

The Food for Health Connection

Case Study of Soybean Isoflavones:

A Soybean Functional Food to Link Agriculture and Health

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**Pre-
Conference
Workshop**

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SOYBEANS AND HEALTH

- Soybeans are the largest acreage field crop in Ontario and have great potential to influence human health
- Soybeans contain bioactive constituents among which isoflavones have been highly studied
- Isoflavones are phytochemicals that can be classified as a phytoestrogen
 - Structurally similar to estrogen
 - Highly concentrated in soybeans
 - Researched in relation to health and disease

SOY ISOFLAVONES AND FUNCTIONAL FOODS

- Increased interest in how dietary choice and food quality can be manipulated to optimize health
- Soy isoflavone intake is low in Western society
- Potential for food product development to consider isoflavones as a bioactive ingredient
- Consumer interest in functional foods is increasing

RESEARCH RATIONALE NOTES

- Isoflavones have received scientific interest as a bioactive constituent of soybeans
- Isoflavone intakes are low in Western society
- The advance of functional foods is an opportunity
- Bread is a rational functional food matrix
- Human bioavailability is essential to the efficacy of a functional food
- The success of a functional foods will be enhanced through evaluation of consumer and economic-related issues

RESEARCH RATIONALE NOTES

- The documented health benefits of soybeans and the advance of functional foods creates multiple opportunities for soybeans:
 - Development of soybean varieties beyond traditional traits to add further value by manipulating components related to human health
 - Development of food products to provide consumers with a wider ability to increase their consumption
 - Bring diverse scientific perspectives together for collaborative efforts

INTERDISCIPLINARY SOYBEAN ISOFLAVONE RESEARCH PROJECT

**Bioavailability and Economic Benefits
of Value-Added Isoflavone-Rich Soybeans
Incorporated into a Functional Food**

***Funded by the Ontario Ministry of Agriculture, Food and
Rural Affairs (OMAFRA) Food Research Program***



RESEARCH METHODS

Phase ONE

Grow soybean varieties with varying isoflavone contents suitable for Ontario



Phase TWO

Process to SPI and soy flours for production of functional breads

Phase THREE

Human clinical studies to evaluate isoflavone bioavailability from three breads



Phase FOUR

Explore consumer issues, sensory response and economic benefits of breads

RESEARCH INTER-DISCIPLINARY TEAM

- PLANT AGRICULTURE: **Dr. Istvan Rajcan**, Plant Agriculture, U of Guelph
- FOOD SCIENCE: **Drs. Massimo Marcone, Koushik Seetharaman, Lisa Duizer**, Food Science, U of Guelph
- HUMAN NUTRITION: **Dr. Alison Duncan**, Human Health & Nutritional Sciences, U of Guelph
- NATURAL PRODUCTS CHEMISTRY: **Dr. Rong Cao**, Agriculture and Agri-Food Canada
- AGRICULTURAL ECONOMICS: **Dr. John Cranfield**, Food & Resource Economics, U of Guelph; **Dr. Al Mussell**, The George Morris Centre



available at www.sciencedirect.com



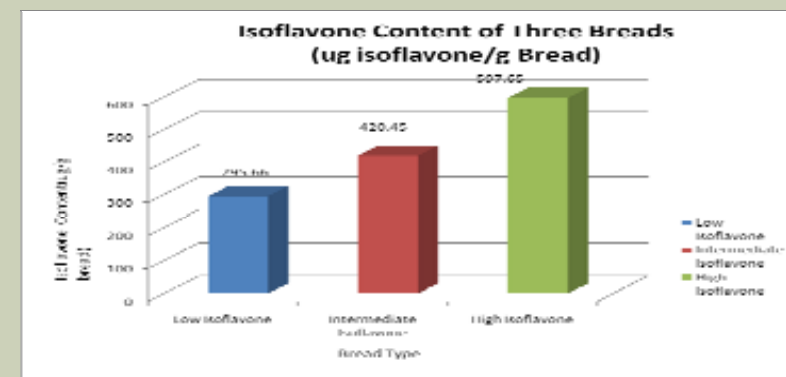
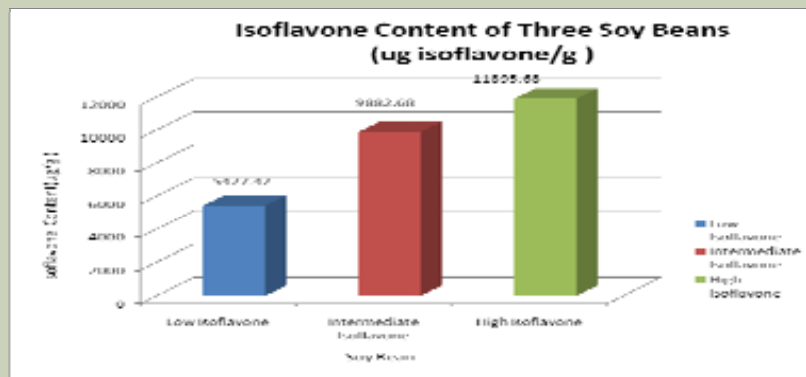
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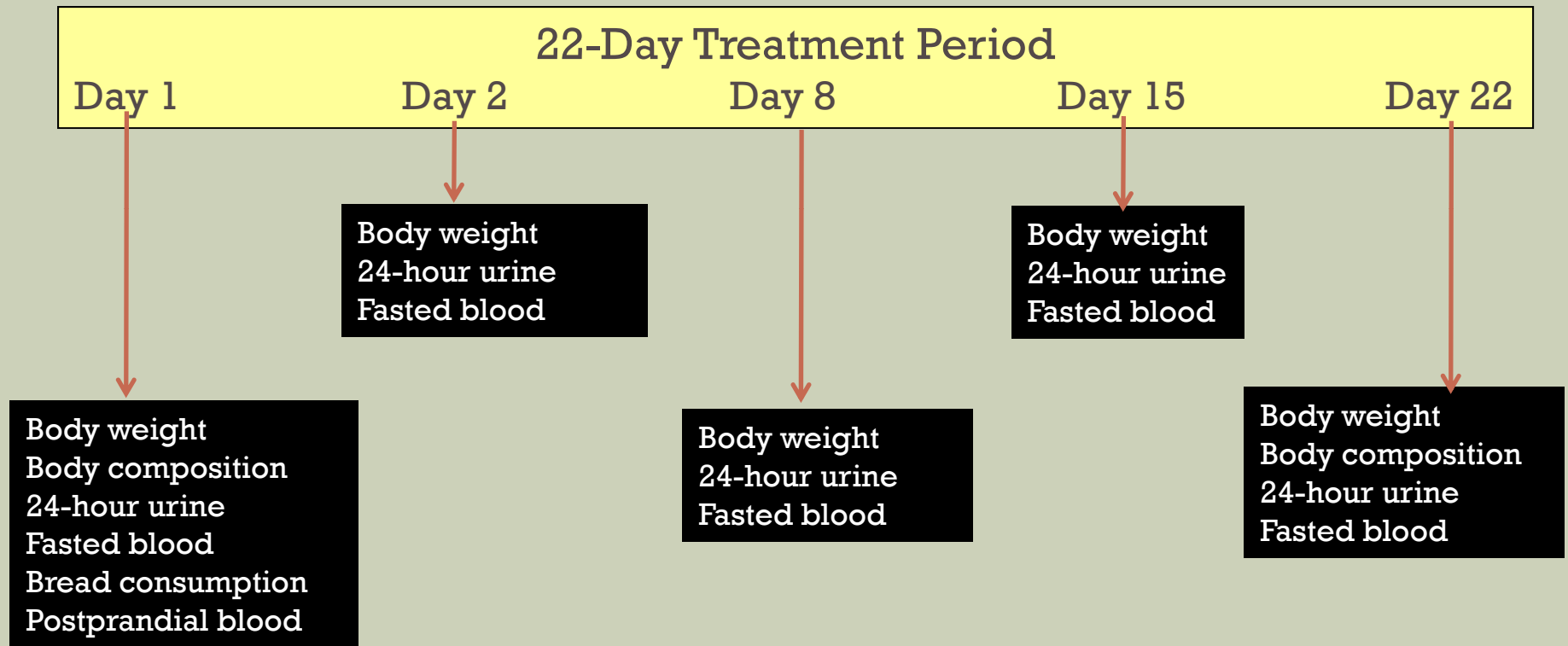
Tracking isoflavones: From soybean to soy flour, soy protein isolates to functional soy bread

Suqin Shao^{a,b}, Alison M. Duncan^b, Raymond Yang^a, Massimo F. Marcone^c, Istvan Rajcan^d, Rong Tsao^{a,*}

- Analysis of isoflavone content through the chain
- Confirmed distinction between low, medium and high
- Soybean seed, soy flour, SPI, soy breads



HUMAN BIOAVAILABILITY STUDY



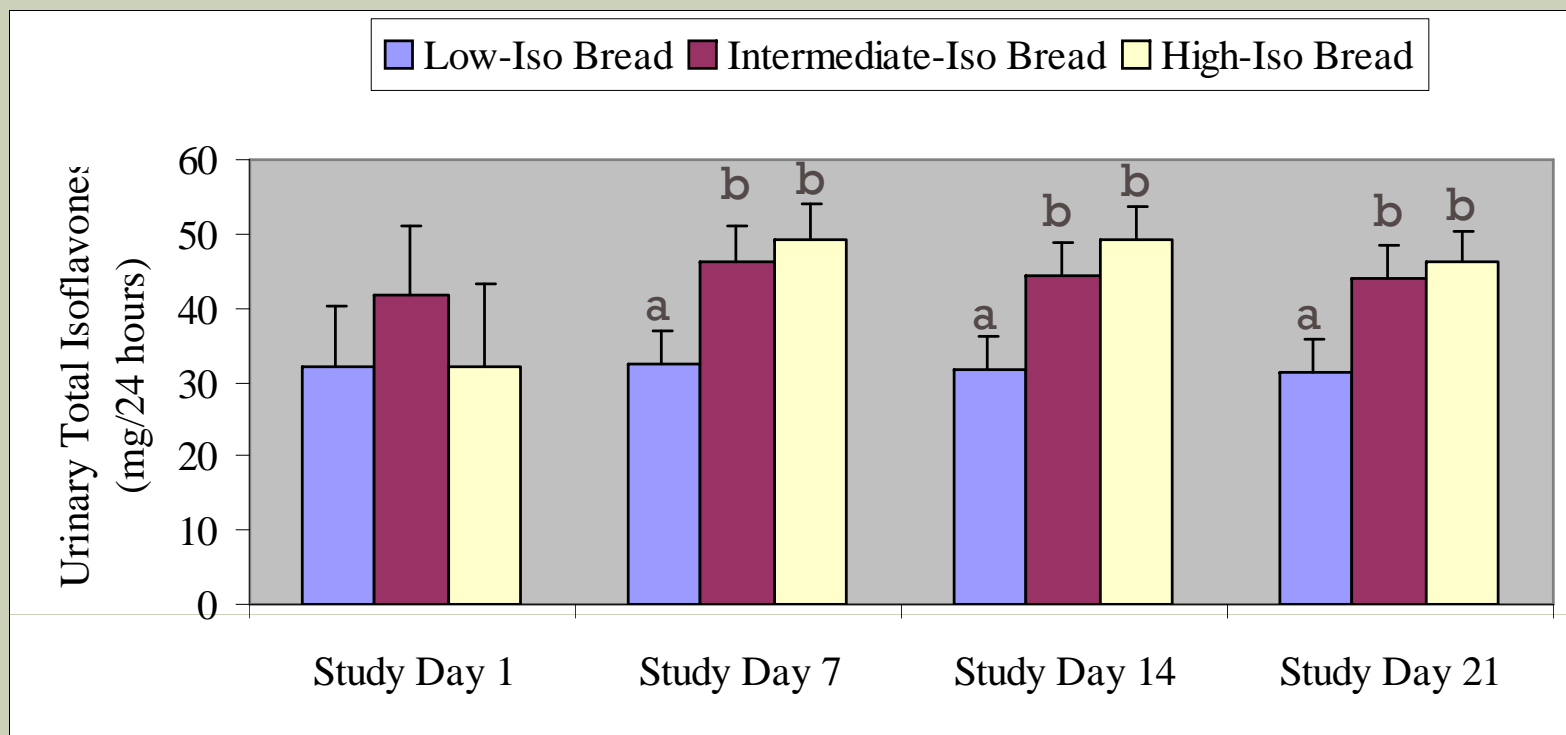
-n=15 healthy adults, randomized crossover design

-ACUTE bioavailability study examined on day 1 from 0 to 24 hours

-CHRONIC bioavailability study examined on days 1-22

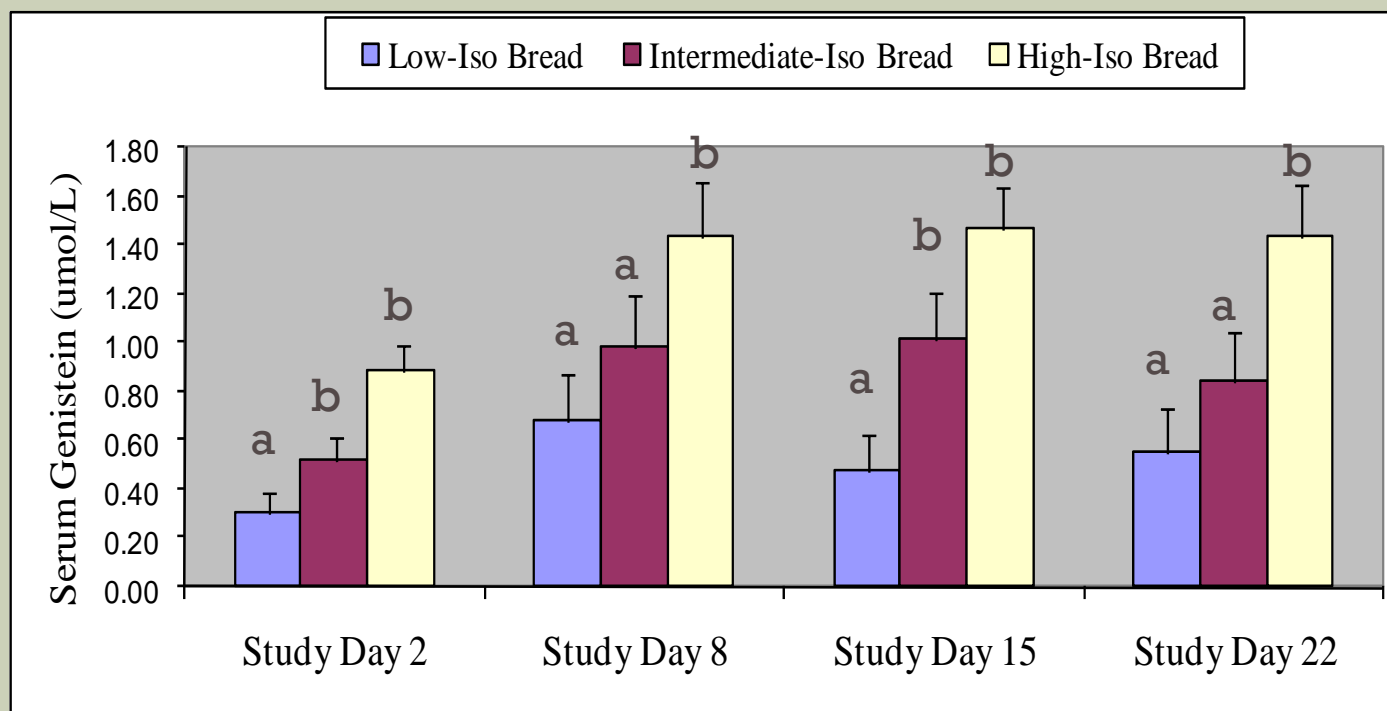
HUMAN BIOAVAILABILITY: URINE

- Urinary isoflavones increased with distinction between high and low (but not intermediate)



HUMAN BIOAVAILABILITY: SERUM

- Serum isoflavones increased with distinction between high and low (but not intermediate)



CONSUMER ISSUES

- Full sensory analysis identified soy flour as more acceptable ingredient
- Consumer and economic experiments identified 3 specific consumer segments including cost-, product- and health-conscious
 - attributes of these consumers identified to facilitate market penetration of an isoflavone-enriched product

PRESENTATION SUMMARY

- Soybeans warrant focus for their contribution to the agri-food-nutrition-health continuum
- Case study explored the ability of isoflavone content manipulation in the soybean seed to endure the continuum
 - Results showed maintenance of varying isoflavone levels through the value chain
- Relevant research model for other agricultural products