



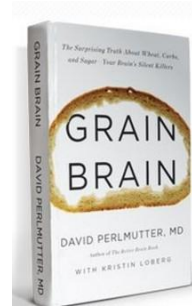
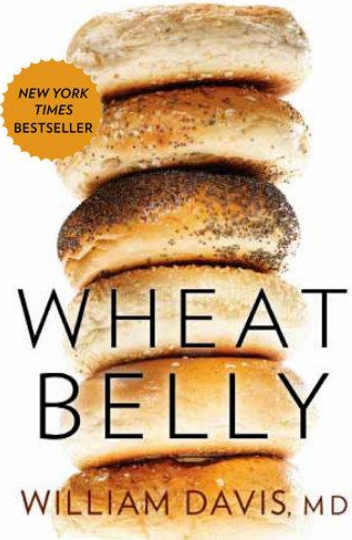
# Myths and Realities Involving Grain Food Consumption What Does the Scientific Evidence Say?

Yanni Papanikolaou, PhDc, MHSc

Joint 2018 CWFHB and CWS Conference, Winnipeg, MB



LOSE THE WHEAT, LOSE THE WEIGHT,  
AND FIND YOUR PATH BACK TO HEALTH



**GRAIN  
BRAIN**  
*The Surprising Truth About  
Wheat, Carbs, and Sugar - Your  
Brain's Silent Killers*

**DID YOU KNOW?**

**GRAINS -R- KILLING YOU**

ALTHOUGH THEY ARE **INSPECTED** BY THE U.S. DEPARTMENT OF AGRICULTURE

**MASS CONSUMPTION DISEASE TO SKYROCKET**

**& PEOPLE -R- GETTING FATTER**

\* PEOPLE SIZE TEND TO HAVE AN INVERSE RELATIONSHIP WITH GRAIN CONSUMPTION

GRAINS ARE THE CAUSE OF MANY INFLAMMATORY DISEASES SUCH AS

**ARTHRITIS, ALLERGIES, & ASTHMA** **AND** INFERTILITY, CANCER, AUTISM, OBESITY, DEPRESSION, SCHIZOPHRENIA, TOOTH DECAY, & MANY MORE!

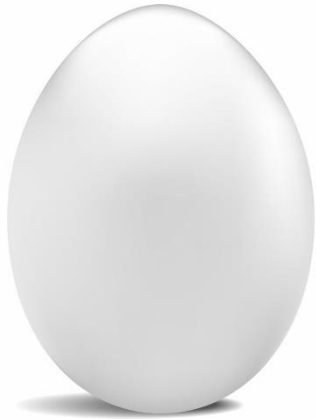
**STOP** BEFORE ITS TOO LATE!

Current environment leaving many to think enriched grains and/or all grains are not part of a healthy diet...but where is the evidence?



MYTHS

FACTS

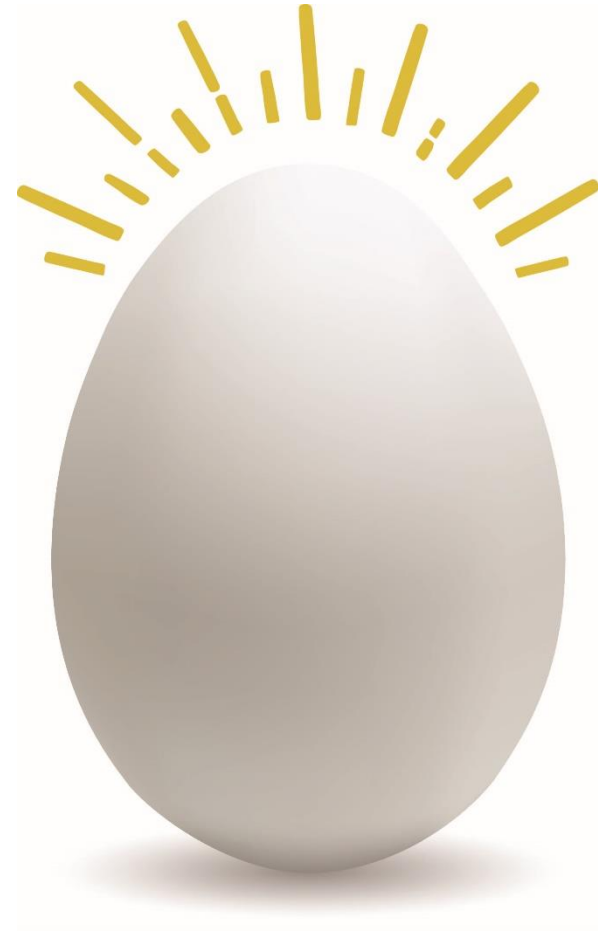


**What lessons can we learn from the past? These foods were once considered to be unhealthy?**

2015-2020  
Dietary Guidelines  
no longer include a  
limit on cholesterol

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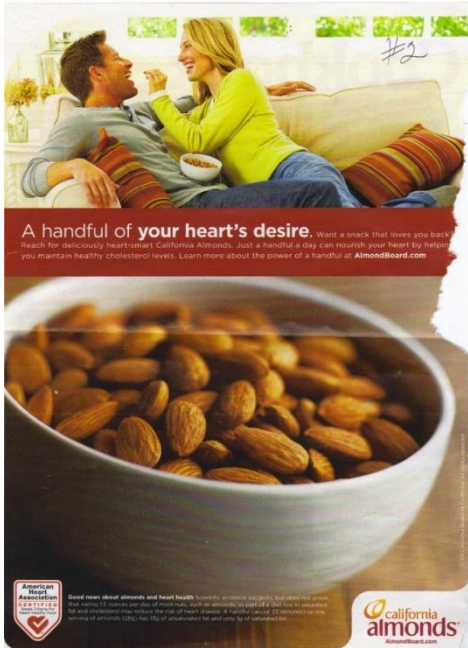
Eggs are included  
in the  
recommended  
dietary patterns







We once believed nuts made us fat!



#2

**A handful of your heart's desire.** Want a snack that loves you back? Reach for deliciously heart-smart California Almonds. Just a handful a day can nourish your heart by helping you maintain healthy cholesterol levels. Learn more about the power of a handful at [AlmondBoard.com](http://AlmondBoard.com).

American Heart Association  
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Good news about almonds and heart health: Scientific evidence suggests that almonds provide heart benefits. 15 almonds per day, or about 1 ounce, can help lower LDL cholesterol and cholesterol may reduce the risk of heart disease. A handful (about 15 almonds) or one serving of almonds adds the fiber of whole grains for and only 140 calories.

**california almonds**  
AlmondBoard.com



Per 1oz serving




Dairy also had a bad reputation, until...





2015-2020 Dietary Guidelines: Dairy products included in all 3 recommended dietary patterns

A detailed still life photograph of various fresh foods. In the center, there are several loaves of bread, some sliced, on a wooden cutting board. To the right, there's a glass bottle of olive oil with a cork stopper. The background features a large bunch of wheat or grain stalks in a dark, ornate vase. In the foreground, there are fresh vegetables like mushrooms, red onions, and tomatoes, along with a bowl of sliced salmon. A large, semi-transparent white circle is overlaid on the left side of the image, containing text.

**So let's talk about  
grains and how they fit  
into the diet...**



**Rationale for  
conducting grains  
research in  
American kids and  
adults....  
is this needed and  
does it fill a gap in  
the literature and  
advance public  
health?**





Grain Foods Are Contributors of Nutrient Density for American Adults and Help Close Nutrient Recommendation Gaps: Data from the National Health and Nutrition Examination Survey, 2009–2012

Yanni Papanikolaou <sup>1,4</sup> and Victor L. Fulgoni III <sup>2</sup>

<sup>1</sup> Nutritional Strategies, Inc., 39 Marriott Place, Paris, OH, USA; <sup>2</sup> Nutrition Impact, LLC, 9725 D Drive North, Battle Creek, MI 49014, USA; <sup>3</sup> Correspondence: papnikolaou.yanni@gmail.com; Tel.: +1-519-504-9252

**Abstract:** The 2015–2020 Dietary Guidelines for Americans (2015–2020 DGA) maintains recommendations for increased consumption of whole grains while limiting intake of enriched/refined grains. A variety of enriched grains are sources of several shortfall nutrients identified by 2015–2020 DGA, including dietary fiber, folate, iron, and magnesium. The purpose of this study was to determine food sources of energy and nutrients for free-living U.S. adults using data from the National Health and Nutrition Examination Survey, 2009–2012. Analyses of grain food sources were conducted using a single 24-h recall collected in adults ≥19 years of age (n = 10,607). Sources of nutrients contained in all grain foods were determined using United States Department of Agriculture nutrient composition databases and the food grouping scheme for grains (excluding mixed dishes). Mean energy and nutrient intakes from the total diet and from various grain food groups were adjusted for the sample design using appropriate weights. All grains provided 285 ± 3 kcal/day or 14 ± 0.2% kcal/day in the total diet in adult ≥19 years of age. In the total daily diet, the grain category provided 7.2 ± 0.2% (4.9 ± 0.1 g/day) total fat, 5.4 ± 0.2% (1.1 ± 0.03 g/day) saturated fat, 14.6 ± 0.3% (4.6 ± 9 mg/day) sodium, 7.9 ± 0.2% (7.6 ± 0.2 g/day) total sugar, 22.8 ± 0.4% (3.9 ± 0.1 g/day) dietary fiber, 13.2 ± 0.3% (122 ± 3 mg/day) calcium, 33.6 ± 0.5% (219 ± 4 mg/day) dietary folate equivalents (DFE)/day) folate, 29.7 ± 0.4% (5.3 ± 0.1 mg/day) iron, and 13.9 ± 0.3% (43.7 ± 1.1 mg/day) magnesium. Individual grain category analyses showed that breads, rolls and tortillas and ready-to-eat cereals provided minimal kcal/day in the total diet in men and women ≥19 years of age. Similarly, breads, rolls and tortillas, and ready-to-eat cereals supplied meaningful contributions of shortfall nutrients, including dietary fiber, folate and iron, while concurrently providing minimal amounts of nutrients to limit. Collectively, a variety of grain food groups consumed by American adults contribute to nutrient density in the total diet and have the potential to increase consumption of shortfall nutrients as identified by 2015–2020 DGA, particularly dietary fiber, folate, and iron.

**Keywords:** NHANES; energy; Dietary Guidelines; adults; grains; shortfall nutrients

Certain Grain Foods Can Be Meaningful Contributors to Nutrient Density in the Diets of U.S. Children and Adolescents: Data from the National Health and Nutrition Examination Survey, 2009–2012

Yanni Papanikolaou <sup>1,4</sup> and Victor L. Fulgoni III <sup>2</sup>

<sup>1</sup> Nutritional Strategies, 39 Marriott Place, Paris, OH, USA; <sup>2</sup> Nutrition Impact, 9725 D Drive North, Battle Creek, MI 49014, USA; <sup>3</sup> Correspondence: papnikolaou.yanni@gmail.com; Tel.: +1-519-504-9252

Received: 17 August 2016; Accepted: 9 February 2017

**Abstract:** Grain foods may play an important role in the diets of children and adolescents. The present study determined and adolescents using data from the National Health and Nutrition Examination Survey, 2009–2012. Analyses of grain food sources were conducted using a single 24-h recall collected in adults ≥19 years of age (n = 6109). Sources of nutrients contained in Agriculture nutrient composition databases and the food grouping scheme for grains (excluding mixed dishes). Mean energy and nutrient intakes from the total diet and from various grain food groups were adjusted for the sample design using appropriate weights. All grains provided 1.3 ± 0.1 g/day dietary fiber, 39.3% ± 0.5% and 34.9% ± 0.5% (5.6 ± 0.1 mg/day) iron in analyses showed that certain grain foods, in particular, breads, rolls and tortillas, and ready-to-eat cereals provided minimal kcal/day in the total diet in men and women ≥19 years of age. Similarly, breads, rolls and tortillas, and ready-to-eat cereals supplied meaningful contributions of shortfall nutrients, including dietary fiber, folate and iron, while concurrently providing minimal amounts of nutrients to limit. Collectively, a variety of grain food groups consumed by American adults contribute to nutrient density in the total diet and have the potential to increase consumption of shortfall nutrients as identified by 2015–2020 DGA, particularly dietary fiber, folate, and iron.

**Keywords:** NHANES; energy; nutrients; children

Grains Contribute Shortfall Nutrients and Nutrient Density to Older US Adults: Data from the National Health and Nutrition Examination Survey, 2011–2014

Yanni Papanikolaou <sup>1,4</sup> and Victor L. Fulgoni III <sup>2</sup>

<sup>1</sup> Nutritional Strategies, 39 Marriott Place, Paris, OH, USA; <sup>2</sup> Nutrition Impact, 9725 D Drive North, Battle Creek, MI 49014, USA; <sup>3</sup> Correspondence: papnikolaou.yanni@gmail.com; Tel.: +1-519-504-9252

Received: 27 March 2018; Accepted: 17 April 2018; Published: 25 April 2018

**Abstract:** Previous data demonstrate grain foods contribute shortfall nutrients to the diet of U.S. adults. The 2015–2020 Dietary Guidelines for Americans have identified several shortfall nutrients in the U.S. population, including fiber, folate, and iron (women only). Intake of some shortfall nutrients can be even lower in older adults. The present analyses determined the contribution of grain foods for energy and nutrients in older U.S. adults and ranked to all other food sources in the American diet. Analyses of grain food sources were conducted using a 24-hour recall in adults (≥51 years old; n = 4522) using data from the National Health and Nutrition Examination Survey, 2011–2014. All grains provided 278 kcal/day or 14% of all energy in the total diet, ranking as the 4th largest contributor of energy compared to 15 main food groups. All grain foods ranked 1st for thiamin (83%) and niacin (23%) intake relative to 15 main food groups. The grain foods category ranked 2nd highest of 15 main food groups for daily dietary fiber (23%), iron (38%), folate (40%), and magnesium (15%) and was the 3rd largest food group contributor for dietary calcium intake (13%). When considering nutrients to limit as outlined by dietary guidance, main group of grains contributed 6% total fat, 8% saturated fat, 14% sodium and 9% added sugar. Bread, rolls and tortillas provided 150 kcal/day or 8% of all energy in the total diet, ranking as the 2nd largest contributor of energy compared to 46 food subcategories. Breads, rolls and tortillas ranked 1st of 46 foods for dietary thiamin (16%) and niacin (10%) intake and 2nd for dietary fiber (12%), iron (12%), folate (13%), and magnesium (7%). Breads, rolls and tortillas ranked 3rd largest food group contributor for dietary calcium (5%) intake. Ready-to-eat cereals provided 47 kcal/day or 2% of all energy in the total diet, ranking as the 20th largest contributor of energy compared to 46 food subcategories. All ready-to-eat cereals ranked 1st for daily iron (19%), 1st for folate (21%), 5th for dietary fiber (7%), 3rd for niacin (9%), 5th for magnesium (4%) and 13th for calcium (2%) intake. Given all grain foods and specific subcategories of grain foods provided a greater percentage of several underconsumed nutrients than calories (including dietary fiber, iron, and folate), grain foods provide nutrient density in the American diet of the older adult.

**Keywords:** NHANES; nutrients; aging; grains; fiber

Several grain dietary patterns are associated with better diet quality and improved shortfall nutrient intakes in US children and adolescents: a study focusing on the 2015–2020 Dietary Guidelines for Americans

Yanni Papanikolaou <sup>1,4</sup>, Julie Miller Jones <sup>2</sup> and Victor L. Fulgoni III <sup>2</sup>

**Abstract:** The present study identified the most commonly consumed grain food patterns in US children and adolescents (n = 4537) relative to those not consuming grains and compared diet quality and nutrient intakes, with focus on 2015–2020 Dietary Guidelines for Americans (2015–2020 DGA) shortfall nutrients. **Methods:** Cluster analysis using data from the National Health and Nutrition Examination Survey, 2010–2012, of main grain groups (31 cereals, cookies and pies, 13 rice, 6 crackers and salty snacks, 61 pastas, waffles, breads, rolls, and tortillas) was conducted. Grain food patterns were compared to no grains, mainly pasta, cooked cereals and rice, and crackers and no grains (n = 1033). Energy-adjusted EA dietary fiber (mg from 1.8 – 2.8 g more per day (all p < 0.01)) and % energy carbs, cookies and pies had higher EA daily (0.0001), EA total fat was lower in 'waffles', pasta, cooked other grains' in comparison to the no grains food pattern. Children and adolescents consuming yeast bread and rolls, pasta, rice, and other grains had higher EA total fat (p < 0.0001). There were no all grain clusters as compared to no grains. Grain food patterns in children and adolescents were associated with diet quality as compared to those consuming no grains, crackers, diet quality.

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Food and Nutrition Sciences, 2016, 7, 773-781  
Published online July 2016 in ScienceDirect (<http://www.scrip.org/journal/fns>)  
<http://dx.doi.org/10.4236/fns.2016.77073>



Certain Grain Food Patterns Are Associated with Improved 2015 Dietary Guidelines Shortfall Nutrient Intakes, Diet Quality, and Lower Body Weight in US Adults: Results from the National Health and Nutrition Examination Survey, 2005–2010

Yanni Papanikolaou <sup>1,4</sup>, Victor L. Fulgoni III <sup>2</sup>

<sup>1</sup> Nutritional Strategies Inc., Paris, OH, USA; <sup>2</sup> Nutrition Impact, LLC, Battle Creek, MI, USA; <sup>3</sup> Correspondence: papnikolaou.yanni@gmail.com

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7 studies completed to date  
15 have been published in peer-review journals

How do American adults and children consume grain foods?

Are grain foods associated with overall nutrient intakes and shortfall nutrients (i.e., dietary fiber)?

Are grain food patterns of consumption linked to BMI?

Are grain food patterns linked to diet quality?



## Certain Grain Food Patterns Are Associated with Improved 2015 Dietary Guidelines Shortfall Nutrient Intakes, Diet Quality, and Lower Body Weight in US Adults: Results from the National Health and Nutrition Examination Survey, 2005-2010

Yanni Papanikolaou<sup>1\*</sup>, Victor L. Fulgoni III<sup>2</sup>

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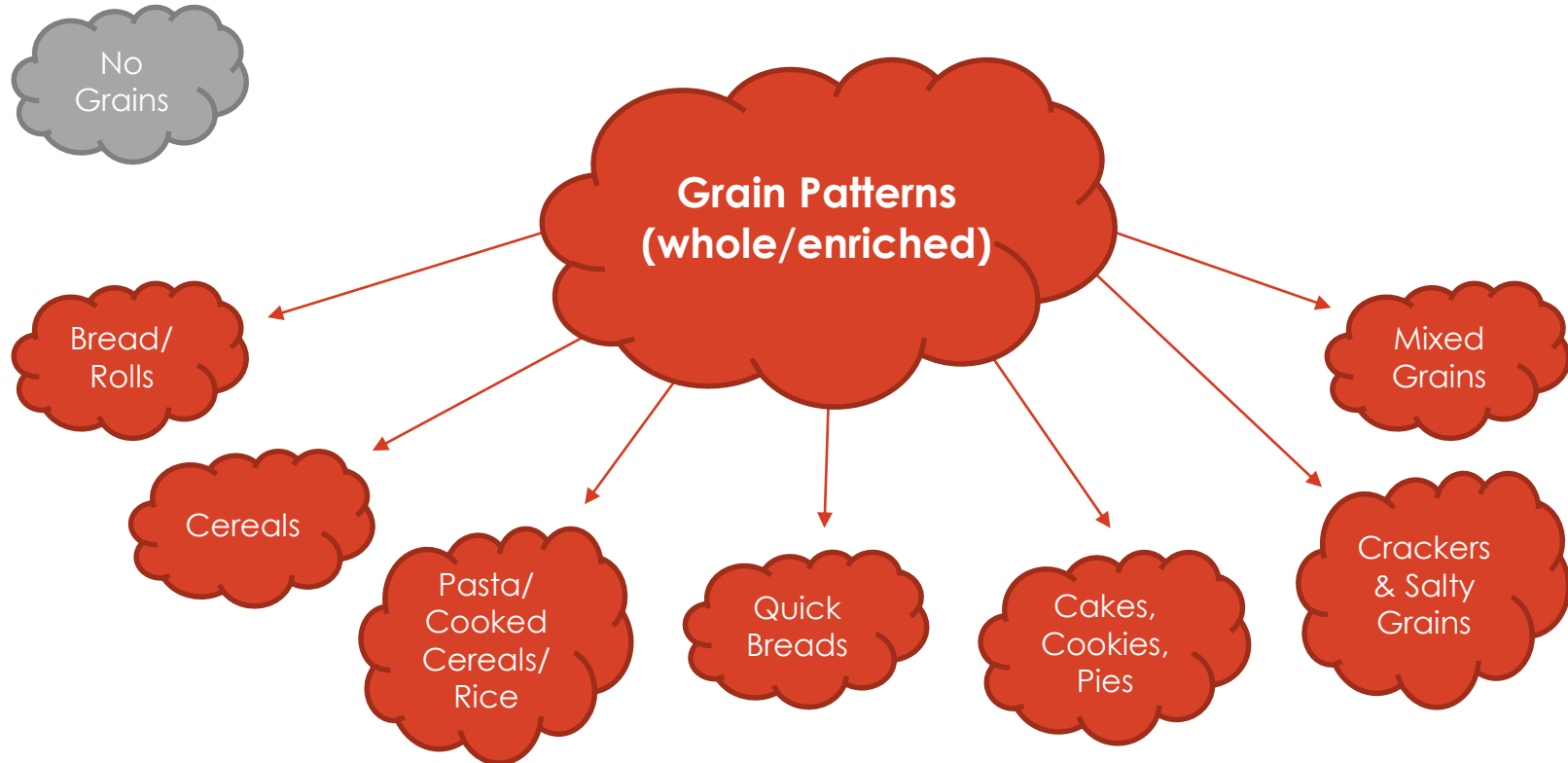
# Adult Study



All Grain Consumption  
(Whole and  
Refined/Enriched Grains)



# 8 Unique Grain Food Patterns Identified in US Adults, 19+ Years-Old

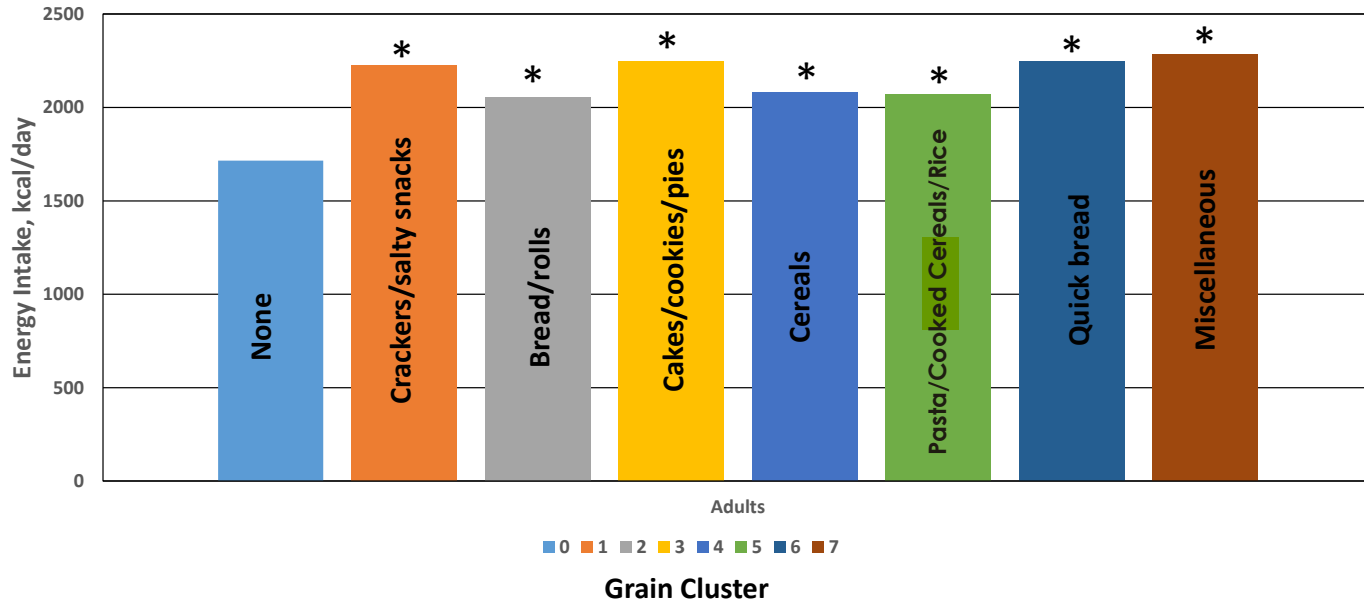


# What are Adults in the No Grains Group Consuming?





# Comparison of Energy Intake Based on Grain Clusters In Those 19+ Years



\* Significantly different from None,  $p < 0.01$ ; Papanikolaou & Fulgoni, 2016 *Food and Nutrition Sciences*



# Adults Consuming Enriched Grains Had Reduced Risk of Being Overweight or Obese and Smaller Waist Sizes



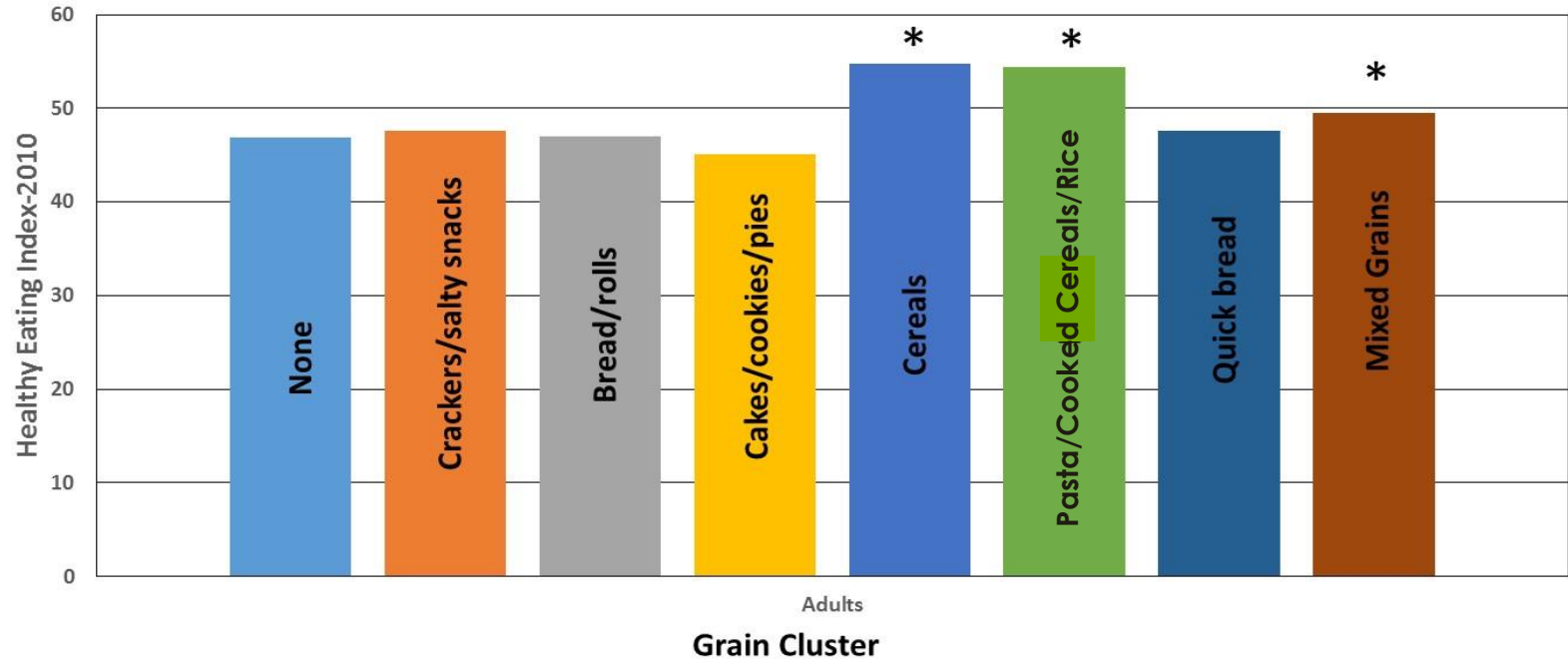
7.6 lbs and 1.2 inches in adults consuming pasta/cooked cereals/rice vs. no grains ( $p < 0.01$ , vs. no grains)



27% reduced risk of being obese in adults consuming pasta/cooked cereals/rice vs. no grains ( $p < 0.03$  vs. no grains)



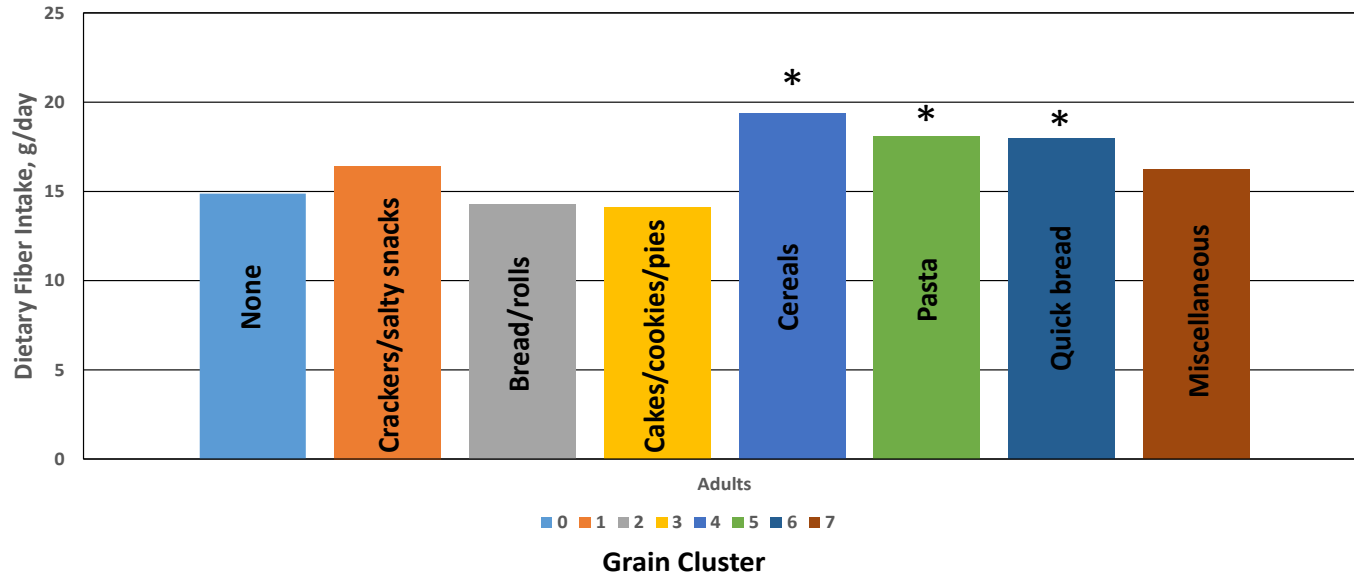
# Certain Grains are Associated with a Better Diet Quality, Adults 19+ Years Old, NHANES 2005-2010



\* Significantly different from None,  $p < 0.01$ ; Papanikolaou & Fulgoni, 2016 *Food and Nutrition Sciences*

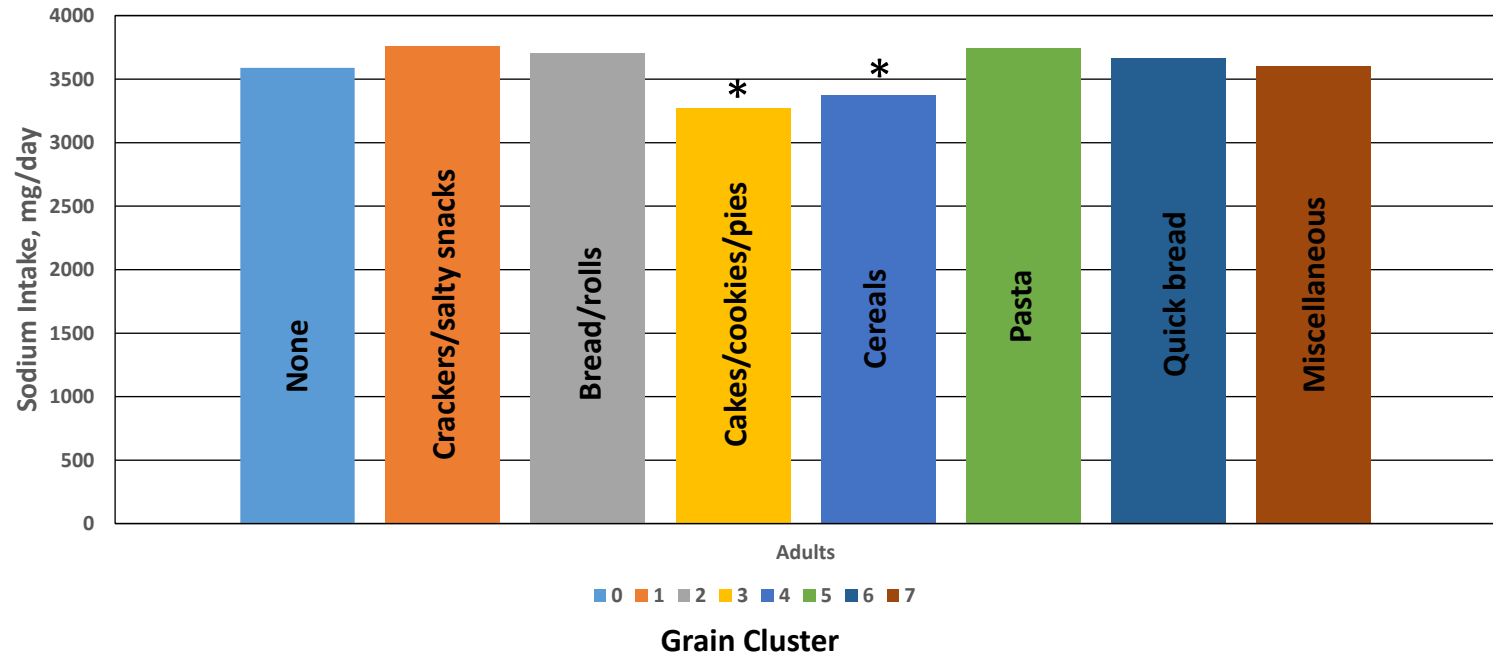
# Certain Grains are Associated with Higher Dietary Fiber

## Comparison of Dietary Fiber Intake Based on Grain Clusters In Those 19+ Years



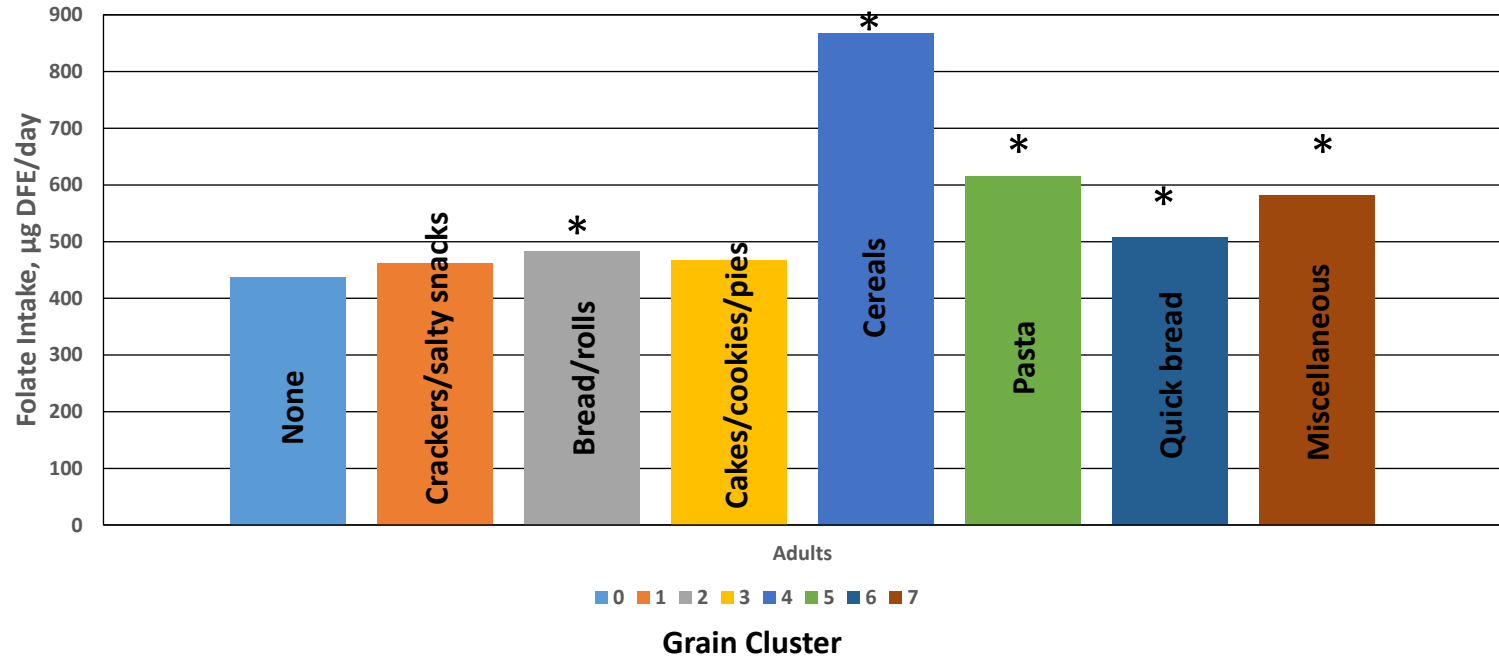
\* Significantly different from None,  $p < 0.01$ ; Papanikolaou & Fulgoni, 2016 *Food and Nutrition Sciences*

## Comparison of Sodium Intake Based on Grain Clusters In Those 19+ Years



\* Significantly different from None,  $p < 0.01$ ; Papanikolaou & Fulgoni, 2016 Food and Nutrition Sciences

## Comparison of Folate Intake Based on Grain Clusters In Those 19+ Years



\* Significantly different from None,  $p < 0.01$ ; Papanikolaou & Fulgoni, 2016 Food and Nutrition Sciences



# Unintended consequences of a low carb diet...

## Birth Defects Research

THE  
TERATOLOGY  
SOCIETY  
PUBLISHED MONTHLY—ESTABLISHED IN 1960



Birth Defects Research / Volume 110, Issue 11

ORIGINAL RESEARCH ARTICLE | [Free Access](#) |

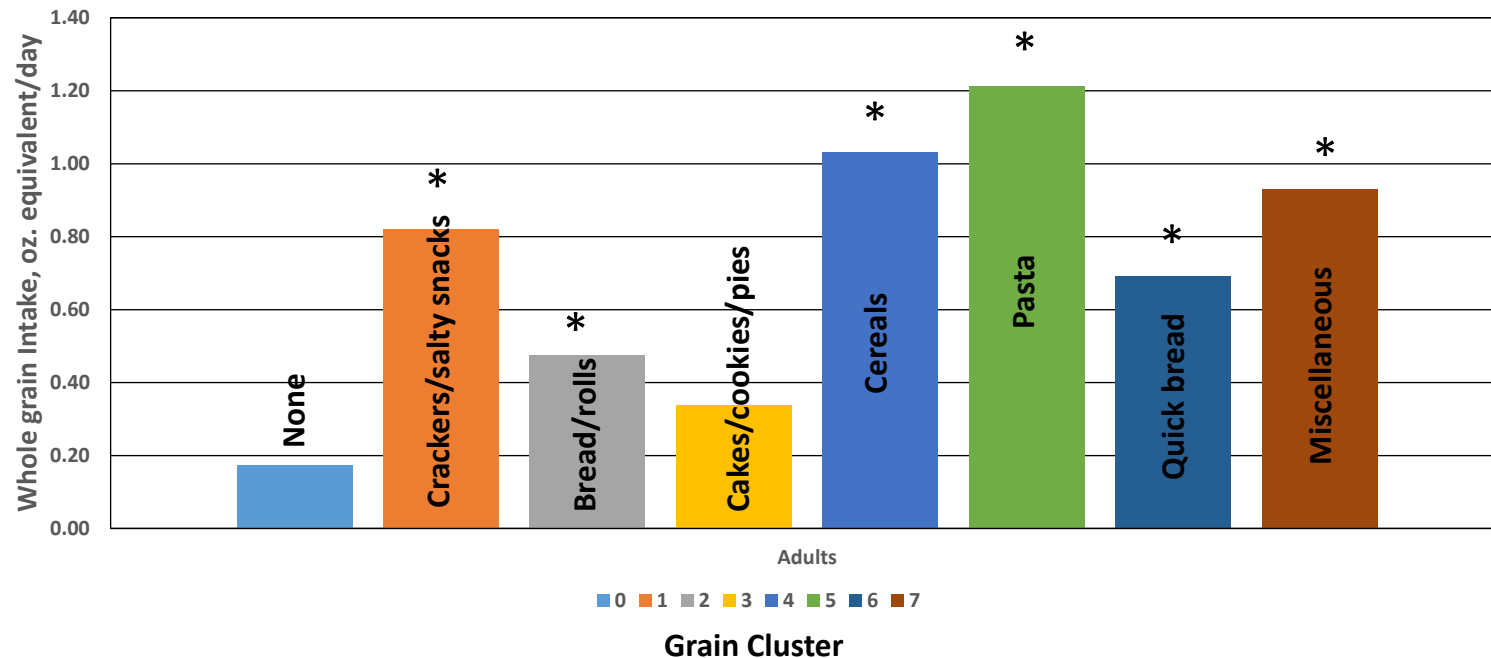
## Low carbohydrate diets may increase risk of neural tube defects

Tania A. Desrosiers [✉](#), Anna Maria Siega-Riz, Bridget S. Mosley, ... [See all authors](#) >

First published: 25 January 2018

women with restricted carbohydrate intake were 30% more likely to have an infant with NTB

## Comparison of Whole Grain Intake Based on Grain Clusters In Those 19+ Years



\* Significantly different from None,  $p < 0.01$ ; Papanikolaou & Fulgoni, 2016 Food and Nutrition Sciences

RESEARCH

Open Access



# Several grain dietary patterns are associated with better diet quality and improved shortfall nutrient intakes in US children and adolescents: a study focusing on the 2015–2020 Dietary Guidelines for Americans

Yanni Papanikolaou<sup>1\*</sup>, Julie Miller Jones<sup>2</sup> and Victor L. Fulgoni III<sup>3</sup>

## Abstract

**Background:** The present study identified the most commonly consumed grain food patterns in US children and adolescents (2–18 years-old;  $N = 8367$ ) relative to those not consuming grains and compared diet quality and nutrient intakes, with focus on 2015–2020 Dietary Guidelines for Americans (2015–2020 DGA) shortfall nutrients.

**Methods:** Cluster analysis using data from the National Health and Nutrition Examination Survey 2009–2012 identified 8 unique grain food patterns: a) no consumption of main grain groups, b) cakes, cookies and yeast bread and rolls, c) pasta, cooked cereals and rice, d) cereals, e) pasta, cooked cereals and rice, f) crackers and salty snacks, g) pancakes and French toast and other grains, and h) quick breads.

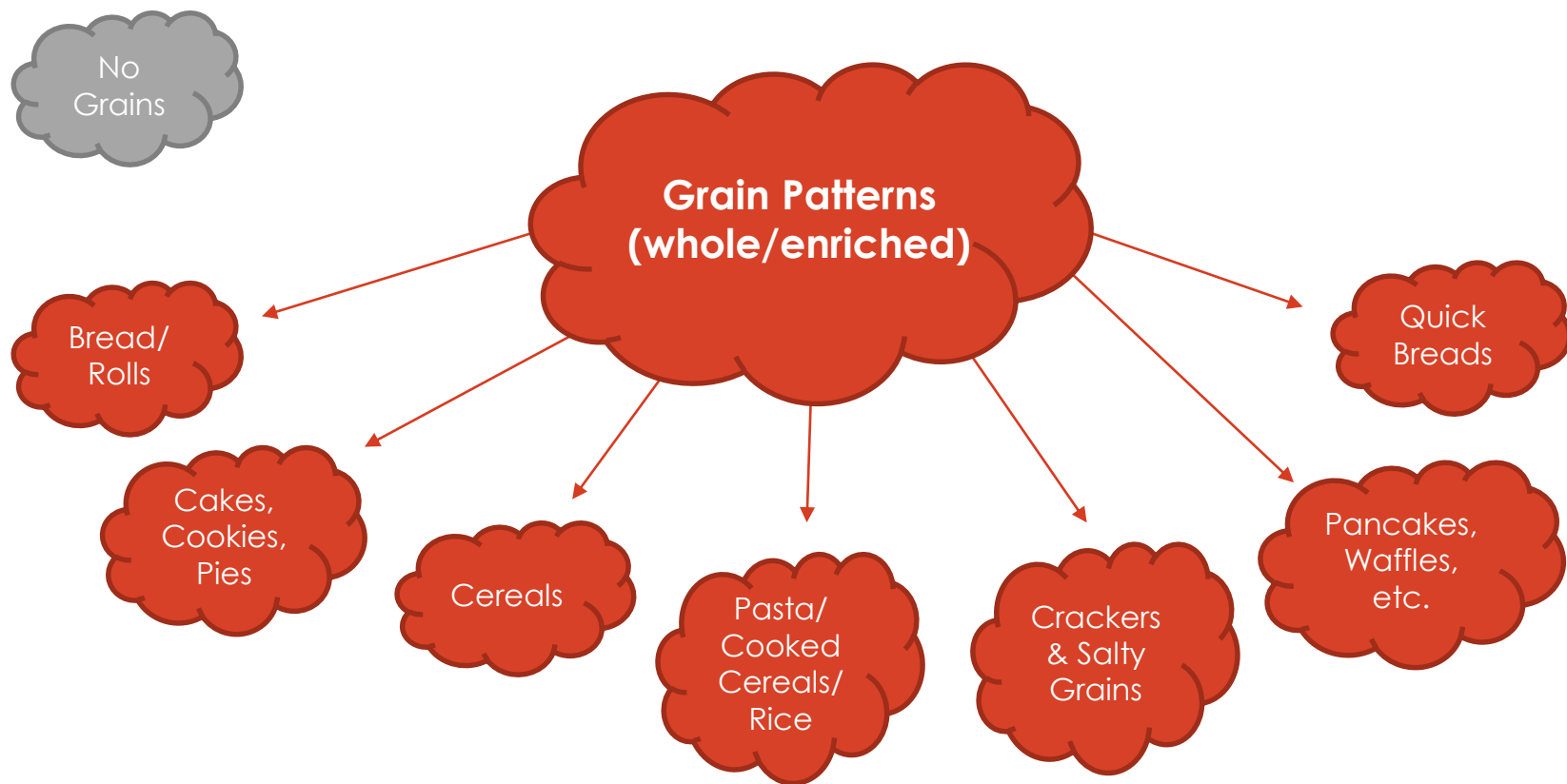
**Results:** Energy intake was higher for all grain cluster patterns examined, except 'cereals', compared to children and adolescents in the 'yeast bread and rolls', 'cereals', 'pasta, cooked cereals and rice', and 'crackers and salty snacks' patterns had a higher diet quality relative to no grains (all  $p < 0.01$ ). Energy and protein intake was greater in five of the seven grain patterns, ranging from 1.8 – 2.8 g more protein and 1.8 – 2.8 g more protein compared to those consuming no grains. All grain patterns, except cakes, cookies and yeast bread and rolls, had higher folate relative to children in the no grains pattern (all  $p < 0.0001$ ). EA total fat was higher in children and adolescents consuming 'cereals and rice', and 'pancakes, waffles, French toast and other grains' in comparison to those consuming no grains (all  $p < 0.01$ ). EA magnesium intakes were greater in children and adolescents consuming 'cereals and rice', 'cooked cereals and rice', and 'quick breads', while EA iron was higher in all grain patterns compared to those consuming no grains (all  $p < 0.01$ ). EA vitamin D intake was higher only in children consuming 'cereals and rice'. There were no significant differences in total or added sugar intake across all grain patterns.

**Conclusions:** Consumption of several, but not all, grain food patterns was associated with improved 2015–2020 DGA shortfall nutrient intakes and better diet quality.

**Keywords:** NHANES, Grains, Children, Adolescents, Nutrient intakes

# Children & Adolescent Study

## 8 Unique Grain Food Patterns Identified in US Children, 2-18 Years of Age

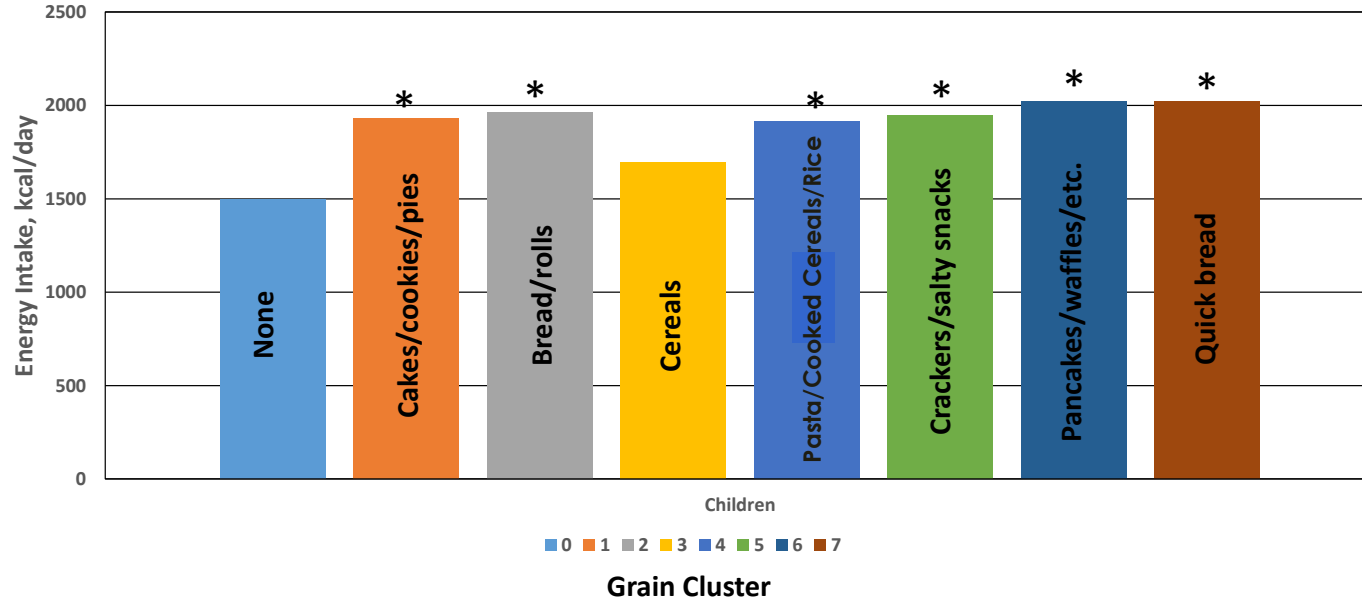




# What are Children in the No Grains Group Consuming?



# Most Grain Patterns are Associated with Greater Calories



\* Significantly different from None,  $p < 0.01$ ; Papanikolaou & Fulgoni, 2017, *Nutrition Journal*

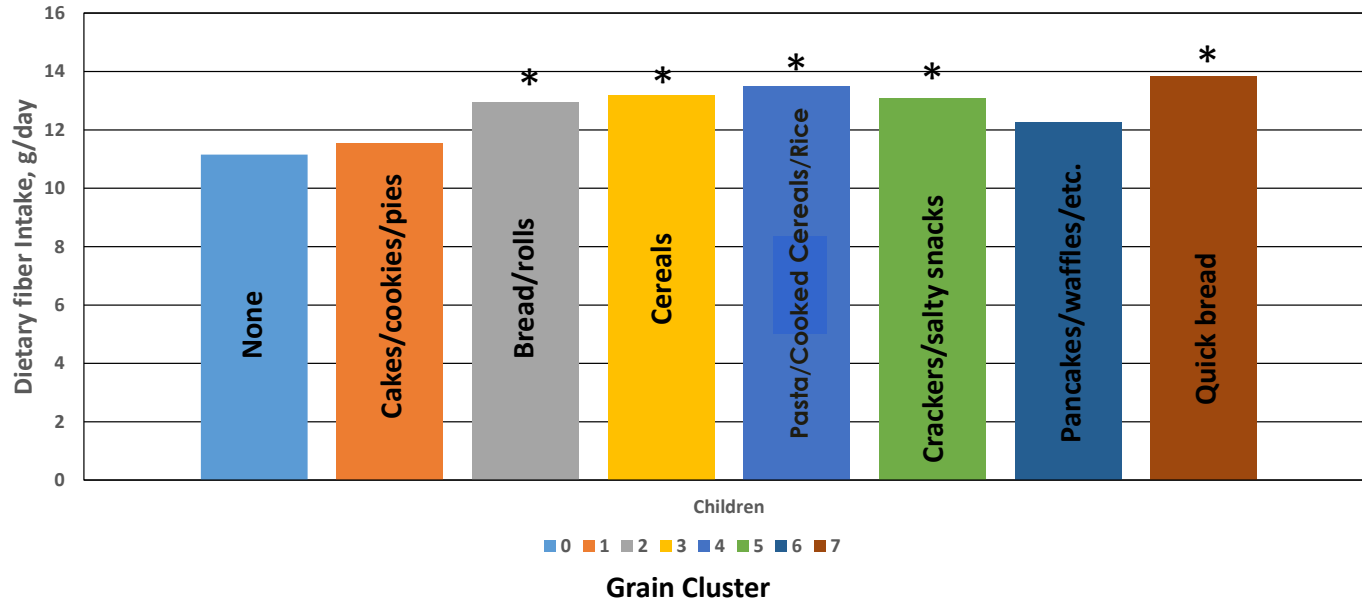
# Body Mass Index (BMI) Scores in Children and Adolescents

- ▶ Children and adolescents consuming yeast breads and rolls **had lower BMI z-scores** compared to children and adolescents not consuming grains
- ▶ No increases in BMI z-scores were seen with any grain pattern of consumption vs. no grains



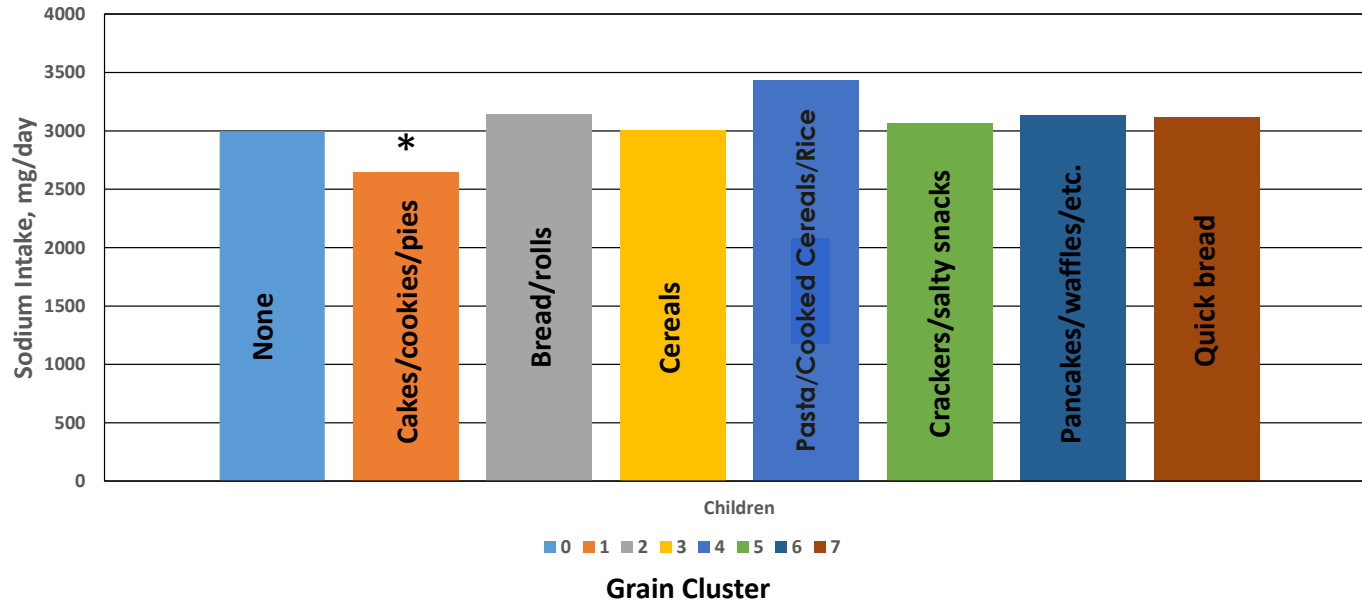


# Children Consuming Grain Patterns Tend to Have Higher Dietary Fiber Intake



\* Significantly different from None,  $p < 0.01$ ; Papanikolaou & Fulgoni, 2017 *Nutrition Journal*

# Comparison of Sodium Intake Based on Grain Clusters In Those 2-18 Years



\* Significantly different from None,  $p < 0.01$ ; Papanikolaou & Fulgoni, 2017, *Nutrition Journal*

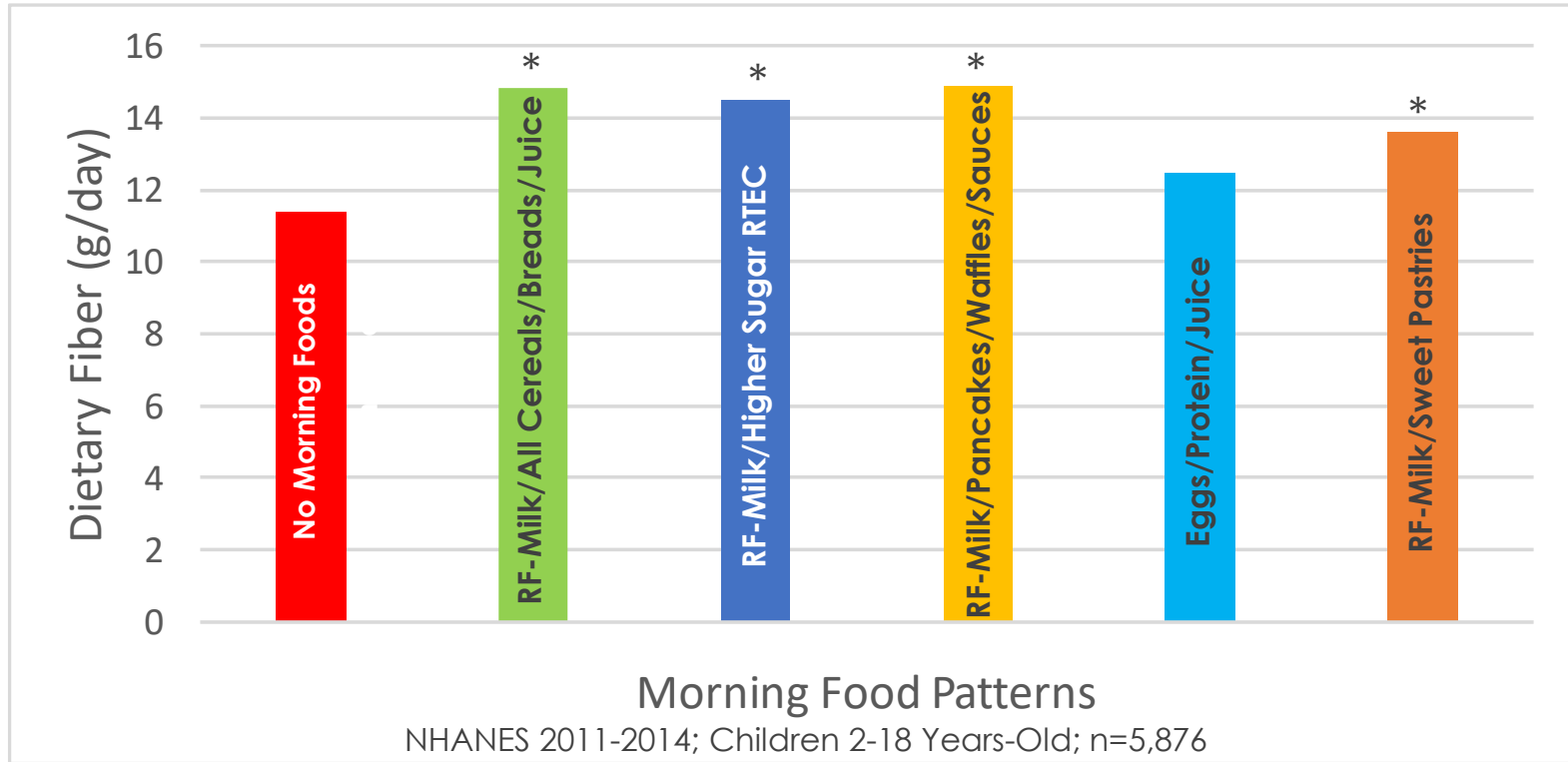


# BREAKING NEWS

Current study in progress...

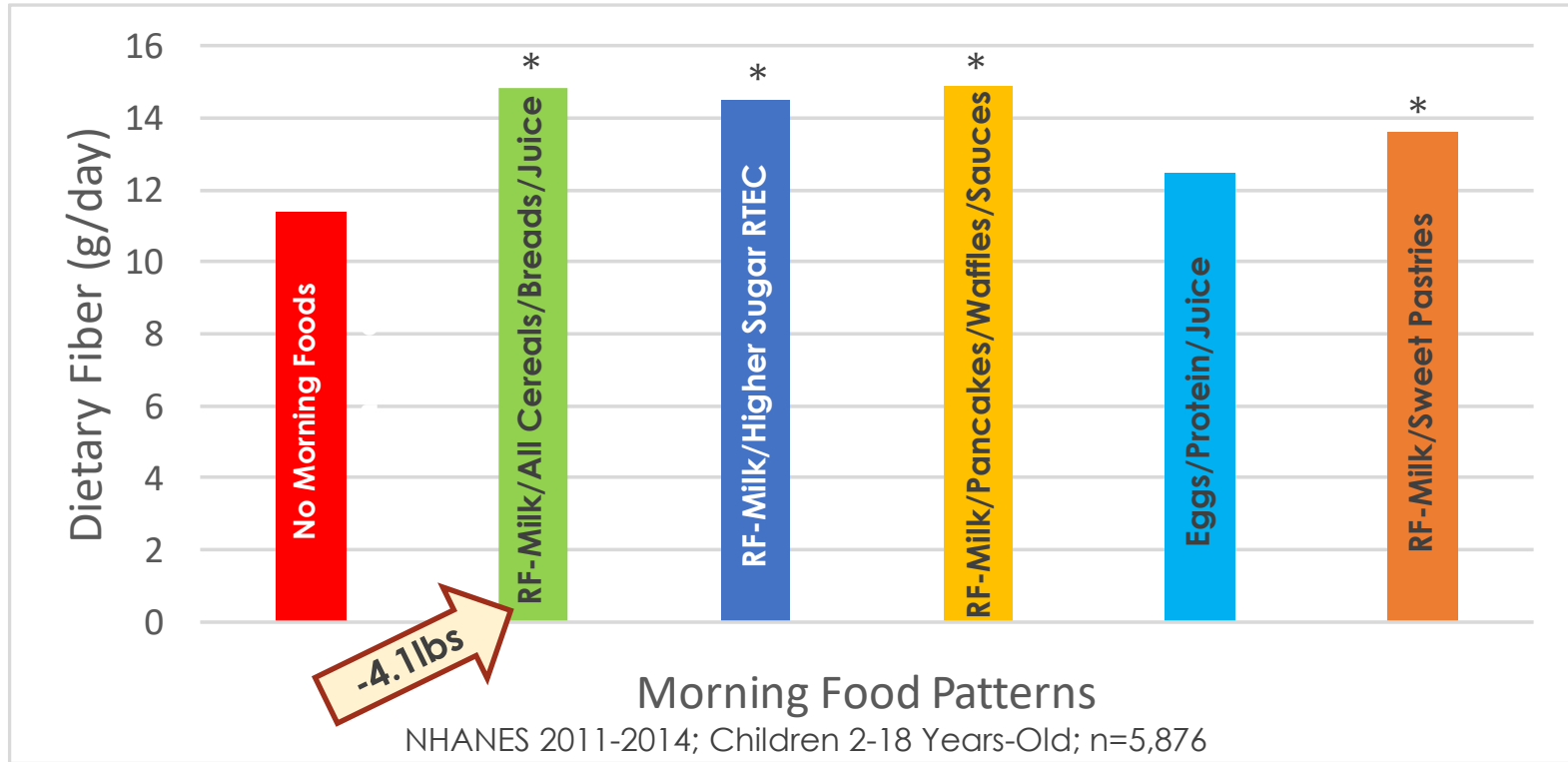


# Kids Who Include Grains in Morning Eating Patterns Get More Fiber



\* Significantly different from No Morning Foods,  $p < 0.0025$ ; (unpublished data)

# Kids Who Include Grains in Morning Eating Patterns Get More Fiber

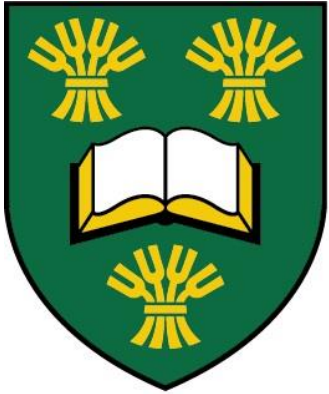


\* Significantly different from No Morning Foods,  $p < 0.0025$ ; (unpublished data)

## Conclusions

- Encouraging certain grain food patterns in the diet of US children and adults, **including selecting a mix of enriched and fortified grains is linked to increased nutrient intakes**, including several shortfall nutrients
- Several grain food patterns are linked to a **better diet quality in kids and adults**
- As we have shown that grain foods can be nutrient-dense foods, **eliminating grains from the US diet may lead to nutrient intake and health consequences.**

Canadian Study in Kids & Adults



**UNIVERSITY OF SASKATCHEWAN**

**School of  
Public Health**

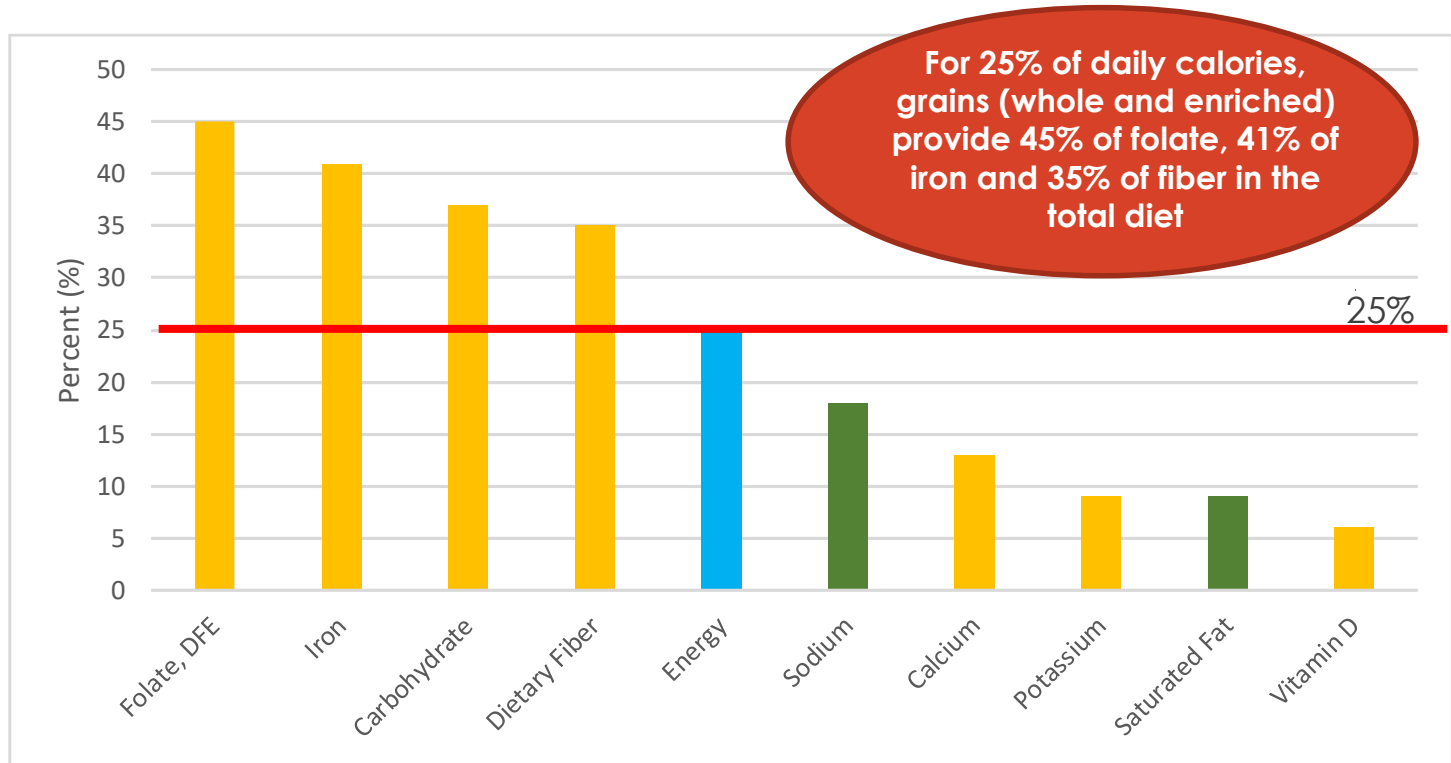
**USASK.CA/SPH**



## Objectives of the Canadian Study

- To determine daily energy and nutrient contribution from all grain products and sub-categories of grains (i.e., breads, ready-to-eat cereals, etc.) in the Canadian diet of children and adults.
- To identify patterns of grain consumption and compare nutrient intakes and weight-related variables relative to no main grain foods intake, among Canadian children and adults.

# All Grain Foods Provide Nutrient Density in the Canadian Adult Diet





***Eliminating grains may have  
nutrient intake consequences  
in adults and children...***

**When compared to the no grain  
group, those consuming several  
grain food patterns had:**

***Significantly higher daily intake of  
folate, dietary fiber, folic acid,  
niacin, thiamin, calcium &  
magnesium***

A collage of various grain products including bread, pasta, rice, and corn. The image features a large loaf of braided bread, a round sesame seed bun, several small round rolls, a pile of yellow corn kernels, a pile of white rice, and various types of pasta like fusilli and shells. There are also some decorative elements like a red ribbon and a green ribbon. The background is white.

## Grain Product consumption was *not* Associated with BMI

Adults and Children:

*No significant* association observed between grain food patterns and BMI, relative to the no grain group



## Take Home Messages

1. Grains are **nutrient dense foods** contributing key nutrients at higher levels than their caloric contribution.
2. **Adults consuming grain foods have higher intakes of dietary fibre, folate, and calcium in comparison to adults with no grain foods in their diet.**
3. **Children consuming grain foods have higher intakes of fibre, folate, calcium, magnesium, niacin and thiamin compared to children not consuming grain foods.**
4. A balance of **whole grains and enriched non-whole grains** is required to meet key nutrients iron, folate, and fibre.
5. The **BMI of grain eaters is no different from the BMI of non-grain eaters.**





Grain Products: Contribution to Energy & Nutrient Intakes





Article

## Certain Grain Foods Can Be Meaningful Contributors to Nutrient Density in the Diets of U.S. Children and Adolescents: Data from the National Health and Nutrition Examination Survey, 2009–2012

Yanni Papanikolaou <sup>1,\*</sup> and Victor L. Fulgoni III <sup>2</sup>

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**Abstract:** Grain foods may play an important role in delivering nutrients to the diet of children and adolescents. The present study determined grain food sources of energy/nutrients in U.S. children and adolescents using data from the National Health and Nutrition Examination Survey, 2009–2012. Analyses of grain food sources were conducted using a 24-h recall in participants 2–18 years old ( $N = 6109$ ). Sources of nutrients contained in grain foods were determined using U.S. Department of Agriculture nutrient composition databases and excluded mixed dishes. Mean energy and nutrient intakes from the total diet and from various grain foods were adjusted for the sample design using appropriate weights. All grains provided  $14\% \pm 0.2\%$  kcal/day ( $263 \pm 5$  kcal/day),  $22.5\% \pm 0.3\%$  ( $3 \pm 0.1$  g/day) dietary fiber,  $39.3\% \pm 0.5\%$  ( $238 \pm 7$  dietary folate equivalents (DFE)/day) folate and  $34.9\% \pm 0.5\%$  ( $5.6 \pm 0.1$  mg/day) iron in the total diet in children and adolescents. The current analyses showed that certain grain foods, in particular breads, rolls and tortillas, ready-to-eat cereals and quick breads and bread products, are meaningful contributors of folate, iron, thiamin, niacin and dietary fiber, a nutrient of public health concern as outlined by the 2015–2020 Dietary Guidelines for Americans. Thus, specific grain foods contribute to nutrient density and have the potential to increase the consumption of several under-consumed nutrients in children and adolescents.

**Keywords:** NHANES; energy; nutrients; children; grains

Article

## Grain Foods Are Contributors of Nutrient Density for American Adults and Help Close Nutrient Recommendation Gaps: Data from the National Health and Nutrition Examination Survey, 2009–2012

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**Abstract:** The 2015–2020 Dietary Guidelines for Americans (2015–2020 DGA) maintains recommendations for increased consumption of whole grains while limiting intake of enriched/refined grains. A variety of enriched grains are sources of several shortfall nutrients identified by 2015–2020 DGA, including dietary fiber, folate, iron, and magnesium. The purpose of this study was to determine food sources of energy and nutrients for free-living U.S. adults using data from the National Health and Nutrition Examination Survey, 2009–2012. Analyses of grain food sources were conducted using a single 24-h recall collected in adults  $\geq 19$  years of age ( $n = 10,697$ ). Sources of nutrients contained in all grain foods were determined using United States Department of Agriculture nutrient composition databases and the food grouping scheme for grains (excluding mixed dishes). Mean energy and nutrient intakes from the total diet and from various grain food groups were adjusted for the sample design using appropriate weights. All grains provided  $285 \pm 5$  kcal/day or  $14 \pm 0.2\%$  kcal/day in the total diet in adult  $\geq 19$  years of age. In the total diet, the grain category provided  $7.2 \pm 0.2\%$  ( $4.9 \pm 0.1$  g/day) total fat,  $5.4 \pm 0.2\%$  ( $1.1 \pm 0.03$  g/day) saturated fat,  $14.6 \pm 0.3\%$  ( $486 \pm 9$  mg/day) sodium,  $7.9 \pm 0.2\%$  ( $7.6 \pm 0.2$  g/day) total sugar,  $22.8 \pm 0.4\%$  ( $3.8 \pm 0.1$  g/day) dietary fiber,  $13.2 \pm 0.3\%$  ( $122 \pm 3$  mg/day) calcium,  $33.6 \pm 0.5\%$  ( $219 \pm 4$  mcg dietary folate equivalents (DFE)/day) folate,  $29.7 \pm 0.4\%$  ( $5.3 \pm 0.1$  mg/day) iron, and  $13.9 \pm 0.3\%$  ( $43.7 \pm 1.1$  mg/day) magnesium. Individual grain category analyses showed that breads, rolls and tortillas and ready-to-eat cereals provided minimal kcal/day in the total diet in men and women  $\geq 19$  years of age. Similarly, breads, rolls and tortillas, and ready-to-eat cereals supplied meaningful contributions of shortfall nutrients, including dietary fiber, folate and iron, while concurrently providing minimal amounts of nutrients to limit. Cumulatively, a variety of grain food groups consumed by American adults contribute to nutrient density in the total diet and have the potential to increase consumption of shortfall nutrients as identified by 2015–2020 DGA, particularly dietary fiber, folate, and iron.

**Keywords:** NHANES; energy; Dietary Guidelines; adults; grains; shortfall nutrients

Article

## Grains Contribute Shortfall Nutrients and Nutrient Density to Older US Adults: Data from the National Health and Nutrition Examination Survey, 2011–2014

Yanni Papanikolaou <sup>1,\*</sup> and Victor L. Fulgoni III <sup>2</sup>

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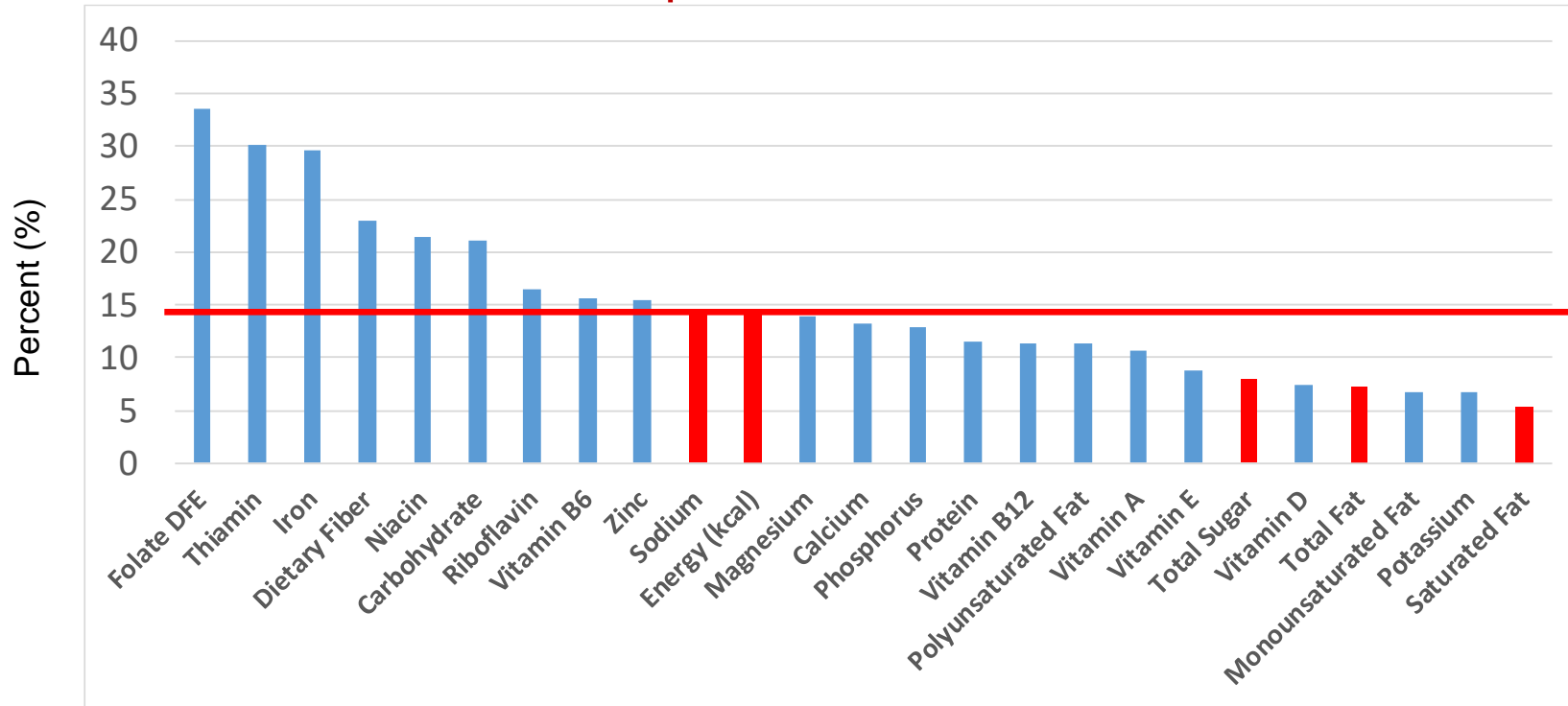
Received: 27 March 2018; Accepted: 17 April 2018; Published: 25 April 2018



**Abstract:** Previous data demonstrate grain foods contribute shortfall nutrients to the diet of U.S. adults. The 2015–2020 Dietary Guidelines for Americans have identified several shortfall nutrients in the U.S. population, including fiber, folate, and iron (women only). Intake of some shortfall nutrients can be even lower in older adults. The present analyses determined the contribution of grain foods for energy and nutrients in older U.S. adults and ranked to all other food sources in the American diet. Analyses of grain food sources were conducted using a 24-hour recall in adults  $\geq 51$  years old;  $n = 4529$  using data from the National Health and Nutrition Examination Survey, 2011–2014. All grains provided 278 kcal/day or 14% of all energy in the total diet, ranking as the 4th largest contributor of energy compared to 15 main food groups. All grain foods ranked 1st for thiamin (33%) and niacin (23%) intake relative to 15 main food groups. The grain foods category ranked 2nd highest of 15 main food groups for daily dietary fiber (23%), iron (38%), folate (40%), and magnesium (15%) and was the 3rd largest food group contributor for daily calcium intake (13%). When considering nutrients to limit as outlined by dietary guidance, main group of grains contributed 6% total fat, 5% saturated fat, 14% sodium and 9% added sugar. Breads, rolls and tortillas provided 150 kcal/day or 8% of all energy in the total diet, ranking as the 2nd largest contributor of energy compared to 46 food subcategories. Breads, rolls and tortillas ranked 1st of 46 foods for daily thiamin (16%) and niacin (10%) intake and 2nd for dietary fiber (12%), iron (12%), folate (13%), and magnesium (7%). Breads, rolls and tortillas ranked 3rd largest food group contributor for daily calcium (5%) intake. Ready-to-eat cereals provided 47 kcal/day or 2% of all energy in the total diet, ranking as the 20th largest contributor of energy compared to 46 food subcategories. All ready-to-eat cereals ranked 1st for daily iron (19%), 1st for folate (21%), 5th for dietary fiber (7%), 3rd for niacin (9%), 8th for magnesium (4%), and 13th for calcium (2%) intake. Given all grain foods and specific subcategories of grain foods provided a greater percentage of several underconsumed nutrients than calories (including dietary fiber, iron, and folate), grain foods provide nutrient density in the American diet of the older adult.

**Keywords:** NHANES; nutrients; aging; grains; fiber

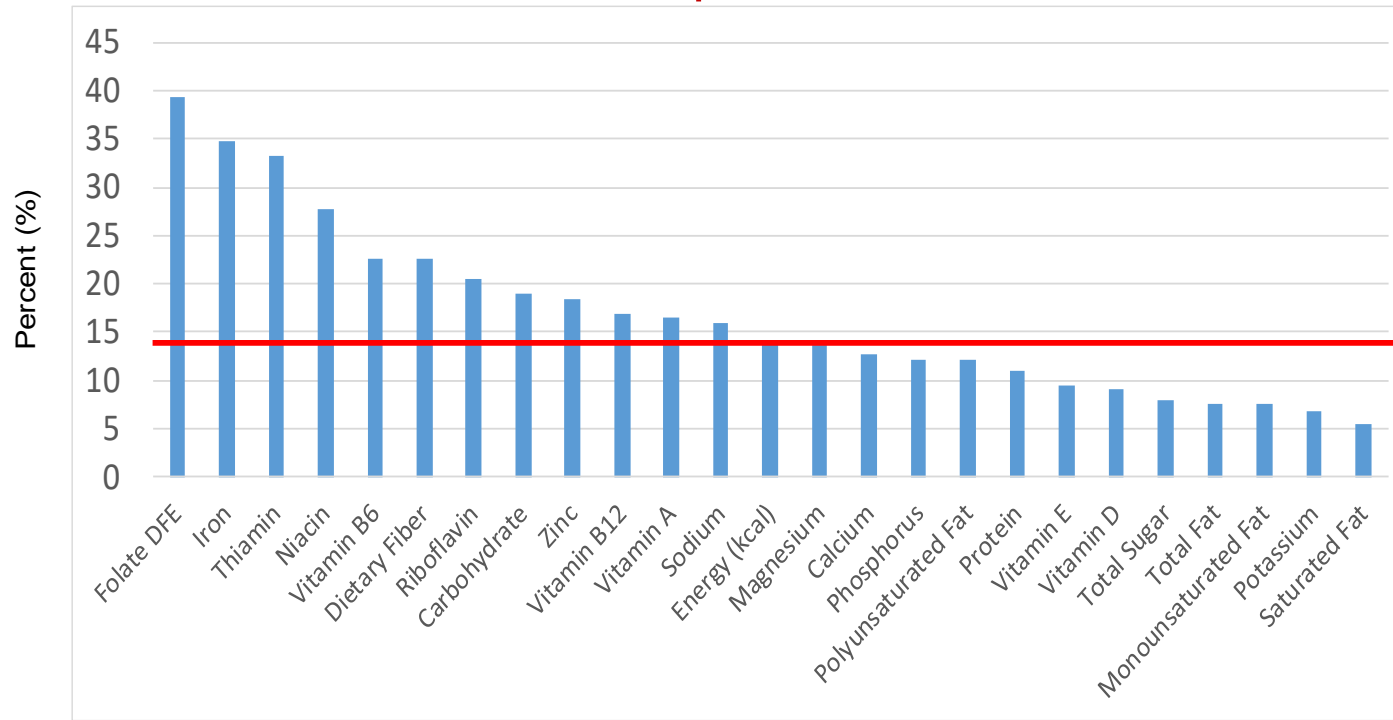
# All Grain Foods in Adults Help Close Nutrient Shortfall Gaps



NHANES 2009-2012; Data are for adults aged  $\geq 19$  years of age (N = 10,697)  
Papanikolaou & Fulgoni, 2017. *Nutrients*

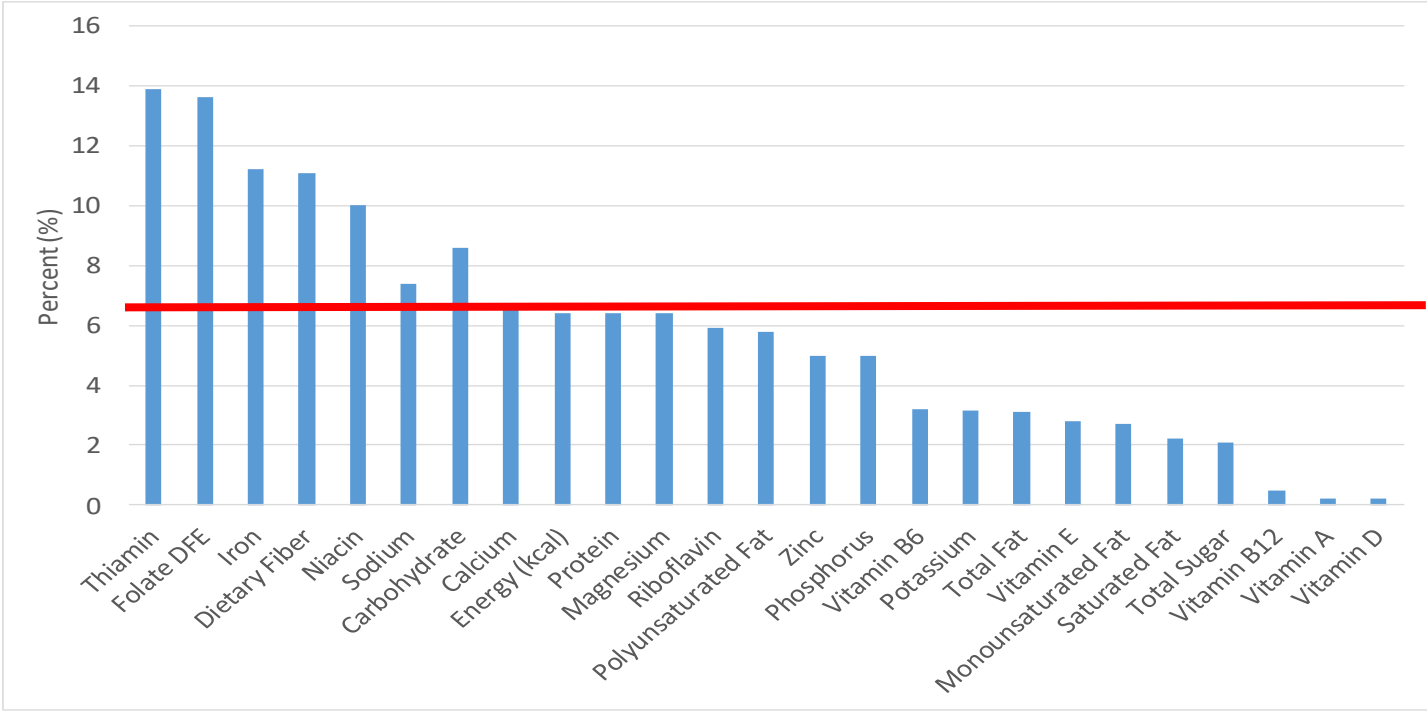


# All Grain Foods in Kids Help Close Nutrient Shortfall Gaps



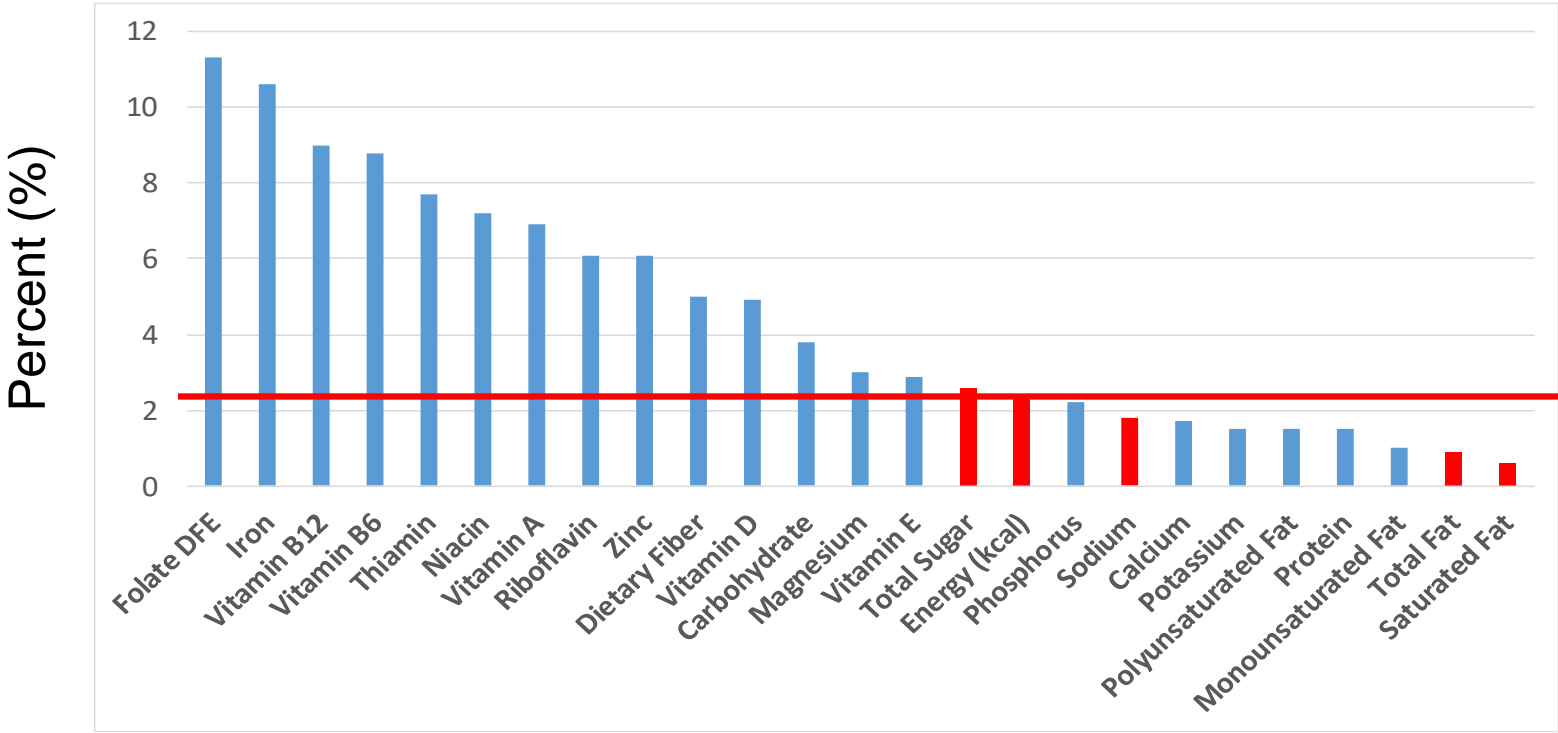
NHANES 2009-2012; All Children & Adolescents 2-18 Years of Age  
Papanikolaou & Fulgoni, 2017. *Nutrients*

# Breads, Rolls and Tortillas in Kids Help Close the Nutrient Shortfall Gap



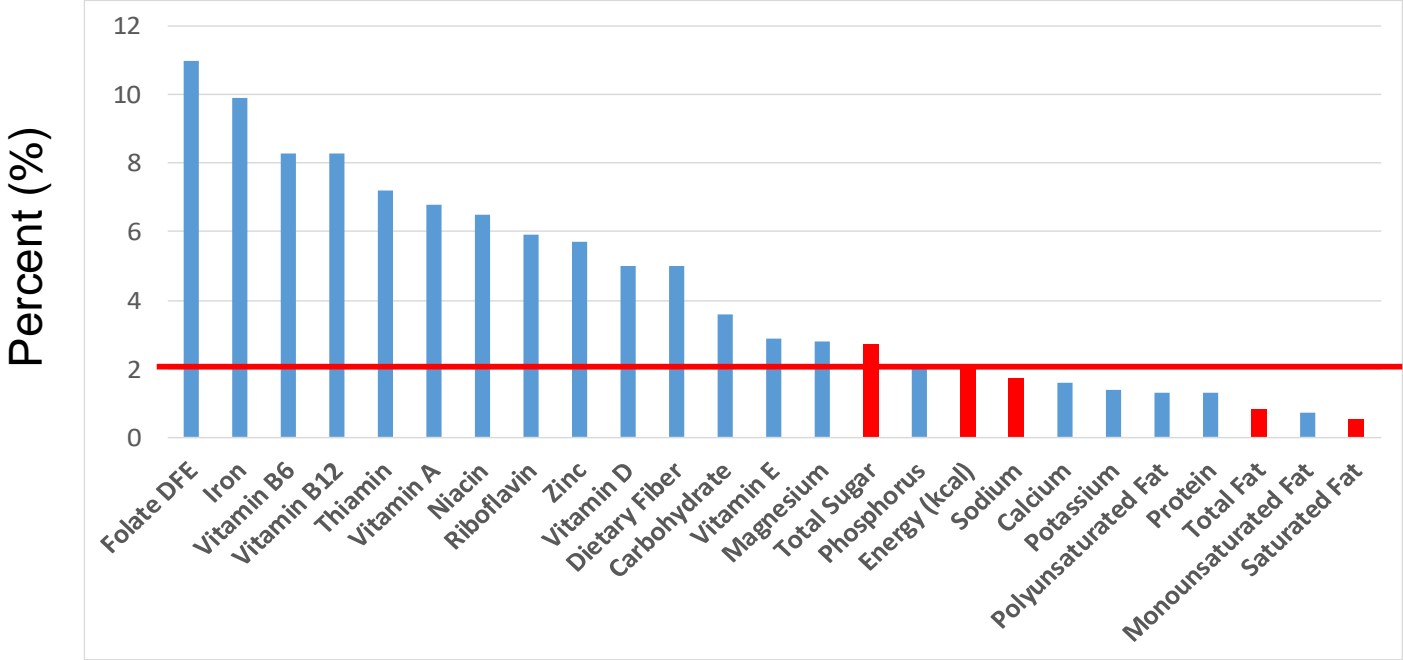
NHANES 2009-2012; All Children & Adolescents 2-18 Years of Age  
Papanikolaou & Fulgoni, 2017. *Nutrients*

# Ready-to-Eat Cereals in Adults Help Close the Nutrient Shortfall Gap-Females



NHANES 2009-2012; Data are for female adults 19+ years-old (N=5,349)  
Papanikolaou & Fulgoni, 2017. *Nutrients*

# Ready-to-Eat Cereals in Adults Help Close the Nutrient Shortfall Gap-Males

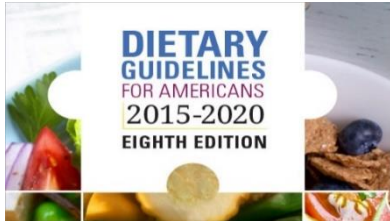


NHANES 2009-2012; Data are for male adults 19+ years-old (N=5,384)  
Papanikolaou & Fulgoni, 2017. *Nutrients*

# 2015-2020 Dietary Guidelines for Americans recognizes ‘shortfall nutrients’ and ‘nutrients of public health concern’



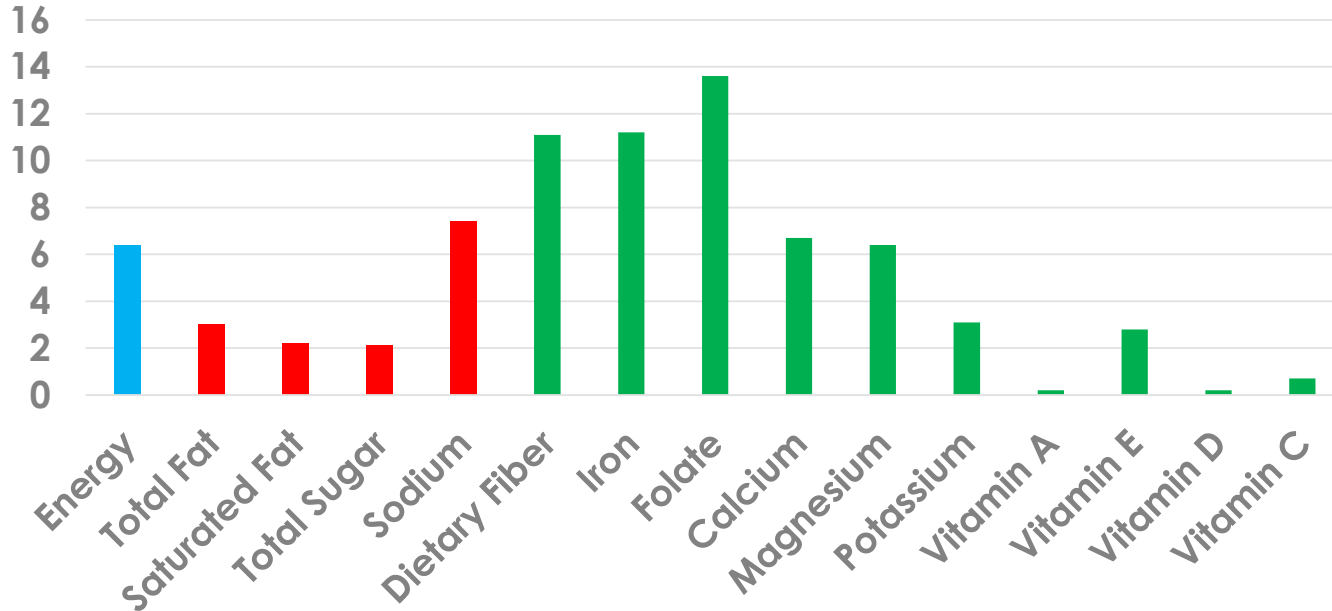
“...several nutrients are under-consumed relative to requirement levels set by the Institute of Medicine (IOM) and the Committee characterized these as shortfall nutrients: **vitamin A, vitamin D, vitamin E, vitamin C, folate, calcium, magnesium, fiber, and potassium.** For adolescent and premenopausal females, **iron** also is a shortfall nutrient. Of the shortfall nutrients, **calcium, vitamin D, fiber, and potassium** also are classified as nutrients of public health concern because their under-consumption has been linked in the scientific literature to adverse health outcomes.”





# Breads, Rolls & Tortillas Help Close Nutrient Shortfall Gaps

% of Nutrients from Breads, Rolls and Tortillas



# Healthy Aging: Grains Are Top Contributors of Key Nutrients

Main Food Group	Rank	% Fiber Contribution
Grains	1	23.12
Mixed Dishes	2	18.95
Vegetables	3	18.25
Fruit	4	11.70
Snacks and Sweets	5	11.69
Protein Foods	6	10.61
Beverages, Nonalcoholic	7	2.38
Condiments and Sauces	8	1.97

Main Food Group	Rank	% Calcium Contribution
Milk and Dairy	1	32.77
Mixed Dishes	2	16.86
Grains	3	13.24
Snacks and Sweets	4	8.00
Beverages, Nonalcoholic	5	7.69
Water	6	6.33
Protein Foods	7	5.90
Vegetables	8	4.95
Fruit	9	1.22

Main Food Group	Rank	% Vitamin D Contribution
Milk and Dairy	1	40.06
Protein Foods	2	30.95
Grains	3	9.33
Mixed Dishes	4	8.19
Beverages, Nonalcoholic	5	5.71
Snacks and Sweets	6	2.14
Vegetables	7	1.56
Fats and Oils	8	1.25

Main Food Group	Rank	% Potassium Contribution
Protein Foods	1	16.75
Mixed Dishes	2	16.32
Beverages, Nonalcoholic	3	16.17
Vegetables	4	14.73
Milk and Dairy	5	9.05
Snacks and Sweets	6	8.01
Fruit	7	7.18
Grains	8	6.66
Alcoholic Beverages	9	2.18
Condiments and Sauces	10	1.60

# Healthy Aging: Grain Foods (Breads/Cereals) Are Top Contributors of Key Nutrients

Food Group	Rank	% Iron Contribution
Ready-to-Eat Cereals	1	18.85
Breads, Rolls, Tortillas	2	11.95
Sweet Bakery Products	3	6.55
Vegetables, excluding Potatoes	4	4.48
Mixed Dishes - Meat, Poultry, Fish	5	4.21
Plant-based Protein Foods	6	4.12
Mixed Dishes - Grain-based	7	4.08
Meats	8	3.56
Mixed Dishes - Sandwiches	9	3.31
Cooked Cereals	10	3.28

Food Group	Rank	% Dietary Fiber Contribution
Vegetables, excluding Potatoes	1	13.64
Breads, Rolls, Tortillas	2	12.02
Fruits	3	11.70
Plant-based Protein Foods	4	9.72
Ready-to-Eat Cereals	5	6.70
Mixed Dishes - Grain-based	6	4.84
White Potatoes	7	4.60
Sweet Bakery Products	8	4.00
Savory Snacks	9	3.59
Mixed Dishes - Meat, Poultry, Fish	10	3.39

Food Group	Rank	% Folate, DFE Contribution
Ready-to-Eat Cereals	1	21.01
Breads, Rolls, Tortillas	2	13.37
Vegetables, excluding Potatoes	3	8.30
Mixed Dishes - Grain-based	4	6.16
Sweet Bakery Products	5	5.37
Plant-based Protein Foods	6	3.88
Mixed Dishes - Pizza	7	3.23
Cooked Grains	8	3.16
Mixed Dishes - Sandwiches	9	3.16
Mixed Dishes - Meat, Poultry, Fish	10	2.77

## Modeling Whole & Enriched Grains Study



Dietary Guidelines recommends making half of your grains whole grains, while limiting intake of enriched grains...

**What if you didn't?**

6 Servings of Grains Daily = 2 Whole Grains + 4 Enriched Grain Foods





# Sandwich Study



## Bread Has Been Made the Villain....why?

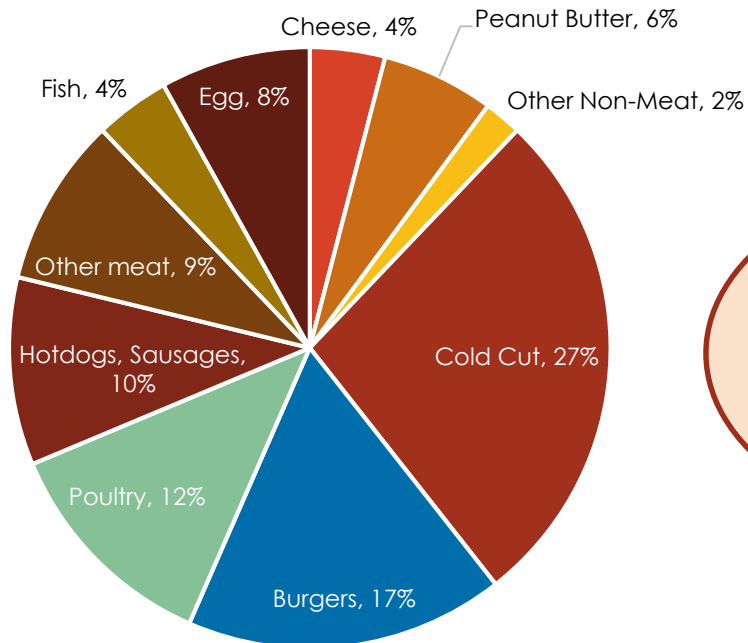


But what about the sodium and solid fats in bacon and sauces/condiments?

2 slices (50g) of bacon = ~20g fat, 7 g saturated fat, 320 mg sodium, 200 kcal

1 hamburger bun (47g) = 1.5 g fat, 0 g saturated fat, 240 mg sodium, 130 kcal

## USDA Distribution of Sandwich Type\*, Adults 20+ years, 2009-2012



**54% of the sandwiches eaten are burgers, cold cuts, hotdogs/sausages—sandwiches with ingredients that are rich in saturated fat, sodium, and calories**

\*Sebastian RS et al. Sandwich consumption by adults in the US. What We Eat in America, NHANES, 2009-2012, Food Surveys Research Group, Dietary Data Brief No. 14; Dec 2015

**delish**

## New Study Says Sandwiches Are Ruining Your Diet

Might be time for soup and salad at lunch ...



JUDY KIM

BY RHEANNA O'NEIL BELLOMO



**CBS NEWS**

LIVE

## Is your sandwich hurting your diet?

JUL 25, 2016 5:29 PM EDT SCITECH

BY RACHAEL RETTNER / LIVESCIENCE.COM



We hypothesized that not all sandwiches are created equal, and building a better sandwich will result in lower calories and less of nutrients to limit...





## NHANES 2013-2014: Typical Sandwich, Adults $\geq$ 19 Years Old

Energy/Nutrient	
Energy (kcal)	561
Total fat (g)	28
Saturated fat (g)	10
Sodium (mg)	1393
Protein (g)	34
Carbohydrate (g)	35



This is what one change can do...



	<b>Whole Grain Bread</b>	<b>Enriched Grain Bread</b>
Calories	-170 (7%)	-184 (8%)
Total Fat	-19 g (18%)	-19 g (18%)
Saturated Fat	-6.6 g (20%)	-6.6 (20%)
Sodium	-697 mg (20%)	-663 mg (-19%)

## Building A Better Sandwich Takeaways:

- The results support the inclusion of select sandwiches within recommended dietary patterns in Americans
- Building a better sandwich with WG/enriched grain breads can lower nutrients to limit (i.e., sodium, saturated fat) and reduce calories
- The data also suggest that ingredients within a sandwich, rather than the bread component, can be an important contributor to daily calories and nutrients to limit in the diet.







What can you do with all this science?



# Identify Consumer Messages

**Grain foods are the foods we love that love us back – finally, we can enjoy bread again!**

## WHY

- Grain foods pack more of a nutrient punch than a caloric one in adult diets.
- Grain foods fill critical nutrient gaps.
- Not all grains are created equally.
- People who choose grains wisely have better diets.
- The grain news for kids is similiary good.
- Refined and enriched grains play a critical role in our diets.

# Develop Supporting Materials

- Press Release
- Infographics
- Q&As
- Blog Posts
- Social Content

**GRAIN FOODS FOUNDATION**

**Adult Sources of Nutrients**  
Blog Post

Everyone is on the hunt for the latest superfood, yet sometimes reach right. Health professionals agree that it is the total diet that is important to our health at every age. A tasty, healthy, and enjoyable pattern of eating that meets our needs is what counts. So, how do we make sure we are getting the most out of our diet? One food that we love, and that we know can live up to the task, is grains. We wanted to determine food sources of nutrients in the American diet. We analyzed data from the National Health and Nutrition Examination Survey (NHANES) to see what adults over the age of 19 were eating. The data was collected by the National Center for Health Statistics (NCHS). This is a nationally representative survey of the U.S. population. The researchers looked at all data on grain consumption and the following grain food groups:

- All grain foods
- Bread, rolls, and tortillas
- Ready-to-eat cereals
- Cooked grains
- Quick breads and bread
- Sweet bakery products

Data were analyzed for iron and calcium. The results showed that iron and calcium intake increased as the amount of grain consumed increased. Iron, calcium, magnesium, and folate intake also increased with grain consumption. The results might surprise those who think that iron and calcium are only found in meat and dairy products. Grains are a good source of iron, calcium, magnesium, and folate. Grains are also a good source of calories and can help you get the most out of your diet.

**GRAIN FOODS FOUNDATION**

**GRAIN FOODS PACK MORE OF A NUTRIENT PUNCH THAN A CALORIC ONE**

**AMERICAN ADULT DIET**  
**15%**  
total calories from  
**GRAIN FOODS**

**NUTRIENT PACKED!**  
FIBER  
FOLATE  
IRON  
CALCIUM  
MAGNESIUM  
VITAMIN A

**BREAD IT LOVES YOU BACK**

**POWERFUL NUTRIENT MIX**

**BOTH WHOLE AND REFINED GRAINS ARE ESSENTIAL IN MEETING DAILY RECOMMENDED NUTRIENTS.**

**GRAIN FOODS FOUNDATION**

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**FNCE 2017: Top RD Media Influencer Meeting, Oct 22, 2017**



Leverage with top media RD influencers who have consumers ear



# Nutrition Influencers

## Media RD Outreach



- **Lighten Up for Holiday Parties Segment**
- Messaging Highlights:
  - “Fill up on grain foods and vegetables, these keep us full for a longer period of time.”
  - “You will hear people say, I’m giving up bread. Forget about them. Forget about those fad diets.”
  - “Grain foods are very important in the diet.”
  - “Grains keep us energized throughout the holiday season.”
  - “They are an important source of B vitamins, minerals and fiber. No need to give these up.”



# Nutrition Influencers

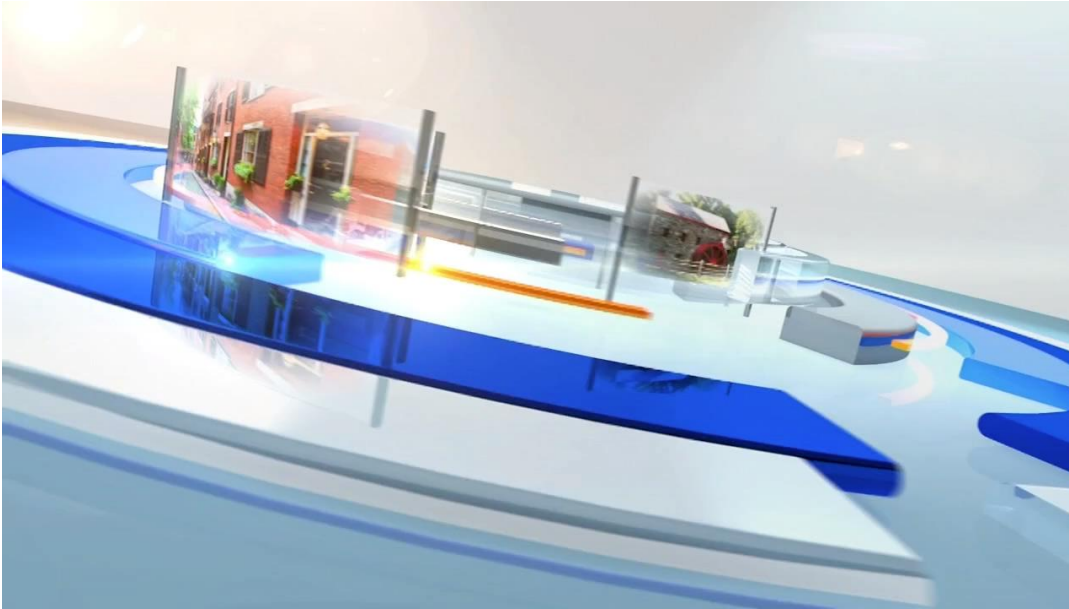
## Media RD Outreach



- **Simple Swaps for Healthy Snacking this Summer!**
- Direct Use of GFF Messaging:
  - Every healthful eating plan including Mediterranean and DASH diets include grain foods.
  - Bread has everything your body needs – B-vitamins, selenium, iron, folate, and fiber
  - Research shows an overall healthy diet with fiber lowers risk of type 2 diabetes, heart disease, and stroke
  - “For summer, I love sandwiches...easy on-the-go, portable, road trips...”

# Nutrition Influencers

## Media RD Outreach



- **Smart Foods to Keep in Your Diet this Summer**
- Direct Use of GFF Messaging:
  - “Grain foods and breads are part of every healthful diet...Mediterranean and DASH diets”
  - They provide beneficial nutrients – B-vitamins, folate, fiber, iron, selenium, magnesium
  - Fiber helps keep you feeling full and most of us aren’t getting enough
  - When we include grains in our diet, we can help to reduce our risk for type 2 diabetes, heart disease and stroke so “go for the bread”
  - Sandwiches are quick, portable and on-the-go options for summer

# Nutrition Influencers

## Media RD Outreach



- **Back to School Nutrition Meals for the Kids**
- Direct Use of GFF Messaging:
  - “it’s not the bread, its what we put inside our sandwich that contributes to most of calories, fat, sodium in our diet”
  - Grain foods contribute less than 15% of total calories + over 20% of shortfall nutrients
  - It’s where we get our fiber, folate, iron, more than 10% of magnesium, calcium and vitamin A
  - Sandwiches/grains come in a variety of forms that kids like!



Grain foods are the foods we love that love us back. Enjoy bread again!

GRAIN FOODS PACK MORE OF A **NUTRIENT PUNCH** THAN A CALORIC ONE

AMERICAN ADULT DIET

15%  
total calories from  
**GRAIN FOODS**

NUTRIENT PACKED!

- FIBER
- FOLATE
- IRON
- CALCIUM
- MAGNESIUM
- VITAMIN A

Source: Agricultural Research Service, 2011. Data from the National Health and Nutrition Examination Survey, 2009-2012.

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SPECTRACOLOR

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bread - focus on the ingredients inside!

**THE INGREDIENTS INSIDE THE SANDWICH**

WITH THE BREAD (FOCUS) - BUT FOCUS ON THE INGREDIENTS INSIDE!

Build a better sandwich.

1. Start with a slice of whole-grain bread.

2. Add a slice of cheddar cheese.

3. Add a slice of ham.

4. Add a slice of lettuce.

5. Add a slice of tomato.

6. Add a slice of sauce.

7. Add another slice of whole-grain bread.

Let our secret power calories, help to do less walking.

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**Hard Rock CAFE**

SPECTRACOLOR

at&t

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