Nutritional Guidelines Update for Dyslipidemia Management and CVD Prevention: Which Dietary Pattern should I Choose?

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Objectives

1. Review 2013ACC/AHA nutrition/lifestyle management guidelines.
2. Summarize the role of dietary cholesterol in dyslipidemia and CVD.
3. Examine evidence in support of cardio-protective dietary patterns.
4. Describe components and mechanisms of cardio-protective dietary patterns.

2

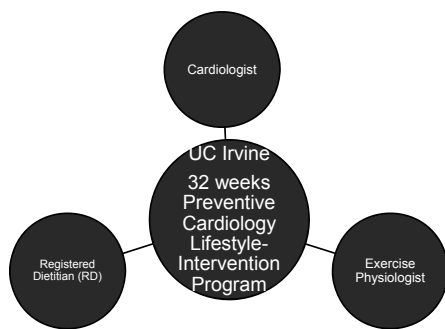## Disclosures

• Nothing to disclose

3

**Executive Summary: Heart Disease and Stroke
Statistics—2015 Update
A Report From the American Heart Association.**

- By 2030, 43.9% of the US population is projected to have some form of CVD.

Mozaffarian D, Benjamin EJ, Go AS, Arnett DK, Blaha MJ et al.
Circulation 2015;131(4):434-41

4

**UC Irvine Preventive Cardiology Lifestyle
Management Program**

Cardiologist

UC Irvine
32 weeks
Preventive
Cardiology
Lifestyle-
Intervention
Program

Registered
Dietitian (RD)

Exercise
Physiologist

**2013 AHA/ACC Guideline on Lifestyle Management to
Reduce CVD Risk**

Summary of Recommendations for Lifestyle Management	
LDL–C - Advise adults who would benefit from LDL–C lowering to:	Evidence

1. Consume a dietary pattern that emphasizes intake of vegetables, fruits, and whole grains; includes low-fat dairy products, poultry, fish, legumes, non-tropical vegetable oils and nuts; and limits intake of sweets, sugar-sweetened beverages and red meats.
  a. Adapt this dietary pattern to appropriate calorie requirements, personal and cultural food preferences, and nutrition therapy for other medical conditions (including diabetes mellitus).
  b. *Achieve this pattern by following plans such as the DASH dietary pattern, the USDA Food Pattern, or the AHA Diet.*
  c. *Consider referral to a registered dietitian nutritionist (RDN)*
	A (Strong)

2. Aim for a dietary pattern that achieves 5% to 6% of calories from saturated fat.	A (Strong)
3. Reduce percent of calories from saturated fat.	A (Strong)
4. Reduce percent of calories from *trans fat.*	A (Strong)

Eckel et al. Circulation. November 12 2013

Classification of Recommendations and Levels of Evidence

SIZE OF TREATMENT EFFECT

	CLASS I Benefit >>> Risk Procedure/Treatment SHOULD be performed/administered	CLASS IIa Benefit >> Risk Additional studies with focused objectives needed IT IS REASONABLE to per-form procedure/administer treatment	CLASS IIb Benefit ≥ Risk Additional studies with broad objectives needed; additional registry data would be helpful Procedure/Treatment MAY BE CONSIDERED	CLASS III No Benefit or CLASS III Harm
LEVEL A Multiple populations evaluated* Data derived from multiple randomized clinical trials or meta-analyses	■ Recommendation that procedure or treatment is useful/effective ■ Sufficient evidence from multiple randomized trials or meta-analyses	■ Recommendation in favor of treatment or procedure being useful/effective ■ Some conflicting evidence from multiple randomized trials or meta-analyses	■ Recommendation's usefulness/efficacy less well established ■ Greater conflicting evidence from multiple randomized trials or meta-analyses	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Sufficient evidence from multiple randomized trials or meta-analyses
LEVEL B Limited populations evaluated* Data derived from a single randomized trial or nonrandomized studies	■ Recommendation that procedure or treatment is useful/effective ■ Evidence from single randomized trial or nonrandomized studies	■ Recommendation in favor of treatment or procedure being useful/effective ■ Some conflicting evidence from single randomized trial or nonrandomized studies	■ Recommendation's usefulness/efficacy less well established ■ Greater conflicting evidence from single randomized trial or nonrandomized studies	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Evidence from single randomized trial or nonrandomized studies
LEVEL C Very limited populations evaluated* Only consensus opinion of experts, case studies, or standard of care	■ Recommendation that procedure or treatment is useful/effective ■ Only expert opinion, case studies, or standard of care	■ Recommendation in favor of treatment or procedure being useful/effective ■ Only diverging expert opinion, case studies, or standard of care	■ Recommendation's usefulness/efficacy less well established ■ Only diverging expert opinion, case studies, or standard of care	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Only expert opinion, case studies, or standard of care
Suggested phrases for writing recommendations	should is recommended is indicated is useful/effective/beneficial	is reasonable can be useful/effective/beneficial is probably recommended or indicated	may/might be considered may/might be reasonable usefulness/effectiveness is unknown/unclear/uncertain or not well established	COR III: No Benefit / COR III: Harm is not recommended / potentially harmful is not indicated / causes harm should not be performed/administered/other / associated with excess morbid-ity/mortality is not useful/beneficial/effective / should not be performed/administered/other
Comparative effectiveness phrases†	treatment/strategy A is recommended/indicated in preference to treatment B treatment A should be chosen over treatment B	treatment/strategy A is probably recommended/indicated in preference to treatment B it is reasonable to choose treatment A over treatment B		

A recommendation with Level of Evidence B or C does not imply that the recommendation is weak. Many important clinical questions addressed in the guidelines do not lend themselves to clinical trials. Although randomized trials are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

†

Table 10 Controlled Feeding Trials (Adults)
2013 ACC/AHA Lifestyle Mgnt Guidelines
ES 11: Saturated Fat

- Dietary Pattern (food supplied): 5%–6% saturated fat, 26%–27% total fat,15%–18% protein, 55%–59% carbohydrate

  versus

  Control diet: 14%–15% saturated fat, 34%–38% total fat, 13%–15% protein, 48%–51% carbohydrate
- Results: LDL-C lowered 11–13 mg/dL in 2 studies and 11% in another study.

  Strength of Evidence: High

8

ES12
Saturated Fat replaced by Carb, MUFA, PUFA
Controlled Feeding Trials (Adults)

Every1% of energy from SFA replaced by 1% of energy from Carb, MUFA, or PUFA:
- LDL-C lowered:1.2, 1.3, and 1.8 mg/dL respectively.
- HDL-C lowered: 0.4, 1.2, and 0.2 mg/dL respectively.

Every 1% of energy from SFA replaced by 1% of energy from:
- Carb and MUFA:TG raised1.9 and 0.2 mg/dL respectively.
- PUFA: TG lowered 0.4 mg/dL.

Strength of Evidence: Moderate 9

ES13. Carbohydrate
Controlled Feeding Trials (Adults)

Every 1% of energy from carb replaced by 1% of energy from:

- MUFA: LDL-C lowered 0.3 mg/dL, HDL-C raised 0.3 mg/dL, TG lowered 1.7 mg/dL.

- PUFA: LDL-C lowered 0.7 mg/dL, HDL-C raised 0.2 mg/dL, TG lowered 2.3 mg/dL.

Strength of Evidence: Moderate

10

ES14. Trans Fat
Controlled Feeding Trials (Adults)

Every 1% of energy from trans fat replaced by 1% of energy from:
- MUFA or PUFA:
  LDL-C lowered: 1.5 mg/dL and 2.0 mg/dL, respectively.

- SFA, MUFA, or PUFA:
  HDL-C increased: 0.5, 0.4, and 0.5 mg/dL, respectively.

- MUFA or PUFA:
  TG decreased: 1.2 and 1.3 mg/dL.

Strength of Evidence: Moderate

11

ES15.Trans Fat
Controlled Feeding Trials (Adults)

Every 1% of energy from trans fat replaced by 1% of energy from Carbohydrate

- Decreased LDL-C: 1.5 mg/dL
- No effect on HDL-C and TG

Strength of Evidence: Moderate

12

Change in LDL-C with Different Dietary Fats Substituted for CHO
Micha et al Lipids , 2010
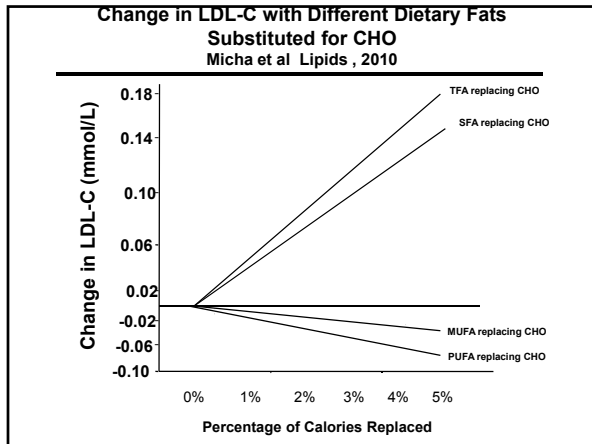
ES16.Dietary Cholesterol

• There is insufficient evidence to determine whether lowering dietary cholesterol intake reduces LDL-C.

  Strength of Evidence: Insufficient

• The ACC/AHA committee cited two meta-analyses in concluding that there was insufficient evidence to make a recommendation regarding dietary cholesterol.

14

NLA Panel 1 Recommendations
Model of Steps in Lifestyle Therapies
J Clin Lipid Sept 15, 2014

15
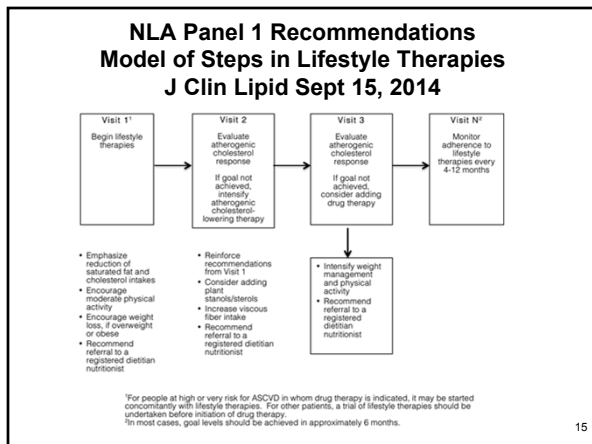
Dietary Cholesterol Intake

- Observational studies suggest no association between cholesterol intake and CHD or CVD risk within the range of typically consumed values. Kanter MN et al. Adv. Nutr 2012.

- Persons with Diabetes: higher cholesterol intake associated with increased CHD/CVD risk for reasons not well understood. (Hu JAMA 1999, Qureshi Med Sci Monit 2007)

16

Does dietary chol increase LDL-C?
Hopkins Meta-analysis 1992 Am J Clin Nutr

- A large egg=210 mg chol
- Unsaturated fat 3 g Saturated fat 2 g
- 200 mg/day dietary chol could raise LDL-C level by 4 mg/dL
- Some people: little or no increase and others a larger increase (8 mg/dL)
- Unfortunately, no clinical tools to identify hyper- and hypo-responders.

17

Dietary Cholesterol Challenges
Hyper-responders

Increased LDL-C and HDL-C (25% of the population): children (Ballesteros Am J Clin Nutr. 2004)
- Young adults (Herron Metabolism. 2004)
- Elderly (Greene J Nutr. 2005)

Some groups: only HDL-C increased, not LDL-C:
- Weight loss interventions (Harman Eur J Nutr. 2008; Mutungi Nutr. 2008) (low cal, low carb, low SFA intake)
- Intake of only 1 egg per day (Ata FASEB J 2010).

18

NLA Expert Panel II
Nutrition Recommendations Expert Work Group

- Julie Bolick, MS, RDN, CLS
- Carol Kirkpatrick,PhD, RDN, CLS
- Penny Kris-Etherton,PhD, RDN, CLS
- Kathy Rhodes, PhD, RDN
- Nancy Smith, MS, RDN, CDE, CLS
- Geeta Sikand, MA,RDN,CDE, CLS

19

NLA: Three Cholesterol Questions

1. Does consumption of dietary cholesterol increase LDL-C in dyslipidemic patients? Is this population different than normolipidemic patients?
2. What should be the recommendations for those on a therapeutic diet intended to lower levels of atherogenic cholesterol with regard to cholesterol intake and egg consumption?
3. Is there a sub-group of individuals that are sensitive to dietary cholesterol intake that leads to an increase in LDL-C and CVD risk?

20

Advise adults who would benefit from BP lowering* to:

I	IIa	IIb	III
A			

Consume a dietary pattern with emphasis on vegetables, fruits, whole grains; include low-fat dairy products, poultry, fish, legumes, nontropical vegetable oils and nuts; and limits intake of sweets, sugar-sweetened beverages, and red meats.

  – Adapt to appropriate calorie requirements, personal and cultural food preferences, and nutrition therapy for co-morbidities e.g. diabetes.
  – Choose DASH dietary pattern, or the USDA Food Pattern, or the AHA Diet.
  – Refer to a registered dietitian nutritionist (RDN) to personalize patients' nutrition needs.

BP: Advise adults who would benefit from BP lowering to: (cont.)

I IIa IIb III
A

Lower sodium intake.
Combine DASH with lower sodium intake.

I IIa IIb III
B

- Consume no more than 2,400 mg of sodium/day.
- Further reduction of sodium intake to 1,500 mg/day leads to greater BP reduction.
- Just reducing sodium intake by at least 1,000 mg/day lowers BP.

Weight Reduction: Best Meal Plan?

- **"A variety of dietary approaches can produce weight loss in overweight and obese adults…if reduction in dietary energy intake is achieved."**
  - Low fat
  - Higher protein
  - Low carbohydrate (30 g to 130 g)
  - Adopting new dietary patterns such as DASH, Mediterranean or Vegetarian
  - At least 14 visits over 6 months with a Registered Dietitian Nutritionist (RDN) for behavior modification and personalized meal planning.

  Jensen et al. 2013 ACC/AHA/TOS Guideline for the Management of Overweight and Obesity in Adults

Which Dietary Patterns are Effective for CVD Risk Reduction & lowering LDL-C?
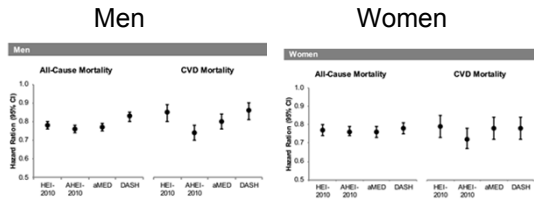
Evidence Supports
- DASH
- Healthy Eating Index (HEI) (USDA diet)
- Alternative Healthy Eating Index (AHEI) (AHA diet)
- Mediterranean

Conclusion: All whole foods dietary patterns are effective.
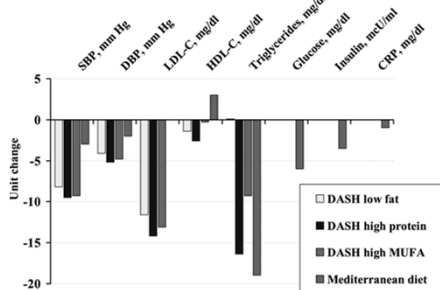
Reedy et al. J Nutr. 2014

24

Evidence among men(n=242,321) and women (n=182,342)

Men   Women

Multivariate HRs and 95%CIs for all cause mortality and CVD,
comparing highest (Q5) to lowest quintile index scores(Q1) for
the HEI-2010, AHEI-2010, aMED, and DASH Score

Reedy et al. J Nutr. 2014

Effects of Dietary Patterns on CVD risk factors in Randomized Controlled trials.

Mozaffarian D et al. Circulation.
2011;123:2870-2891

DASH Dietary Pattern

- Meta-analysis CVD Risk Reduction
  - Reduced CVDs (RR = 0.80; 95% CI, 0.74-0.86; P < 0.001), CHD (RR = 0.79; 95% CI, 0.71-0.88; P < 0.001), stroke (RR = 0.81, 95% CI, 0.72-0.92; P < 0.001) & HF (RR= 0.71, 95% CI, 0.58-0.88; P < 0.001) risk.
  - A linear and negative association obtained between DASH-style diet concordance and all CVD end points.
    - *Salehi-Abargouei et al. Nutrition. 2013*
- Effects on Lipids
  - RCT lowered LDL-C (-10.7 mg/dL), and HDL- C (-3.7 mg/dL) (all P < 0.0001), no significant effects on TG.
   - *Obarzanek E et al., Am J Clin Nutr. 2001*

DASH Dietary Pattern

– ↑ vegetables, fruits, low-fat dairy products, whole grains, poultry, fish, and nuts

– ↑ potassium, magnesium, calcium, protein & fiber

– ↓ sweets, sugar-sweetened beverages & red meats

– ↓ refined carbs, saturated fat & total fat

– Strength of evidence (High)
  • "**. . . the DASH dietary pattern lowered LDL–C by 11 mg/dL, lowered HDL–C by 4 mg/dL, no effect on TG & BP was lowered 5-6/3 mm Hg"**
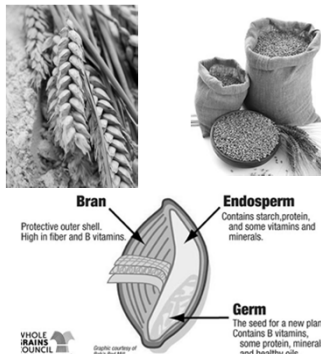
AHA/ACC Lifestyle Management Guidelines
Strength of Evidence: High

28

Low Glycemic Load CHO's

• Legumes
  – Chickpeas, lentils, split peas
• Beans

Chickpeas (canned)
Yellow split peas
Green split peas
Lima beans (canned)
Brown lentils
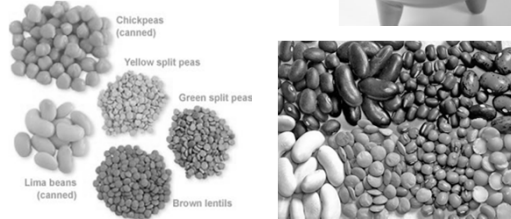
Whole Grains
Low Glycemic Load Carbs

– Bulgar,
– Brown/wild rice,
– barley
– Quinoa
– Whole oats
– Whole rye

Bran
Protective outer shell. High in fiber and B vitamins.

Endosperm
Contains starch, protein, and some vitamins and minerals.

Germ
The seed for a new plan Contains B vitamins, some protein, mineral and healthy oils.
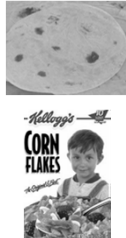
WHOLE GRAINS COUNCIL
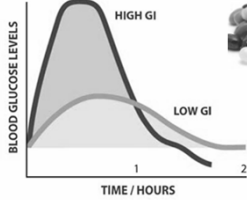
Low Glycemic Load Carbs

- Vegetables
- (many) Whole Fruits

Glycemic Load leads to Insulin Resistance and Inflammation

Low Glycemic Load Carbs

- Decrease inflammation
  - ↓ CRP, Fibrinogen, other inflammatory markers
- Less Insulin resistance
  - ↓ FBS, HbA1c
- Improved Lipid profiles
  - ↓ TG's, ↑ HDL

- ↓ CAD risk 20-30%
- ↓ Progression to DM,
- ↓ Associated cancer: prostate, breast, colorectal
- High Fiber ➔ promote satiety

Plant-based Foods contain Polyphenols
>8,000 Flavonoids

6 classes
- Flavan-3-ols
- Flavonones
- Flavones
- Isoflavones
- Flavonols
- Anthocyanins

34

Dietary Flavonoids,CVD Mortality & CVD Risk
Inverse Relationship

Toh et al. Current Atherosclerosis Reports 2013

- Epi studies: Zutphen Elderly Study, Iowa Womens' Health Study, Kupio Ischemic Heart Disease Risk Factor Study: inverse relationship.

- Three cohort studies: Nurses Health Study 1 and II, Health Professionals Follow up Study: 8 % reduction in HTN risk.

- Meta-analysis (184 intervention trials): improved acute and chronic flow mediated dilation (FMD) & lowered BP (Kay et al. 2012) 35
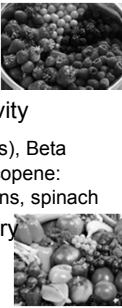

Mechanisms of Flavonoids

- Reduce oxidative stress: up-regulate antioxidant enzymes to prevent cholesterol ester accumulation with macrophages
- Anti-inflammatory: inhibit platelet adhesion, secretion and aggregation
- Prevent thrombus formation
- Improve Endothelium funx: inhibit enzyme that reduces Nitric Oxide (vasodilator)
- Improve lipids, BP & glucose metabolism

Phytochemicals: Veg & Fruits

- Anthocyanins Red and blue berries, grapes, peppers, cherries, wine
  - Highest measured antioxidant activity
- Carotenoids Alpha (carrots, red peppers), Beta (apricots, cantaloupe, sweet pot, chard, Lycopene: tomatoes, watermelon, Lutein: apples, greens, spinach
  - Immunity, anti-CA, anti-inflammatory
  - Lycopene: Potent antioxidant
  - ↓ risk MI 48% Men
  - 2 servings/wk (1/2 c) ↓ Prostate CA 28%

Phytochemicals: Veg & Fruits

- Flavonoids Artichokes, asparagus, green tea, apples
  - ↓ LDL, ↓ BP, ↑ endothelial vasodilation
  - Free radical scavengers, anti-inflammatory, ↓ plt aggreg
- Indoles, Isothiocyanates (Cruciferous veg: broccoli, kale, brussel sprouts, cauliflower
  - 1 cup cruciferous veg/day → 40% ↓ Breast CA
  - 3 servings /wk → 40% ↓ Prostate CA
  - Also ↓ Lung, stomach, Colo-rectal CA

Avocado Study:45 overweight or obese adults

- A cardio-protective moderate fat diet including one avocado a day achieved a more favorable lipid/lipoprotein profile compared to a similar high MUFA diet (without avocado) and also compared to a lower fat diet:
  - o Greater reduction in LDL-C
  - o Greater reduction in non-HDL-C
  - o Greater reduction in apoB
  - o Greater reduction in small dense LDL

- Bioactives in avocados importantly contribute to the more favorable effects on CVD risk factors beyond the impact of MUFA in a moderate fat diet.

Wang et al J Am Heart Assoc January 27, 2015

39

Avocado Study
Wang et al J Am Heart Assoc January 27, 2015

Plant Sterols: 103mg   **Folate:** 121 mcg

Fiber: 9g
Viscous fiber: 3g

Potassium: 690mg

MUFA/Oleic acid: 13g

Polyphenols: 260mg
Catechin, epicatechin
polyphenol oxidase
Persenone A & B, etc.

Antioxidants

avenasterol Carotenoid	19mg
β -carotene	86mcg
α- carotene	33mcg
Lutein + zeaxanthin	369mcg
Vitamin C	12mg
α-tocopherol	2.68mg
Coenzyme Q_{10}	1.4mg
glutathione	8.5 mg

One Avocado (HASS variety):
Calories: 227
: 0
SFA: 3g

D-mannoheptulose: 1g

Choline: Emerging Research

- Required: structural integrity, neurotransmission and lipids transport.
- Protective CV effects and breast cancer prevention (Cassidy Radiographics. 2009)
- Excellent-to-good sources (animal origin): eggs, liver, beef, chicken, fish, pork.
- Good sources: Broccoli, brussel sprouts, soybeans

Patterson. USDA Database for Choline Content of Common Foods.2008.

41

A statin a day keeps the doctor away: Comparative Proverb Assessment Modeling study.

- Conclusion: "Offering a daily statin to 17.6 million more adults would reduce the annual number of vascular deaths by 9,400, but offering a daily apple to 70% of the total UK population aged over 50 years (22 million people) would avert 8,500 vascular deaths without any statin side effects."

Briggs A et al. BMJ 2013

Conclusion
Focus of the Guidelines

- Whole food dietary patterns: fruits, vegetables, whole grains, fish, nuts, seeds, legumes, low-fat dairy and lean protein
- Achieve optimal body weight.
- Reduce: sodium, added sugar, saturated fat.
- For most people: lowering saturated fat intake will also reduce cholesterol intake, since these dietary components cohabitate in meat and dairy products.
- Refer to a Nutritional Professional.

43

Take Home Message

- Whole food dietary patterns have more direct evidence for cardio-protective effects e.g. DASH, Mediterranean, USDA, AHA.

- Dietary Recommendations as numerical scientific language e.g. 300 mg/day dietary cholesterol confuse consumers, leads to strict exclusion of certain foods (e.g. eggs and sea food).

- Dietary recommendations should be based on tangible directives e.g. eat a rainbow every day, increase fruits and vegetables to 5 a day, eat two servings of fish (prefer fatty fish) per week, choose non-tropical oils etc.[44]

Thank you