Research
a dietetic practice group of the
Academy of Nutrition and Dietetics

TheDigest

Volume 49, Number 2 – Spring 2014

USDA Nutrition Evidence Library Systematic Reviews: Using food and nutrition research to inform nutrition programs and policies

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Introduction

The U.S. Department of Agriculture's Nutrition Evidence Library (NEL) is housed within the Center for Nutrition Policy and Promotion, and specializes in conducting systematic reviews (SRs) to inform Federal food- and nutrition-related policies and programs. NEL SRs provide government policymakers and program leaders with the scientific foundation that allows decisions to be made based on the strongest available evidence. For example, NEL SRs, conducted in conjunction with the 2010 Dietary Guidelines Advisory Committee (DGAC) and currently underway with the 2015 DGAC, provide evidence to support development of the *Dietary Guidelines for Americans*. Use of the NEL helps ensure compliance with mandates that Federal agencies ensure the quality, objectivity, utility, and integrity of the information used to form federal guidance as are outlined in the Consolidated Appropriations Act of 2001, the *Data Quality Act*.

Historically, SRs have been used to guide clinical decision-making in the healthcare arena. However, in recent years, the use of SRs has expanded to many other disciplines, including clinical and public health nutrition, as well as other areas of public health, education, and the social sciences. In response to this expansion, SR methods have been adapted and developed to address the diverse types of evidence that exist in these fields. Groups such as the Cochrane Collaboration Public Health Group (http://ph.cochrane.org), the Campbell Collaboration (http://www.campbellcollaboration.org), and the Agency for Healthcare Research and Quality (http://www.ahrq.gov) are leaders in the development of SR methodology, and the research conducted by these organizations can be leveraged by a variety of disciplines as they seek to ensure that SRs are being conducted using the most up-to-date methods and tools.

The field of public health nutrition, and in particular, the work of the NEL, has benefitted from this evolution in SR methodology. NEL has worked to ensure that its process meets current standards for conducting SRs,[1] and utilizes the most up-to-date methods and tools available.[2-4] The purpose of this paper is to describe the NEL methodology for conducting SRs, and highlight parts of this process that may be of particular interest to researchers.

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Nutrition Evidence Library Systematic Review Methodology

NEL's methods are designed to promote objective and transparent review, evaluation, and synthesis of peer-reviewed research to answer important food- and nutrition-related questions. Each step of the SR process is guided by a group of scientific experts with expertise in the topic being addressed (e.g., the DGAC or a Technical Expert Collaborative [TEC]). The TEC/DGAC makes the substantive decisions required throughout the process of conducting a SR, while NEL staff provides facilitation and support to ensure that the process is consistently implemented in accordance with NEL systematic review methodology. All NEL SRs are publically available at www.NEL.gov. Each step of the NEL SR methodology is described below.

Topic identification and systematic review question development

The primary aim of topic identification and SR question development is to obtain input from a broad group of experts to identify SR topics and key SR questions relevant to federal food and nutrition policy and programs.[5] As systematic reviews are labor intensive, this process is designed to ensure that the most relevant topics are selected for SRs, and questions are clearly focused and appropriate in scope. In general, a topic is considered to be within scope, and therefore appropriate for a NEL SR, if it addresses a food or nutrition issue that will inform public health action to: 1) promote population health or well-being, and/or 2) reduce the significant burden of avoidable disease in the U.S. population as a whole or in specific population subgroups. A topic is considered to be important when the results of a SR stimulated by the topic are likely to inform decisions about federal public health food and nutrition policies and programs, in particular, those areas of major public health concern for which there is uncertainty and/or a knowledge gap that is critical to improving public health. The SR questions developed to address these topics should reflect important decisional dilemmas in public health nutrition and reflect what decision makers need in order to make evidence-based policy and program decisions. SR questions must be specific enough to be researchable using NEL methodology, but broad enough to not overly limit the scope of the literature search. As part of the process, core elements of a SR question, Population, Intervention or Exposure, Comparator and Outcomes (PICO) are identified. The PICO represents key aspects of the topic that need to be considered in developing a SR framework. Once SR questions have been drafted, an analytic framework is created to help further refine and define elements of the SR question(s) and lay the foundation for the rest of the SR process. An analytic framework is a type of evidence model that defines and links populations, interventions or exposures and the comparators, intermediate outcomes, and clinical health outcomes, as well as key confounders to consider.

Literature search, screening, and selection

Searching, screening and selection of scientific literature is an objective process used to identify the body of evidence available to answer a systematic review question. This process is guided by inclusion/exclusion criteria that are determined a *priori*. Because NEL reviews are used to inform U.S. policies and programs, these criteria are often designed to ensure that the literature collected offers the strongest evidence for a causal relationship, and is most representative of the U.S. population. The NEL uses a standard set of criteria that are tailored based on the SR question, addressing various aspects of study design and implementation (e.g., study design, type of study subjects, study setting and location, sample size, dropout rate).

The NEL librarian creates and implements a search strategy that includes a list of appropriate databases and search terms to use in identifying literature. The results of the literature search are screened by the NEL staff in a dual, step-wise manner, beginning with titles, followed by abstracts, and then full text articles, to determine which articles meet the criteria for inclusion in the review. All articles that meet the inclusion criteria and related SRs are hand searched in an effort to find additional pertinent articles not identified through the electronic search. In addition, as part of this process, a duplication assessment is conducted to determine whether there are existing high-quality SRs or meta-analyses (MAs) that can be used to augment or replace a NEL SR.

The TEC/DGAC provides input throughout this process, to ensure that the inclusion and exclusion criteria are applied appropriately and the final list of included articles is complete and captures the most

relevant research to answer a SR question. In addition, each step of the process is meticulously documented to ensure transparency and reproducibility.

Data extraction and risk of bias assessment

Key data relevant to the SR question are extracted by NEL abstractors (i.e., trained volunteers with advanced degrees in nutrition or a related field) based on a data extraction template developed by NEL and the TEC/DGAC, and an Evidence Grid is developed that includes the data extracted for all studies included in the review. In addition, the risk of bias (i.e., internal validity) for each study is assessed by NEL abstractors using the NEL Bias Assessment Tool (BAT). These materials are then used by the TEC/DGAC in their review and synthesis of the body of evidence.

The data extraction from each article included in a systematic review should provide an overview of the methodology and key findings of an individual study as it relates to the SR question being addressed. Standard types of data extracted include:

- Sample size
- Location
- Subject characteristics: age, gender, race/ethnicity, socio-economic status, health status
- A description of the study
- Study duration
- Dietary assessment method
- Description of the independent variables
- Description of the outcomes measures and methods of outcome assessment
- Statistical adjustments/models
- Results
- Risk of Bias rating and limitations
- Funding source

Table 1: The types of bias that are addressed by the Nutrition Evidence Library Bias Assessment Tool

Selection Bias	Systematic differences between baseline characteristics of the groups that are compared; error in choosing the individuals or groups taking part in a study
Performance Bias	Systematic differences between groups in the intervention/exposure received, or in experience with factors other than the interventions/exposures of interest
Detection Bias	Systematic differences between groups in how outcomes are determined; outcomes are more likely to be observed or reported in certain subjects
Attrition Bias	Systematic differences between groups in withdrawals from a study, particularly if those who drop out of the study are systematically different from those who remain in the study

Adapted from: Cochrane Bias Methods Group: http://bmg.cochrane.org/assessing-risk-bias-included-studies

The NEL BAT is used to assess the risk of bias (i.e., internal validity) of each individual study included in a SR to determine whether any systematic error exists to either over- or under-estimate the study results. The types of bias that are addressed in the NEL BAT are described in Table 1.

The NEL BAT is tailored by study design, with different sets of questions applying to randomized controlled trials (14 questions), non-randomized controlled trials (14 questions), and observational studies (13 questions). NEL Abstractors complete the NEL BAT after data extraction for the article is complete, answering the questions based on the SR question being addressed. There are four response options:

- **Yes:** Information provided in the article is adequate to answer "yes".
- **No:** Information provided in the article clearly indicates an answer of "no".
- **Cannot Determine:** No information or insufficient information is provided in the article, so an answer of "yes" or "no" is not possible.
- **N/A:** The question is not applicable to the article.

The completed NEL BAT is used to rate the overall risk of bias for the article by tallying the responses to each question. Each "Yes" response receives 0 points, each "Cannot Determine" response receives 1 point, each "No" response receives 2 points, and each "N/A" response receives 0 points. Since 14 questions are answered for randomized controlled trials and non-randomized controlled trials, they will be assigned a risk of bias rating out of a maximum of 28 points; while observational studies will be out of 26 points. The lower the number of points received, the lower the risk of bias. Table 2 lists each question in the NEL BAT, the response options, and the applicable study design(s) for each question.

Evidence synthesis, conclusion statements and grading the strength of the evidence

Evidence synthesis is the process by which evidence from multiple studies is compared, contrasted, and analyzed to develop a graded conclusion statement that answers the SR question. This qualitative synthesis of the body of evidence

Table 2: NEL Bias Assessment Tool Questions, response options, and applicable study designs

	Risk of Bias Questions	Response Options	Randomized Controlled Trials	Controlled Trials	Observational Studies
1.	Were the inclusion/exclusion criteria similar across study groups?	• Yes • No • Cannot Determine • N/A		X	X
2.	Was the strategy for recruiting or allocating participants similar across study groups?	• Yes • No • Cannot determine • N/A		X	X
3.	Was the allocation sequence randomly generated?	• Yes • No • Cannot determine • N/A	X		
4.	Was the group allocation concealed (so that assignments could not be predicted)?	• Yes • No • Cannot determine • N/A	X		
5.	Was there an attempt to balance the allocation between the study groups or match the study groups (e.g., through stratification, matching, propensity scores)?	• Yes • No • Cannot determine • N/A			X
6.	Was distribution of health status, demographics, and other critical confounding factors similar across study groups at baseline? If not, does the analysis control for baseline differences between groups?	• Yes • No • Cannot determine • N/A	X	X	X
7.	Did the investigators account for important variations in the execution of the study from the proposed protocol or research plan?	• Yes • No • Cannot determine • N/A	X	X	X
8.	Was adherence to the study protocols similar across study groups?	• Yes • No • Cannot determine • N/A	X	X	X
9.	Did the investigators account for the impact of unintended/unplanned concurrent interventions or exposures that were differentially experienced by study groups and might bias results?	• Yes • No • Cannot determine • N/A	X	X	X
10.	Were participants blinded to their intervention or exposure status?	• Yes • No • Cannot determine • N/A	X	X	
11.	Were investigators blinded to the intervention or exposure status of participants?	• Yes • No • Cannot determine • N/A	X	X	
12.	Were outcome assessors blinded to the intervention or exposure status of participants?	• Yes • No • Cannot determine • N/A	X	X	X
13.	Were valid and reliable measures used consistently across all study groups to assess inclusion/exclusion criteria, interventions/exposures, outcomes, participant health benefits and harms, and confounding?	• Yes • No • Cannot determine • N/A	X	X	X
14.	Was the length of follow-up similar across study groups?	• Yes • No • Cannot determine • N/A	X	X	X

Table 2: Contunued on page 5

Table 2: **Continued**

15. In cases of high or differential loss to follow-up, was the impact assessed (e.g., through sensitivity analysis or other adjustment method)?	• Yes • No • Cannot determine • N/A	X	X	X
16. Were other sources of bias taken into account in the design and/or analysis of the study (e.g., through matching, stratification, interaction terms, multivariate analysis, or other statistical adjustment such as instrumental variables)?	• Yes • No • Cannot determine • N/A	X	X	X
17. Were the statistical methods used to assess the primary outcomes adequate?	• Yes • No • Cannot determine • N/A	X	X	X

involves identifying overarching themes or key concepts from the findings, identifying and explaining similarities and differences between studies, and determining whether certain factors impact the relationships being examined. A series of probing questions designed to facilitate the TEC's/DGAC's review and analysis of the evidence are developed and provided to the TEC/DGAC. The TEC/DGAC uses the description of the evidence, along with the full data extraction grid, the NEL BAT summary information, and full-text manuscripts, to critically examine the evidence and respond to the probing questions. Feedback from the TEC/DGAC is compiled and used to draft the qualitative evidence synthesis and the conclusion statement. The conclusion statement is then graded (Table 3), taking into consideration the following characteristics of the body of evidence used to develop the conclusion statement:

- **Quality (Risk of Bias)** assessment for studies included in a NEL SR is done using the NEL BAT. The NEL BAT assesses the internal validity of each study, or the scientific soundness of study design and execution to avoid potential bias in the findings.
- **Quantity** involves an assessment of the number of available studies, the number of subjects studied and adequacy of statistical power to detect type I and type II errors.
- **Consistency** refers to the degree of similarity in the direction and size of effect, degree of association and statistical significance across the studies available to answer the question.
- **Impact** assessment evaluates the directness of the study outcomes and magnitude of effect. Directness refers to the extent to which the body of evidence was designed to address the SR question, specifically, the link between the intervention or exposure of interest and a defined health outcome. Studies are considered indirect if the outcome measured is a surrogate outcome versus a health outcome. An evaluation of the size of the effect and judgment regarding clinical significance is also involved.
- **Generalizability**, or external validity to the U.S. population, is also assessed. NEL SRs are conducted to inform development of US Federal food and nutrition policy and guidance, therefore this assessment is important to decision makers. Experts must evaluate exposures and/or interventions, the comparators and outcomes measured for applicability to the US population as a whole or segments of the US population specified in the conclusion statement.

Research recommendations

Finally, NEL staff draft research recommendations based on input received from the TEC/DGAC throughout the process of reviewing and synthesizing the evidence. These research recommendations often reflect gaps in the literature, or the need to improve upon limitations in study methodology commonly found in the body of evidence examined. Some example research recommendations that were developed during the course of NEL systematic reviews examining the evidence around effective nutrition education for children and adolescents, and dietary patterns and health (full reviews are available at www.NEL.gov), are outlined in Table 4.

Table 3: **Description of Grades Used by the USDA Nutrition Evidence Library**

Strong	The conclusion statement is substantiated by a strong body of evidence and is unlikely to change if new evidence emerges.
Moderate	There are some methodological concerns related to the body of evidence, and new data might arise which would modify the conclusion statement.
Limited	The quality and/or quantity of evidence available to support the conclusion statement are weak, and are not strong enough to support policy recommendations.
Grade not assignable	The body of evidence is too small or has serious design flaws and a valid conclusion statement is not possible.

Table 4: Sample research recommendations from Nutrition Evidence Library systematic reviews.

Research recommendations from a series of systematic reviews on the effects of nutrition education on children's and adolescents' dietary intake
The systematic reviews highlighted a number of overarching limitations in the research on nutrition education, and research recommendations which apply globally to the field of nutrition education were identified. The following limitations were identified in the literature reviewed: • Many studies were conducted in single school districts or individual schools, limiting the generalizability of the study findings. • A number of studies were not designed or adequately powered to determine whether certain children are more responsive to nutrition education. • In much of the existing nutrition education research, the dose, frequency, and intensity of the interventions tested were not well characterized. More research is recommended to investigate: • Whether subject characteristics, such as age, gender, ethnicity, or socioeconomic status, affect the outcomes of nutrition education, and how nutrition education can effectively be delivered to diverse populations • Which dose of nutrition education is optimal in terms of changing children's and adolescents' dietary intake behavior • If there are long-term impacts of these types of interventions on children's and adolescents' dietary intake behavior, as well as body weight and other health outcomes.
Research recommendations from a series of systematic reviews on the relationship between dietary patterns and health outcomes
These systematic reviews highlighted a number of overarching limitations in the research on dietary patterns. The following limitations and research recommendations were identified: • Many studies only assessed dietary intake once at baseline. Dietary patterns are likely to change over time, due to a myriad of factors, including trends in the food supply, population and individual-level changes in food choices, and individual circumstances and physical needs, future studies which examine diet patterns over time in relation to the life course would be beneficial to understand the relationship between dietary patterns, critical periods of exposure, and health. • There was variability in how studies grouped foods and assessed the types and amounts of foods consumed; therefore, it was difficult to compare food and beverage intakes across studies. Additional research is needed to better quantitate the components of dietary patterns. • A number of studies, particularly studies examining vegetarian diets, were excluded from the reviews because they did not provide sufficient description of the dietary pattern consumed. Complete description of the foods and beverages consumed is essential for comparing studies and understanding the characteristics of the dietary patterns. • Many of the studies were conducted in predominantly Caucasian populations or presumed predominantly Caucasian for those conducted in Europe. Additional research should be conducted to examine if and how sex and ethnicity might influence the relationship between dietary patterns and health outcomes. Additionally, more research is recommended to: • Advance dietary pattern methodologies to better elucidate the indispensable aspects of dietary patterns which are key to promoting health and preventing disease. • Investigate other aspects of dietary patterns, including where and when foods and beverages are consumed • Test the effectiveness of dietary patterns identified in observational studies in randomized controlled trials. • Regarding *a priori* scores, examine the effects of different methods by which components are chosen, grouped, and scored and the effect those different methods have on the resulting relationships with health outcomes. • Strengthen the analysis of food components and their association with health outcomes, within the context of dietary patterns, to determine "drivers" of dietary patterns. For example, further investigation into the multivariate patterns within the range of overall scores is needed in index analyses. Scores that are neither very high nor very low can represent tremendous variation in patterns of dietary components. • Regarding *a posteriori* approaches, evaluate and standardize methods used to assess, organize, aggregate, and adjust food variables to facilitate interpretation of findings across studies.

Roles for nutrition researchers in the systematic review process

Systematic reviews that address public health nutrition questions are an important resource for the development of Federal policies and programs designed to improve the health of all Americans. Nutrition researchers play an essential role in building the scientific foundation supporting Federal food and nutrition policy and programs. The strength of a SR depends upon the availability of well designed, implemented, analyzed and reported research studies. Nutrition researchers also support the NEL process by participating in a TEC/DGAC, serving as NEL abstractors, and by using SR tools and products, including the NEL BAT and research recommendations, to inform decisions they make when developing and implementing new

research. Additionally, nutrition researchers can contribute to the continuing evolution and refinement of SR methodology by collaborating with systematic review methodologists to understand how best to address the complexities of public health nutrition. Strategic use of SR products may support development of evidence in areas of high nutrition policy importance.

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Volunteers Needed…

Get involved! The RDPG needs volunteers for the following positions.

Student Editor for The Digest:
We are looking for a PhD student with experience publishing in peer-reviewed journals and strong editorial skills to serve as the student editor for *The Digest*. Email by 5/10/14 for details.
Contact: Ashley Vargas
AshleyVargasRDN@gmail.com

Student Writer for The Digest:
Are you a student? Consider writing a review or short research article for *The Digest*.
Contact: Ashley Vargas
AshleyVargasRDN@gmail.com

LinkedIn Coordinator:
We are looking for someone who is experienced with LinkedIn, has been actively involved in the RDPG, and has a presence on LinkedIn. Assistance is needed in monitoring our private community site and assisting in content contributions as needed.
Contact: Lauri Byerly
lbyerly@msn.com

Student Reps:
Participate with the practice group as a student volunteer. We need three volunteers: one to represent the eastern part of the US, one to represent the western part of the US, one to represent the middle part of the US. Student representatives would be responsible for representing student interests within the RDPG, organizing a meet-and-greet at FNCE for students interested in research, and other student-related opportunities.
Contact: Lauri Byerly
lbyerly@msn.com

The Chair's Message

Nancy Emenaker, PhD, RD
RDPG Chair

As we transition into the spring season, it is also time for us as a DPG to look towards our future and new opportunities to grow as researchers. Over the past year, it has been my privilege to serve as your Chair. So I would like to express my heartfelt appreciation to you, our DPG members, for supporting me and your DPG leadership team. You have shared your enthusiasm for improving the health of all those we serve –helping make my year as Chair a rewarding experience. As the first of June approaches and my term as your 2013-2014 Chair concludes, I do so knowing we are in the capable hands of our dedicated Research DPG colleagues. My hope is we continue to grow not just in our numbers or intellectually, but also in our confidence within, to stretch ourselves past individual comfort zones to dream big as researchers and as the Research DPG.

Remember that our field moves forward because of each of our contributions to advancing science. I encourage you all to continue to network within and beyond your areas of expertise, in order to gain the perspective and mutual understanding that moves us from the ordinary towards the extraordinary. Remember it is our passion for nutrition that unites us in our purpose, so use it to spur yourself and others into action within and beyond the DPG. I encourage you to continue to look for ways to make an impact in our field through your work place, the Research DPG or the Academy.

You can start by using your LinkedIn account to send us a request to join our member's only group at Research Dietetics Practice Group! Also, if you have not joined our EML you can join by emailing your request to ResearchDieteticsPG@ googlegroups.com. It's the best way to keep connected with the latest Research DPG news. As always, your research colleagues and I are here to support you. That said, we still need website design and web site implementation savvy volunteers!

Best wishes for a productive 2014!
Nancy Emenaker, PhD, RDN
2013-2014 Chair

USDA Nutrition Evidence Library Systematic Reviews:

Using food and nutrition research to inform nutrition programs and policies

CPE Questions

1. The Consolidated Appropriations Act of 2001, the *Data Quality Act*, mandates that federal agencies ensure that which of the following standards are met for information used to form federal guidance?
   a. Quality
   b. Objectivity
   c. Utility
   d. Integrity
   e. All of the above
2. The Nutrition Evidence Library's (NEL) systematic review methodology is designed to promote objective and transparent review, evaluation and synthesis of:
   a. Nutrition-related topics that are trending on social media outlets
   b. Peer-reviewed research to answer important food- and nutrition-related questions
   c. Food and nutrition oriented grey literature and print media articles
   d. Consensus reports on nutrition and health promotion topics
3. Since, systematic reviews are labor intensive, the NEL topic identification process was designed to ensure that:
   a. The most relevant topics are selected for systematic reviews
   b. The systematic review questions are clearly focused and appropriate in scope
   c. Both a and b
   d. None of the above
4. In NEL systematic review methodology, an analytic framework is created to help refine the systematic review by defining and linking which of the following elements for consideration?
   a. Populations
   b. Interventions or exposures and their comparators
   c. Intermediate outcomes and clinical health outcomes
   d. Key confounders
   e. All of the above
5. Searching, screening and selection of scientific literature is an objective process used to identify the body of evidence available to answer a systematic review question. This process is guided by inclusion/exclusion criteria that are determined in which of the following ways?
   a. a priori
   b. a posteriori
   c. both a and b
   d. None of the above
6. When conducting a NEL systematic review, data is extracted from each included article to provide an overview of the methodology and key findings related to the research question being addressed.
   a. True
   b. False
7. The NEL Bias Assessment Tool (BAT) is used to determine whether there are systematic errors that might over- or under-estimate the results of individual studies. The NEL BAT addresses which of the following types of bias?
   a. Selection Bias
   b. Performance Bias
   c. Detection Bias
   d. Attrition Bias
   e. All of the above
8. Which of the following characteristics of the body of evidence are considered when developing the conclusion statement for a NEL systematic review?
   a. The quality (Risk of Bias) assessment of included studies
   b. The quantity of available studies, number of subjects studied and adequacy of statistical power to detect type I and type II errors
   c. The consistency in the direction and size of effect, as well as the statistical significance across the studies available to answer the question
   d. The impact in terms of the directness of the study outcomes and magnitude of effect
   e. The generalizability or external validity to the population specified in the conclusion statement.
   f. All of the above
9. Generally, research recommendations developed during a systematic review process reflect gaps in the literature or identify needed improvements in study methodologies found in the body of evidence examined.
   a. True
   b. False
10. Nutrition researchers can support systematic review processes by using systematic review tools and products to inform decisions they make when developing and implementing new research.
   a. True
   b. False

Answer Key on page 27

Notes from the Secretary's Desk

Lauri O. Byerley, PhD, RD, LDN

We are continuing to expand the mechanisms by which our group and members can communicate professionally with each other. Now, available is our EML (electronic mailing list), LinkedIn, monthly email blast and the website. Check each of these out! I encourage you to join and participate. I put information for subscribing to the EML and LinkedIn below. All of these are free!

Hopefully you received an email and took a few minutes to complete a member survey. This information is very valuable to the RDPG Executive Committee. We plan to use it to help guide us in making decisions for future goals.

Don't forget to volunteer! The RDPG is always looking for volunteers to help out. If you are interested, send me an email at lbyerley@msn.com.

LinkedIn: You are invited to join the Research Dietetics Practice Group on LinkedIn! We are a private member community. Just send Nancy Emenaker (emenaken@mail.nih.gov) a request to join. See you there!

Electronic Mailing List: If you want to subscribe to the EML, then send an email message to ResearchPracticeDP@googlegroups.com. Please include your name in the body of the email. When I receive that email, I will send you back an email from the EML. When you receive this email, you must respond in order to become a member. Within the EML, you can set options. For example, you might not want to receive an email every time something is posted on the EML. You can modify your EML settings to receive notifications less frequently.

If you already participate in the EML, you should be receiving emails occasionally from the EML, Research DPG with the subject line showing ResearchDieteticPG. If you are not getting these, please contact Inés Anchondo at Ines.Anchondo@ttuhsc.edu.

If you have had difficulty accessing the EML or posting on the EML, then send Inés Anchondo an email at Ines.Anchondo@ttuhsc.edu The email address you use to contact the EML must match the email address in the EML database. If it does not, then your message will bounce back to you.

Happy Spring!
Lauri O. Byerley, PhD, RD, LDN

2014 Academy of Nutrition and Dietetic National Election Results

The Nominating Committee is pleased to report the outcome of the 2014 national election. The following individuals have been elected from among many excellent candidates. The Committee thanks all who participated in the nomination and election processes.

Board of Directors

President-elect: Evelyn Crayton, EdD, RDN, LDN (AL)
Treasurer-elect: Kay Wolf, PhD, RD, LD (OH)
Director-at-Large: Denice Ferko-Adams, MPH, RDN, LDN (PA)

House of Delegates

Speaker-elect: Aida Miles, MMSc, RD, LD (MN)
Director: Tracey Bates, MPH, RD, LDN (NC)
At-Large Delegate -Retired: Elaine Long, PhD, RDN, LD (ID)
At-Large Delegate - 30 Yrs of Age or Under: Laura Romig, RD, LD (TX)

Accreditation Council for Education in Nutrition and Dietetics

Practitioner Representative, RD: Ashley Vargas, PhD, RDN, CSG (VA)

Nominating Committee

Lorna Fuller, MS, RD, LDN (OH)
Penny McConnell, MS, RDN, SNS (VA)
Tracy Wilczek, MS, RDN, LDN (MA)

Commission on Dietetic Registration

Registered Dietitian:
Khursheed Navder, PhD, RDN (NY)
Kevin Sauer, PhD, RD, LD (KS)
Board Certified Specialist in Renal Nutrition:
Jessie Pavlinac, MS, RD, CSR, LD (OR)

For more information regarding nominations and elections, visit www.eatright.org/elections.

Member Spotlight

Mary-Jon Ludy, PhD, RDN

Erin Gaffney-Stromberg, PhD, RD
Nutrition Fellow, ORISE in support of USARIEM

Mary-Jon Ludy, PhD, RDN

Our spotlight member for this edition is Mary-Jon Ludy, PhD, RDN. Dr. Ludy is an Assistant Professor of Clinical Nutrition at Bowling Green State University in Bowling Green, Ohio. Like most academic positions, hers is comprised of the three classical elements of teaching (60%), research (25%), and service (15%). She teaches undergraduate courses in nutritional assessment and clinical nutrition therapy, as well as clinical nutrition at the graduate level. She supervises the research of undergraduate honors students and master's candidates. She writes grants and manuscripts, presents research at conferences, interprets findings for popular press reporters, and reviews journal articles. She is also the acting chair of her college's Research Development Council, serves as a faculty affiliate of her University's Center of Excellence for Health and Wellness Across the Lifespan, and looks forward to being our Research DPG's representative at the 2014 Public Policy Workshop.

Dr. Ludy, please tell us about your background. How did you get to where you are now?

My interest in nutrition began with a GI tract-themed science fair project in 2nd grade science. I continued to nourish that passion with 10 years of 4-H cooking projects. When I arrived at Bowling Green State University (BGSU) as a freshman, it was little wonder that dietetics became my major. From there, I pursued Tufts' combined MS and dietetic internship. That enabled me to begin conducting scientific research – both while interning with a micronutrient supplementation program in Nepal and analyzing data from a cross-sectional study of adults with HIV in Thailand. Employment as an outpatient clinical dietitian at Massachusetts General Hospital exposed me to the strong behavioral component of eating and my patients' desire to hear positive messages surrounding food. This prompted me to pursue a PhD in nutrition at Purdue where my research focused on whole foods, including chili peppers and peanuts, which may aid in weight management. The fall prior to my dissertation defense, life came full-circle when I was invited to present an alumni lecture at BGSU's annual nutrition symposium. Although I'd intended to complete a post-doctoral project, I was informed of a faculty position that appeared written for me – clinical nutrition, dietetics experience, and research/teaching balance… so here I am back at my alma mater.

Could you please summarize your current research for us?

The broad focus of my research is energy balance through dietary manipulation. Under this broad scope, I have two current projects underway. One is comparing the appetitive effects of spicy, capsaicin-containing peppers vs. non-spicy, capsiate-containing peppers in a traditional meal. This is supported by the Academy, the McCormick Science Institute, and Ajinomoto. The other is an internally-funded project exploring the patterns of weight change in college students. The purpose is to explore my belief that the overweight/obesity epidemic stems from marked overconsumption at specific time points rather than from a small, sustained positive energy balance.

Pedagogically, I am interested in promoting active learning with technology across the dietetics curriculum. A colleague and I obtained a multi-year grant which will enable us to incorporate a technology module across each course in our undergraduate dietetics curriculum (ex. March Madness-style reviews of health apps and professionally-oriented Twitter chats).

How did you become involved/interested in your current line of research?

My training as a nutrition scientist, specializing in human ingestive behaviors, was inspired by my professional experience as a dietitian and upbringing in a rural Appalachian community. Further, it was guided by my desire to conduct research that has practical application in real-life situations and involves students in the research process.

As an outpatient clinical dietitian, my patients frequently approached their appointments having consumed a "last supper," laden with foods they deemed responsible for causing their health problems. These patients expected me to present them with a list of foods that they may never eat again, but were pleasantly surprised to learn and experience the benefits of alternative foods – such as the chili peppers that I now research. I believe that positive recommendations are important modes of disseminating simple, usable nutrition knowledge.

I believe that research provides the opportunity for students to learn actively and become more responsible for their learning

outcomes. Having spent my formative years in a region where obtaining a college education was not the norm, I cherish the opportunity to provide students (many of whom are first-generation college students) with their initial exposure to the research process. I believe that good research drives good teaching, and vice versa.

Dr. Ludy, what advice would you give to a young researcher for developing a successful line of research?

Get out of your office and meet people! Mentors, collaborators, and supporters come from surprising places. To push myself with writing, an interdisciplinary group of tenure-track assistant professors and I formed a peer-review group. For general sanity, a group of new faculty and I gather for a weekly meeting titled "Nerd Club" where we share meals, drinks, and discuss the ups/downs of our transitions to higher education. For example, one of my recent NIH grant submission was developed over the "random" paring with a psychologist on a conference panel.

Don't be afraid to talk with heavy hitters! If you're a student, make connections by going to conferences, and/or by volunteering to transport speakers between the airport and your university/conference venue. Some of my best career advice has come from shared taxi rides and bus seats. Networking is vital to learning about career opportunities with people in and out of your field of expertise.

Protect your research time! I establish times for writing and am known to post a sign on my door that says, "do NOT interrupt unless someone is hurt or the building is on fire." Also, realize that it is okay to say "NO." As a promising young researcher, everyone is going to want a piece of your time. If you're apprehensive about turning down a project/responsibility, ask your department head if you can use him/her as a shield – "This sounds like a fascinating opportunity, but XXX advised me against it at this time."

What are your career goals?

As a teacher-scholar, I have the special opportunity of providing many students with their initial immersion into nutrition research. My career goal is to promote an early interest, promote understanding, and support research among future nutrition professionals. With this, I hope that a ripple effect will occur: my university will be stronger, students' lives will be richer, the message will amplify to other institutions, and our field will move forward.

How has your affiliation with the Academy impacted your career progression?

I like to think of the Academy as my roots. As a student, Academy scholarships helped support my education, and FNCE sparked my interest in research. As a young investigator, the Academy provided my first externally-funded grant. The Academy's Daily News, Evidence Analysis Library, Journal of the Academy of Nutrition and Dietetics, and DPG listserv are my go-to resources. Most of all, I appreciate the professional network that the Academy has helped me create.

If someone were to ask you to explain why research is important to the field of dietetics, what would you say?

Nutrition is a science. Research is the base of any science. Whether or not you choose to practice as a research dietitian, you must be able to evaluate research. The general public is bombarded with both questionable and quality nutrition information. As dietitians, it is our responsibility to use evidence-based guidelines to help consumers navigate our complex food environment.

2013-14 RDPG Awards Announcements

Undergraduate and Graduate Student Research Awards

One undergraduate student award of $400
One graduate student award of $400
Applicants must have an abstract accepted for presentation at FNCE in Atlanta in October, 2014.
All applications should be one pdf file sent by email. Applications provided in another format will not be accepted

Please include:

1. Your name and your academy member number (all award winners must be RDPG members as of 5/15/13)
2. Your mailing address, email address, your phone number
3. Your mentor's name
4. The name of the project
5. A copy of your acceptance letter from the academy (notification of abstract acceptance or non-acceptance will be e-mailed by the academy.)
6. A copy of the abstract including title and authors
7. Applications should be submitted electronically to: Dr. Jeanene Fogli at jeanenefogli@gmail.com
8. Applicant will be notified by email of receipt of application. It is the responsibility of the applicant to follow-up if an email notification of receipt is not received.
9. Applications are due June 1, 2014

Award winners will be notified via email and phone by July 15, 2014. Award will be given at the RDPG member breakfast during fnce.

Published Paper First Author Award

One RDPG member will be selected to receive this award.

Please include:

1. Your name and your academy member number (all award winners must be RDPG members as of 5/15/13)
2. Your mailing address, email address, and phone number
3. Electronic copy of paper; paper must have been published in an issue of a refereed journal dated between May 1, 2013 and April 30, 2014. Papers submitted or accepted but not published will not be considered this year but could be submitted for a future award. Applicant must be the first author.
4. A 250 word explanation of why the paper should receive this award from the rdpg
5. Applications should be submitted electronically to: Dr. Jeanene Fogli at jeanenefogli@gmail.com
6. Applicant will be notified by email of receipt of application. It is the responsibility of the applicant to follow-up if an email notification of receipt is not received.
7. Applications are due July 1, 2014

Award winners will be notified via email and phone by September 1, 2014.

Awardee will be introduced at the RDPG member breakfast at FNCE. the award certificate will be presented at this meeting or mailed to the recipient.

Published Paper Junior Faculty Award

One RDPG member will be selected to receive this award.

Please include:

1. Your name and your academy member number (all award winners must be RDPG members as of 5/15/13)
2. Your mailing address, email address, and phone number
3. Electronic copy of paper; paper must have been published in an issue of a refereed journal dated between May 1, 2013 and April 30, 2014.
   Papers submitted or accepted but not published will not be considered this year but could be submitted for a future award.
   Applicant must be within the first 5 years of post-doctoral career.
4. A 250 word explanation of why the paper should receive this award from the RDPG
5. Applications should be submitted electronically to: Dr. Jeanene Fogli at jeanenefogli@gmail.com
6. Applicant will be notified by email of receipt of application. It is the responsibility of the applicant to follow-up if an email notification of receipt is not received.
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Treasurer 's Report

Spring Greetings Research DPG Members!

Karin Pennington, MS, RD, LD
RDPG Treasurer

This will likely be my last update as Treasurer, so this is a bittersweet report. Thank you for entrusting me with the DPG finances! I hope these quarterly updates are helpful. We are in good financial standing. Our current reserves stand at 119% of budget. Recent expenses are payment for The Digest production (design company, CPEU writer, and honorarium to the lead writer). Before the fiscal year ends, we will have expenses for PPW, this Digest, and a donation to The Academy's Foundation.

As we move into the next fiscal year starting June 1, we will have a new budget. We hope to continue to provide multiple member benefits – at FNCE, with The Digest, and for CPEUs among others. If there are additional ideas for members, please let one of the Executive Committee members know!

Karin Pennington, M.S., R.D., L.D.
RDPG Treasurer

Research DPG 2013-14 Budget

		Annual Budget ($)	As of February 2014 ($)
Revenue	Membership	18,580	13,479
	Grants/Contracts	8,000	3,000
	Interest Income	—	3,519
		26,580	19,998
Expenses	Lodging/ Subsistence	1,393	1,259
	Transportation	5,130	1,996
	Professional/ Consulting	1,500	2,580
	Postage/Mailing Services	150	31
	Teleconferences	90	58
	Advertising/Promotion	0	774
	Member Dues/ Fees	973	1,831
	Outside Services	5,200	200
	Awards	4,600	4,000
	Audio Visual	3,000	1,223
	Food Service	5,250	2,330
	Printing/Copying	100	19
	Other	50	0
		28,119	16,301
	NET	**-1,536**	**3,697**
Reserve	**November 2013 Reserve**	**28,116**	**33,494**
	Reserve Percentage	**—**	**119%**

High-Sodium Diets in Spaceflight: Health Consequences and Methods to Reduce Intake

Barbara Rice, MS, RD; Helen W. Lane, PhD, RD; and Vickie Kloeris, MS, CFS
Affiliations: National Aeronautics and Space Administration

For some 50 years, the dietitians, researchers, and food scientists of the National Aeronautics and Space Administration (NASA) have provided the nutritional and food safety standards, developed the food systems, and produced the food provisions for all U.S. human spaceflights. In the past 12 years, the challenge to provide food has become more pronounced with the continuous operation of the International Space Station (ISS).[1,2] All diets must meet the health and safety guidelines for crewmembers living and working in space for up to 6 months.[3,4] NASA researchers spent about 20 years studying the effects of dietary sodium on the health and safety of crewmembers, resulting in the conclusion that the dietary sodium content should be lowered.

The ISS standard menu utilized in 2010 contained more than 5,600 mg/day of sodium and 2,900 kcal/day. Dietary sodium intake averaged about 4,600 mg/day over the first 18 ISS expeditions (an expedition is an ISS increment that has a set of crewmembers and generally lasts 6 months). At the same time, energy intake was generally less than 2,500 kcal/day.[1]

Historically, NASA research focused on two aspects of sodium: fluid and electrolytes, and bone. Initially, there was concern about fluid and electrolyte changes due to microgravity. Investigators studied endocrine controls along with measurements of fluid spaces (intracellular, extracellular, and total body water) and electrolyte levels in urine and blood. Although extracellular fluid levels decreased during space flight, total body water did not. Urine volumes decreased and concentration increased, but blood sodium levels did not change during flight. Urinary sodium levels reflected dietary sodium intakes (e.g. increased dietary sodium = increased urinary sodium). The endocrine hormones, such as aldosterone, antidiuretic hormone, and angiotensin systems, reflected normal regulation of blood sodium levels. Thus, the level of sodium in the astronauts' foods was not considered an issue related to the fluid changes in space flight.

At the same time, NASA and the European Space Agency[5] investigators conducted calcium and bone studies, using actual space flight and simulations of microgravity with bed rest. As dietary sodium levels increased, urinary sodium and calcium levels increased. A major concern for many years was that the combination of the concentrated urine, with higher concentrations of calcium and purines due to bone and muscle losses, respectively, would increase the risk factors for renal stones.

As crew members flew longer flights during the ISS program, vision changes were noted in some crew members.[5] The medical team attributed this to the increased intracranial pressures found after spaceflight. With these changes, NASA developed some countermeasures including lowering the sodium levels in the foods. This required a major reformulation effort described below.

U.S. Food System for the ISS

The current U.S. food system for the ISS is based on the Space Shuttle food system that has been in use since the beginning of the Space Shuttle program in 1981. Because of the longer duration of the ISS missions, the ISS food system was expanded from the more limited Space Shuttle food list to a current inventory of about 200 foods and beverages. A standard menu of foods for an 8-day rotation is packed pantry style (i.e., all meats are packed together, all vegetables are packed together, etc.). Crewmembers assemble meals from the various food categories, so they are eating from a standard menu but not eating in the exact meal combinations on the menu. In addition, crewmembers are allowed a small quantity of bonus food items to augment the standard menu. This bonus food equates to about 10% of the food supply available to a crewmember in orbit and can consist of more U.S. space food or even some commercial shelf-stable food items.

The NASA food system menus are high in sodium because only ambient-stored processed foods are used. The lack of refrigerators and freezers for food, both on the Space Shuttles and the ISS, mandates a shelf-stable food system. Shelf-stable foods historically tend to be high in sodium because sodium aids in the preservation of these foods.[1] Furthermore, the Space Shuttle food system was designed with the premise of using as many commercial off-the-shelf (COTS) foods as possible to save money. The NASA food systems that preceded Space Shuttle consisted of custom-produced foods that were extremely costly. The use of COTS foods automatically led to a high level of sodium in the diet because commercially processed foods tend to be high in sodium,

which is an inexpensive way to make foods taste good. In addition, crews in spaceflight have very limited, if any, access to fresh fruits and vegetables, which are naturally low in sodium. With so few fresh foods available to astronauts, the sodium content of the diet is increased even further over the typical ground-based diet.

The Process to Reduce Dietary Sodium

In March 2010, the Space Food Systems Laboratory (SFSL) at NASA's Johnson Space Center began a project to reformulate existing products to reduce sodium levels. The project team in the SFSL consisted of several food scientists and a dietitian. This team reviewed the sodium content of the some 200 different foods and beverages on NASA's food list and identified 90 different thermostabilized and rehydratable food products to be reformulated. These 90 were selected on the basis of sodium content.

The team developed a schedule for reformulation that would have required about 4 years to complete with in-house resources. NASA management wanted the project completed in less time, so to augment the SFSL reformulation efforts, two outside firms, one with expertise in freeze-dried foods and one with expertise in thermostabilized foods, were hired to expedite the project. The 90 products were reformulated in about 2 years, with 30 foods each for the two consultant firms and for the SFSL. Existing foods were reformulated, rather than replaced with totally different products because the existing food list was balanced among food types, providing variety that is important to ISS crewmembers during their lengthy stays in orbit.

The primary approach was to remove sodium by either using low-sodium versions of ingredients or by removing salt altogether and using other ingredients, such as spices and herbs, to compensate for the sodium in the reformulated products. Some of the spices included were disodium inosinate and disodium guanylate to increase the umami flavor in savory foods along with lemon juice, basil, oregano, sugar, Mrs. Dash Fiesta Lime Seasoning®, and Mrs. Dash Garlic & Herb Seasoning®.

Because of the low volumes of food required for spaceflight, NASA has an advantage over the commercial food industry in being able to use these typically much more expensive ingredients in formulations without significant economic impact. For freeze-dried food products, NASA had, in many instances, used COTS frozen foods and further processed them into freeze-dried foods. The reformulation of these products produced foods made from individual ingredients rather than further processed commercial products with the expected increased labor costs. In contrast, NASA's thermostabilized products were already predominately made from individual ingredients, so this project had little effect on labor costs to produce these items.

When a new formulation was identified for a product, a small test batch was made in the SFSL for evaluation by the project team. This often resulted in rejection and rework of many of the formulations. When the team found a new, acceptable formulation, the next step was to produce enough of the product to allow for large-scale sensory evaluation using a group of untrained volunteer panelists. These evaluations were publicized to the astronaut corps and some participation by current astronauts did occur.

During sensory evaluation, the product was rated for appearance, color, odor, flavor, and texture, and given an overall rating. A 9-point hedonic scale was used for these rankings, and an overall score of 6.0 or higher was required before the product was deemed acceptable for further production. Occasionally a reformulated product did not pass this evaluation. In that case, the comments made by the panelists were evaluated and revisions were made to the formulation and tested again. In the case of the reformulations done by the two consultant companies, those reformulations went directly to large-scale sensory evaluation.

Sensory evaluations of the final reduced-sodium formulations showed acceptance scores that were not significantly lower than the scores of their higher-sodium predecessors and in a few cases were higher. The net result of the reformulation task was a 40% reduction in the sodium content of the previous ISS standard menu from 5,600 mg/day to approximately 3300 mg/day.

These reduced-sodium products were manufactured and shipped (launched) to the ISS. The orbiting crews began consuming significant quantities of these reformulated

foods in 2013 and the project team is anxiously awaiting their feedback.

It is interesting to note that salt, in liquid form, has always been available for crewmembers to use in orbit. One of the assumptions of this project was that liquid salt would continue to be made available to the crewmembers. NASA decided that the reduced-sodium diet would not be mandated to all crewmembers, but reduced-sodium products would be available for crewmembers who desired them or had symptoms of increased intracranial pressure. As another variable, Russian foods as well as foods provided by the Canadian, European, and Japanese space agencies are available on the ISS— and NASA obviously cannot regulate the sodium content of those foods.

Measuring Dietary Intakes: Food Frequency Questionnaire

With the advent of the ISS, nutrition researchers needed an easy-to-use valid method to determine dietary intakes. This led to testing a food frequency questionnaire (FFQ) originally developed by Gladys Block. The questionnaire was validated against 24-hour dietary records during studies of crewmembers who lived in a closed chamber for 60 or 91 days.[7, 8]

This semi-quantitative FFQ is self-administered each week.[4] The FFQ is designed to include the foods that are available for a specific expedition and requires about 5 to 10 minutes to complete. The FFQ assesses intake of seven nutrients including sodium along with energy, protein, potassium, iron, fluids, and calcium. Data from the completed questionnaire are routinely provided to the medical-nutrition teams for assessments of the astronauts' diets. These teams then make recommendations to the astronauts about their diets within 48 hours of completion of the FFQ, thereby allowing for self-corrections in their diets. With a sodium recommendation of 3,500 mg/day, the sodium reformulation project will enable astronauts to meet this level.

Summary

The level of sodium in astronauts' diets has always been high and, in light of the continuous operation of the ISS, NASA decided to reduce astronauts' dietary sodium intake. Within a couple of years, NASA hopes that astronauts will consume diets closer to 3,500 mg/day, and if they consume only items from the U.S. menu, they will easily meet this recommendation.

Barbara Rice, MS, RD, is with Enterprise Advisory Services, NASA, and Helen W. Lane, PhD, RD, and Vickie Kloeris, MS, are with NASA Johnson Space Center, Human Health, and Performance Directorate, in Houston, TX

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Preparing for a Healthy Pregnancy: Nutritional Advice for Men and Women

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Conceiving a child is a natural and instinctive part of human existence. Yet, the modern world exposes would be parents to a multitude of potentially harmful influences, making it vital to prepare for pregnancy. Nutrition, moderate exercise, maintaining a normal weight, managing stress, and reducing environmental toxins are all important lifestyle factors that can enhance fertility as well as the health of an unborn child.

Three to four months prior to conception is the effective window to maximally influence a developing oocyte or spermatozoa. The fetal origins hypothesis posits that the uterine environment primes a human being for a lifetime of better or worse health.[1] It is a compelling reason to follow a healthy lifestyle when trying to conceive as well as during pregnancy.

Research reveals that eating a healthy diet makes it easier to conceive.[2] Abundant evidence supports recommending a fresh, whole food diet, rich in vegetables and fruits, abundant in omega-3 fatty acids (choosing low-mercury fish such as wild salmon and sardines), eggs, and vegetable sources of protein. The diet should be low in processed foods, meats, and rapidly digesting, high glycemic index carbohydrates. The Mediterranean diet is one such whole food diet; in two recent studies it was associated with a 44% lower risk of infertility in women attempting to conceive naturally, and a 40% greater likelihood of conception in couples using In Vitro Fertilization (IVF) to conceive.[3,4]

Macronutrients and Fertility

The Nurse's Health Study (NHS) II, which began in 1989, has demonstrated ways in which macronutrients can influence the risk of ovulatory infertility. Ovulatory infertility is a broad term that encompasses polycystic ovarian syndrome, luteal phase dysfunction, hypothalamic problems, and even stress induced infertility. The type of protein consumed was shown in NHS II to impact the risk of ovulatory infertility.[5] In women over the age of 32, each additional daily serving of red meat, chicken, or turkey increased the risk of ovulatory infertility by nearly one-third, while fish and eggs had no effect, and vegetable protein reduced the risk by 50%.

In 2004 the FDA/EPA issued a joint warning to pregnant women and women who might become pregnant; the agencies advised these women to eat no more than 12 ounces per week of seafood, to entirely avoid eating shark, swordfish, king mackerel, and tilefish and to limit albacore tuna to 6 ounces or less per week. These large predatory fish were to be avoided because they can contain significant amounts of mercury that is neurotoxic to a developing fetus. The 2011 National Health and Nutrition Examination Survey (NHANES) showed that in response to this warning, 90 percent of women are consuming less than the FDA-recommended amount of fish.

However, fish is the best source of omega-3 in the diet. The Avon Longitudinal Study of Parents and Children, which began in 1991, showed that when pregnant mothers ate less than the recommended 12 ounces of seafood per week their children tended to have lower verbal IQs.[6] The ideal fish to eat is low in mercury and high in omega-3s such as wild Alaskan salmon, sardines, herring and trout. The Natural Resources Defense Council (NRDC) website (www.nrdc.org) contains a "Consumer Guide to Mercury in Fish".[7]

The NHS II also revealed increased ovulatory infertility in women who ate high glycemic index carbohydrates. Processed breakfast cereals in particular stood out with a near double relative risk of ovulatory infertility.[8] Flours are the first ingredients in many breakfast cereals; flour, including whole-wheat, is a high glycemic index carbohydrate that is rapidly metabolized into blood sugar leading to spikes of insulin with subsequent inflammation. Higher levels of insulin reduce sex-hormone-binding globulin (SHBG). Less SHBG leads to higher levels of circulating free testosterone, which can also impair fertility. Soda consumption has also been linked to infertility. Two studies show a linear relationship; the more caffeinated soda consumed, the longer the time to conceive.[9,10]

Trans-fats in the diet have been linked to coronary heart disease, diabetes, obesity, and other negative health outcomes. While they are gradually being removed from the American diet, a significant amount persists in products that use partially hydrogenated oils; the NHS II revealed that trans fats increase the risk of ovulatory infertility by 73%.[11]

Micronutrients and Fertility:

The American Academy of Pediatrics, the American College of Obstetrics and Gynecology, and the American Academy of Family Physicians all recommend that women of childbearing age take a multivitamin with folic acid. When taken before conception and in the first trimester of pregnancy these supplements reduce the risk of neural tube defects, heart defects, musculoskeletal defects, and oro-facial defects.[12] Yet the 2011 NHANES revealed that only 34% of women between the ages of 20-39 get the recommended amount of supplemental folic acid.

The NHS II also showed that multivitamins make it easier to conceive and less likely that you will miscarry.[13] And three separate studies revealed an association between the use of folic acid prior to conception and a 40% reduced risk of autism.[14, 15, 16] Choose multivitamins carefully; a preconception multivitamin should contain folic acid 400-600 mcg, iron 18 mg, and iodine 150 mcg among its various ingredients.

Women who are consuming less than the recommended 12 ounces of fish per week may benefit from supplementing with omega-3s. These essential fats are scarce in the American diet and critical to the developing fetus' nervous system. If necessary, women should choose a molecularly distilled fish oil product with DHA (300-400 mg) and EPA (500-600 mg).

The Male Diet and Fertility:

We now know that a father's diet plays an important role in the health of his sperm and his offspring. Oxidative stress is a leading cause of male subfertility; yet, in the US, 80% of men do not consume the recommended five servings of fruits and vegetables per day. Encouraging men to consume more vegetables and fruit is healthy dietary advice.

A study of military recruits in Denmark revealed that the men who ate the most saturated fats had a 38% lower sperm concentration and 41% lower sperm counts than those who ate the least fat.[17] A similar result was found in the US in men attending an infertility clinic.[18] Eating more mono-unsaturated fat may be protective; when added to the Western-style diet of healthy young men, 2.5 ounces a day of walnuts were shown to increase sperm vitality, motility, and morphology.[19]

Subfertile men benefit from taking multivitamins as well. A 2011 meta-analysis of 34 studies found that men who took supplements were four times as likely to impregnate their partner and five times as likely to have a live birth.[20] Another study showed that men who supplemented with omega-3s (EPA 1.1 g + DHA 700 mg) had higher sperm counts and more normal morphology.[21]

Environmental chemicals:

Food and beverages are the primary way that we absorb environmental toxins into our bodies.[22] Disturbingly, the average baby has more than 200 chemicals in their bodies at the time of birth.[23] These environmental chemicals can increase a child's risk of ADHD, autism, diabetes, and heart disease.[24] While frightening, lifestyle modification that reduces exposure to toxic chemicals in parents can reduce the risk to the fetus.[25, 26]

Choosing organic meat, poultry, pork, and produce whenever possible is the best way to reduce pesticide exposure and genetically modified organisms (GMO). When the cost is prohibitive, selectively purchasing the least contaminated conventionally grown vegetables and fruits as listed on the Environmental Working Group website list is a wise alternative. The Environmental Working Group (EWG; www.ewg.org) has calculated that you can reduce your pesticide exposure by 92% when you eat from the clean fifteen rather than the dirty dozen.[27]

Many resources are available to guide prospective parents to safer choices and practices.[28] The EWG website (www.ewg.org) provides information on chemicals in specific food, water, cosmetics, and cleaning products. Adopting new behaviors that reduce environmental chemical exposure in food, water, and food storage containers can significantly and rapidly reduce the body burden of many of these toxins.[29, 30] A 2011 study revealed that adults dropped their urinary BPA levels by two thirds in just three days when they were provided with freshly catered meals that avoided canned foods and the use of plastic containers.[31]

While changing lifestyle habits is challenging, most couples are maximally motivated to do so when they consider becoming pregnant. Registered dietitians can help their clients conceive with greater ease and bear healthier children.

It is recommended that they discuss a healthy lifestyle with all women of childbearing age including:

- Eating fresh, whole food with five or more servings of vegetables and fruits, sufficient omega-3 fatty acids, and more vegetable and less animal protein
- Taking a daily multivitamin with folic acid
- Reducing exposure to environmental chemicals in food and beverages
- Recommending immunizations before pregnancy
- Maintaining or achieving a normal weight before conception
- Avoiding alcohol, cigarette smoking, and recreational drug use

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The History of High Fructose Corn Syrup

Jody L. Vogelzang, PhD, RDN, FAND, CHES

Food can be classified in ways other than by the nutrients they contain. In today's fast moving culture, foods are characterized as having "magical" qualities that can turn consumers into "superstars", or reduce them to a less than optimal state of health and wellness. Sugars appear to be one of those vulnerable foodstuffs that can be enjoyed in moderation, but also contribute to the development of Type 2 Diabetes, metabolic syndrome, impaired cognitive function, obesity, and tooth decay.[1]

Within this debate on the role of sugars in the diet, the most highly contested in recent years is high fructose corn syrup (HFCS).[2] This article will discuss the history of this sweetener in our diet, and how its metabolism may or may not be related to obesity.

HISTORY OF HFCS

The innate preference for sweet foods has been well established, in fact, the decoding of the genome has shown the exact chromosomal location for the gene that drives our consumption of sweet foods.[4] Food manufacturers were aware of the desire for sweet foods well before the decoding of the genome and satisfied this instinctive food preference with sucrose derived from sugar cane or sugar beets. The fluctuating price in sugar cane, usually grown in tropical climates outside the United States (US), spurred American ingenuity and in the 1950s ground-breaking work in food chemistry yielded HFCS. This liquid alternative to sucrose began appearing in food products in the 1960s and existed in obscurity until the 1980s when evidence appeared, though inconclusive, implying HCFS promoted metabolic anomalies.[2,3]

When it was developed, HFCS was an appealing food additive. It was generally recognized as safe (GRAS) with a Type 2 conclusion on safety by the Food and Drug Administration,[5] added little cost, dissolved easily, and delivered a well-accepted sweet flavor. In addition, fructose, which makes up 42-55% of HFCS, was a naturally occurring product found in honey, fruits, and vegetables. These favorable characteristics allowed HFCS to emerge as a one-to-one replacement for sucrose from 1970-1998.[2,3]

From 1998 to the present, sucrose and HFCS have existed in relatively equal amounts in the American diet. In 2004, Bray, Nielsen and Popkin ignited discussion in the scientific community with their article linking HFCS to the growing rate of obesity in the US. [6]

METABOLISM OF HFCS

The science of fructose metabolism appears clear cut from the standpoint of biochemistry, overconsumption results in storing the energy from HFCS as fat and glycogen. Yet the real question is not only the metabolic pathways, but also what happens when we eat beyond our metabolic needs. In any sugar over-feeding, more insulin is required to maintain a normal level of blood glucose. For many years, the similarity in structure between fructose and sucrose suggested that it would be similarly metabolized. However, meals containing high amounts of dietary fructose did not decrease the insulin and leptin levels in women and the study subjects reported lower satiety leading to an increase in food intake.[1] In hepatic insulin resistance, additional insulin is needed to achieve normal blood sugar in the presence of fructose, yet, high circulating insulin did not suppress further gluconeogenesis. The important piece of information here is not that fructose was included in the carbohydrate mix with negative results but rather that the mix was in excess of metabolic needs.[7]

In clinical studies, the individual response to varying amounts of fructose should be considered. Since any unusual effects of fructose are intermediated by interactions with glucose (metabolically a large amount of fructose converted to glucose), underlying genetic differences in the way glucose is metabolized should be considered in study interpretations. The genetic uniqueness of study subjects makes it difficult to tell if results were due to the fructose, or preexisting issues with glucose metabolism.[6]

Variations in individual response to sweetener intake make it difficult to use population level data (i.e., ecological and epidemiological data) in making a case for or against HFCS. However, the correlation between metabolic disease and HFCS exists: by the year 2002 HFCS sweeteners represented >56% of the US nutritive sweetener market, and obesity and Type 2 diabetes were on the rise.[8]

OBESITY, SOFT DRINKS, AND HFCS

Given the American diet has changed over the last century, it is impossible to refute. The creep of HFCS into foods and into our refrigerators and pantries was only one of these changes. During the first six decades of the 20th century, consumption of dietary carbohydrates decreased.

This change was largely due to a decrease in whole grains, as meat rose to the center of the plate bringing with it a 30% increase in fat consumption. Since the mid-1960s, carbohydrate intakes rose back to 19th century levels; although the mix of carbohydrates was different than it was pre-1960. Specifically, fiber intake decreased as refined foods became the preferred source of carbohydrates. It was during this same time period that caloric sweeteners gained a strong foothold in American diets with an overall increase of over 87%.[8]

With these changes in dietary consumption, chronic disease rates began to reflect the changes in food intake. In the 1980s prevalence of heart disease and high cholesterol increased due to the years of increased meat consumption and led to a scientific discussion about the role of fats in the diet. However, it wasn't until 2004 that attention was acutely focused on obesity, diabetes type 2 and metabolic syndrome and the foods containing HFCS.[8]

Today, the controversy bubbles around the soft drink industry and obesity. At the heart of the issue is HFCS. According to White et al., HFCS levels in our diet have been in decline since 2002, yet the US obesity crisis continued to worsen during that time.[9] While on the surface this data does not support an impact of HFCS on obesity, controversy continues to exist around this topic.[10]

The role soft drinks play in appetite stimulation is one additional effect of HCFS that is currently under investigation. However, research in this area is complex, contradictory, and unclear. Several feeding studies showed that individuals who drank caloric beverages shortly before or with a meal ate the same amount of calories as those who had a calorie free drink. Yet, moving that drink to one hour before a meal gave quite different results. In another gender stratified study, women who drank a caloric beverage one hour before a meal significantly increased their calorie load at the next meal but the opposite was seen in males.[11]

CONCLUSION

Since sucrose and HFCS are similar in calories, would it make sense to restrict or eliminate HFCS from the diet only to replace it with sucrose? Or, should dietetic professionals advocate for more fiber and less refined carbohydrates as a general approach to the sweetener dilemma? While HFCS may not be the villain it has been painted to be, looking at the total amount of sweeteners consumed in the diet is still valid. Whether it is sucrose, fructose, or a blend of the two as found in HFCS, Americans could do well to heed the adage of "everything in moderation".

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Foods That Make You Fertile: Nutritional Advice for Women and Men

Kathleen Zelman, MPH, RD/LD

Healthy pregnancies can be difficult to achieve. It is estimated that infertility impacts 1 out of 10 women. While some medical interventions drugs and high-tech medical procedures can improve infertility, a safer, more natural approach of optimum nutrition and lifestyle changes can increase pregnancy success rates.

Preconception nutrition research shows that healthy diets are tied to fertility health for men and women, yet diet is an often-overlooked component of fertility. Changes in lifestyle, diet and exercise habits remain important influences in pregnancy success rates and fetal health outcomes.[1] It is estimated that 1 in 4 women in reproductive age is obese and 75% of infertility is related to weight and polycystic ovary syndrome (PCOS).[2, 3]

Importance of Achieving a Healthy Weight

Overweight and obese women have a reduced probability of getting pregnant.[2] The best weight range for pregnancy is between 20 and 24 on the body mass index scale.

Being overweight or underweight with too little or too much body fat may interfere with a woman's fertility.[1] For overweight women, weight loss can help regularize menstrual cycles and increase the chance of spontaneous ovulation and conception.[4] Furthermore, women who are obese before conception tend to gain and retain more weight during pregnancy than recommended.

But how much pre-conception weight loss is necessary? Some data suggest that as little as 5–10% weight loss can improve fertility outcomes.[5] Zain and Norman found improved pregnancy rates and positive results were obtained with female subjects who lost 5 percent of their body weight.[6]

A recent Stanford study of 39 patients found that women who achieved meaningful weight loss, defined as lost 10% of their maximal weight (initial BMI: 29.7) along with decreased calorie intake and an increase in exercise, had an 88% pregnancy rate compared to women who lost less than five percent (initial BMI 33.6) who only had a 33% pregnancy rate.

Trying to Conceive Diet Strategies

Pre-conception nutrition is a vital part of preparing for pregnancy. A healthy diet rich in nutrients is the best bet to improve ovulation, fertility and offer an excellent start to a pregnancy.[7] Nutrition intervention to promote fertility focuses on weight, dietary quality, insulin resistance, and hormonal imbalance.

The Academy states that the link between fertility and healthy eating is unclear, and fertility diets in general have limited, if any, scientific evidence to support their claims. The following is a general fertility diet pattern thought by some to promote increased fertility in otherwise healthy individuals:[8]

- Emphasis on meeting calorie and nutrient needs in 3 plus meals per day.
- Eating foods from all food groups, including at least 5 servings of antioxidant rich fruit or vegetables, low glycemic whole grain carbohydrates, healthy fats, low fat dairy and plant and lean animal protein.
- More natural foods, closer to the earth and organic if affordable.
- Adequate intake of omega 3 rich fats - consume at least 12 ounces of low mercury fish and no more than 6 ounces of canned albacore tuna weekly. Fish is the best source of omega 3 fatty acids, which are critical to a baby's brain development.
- A multi and pre-natal vitamin (max 200% of DRI)

While the overall evidence is weak, there are multiple versions of fertility diets designed to help women conceive. One of the most popular recommendations stem from the Harvard Nurses' Health Study of more than 18,000 women and are aimed at preventing and reversing ovulatory infertility.[7] These strategies won't guarantee a pregnancy but are without side effects and are the foundation of a healthy eating strategy for motherhood and beyond.

These dietary recommendations include:

- Avoid trans fats
- Use more unsaturated fats that can improve insulin sensitivity and cool inflammation; cut back on saturated fats
- Eat more plant protein and less animal protein. Replace one serving of meat daily with a plant protein source
- Enjoy whole milk or full fat ice cream or yogurt daily
- Choose carbohydrates that are high in fiber and slowly digested to help control blood sugar and insulin levels
- Take a multi-vitamin and get an extra 400 micrograms per day of folic acid. All women capable of getting pregnant should consume

400 mcg of folic acid daily from fortified foods or supplements in addition to food forms of folate from a varied diet[9]
- Get plenty of iron. The 2010 Dietary Guidelines suggests improving iron status by choosing foods that supply heme iron which is more readily absorbed by the body and enhancing absorption with vitamin C rich foods[9]
- Drink more water, limit alcohol and skip sugary sodas that appear to promote infertility. Note, the Center for Disease Control states that at no time during pregnancy is it safe to drink alcohol1,[10]
- Daily physical activity within your comfort zone

These recommendations generally echo those of the Dietary Guidelines for Americans and other Federal healthcare agencies. A healthy whole food diet like The Mediterranean diet can also be effective. In a recent study of women trying to conceive naturally, the Mediterranean style diet was associated with a 40% reduction in risk of infertility.[11]

Foods and Behaviors to Avoid

There are several foods that are generally not recommended for mother or baby during conception or pregnancy due to their poor nutrient quality, and greater risk of microbial or other contaminants. High fat foods, trans fats, refined sugars, overly processed foods, too much salt, caffeine and sugary drinks tend to be nutrient poor and not recommended.[10,12,13] Further, foods with many additives, preservatives, chemicals, and artificial sweeteners should be approached with caution. Soft cheeses and pates, foods that may contain high levels of listeria, should be avoided. The American College of Obstetricians and Gynecologists, American Academy of Pediatrics and CDC recommend cessation of smoking and reduction of ethanol intake before and during pregnancy as a part of primary preconception care as well as preventive care.[1]

Beyond Diet: Exercise

Most experts recommend regular physical activity of about 30 minutes to 1 hour/day of mild to moderate exercise. Some good exercise options include walking, swimming, bicycling, and aerobics as long as they are within the comfort zone of the woman. Yoga is an excellent choice because it incorporates posture, breathing, and concentration which will be beneficial during labor.

A 2012 study of 3,000 pre-conceptive Danish women not undergoing fertility treatments found that the women who reported moderate exercise (walking) were more likely to get pregnant than the women who reported engaging in five or more hours of intense exercise (running) per week.[14]

Fertility Guidelines for Men

A growing body of evidence suggests that men's diet and lifestyle can affect fertility, sperm quality and motility. Just like women, the CDC recommends men need to eat a healthy diet, take multi vitamins, quit smoking and reduce intake of alcohol.[15] Chronic drinking and smoking is associated with reduced sperm concentration, volume and motility.[16]

Following a similar dietary pattern as outlined above is highly recommended for men. In addition, an emphasis on walnut consumption will improve diet quality and may promote sperm quality. A recent study showed that healthy young men aged 21-35 years who ate 2.5 ounces of walnuts a day (~1/2 cup) for 12 weeks improved sperm quality.[17]

Men also need to pay close attention to their weight as being under or over weight can affect sperm quality.[18-19] Exercise can help achieve a healthy weight and may also play a role in sperm counts. One study showed men who engaged in exercise for seven hours or more per week, had a 48 percent higher sperm concentration than men who exercise less than one hour per week.[20]

Role of the RDN: Nutritional Assessment and Counseling

As part of a comprehensive medical team, RDNs should conduct a thorough evaluation and nutritional assessment of both potential parents addressing the following:
- Height, weight
- Medications, dietary and herbal supplements
- Typical meals and snacks per day (week day and weekend)
- Fish intake
- Beverage intake (caffeine, alcohol, water, dairy, sweetened beverages)
- Frequency of eating out and types of restaurants 3 day intake
- Nutrient adequacy of meals
- Types of preferred foods
- Intake of sugar/fat/sodium
- Cigarettes
- Activity level
- Average amount of sleep
- Stress level

Couples are usually highly motivated to make lifestyle changes for the sake of their unborn children. Eliminating risky behaviors, may be difficult at other times, becomes easier with the goal of a much-desired pregnancy.

While some may need hand holding, supportive texts, newsletter or social media outreach, one role of the RDN is to inspire, motivate and support fertility clients to make healthy changes that carryover into pregnancy and parenthood.

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