A talk on nutrition

Furio Brighenti University of Parma



Agenda

- Understanding nutrition basics
- Nutrition-related risks in Europe
- Guidance and education



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- Understanding nutrition basics
- Nutrition-related risks in Europe
- Guidance and education



Nutrition mantra

- Risk
- Benefit

- Assessment
- Management
- Communication









What does nutritional risk mean?

- Nutritional risk is multifaceted;
- Both high and low nutrient intakes are inherently associated with risk of adverse health effects (risk-risk scenario);
- Energy and nutrients (micro- and macro-), as well as food non-nutrients, can also positively or negatively affect the occurrence/progression of chronic diseases (risk-benefit scenario).



When nutritional risk assessment is needed?

- Setting DRVs related to nutrient requirements;
- Setting FBDG related to dietary guidance for the population at large;
- Setting guidelines for diet-therapy or life-style intervention for specific diseases;
- Informing food policies (e.g. related to reduction of health-care expenditure);
- Supporting legal rules:
 - Nutrition and Health Claims made on foods;
 - Food fortification;
 - Novel foods;
- Orienting the innovation in the food industry...



What we are dealing with in nutritional risk assessment?

- Micronutrients, macronutrients, bioactives, supplements
- Foods (including novel foods)

Dietary patterns

Food groups





Similarities and differences between food safety and nutrient adequacy



Risk of adverse health effects

UNIVERSITÀ DI PARMA

Assessing Nutrient adequacy

- Knowing the distribution of requirements for a nutrient allows the estimation of the prevalence of inadequacy;
- They form the basis for setting the DRVs;
- Adequacy should be set for subgroups of population, i.e taking into account whenever possible not only gender/age/special needs/genetic background but also the actual and expected prevalence of nutrient deficiency



Assessing Nutrient adverse effects

- The situation is somewhat different for adverse effects.
- In particular, knowing a threshold for adverse effects allows estimation of the proportion of the population at risk of adverse effects, not the proportion experiencing adverse effects.



Assessing Nutrient adverse effects

 The scientific principles of risk assessment for nonnutrient substances can be adapted for setting limits to deal with adverse effects of nutrients.

A Model for Establishing Upper Levels of Intake for Nutrients and Related Substances: Report of a Joint FAO/WHO Technical Workshop on Nutrient Risk Assessment (FAO/WHO, 2005), <u>http://www.who.int/ipcs/methods/nra/en/index.html</u>.

• We'll not go further on this topic





DEMAND EVIDENCE AND THINK CRITICALLY

Hierarchy of evidence in Evidence-Based Medicine

- Systematic review/meta-analysis of RCTs
- Randomized controlled trial (RCT)
- Systematic review/meta-analysis NRCTs
- Non-randomized controlled trial (NRCT)
- Systematic review/meta-analysis of cohort/case-control studies
- Cohort study/case-control study
- Cross-sectional study
- Case series/time series
- Expert opinion



Risk of chronic disease. Which evidence for outcomes?

- Hard points (i.e. disease/impaired function)
- Validated surrogate markers of effect (i.e. risk factors of disease)
- Dose/response effect on risk factors
- Mechanisms of action
- Consider co-causes

The problem of risk factor Vs. surrogate marker of disease Vs. Disease



The problem of risk factor(s) Vs. surrogate marker(s) of disease Vs. Disease





Interlude

surrogate markers of disease, do we miss something in calculating the effect of n6polyunsaturated fats on CVD risk?

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Lower risk for CHD / atherosclerotic plaque

Re-evaluation of the traditional diet-heart hypothesis: analysis of recovered data from Minnesota Coronary Experiment (1968-73)

Christopher E Ramsden,^{1,2} Daisy Zamora,³ Sharon Majchrzak-Hong,¹ Keturah R Faurot,² Steven K Broste,⁴ Robert P Frantz,⁵ John M Davis,^{3,6} Amit Ringel,¹ Chirayath M Suchindran,⁷ Joseph R Hibbeln¹

- **Design**: Double-blind randomized controlled trial;
- Intervention: Serum cholesterol-lowering diet that replaced saturated fat (mainly animal) with linoleic acid (corn oil);
- **Study subjects**: randomized cohort of 9423 women and men aged 20-97;
- **Study setting**: close setting (one nursing home and six state mental hospitals with all food provided by the institution)
- **Analysis**: longitudinal data on serum cholesterol for the 2355 participants exposed to the study diets for a year or more (up to 5 years); 149 completed autopsy files.
- Results: The intervention group had the expected significant reduction in serum cholesterol compared with controls (mean change from baseline -13.8% v -1.0%; P<0.001). However, this did not translate to improved survival. Paradoxically, MCE participants who had greater reductions in serum cholesterol had a a 22% higher risk of death for all causes for each 30 mg/dL (0.78 mmol/L) reduction in serum cholesterol. There was no evidence of benefit in the intervention group for coronary atherosclerosis or myocardial infarcts.



Fig 7 | Meta-analysis for mortality from coronary heart disease in trials testing replacement of saturated fat with vegetable oils rich in linoleic acid. Main analysis: trials provided replacement foods (vegetable oils) and were not confounded by any concomitant interventions. Sensitivity analysis: includes trials that provided advice only and/or were confounded by addition of n-3 EPA and DHA. Risk ratios were used as estimates of hazard ratios in MCE, RCOT, LA Vet, and MRC-Soy. MCE=Minnesota Coronary Experiment; SDHS=Sydney Diet Heart Study; RCOT=Rose Corn Oil Trial; LA Vet=Los Angeles Veterans Trial; MRC-Soy=Medical Research Council Soy Oil Trial; DART=Diet and Re-infarction Trial; ODHS=Oslo Diet Heart Study; STARS=St. Thomas Atherosclerosis Regression Study; LA=linoleic acid; SFA=saturated fat; ALA= α linolenic acid; EPA=eicosapentaenoate; DHA=docosahexaenoate

the bmj | BMJ 2016;353:i1246 | doi: 10.1136/bmj.i1246

End of interlude



Interlude SRMA – what about sugar?

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Guideline:

Sugars intake for adults and children

Added sugars <10%E (strong recommendation) Added sugars <5% E (conditional recommendation)

Based on outcomes : obesity & dental caries

A sugar (fructose)-centric view of cardiometabolic disease emerges



The New Hork Times Magazine

Is Sugar Toxic?



ByGARYTAUBES

On May 26, 2009, Robert Lustig gave a lecture called "Sugar: The Bitter Truth," which was posted on YouTube the following July. Since then, it has been viewed well over 800,000 times, gaining new viewers at a rate of about 50,000 per month, fairly remarkable numbers for a 90-minute discussion of the nuances of fructose biochemistry and human physiology.

supply was lisked to ligher dishetes rates independent of rates of obesity

In other words, according to this study, it's not just obesity that can cause diabetes: sugar can cause it, too, irrespective of obesity. And obesity does not always lead to diabetes.

keynote speaker of the event was Professor Robert Lustig, a paediatric endocrinologist from University of California, San Francisco, known as much for his forthright manner and

Swamped with information

Physiol Rev 10: 25-44, 2003

THE GLOBE AND MAIL

The sickly side of sweet

LESLIE BECK

April 22, 2009 at 8:35 AM EST

It's been implicated in the rise of obesity and Type 2 diabetes, not to mention other health concerns. On food labels you'll see it listed as glucose-fructose (a.k.a. high-fructose corn syrup), an inexpensive sweetener that's added to soft drinks, fruit drinks, breakfast cereals, baked goods, yogurt, canned fruit and condiments.

The potential health hazards of high-fructose corn syrup made headlines in 2004 when researchers in the United States published a report linking our increased use of corn syrup sweeteners over the past 20 years with rising obesity rates. Experts have argued that high-fructose corn syrup is processed differently than table sugar by the body. It's thought that fructose doesn't trigger hormone responses that regulate appetite and satiety, which could cause you to overeat.

Now, a new study published this week in the Journal of Clinical Investigation reveals that fructose-sweetened beverages can impair how the body clears blood sugar and handles fat-detrimental effects that can increase the risk of heart disease and heart attack.

Since its introduction in the 1970s, high-fructose corn syrup has been a boon to the food and beverage industry - it's cheaper than ordinary sugar, easier to blend into foods and tastes sweeter.

The New York Times

July 24, 2008, 2:40 pm

Does Fructose Make You

Fatter?

By TARA PARKER-POPE

High-fructose corn syrup is a sweetener used in many processed foods ranging from sodas to baked goods. While the ingredient is cheaper and sweeter than regular sugar, new research suggests that it can also make a you fatter.

In a small study. Texas researchers showed that the body converts fructose to body fat with "surprising speed," said Elizabeth Parks, associate professor of clinical nutrition at the University of Texas Southwestern Medical Center in Dallas, in a press release. The study which appears in The Journal of Nutrition, shows how glucose and fructose, which are forms of sugar, are metabolized differently.

In humans, triglycerides, which are a type of fat in the blood, are mostly formed in the liver. Dr. Parks said the liver acts like "a traffic cop" who coordinates how the body uses dietary sugars. When the liver encounters alucose, it decides whether the body needs to store it, burn it for energy or turn it into triglycerides.

But when fructose enters the body, it bypasses the process and ends up being quickly converted to body fat. "It's basically sneaking into the rock concert through the fence," Dr. Parks

The New Hork Times Magazine





By GARY TAUBES

Published: April 13, 2011

On May 26, 2009, Robert Lustig gave a lecture called "Sugar: The Bitter Truth," which was posted on YouTube the following July. Since then, it has been viewed well over 800,000 times, gaining new viewers at a rate of about 50,000 per month, fairly remarkable numbers for a 90-minute discussion of the nuances of fructose biochemistry and human physiology.

Metabolic Effects of Fructose and the Worldwide Increase in Obesity LUC TAPPY AND KIM-ANNE LÊ Department of Physiology, Faculty of Biology and Medicine, University of Lansanne, Lausanne, Switzerland A. General context B. Historical perspective C. Fructose consumption TEM-697; No. of Pages 6 Ce Fructose induced lipogenesis: from sugar to fat to insulin resistance Varman T. Samuel^{1,2}

Departments of Internal Medicine, Yale University School of Medicine, New Haven, CT 06536-8012, USA /eteran's Affairs Medical Center, West Haven, CT 06516, USA

Increasing consumption of sugars is one of the contribute of ~18 kg per capita, the contributions to the obesity epi

f Obenity (2008) 32, 5127-5131 Istes Limited All rights essened 0.307-0565/08 \$32.00

Fructose: should we worry?

REVIEW

GA Bray

www.pt

Pennington Biomedical Research Center, Baton Roure, LA, USA

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RESEARCH

Review

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American Dietetic right. American Di Commentary

Are Ethanol and Fructose Similar? LAURI O. BYERLEY, PhD. RD: WAI-NANG PAUL LEE, MD

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Am J. Physiof Endocrinol Metab 299: E885-E694, 2010. First published Semember 7, 2010, doi:10.1152/ajpendo.00283.2010

Fructose: a highly lipogenic nutrient implicated in insulin resistance, hepatic steatosis, and the metabolic syndrome

Mainly Commentaries & Opinion Pieces =**BIAS**

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0195-181910 Converter © 2010 the American Physiological Society

Soft drink consumption and obesity: it is all about fructose George A. Bray

Pennington Center, Louisiana State University, Baton Purpose of review

The purpose of the review is to suggest that fructose, a component of both sucrose (common sugar) and high fructose corn syrup, should be of concern to both healthcare orrespondence to George A. Bray, MD, 6400 Perkins load, Baton Rouge, LA 70808, USA el: +1 225 763 3176; e-mail: brayga@pbrc.edu providers and the public.

Recent findings Current Opinion in Lipidology 2010, 21:51-57

Consumption of sugar-sweetened beverages has increased steadily over the past century and with this increase has been been more and more reports associating their use with the risk of overweight, diabetes and cardiometabolic disease. In a meta-analysis of the relationship between soft drink consumption and cardiometabolic risk, there was a 24% overall increased risk comparing the top and bottom guantiles of consumption Several factors might account for this increased risk, including increased carbohydrate load and increased amounts of dietary fructose. Fructose acutely increases thermogenesis, triglycerides and lipogenesis as well as blood pressure, but has a smaller effect on leptin and insulin release than comparable amounts of glucose. In controlled feeding studies, changes in body weight, fat storage and triglycerides are

Ann, N.Y. Acad. Sci. ISSN 0077-8922

ANNALS OF THE NEW YORK ACADEMY OF SCIENCES

Fructose consumption: recent results and their potential implications

Kimber L. Stanhope^{1,2} and Peter J. Havel^{1,2}

Department of Molecular Biosciences, School of Veterinary Medicine, University of California, Davis, California, USA. ²Department of Nutrition, University of California, Davis, California, USA Address for correspondence: Peter J. Havel, D.V.M., Ph.D., Department of Molecular Biosciences, School of Veterinary Medicine, University of California, One Shields Avenue, Davis, CA 95616, phavel@ucdavis.edu

In addition to acquiring a better understanding of foods that may have intrinsic health benefits, increasing ou knowledge of dietary components that may adversely impact health and wellness, and the levels of consumption at which these adverse effects may occur, should also be an important priority for the Foods for Health initiative This review discusses the evidence that additional research is needed to determine the adverse effects of consumin added sugars containing fructose. Current guidelines recommend limiting sugar consumption in order to prevent weight gain and promote nutritional adequacy. However, recent data suggest that fructose consumption in human results in increased visceral adiposity, lipid dysregulation, and decreased insulin sensitivity, all of which have been

0163-769X/06/820.00/0 Printed in U.S.A.

Endocrine Reviews 30(1):96-11 Copyright © 2009 by The Endocrine Societ

Hypothesis: Could Excessive Fructose Intake and Uric Acid Cause Type 2 Diabetes?

Richard J. Johnson, Santos E. Perez-Pozo, Yuri Y. Sautin, Jacek Manitius, Laura Gabriela Sanchez-Lozada, Daniel I. Feig, Mohamed Shafu, Mark Segal, Richard J. Glassock, Michiko Shimada, Carlos Roncal, and Takahiko Nakagawa

Terrismi of Naphrophysical (J.J., Y.J.S., L.G.S.L., M.Sha, M.Sa, R.J.G., M.Shi, C.B., T.N., University of Plorida, Catasentile, Farnika 2020-2022, Distance of Naphrodyce (S.E.P.-P.), Matrix Orifita Hauptica, 1070 Minorea Balancia Department of Naphrodyce (J.G.S.L.), Hartismi Navional & Gendrafonga Igancia Catasentine, 1700 Minorea Orig, Marico Distance of Poliatric Verphrology (D.E.F.), Baylee College of Medicine, Houston, Teams 77039; and Bettred Professor R.G.O.J. Terranse, Cultifornia

We prepare that excensive fractions instals (>20 g(b) may be organ 2 diabetes, The primary searces of fractionare magn-constraints of the second second second second second contrast of the diabetes, the instal second second second contrast of the second secon with well in the pathways of metal-field synthesis of metal-field synthesis. For the curve acceptibilities of why certain groups might as more susceptibilities for veloping allocitors. Finally, we discuss potential explanation of why certain groups might be reader from accessive instate of tractors, then simple public reader from accessive instate of tractors, then simple public the overall health of our populates. *Endocrine Reviews* 20 69–106, 2009

I. Introduction II. Unique Characteristics of Fructose Metabolism III. Unique Characteristics of Fructose Metabolism III. Fructose Causes Metabolic Syndrome in Animals IV. Mechanism(s) by Which Fructose Induces Other Feature V. Mechanism(s) by Which Fructose Induces Other Feature (New Network) (Network) (Networ

- Metalanano by Windom Proceed Induces Could Features of the Metabolic Syndrome: Role of Uric Acid
 VI. Human Studies with Fructose
 VII. Epidemiological Studies: Sugar Intake and Type 2
- Diabetes VIII. Epidemiological Studies: Uric Acid and Type 2 Diabetes IX: Do Other Conditions That Modify Uric Acid Levels Affect the Development of Metabolic Syndrome or Diabetes? X. Twelve Countering Arguments and Caveats XI. The Thrifty Cane Revisited XII. What Research Should Be Done to Prove Our Hypothesis?

I. Introduction

FINTER AND A STATEMENT AND l diabetes), and a slower and more progra

First Published Online January 16, 2009 Abbreviations: Glut, Glucose transporter; HDL, high-density lipopro-toin; HECS, high fractiose core syrup; KHK, katohoxokinase; MCP-1, monocytic chemoaturactuat proteini's; NO; initic oxide indocrine Reviews is published by The Endocrine Society fittps// www.endo-society.org/.hte foremost professional society servine the

overweight or obsese tubject (likely type 2 diabetes) (1, 2). Both conditions were rare; indeed, Oker (3) projected a prev-alence of approximately two or three cases per 10000 per po-ulation in Europe and North America. By the early 1900s, however, a remarkable in its in the prevalence of the second type of diabetes was observed in Europe and the United State (4). Similary, a dramatic increase in diabetes was observed in neuroper and the second project of the second observed in the second second second second seco Ithy, overweight, and living in an urban enviror 5). However, over the last 50 yr there has been a transiti such that diabetes is now increasing most rapidly among the poor and minorities (6). Although some of the increase in diabetes prevalence may be due to the increasing longevity of the population, an increase in the rate of type 2 diabetes is also being observed among the young, suggesting that a active process is driving the epidemic. Today diabetes is present in over 217 million individuals worldwide. Approx mately 7% of the U.S. adult population has type 2 diabete that carries a yearly financial burden of over \$130,000,000,000 that carries a yearly financial burden of over \$120,000,000,000 (7). Over the next few decades a remarkable increase in diabetes is projected, especially in Asia and India (8). By 2020 over 350 million people are projected to suffer from this condition, making it one of the most serious diseases o humankind (7, 8).

humankind (7, 8). Identifying the etiology of type 2 diabetes is key to pro-vention. The frequent association of diabetes with obesity has led many investigators to propose that obesity may be re-sponsible for up to 90% of type 2 diabetes (9). Obesity, and in particular intraabdominal fat accumulation, has been

College of Pha

Duvid J.A. Jenkins, MD, PhD, DS

Risk Factor Modification Centre St Michael's Hospital Toronto, ON, Canada

O 2011 by the American Dietetic Association

Making decisions

- How do we best conclude if carbs/sugar (fructose) causes harm?
- How do clinicians make clinical decisions?
- How are clinical practice guidelines made?



A suitable means to collate information

- An Ideal Review: comprehensive and unbiased
- Narrative Review <u>vs</u> Systematic Review

What is a narrative review?

- discusses and summarizes the literature on a particular <u>topic</u>
- Usually a <u>comprehensive overview</u> of a topic by <u>"a content expert"</u>, rather than addressing a specific question
- <u>do not often report on how</u> the search for literature was carried out or how it was decided which studies were relevant to include

What is a systematic review?

 "A review of a <u>clearly formulated question</u> that uses systematic and <u>explicit methods to</u> <u>identify, select</u> and critically appraise relevant research, and to collect and analyze data from the studies that are included in the review."

What is "meta-analysis"?

- a <u>statistical technique</u> for combining the findings from several independent studies
- <u>combines data</u> from two or more randomized controlled trials (or observational studies) – resolves discrepancies
- provides a <u>quantitative estimate</u> of the treatment effect, giving due weight to the size and precision of the different studies included
- Gives a larger sample size and more events than any individual study = greater precision of estimates
- Identify sources of diversity (different patient types, settings)
 http://www.whatisseries.co.uk/whatis/ Ioannidis JP, et al. Jt Comm J Qual Improv 1999

Are all meta-analyses systematic reviews?

Dr. Black found 10 studies in which A <u>raised</u> tissue vitamin X levels by 26 units compared with **B**,

Meta-Analysis Conclusion: Highly consistent effect showing A <u>raised</u> tissue vitamin X levels



Are all meta-analyses systematic reviews?

Dr. White found 10 studies in which **A** <u>**Iowered**</u> tissue vitamin **X** by 28 units compared with **B**.

Meta-Analysis Conclusion: Highly consistent effect showing A <u>lowered</u> tissue vitamin X levels



Heterogeneity $X^2 = 7.70$ (d.f. = 9) p = 0.564 I² (variation in ES attributable to heterogeneity) = 0.0% Test of ES=0 : z= 7.20 p < 0.001

Are all meta-analyses systematic reviews?

Dr. Grey conducted a **systematic review** and meta-analysis of 20 studies of the effect of treatment (**A** vs. **B**) on tissue levels of **Vitamin X**

SR & Meta-analysis Conclusion: <u>No treatment effect</u>



Heterogeneity $X^2 = 117.80$ (d.f. = 19) p < 0.001 I² (variation in ES attributable to heterogeneity) = 83.9% Test of ES=0 : z= 0.42 p = 0.676

How a SRMA is Conducted

DEVELOP PROTOCOL

1. Formulate the question

2. Define the eligibility criteria for studies to be included in terms of Patient, Intervention, Comparison, Outcome, Time, and Study design (PICOTS)

3. Develop a priori hypotheses to explain heterogeneity

Adapted from Murad et al. JAMA. 2014;312(2):171-179.

Why is the research question important?

- The answer you get will depend on the question you pose
- Defines the types of studies you will include
- Defines the outcomes you will look at
- Defines the exposures/intervention

• Consult with an information specialist
How a SRMA is Conducted

DEVELOP YOUR PROTOCOL

1. Formulate the question

2. Define the eligibility criteria for studies to be included in terms of Patient, Intervention, Comparison, Outcome, Time, and Study design (PICOTS)

3. Develop a priori hypotheses to explain heterogeneity

Adapted from Murad et al. JAMA. 2014;312(2):171-179.

Developing Eligibility Criteria

- **P** opulation
- Intervention (Exposure)
- C omparator
- **O** utcome
- **T** ime
- S tudy Design
- In _____(P), how does _____(I) compared to _____(C) affect _____(O) within _____(T)?

http://www.hkcochrane.cuhk.edu.hk http://www.sonoma.edu/users/k/koshar/n312c/PICOT%20Samples.html

PICOTS – Eligibility Criteria

• E.g. fructose-containing sugars & cardiometabolic risk

 In <u>adults (P)</u>, how do <u>fructose-containing</u> <u>sugars (I)</u> compare to <u>other carbohydrates (C)</u> on <u>cardiometabolic risk factors (O)</u> within <u>randomized controlled trials ≥3 weeks (T, S)</u>?

Additional Considerations

- E.g. Population you wish to include OR exclude:
 - Healthy
 - Overweight/obese
 - Diabetes
 - Cancer

Understanding the Research Question



Assessments of Quality of Evidence

- Risk of Bias
- Publication Bias
- GRADE

Assessments of Quality of Evidence

- Risk of Bias
 - Sequence generation -> selection bias (randomization)
 - Allocation concealment -> selection bias
 - Blinding->performance bias (of participants and personnel)
 - Incomplete outcome data->attrition bias (how missing data was handled; assessed if influential)
 - Selective outcome reporting-->reporting bias (specified 1°, 2° outcomes)
 - HIGH, LOW, UNCLEAR
 - Cochrane Risk of Bias Tool

Assessments of Quality of Evidence

• GRADE:

Evidence Assessment



- The strength of the evidence for each outcome will be assessed using the Grading of Recommendations Assessment, Development and Evaluation
- Quality of evidence = the extent to which we are confident that an estimate of the effect is correct

GRADE	DEFINITION
High ⊕⊕⊕⊕	Further research is very unlikely to change our confidence in the estimate of effect.
Moderate ⊕⊕⊕O	Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low ⊕⊕OO	Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low ⊕000	Any estimate of effect is very uncertain.

GRADE is widely used















SIGN Scottish Intercollegiate Guidelines Network





AMERICAN ASSOCIATION FOR THE STUDY OF LIVER DISEASES









Results

Fructose & cardiometabolic risk factors

Isocaloric conditions

Cardiometabolic endpoint		No. trials	N	Standardized Me	an Differences (SMD) with 95% CI	I 2
Body weight ²		31	637	-0.22 (-0.58, 0.13)	-++	37%*
Lipids in diabetes ³	TG	16	236	0.33 (-0.11, 0.71)	+	59%*
	TC	14	172	0.50 (-0.06, 1.03)	•	71%*
	LDL-C	7	99	0.35 (-0.25, 0.99)	•	14%
	HDL-C	12	164	-0.06 (-0.68, 0.56)	•	77%*
Linide in non dishatae	TC	22	540	0.22 (0.27 0.02)		650/*
Lipid's in non-diabetes	TO	12	066	0.55 (-0.27, 0.92)		61%*
		13	200	0.35 (-0.55, 1.25)		66%*
		10	103	-0.06 (-0.94, 0.82)	Ţ	79%*
	HDL-C	10	105			
Non-alcoholic fatty liver (NAFL)	IHCL	2	21	0.01 (-0.42, 0.44)	_ _	0%
Glycemic control in diabetes	GBP	13	172	-0.27 (-0.49, -0.04)	•	66%*
	FBG	16	176	-0.46 (-0.95, 0.03)	-+-	63%*
	FBI	7	57	-0.16 (-0.90, 0.58)	_ _	13%
Glycemic control in non-diabetes	GBP	6	121	-0.33 (-0.63, -0.02)		0%
	FBG	28	598	0.05 (-0.29, 0.45)		0%
	FBI	24	458	-0.27 (-0.67, 0.14)		0%
Blood pressure ⁴	sBP	13	352	-0.39 (-0.93, 0.16)	_ _	31%
	dBP	13	352	-0.68 (-1.23, -0.14)		47%*
	MAP	13	352	-0.64 (-1.19, -0.10)	-•-	97%*
Uric acid		18	390	0.04 (-0.43, 0.50)		0%
					-4 -3 -2 -1 0 1 2 3	4
					Favors fructose Favors any CH	0

Hypercaloric conditions

Cardiometabolic endpoint		No. trials	Ν	Standardized Me	an Differences (SMD) with 95% CI	2
Body weight ²		10	119	1.24 (0.61, 1.85)		30%
Lipids in non-diabetes	TG	6	127	1.07 (0.27, 1.87)		96%*
•	тс	4	59	1.41 (0.43, 2.39)	_	84%*
	LDL-C	2	28	-0.40 (-1.79, 0.98)		96%*
	HDL-C	2	28	0.57 (-0.82, 1.96)		0%
Non-alcoholic fatty liver (NAFL)	IHCL	6	64	0.53 (0.28, 0.93)	+	75%*
Glycemic control in non-diabetes	FBG	10	124	0.67 (0.06, 1.30)		27%
	FBI	10	124	0.43 (-0.19, 1.05)		0%
Blood pressure ⁴	MAP	2	24	-0.76 (-2.15, 0.62)	-+-	24%
Uric acid		3	35	2.26 (1.13, 3.39)	_ -	0%
					-4 -3 -2 -1 0 1 2 3 4	
					Favors fructose Favors control	

Overall Conclusions

- There is a <u>moderate</u> body of consistent evidence from controlled feeding trials that fructose-containing sugars at low to moderate doses do <u>not</u> harm body weight, serum fasting or postprandial lipids, blood pressure, uric acid, and NAFLD and may even <u>benefit</u> glycemic control in humans.
- There is an <u>emerging</u> body of consistent evidence from controlled feeding trials that fructose consumed under hypercaloric feeding conditions may promote weight gain, fasting and postprandial dyslipidemia, raised uric acid levels, and NAFLD, <u>effects which may be more attributable to the excess energy than the fructose itself</u>.
- The shorter duration, poor quality and heterogeneity in the available trials creates some uncertainty about the true effects of fructose. <u>There is a need</u> for larger, longer-term, higher quality "real world" feeding trials to guide our <u>understanding of the metabolic effects of fructose.</u>

End of interlude

Agenda

- Understanding nutrition basics
- Nutrition-related risks in Europe
- Guidance and education



Health Metrics





Dept. Food & Drug

GBD dietary risk

<u>http://vizhub.healthdata.org/gbd-compare/</u>





Agenda

- Understanding nutrition basics
- Nutrition-related risks in Europe
- Guidance and education



Guidance: the regulatory frame

- EU regulation 1924/2006
 - Nutrition & Health claims
- EU regulation 1925/2006
 - Addition of vitamins and minerals
- EU regulation 1169/2011 (FIR)
 - General food labelling provisions
- EU regulation 609/2013 (FSG)
 - Infant and follow-up formulas, processed cereal-based foods, food for special medical purposes, total diet replacements for weight control



Mandatory nutrition label (1169/2011)

- Information required on energy value (in both kJ and kcal)
- Amounts (in g) of fat, saturates, carbohydrates, sugars, protein and salt - to be given per 100g and/or 100ml
 - This is a change from previous requirements on nutrition information, adding saturates and sugars, removing fibre and sodium which is no longer permitted, although statement can be added explaining salt is due to naturally occurring sodium
- With exemptions..(e.g. waters, spices, salt, additives, alcoholic drinks..)



Voluntary nutrition label (1169/2011)

- In addition to the mandatory elements of nutrition labelling supplementary information may be given on a voluntary basis.
- Supplementary information can be given for:
 - mono-unsaturates, polyunsaturates (under total fats)
 - polyols, starch (under carbohydrates)
 - fibre and
 - any of the permitted vitamins & minerals listed in Annex XIII
- When making a nutrition or health claim or fortifying a food, if the claim is about any of these supplementary elements, they must be declared as part of the nutrition declaration.



Voluntary nutrition label (1169/2011)

- All nutrition labelling information must be given on a per 100g/100ml basis;
- In addition, information can be given per portion and/or per consumption unit (number in package must be stated)
- %RI information may be provided voluntarily per 100g/ml only or Per 100g/ml plus per portion and/or consumption unit or per portion and/or per consumption unit only



Voluntary nutrition label (1169/2011)

- % reference intakes for the 7 mandatory may be given voluntarily;
- if provided per 100g/ml only or per 100g/ml and per portion and/or per consumption unit, this statement must appear in close proximity to the information on reference intakes

"Reference intake of an average adult (8400kJ / 2000 kcal)"

• %RI cannot be given for the supplementary elements except vitamins and minerals when it is mandatory



Additional Forms of Expression - FOP

DIMENSIONS ON WHICH FOP LABELS DIFFER:



A. Non Directive

B. Semi Directive

C. Directive

Bix L, Sundar RP, Bello NM, Peltier C, Weatherspoon LJ, Becker MW (2015) *To See or Not to See: Do Front of Pack Nutrition Labels Affect Attention to Overall Nutrition Information?* PLoS ONE 10(10): e0139732. DOI:10.1371/journal.pone.0139732



Additional Forms of Expression - FOP

DIMENSIONS ON WHICH FOP LABELS DIFFER:



Ellen Van Kleef & Hans Dagevos (2015) *The Growing Role of Front-of-Pack Nutrition Profile Labelling: A Consumer Perspective on Key Issues and Controversies,* Critical Reviews in Food Science and Nutrition, 55:3, 291-303, DOI: 10.1080/10408398.2011.653018



Open question(s)

- Do consumers want FOP labeling?
- How different FOP schemes are perceived by the consumer?
- Do different FOP schemes allow identification of healthier choices?
- Does the presence of FOP labeling improve the nutritional quality of purchased goods?
- Are there unintended consequences in the application of FOP labeling?



Do consumers want FOP labelling?



Yes. Consumer organisations' surveys revealed that most consumers say FOP labelling should be modelled in a way to raise awareness about the nutritional profile of food...

Consumer organizations' surveys also shows consumer want and prefer semi-directive, interpretative (i.e.color-coded) schemes

Etiquetage nutritionnel – Clair et complet s'il vous plait. Test Achats, October/November 2012

Ampel-Kennzeichnung bei Lebensmitteln hilft Verbrauchern - Ergebnisse eines Online-Quiz zur Nährwertkennzeichnung. VZBV, June 2013.

http://www.consumentenbond.nl/actueel/nieuws/nieuwsoverzicht-2013/Kleurcodering-verdubbelt- inzicht-in-vet-zout-en-suikergehalte/ Front of pack nutrition labelling. Which?, August 2012.



How different FOP schemes are perceived?

PLOS ONE PLOS ONE | DOI:10.1371/journal.pone.0140898 October 28, 2015

RESEARCH ARTICLE

Effectiveness of Front-Of-Pack Nutrition Labels in French Adults: Results from the NutriNet-Santé Cohort Study

N=13.578

1 country (France)

5 food categories (Pizzas, Dairy products, Fish dishes,

Breakfast cereals, appetizers)

5 labelling alternatives



How different FOP schemes are perceived?

No label (None)

Traffic lights (TL)

Guideline daily Amounts (GDA)



Lipides

2,5 g

Acides gran satures

1 g

Sodium

0,72 g

5-colours nutrition label (5-CNL)



Matière grasse

Energie

106 kcal

Sucres

0,5 g

Health logo (Tick)



How are different FOP schemes perceived?



How are different FOP schemes perceived?

Conclusions:

"Our study supports the fact that nutritional FOP labelling systems could be effective instruments to guide consumers in their food choices. No system was identified as the most appropriate for all studied dimensions of acceptability."



Do different FOP schemes allow identification of healthier choices?

British Journal of Nutrition (2015), **113**, 1652–1663 © The Authors 2015 doi:10.1017/S0007114515000264

Guiding healthier food choice: systematic comparison of four front-of-pack labelling systems and their effect on judgements of product healthiness

N=2.068

4 countries (Germany, Poland, UK, Turkey)3 food categories (Pizzas, Yogurt, Biscuits)3 healthy variants (High, Medium, Low) fora total of 9 foods (3 for each category)

5 labelling alternatives



Schemes tested

Energy	Sugars	Fat	Saturates	Salt
xx kJ	xx g	xx g	xx g	xx g

Energy	Low	Med	High	Low
	Sugars	Fat	Saturates	Salt
(xx kJ	xx g	xx g	Lxx g	xx g

Basic	label	(BL)
		\ /

Traffic lights (TL)

	\frown	\frown	\frown	\frown	\frown	
1	Energy	Sugars	Fat	Saturates	Salt	
	xx kJ	xx g	xx g	xx g	xx g	
	(X%)	(X%)	(X%)	(X%)	(X%)	

Guideline daily Amounts (GDA)

\square				
Energy xx kJ	Sugars xx g	Fat xx g	Saturates XX g	Salt xx g
X%	X%	X%	X%	X%

Hybrid TL + GDA (HYB)

Energy	Sugars	Fat	Saturates	Salt	SCHUTHY CA
xx kJ	xx g	xx g	xx g	xx g	ASCO ON HILDRATIONAL DIS

Health logo (HL)





Fig. 3. Front-of-pack × healthiness × system interaction utilising dependent variable 1 (DV1; mean healthiness ratings). $F^{1}(5 \cdot 9,3989 \cdot 5) = 7 \cdot 17$, $P \le 0.001$, $\eta_{p}^{2} = 0.010$. Within the different healthiness variant groups, the following statistically significant differences were observed. High health variant: basic label (BL) v. health logo (HL) ($P \le 0.001$), guideline daily amounts (GDA) v. HL (P = 0.014). Medium health variant: BL v. traffic lights (TL) (P = 0.013), BL v. HL (P = 0.005), BL v. GDA + TL hybrid (HYB) (P = 0.023), GDA v. TL ($P \le 0.001$), GDA v. HYB (P = 0.004), TL v. HL ($P \le 0.001$), HL v. HYB ($P \le 0.001$). Low health variant: BL v. HYB (P = 0.013).

NOTE: the SSAg/1 objective health score scale starts at 0 for the healthiest foods, and foods with higher scores are considered less healthy.



Do different FOP schemes allow identification of healthier choices?

Conclusions:

"Under experimental conditions, any structured and legible presentation of key nutrient and energy information on the front of the pack is sufficient to enable consumers to detect a healthier alternative within a food category when they are provided with foods that have distinctly different levels of healthiness."



Does the presence of FOP labeling improve the nutritional quality of purchased goods?

So far, the large majority of consumer research explored the understanding and the ability of consumers to identify healthier food choices.

However, revealed preference data analyses do not support that these tendencies translate into healthy behaviours at the point of sale. An analysis of scanner data from Sainsbury stores in the UK – (collected on a short period and for a limited number of items) when Sainsbury introduced TL labels on its private brand products – found no evidence that the new label shifted choices to more healthful products.

Sacks, Rayner, & Swinburn, (2009) Impact of front-of-pack 'traffic-light' nutrition labelling on consumer food purchases in the UK, health Pmot. Int., 24:2 344-352 DOI: 10.1093/heapro/dap032


Does the presence of FOP labeling improve the nutritional quality of purchased goods?

ONGOING LARGE FIELD STUDIES:

- **Methods**: 5-wk RCT design; three FOP labels:
 - Star label, traffic light label, no FOP (nutrition label only)
 - Assisted by phone App
 - Outcome: healthiness of food purchased at supermarket
- Expected Results: The Starlight randomised, controlled trial will determine the effects of interpretive front-of-pack nutrition labels on the healthiness of consumer food purchases in the real world.

Volkova E. et al. Effects of interpretive front-of-pack nutrition labels on food purchases: protocol for the Starlight randomised controlled trial. BMC Public Health 14 (2014) 968-75



Are there unintended consequences in the application of FOP labeling?

PLOS ONE

PLOS ONE | DOI:10.1371/journal.pone.0139732 October 21, 2015

RESEARCH ARTICLE

To See or Not to See: Do Front of Pack Nutrition Labels Affect Attention to Overall Nutrition Information?

N=74

Eye tracking (time spent on label)

2 products (cereals, crackers)

2 label conditions (TL FOP yes/no)

2 healthy representation (healthy/unhealthy)











Fig 3. Plots the percentage of each type of nutritional label that has been fixated as a function of viewing time. Data were collapsed across participants so the percentage was based on the number of labels fixated out of the 220 total labels per label type (4 labels x 55 participants)



Are there unintended consequences in the application of FOP labeling?

Conclusions:

"FOP labels are effective at garnering attention to nutrition information. The added presence of color-coded FOP labels on food packages attracted attention to nutrition information more rapidly and increased the total time that people spent attending to any nutrition information. However, we also found that FOP labels can be used, under certain situations, as a short-cut, thereby decreasing people's attention to the more comprehensive information found in the NFP. (....) Conversely, this "short-cut" finding suggests that manufacturers should not be allowed to selectively report nutrition information on the front-of-pack, as it has the potential to mislead consumers."

