U.S. Department of Agriculture
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U.S. Dept. of Agriculture, State Agricultural Experiment Stations and Other Institutions

Date (Month/Day/Year): 07/16/2012

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	2. NIFA	3. LA.B	LAB94120	A = New Project

7. Title
Efficacy of Functional Foods in Reducing Inflammatory Biomarkers in Obesity

8. Performing Organization 1120 - 2010
Food Science
Agricultural Experiment Sta, Louisiana State Univ

9. Cooperating Departments within State Performing Institution

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10. Multistate Project No.

11. Cooperating States

12. Investigator Name(s) Last Name and Intitials)

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Hatch			

18. Award Date (Month/Day/Year)	19. Start Date (Month/Day/Year)	20. Termination Date (Month/Day/Year)
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Goals/Objectives/Expected Outputs

The long term goal of this project is to help consumers select and consume bioactive compound-rich and tasty foods from Louisiana and US Agriculture that can help prevent the development of obesity. GENERAL OBJECTIVE: The primary aim of this proposed project is to investigate whether extracts from functional foods including berries, soybean, algae, corn, ginger, or tomato attenuate high-fat diet (HFD)-induced adipogenesis and chronic low-grade inflammation in the visceral fat tissues of rats or humans and to explore the underlying mechanisms involved in this attenuation.

Methods

Research Objective 1: We propose to evaluate the effects of and determine the mechanism of action of bioactive compounds in berries, soybean, algae, corn, tomato, or ginger on the development of visceral obesity in cell cultures. To determine the effects of bioactive on preadipocyte differentiation, freshly harvested human subcutaneous or visceral preadipocytes from five donors will be used. Preadipocytes will be differentiated in absence or presence of bioactive compounds for 14 days. Cells will be analyzed for viability and stained for fat droplet accumulation. To determine the expression of adipocyte-specific transcripts involved in the early stage of differentiation including adiponectin, PPARgamma, sterol regulatory element-binding protein -1 (SREBP-1), VEGF, VEGFR-2, and ChREBP we will perform RNA extraction and quantitative real-time PCR. To determine the effect of bioactives on differentiated adipocytes, bioactive at various concentrations will be incubated with the adipocytes followed by addition of LPS or with LPS followed by addition of adipocytes. The levels of inflammatory markers such as IL-6, IL-8, IL-1beta, MCP-1, PGE2, and VEGF will be determined by ELISA. The levels of ANGPTL4 (angiopoietin-like protein 4/fasting-induced adipose factor) implicated in angiogenesis, lipid metabolism and glucose homeostasis will be determined by PCR. Research Objective 2: To determine the performance of the bioactives in vivo, 5-week old male lean or obese zucker rats will be used. At 7 weeks old animals will be randomly divided into lean (n=10), obese control (n=10), obese treatment 1, and obese treatment 2 (n=10) groups. All animals will be fed a normal diet. The control group will be administered water daily. The obese treatment group will be administered two different levels of bioactive extracts (to be determined based on in vitro data) for 12 weeks. After the experiment period (12 weeks), the animals will be fasted for 18 hours and sacrificed by decapitation. Blood and tissues will be collected and analyzed for cholesterol, triglycerides, free fatty acids, TNF-alpha, IL-6, ANGPTL4, adiponectin, VEGF, VEGFR-2, and sirtuin 1 (SIRT1) by appropriate methods. Statistical Analysis: Statistical analyses will be performed using SAS for Windows (SAS Institute). Values will be expressed as means plus or minus standard deviation (SD) of (n) independent experiments. Post hoc pairwise multiple comparisons will be evaluated using the Tukey's Multiple Comparison

test or Bonferroni posttest, after ANOVA. Results will be considered significant at less than 5 percent

23. Non-Technical Summary

Abdominal obesity also known as visceral fat has been established as one of the main contributory factors in the development of chronic diseases such as diabetes, hypertension, and cardiovascular disease. Tissues in abdominal fat generate inflammation which in turn reduces insulin sensitivity and as a result a long list of opportunistic chronic diseases can invade the body. Obesity is an epidemic disease in the US and worldwide. The major change to get obesity and overweight under control in the US and around the world is prevention rather than treatment. Prevention involves changes in lifestyle, decrease food intake and adopting a healthy diet, and adopting more physical activity. Recent studies indicate that bioactive compounds in food can help prevent the development of obesity. However, studies on the potential effect of dietary bioactive compounds on obesity are still in its infancy. Although ginger, berries, soybean, or tomato have been suggested to inhibit inflammation, there are scanty reports on the anti-adipogenic and anti-inflammatory effects of soybean, tomato, or algae. Recent studies in our laboratory have shown that berry anthocyanins can inhibit the biomarkers of inflammation in human subcutaneous adipocytes. Recent studies in our laboratory have also shown that ginger extracts inhibit several biomarkers of inflammation. We have previously shown that resveratrol can enhance cell to cell communication by inducing connexin 43 in retinal pigment epithelial cells. The soybean Bowman-Birk inhibitor is an anti-inflammatory protein that has shown ability to inhibit inflammation biomarkers in chronic degenerative diseases including multiple sclerosis and cancer. Tomato is a good source of carotenoids lycopene and β-carotene. There are reports showing inverse relation of obesity and levels of plasma carotenoids; however, the mechanisms of the relationship need to be identified. Algae are good sources of carotenoids other than lycopene and carotene and the potential inverse relationship between algal bioactive compounds and visceral inflammation needs investigation. The rationale of this study is as follows: Americans eat berries, lots of tomatoes or tomato products, soybean products, ginger, corn, and corn products because they understand that these foods provide health benefits. However, most people may not know the optimal levels that may help reduce obesity if any. The study of adipose tissue is central to the understanding of the metabolic abnormalities associated with obesity development. Our preliminary studies show that berries inhibit inflammatory biomarkers in subcutaneous fat. Recent studies in our lab also show that ginger oil at a concentration that is physiologically attainable inhibit several biomarkers of inflammation. This project is written in response to USDA to find solutions to the obesity crisis that is increasing in the US and all over the world. Because the US is a major producer of tomato, berries, soybean, and corn, successful completion of the project will have a major impact on long-range improvement and sustainability of the health of American populations and US agriculture and food systems.

24. Keywords

obesity; berries; blueberry; cranberry; raspberry; soybean; ginger ; tomato; corn; carotenoids; lutein; lycopne; visceral fat; subcutaneous fat

****** The Original signed document is on file at this institution. ******

Signature	Title	Date
Dept: Admin:	*Associate Director*	