



**FY 2019 Narrative
Developing the Story
National Processed Raspberry Council
For the period October 1, 2018 – September 30, 2019**

Nutrition Research

Awareness of the importance of a healthy diet is at an all-time high, sparking changes in consumer purchasing decisions, which in turn stimulates the food industry to make pivotal shifts. Food manufacturers are reformulating and developing new products; restaurants are simplifying their menus; and retailers are positioning dietitians at the front and center of their stores for shopper education. And at the core of this paradigm shift is a critical need for more credible science that helps explain the human health impact of foods.

The *2015 Dietary Guidelines for Americans* highlighted the importance of a “healthy eating pattern,” which includes “fruits, especially whole fruits.” It is understood and accepted that whole fruits are “healthy.” And through the significant amount of research conducted over the past 20 years, the public is beginning to understand the bioactive components found in fruits and their mechanisms of action in the human body.

The goal of the Council’s nutrition research program is to establish a link between red raspberry consumption and human health. This research not only provides important scientific insights, but it also delivers information of interest to many of the Council’s target audiences— food manufacturers, foodservice decision makers, consumers, and health professionals.

To guide the Council’s research strategy, the Council’s marketing and research team consults each year with leading berry researchers to evaluate the current body of red raspberry nutrition research and consumer trends, and to identify priorities for the Council’s research efforts. As such, it has been determined that the Council should continue to focus on research related to cardiometabolic health, diabetes, and cognitive function. These areas also align with the 2017-2021 Strategic Plan and will lay the foundation for a Qualified Health Claim application.

Post-Harvest Research

The Council has recognized post-harvest research could drive increased demand by delivering value added new products or product innovation. The Council will consider proposals in these

areas with health-related research its first priority. Food safety and/or validation research aimed at minimizing microbial contamination is included within post-harvest research.

FY 2019 Developing the Story Budget: Total recommended: \$479,624.

The FY 2019 research budget has four components:

1. **Program Management and Services.** These annual administrative expense items are necessary to support research projects and related activities.
2. **FY2019 Ongoing Multi-Year and New Research Projects.** Two Request for Proposals (RFP) were sent to scientists in anticipation of the FY 2019 fiscal year. The first was targeted towards funding human and/or clinical research focused on diabetes and cardiometabolism with the goal of expanding the body of science to support a qualified health claim application in the future. The second RFP was for proposed exploratory projects seeking information on the impact of raspberries in a broader set of health issues. The stated priority for new project funding in either RFP was human and/or clinical studies. The proposed budget includes funds for new projects and subsequent year expenses of previously approved multi-year projects.
3. **FY 2018 Research Projects.** This budget represents the balance remaining on FY 2018 funded research expenses which have yet to be invoiced pending receipt of final reports.
4. **Research Support.** Expenses in this category target broad research objectives and/or support services outside of general administration, including preparation of quarterly research summaries and participation in meetings to present summaries.

Program Management and Services: Total: \$74,475. Included is a portion of the Executive Director's time and expenses to complete activities that support funded research and contractor oversight, administrative services including legal review of contracts, and Council travel to attend and participate in Council and committee meetings to discuss research projects and findings. A Science Advisor assists the Executive Director, Research Committee, and Marketing Team as it reviews and assesses the merits of current and potential future research projects and reviews marketing communications for scientific accuracy and is funded from this budget category. USDA User fees, representing costs associated with program oversight and contract review/management, are included in this budget.

FY 2018 Nutrition Research Projects (Ongoing Project Funding): Total: \$359,419.

- a. **Ana Rodriguez-Mateos: The role of the gut microbiota on the cardiovascular health benefits of raspberry consumption. \$68,479.** This project seeks: 1) to determine if chronic raspberry consumption leads to sustained cardiovascular health benefits; and 2) the role of gut microbiota in obese people predisposing to cardiovascular disease. The study will conduct metabolomic and metagenomic analyses and will look at correlations between changes in clinical outcomes, metabolites, and gut microbial species. The findings will contribute to understanding the potential cardiovascular health benefits of raspberry (poly)phenols and provide necessary scientific data for future dietary recommendations and potential health claims regarding raspberry and raspberry (poly)phenol consumption. Funding is for year two of a proposed three-year project.

- b. Britt Burton-Freeman, Barbara Shukitt-Hale: The effects of acute raspberry intake on the relationship between enhanced metabolic control and cognitive and psychomotor function. \$149,988.** The aim of this proposal is to determine whether restoring metabolic/inflammatory balance via supplementation with raspberries results in improved cognitive performance in humans, and whether these enhancements are mediated through improvements in vascular function. The project hypothesizes that raspberry supplementation will improve motor and cognitive functions in older, overweight/obese, adults following a meal challenge. It also hypothesizes that raspberry supplementation will improve vascular and neurovascular function and reduce inflammation, and that these changes will correlate with the improvements in behavior.

To test these hypotheses, a multi-center, double-blind, placebo-controlled, crossover study to explore the effects of acute raspberry supplementation in older (55-70 years old), overweight/obese (BMI 27-35) adults is proposed. The primary working hypothesis is that red raspberries will improve metabolic- / inflammatory- balance in older overweight and obese adults resulting in improved cognitive and psychomotor performance mediated in part through improvements in vascular function. Funding is for year two of a two-year study.

- c. Marie-Claude Vohl: Beneficial effects of raspberries in overweight/obese individuals: potential role of the gut microbiota in alleviating metabolic syndrome. \$80,952.** Given the increased prevalence of obesity and metabolic syndrome, it is essential to identify nutritional strategies to prevent associated diseases such as type 2 diabetes and cardiovascular complications. Their beneficial health effects may be related to their polyphenol content. Research in the last decade has shown that the gut microbiota is a key modulator of immunometabolic pathways and thereby has a major influence on several chronic inflammatory conditions including obesity and insulin resistance. There is growing evidence that nutritional interventions with dietary polyphenols can favorably modulate the gut microbiota and improve cardiometabolic health. Certain fruit polyphenols exert significant prebiotic effect on the gut bacterial species and improve gut health as well as the metabolic profile in animal models of obesity. Whether the beneficial effects of raspberries on obesity and the metabolic syndrome can be linked to their potential impact on the gut microbiota and intestinal integrity remains speculative at this time. Moreover, the mechanisms of action underlying health benefits associated to raspberry consumption are still unknown. This project proposes to combine the study of metagenomics and transcriptomics to test whether a prebiotic activity of raspberries can play a role in the prevention of obesity-linked metabolic syndrome in a clinical setting. Funding is for the second year of a three-year proposed study.
- d. Neil Shay: The Healthful Effects of Raspberries Polyphenols, Fiber, and Other Raspberry Components: \$60,000.** This project will examine the role of raspberry food products, raspberry phytochemicals, and raspberry fiber in terms of their ability to reduce the development of a set of related metabolic disease conditions including obesity, elevated blood lipids, diabetes, fatty liver disease, hypertension, chronic inflammation, and osteoporosis. The objective is to evaluate the beneficial effect of processed raspberry

products and to identify the relative contributions of raspberry polyphenols and fiber to the healthful effects associated with the consumption of raspberries. This project builds off a successful study previously funded by the NPRC which demonstrated that the addition of a raspberry puree concentrate (RPC) or raspberry juice concentrate (RJC) to a High Fat (HF) diet reduced the development of obesity compared to consumption of the HF diet alone. That prior project will be extended by examining the effect of a variety of polyphenol- and fiber-containing fractions in year one followed by an examination of other fractions containing various levels of raspberry phytochemicals and fiber in years two and three. An animal trial will be completed each year followed by post-mortem analysis of metabolic factors. This project is intended to support and strengthen existing health messages. After a successful 2-year project funded by the NPRC (2015-2016), the present proposal will further clarify the healthful components of raspberry and expand the knowledge on raspberry fiber. Funds will be used for the third year of a three-year project.

Completion of projects funded in FY 2018: Total: \$34,230.

- a. **Chris Gill: The impact of raspberries on dis-regulation of cerebral microvasculature-mediated cognitive decline: \$7,066.** Disruption and deregulation of the microvascular architecture is a common pathogenic mechanism in the progression of numerous chronic diseases including cardiovascular disease, cancer, and Alzheimer's disease (AD). A direct relationship can be readily observed between microvascular pathology and cognitive decline. Berries have positive effects on aspects of cognition that cannot be fully explained by effects on either neurogenesis or inflammation. This project will determine whether a diet rich in raspberries can improve cerebral microvascular architecture and murine cognition. Funds will be used to complete year two of a two-year project.
- b. **Neil Shay: The Healthful Effects of Raspberries Polyphenols, Fiber, and Other Raspberry Components: \$15,000.** This project will examine the role of raspberry food products, raspberry phytochemicals, and raspberry fiber in terms of their ability to reduce the development of a set of related metabolic disease conditions including obesity, elevated blood lipids, diabetes, fatty liver disease, hypertension, chronic inflammation, and osteoporosis. The objective is to evaluate the beneficial effect of processed raspberry products and to identify the relative contributions of raspberry polyphenols and fiber to the healthful effects associated with the consumption of raspberries. This project builds off a successful study previously funded by the NPRC which demonstrated that the addition of a raspberry puree concentrate (RPC) or raspberry juice concentrate (RJC) to a High Fat (HF) diet reduced the development of obesity due to consumption of the HF diet alone. That prior project will be extended by examining the effect of a variety of polyphenol- and fiber-containing fractions in year one followed by an examination of other fractions containing various levels of raspberry phytochemicals and fiber in years two and three. An animal trial will be completed each year followed by post-mortem analysis of metabolic factors. This project is intended to support and strengthen existing health messages. After a successful two-year project funded by the NPRC (2015-2016), the present proposal will further clarify the healthful components of raspberry and expand the knowledge on raspberry fiber. Funds will be used to complete the second year of a three-year project.

c. Britt Burton-Freeman: Red Raspberries and Insulin Action in Humans: \$12,164.

Preliminary results from an ongoing red raspberry trial suggest a decrease in the amount of insulin required to manage (and in some cases even reduce) post meal glucose concentrations in people with insulin resistance in an acute meal setting. The effects are preliminary but reveal activity associated with improved insulin sensitivity and less pancreatic β -cell burden, both critical in maintaining glycemic health and reducing risk of Type 2 Diabetes Mellitus. Additionally, as limited information is available about the type and properties of red raspberry dietary fibers (of which red raspberries are an excellent dietary source), fermentable fibers have been shown to improve insulin action in other studies, particularly as it relates to “second meal” effects. The proposal looks to extend and expand the current / ongoing study: 1) to increase sample size and power of analysis in both the insulin resistant and healthy reference group on acute endpoints of insulin and glucose and secondary endpoints as appropriate; 2) to increase the sample size of the acute breath hydrogen sub-study; and 3) to extend the findings of the acute study with the aim of testing chronic effects of red raspberry on insulin sensitivity and exploring the relationship between shifts in the gut microbiome composition with concomitant assessment of the urolithin metabolite pool as potential mechanisms for the observed clinical effects. Budgeted funds will be used to complete year two of a two-year project.

Research Support: \$11,500

- a. Berry Health Benefits Symposium: \$7,500.** The raspberry industry has been represented and been a principal sponsor for the Berry Health Benefits Symposium since it was begun. It is expected that in 2019 research projects funded by the Council will be presented at the bi-annual Symposium scheduled for Portland, OR, May 2019.
- b. National Berry Crops Initiative: \$4,000.** The 2005 Dietary Guidelines launched the concept of nutrient density as the cornerstone of nutrition education and dietary guidance. Americans were advised to get the most nutrition out of their calories by making smart, nutrient dense choices from every food group. However, nutrient dense foods were merely described as those that provided “relatively” more nutrients than calories and no formal definition of nutrient density was provided. This project will advance berry science by leveraging past work on nutrient profiling. The project is expected to lead to a publication in a peer-review journal and to media coverage that includes polyphenols in addition to the more usual vitamins and minerals. NPRC will be a contributor to this project along with other berry organizations.