

Isoflavone and Saponin Content of Edamame

Patricia A. Murphy
Iowa State University

Why Isoflavones & Saponins?

- Isoflavones correlated with:
 - improved cardiovascular health
 - prevention of breast, prostate & colon cancers
 - improved bone health for postmenopausal women
- Saponins may be correlated with cholesterol lowering observed with soy diets

Soy Isoflavone Glucosides

Isoflavones



	R ₁	R ₂	R ₃
Genistin	H	OH	H
Glycitin	OCH ₃	H	H
Daidzin	H	H	H
6''-O-Malonyl			OCCH ₂ COOH
6''-O-Acetyl			OCH ₃

USDA-Iowa State University Isoflavone Database

- <http://www.nal.usda.gov/fnic/foodcomp/isoflav/isoflav.html>
- approximately 160 foods
- confidence codes
- not all isoflavones
 - exception is coumestrol
- other non-soy isoflavones
 - biochanin A & formononetin

HPLC Methods

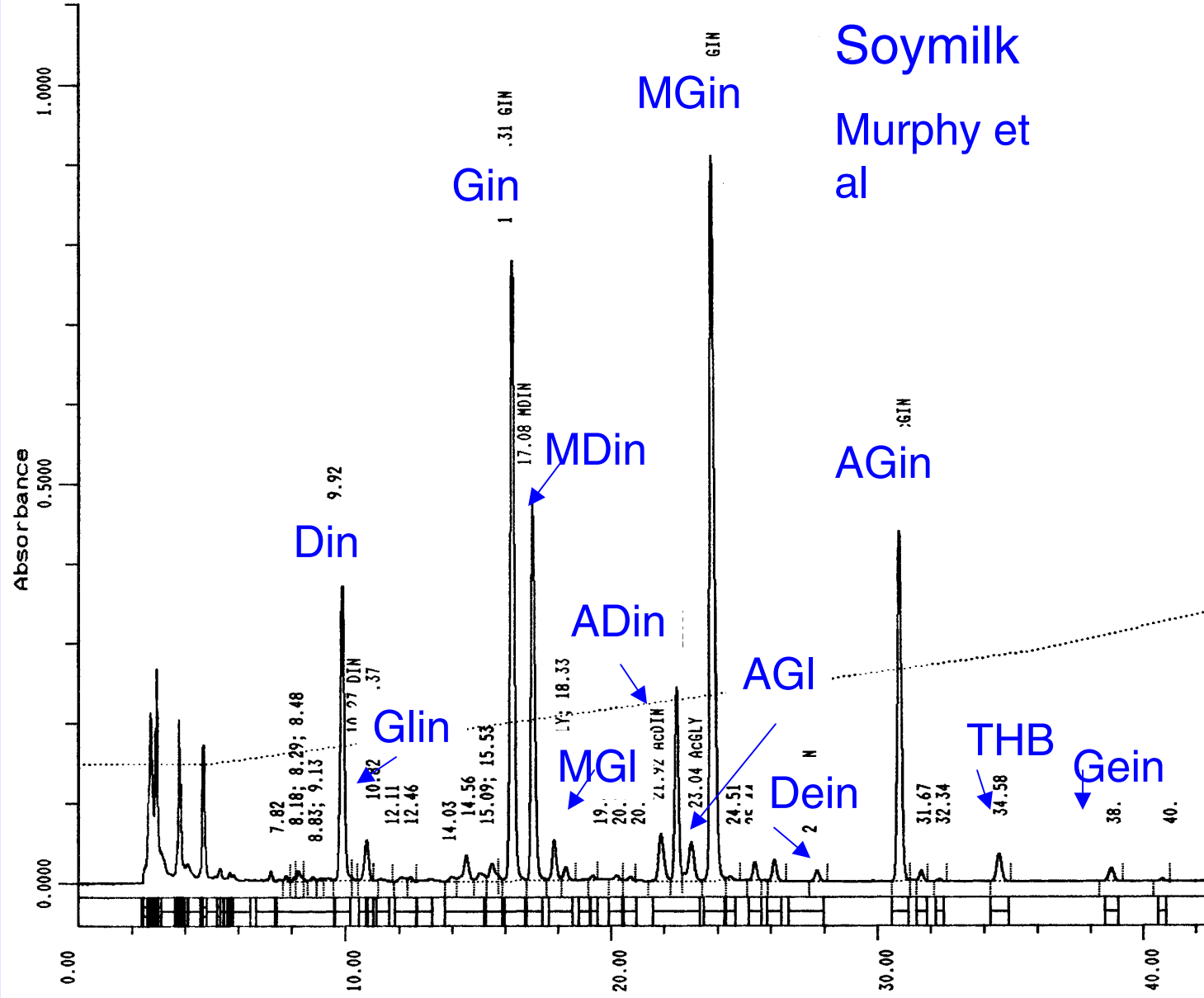
Gradient elution

Analysis of 12 soy isoflavones

direct

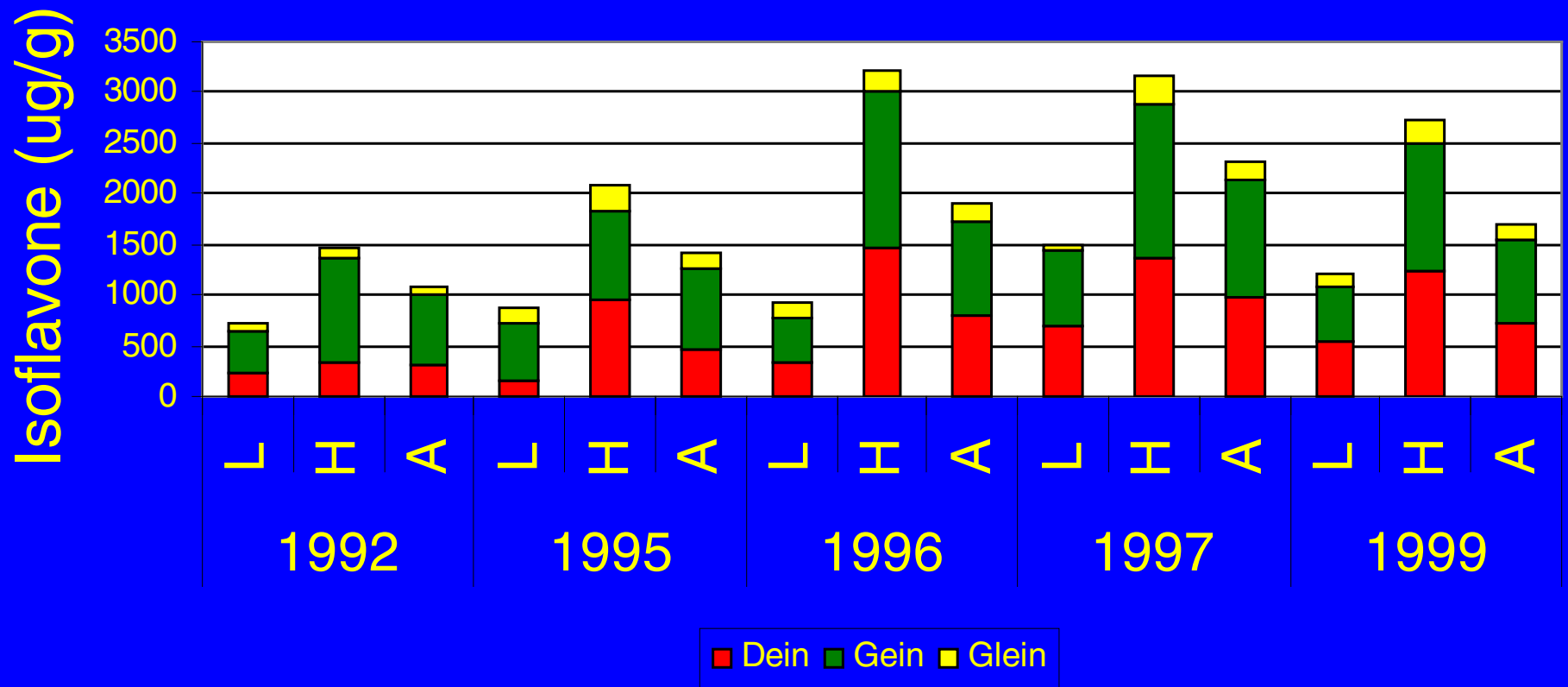
acid hydrolysis to yield “conjugated” and “free”

AOAC method of 3 β -glucosides & 3 aglycons
after alkaline/heat treatment



Soy milk
Murphy et al

Soybean Isoflavones



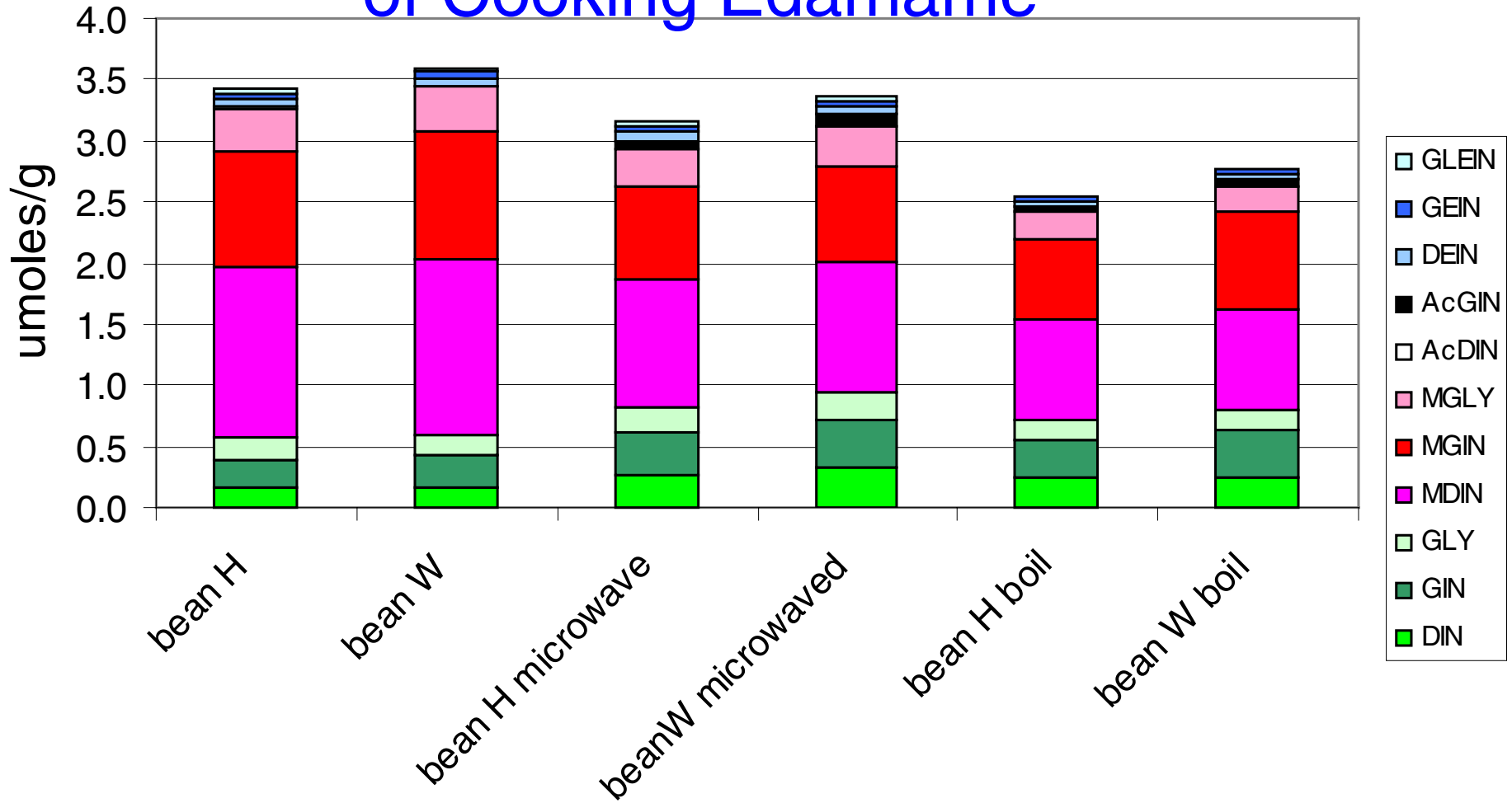
Effects of Processing

- Extraction in water
 - soybean glucosidases hydrolyze glucosides
 - decarboxylation of malonyls
- Heat
 - minimal
 - conversion of malonyl to glucosides
 - toasting, extrusion
 - generation of acetyl

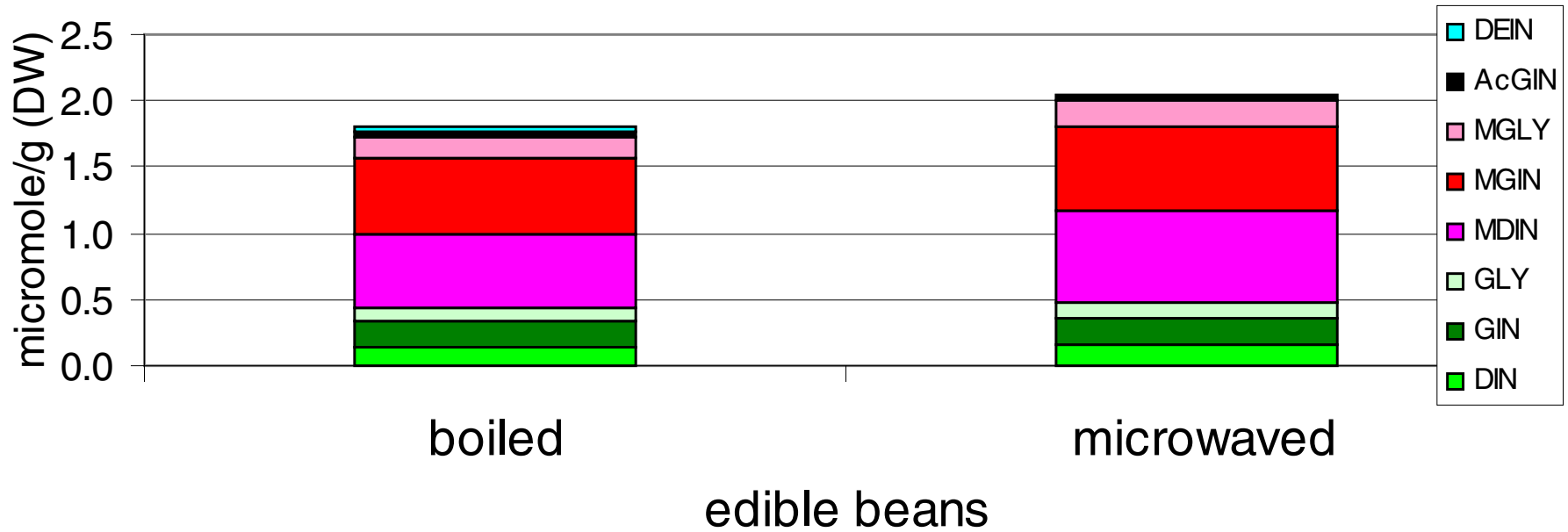
Effects of Processing

- Fractionation
 - loss in discarded fraction
 - tofu whey, soy isolate wheys, soy concentrate ethanol wash, leaching
- Fermentation
 - hydrolysis by microbial glucosidases
 - miso, tempeh, natto
 - catabolism of isoflavones
 - soy sauce

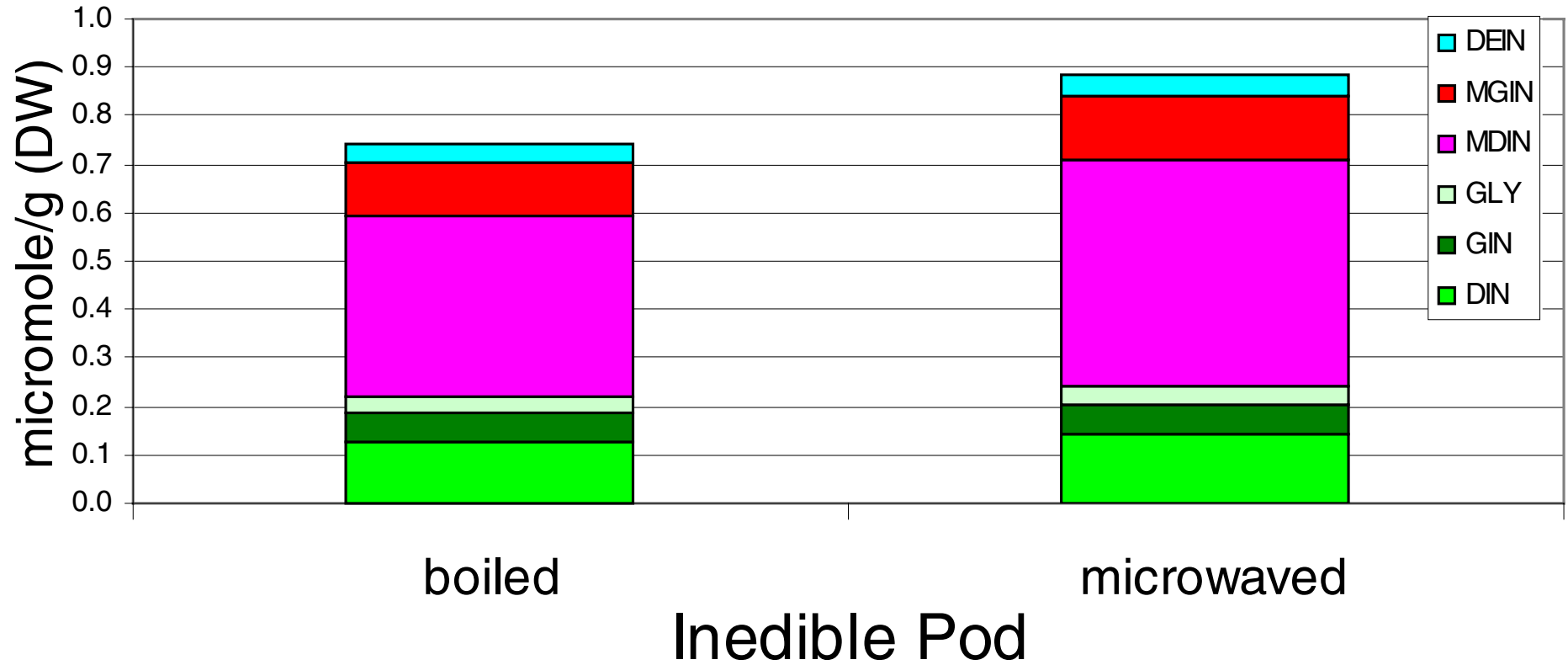
Effect on Isoflavones of Cooking Edamame



Effect of Cooking on Isoflavones in Pod



Isoflavones in Edamame Pods



Saponin



R₁
|
R₂
|
R₄

ag
Bg
Ba

R1

R2

R3

R4

glucuronic acid
glucuronic acid
glucuronic acid

galactose
galactose
galactose

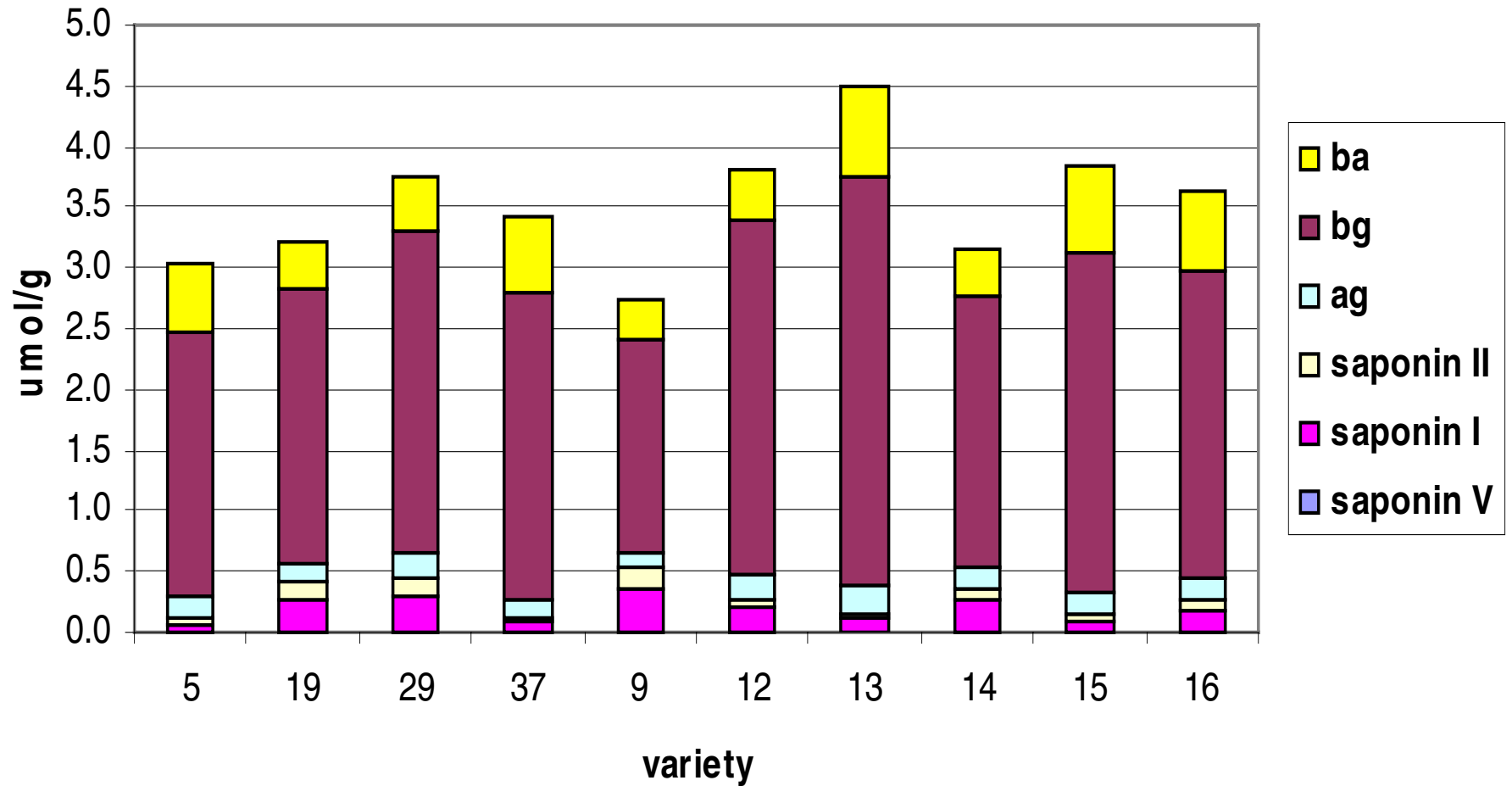
CH₂OH
CH₂OH
H

glucose
rhamnose
rhamnose

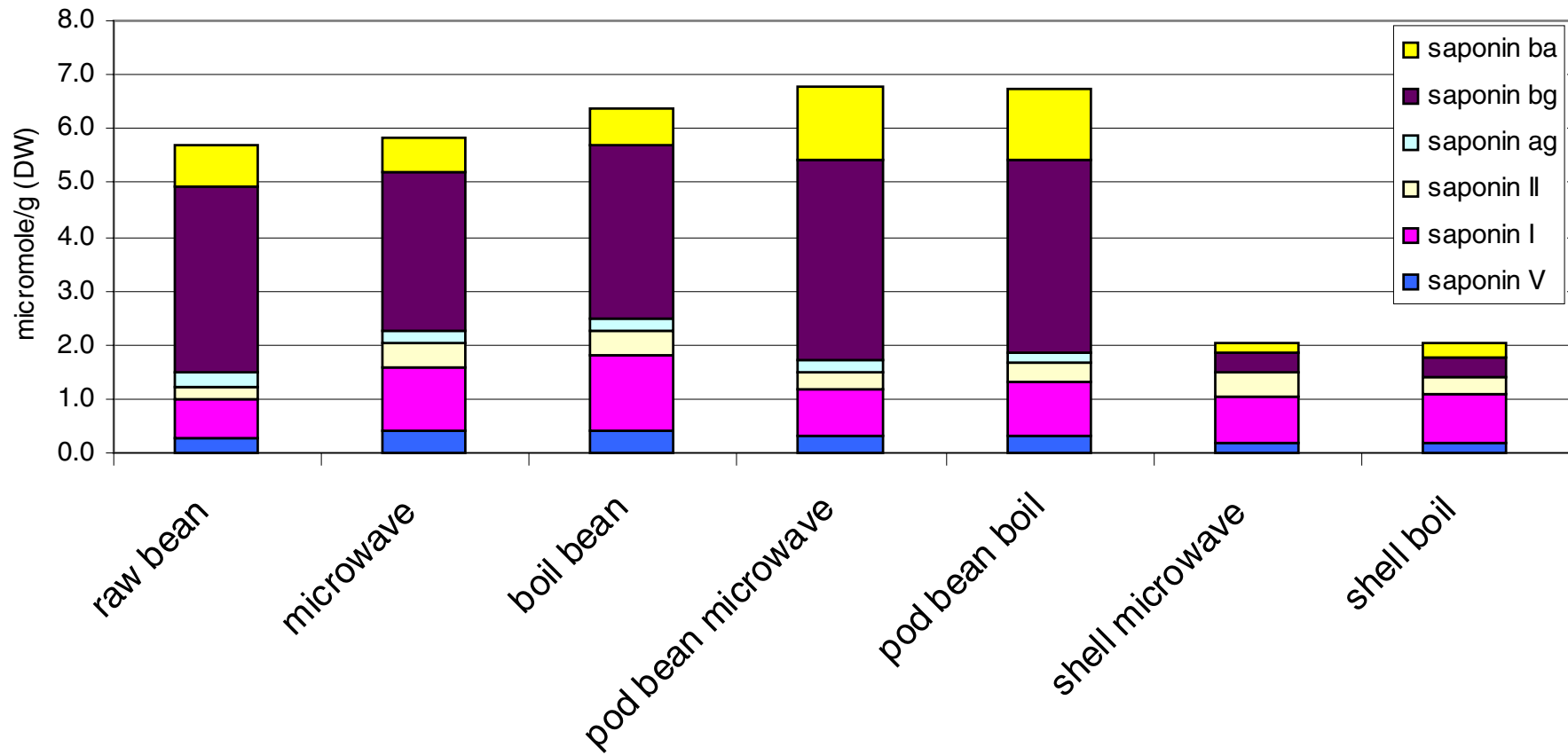
Minus DDMP
Saponin V
Saponin I
Saponin II

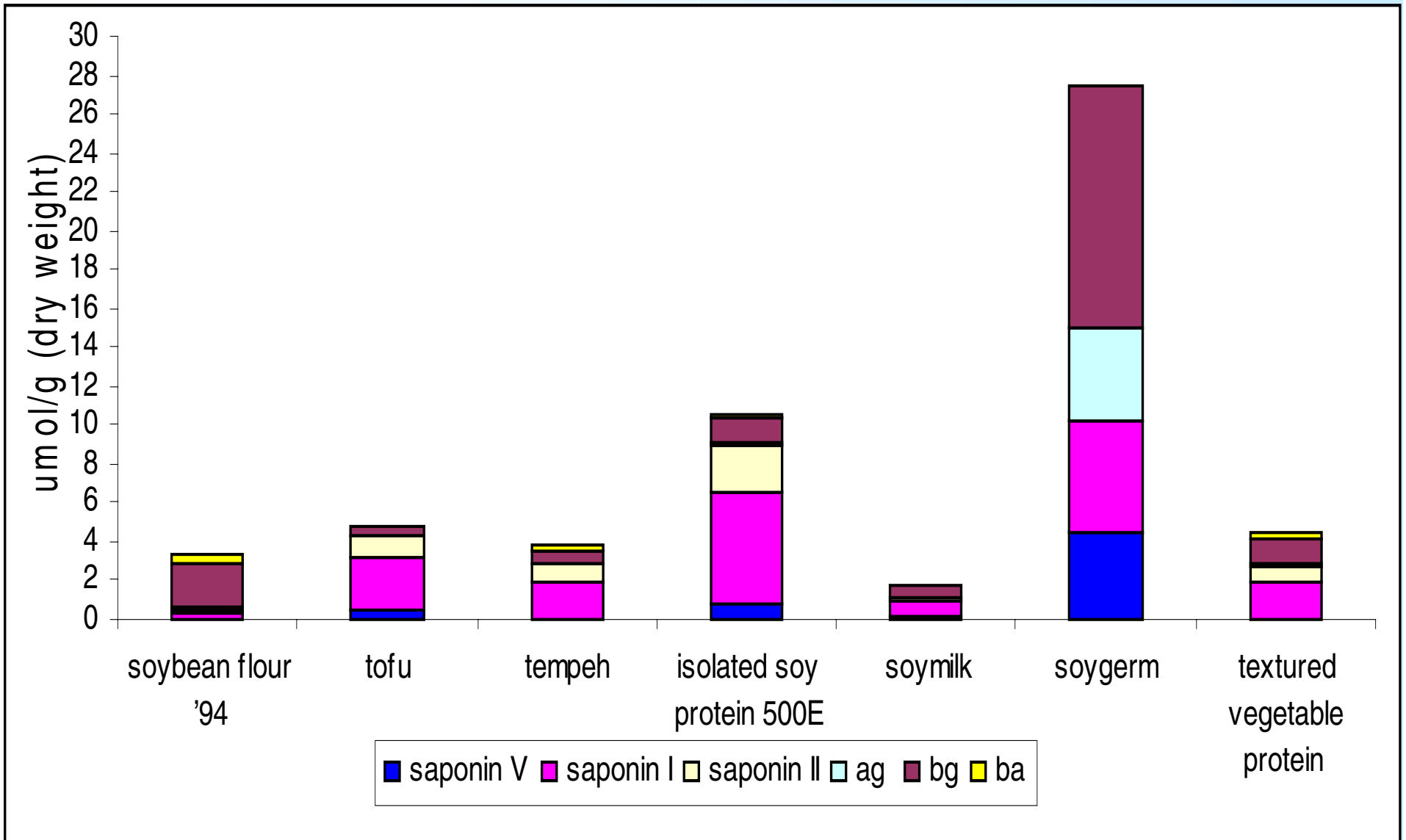
R₃ is C₆ of galactose

Saponins in Mature Soybeans



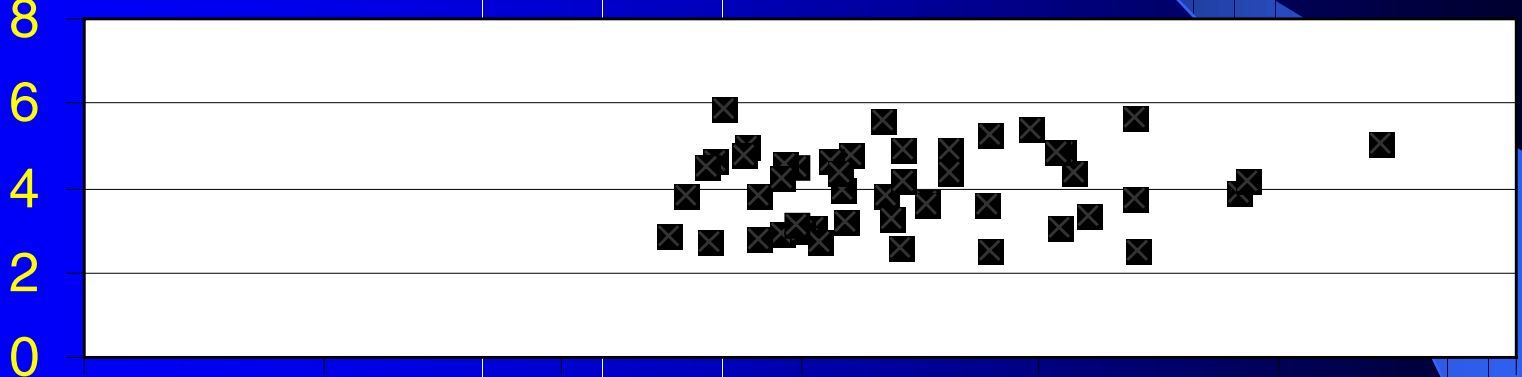
Saponins in Edamame





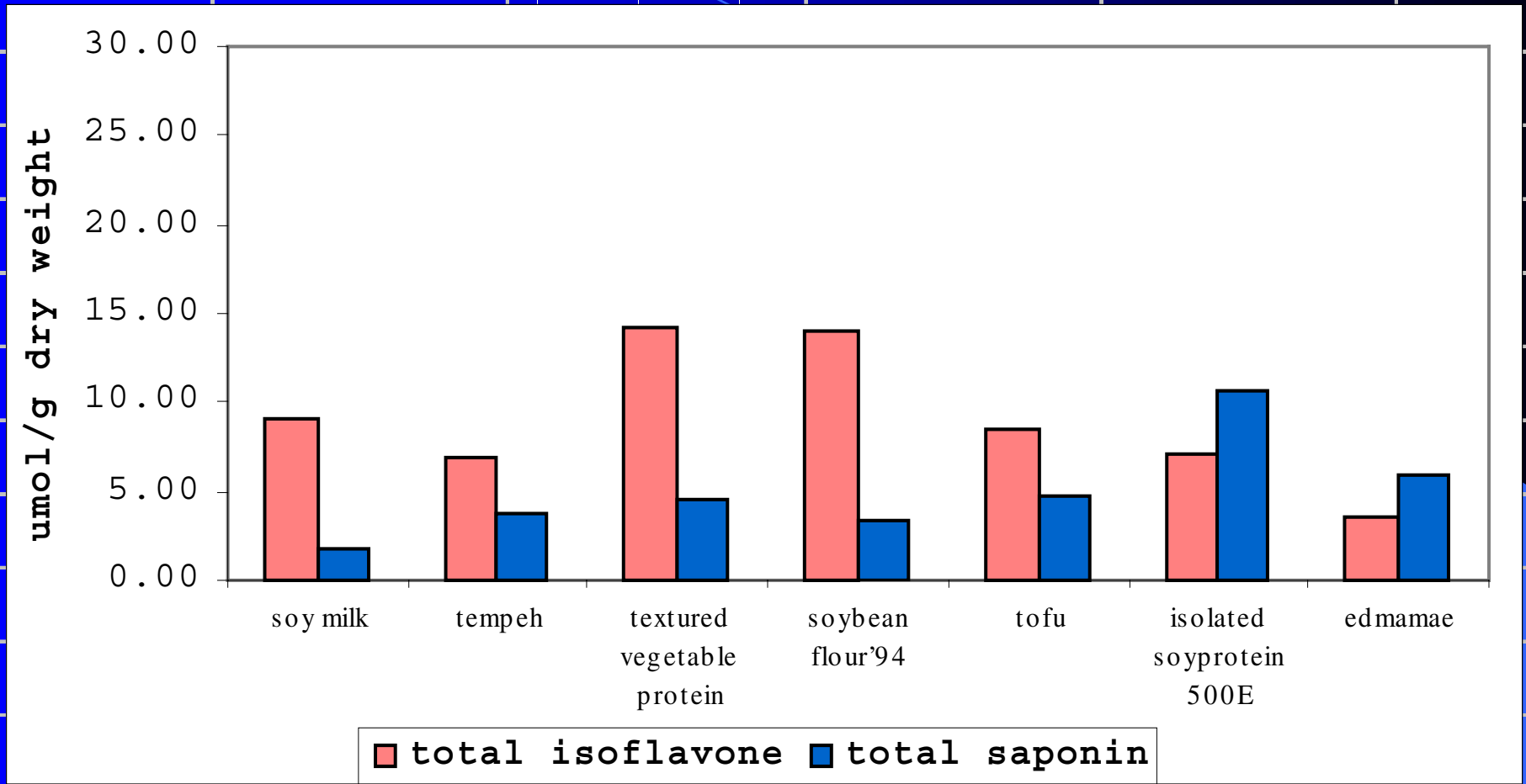
Isoflavone-Saponin Correlation

Total Saponin
($\mu\text{mole/g}$)



0 500 1000 1500 2000 2500 3000

Total Isoflavones (ug/g)



Acknowledgments

- Efi Farmakalidis
- Huei-ju Wang
- Suzanne Hendrich
- John Hathcock
- Gary Beecher
- Joanne Holden
- Xia Xu
- Zhibin Lu
- Joan Cunnick
- Jiang Hu
- David Rickert

- KW Lee
- Kobita Barua
- Tong Song
- Gwen Buseman
- Yan Zhang
- Vanessa Smith
- Funders: NIH, Army Breast Cancer Initiative, Fund for Rural America, ISPB, Schouten