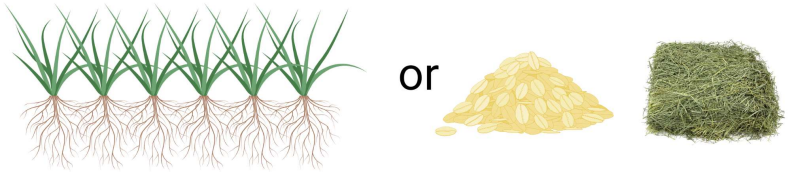
The Effects of Grazing and Finishing Practices on Bison Health and Meat Nutrient Density



Stephan van Vliet, PhD
Department of Nutrition, Food Sciences, and Dietetics
College of Agriculture and Applied Sciences
Utah State University

Email: stephan.vanvliet@usu.edu

@vanvlietphd Stephan van Vliet

UtahStateUniversity

A half truth to the saying, you are what you eat!

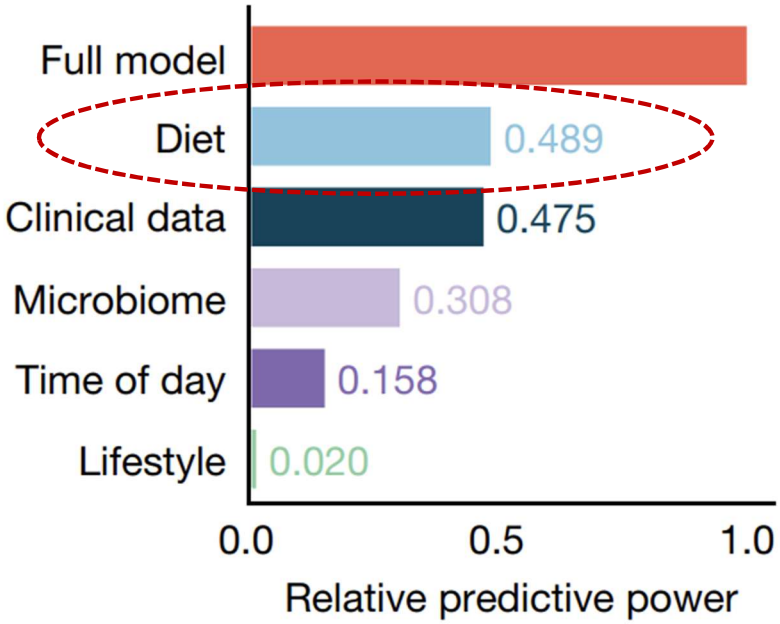
Article

A reference map of potential determinants for the human serum metabolome

https://doi.org/10.1038/s41586-020-2896-2
Received: 23 January 2019
Accepted: 29 September 2020

Noam Bar[1,2,81], Tal Korem[1,2,3,4,5,81], Omer Weissbrod[1,2,6], David Zeevi[1,2,7], Daphna Rothschild[1,2], Sigal Leviatan[1,2], Noa Kosower[1,2], Maya Lotan-Pompan[1,2], Adina Weinberger[1,2], Caroline I. Le Roy[8], Cristina Menni[8], Alessia Visconti[8], Mario Falchi[8], Tim D. Spector[8], The IMI DIRECT consortium*, Jerzy Adamski[9,10,11], Paul W. Franks[12,13], Oluf Pedersen[14] & Eran Segal[1,2]✉

I am what I ate?



About 50% of what circulates in the human body is determined by what we eat

Linking plant compounds, animal health and human nutrition

BMC Part of Springer Nature

Journal of Animal Science and Biotechnology

Home About Articles Submission Guidelines Submit manuscript

Research | Open Access | Published: 01 April 2023

Pasture-finishing of bison improves animal metabolic health and potential health-promoting compounds in meat

Stephan van Vliet, Amanda D. Blair, Lydia M. Hite, Jennifer Cloward, Robert E. Ward, Carter Kruse, Herman A. van Wietmarchsen, Nick van Eekeren, Scott L. Kronberg & Frederick D. Provenza

Journal of Animal Science and Biotechnology **14**, Article number: 49 (2023) | Cite this article

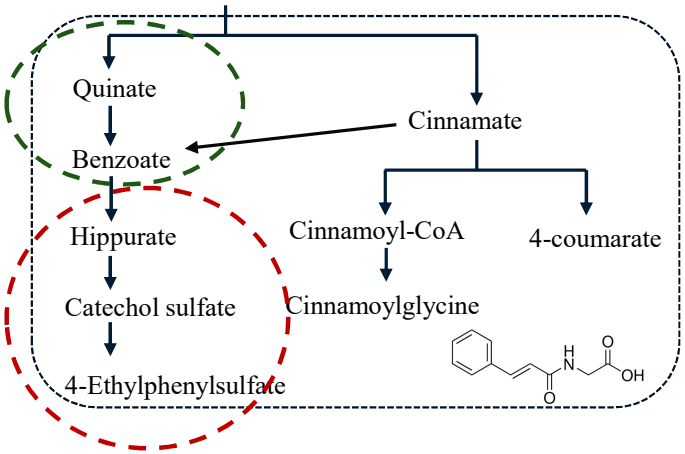
536 Accesses | **1** Altmetric | Metrics

Studying metabolites related to animal health and human nutrition in bison meat in response to pasture vs. pen-finishing

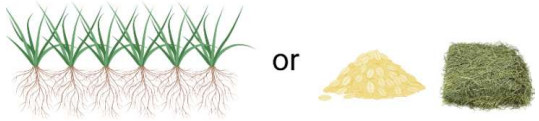
TURNER RANCHES

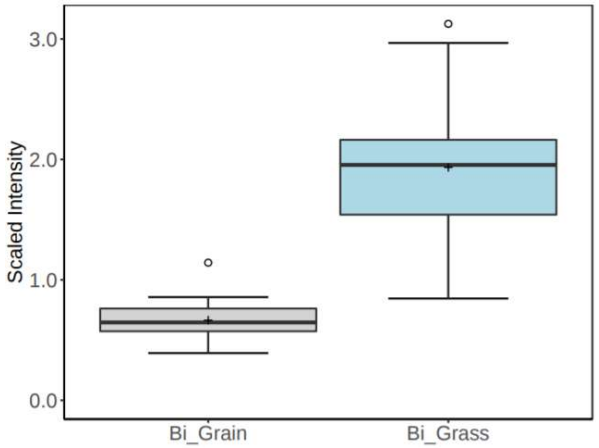
Phytochemicals antixodiants and health

Plant phenolic compounds

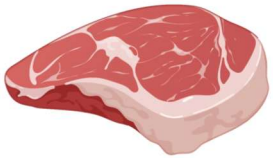


On average 2.5 times more plant-derived anti-oxidants in pastured bison

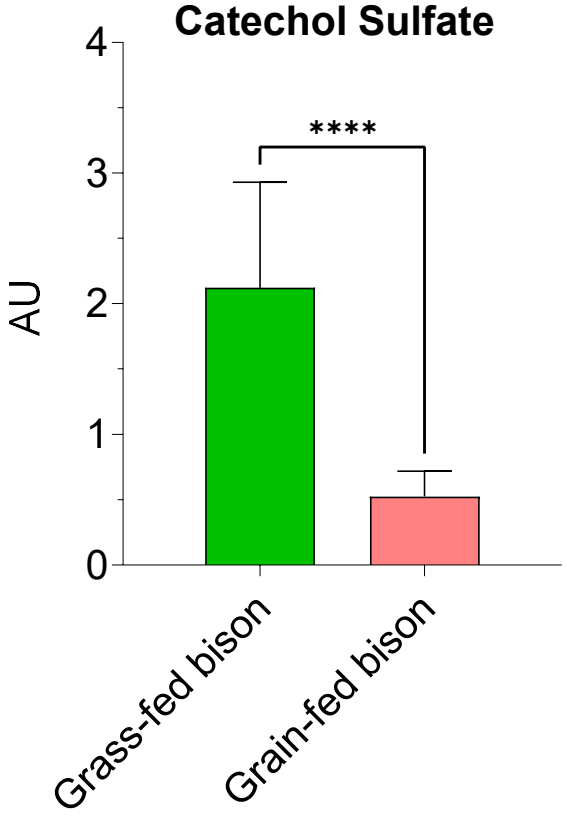


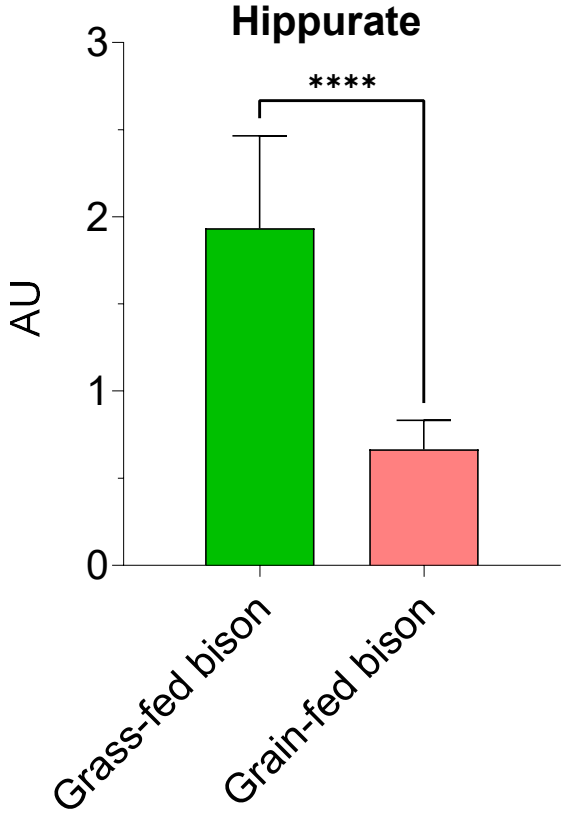


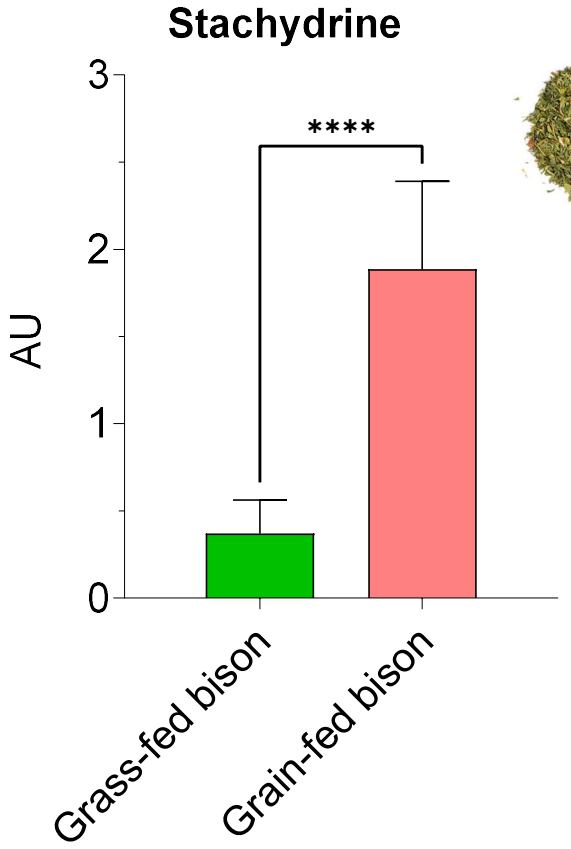
Hippurate



Nutrient Class	Compound Name	Fold difference Bi_Grass / Bi_Grain
Phytochemicals	hippurate	2.91
	catechol sulfate	4.06
	cinnamoylglycine	3.27
	p-cresol sulfate	1.32
	4-ethylphenylsulfate	17.96
	2,6-dihydroxybenz acid	3.24
	homostachydrine	0.41
	stachydrine	0.2





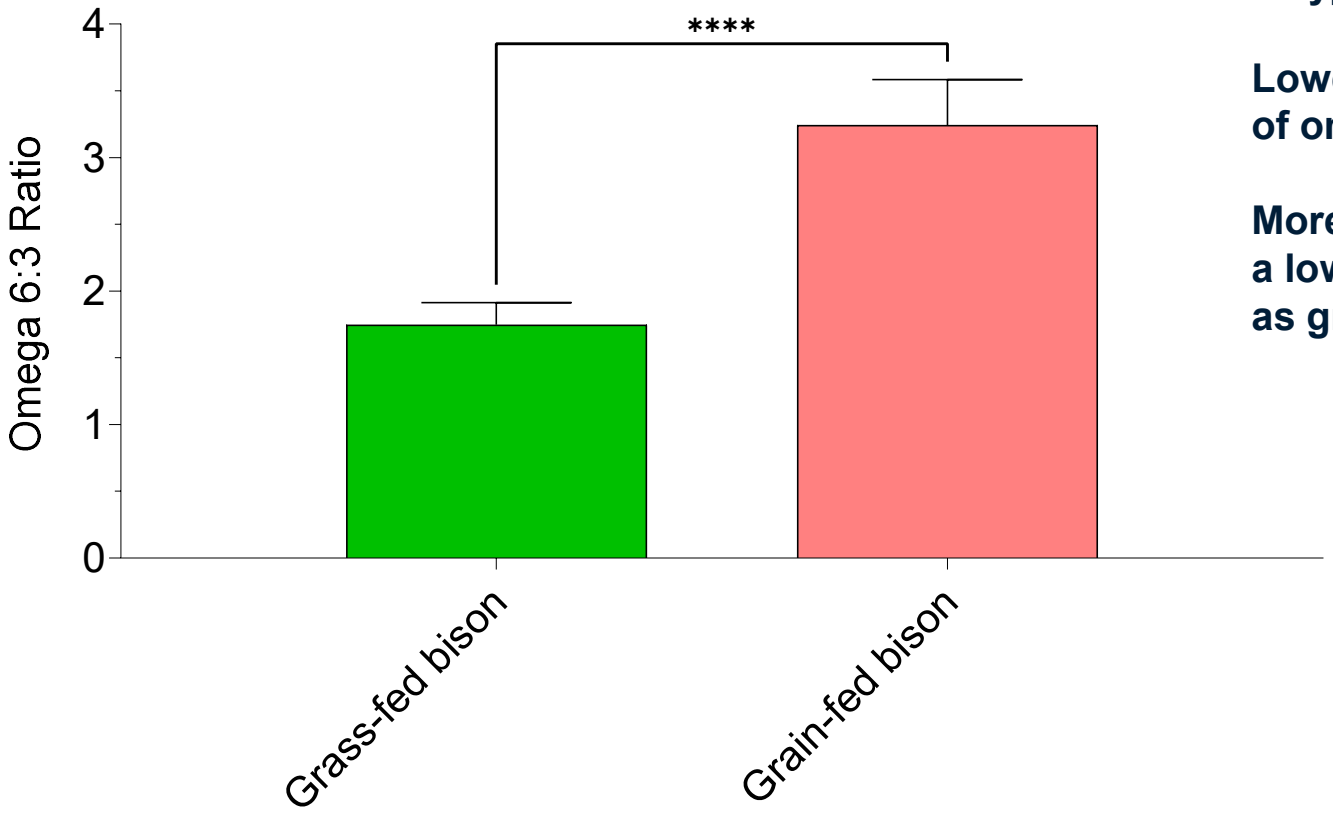


Anti-oxidant; anti-inflammatory; associated with ↓ odds of metabolic syndrome

Anti-oxidant high in alfalfa/legumes (grain-fed bison had free-choice access to alfalfa hay and corn)

Omega-3 fats

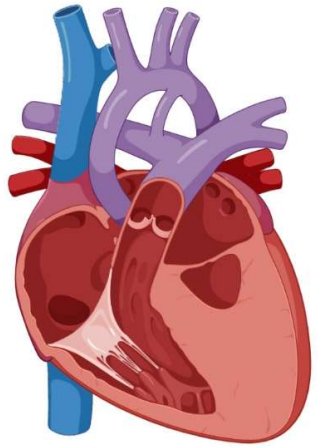
A lower omega 6:3 ratio is typically considered beneficial.



Omega-3s have known benefits to heart and brain health. A lower omega 6:3 ratio is typically considered beneficial.

Lower ratios means a higher abundance of omega-3 fatty acids.

More biodiverse forage feeding results in a lower ratio compared to grain-finishing as grains contain more omega 6s.



Bison Meat Project 2.0: Preliminary findings

1: Range-finished on diverse species

2: Range-finished on monoculture species/less diverse

3: Range-finished on monoculture species w free-choice corn

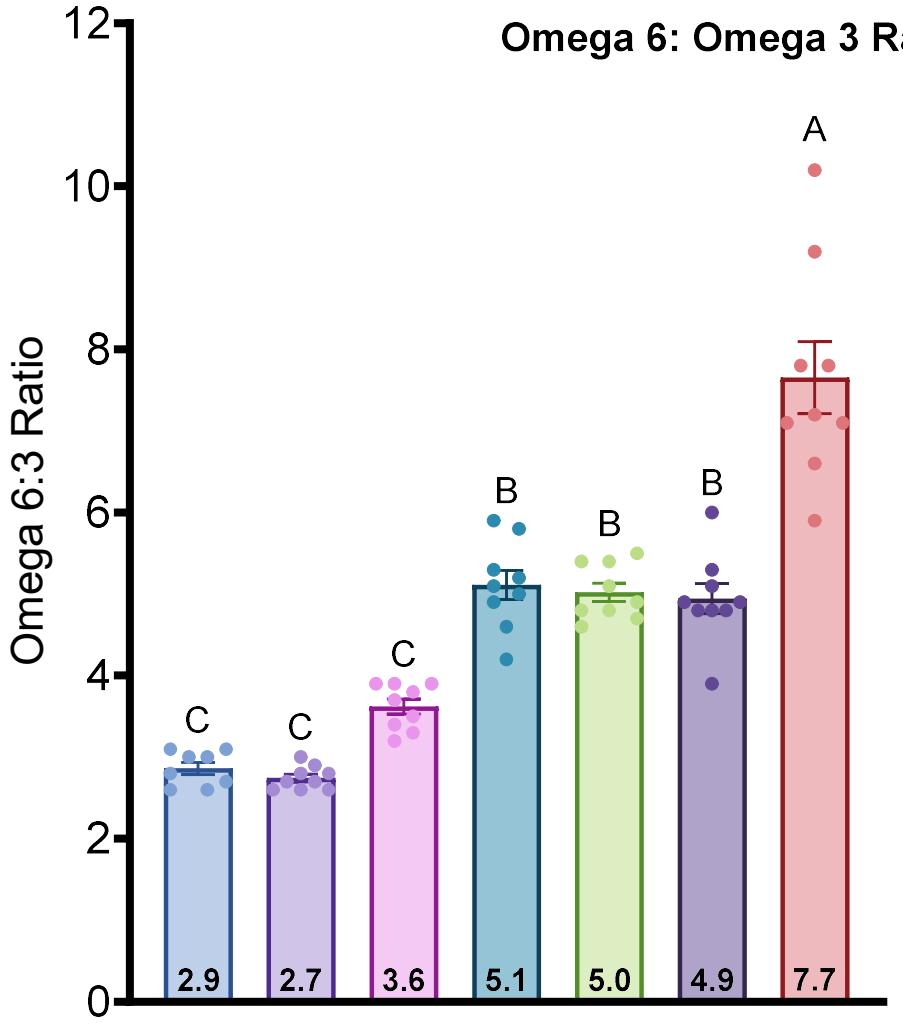
4: Pen-finished w low-stocking density and free-choice alfalfa, meadow hay, and corn

5: Pen-finished w low-stocking density and total mixed ration

6: Pen-finished w high-stocking density and free-choice alfalfa, meadow hay, and corn

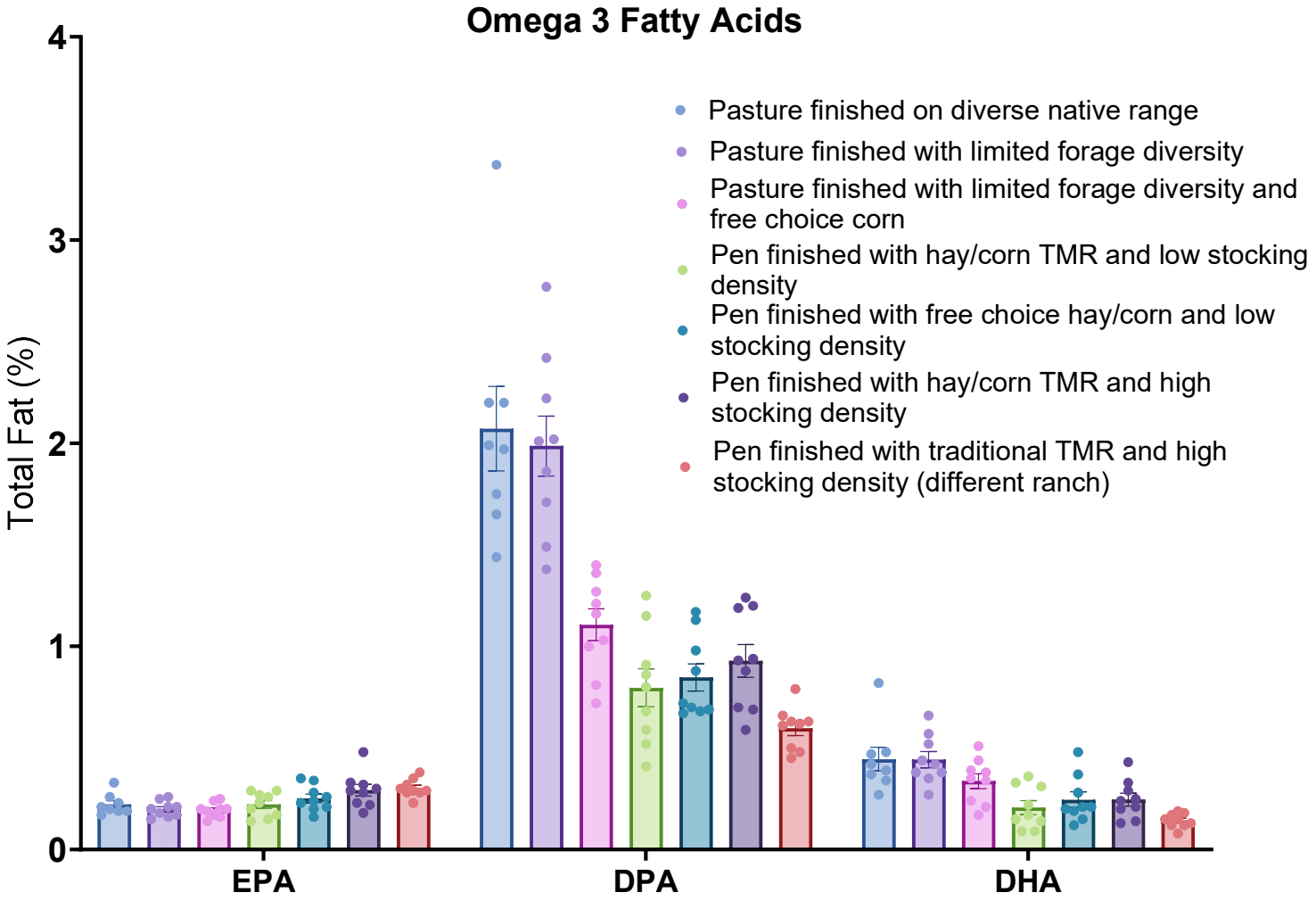
7: Pen-finished w high-stocking density and total mixed ration (different ranch)

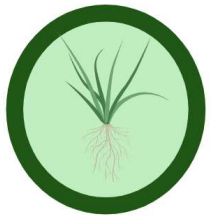
Bison Meat Metabolomics Project 2.0: Preliminary findings



- Pasture finished diverse native range
- Pasture finished limited forage diversity
- Pasture finished limited forage diversity + free choice corn
- Pen finished free choice hay/corn + low stocking density
- Pen finished with hay/corn TMR + low stocking density
- Pen finished with hay/corn TMR + high stocking density
- Pen finished with TMR + high stocking density (different ranch)

Bison Meat Metabolomics Project 2.0: Preliminary findings

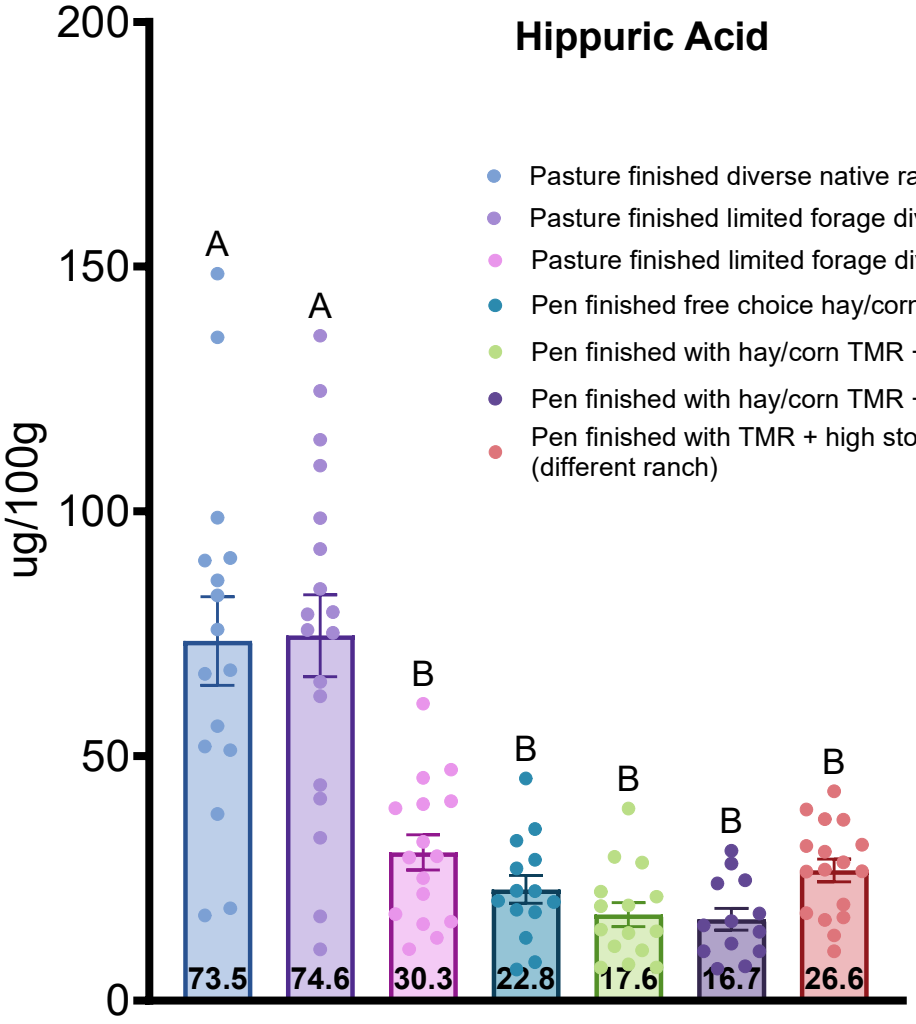


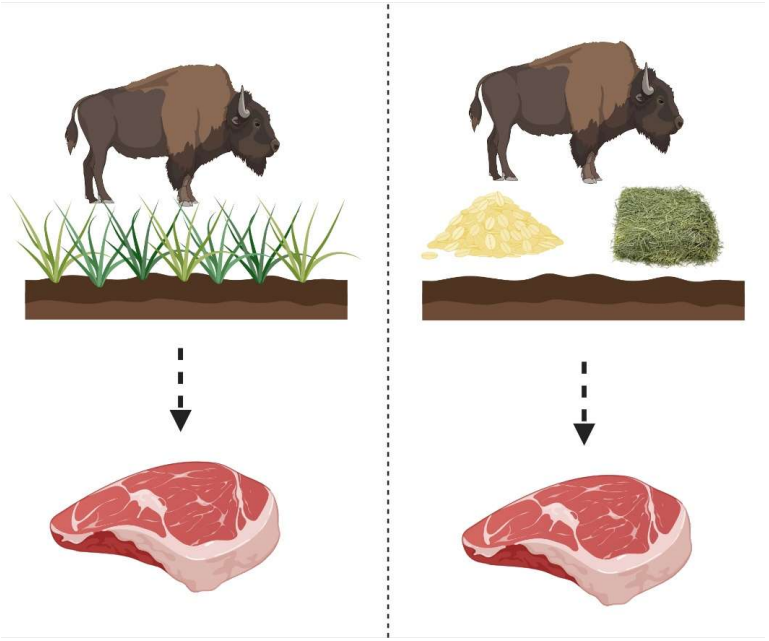


Forages are rich in omega-3s =

More omega-3s in pastured bison

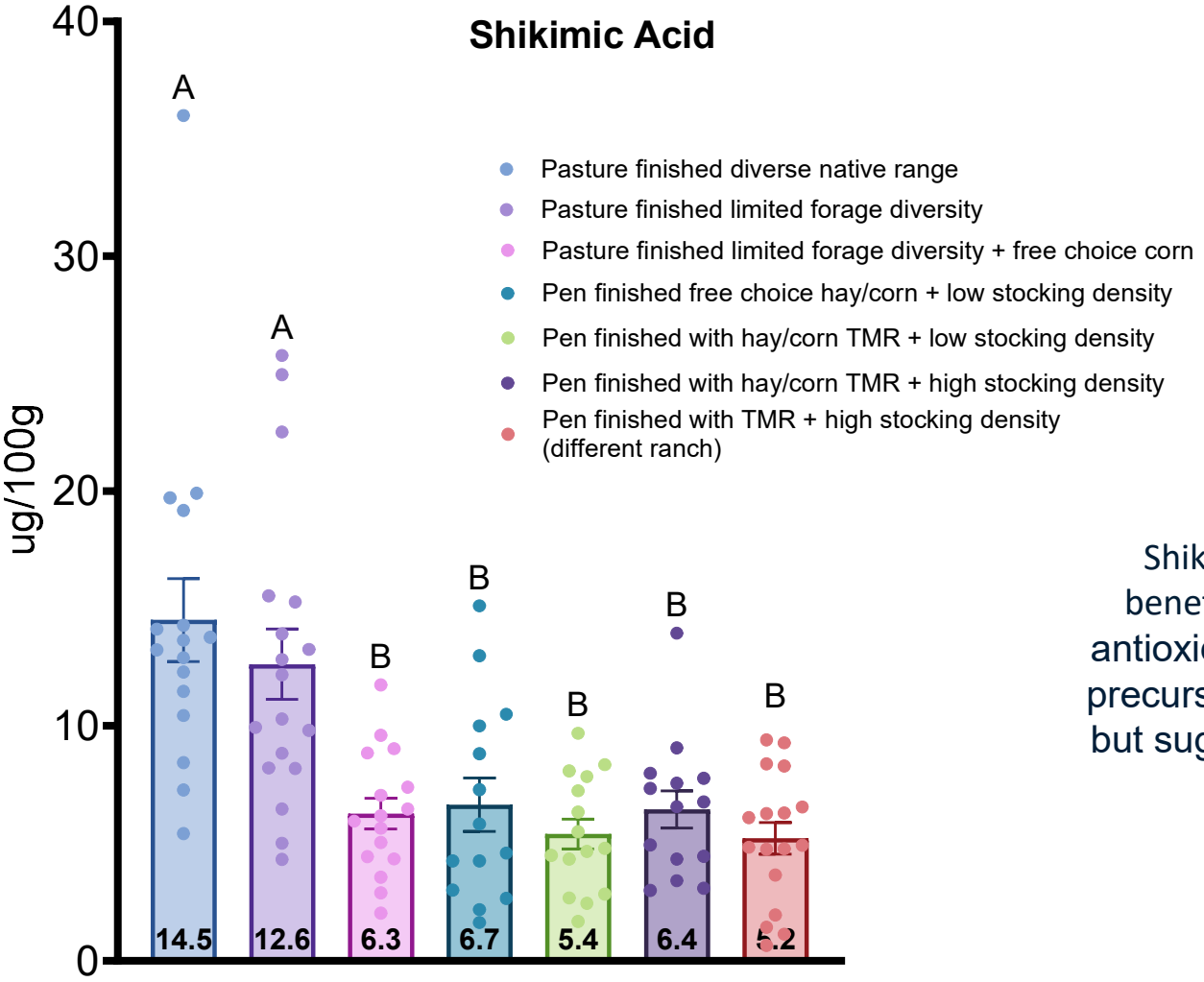
Bison Meat Metabolomics Project 2.0: Preliminary findings

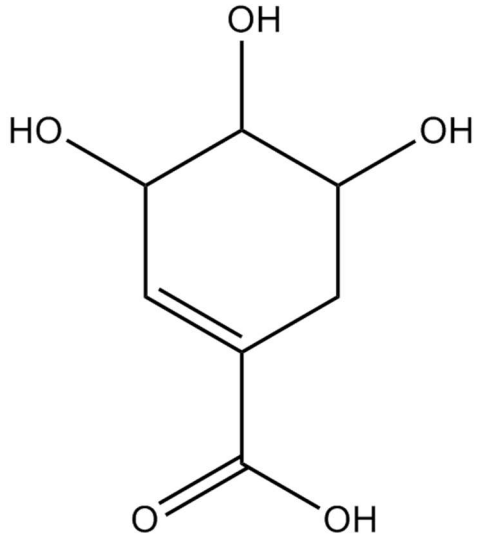




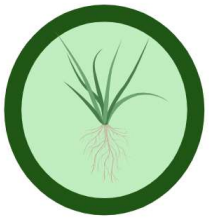
Hippuric acid is biomarker of polyphenol intake in mammals and an important antioxidant.

Bison Meat Metabolomics Project 2.0: Preliminary findings



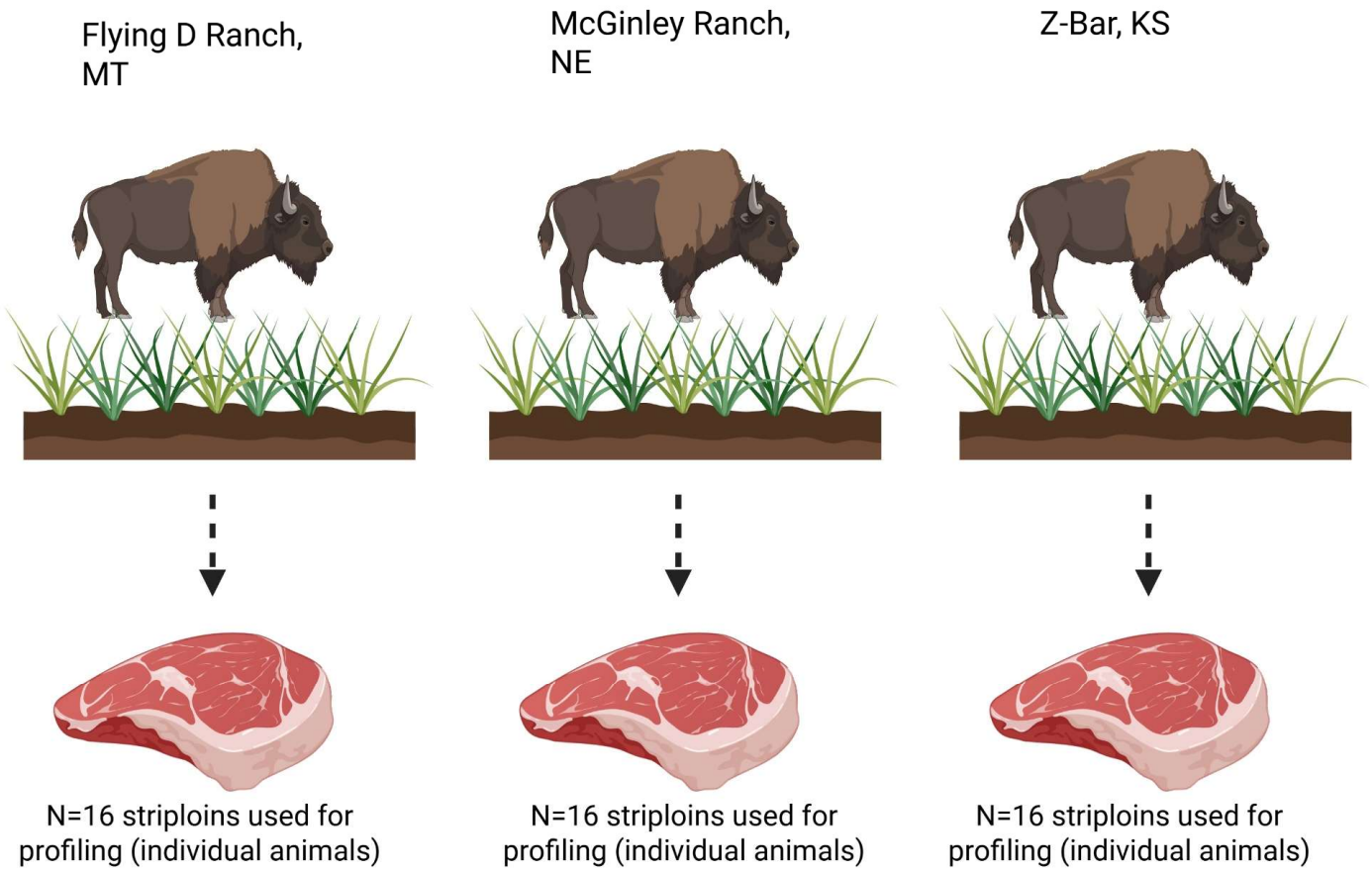


Shikimic acid (SA) has several potential health benefits, including antiviral, anti-inflammatory, antioxidant, and antibacterial properties: a major precursor to phenolics. Study in cattle are limited but suggestive of animal health/welfare benefits.



Next steps: impact of terroir (ecoregion) on the phytochemical richness and fatty acids in bison

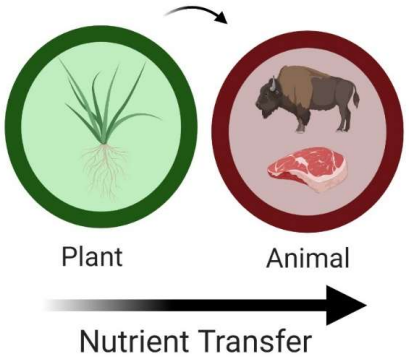
Pastured-finished on Western Rangelands in different ecoregions ("terroir")



Conclusion and future directions

- Phytonutrient metabolites—phenols, flavanoids, and other anti-oxidants—become concentrated in the meat of bison finished on pasture. Likely to have health benefits to the animal and potentially humans (though more research is needed on that!)
- Providing corn on pasture or a mix of hay and corn in pens provides a more intermediate profile regarding fatty acids and phytochemicals.
- No major difference in this work between a more diverse and less diverse range.
- Management practices may be more important (e.g., not overgrazing).
- Studying the effect of different regions next.

"Herbivores consume plant species otherwise not consumed by humans; representing a dietary avenue by which additional unique phytochemicals are ingested."



Acknowledgements

UTAH STATE

Joseph Varre
Fred Provenza
Jennifer Cloward
Robert Ward
Marina Carbonell
Muhammad Ahsin

SOUTH DAKOTA STATE UNIVERSITY

Amanda Blair
Lydia O'Sullivan
Garrett Weldy

USDA ARS

Scott Kronberg

Bob Wesley
Carter Kruse
Tyrell McClain
Jessica Lovitt

TURNER INSTITUTE of Ecoagriculture