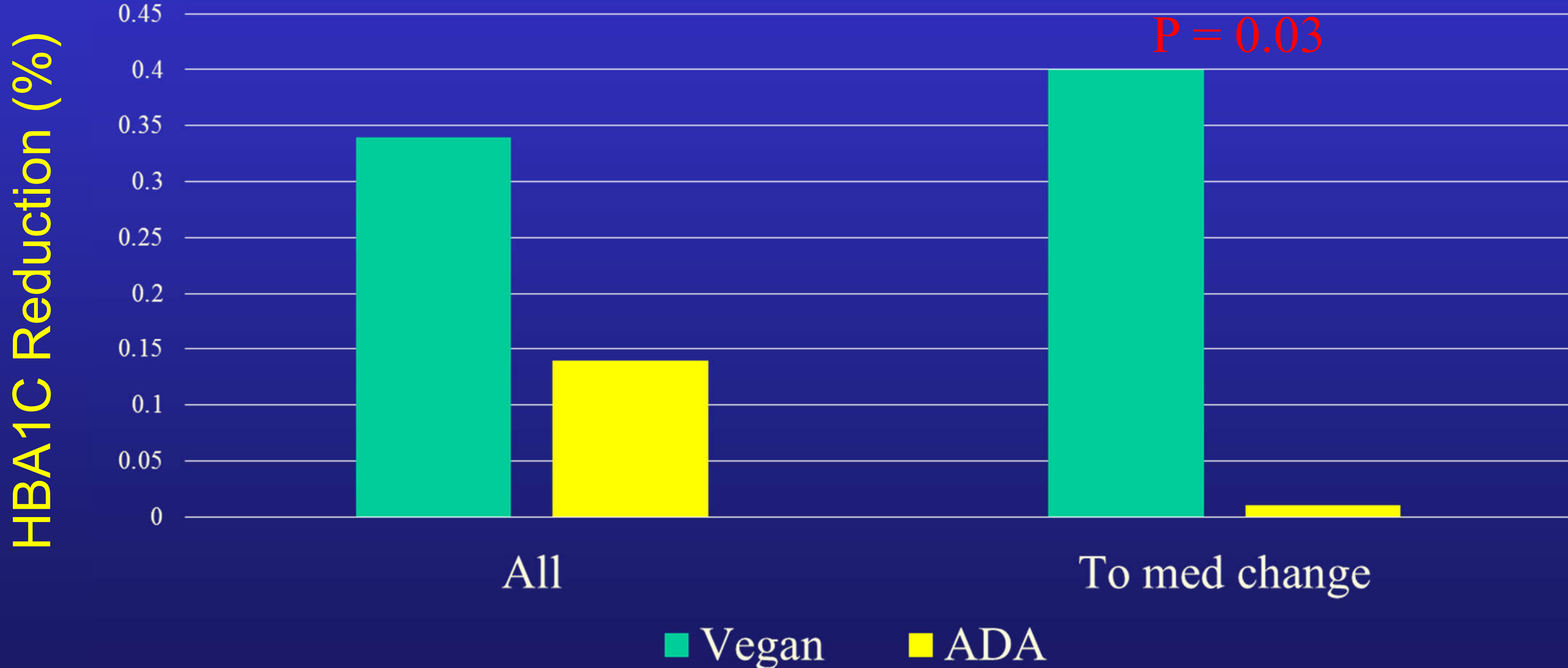


SCG 2012

P = 0.03

Am J Clin Nutrition 2009:89sup:1588S-1596S PMID 1683779

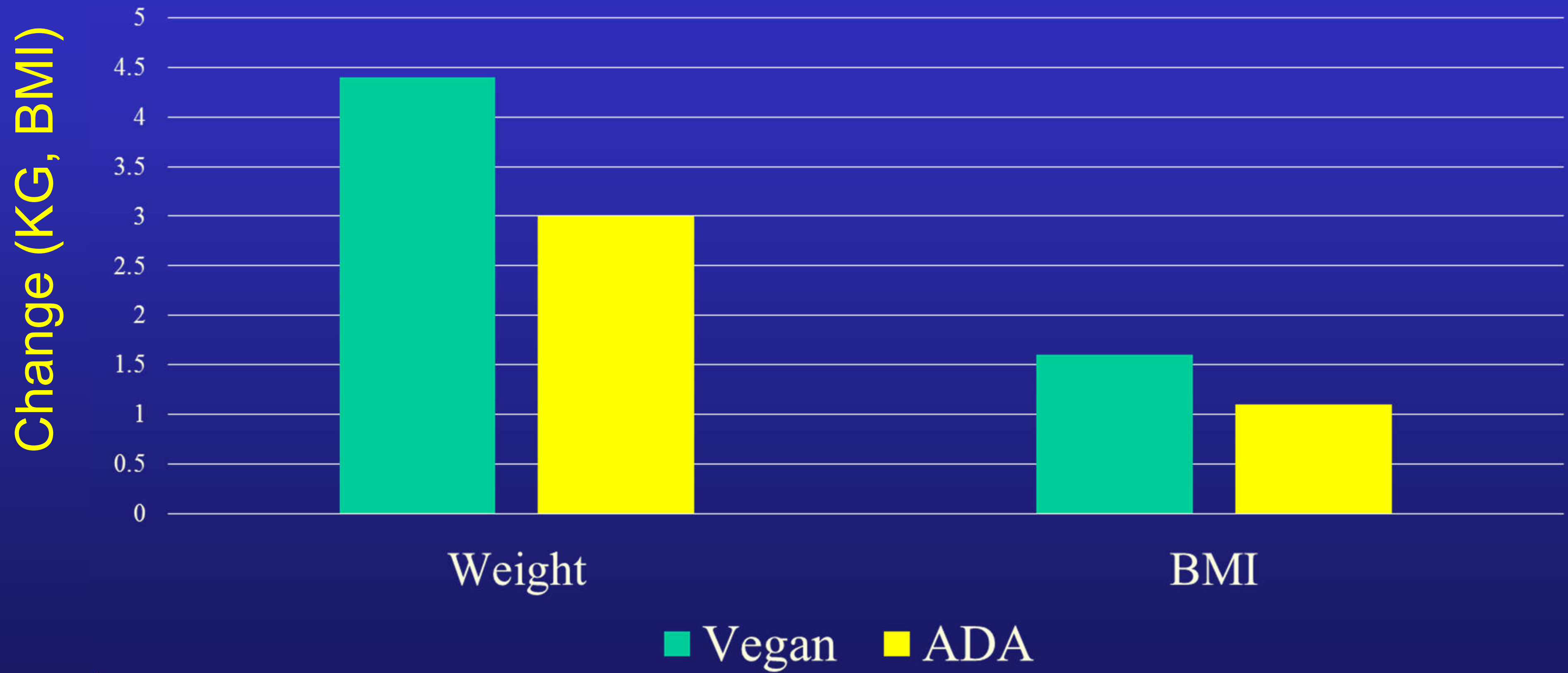
RCT Vegan vs ADA diet in NIDDM Change in $HBA_{1}c$ (74 wks)



SCG 2016

Barnard ND Am J Clin Nutrition 2009:89 sup: 1588S=96S PMID 19339401

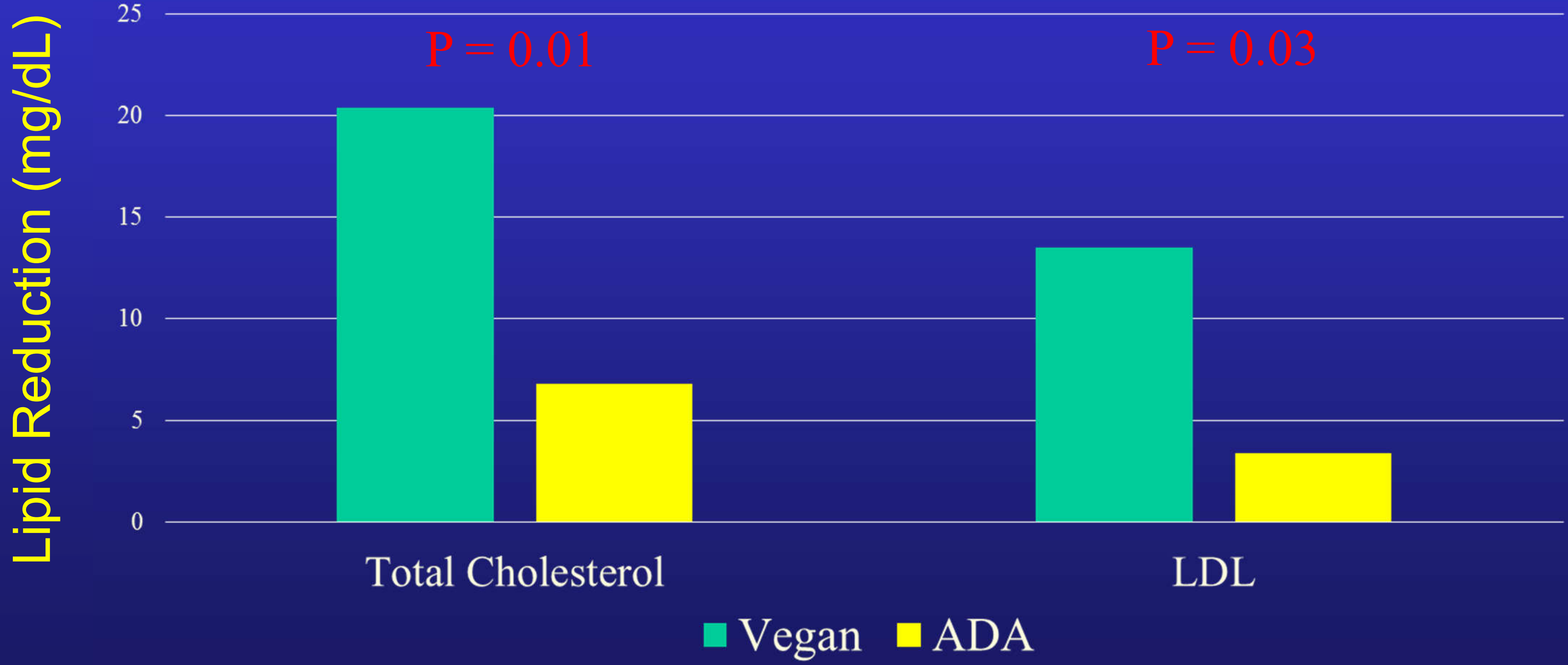
RCT Vegan vs ADA diet in NIDDM Change in weight & BMI (74 wks)



SCG 2017

Barnard ND Am J Clin Nutrition 2009:89 sup: 1588S=96S PMID 19334901

RCT Vegan vs ADA diet in NIDDM
Change in Lipids (74 wks)



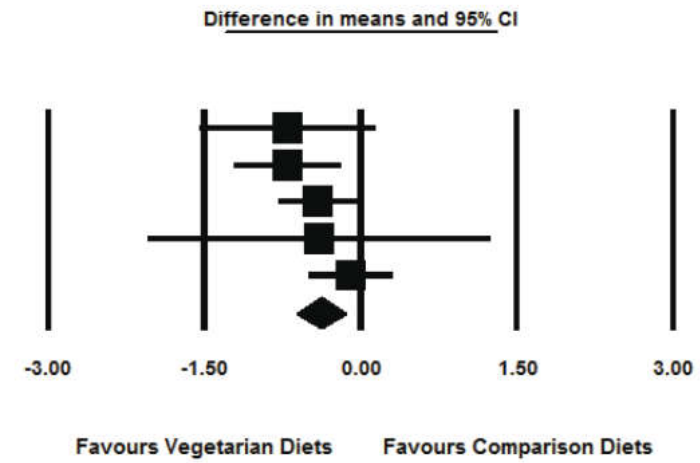
SCG 2016

Barnard ND Am J Clin Nutrition 2009:89 sup: 1588S=96S PMID 19334901

25414824

Meta: Vegetarian Diets & Diabetes Control

Study name	Subgroup within study	Comparison	Outcome	Statistics for each study			
				Difference in means	Lower limit	Upper limit	p-Value
Ferdowsian et al., 2010	low fat vegan	omnivorous	HbA1c	-0.700	-1.543	0.143	0.104
Mishra et al., 2013	low fat vegan	omnivorous	HbA1c	-0.700	-1.210	-0.190	0.007
Barnard et al., 2009	low fat vegan	ADA	HbA1c	-0.410	-0.782	-0.038	0.031
Nicholson et al., 1999	low fat vegan	low fat	HbA1c	-0.400	-2.044	1.244	0.633
Kahleova et al., 2011	lacto vegetarian	diabetic diet	HbA1c	-0.090	-0.489	0.309	0.658
				-0.387	-0.621	-0.152	0.001



Overall mean drop in HbA1c of 0.39%

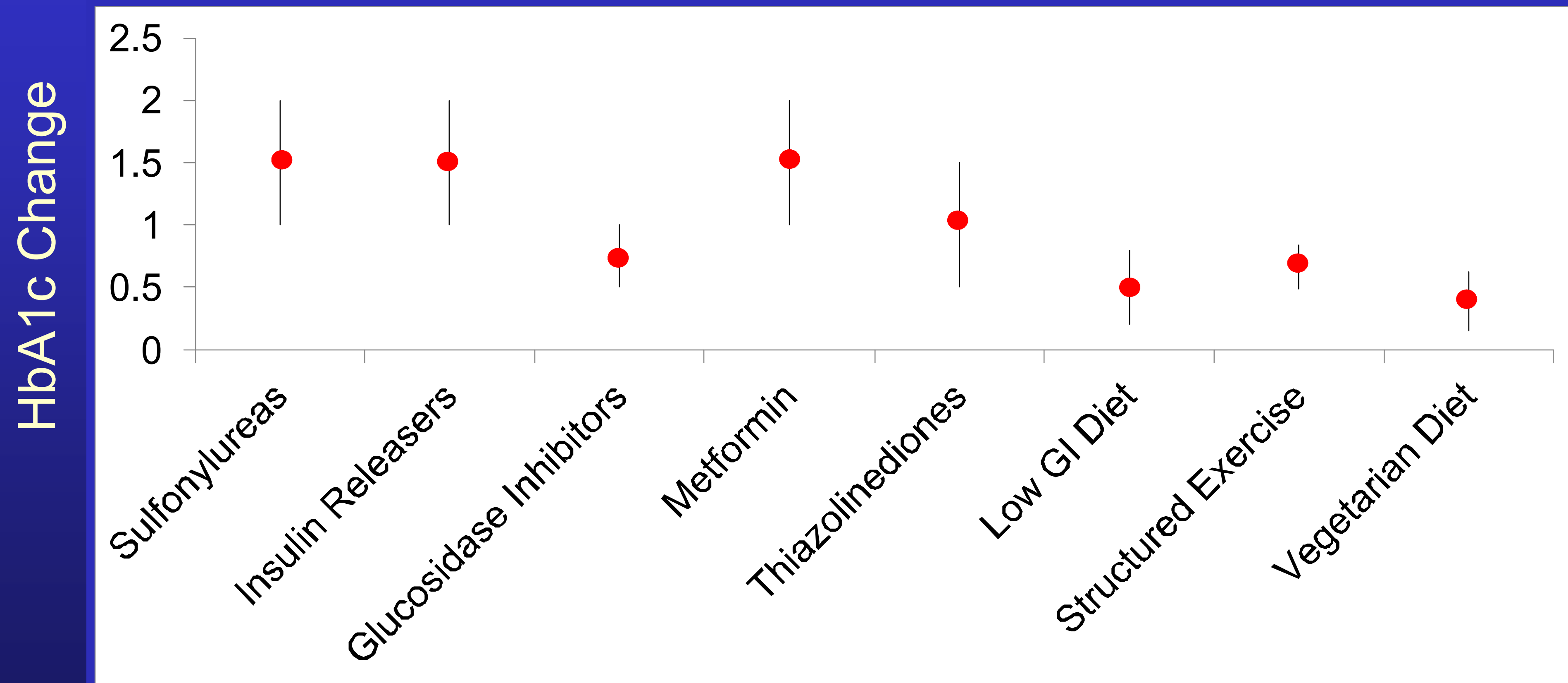
P = 0.001

P for heterogeneity = 0.389

Y Yokoyama. Cardiovasc Diagn Ther 2014:4(5):373-382

SCG 2016

Diabetes: Oral Agents, Diet (Low GI, Vegetarian), Exercise

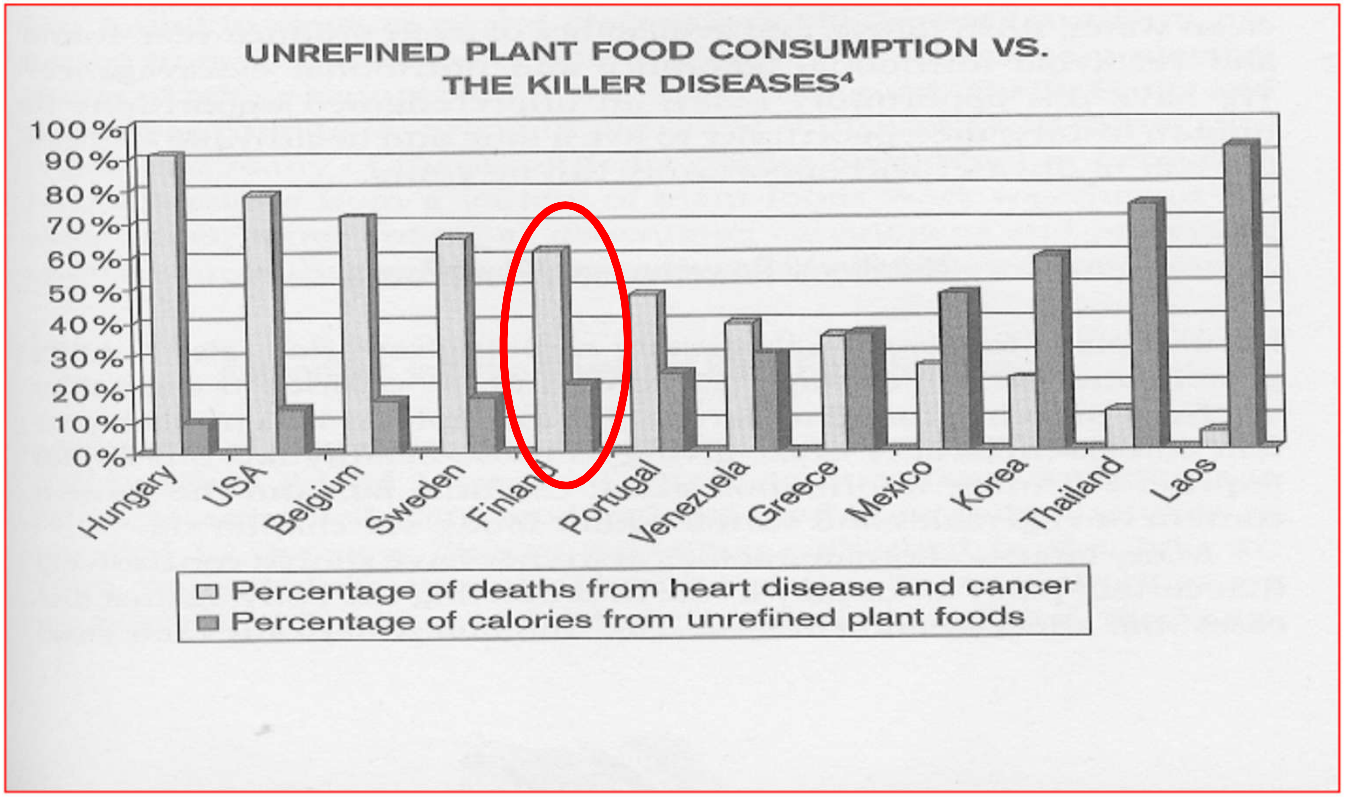


Thomas D, Cochrane Library 2009 Issue 1

AJ Krentz Drugs 2005;65(3):385-411

Heart Disease

UNREFINED PLANT FOOD CONSUMPTION VS. KILLER DISEASES



SCG 2013

World Health Statistics Annual 1994–1998. Online version. www.who.int/whosis; Food and Agriculture Organization of the United Nations. Statistical database food balance sheets, 1961– 1999. Available online at www.fao.org; National Institutes of Health. Global cancer rates, cancer death rates among 50 countries, 1986–1999. Available online at www.nih.gov.

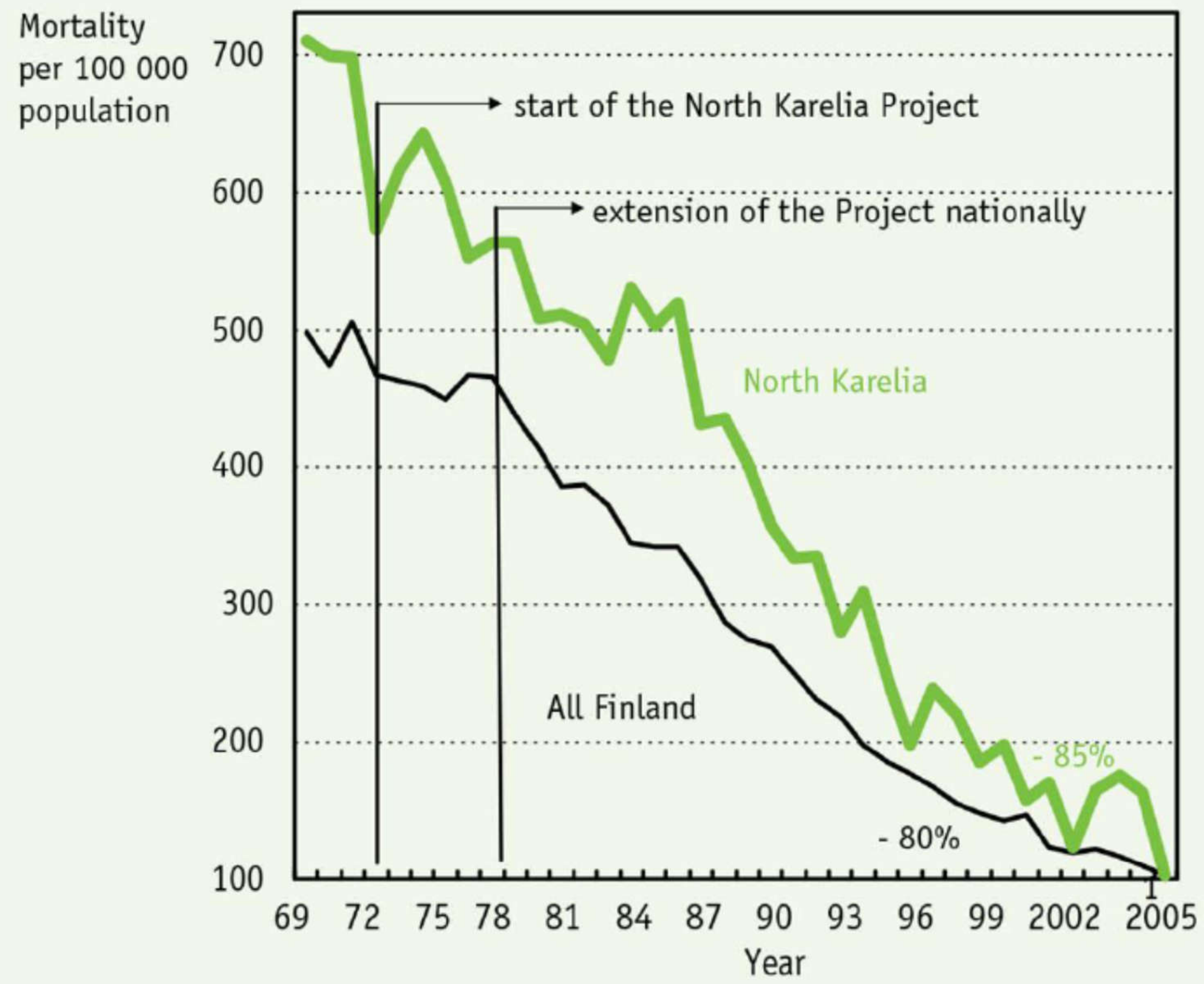


Figure 1. Age-adjusted mortality rates of coronary heart disease in North Karelia

Mortality Changes, N Karelia, 1970-2006

	1969-1971	2006	Change
All causes	1 509	572	-62%
All cardiovascular	855	182	-79%
Coronary heart disease	672	103	-85%
All cancers	271	96	-65%
Lung cancers	147	30	-80%

Diabetes Voice 2008:53:26-29

RCT Diet + Lifestyle in CAD

Aim: Assess effect of a comprehensive lifestyle intervention for 1 year in pts with atherosclerosis.

Patients: Angiographically documented CAD (1, 2 or 3 vessels)

- EF > 25%, no MI last 6 weeks

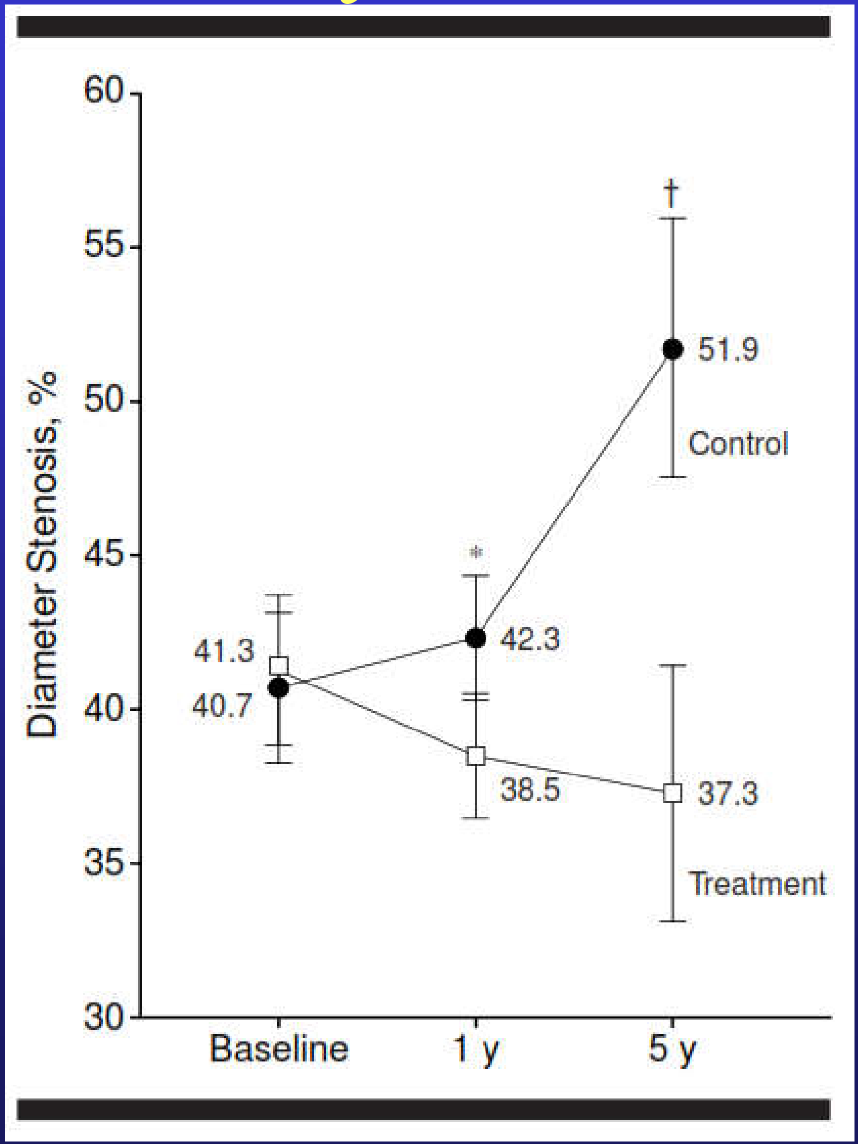
Randomised (n=28) (control = 20)

1) Low-fat vegetarian diet
2) Moderate aerobic exercise
3) Stress management training
4) Stopping smoking
5) Group support

Progression of CAD (195 lesions) assessed by blinded quantitative coronary angiography at baseline and after 1 year.

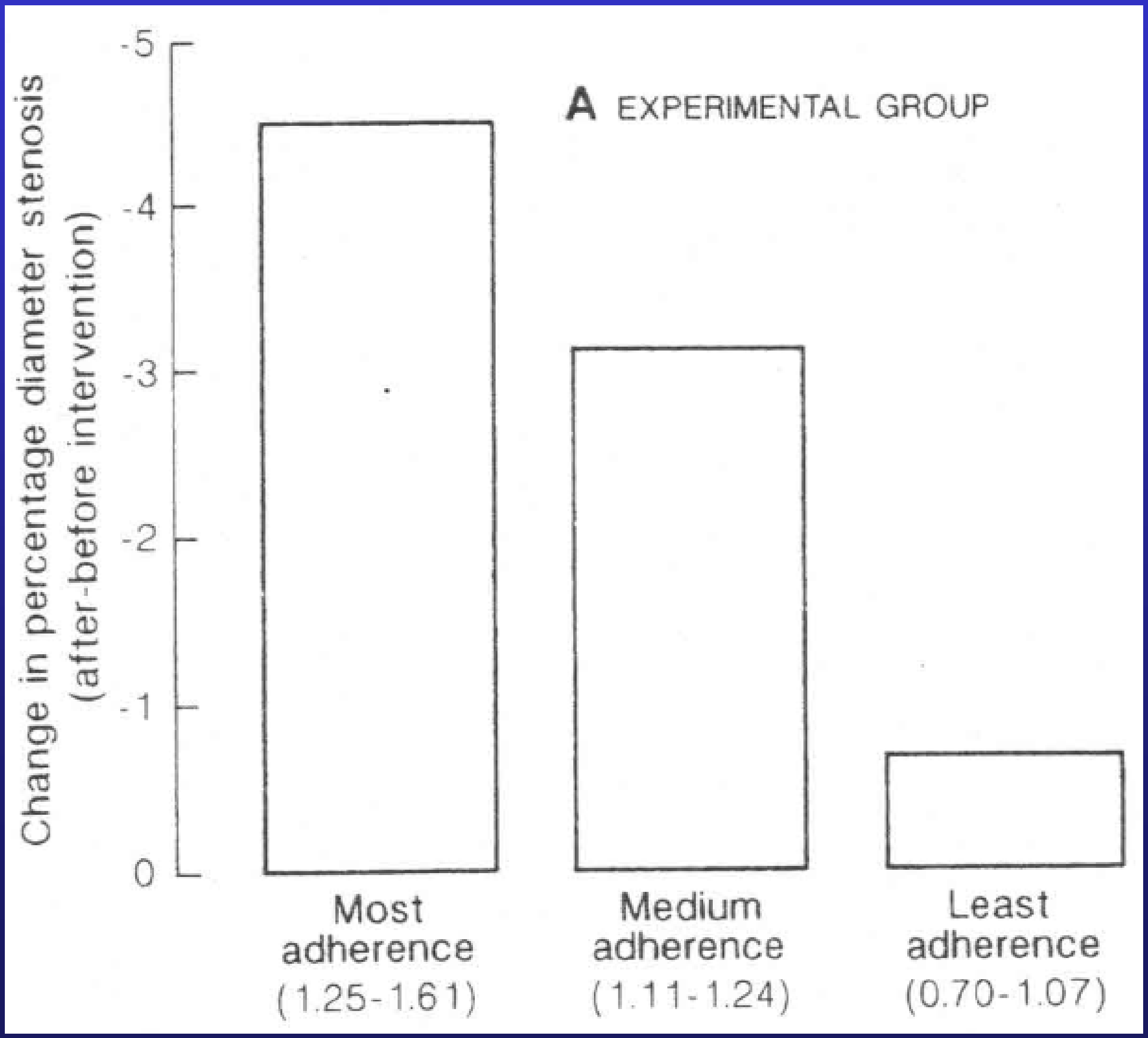
Ornish Lancet 1990:336:123-133

RCT Lifestyle in CAD: 5 Yr Results



Ornish JAMA 1998:280:2001-7

RCT Lifestyle in CAD: Role of Adherence

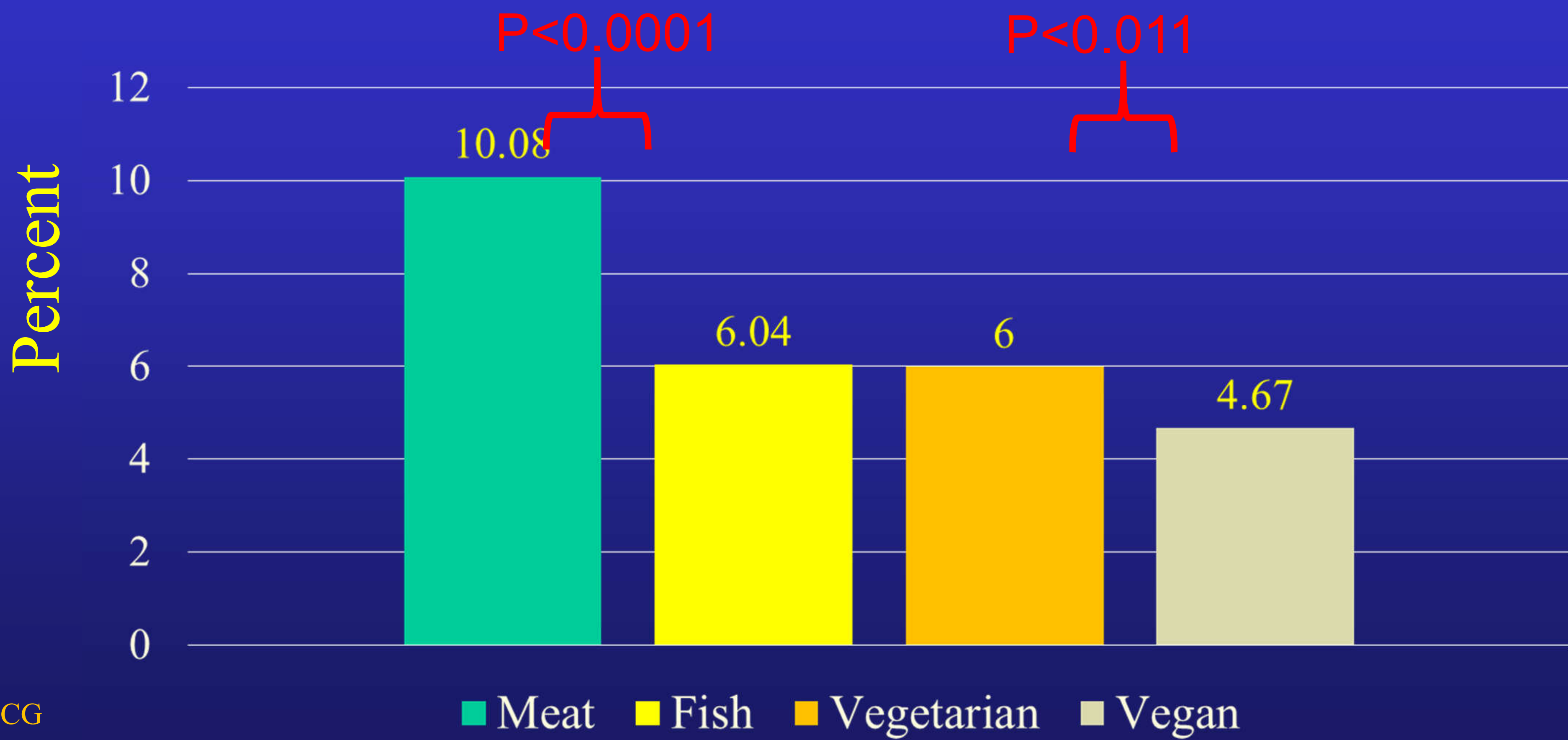


SCG 2017

Ornish Lancet 1990:336:123-133

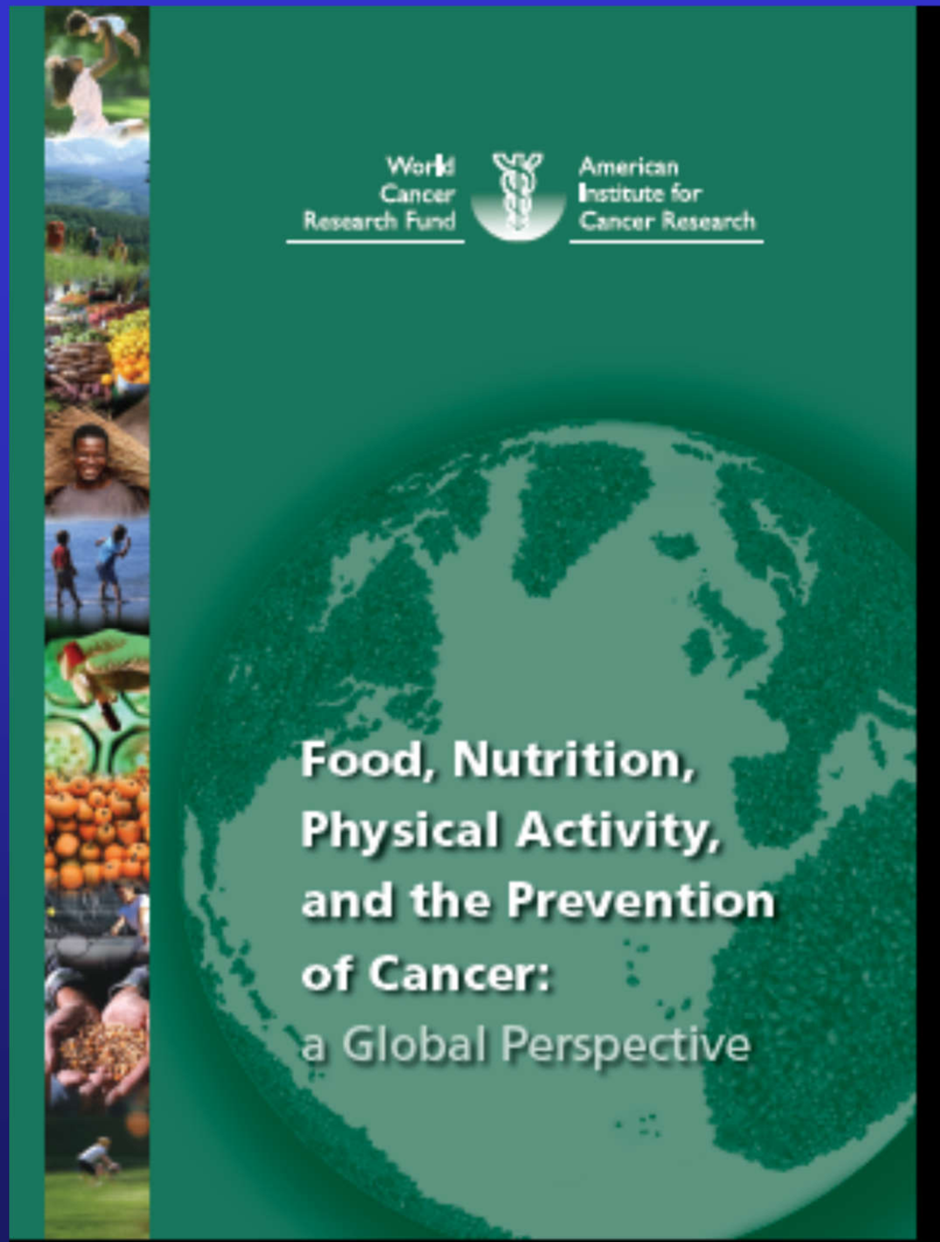
What about Cancer ?

UK Study: All Cancers in meat (32,491), fish (8612), vegetarians (18,298) vegans (2246)



SCG
2016

Am J Clin Nutrition 2014; 100 (suppl):378S-85S



http://www.dietandcancerreport.org/

SCG 2007

Food, Nutrition & Prevention of Cancer

	# Studies	Type Studies	Type of outcome	Result	Significant (p<0.05)
Nasopharynx					
Salted Fish	9	Case-control	Relative Risk	28% increase per time per week	Yes
Mouth/pharynx/larynx					
Non-starchy vegetables	3	Case-control	Relative Risk	38% decrease per 50g per day	Yes
Fruits	7	Case-control	Relative Risk	28% decrease per 100g per day	Yes
Citrus fruits	6	Case-control	Relative Risk	24% decrease per 50g per day	Yes
Alcoholic drinks	2	Cohort	Relative Risk	24% increase per drink per week	Yes
Alcoholic drinks	31	Case-control	Relative Risk	3% increase per drink per week	Yes
Esophagus					
Non-starchy vegetables	5	Case-control	Relative Risk	13% decrease per 50g per day	Borderline
Raw vegetables	5	Case-control	Relative Risk	31% decrease per 50g per day	Yes
Fruits	8	Case-control	Relative Risk	44% decrease per 100g per day	Yes
Citrus fruits	7	Case-control	Relative Risk	30% decrease per 50g per day	Yes
Alcoholic drinks	23	Case-control	Relative Risk	4% increase per drink per week	Yes
Lung					
Fruits	15	Cohort	Relative Risk	6% decrease per serving per day	Yes
Fruits	14	Case-control	Relative Risk	20% decrease per serving per day	Yes
Breast					
Ethanol	9	Cohort	Relative Risk	10% increase per 10g per day	Yes
Ethanol	7	Case-control	Relative Risk	6% increase per 10g per day	Yes

SCG 2012

Good
0-10%
10-20%
>20%

Bad
0-10%
10-20%
> 20%

Food Nutrition Physical Activity and the Prevention of Cancer
AICR 2007, Washington DC

Food, Nutrition & Prevention of Cancer

Stomach					
Non-starchy vegetables	21	Case-control	Relative Risk	30% decrease per 100 g per day	Yes
Non-starchy vegetables	9	Cohort	Relative Risk	2% decrease per 100g per day	No
Green-yellow vegetables	6	Cohort	Relative Risk	37% decrease per 100g per day	Yes
Green-yellow vegetables	12	Case-control	Relative Risk	41% decrease per 100 g per day	Yes
White or pale vegetables	3	Cohort	Relative Risk	51% decrease per 100g per day	Borderline
White or pale vegetables	3	Case-control	Relative Risk	43% decrease per 100g per day	Borderline
Raw vegetables	4	Cohort	Relative Risk	20% decrease per 100g per day	No
Raw vegetables	14	Case-control	Relative Risk	50% decrease per 100g per day	Yes
Allium vegetables	2	Cohort	Relative Risk	45% decrease per 100g per day	Yes
Allium vegetables	15	Case-control	Relative Risk	41% decrease per 100g per day	Yes
Fruits	10	Cohort	Relative Risk	5% decrease per 100g per day	No
Fruits	28	Cohort	Relative Risk	33% decrease per 100g per day	Yes
Total salt intake	3	Cohort	Relative Risk	8% increase per gram per day	Yes
Total salt intake	9	Case-control	Relative Risk	1% increase per gram per day	No
Salted food	4	Cohort	Relative Risk	32% increase per serving per day	No
Salted food	5	Case-control	Relative Risk	420% increase per serving per day	Yes
Pancreas					
Folate	2	Cohort	Relative Risk	16% decrease per 100 mcg per day	Yes
Liver					
Alcoholic drinks	5	Case-control	Relative Risk	18% increase per drink per week	Yes
Ethanol	6	Cohort	Relative Risk	10% increase per 10g per day	Yes
Ethanol	15	Case-control	Relative Risk	17% increase per 10g per day	Yes
Colon					
Dietary Fiber	10	Cohort	Relative Risk	10% decrease per 10g per day	Yes
Dietary folate	6	Cohort	Relative Risk	16% decrease per 100 mcg per day	Yes
Red meat	9	Cohort	Relative Risk	43% increase per time per week	Yes
Red meat	3	Cohort	Relative Risk	29% increase per 100g per day	Yes
Processed meat	6	Cohort	Relative Risk	21% increase per 50g per day	Yes
Ethanol	11	Cohort	Relative Risk	9% increase per 10g per day	Yes

SCG 2012

Good
0-10%
10-20%
>20%

Bad
0-10%
10-20%
> 20%

Food Nutrition Physical Activity and the Prevention of Cancer
AICR 2007, Washington DC

RCT Lifestyle Change & Prostate Cancer

Population: Men (n=93) who had low risk prostate cancer and had chosen not to undergo any conventional treatment.

Design: RCT

Control group told to follow the advice of their physician about lifestyle changes

Intervention (for 1 year)

1) Vegan diet + soy supplementation (~ 10% calories from fat)
2) Fish oil (3 g/day)
3) Vitamin E (400 IU/day) + Selenium (200 mcg/d) + Vitamin C (2g/d)
4) Moderate aerobic exercise (walking 30 min 6 days per week)
5) Stress management for 60 min per day

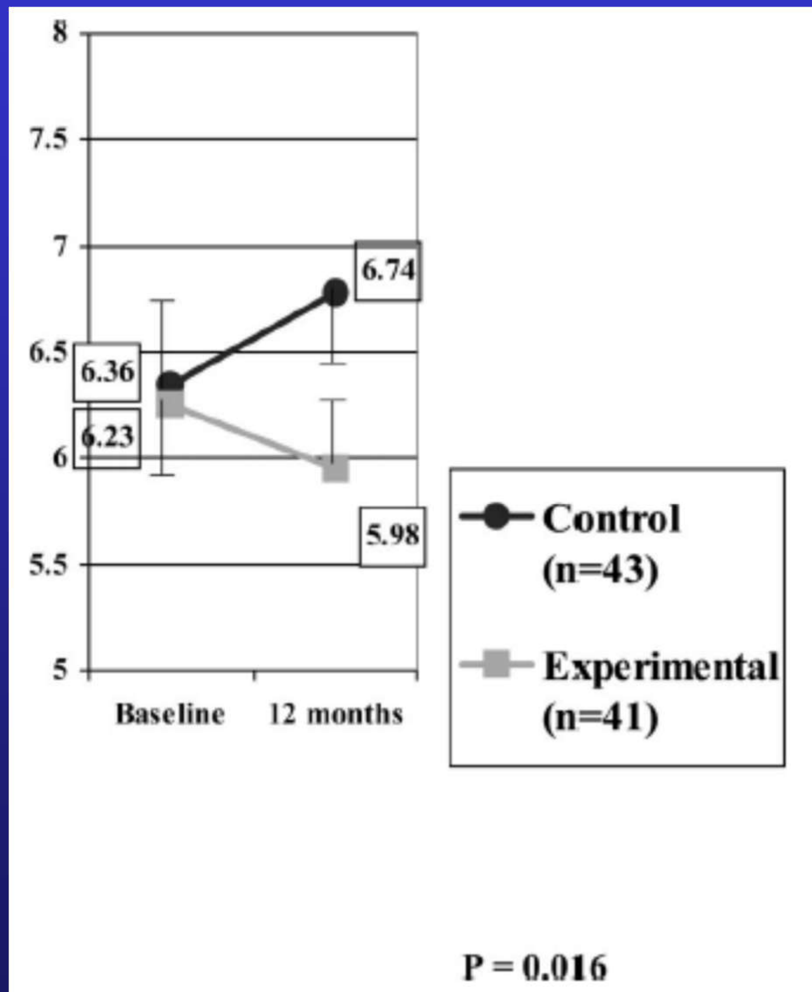
Outcomes

1) PSA (baseline & 1 year)
2) Inhibition of LNCaP prostate cancer cells **by serum**

D Ornish J Urology 2005:174:1065-70

RCT Lifestyle Change & Prostate Cancer

Mean change in serum PSA after 1 year

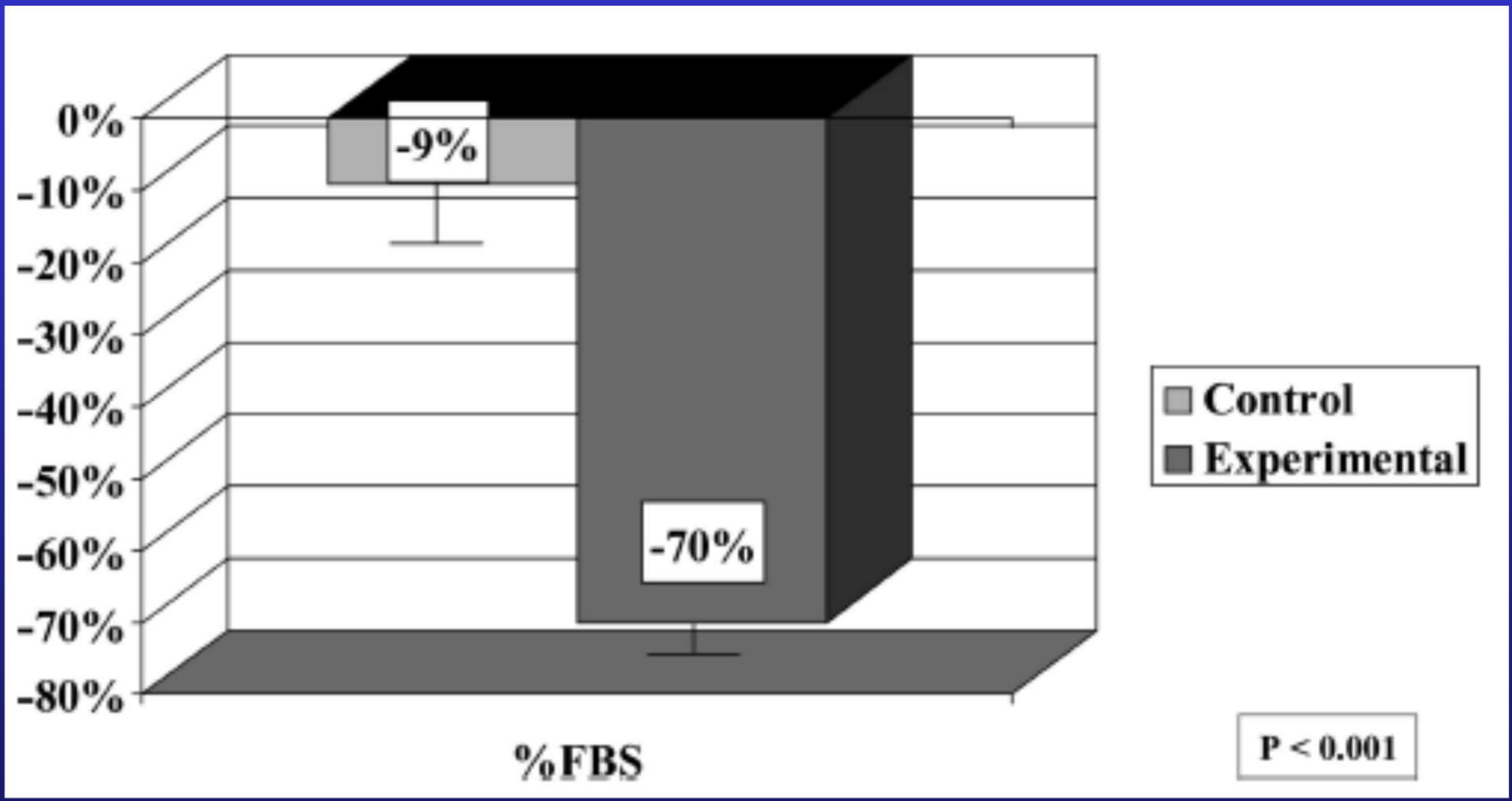


SCG 2013

D Ornish J Urology 2005:174:1065-70

RCT Lifestyle Change & Prostate Cancer

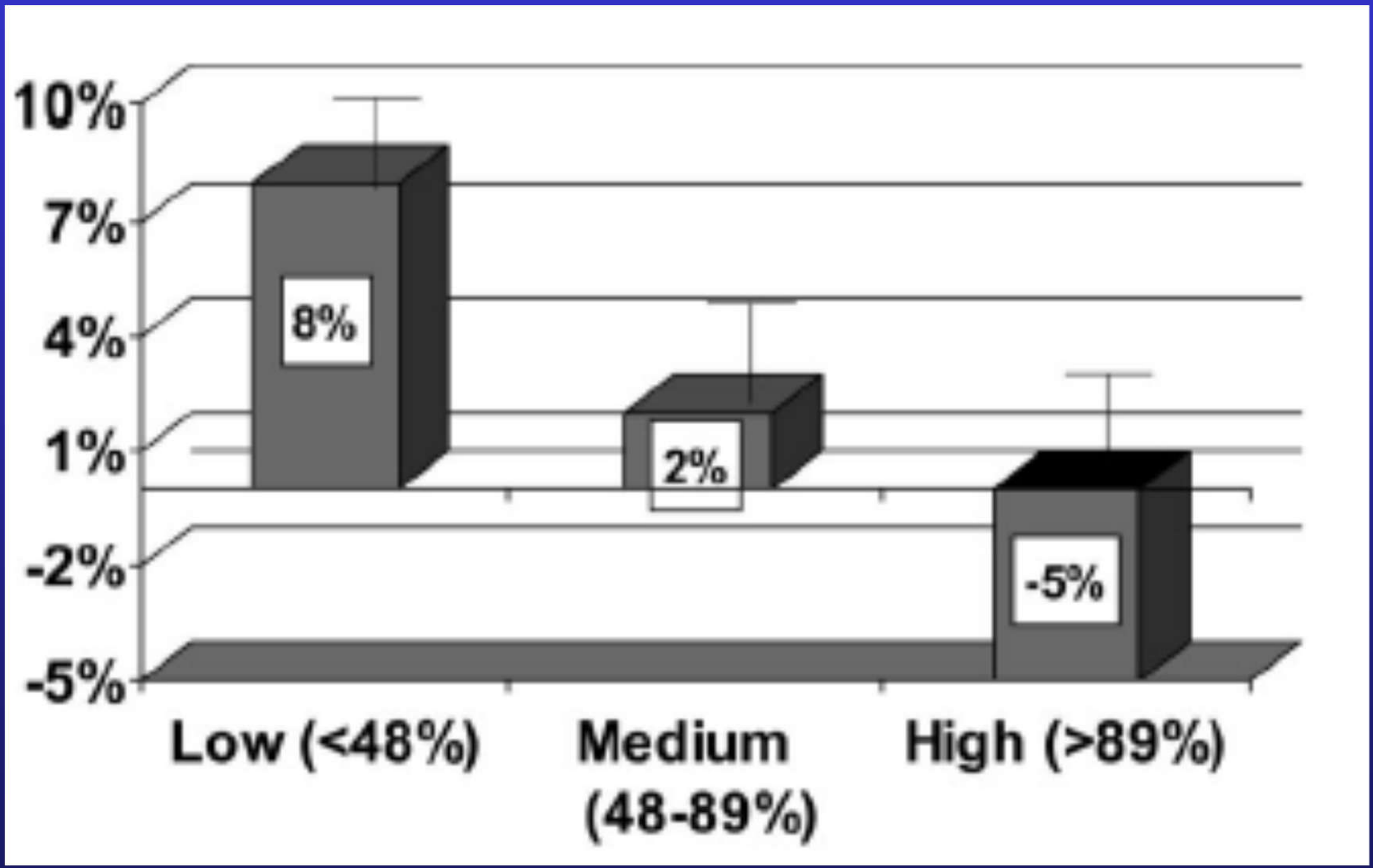
Mean change in % LNCaP cell Growth at 1 year



SCG 2016

D Ornish J Urology 2005:174:1065-70

RCT Lifestyle Change & Prostate Cancer
Lifestyle change (tertiles) and PSA change

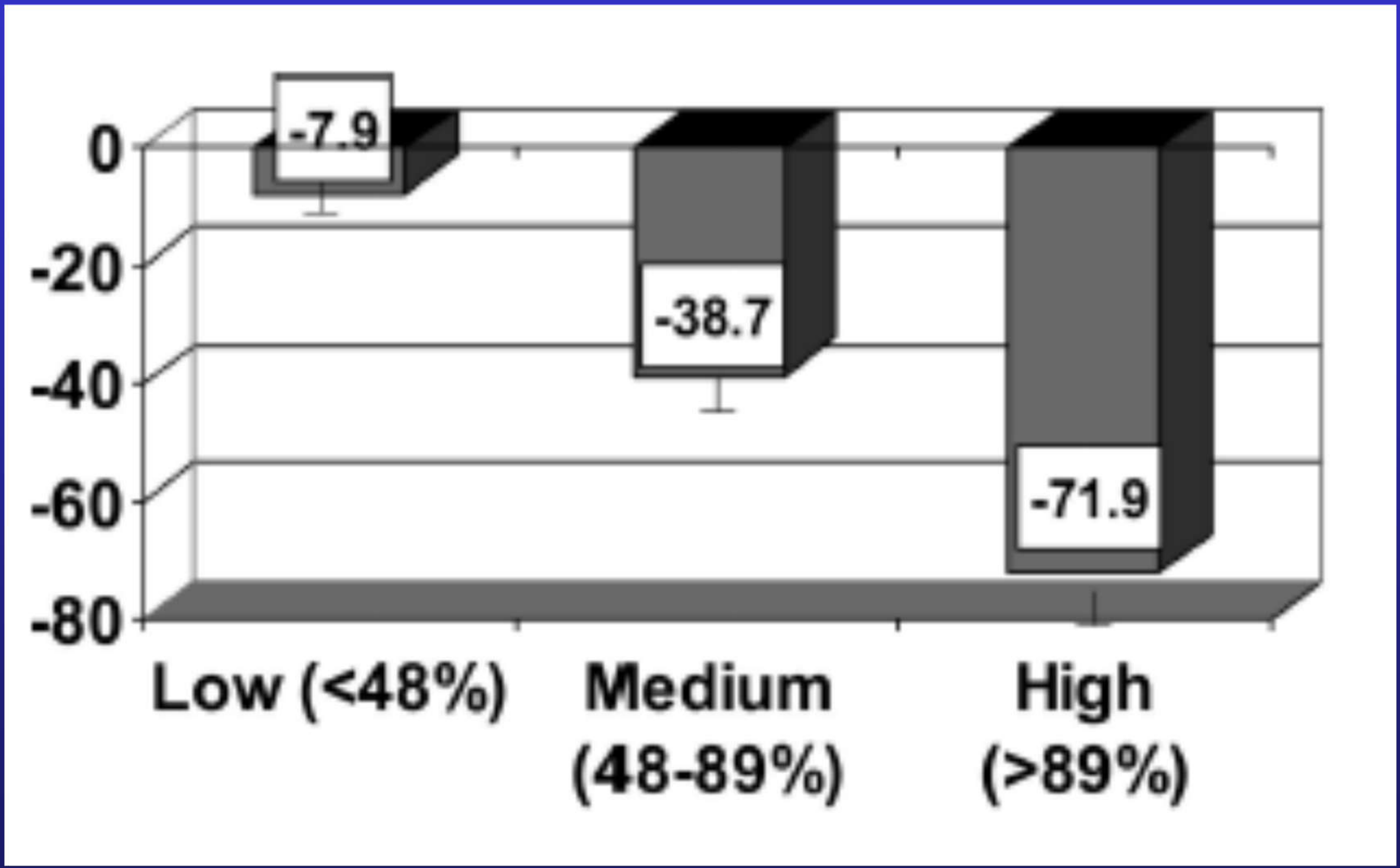


r = -0.23, p=0.035

SCG 2013

D Ornish J Urology 2005:174:1065-70

RCT Lifestyle Change & Prostate Cancer
Lifestyle change (tertiles) and LNCaP growth



SCG 2013

r = -0.37, p<0.001

D Ornish J Urology 2005:174:1065-70

Antiproliferative & antioxidant activities of common vegetables

- Epidemiologic studies have shown a close relationship between diet and cancer especially the intake of fruit & vegetables

- Aim of present study: Better delineate above relationship by evaluating the inhibitory effects of extracts from 34 vegetables on 8 different tumour cell lines.

- Processing of fresh local vegetabls included passage thru a domestic juice extractor, centrifugation (50,000 G x 45 min) and sterilization by filtering (0.22 um).

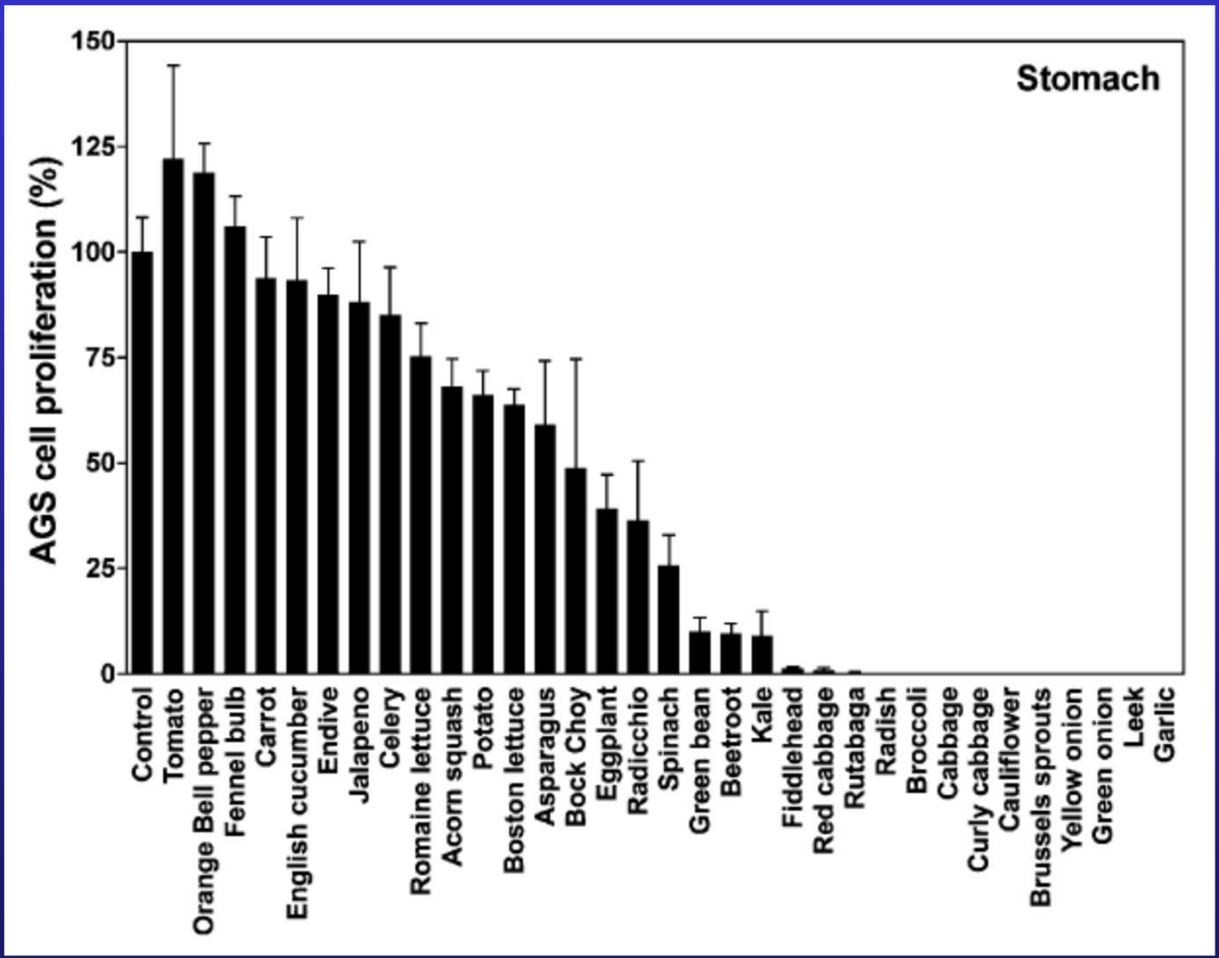
D Boivin Food Chemistry 2009:112:374-80

Antiproliferative & antioxidant activities of common vegetables

Tissue / Neoplasm	Name of cell line	Comment
Stomach adenocarcinoma	AGS	ATCC CRLl-1739
Breast adenocarcinoma	MCF-7	ATCC HTB-22
Pancreatic carcinoma	Panc-1	ATCC CRL-1469
Prostate adenocarcinoma	PC-3	ATCC CRL-1435
Lung carcinoma	A 549	ATCC CCL-185
Medulloblastoma	Daoy	ATCC HTB-186
Glioblastoma	MG	ATCC HTB-14
Renal carcinoma	Caki-2	ATCC HTB-186
Normal dermal fibroblasts	NHDF	

D Boivin Food Chemistry 2009:112:374-80

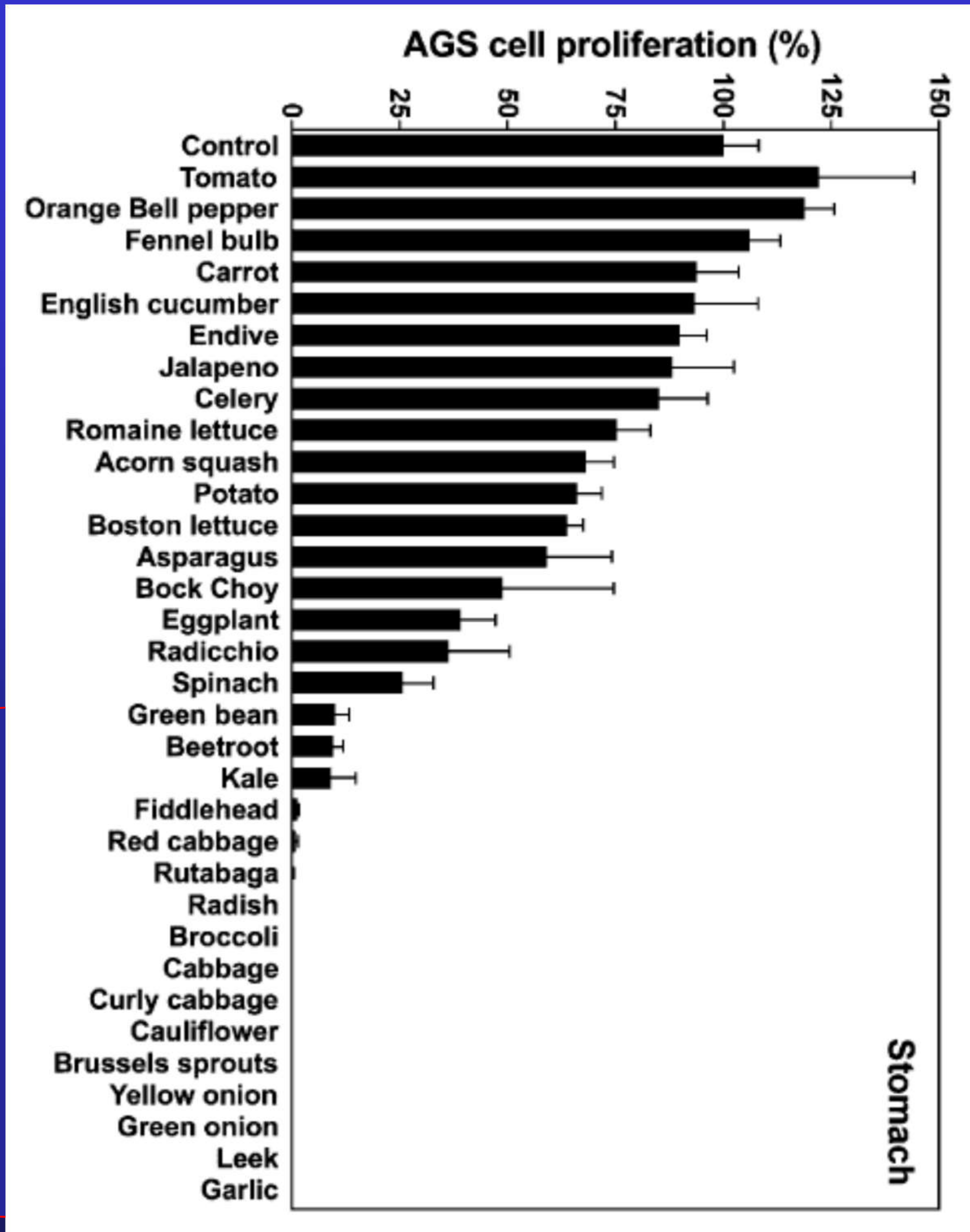
Antiproliferative activities of vegetables
Stomach Cancer



SCG 2012

D Boivin Food Chemistry 2009:112:374-80

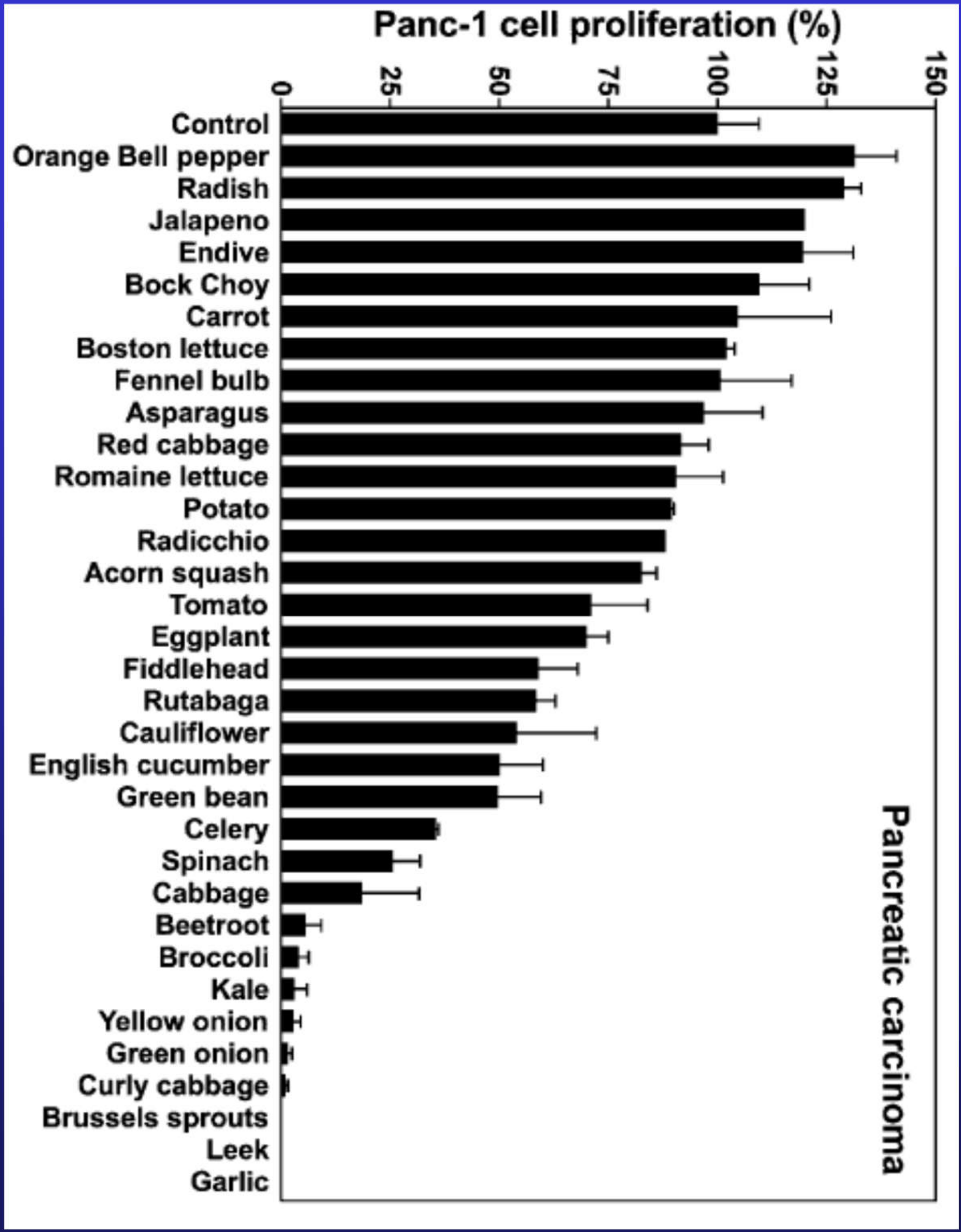
Stomach Cancer



D Boivin Food Chemistry 2009:112:374-80

SCG 2012

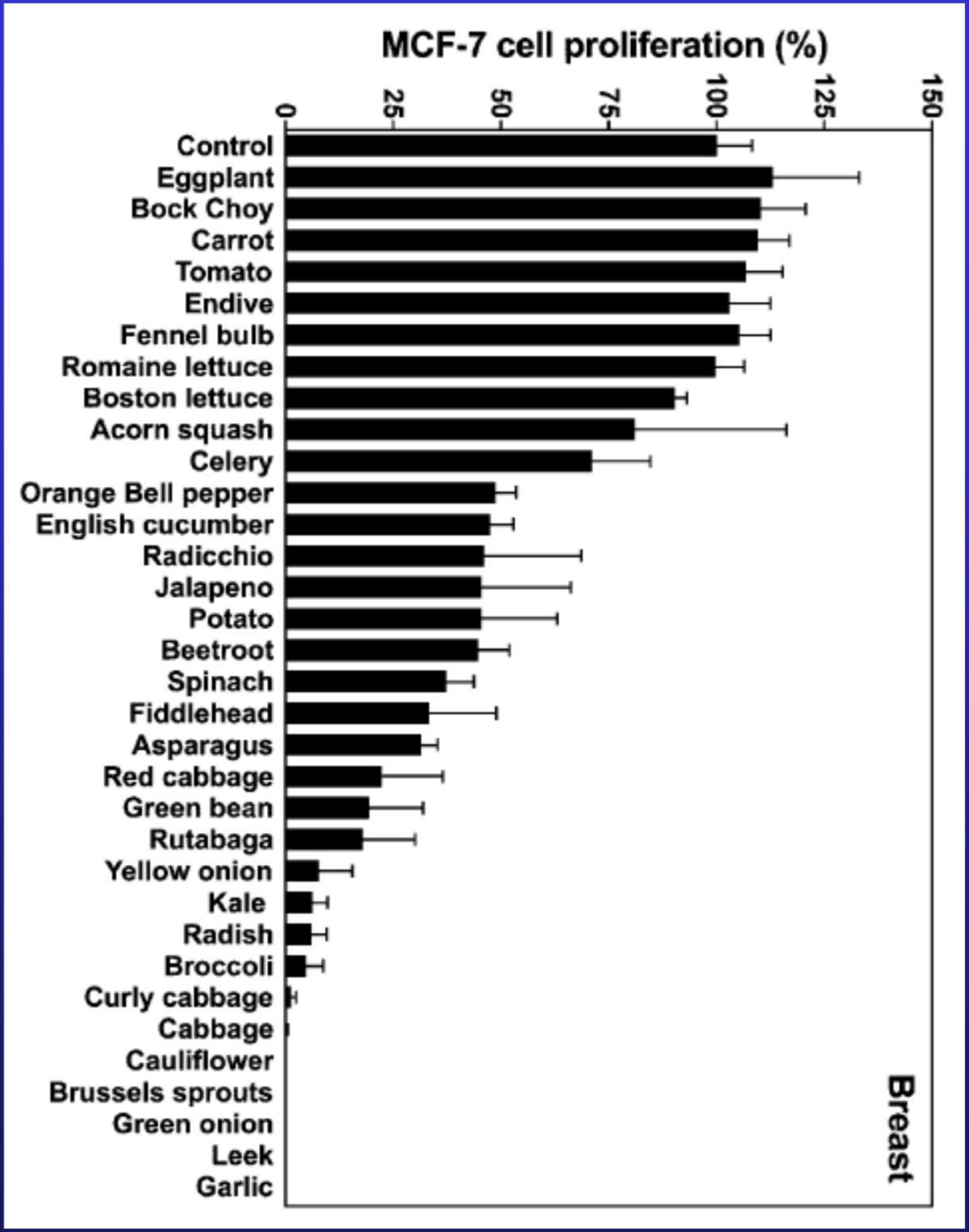
Pancreatic Cancer



D Boivin Food Chemistry 2009:112:374-80

SCG 2012

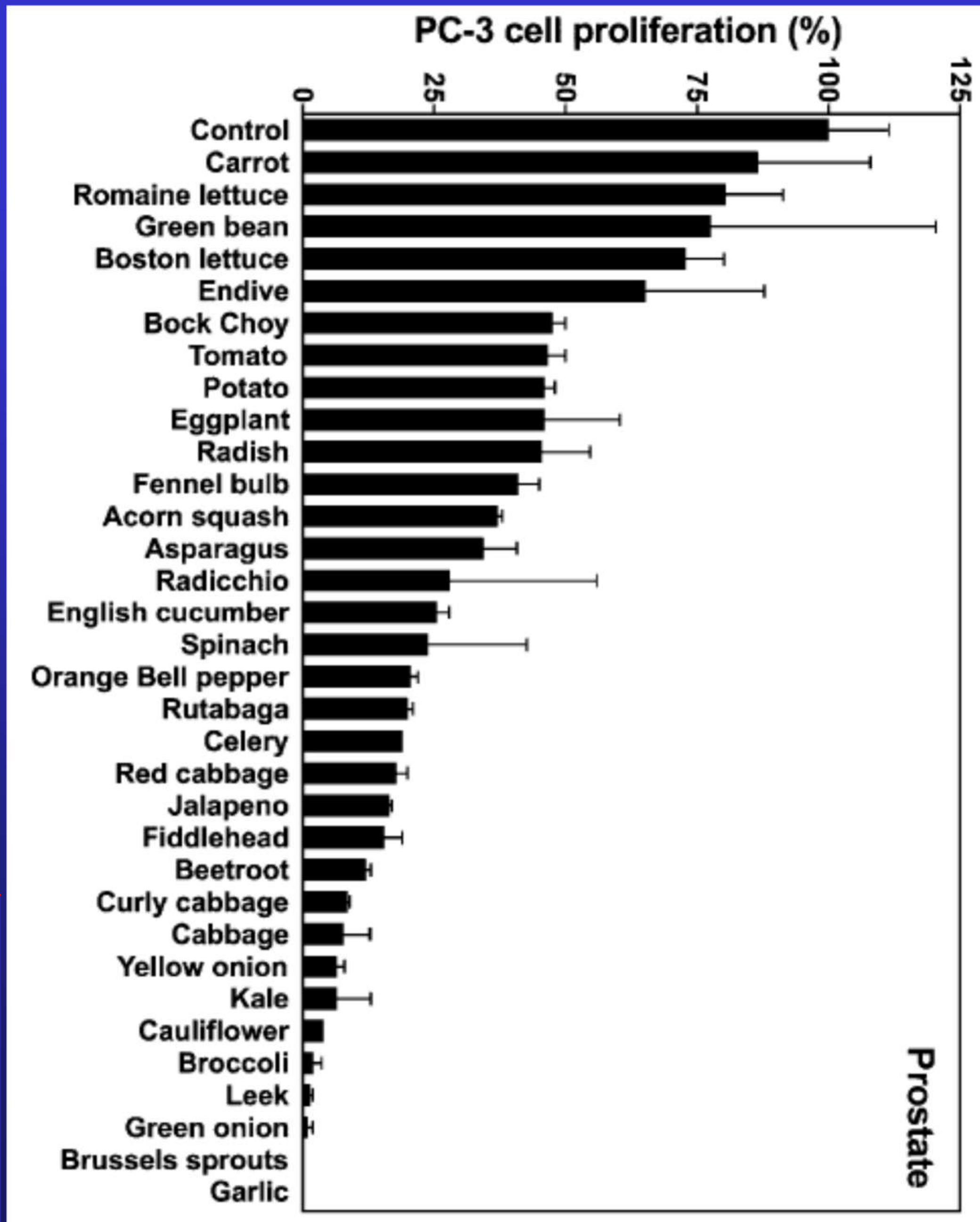
Breast Cancer



D Boivin Food Chemistry 2009:112:374-80

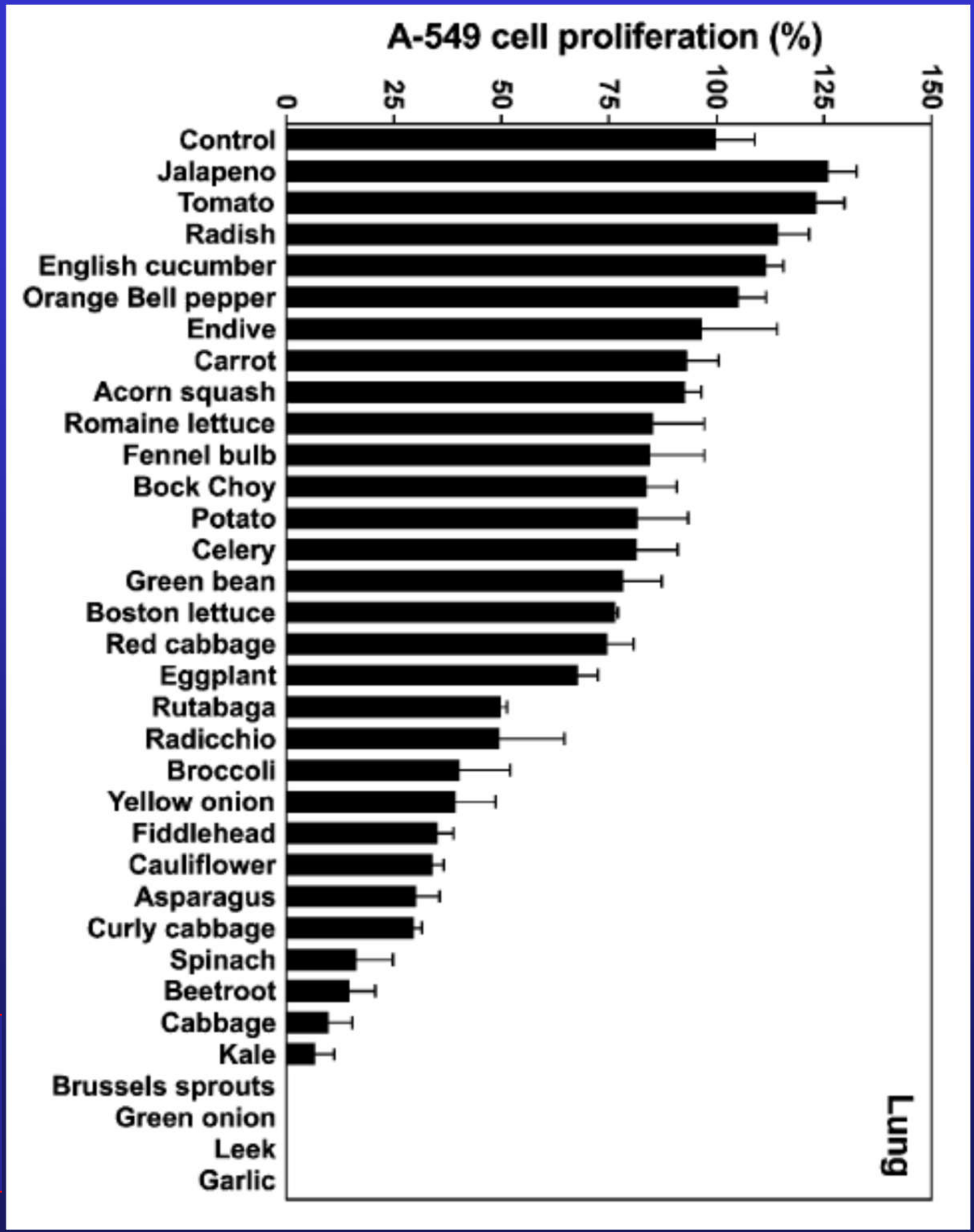
SCG 2012

Prostate Cancer



D Boivin Food Chemistry 2009:112:374-80

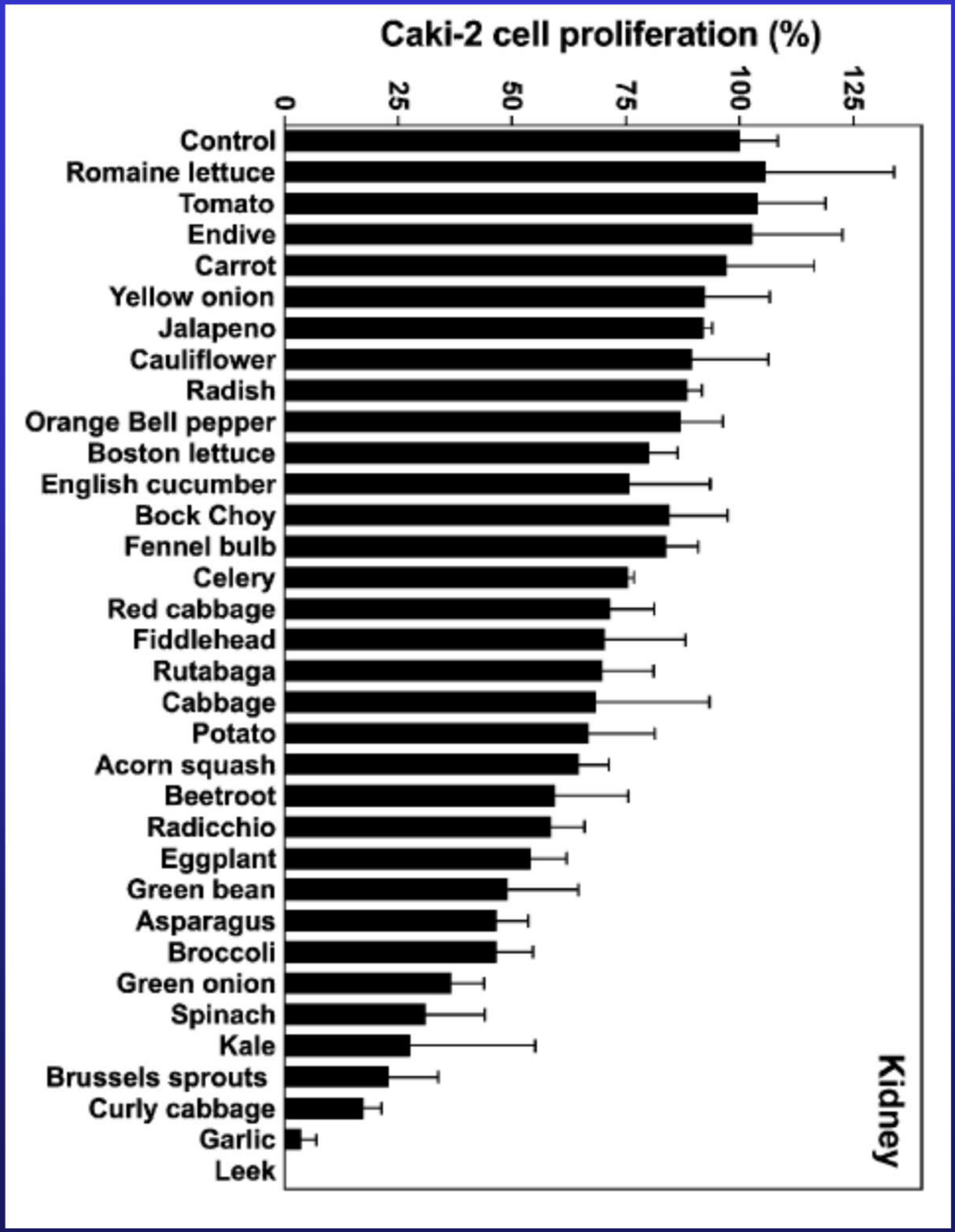
Lung Cancer



D Boivin Food Chemistry 2009:112:374-80

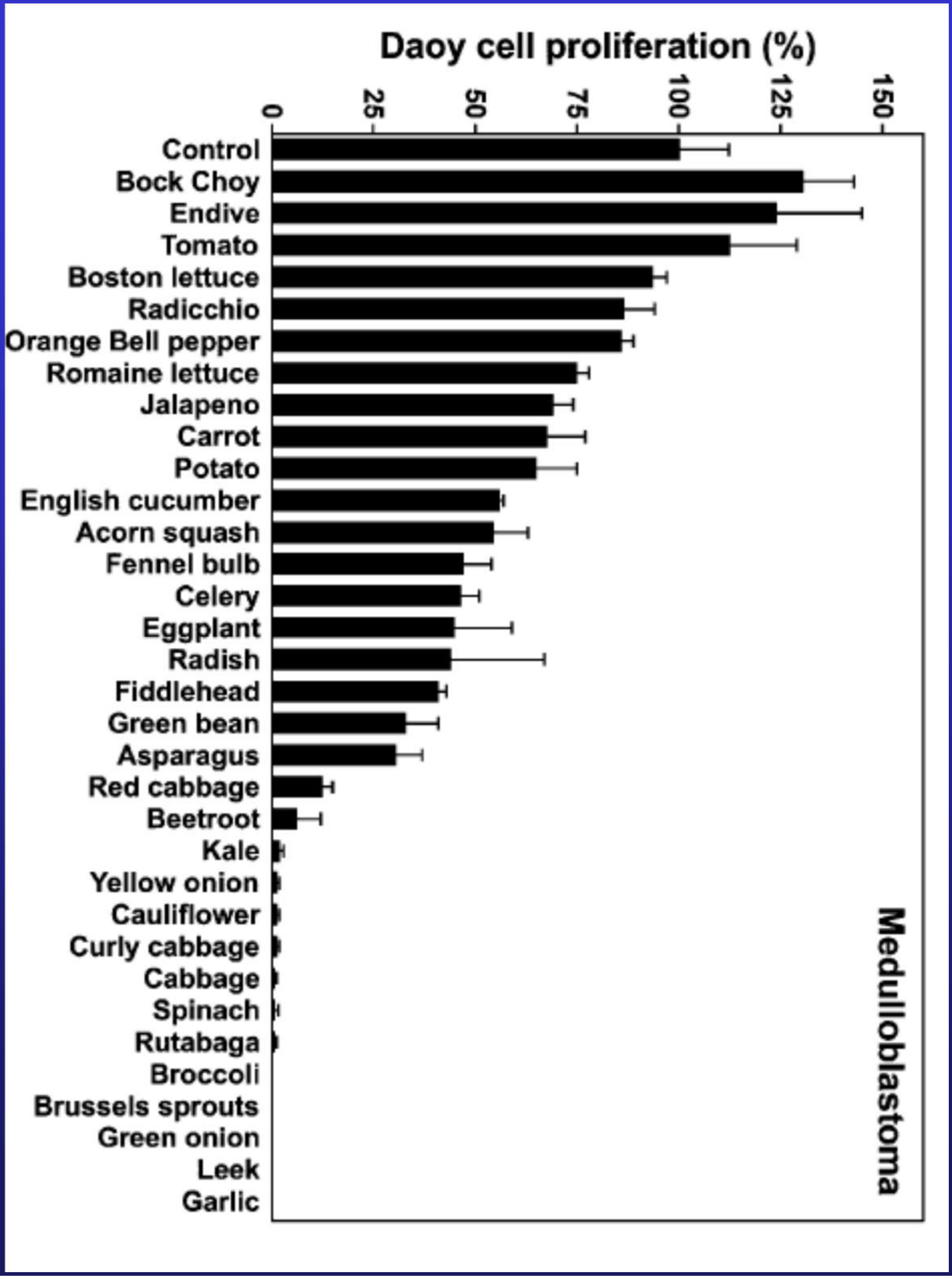
SCG 2012

Kidney Cancer



D Boivin Food Chemistry 2009:112:374-80

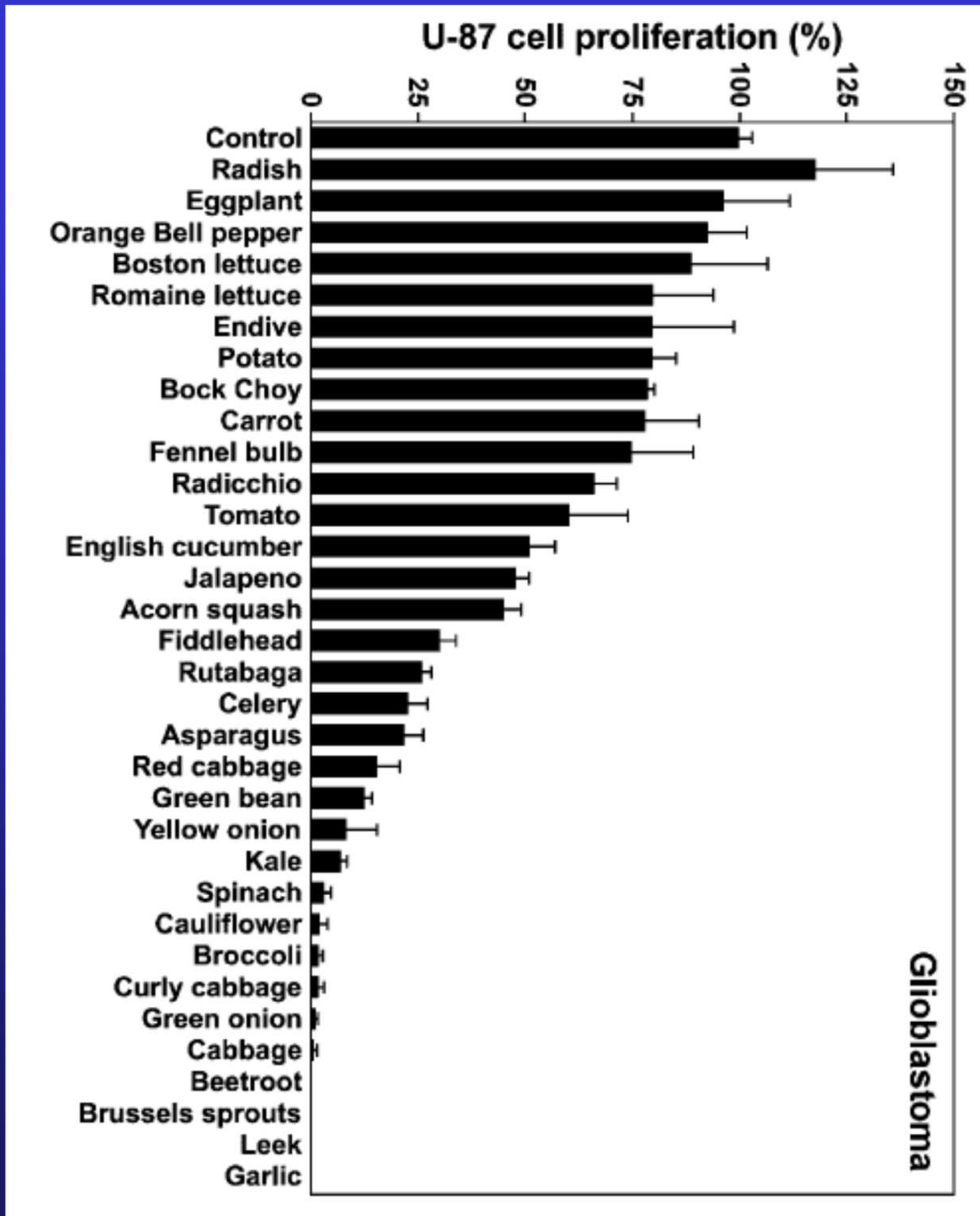
Brain Cancer (Medulloblastoma)



D Boivin Food Chemistry 2009:112:374-80

SCG 2012

Brain Cancer (Glioblastoma)



SCG 2012

D Boivin Food Chemistry 2009:112:374-80

Antiproliferative Effect of Vegetables

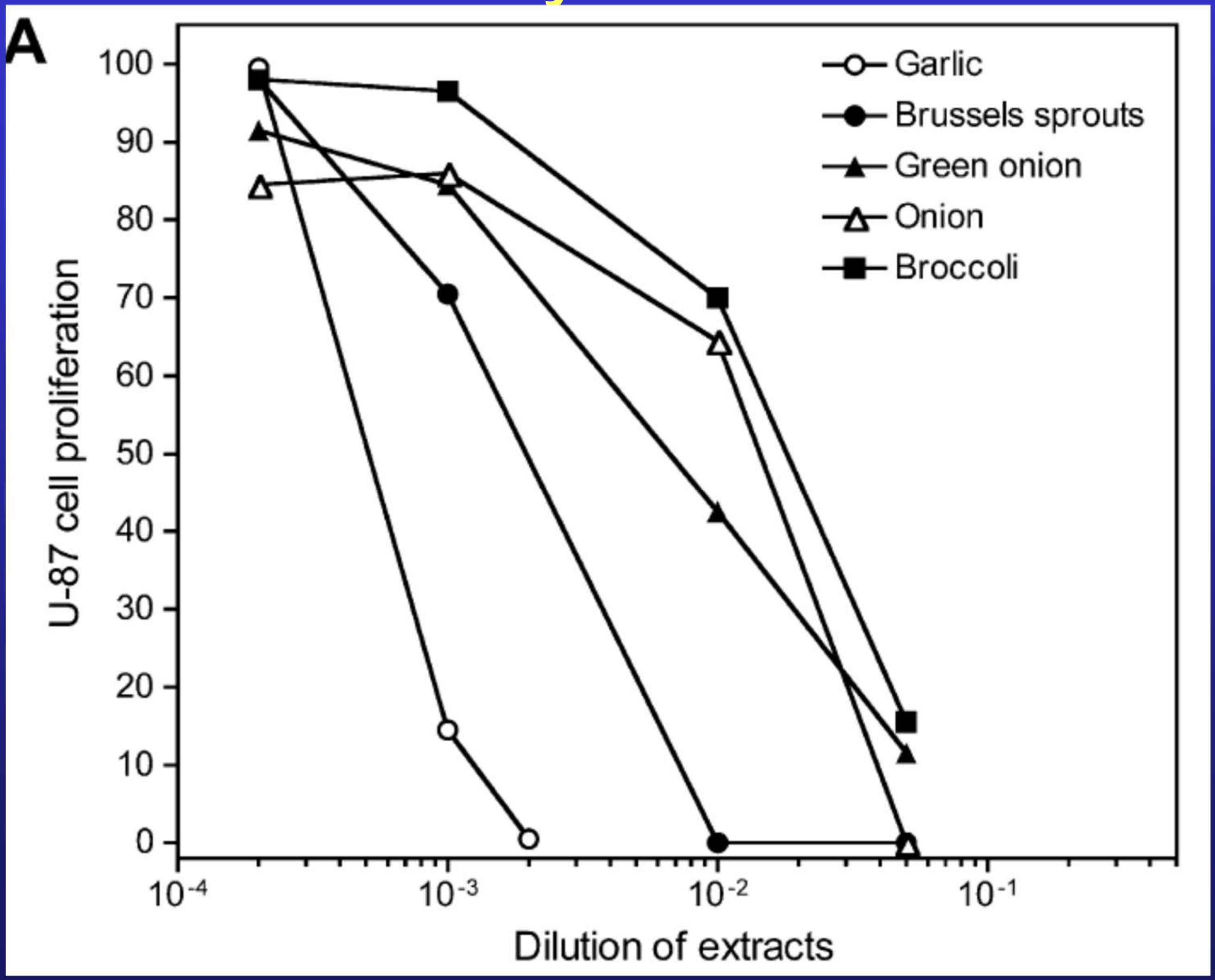
Little	Intermediate	High	Very High
50% on < 2	**50% on 2-4**	**50% on >= 4**	**>=50 on all lines**
Acorn squash	Celery	Asparagus	Brussel sprouts
Bok choy	Eggplant	Beetroot	Cabbage
Boston lettuce		Broccoli	Curly cabbage
Carrot		Cauliflower	Garlic
Endive		Fiddlehead	Green onion
English cucumber		Green bean	Kale
Fennel bulb		Radish	Leek
Jalapeno		Red cabbage	Spinach
Orange sweet pepper		Rutabaga	
Potato		Yellow onion	
Radicchio			
Romaine lettuce			
Tomato			

Cell lines: Stomach, Pancreas, Breast, Prostate, Lung, Kidney, Medulloblastoma, Glioblastoma

SCG 2012

D Boivin 2009:112:374-80

Antiproliferative activities of vegetables
Potency of inhibition



SCG 2012

Glioblastoma cell line

D Boivin Food Chemistry 2009:112:374-80

Antiproliferative & antioxidant activities of common vegetables: Discussion & Conclusions

- While governments recommend at least 5 servings of ‘fruit & vegetables’ per day as a way to reduce cancer & chronic diseases, this study shows that increased consumption of **specific** foods with the highest phytochemical content must also be strongly encouraged.
- Potato, carrots, tomatoes, and leaf lettuces which account for 60% of US total per capita vegetable intake **lack** a significant cancer inhibitory effect.
- A diversified diet (with several different classes of vegetables) is essential for the effective prevention of cancer.
- A number of **cruciferous vegetables** (**kale**, brussels sprouts, broccoli, cabbage) and **Allium vegetables** (**garlic**, leek, green onions, yellow onion) possess very potent inhibitory activities against all tested cell lines.

D Boivin Food Chemistry 2009:112:374-80

Conclusions: Diet & Cancer

1) Red meat consumption correlates with total, CVD and cancer mortality.
2) Real world experience has shown that a national public health based intervention can reduce mortality from all causes, cardiac and malignancy by over 60 % over the course of 30 years.
3) Observational studies have shown that
    1) Cancer incidence rates: Omnivores > Vegetarians > Vegans
    2) Intake of variety of fruits and vegetables associated with lower rates of many cancers
    3) Adolescent fruit and vegetable intake may predict future risk of breast cancer.
4) Randomized controlled trials have shown:
    1) Increase of 1.1 portions (F+V)/day gives 9% decrease in breast CA (NS) and 17% decrease in ovarian CA (Sig)
    2) High vegetable diet after the diagnosis of breast cancer is ineffective
    3) Flaxseed
        1) Breast cancer decreased proliferation & increased apoptosis
        2) Prostate cancer decreases PSA
5) In vitro it appears some vegetables have potent anti-cancer effects (similar results from case-control human studies)

My Lifestyle Then & Now

Then

Breakfast

- Bran flakes + granola + milk

Lunch

- Sandwich +/- veggies + diet coke

Suppers

- Spaghetti Bolognese +/- salad
- Chicken curry, rice, dal

Now

Breakfast

- Oats + Chia + blueberries + flax

Lunch

- Kale salad + nuts

Suppers

- Veggie stir fry (Mediterranean, Asian, Indian) w garlic/ginger
- Rice/quinoa, dal/beans

Exercise: Minimal => 2-3 hrs per week

Food As Prevention

Avoiding chronic disease through a healthy diet

HOME START HERE ⌄ RESOURCES ⌄ VIDEOS ETC ⌄ ABOUT ⌄

Welcome to 'Food as Prevention'

Welcome to the Food as Prevention website !

This website is maintained by a Canadian physician who is a gastroenterologist (specialist in diseases of the intestines) with the aim of connecting members of the public with information on a healthier diet to lower mortality and the risk of developing diseases such as heart attacks, strokes, adult-onset (type 2) diabetes, and cancer.

I have a masters degree in health research methodology and have tried to make the information in this site as evidence-based as possible. Fortunately, the peer-reviewed medical literature has a lot of information on the role of food in preventing disease.

The site is divided into an 'evidence' section that guides you through evidence about the healthiest diet and an 'application' section to help you make changes to your diet and lifestyle.

This site is aimed at several audiences:

1. **Members of the general public** who are looking for credible information on the healthiest diet. I


MICHAEL GREGER, M.D.
DAILY DOZEN
NOT
DIE
1. BEANS
2. BERRIES
3. OTHER FRUITS
4. CRUCIFEROUS VEGETABLES
5. GREENS
6. OTHER VEGETABLES
7. FLAXSEEDS
8. NUTS
9. SPICES
10. WHOLE GRAINS
11. BEVERAGES
5 SERVINGS
12. EXERCISE
INFOGRAPHIC created by Modern Vegan Family based on healthy diet recommendations by Dr. Michael Greger's DAILY DOZEN,
suggested daily servings and New York Times Bestselling Book, "How Not to Die". www.nutritionfacts.org

SCG 2017

www.foodasprevention.com

- Newsletter

4leafsurvey.com

DVD: Forks Over Knives

Book How Not to Die - Greger

Food as Medicine Elective

FoodAsPrevention.com/student

Questions