Agenda & Learning Objectives

1. Attendees will gain a clear understanding of the prevalence and management of pediatric hyperlipidemia.
2. Attendees will be up to date on current research regarding fats and cardiovascular disease risk.
3. Attendees will be able to deliver confidently appropriate nutrition education goals specific to pediatric lipid abnormality.

2

Prevalence of and Trends in Dyslipidemia and Blood Pressure Among US Children and Adolescents, 1999-2012

- **20% of youths** have ≥ 1 abnormal lipid value.[1]
- **11.0% of youths** have high or borderline blood pressure.[1]
- **32% of children** are overweight or obese; 17% are obese.[2]
  - Obese children are 3 times as likely to have abnormal lipids
- **Only 27% of US high school students** meet the American Heart Association exercise recommendations of 60 minutes per day. [2]

1. Kit, Brian K., et al. "Prevalence of and trends in dyslipidemia and blood pressure among US children and adolescents, 1999-2012." JAMA pediatrics169.3 (2015): 272-279.
2. Mozaffarian D, Benjamin EJ, Go AS, Arnett DK, et. al., on behalf of the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2016 update: a report from the American Heart Association [published online ahead of print December 16, 2015]. Circulation. doi: 10.1161/CIR.0000000000000350.

3

High Cholesterol and Blood Pressure Contributes to Cardiovascular Disease Across the Lifespan

Autopsy studies show atherosclerosis can begin during childhood and adolescence

- PDAY: Cholesterol, BMI, and blood pressure levels correlate with the presence of atherosclerosis.[1]
- Bogalusa: Increasing risk factor levels are associated with greater fibrous plaque area.[2]

1. McGill HC Jr et al Circulation 2000; 102:374-379
2. NEJM 1998; 338: 1650-6

4

Carotid IMT is Related to Cardiovascular Risk Factors [1]

- Higher carotid IMT is related to cardiovascular risk factors measured from childhood through middle age.
- Significant current predictors of IMT were age and LDL cholesterol.

1. Davis, Patricia H., et al. "Carotid intimal-medial thickness is related to cardiovascular risk factors measured from childhood through middle age the muscatine Study." Circulation 104.23 (2001): 2815-2819.

5

The Lipid Profile

Total = LDL + HDL + VLDL*

Chol Lousy Healthy TG/5

160 = 95 + 55 + 10

*Triglycerides/divided by 5 = VLDL

TC/HDL ratio <4.0

6

Hypertriglyceridemia

- Affects 5-15% of general pediatric population
  - Up to 32% of obese patients[1,2]
- Primary risk: PANCREATITIS
  - Substantially higher risk when TGs >1000 mg/dL
  - Risk not always directly dose related
  - TGs certainly indicate disordered lipid metabolism & likely insulin resistance

1. Can M, Piskin E, Guven B, Acikgoz S and Mungan G. Evaluation of serum lipid levels in children. Pediatr Cardiol. 2013;34:566–9.
2. Hickman TB, Briefel RR, Carroll MD, Rifkind BM, Cleeman JI and Maurer KR. Distributions and trends of serum lipid levels among United States children and adolescents ages 4–19 years: data from the Third National Health and Nutrition Examination Survey. Prev Med. 1998;27:879-90.

7

Low HDL[1]

- Normal/higher HDL strongly correlated with lower rates of heart disease
  - Causes efflux of cholesterol from cells = limits plaque growth
- Low HDL:
  - Can be familial
    - **75% of variability is genetically determined**
  - Often onsets during puberty, particularly in males
  - Elevated weight and low physical activity levels are important determinants
  - Can be caused or exaggerated by smoke exposure

1. Ferranti, S. D. d., Steinberger, J., Ameduri, R., Baker, A., Gooding, H., Kelly, A. S., . . . Zaidi, A. N. (2019). Cardiovascular Risk Reduction in High-Risk Pediatric Patients: A Scientific Statement From the American Heart Association. Circulation, 139(13), e603-e634.

8

It's Not Just About Weight…

Among US adolescents 12-19 years old:

- **56% of kids** with any CVD risk factor are normal weight
- **54% of kids** with high/borderline high LDL are normal weight
- **35% of kids** with low HDL-C are normal weight[1]

1. May, Ashleigh, Elena, Kiklina et al "Preventive of CVD risk factors among US adolescents. Pediatrics 129.6 (2012): 1035-1041.

9

Screening Children to Identify Lipid Disorders and Reduce Future Heart Disease

Pediatric Screening and Treatment Recommendations [1,2]

- **Universal lipid** screening for ALL children between 9-11 years old and again between 17-21 years old.
- **Treatment begins** with lifestyle modification.
- **Statins are indicated** for children who are not responsive to lifestyle therapy starting at age 8 years old
- **3 lifestyle visits** with dietitian generally recommended

1. Expert Panel on Integrated Guidelines for Cardiovascular H, Risk Reduction in C, Adolescents, National Heart L, Blood I. Expert panel on integrated guidelines for cardiovascular health and risk reduction in children and adolescents: summary report. Pediatrics. 2011;128 Suppl 5:S213-256.
2. Ferranti, S. D. d., Steinberger, J., Ameduri, R., Baker, A., Gooding, H., Kelly, A. S., . . . Zaidi, A. N. (2019). Cardiovascular Risk Reduction in High-Risk Pediatric Patients: A Scientific Statement From the American Heart Association. Circulation, 139(13), e603-e634.

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When to Consider Statins[1]

Consider statins at ≥ 10 years IF despite 6 months of lifestyle counseling

- LDL ≥ 190 mg/dL
- LDL ≥ 160 mg/dL and
  - family history of early coronary disease OR two or more moderate risk factors, OR one high-level risk factor

LDL ≥ 130 mg/dL and

- 2 high level Risk factors OR 1 high level and 2 moderate level Risk factors

1. Ferranti, S. D. d., Steinberger, J., Ameduri, R., Baker, A., Gooding, H., Kelly, A. S., . . . Zaidi, A. N. (2019). Cardiovascular Risk Reduction in High-Risk Pediatric Patients: A Scientific Statement From the American Heart Association. Circulation, 139(13), e603-e634.

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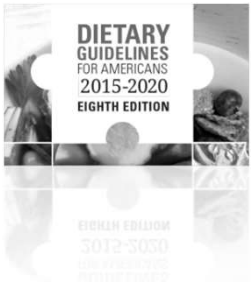
An Update on Fats

2015 Dietary Guidelines Advisory Committee Key Recommendations[1]

- "<10% of calories from saturated fats"
- "Saturated fats should be replaced with unsaturated fat, particularly polyunsaturated fat"
- 2015 DGAC did not list total fat as a nutrient of concern nor did they place an upper limit on total fat consumption



1. Scientific Report of the 2015 Dietary Guidelines Advisory Committee: Advisory Report to the Sec. of HHS and the Sec. of Agriculture. USDA Research Service, Washington, DC.

14

2015 Dietary Guidelines Advisory Committee Key Recommendations[1]

- Strong and consistent evidence from RCTs and prospective cohort studies show that replacing SFA with PUFA reduces total and LDL-C and the risk of CVD events and coronary mortality
- Reducing SFA with CHO reduced total and LDL-C but increases TG and reduces HDL-C

1. Scientific Report of the 2015 Dietary Guidelines Advisory Committee: Advisory Report to the Sec. of HHS and the Sec. of Agriculture. USDA Research Service, Washington, DC.

15

Chowdhury, et. al.[1]

- Their goal was to summarize evidence about associations between fats, acids and coronary disease
  - **49** observational studies, 27 RCTs
  - **600,000** participants in 18 countries
  - **Measures of fatty acid biomarkers**, food frequency and diet history questionnaires to assess fatty acid exposure
- "No evidence supporting the longstanding recommendation to limit saturated fat consumption"

1. Original article: Chowdhury, Rajiv, et al. "Association of dietary, circulating, and supplement fatty acids with coronary risks systematic review and meta-analysis." Annals of internal medicine 160.6 (2014): 398-406.

16

SO, **IS** BUTTER REALLY BACK?

"Butter is not back. Long term health will be better with olive oils (sorry Julia)."

–Walter Willett

17

Research Can Be Misleading

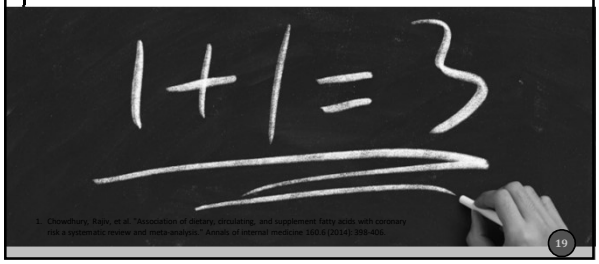
- Association of Dietary, Circulating, and Supplement Fatty Acids With Coronary Risk: A Systematic Review and Meta-analysis
  - "No link between saturated fat and cardiovascular disease."
  - "This paper is bound to cause confusion. A central issue is what replaces saturated fat if someone reduces the amount of saturated fat in their diet. If it is replaced with refined starch or sugar, which are the largest sources of calories in the U.S. diet, then the risk of heart disease remains the same. However, if saturated fat is replaced with polyunsaturated fat or monounsaturated fat in the form of olive oil, nuts and probably other plant oils, we have much evidence that risk will be reduced."
- Walter Willett, chair of the Department of Nutrition at Harvard School of Public Health[1]

https://www.hsph.harvard.edu/nutritionsource/2014/03/19/dietary-fat-and-heart-disease-study-is-seriously-misleading

18

Problems with Chowdhury, et. al. [1]

- Gross errors in data abstraction from original papers
- Omitted important studies, especially on PUFA (Omega 3s and Omega 6s)
- Lack of specific comparisons and failure to acknowledge this, which led to misrepresented findings (eg, did not replace SFA with PUFA)
- Failed to acknowledge other summaries based on primary data with different conclusions



1. Chowdhury, Rajiv, et al. "Association of dietary, circulating, and supplement fatty acids with coronary risk a systematic review and meta-analysis." Annals of internal medicine 160.6 (2014): 398-406.

19

Problems with Chowdhury, et. al.[1]

A central issue is what replaces saturated fat if someone reduces the amount of saturated fat in their diet.

- If it is replaced with refined starch or sugar, which are the largest sources of calories in the U.S. diet, then the risk of heart disease remains the same.
- However, if saturated fat is replaced with polyunsaturated fat or monounsaturated fat in the form of olive oil, nuts and probably other plant oils, we have overwhelming evidence that states the risk will be reduced.

1. Chowdhury, Rajiv, et al. "Association of dietary, circulating, and supplement fatty acids with coronary riska systematic review and meta-analysis." Annals of internal medicine 160.6 (2014): 398-406.

20

"All the Chowdhury meta-analysis showed is that if you look over time in the United States, we had a very high rate of heart disease when our saturated fat intake was a bit higher, and we have the same very high rate of heart disease now that our intake of saturated fat is a little bit lower. There are two important points here: one, our intake of saturated fat is only a bit lower; and two, we've replaced it with sugars and starch, not with kale and broccoli. There is no evidence here even hinting at the notion that saturated fat is good for us."

— David Katz, MD, MPH, FACPM, FACP, director of the Yale-Griffin Prevention Research Center

What About Coconut Oil?

- 21 studies analyzed (8 clinical trails + 13 observation studies) in adults
- Conclusion: coconut oil generally raised LDL-C to a greater extent then unsaturated plant oils, but to a lesser extent than butter
- Coconut oil will not reduce CVD risk
- Coconut oil cannot be assumed to have the same health effects as medium-chain triglycerides (MCT) oil
- Coconut: primarily lauric acid (not caprylic or capric) and is not 100% MCT

Eyres et al. Nutr Rev. 2016;74(4):267-280, Vannice G, Rasmussen H J Acad Nutr Diet. 2014;114:136-153.

22

What About Coconut Oil?

- 1 tablespoon of coconut oil contains 11.7 g of saturated fat and 1 tablespoon of virgin coconut oil contains 13.6 g saturated fat
- Generally, recommendations in pediatrics for saturated fat is 10% of total calories
- General clinic recommendation is 12-15 g/day
- National School Lunch provides 7 g/meal
- National Breakfast Program provides 5 g/meal

https://www.govinfo.gov/content/pkg/FR-2012-01-26/pdf/2012-1010.pdf

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Dairy Fat

- Dairy fat not associated with risk of total CVD or stroke (adults)
- However, the replacement of dairy fat with vegetable sources of fat or PUFA was associated with significantly lower risk of CVD
- Replacement of dairy fat with other animal sources of fat was associated with slightly higher risk of CVD

Brassard D, et al. Am J Clin Nutr. 2017 Apr;105(4):800-809

24

Egg-cellent Study?[1]

- Are eggs or cholesterol from foods associated with an increased risk of cardiovascular disease (CVD) or deaths from any cause?
- Pooled analysis of data from six prospective studies that had followed 29,615 U.S. men and women for up to 31 years.
- Single dietary measurement tool

1. Zhong and colleagues, March 2019 JAMA.

25

Egg-cellent Findings?

- For every additional 300 mg of dietary cholesterol eaten per day, the risk of CVD and all-cause mortality was higher by 17% and 18%, respectively.
- These associations became non-significant after adjustment for consumption of eggs and red meat.
- For each additional half of an egg consumed daily, the risk of CVD and all-cause mortality was higher by 6% and 8%, respectively.
- When the authors looked more closely, dietary cholesterol intake was more strongly associated with risk of stroke than heart disease, and it was associated with both CVD and non-CVD deaths.

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Guess What Happened Next?

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Egg-xamining the Evidence?

- A major limitation is the use of a single measure of diet to look at outcomes up to 30 years later.
- Individuals may have changed their diet after developing high cholesterol or other conditions.
- These findings should be interpreted in the context of several previous studies, which have shown that low-to-moderate egg intake is not associated with a higher risk of CVD in generally healthy people.

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"These new findings may rekindle the debate about the role of dietary cholesterol and egg consumption in cardiovascular disease, but would not change general healthy eating guidelines that emphasize increasing consumption of fruits, vegetables, whole grains, nuts, and legumes and lowering consumption of red and processed meats, and sugar."

— Dr. Frank Hu, Chair of the Department of Nutrition at the Harvard Chan School of Public Health

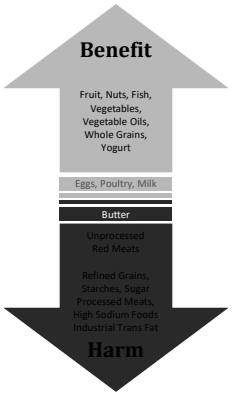

Figure 3. Evidence-based dietary priorities for cardiometabolic health. The placement of each food/factor is based on its net effects on cardiometabolic health, across all risk pathways and clinical end points, and the strength of the evidence, as well. For dietary factors not listed (e.g., coffee, tea, cocoa), the current evidence remains insufficient to identify these as dietary priorities for either increased or decreased consumption (see Table 3).

Mozaffarian, Dariush. "Dietary and policy priorities for cardiovascular disease, diabetes, and obesity." Circulation 133.2 (2016): 187-225.

30

"When considering different components of the diet, it is rarely an either/or situation… If something in the diet increases, another, by definition, decreases. Choosing to focus on only one part of the change and not both, can result in questionable conclusions. Not withstanding that qualification, I don't think any of us would encourage people to eat diets high in refined carbohydrate."

— Dr. Alice Lichtenstein

Nutrition for Pediatric Hypercholesterolemia

Lifestyle and Lipids

- **STRIP:** Dietary counseling is effective in improving serum lipids
  - Decreasing saturated fat intake decreased serum LDL-C levels from infancy until 19 years of age[1]
- **DISC:** Fat-modified diet improved moderately elevated plasma low-density lipoprotein cholesterol (LDL-C) levels[2]
- **Mietus-Snyder, et. al.:** Improvement in HDL-C through liberalizing of the use of monounsaturated fat[3]

1. Simell, O., Niinikoski, H., Ronnemaa, T., Lapinleimu, H., Routi, T., Lagstrom, H., . . . Viikari, J. (2000). Special Turku Coronary Risk Factor Intervention Project for Babies (STRIP). *Am J Clin Nutr*, 72(5 Suppl), 1316s-1331s.
2. Niinikoski, Harri, et al. "Impact of Repeated Dietary Counseling Between Infancy and 14 Years of Age on Dietary Intakes and Serum Lipids and Lipoproteins The STRIP Study." Circulation 116.9 (2007): 1032-1040.
3. Mietus-Snyder, Michele, et al. "Effects of nutritional counseling on lipoprotein levels in a pediatric lipid clinic." American Journal of Diseases of Children 147.4 (1993): 378-381.

33

High LDL-C

Lower Saturated Fats
- 7-10% of total calorie needs

Eliminate Trans Fats
- "partially hydrogenated oils"

Increase Fiber Intake
- fruits, veggies, whole grains, beans/legumes

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High LDL-C

Plant Sterols/Stanols
- Reserved for children who do not achieve LDL-C cholesterol goals with conventional dietary treatment alone.

Low-fat Dairy
- Between 12-24 months, reduced fat milk (2% or lower) can be used.
- >24 months, fat free or 1% milk is recommended, as it optimizes the nutrient benefit without adding additional saturated fat.

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What Does 12-15 grams of Saturated Fat Look Like?

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High LDL-C

Lean Proteins

- Replacement for high saturated fat proteins

Cooking Methods

- Reduce deep or pan frying
- Discourage the use of heavy sauces

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High TG

Limit Added Sugars

- SSB, white carbohydrates, desserts

Choose Whole Grains

- Whole wheat, oat, brown rice

Omega 3 rich fish 2x/week

- High dose Omega 3 supplements (EPA + DHA) decreased TG values by 24% in those 10-19 y.o.1

Alcohol (if applicable)

- Limit Binge Drinking

de Ferranti, Sarah D., et al. "Using high-dose omega-3 fatty acid supplements to lower triglyceride levels in 10-to 19-year-olds." Clinical pediatrics 53.5 (2014): 428-438.

39

Low HDL-C

Increase Exercise
- 300 minutes/week of vigorous activity.

Eliminate Trans Fats
- "partially hydrogenated oils"

Increase Heart Healthy Fat Sources
- Oils, avocadoes, fatty fish, nuts, seeds

Eliminate Smoke Exposure
(if applicable)

40

Identify Potential Lifestyle Barriers

If lifestyle continues to be sub-optimal after multiple visits, consider barriers to success:

- Food-safe house (exposure to undesirable foods)
- Parent/child conflict (sneaking food)
- Financial stressors (food security, safe space to exercise)
- Mental health issues
- Undetected medical issues

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Weight Loss is Not the Primary Focus

- Weight loss is not the primary goal in nutrition counseling for lipid disorders.
- Weight loss may accompany improvements in lipid values as a consequence of recommended lifestyle modifications.
- We choose not to focus on weight first, but rather counsel on other sustainable lifestyle changes that will improve overall cardiovascular health.
- Weight = sensitive issue for many.

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Helpful Smart Tech

Food records, Calorie Counters
- MyFitness Pal

Restaurant Nutrition
- HealthyOut

Cooking/Shopping
- ShopWell
- Fooducate

Meal Prep
- Whole Foods Market Recipes

Food Safety
- Is My Food Safe?

Sleep/Relaxation
- Sleep Cycle
- Simply Being Meditation

Physical Activity
- NIKE Training Club

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Key Recommendations

- Controversies about saturated fat remain unproven based on scientific evidence.
- Coconut oil should be avoided.
- More research is needed on the health effects of dairy fat, however, replacing dairy fat with unsaturated fat has CVD benefits.
- The “replacement” or “compared to what” message is key for heart health.
- Patients with high cholesterol should be counseled according to their lipid abnormality.

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with Thanks to…

Jack Graham, Great Valley Publishing
Preventive Cardiology Team, Boston Children’s Hospital

Questions?

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Credit Claiming

You must complete a brief evaluation of the program in order to obtain your certificate. The evaluation will be available for 1 year; you do not have to complete it today.

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2. **Click "Take Course"** on the webinar description page.
3. **Select "Start/Resume"** Course to complete and submit the evaluation.
4. **Download** and print your certificate.

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