

## Human Nutrition (NP 107) 2022 Annual Report

The Human Nutrition National Program (NP 107) addresses high-priority problems of national importance as outlined in the USDA Strategic Plan for FY22-26 Goal 4, which addresses providing all Americans safe, nutritious food: Objective 4.2- Encourage healthy dietary choices through data-driven, flexible, customer-focused approaches. This research also addresses the 2020-2025 USDA Science Blueprint Theme 3- Food and Nutrition Translation.

The vision of the program is that well-nourished Americans make health-promoting diet choices based on scientific evidence. To accomplish these goals, the Human Nutrition Program of ARS conducts basic and applied research resulting in discoveries at the molecular, cellular, individual, and population levels on nutrient requirements, metabolism and health, and intake of foods and nutrients in the U.S.

There are five research components in the [Human Nutrition Action Plan](#) for 2019-2024:

- Linking Agricultural Practices and Beneficial Health Outcomes
- Monitoring Food Composition and Nutrient Intake of the Nation
- Scientific Basis for Dietary Guidance
- Prevention of Obesity and Obesity-Related Diseases
- Life Stage Nutrition and Metabolism

Selected accomplishments completed during fiscal year 2022 and expected to have high impact in the field are listed below. Links to publicly available documentation are provided after each result.

**Antibiotic resistance is lower with diverse, high-fiber diets.** Antibiotic resistance is expected to be a major cause of death worldwide in the coming decades. ARS researchers in Davis, California, studied how diet is related to the antibiotic resistance (ABR) of bacteria in healthy adults. The researchers found that individuals who consumed diverse high-fiber diets had bacteria with lower ABR levels than ABR levels in bacteria from individuals with less diverse diets. These results suggest that dietary modification towards a more diverse, fiber-rich diet may reduce the individual and population-scale burden of bacterial infections resistant to antibiotics treatment. (NP 107, C 3, PS 3B, Project #: 2032-51530-026-000D)

Oliver, A., Xue, Z., Villanueva, Y.T., Durbin-Johnson, B., Alkan, Z., Taft, D.H., Liu, J., Korf, I., Laugero, K.D., Stephensen, C.B., Mills, D.A., Kable, M.E., Lemay, D.G. 2022. Association of diet and antimicrobial resistance in healthy U.S. adults. *mBio*. 13(3). Article e00101-22.  
<https://doi.org/10.1128/mbio.00101-22>.

**Maternal weight affects some human milk amino acids influencing infant growth.** To better understand how excessive maternal weight changes human milk composition, cooperative researchers in Little Rock, Arkansas, investigated how the branched-chain amino acid content in human milk differed between mothers of normal weight and overweight or obese mothers. They found that the amino acid content differed in milk from the two groups and that infant consumption of these branched-chain amino acids was associated with growth and body

composition. (NP 107, C 4, PS 4A, Project#: 6026-51000-012-000D)

Saben, J.L., Sims, C.R., Pack, L., Lan, R., Borsheim, E., Andres, A. 2021. Infant intakes of human milk branched chain amino acids are negatively associated with infant growth and influenced by maternal body mass index. *Pediatric Obesity*. <https://doi.org/10.1111/ijpo.12876>.

**Release of national dietary survey data - What We Eat in America, NHANES 2017-March 2020.**

Monitoring dietary intakes is critical to understand how nutrition affects the health and well-being of Americans. New nationwide dietary intake data collected in What We Eat in America (WWEIA) for 2017-March 2020 were released on the web for public use. The data include information on dietary intakes of more than 12,600 individuals from 2 nonconsecutive days, 24-hour dietary recalls, and sample weights that can be used to make estimates about dietary intakes of the U.S. population. Select results show that 1) two out of three adults are late evening eaters (from 8:00 p.m. on), and that sweets, sandwiches, and beverages the most likely types of foods reported; 2) one out of four adults consume food items from convenience stores on any given day, accounting for nearly 20 percent of daily energy intake for reporters who reported convenience store purchases; and 3) more than one in three individuals consume a savory snack food such as chips, flavored snacks, popcorn, and pretzels on any given day. Linked with health indicators from other components of the NHANES, these data provide stakeholders critical measures to study relationships between nutrient intake, eating patterns, and health conditions. The data and 39 summarized data tables are accessible from [www.ars.usda.gov/nea/bhnrc/fsrg](http://www.ars.usda.gov/nea/bhnrc/fsrg). (NP 107, C 2, PS 2B, Project#: 8040-53000-020-000D)

**The effect of cardiorespiratory fitness and insulin resistance on bone health in Hispanic children.**

Obesity appears to have a negative impact on pediatric bone health and insulin resistance may mediate this relationship, but it is unclear if cardiorespiratory fitness also has a protective effect on bone health in obese children. Researchers at the Children's Nutrition Research Center in Houston, Texas, examined data on a large number of Hispanic youths to evaluate the effect of insulin resistance and cardiorespiratory fitness on bone health. They found that lean body mass was the major determinant of bone mineral content and bone mineral density; a higher fitness level was positively related to bone health, but obesity and higher body fat had a negative effect on this relationship. Cardiorespiratory fitness measured during exercise attenuated the relationship between insulin resistance and bone mineral concentration. This suggests that greater cardiorespiratory fitness and higher lean mass may reduce the adverse effects of adiposity and insulin resistance on bone health in children. These findings support the importance of promoting an increase in physical activity to prevent the negative impact of obesity on bone health in children. (NP 107, C 3, PS 3B, Project#: 3092-51000-065-000D)

Shawar, R.S., Puyau, M., Shypailo, R., MUSAAD, S., Butte, N.F., Bacha, F. 2022. Adiposity, insulin resistance, cardiorespiratory fitness and bone health in Hispanic children. *Journal of Clinical Endocrinology and Metabolism*. <https://doi.org/10.1210/clinem/dgac344>.

**The stress hormone cortisol may limit cholesterol benefits from a healthy diet.** Concentrations of the steroid hormone cortisol, which has important effects on behavior and body metabolism, fluctuate throughout the day. Individual differences in cortisol levels during certain times of the day may help explain why some people do or don't respond to nutrition interventions aimed at improving metabolic health. ARS researchers in Davis, California, studied whether the magnitude of cortisol concentrations during certain times of the day modified effects of a healthy diet on

clinical markers of metabolic health. Results from this study showed that compared to a more typical American high fat and sugar diet, a Dietary Guidelines for Americans (DGA)-based diet reduced total and low-density lipoprotein (LDL) cholesterol; however, this potentially beneficial effect of the DGA was inhibited in participants who also had high morning concentrations of circulating cortisol. These findings suggest that the cholesterol-lowering effect of a DGA diet is sensitive to variations in morning cortisol status and imply that stress or other factors that significantly elevate morning cortisol may limit some effects of whole food diets to reduce cardiovascular disease risk. (NP 107, C 4, PS 4A, Project #: 2032-51530-025-000D)

Soltani, H., Keim, N.L., Laugero, K.D. 2022. Waking salivary cortisol associated with magnitude of cholesterol reduction in women fed a healthy whole-food diet for 8 weeks. *Current Developments in Nutrition*. 6(5). Article nzac083. <https://doi.org/10.1093/cdn/nzac083>.