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# Nutrition Perspectives

UC Davis Department of Nutrition, UC Agriculture and Natural Resources, and Center for Nutrition in Schools

## Low Gluten Consumption Does Not Reduce Heart Disease Risk in Those Without Celiac Disease

A recent dietary trend that has gained in popularity is the avoidance of gluten by those without celiac disease. Celiac disease, which is present in less 1 percent of the U.S. population, requires a gluten-free diet to avoid symptoms. In the last several years, a common public perception is that restricting gluten has health benefits, though data to support this belief is limited.

*There is little evidence to support gluten-free diets for those without celiac disease or gluten senstivitity on the basis of health.*

"Despite the relatively low prevalence of celiac disease and non-celiac gluten sensitivity, surveys suggest that about one-third of Americans are trying to cut down on gluten," said lead author Dr. Lebwohl, a professor at Columbia University.[1] "This certainly benefits companies that sell gluten-free products. But does it benefit the public? That is the question we wanted to answer."

In a study published in *BMJ*, researchers tracked 64,714 women and 45,303 men without celiac disease over 26 years to examine if gluten consumption was associated with risk of coronary heart disease.[2] To test the hypothesis that increasing amounts of gluten consumption is associated with coronary heart disease, the authors compared the incidence across five different

*While gluten is most often associated with wheat, it also found in other grains, including rye.*

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levels of gluten consumption. In other words, were those who were among the highest fifth of gluten consumption more likely to develop heart disease compared to those who were in the lowest fifth and ate the least amount of gluten?

At first they found that those who consumed the most gluten were at the lowest risk for coronary heart disease compared to those who consumed the least gluten (hazard ratio = 0.88).

After this preliminary analysis, they also took into account several factors that might also be related to heart disease, including age, body mass index, physical activity, diet, smoking history, diabetes, cholesterol, and other health markers. After including these in the analysis, the researchers found that there was no significant association between gluten consumption and risk of coronary heart disease. Those that ate the most gluten were not at any higher risk than those who ate the least gluten.

*Gluten can also be found in small amounts in unexpected foods, such as salad dressing.*

Next, the authors factored in refined grain and whole grain consumption, as gluten is primarily obtained from these. When they adjusted the analysis for refined grains, the highest gluten consumption was associated with lower risk of coronary heart disease compared to the lowest gluten consumption (hazard ratio = 0.85). However, when they adjusted for whole grain consumption as well, there was no longer any association between gluten consumption and coronary heart disease risk.

The authors concluded that these findings do not support limiting gluten consumption for heart health and suggest that those who severely limit gluten may be limiting their consumption of whole grains. Whole grain intake is associated with lower risk for coronary heart disease; by limiting gluten some may be limiting their consumption of heart-healthy whole grains.

References:


1. Dietary Gluten Is Not Linked to Heart Risk in Non-Celiacs. May 3, 2017; Columbia University Medical Center Newsroom; http://newsroom.cumc.columbia.edu/blog/2017/05/03/dietary-gluten-is-not-linked-to-heart-risk-in-non-celiacs/
2. Lebwohl B, Cao Y, Zong G, et al. Long term gluten consumption in adults without celiac disease and risk of coronary heart disease: prospective cohort study. BMJ. 2017 May ;357:j1892. doi: 10.1136/bmj.j1892.


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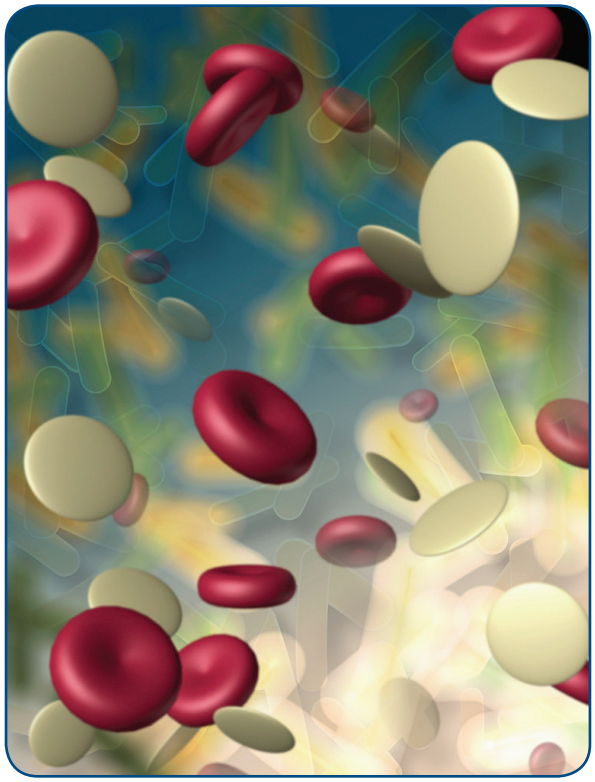
# HDL Composition May Help Predict Health Risks and Design Therapeutics

To most of us, HDLs, or high-density lipoproteins, are simply tiny, cholesterol-rich particles that act as the biochemical "good guys" in the battle against clogged arteries and coronary heart disease.

But a team led by University of California, Davis, researchers found that not all HDLs are alike. The amounts and specific structure of complex sugars called glycans in these particles can powerfully influence the body's inflammatory and immune responses.[1]

The composition of these HDL sugars differentiated healthy individuals from those with metabolic syndrome and from those who were diabetic and undergoing dialysis, the researchers found. Even more interesting, the ability of HDLs to tame the inflammatory response of immune cells was associated with the composition of these sugars.



*High-density lipoprotein (HDL) is a type of blood cholesterol. New research suggests the composition of these impacts their influence on inflammatory responses.*

"HDLs are these cool little particles, but they are incredibly diverse in composition," said the study's lead author Angela Zivkovic, an assistant professor in the Department of Nutrition, whose research focuses on personalized or "precision" nutrition. "They continually remodel themselves, gaining new functions as they change."

"Based on the findings of this study, we anticipate that profiles of the glycan-containing glycoproteins in HDL particles could provide valuable biomarkers for predicting a person's susceptibility to inflammatory diseases and to certain types of infections," she said.

Zivkovic and colleagues have reported their findings online in Nature's Scientific Reports and filed a patent application on the newly identified process.

**More than meets the eye**

During the past decade, scientists have discovered that HDLs not only help prevent the hardening and narrowing of the arteries associated with heart disease and stroke, but also play key roles related to the body's inflammatory and immune responses.

It also has been shown that HDLs' anti-inflammatory capacity is reduced in people with Type 2 diabetes or metabolic syndrome, which is characterized by high blood pressure, obesity, low HDL levels and high blood sugar and triglyceride levels.

"We wanted to know what makes some people's HDL anti-inflammatory and other people's HDL pro-inflammatory," Zivkovic said.

The relationships between HDLs and the immune system are poorly understood, and researchers are looking for new connections

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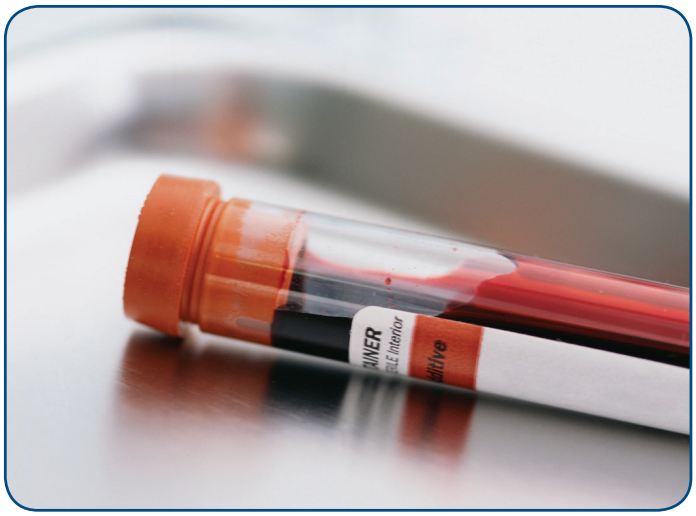
# HDL (Continued from page 3)

that may explain how HDLs interact with the immune system to turn inflammation on or off.



*"We now know that it is not just the amount of HDL in your bloodstream that counts, but exactly what proteins and fats the particles are made of," Zivkovic said.*

**HDL: A complicated history**

At first, it seemed that the connection between HDL and health was straight-forward: the more HDL a person has circulating in their bloodstream, the less likely they are to get heart disease. But drugs that increased HDL levels failed in clinical trials: patients who were on the drugs actually had a higher likelihood of dying.

"We now know that it is not just the amount of HDL in your bloodstream that counts, but exactly what proteins and fats the particles are made of," Zivkovic said. The glycans attached to those proteins and fats act as keys to let the HDL particles do their job, she said.

Using a sophisticated analytical system developed by Professor Carlito Lebrilla in the UC Davis chemistry department, Zivkovic and Lebrilla were the first to demonstrate that HDL particles are not "naked," as depicted in most textbooks, but instead are covered with glycan sugars. They then showed that measuring the amounts and types of these glycans on HDL could identify people who have heart disease. Their next question focused on whether these sugars affect the function of HDL.

*Recommendations to raise HDL include 60 minutes of moderate-intensity exercise per week.*

**The new study**

Zivkovic and colleagues set out to examine just how HDLs' composition impacts their capacity to influence the immune system.

The researchers analyzed HDL glycans from 50 patients, identified as being either healthy, diabetic and receiving dialysis treatments, or exhibiting symptoms of metabolic syndrome.

The analyses revealed that the patterns of attachment of the glycans to the HDL proteins

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were characteristic of the patients' health status.

More importantly, the glycan profiles indicated which individuals' HDLs were boosting or inhibiting production of interleukin 6, a protein related to the body's inflammatory response.

"What's exciting is that the traditional markers of disease risk, like LDL cholesterol levels, BMI (body mass index), and blood pressure were not able to predict whose HDL would be pro- vs. anti-inflammatory, but the glycan profiles of their HDL did," Zivkovic said.

**Looking toward new therapies**

Zivkovic said that additional studies of larger patient groups are now needed to explore the influences of gender and age on HDLs' influence on the immune responses.

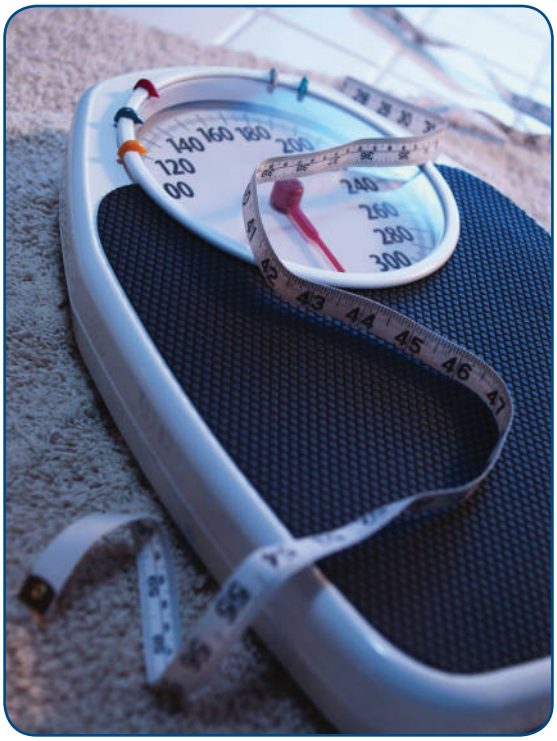
"Now we want to see what we can do to change the glycosylation of a person's HDLs," Zivkovic said. "As a nutritionist, I am looking at dietary approaches, but to a cardiologist, that might mean new medicines to alter HDL glycosylation."

Reference:

1. Krishnan S, Shimoda M, Sacchi R, et al. HDL Glycoprotein Composition and Site-Specific Glycosylation Differentiates Between Clinical Groups and Affects IL-6 Secretion in Lipopolysaccharide-Stimulated Monocytes. Sci Rep. 2017 Mar 13;7:43728. doi: 10.1038/srep43728.

Source: Pat Bailey. UC Davis News; Apr 6, 2017; https://www.ucdavis.edu/news/hdl-composition-may-help-predict-health-risks-and-design-therapeutics-0

# Alternate-day Fasting No More Effective than Daily Calorie Restriction



Alternate-day fasting has been receiving attention lately as a means for weight loss because it can be difficult to restrict calories on a daily basis as with a traditional diet. With alternate-day fasting, calories are restricted every other day (fast days), while the intervening days are not restricted at all (feast days). While it has been growing in popularity because, very few studies have examined the effectiveness of the diet for longer than a few months.

In a study published in *JAMA Internal Medicine,* researchers examined whether alternate-day fasting would lead to greater weight loss and better adherence compared to daily calorie restriction, because it only requires restricting intake every other day rather than every day.[1]

Participants were randomly assigned to one of three groups: alternate-day fasting, daily caloric

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# Alternate-day Fasting (Continued from page 5)

restriction, or control, which received no treatment and were asked to maintain their weight during the duration of the study.

The first six months of the study consisted of weight reduction, followed by six months of weight maintenance. The alternate-day fasting group was asked to consume 25 percent of the calorie requirement on between 12 pm and 2 pm on fast days and 125 percent of the caloric requirement on feast days.

The daily calorie restriction group was asked to consume 75 percent of their daily calorie requirements each day. All meals were provided to both intervention groups for the first three months. During months 4 through 6, participants met weekly with a dietician or nutritionist to learn how to continue the diet on their own.

During the six months of weight maintenance phase, those in the alternate-day fasting group were asked to consume 50 percent of the their caloric needs on fast days and 150% of their caloric needs on feast days. In the daily caloric restriction group, participants were asked to consume 100 percent of the their calorie needs. To help participants with weight maintenance, both groups met monthly with a dietician during this phase.

At the end of the study, there was no significant difference in weight lost between the alternate-day fasting group and the daily caloric restriction group. However, the alternate-day fasting group had lower adherence to the diet (eating more on fast days and less on feast days than prescribed). They also had a higher rate of withdrawal from the study compared to the daily calorie restriction group (38 percent versus 29 percent). Many cited the difficulties of adhering to the alternate-day fasting regimen as the reason for withdrawing from the study.

*In the alternate-day fasting group, many participants that withdrew from the study cited the difficulty of adhereing to the diet as the reason for withdrawal.*

The authors concluded that alternate-day fasting was not more effective than daily caloric restriction, as well as being more difficult to adhere to. The authors suggested future work should explore whether lack of adherence is due to cognitive, environmental, or physiological factors.

Reference

1. Trepanowski JF, Kroeger CM, Barnosky A, et al. Effect of Alternate-Day Fasting on Weight Loss, Weight Maintenance, and Cardioprotection Among Metabolically Healthy Obese Adults: A Randomized Clinical Trial. JAMA Intern Med. 2017 Jul 1;177(7):930-938. doi: 10.1001/jamainternmed.2017.0936.

By Anna M. Jones; University of California, Davis, Department of Nutrition.

# How Gender, Diet, Microbiota and Molecules Contribute to Metabolic Disease and Liver Cancer

Researchers at UC Davis Health and other institutions have shown that gender differences in mice microbiota can modulate the risk of developing metabolic disease and liver cancer.[1] In addition, the team found that a bile acid receptor protein, called FXR, has a profound impact on mouse microbiota and bile acid profiles and is differentially expressed based on gender. The study was published in the journal Scientific Reports.

Yvonne Wan's mouse study found gender differences in gut microbiota.

"Liver cancer is a male-predominant disease," said Yu-Jui Yvonne Wan, vice chair for research in the Department of Pathology and Laboratory Medicine and senior author on the paper. "The gender difference is in part due to differences in gut microbiota. Men and women have different bacterial compositions, which plays a role in metabolism and disease development."

*There are many products containing probiotics on the market, including yogurt, that claim to have beneficial effects on gut microbiota.*

The research team's quest to understand liver disease revolved around steatosis, or fatty liver, which sometimes leads to cancer. Gut microbes play a significant role, as some strains convert primary bile acid into secondary, toxic bile acid. This relationship between microbiota and bile acid may modulate whether a person develops a fatty liver or a fatty liver that becomes cancerous.

In addition, the researchers wanted to understand the role FXR plays in metabolic disease. Previous studies have shown that patients suffering from cirrhosis or cancer have low levels of this protein.

To investigate these complex pathways, the lab fed high-fat, high-carbohydrate Western diets or healthier control diets to normal and FXR knockout mice. They found that both the Western diet and the loss of FXR generated compromised microbiota and bile acid profiles.

Male FXR knockouts feasting on a Western diet fared worst, exhibiting severe steatosis, high liver and blood lipids and insulin resistance. Females did substantially better.

"Gender differences in gut microbiota and bile acid profiles can explain the difference in steatosis development," Wan said.

FXR-deficient mice had higher levels of potentially dangerous gut bacteria, such as Helicobacteraceae, Desulfovibrionaceae and Deferribacteraceae, as well as secondary bile acids. They also developed a form of steatosis that could lead to liver cancer. Helicobacteraceae levelsincreased by 40 percent in these mice. Through its ability to modulate microbiota and bile acid profiles, FXR may inadvertently act as a

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cancer suppressor.

"The key differences between simple steatosis and cancer-promoting steatosis are microbiota and bile acid," Wan said.

These findings indicate that potential probiotic therapies should be customized to a patient's gender. In addition, researchers can now explore biomarkers that clarify a patient's risk of developing steatosis and liver cancer based upon their microbiota and bile acid profiles.

"We might be able to use bacteria to predict metabolic disease or cancer development," said Wan. "We could probably use bile acid as well to accomplish the same thing."

Reference:

1. Sheng L, Jena PK, Liu HX, et al. Gender Differences in Bile Acids and Microbiota in Relationship with Gender Dissimilarity in Steatosis Induced by Diet and FXR Inactivation. Sci Rep. 2017 May 11;7(1):1748. doi: 10.1038/s41598-017-01576-9.

Source: UC Davis Health News; Jun 6, 2017; http://www.ucdmc.ucdavis.edu/publish/news/newsroom/12063

## Alliance Calls to Eliminate Lead Poisoning in American Children by 2021

*According to the CDC, lead-based paint is the most widespread and dangerous source of lead exposure for children. Lead-based paint was commonly used in homes until it was banned in 1979.*

An alliance of leading scientists, health professionals and children's advocates known as Project TENDR has recommended new national goals for protecting American children from lead poisoning. [1]

In a viewpoint published in *JAMA Pediatrics,* alliance members David Bellinger, Bruce Lanphear and Aimin Chen chart a course for better safeguarding children from lead poisoning within five years and eliminating lead exposures by 2030.

"Project TENDR was launched with the goal of eliminating chemicals from the environment that science has shown are harmful to children's health," said TENDR co-founder Irva Hertz-Picciotto, professor in the UC Davis Department of Public Health Sciences. "We are beginning with specific recommendations for reducing lead exposure and toxicity, given the volume of evidence that it is a preventable and far too common danger to children's brain development."

Recent research shows that even low levels of lead in a child's blood can harm neurodevelopment, leading to learning disabilities, lowered IQ and attention disorders. The National Center on Birth

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Defects and Developmental Disabilities confirms that one in six children in the U.S. has a learning or developmental disability. On average, it costs twice as much to educate a child with a learning or developmental disability as it does to educate a child without one, according to the National Education Association and the American Institutes for Research.

"The time has come to consign childhood lead poisoning to the medical history books," said Bellinger, lead author of the viewpoint and professor of neurology at Boston Children's Hospital, Harvard Medical School. "We know where the lead is, we know how it gets into children's bodies, we know what it does to harm health. What we need is the political will to get the job done."

*Last year, the FDA issued a recall of a brand of curry powder due to excessive lead content. The CDC also lists lead-contaminated candy imported from Mexico, toys with lead paint and folk medicines as potential sources of lead exposure.*

According to the U.S. Centers for Disease Control and Prevention (CDC), there is no safe level of lead. However, federal standards on allowable levels of lead in paint, dust, air, water and soil are obsolete and have failed to protect children and pregnant women in cities nationwide.

The viewpoint authors recommend these prevention-based standards to eliminate lead toxicity:

Federal agencies should adopt health-based standards and actions that rely on the most up-to-date scientific knowledge.

Federal, state and local governments should protect pregnant women and children by identifying and remediating sources of lead exposure prior to exposure.

Congress should create an independent expert advisory committee to develop and fund a long-term national strategy to eliminate lead toxicity in pregnant women and children.

"Some may say that lead is already low, or, that we are pushing for too much," explained viewpoint co-author Chen, associate professor of environmental health at the University of Cincinnati College of Medicine. "But lead is entirely toxic, period. We want to reduce exposure so that by 2021 there is no child with blood lead levels above 5 microgram/deciliter, which is the current reference limit set by the CDC. Currently about 2.5 percent of U.S. children between ages 1 and 5 years still have blood lead levels above that."

The viewpoint team said their recommendations incur high benefits for low costs. A 2009 study by the Economic Policy Institute found that for every $1 spent to reduce exposures to lead, society would benefit by $17-$221. This benefit is comparable to that of childhood vaccines.

"No matter how you look at it — protecting kids' brains, reducing the numbers of kids needing special education, increasing the number of productive workers paying taxes or increasing global competitiveness — it makes

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sense to eliminate lead exposure," said co-author Lanphear, professor of children's environmental health at Simon Fraser University in Vancouver, British Columbia.

At its interim meeting in November 2016, the American Medical Association's House of Delegates adopted policy supporting regulations and efforts designed to protect young children from lead exposure, in alignment with Project TENDR's goals.

**About Project TENDR**

Project TENDR, which stands for "Targeting Environmental Neuro-Development Risks," is an alliance of over 50 of the nation's top scientists, health professionals and children's advocates. It was launched and is co-directed by Maureen Swanson of the Learning Disabilities Association of America and Irva Hertz-Picciotto, director of the UC Davis Environmental Health Sciences Center. TENDR's long-term mission is to lower the incidence of neurodevelopmental disorders such as ADHD, autism and learning disabilities by reducing exposure levels of chemicals and pollutants that can contribute to these conditions, especially during fetal development and early childhood. Visit Project TENDR's consensus statement for more information.

Reference:

1. Bellinger DC, Chen A, Lanphear BP. Establishing and Achieving National Goals for Preventing Lead Toxicity and Exposure in Children. JAMA Pediatr. 2017 Jul 1;171(7):616-618. doi: 10.1001/jamapediatrics.2017.0775.

Source: UC Davis Health News; May 15, 2017; http://www.ucdmc.ucdavis.edu/publish/news/newsroom/12010

## Immigrant Farmworkers Less Likely to Use SNAP, Study Shows

The federal Supplemental Nutrition Assistance Program (SNAP) — formerly known as "food stamps" — that helps low-income individuals and families purchase food is less likely to be used by farmworkers eligible for the benefit who are immigrants, Hispanic, male, childless or residing in California, new research from UC Davis health economists shows.[1]

Published in the *Journal of Immigrant and Minority Health*, the study undercuts the common assumption that immigrant crop workers, especially Hispanic crop workers, utilize SNAP more than others. It also highlights the need to address nonparticipation among those who are legally eligible and could benefit from the program, which reduces hunger and stimulates spending.

"The worldwide financial crisis in the last decade definitely increased SNAP use among

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*Immigrant farmworkers were less likely to participate in SNAP than households headed by non-Hispanic white citizens with the same need.*

agricultural workers, which wasn't surprising since SNAP participation historically fluctuates in tandem with poverty levels," said lead author Paul Leigh, a professor with the Department of Public Health Sciences and Center for Healthcare Policy and Research at UC Davis.

"We did not see a disproportionate increase in SNAP use among immigrants — documented or undocumented — who are often the hardest hit by economic downturns," Leigh said. "The greatest percentage point increase was among citizens."

Image credit: USDA / Flickr. Used under Creative Commons 2.0 https://creativecommons.org/licenses/by/2.0/

*California has traditionally had lower SNAP enrollment than the rest of the nation, based on enrollment potential, possibly due to burdens associated with the application process, fear of deportation or lack of familiarity with the program.*

A program of the U.S. Department of Agriculture, SNAP offers funding for food or plants and seeds to grow food based on eligibility criteria such as income and family size. Undocumented immigrants may qualify if they have U.S. born children, and documented immigrants may qualify after residing in the U.S. for five years.

**An evaluation of comprehensive data on farmworker households**

Leigh, together with co-author Alvaro Medel-Herrero of the UC Davis Center for Health and the Environment, wanted to develop a clear picture of SNAP participation among U.S. farmworkers, focusing on the recession years following the financial crisis of 2007-2008.

They analyzed data from 2003 through 2012 on adult respondents in about 18,000 households included in the National Agricultural Workers Survey of the U.S. Department of Labor, which contains demographic, employment, immigration and health information on crop workers, including their SNAP use or nonuse. The dataset is rare, according to Leigh, because it contains information on undocumented immigrants.

Respondents were divided for comparisons into three groups: citizens, documented immigrants and undocumented immigrants. Immigrants in the study were nearly all Hispanic, however citizens were also grouped by ethnicity: non-Hispanic white, Hispanic and other.

**More people participated in SNAP, mostly citizens**

The results showed that SNAP participation among U.S. farmworkers increased from 4.9 percent in 2008 to 18.7 percent in 2012 (13.8 percentage points), reversing a downward participation trend during the previous six years as the economy expanded. The number of farmworker households under the poverty line also increased, from 15 percent in 2008 to 24 percent (9 percentage points) in 2012.

In terms of farmworkers' citizenship status, the greatest increase in SNAP participation was among citizens — from 9.5 percent to 26.9 percent (17.4 percentage points). The second highest increase was among undocumented immigrants, which went from 3.9 percent to 16.4 percent (12.5 percentage points). SNAP participation among documented

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immigrants rose from 6.3 percent to 7.2 percent (0.9 percentage points).

**Immigrants were less likely to use SNAP**

From 2003 through 2012, documented and undocumented farmworker immigrants were 40 percent and 43 percent less likely to participate in SNAP than households headed by non-Hispanic white citizens with the same need, as determined by poverty level and number of children.


*Female heads-of-households were more likely to participate in SNAP than male heads-of-households.*

**Hispanic citizens were less likely to use SNAP**

Also for 2003 through 2012, the researchers found that farmworkers who were Hispanic citizens were 30 percent less likely to participate in SNAP than non-Hispanic white citizens with the same poverty status and number of children.

**SNAP utilization was higher for the poorest, parents and women**

The researchers found that, regardless of race or ethnicity, household poverty level and the number and ages of children in the household were among the most powerful predictors of farmworker participation in SNAP. Female heads-of-household also were 43 percent more likely to participate in the program than male heads-of-household.

**California lags in SNAP enrollment**

Finally, holding constant household poverty status and numbers of children, farmworkers who were residents of California were least likely to participate in SNAP, while residents of the Northwest were most likely to participate when compared with the East, Southeast, Midwest and Southwest. California has traditionally had lower SNAP enrollment than the rest of the nation, based on enrollment potential, possibly due to burdens associated with the application process, fear of deportation or lack of familiarity with the program.

The researchers hope their study helps secure the future of SNAP, which was expanded following the economic crisis but is currently being considered for sharp cuts. They also hope additional research identifies ways to address barriers to utilizing SNAP among eligible nonusers.

"Farmworkers and their families advance our agricultural economy and put food on all of our tables, and they have a right to eat as well," said Medel-Herrero. "Assuring that SNAP is both available and accessible to them benefits all of us."

Reference:

1. Medel-Herrerzo A, Leigh JP. Changing SNAP-Participation Trends Among Farmworker Households in the U.S., 2003-2012. J Immigr Minor Health. 2017 Jun 6. doi: 10.1007/s10903-017-0600-x. [Epub ahead of print]

Source: UC Davis Health News; Jun 15, 2017; http://www.ucdmc.ucdavis.edu/publish/news/newsroom/12073

# Tri-Ponderal Mass Index May Be a Better Way to Estimate Obesity in Children

A new study published in *JAMA Pediatrics* suggests there may be a better way to estimate obesity in children.[1,2] In adults, body mass index (BMI) is used to classify weight status, as weight is roughly proportional to height squared in adults. However, this is not the case in children and adolescents. Furthermore, BMI changes as children and adolescents grow, which makes it problematic to use as a screening tool for overweight and obesity. Instead, BMI-for-age percentiles or BMI z-scores are used. A child is considered obese at or above the 95th percentile of BMI-for-age for their gender, and overweight if between the 85th and 95th percentiles.

*Tri-ponderal mass was reported to have significantly lower rates of misclassification of overweight status compared to BMI z-scores.*

Research suggests that tri-ponderal mass index (TMI) might be a better screening tool for overweight and obesity in children and adolescents. TMI is calculated as weight in kilograms divided by height in meters cubed (kg/m$^3$).

In this study, researchers compared how well BMI z-scores and TMI estimated percent body fat and how well they classified overweight and normal weight status. To do this, they used NHANES dates from 1999 to 2006, and compared BMI z-scores and TMI to body composition as measured by dual energy x-ray absorptiometry.

The researchers found that TMI was stable until age 20 for male adolescents and age 16 for female adolescents, while BMI increased steadily. They also reported that TMI was better able to explain the variance in body fat percentage compared to BMI, particularly in boys (64 percent of variance explained versus 38 percent of variance explained).

When determining how well BMI z-scores and TMI diagnosed overweight status, the researchers reported significantly lower rates of misclassification with TMI compared to BMI z-scores (8.4 percent versus 19.4 percent). In addition to being less likely to misclassify weight status, TMI was also a simpler measure to use, requiring thresholds for classifying overweight and obesity for each gender that are not dependent on age, while BMI z-scores require age-specific thresholds for each gender.

The authors concluded that TMI shows promise as a simpler measure for diagnosing overweight and obesity in children between the ages of 8 and 17 years. However, more research is needed, as the study was conducted only in white children and the results may not be consistent in other racial or ethnic groups.

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1. JAMA News Releases; May 15, 2017. https://media.jamanetwork.com/news-item/better-way-estimate-body-fat-levels-children-adolescents/
2. Peterson CM, Su H, Thomas DM, et al. Tri-Ponderal Mass Index vs Body Mass Index in Estimating Body Fat During Adolescence. JAMA Pediatr. 2017 Jul 1;171(7):629-636. doi: 10.1001/jamapediatrics.2017.0460.


By Anna M. Jones; University of California, Davis, Department of Nutrition.

# Barbecue Basics: Tips to Prevent Foodborne Illness

It's the season for picnics, cookouts, and other outdoor parties. But eating outdoors in warm weather presents a food safety challenge. Bacteria in food multiply faster at temperatures between 40°F and 140°F, so summer heat makes the basics of food safety especially important.

"Fortunately, there are a lot of steps consumers can take to keep family and friends from becoming ill," says Marjorie Davidson, Ph.D., education team leader in FDA's Center for Food Safety and Applied Nutrition.

**Wash hands.**

It seems basic, but not everyone does it. Wash hands well and often, with soap and water for at least 20 seconds, especially after using the bathroom and before cooking or eating. If you're in an outdoor setting with no bathroom, use a water jug, some soap, and paper towels. Consider carrying moist disposable towelettes for cleaning your hands.

**Keep raw food separate from cooked food.**

Don't use a plate that previously held raw meat, poultry, or seafood for anything else unless the plate has first been washed in hot, soapy water. Keep utensils and surfaces clean.

**Marinate food in the refrigerator, not out on the counter.**

And if you want to use some of the marinade as a sauce on the cooked food, reserve a separate portion. Don't reuse marinade that contained raw meat.

**Cook food thoroughly.**

To kill any harmful bacteria that may be present, use a food thermometer. Hamburgers should be cooked to 160°F. If a thermometer is not available, make sure hamburgers are brown all the way through, not pink. Chicken should be cooked to at least 165°F. If you partially cook food in the microwave, oven or stove to reduce grilling time, do so immediately before the food goes on the hot grill.

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# Barbecue Basics (Continued from page 14)

**Refrigerate and freeze food promptly.**

It can be hard to remember while a party is going on, but food should not be left out of the cooler or off the grill for more than two hours. Never leave food out for more than one hour when the temperature is above 90°F.


**Keep hot food hot.**

Hot food should be kept at or above 140°F. Hot food should be wrapped well and placed in an insulated container. If bringing hot take-out food such as fried chicken or barbecue to an outdoor party, eat it within two hours of purchase. In addition to bringing a grill and fuel for cooking to an outdoor location, remember to pack a food thermometer to check that your meat and poultry reach a safe internal temperature. When re-heating food at the outing, be sure it reaches 165°F.

**Keep cold food cold.**

Cold food should be held at or below 40°F. Foods like chicken salad and desserts that are in individual serving dishes can be placed directly on ice or in a shallow container set in a deep pan filled with ice. Drain off water as ice melts and replace ice frequently.

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