

UC ANR Nutrition Policy Institute

Brown Bag Seminar Series

Contributors to Fruit and Vegetable Consumption in Diverse Food Environments

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Thursday, January 25th, 2018

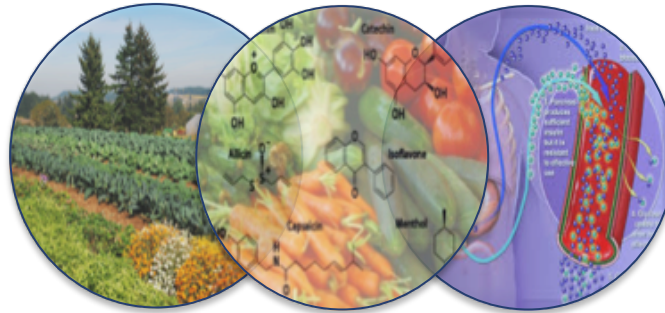
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Contributors to Fruit and Vegetable Consumption in Diverse Food Environments



ABSTRACT Worldwide, adults consume fewer fruits and vegetables (FVs) than recommended. The food environment is one potential influence on dietary quality, where food venues, food types, and processes impact the availability and affordability of high quality and desirable FVs. This research examined disparities in availability, affordability, quality, and desirability of FVs in rural versus urban food environments as measured by observational surveys, consumer sensory testing, and total phenolic concentration. Metrics to evaluate FV availability, affordability, quality, and desirability will be presented. Our findings indicate that fruits and vegetables were significantly lower in quality and desirability in all three measures on the basis of rurality. Intervention strategies should aim to increase FV quality and desirability in rural food environments to promote consumption. These findings should be examined for their applicability in various settings worldwide towards reducing disparities among food environments.

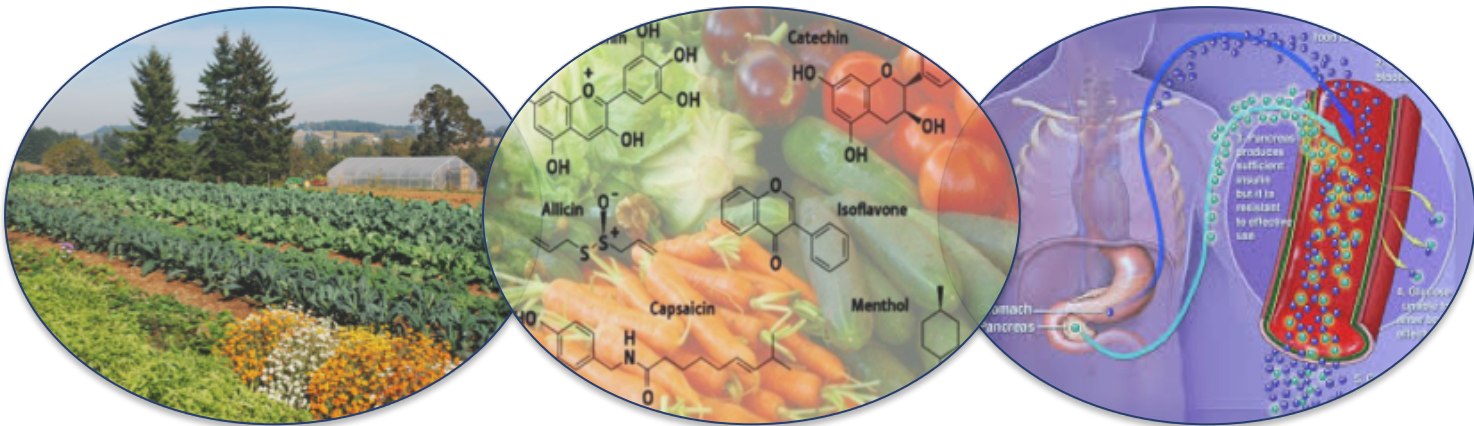
Carmen Byker Shanks, PhD, RDN

UC Nutrition Policy Institute Brown Bag Seminar

25 January 2018



Contributors to Fruit and Vegetable Consumption in Diverse Food Environments



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Co-Authors: Selena Ahmed and Justin Shanks



Food + Health Lab

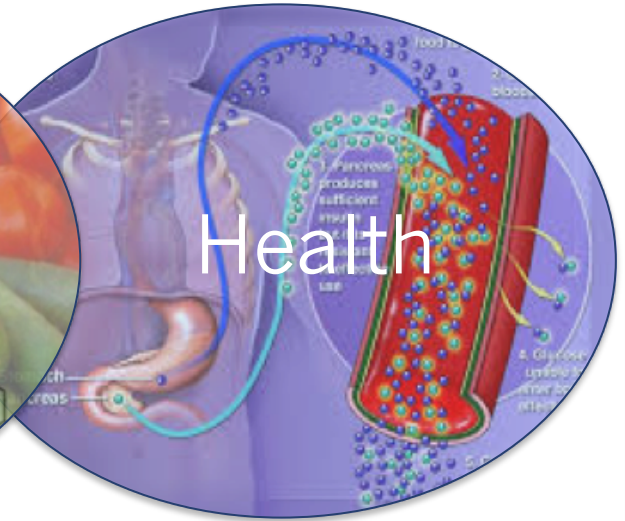
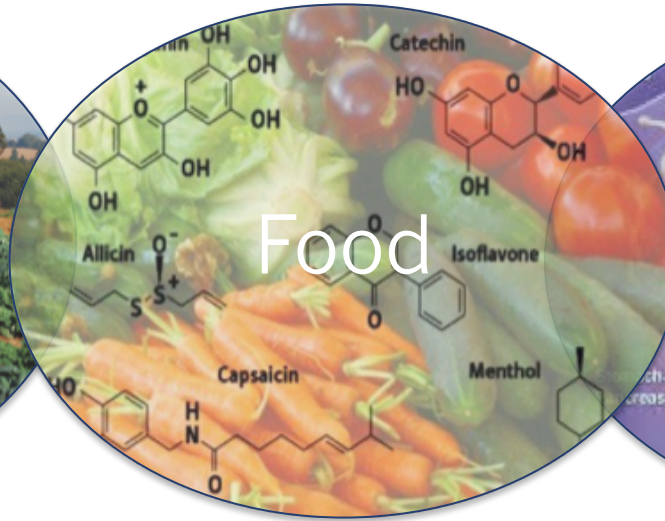


Carmen Byker Shanks, PhD, RDN
Human Nutrition + Behavior

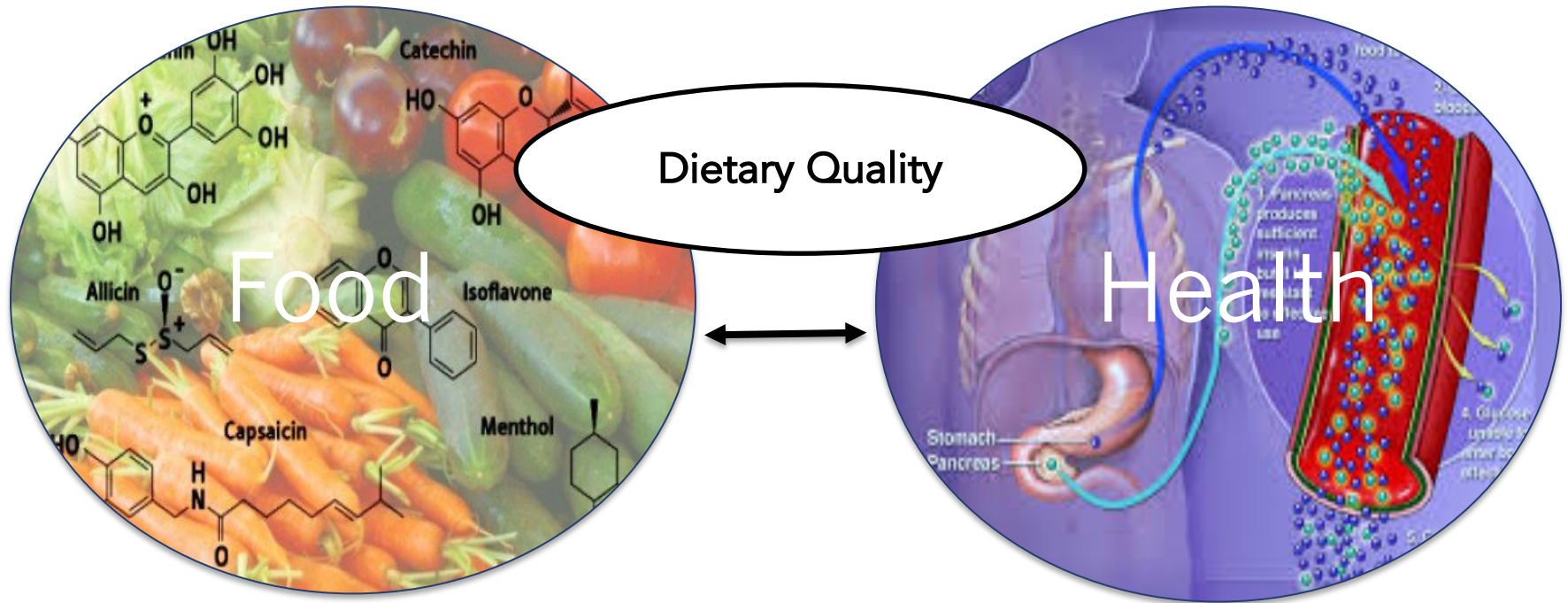
The Food + Health Lab at Montana State University, co-led by Dr. Carmen Byker Shanks (Human Nutrition and Behavior) and Dr. Selena Ahmed (Phytochemistry + Agroecology), carries out basic + applied research in the field and in the lab to improve dietary quality for human + environmental health outcomes.



1. Framework



Co-Construction of Food and Health Linkages



Foods consumed produce an overall dietary quality (nutrient or energy dense) and ultimately influence health outcomes.

Food Patterns Vary



Source: Dietary Guidelines for Americans, 2010



Recent population adherence to and knowledge of United States federal nutrition guides, 1992–2013: a systematic review

Sarah A Haack and Carmen J Byker

The Dietary Guidelines for Americans dictates the federal nutrition programs, policies, and recommendations of the United States. Corresponding nutrition guides have been established to help educate the public about the dietary intake patterns recommended in these guidelines as well as to ameliorate the US obesity epidemic and its health-related outcomes. The purpose of this systematic review was to summarize population adherence to and knowledge of these corresponding US nutrition guides issued since 1992, including the Food Guide Pyramid, MyPyramid, and MyPlate. Of the 31 studies included in the review, 22 examined adherence, 6 examined knowledge, and 3 examined both adherence and knowledge. Across studies, adherence to nutrition guides was low, with participants consuming inadequate levels of fruit, vegetables, and dairy in particular. Knowledge of nutrition guides increased over time since publication and decreased with age of the participants. An association between knowledge of and adherence to nutrition guides was not found. Disparities in knowledge and adherence existed across demographic groups. Based on these findings, it is suggested that federal dietary guidance can be strengthened by increasing dissemination of nutrition guides to the public and tailoring promotional activities to specific demographic and socioeconomic groups.

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INTRODUCTION

As of 2012, 34.9% of US adults and 16.9% of US children are widely considered to be obese,¹ compared with 35.1% and 16.7%, respectively, in 2010^{2,3}; these figures are a reflection of a national diet high in empty calories, refined grains, and saturated fat.⁴ Since the passage of the 1990 National Nutrition Monitoring and Related Research Act, the US Department of Agriculture, and the Department of Health and Human Services have been charged with publishing the Dietary Guidelines for Americans (DGA) once every 5 years in order to provide the public with nutrition information and to guide federal nutrition programs.⁵ These guidelines have evolved to meet population needs in accordance with current research. The DGA 2010, for example, address overweight, obesity, and chronic disease

concerns and emphasize both individual and environmental factors as determinants of health outcomes.⁶

The DGA have served as the inspiration and scientific basis for the development of nutrition guides, which are visual tools for communicating nutrition information to the public.⁷ Also reflecting the current national health status, nutrition research, and consumer needs are the Food Guide Pyramid (1990),⁸ MyPyramid (2005),⁹ and MyPlate (2010),¹⁰ which have provided iconic representations of health promotion and education materials. The Food Guide Pyramid portrayed recommended food group servings as proportional segments within a pyramid shape, with the tip representing minimal intake of fats, oils, and sweets.⁸ In 2005, MyPyramid accompanied that year's DGA.⁹ MyPyramid replaced the horizontal food group servings in the Food Guide Pyramid with

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Key words: adherence, dietary guidelines, Food Guide Pyramid, knowledge, MyPlate, MyPyramid


doi:10.1111/nure.12140

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613

Knowledge Does Not Equal Behavior

Natural Fruit and Vegetable for Health Benefits



Lower blood pressure

Reduced risk of heart disease

Mental Health

Boost your energy level

Control your Weight

Look and feel great

As part of a healthy diet

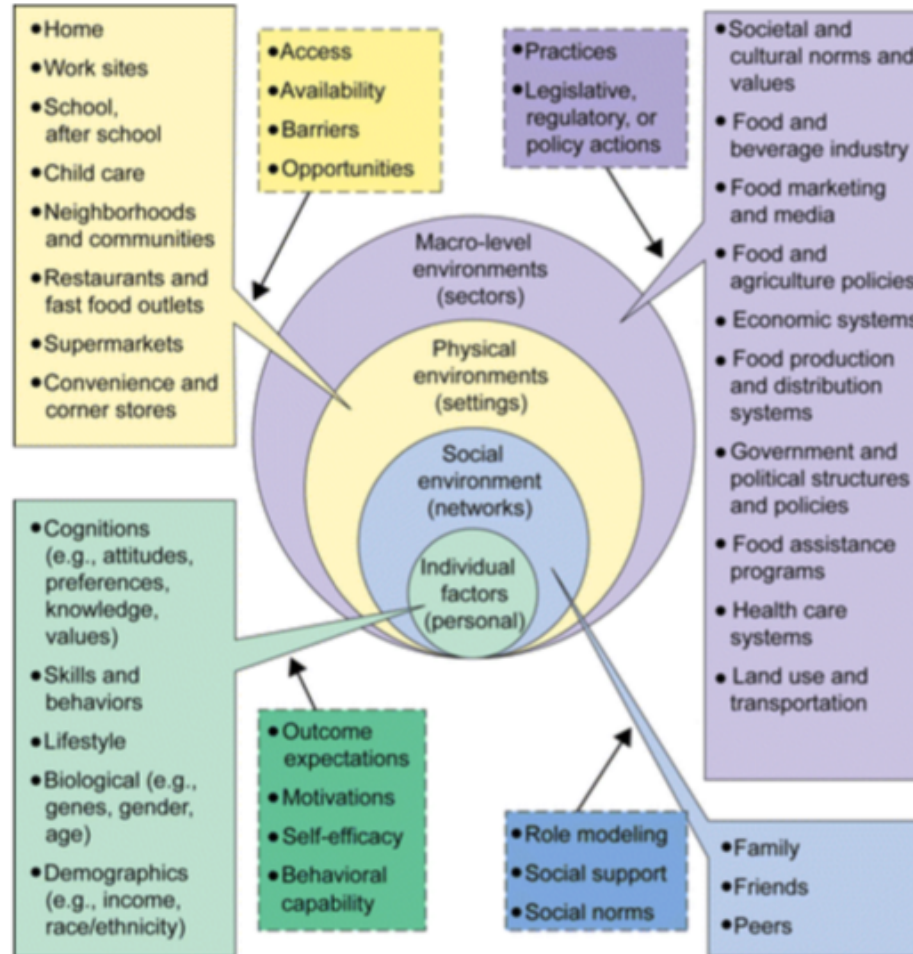
Protect you from chronic diseases

Low in sodium and calories

They help your body get the vitamins, minerals, fiber, and other natural substances it needs to stay healthy.



Socio-ecological Framework Depicting the Multiple Influences of What People Eat



Story M, et al. 2008.
Annu. Rev. Public Health. 29:253-72



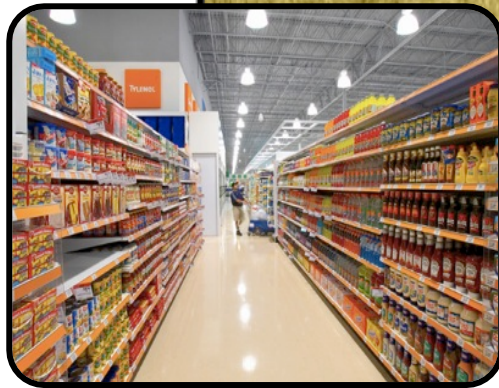
Co-Construction of Food Environments and Food Linkages



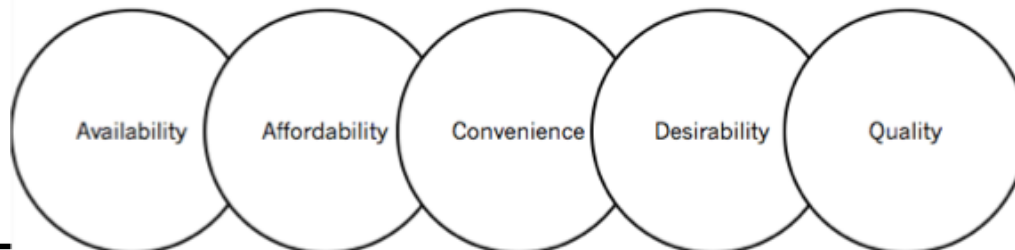
Food environments influence what food is available, affordable, convenient, desirable, and quality.



Food Environments Vary



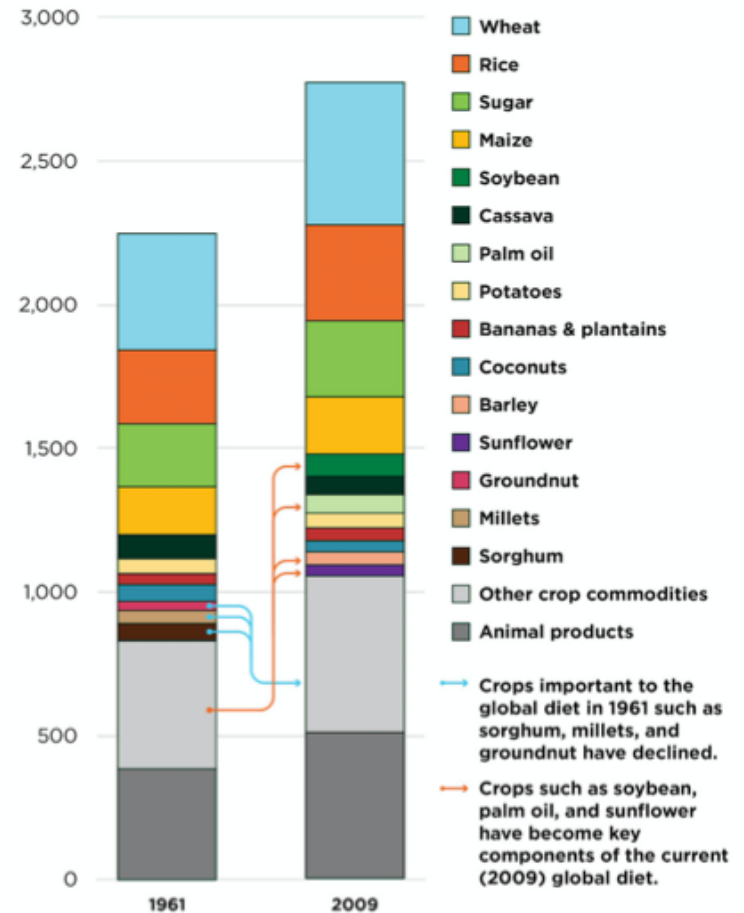
Source: Shutterstock



Food Environments in Transition

Diets worldwide are increasingly comprised of major globalized crops.

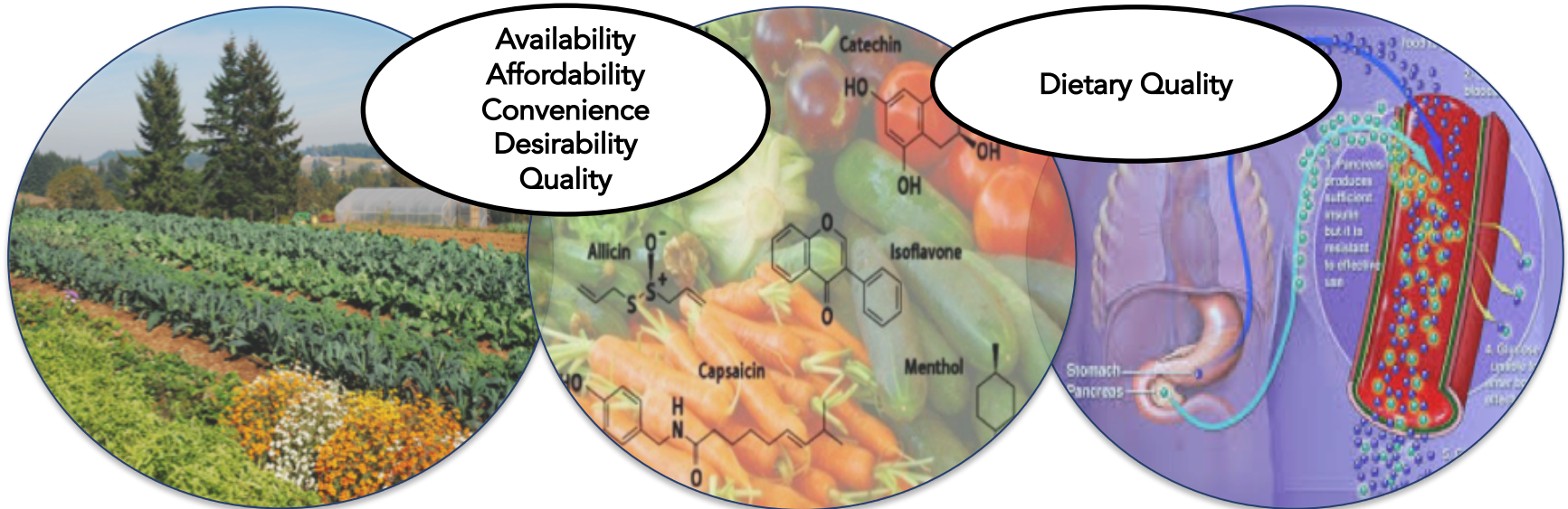
Relative contribution of major crops to the average food supply composition for calories (kcal/capita/day) worldwide, 1961 and 2009



Source: Khoury et al. 2014. Proc. Natl. Acad. Sci. USA.



Food Environments and Nutrition Transitions



Availability
Affordability
Convenience
Desirability
Quality

Dietary Quality

Food environments influence what food is available, affordable, convenient, desirable, and quality. Foods consumed produce an overall dietary quality (nutrient or energy dense) and ultimately influence health outcomes, leading to a nutrition transition.

Technological Clashes with our biology

Biology	Technology
Sweet preferences	cheap caloric sweeteners, food processing benefits
Thirst and hunger/satiety mechanisms not linked	Caloric beverage revolution
Fatty food preference	Edible oil revolution-high yield oilseeds, cheap removal of oils
Desire to eliminate exertion	Technology in all phases of movement/exertion

Source: Popkin, et al. 2012. Global nutrition transition and the pandemic of obesity in developing countries. *Nutrition Reviews*.

HEALTH PROMOTION AND CHRONIC DISEASE PREVENTION

Risk factors for many chronic diseases can begin early in life. But evidence shows that making dietary and lifestyle changes may prevent disease progression and premature death.

CHRONIC CONDITIONS RELATED TO DIET

1. HEART DISEASE & STROKE

HEART DISEASE:
LEADING CAUSE OF DEATH IN THE U.S.
for 100+ years and currently accounts for 1 in 3 deaths.

STROKE: 1 IN 18 DEATHS IN THE U.S.

2. OBESITY

1 IN 3 ADULTS IN THE U.S. IS OBESE
Obesity in all age, ethnic and gender groups within the U.S. has reached epidemic proportions.

16% OF 6-19 YEAR OLDS ARE OBESE
based on BMI guidelines for children and adolescents.

3. CANCER

CLAIMS MORE LIVES THAN HEART DISEASE
among people younger than 85 years of age.

CAUSING FACTORS: OBESITY, POOR DIET & PHYSICAL INACTIVITY

- Consuming less fat can be effective in reducing risk of breast and ovarian cancers.
- Moderate to vigorous exercise results in 30% reduction of colon cancer risk.

4. OSTEOPOROSIS

8% OF 20+ YEAR OLD FEMALES IN THE U.S. ARE AFFECTED

BONE FRACTURE PREVENTION
is strongly linked to weight-bearing exercise, and vitamin D and calcium intake.

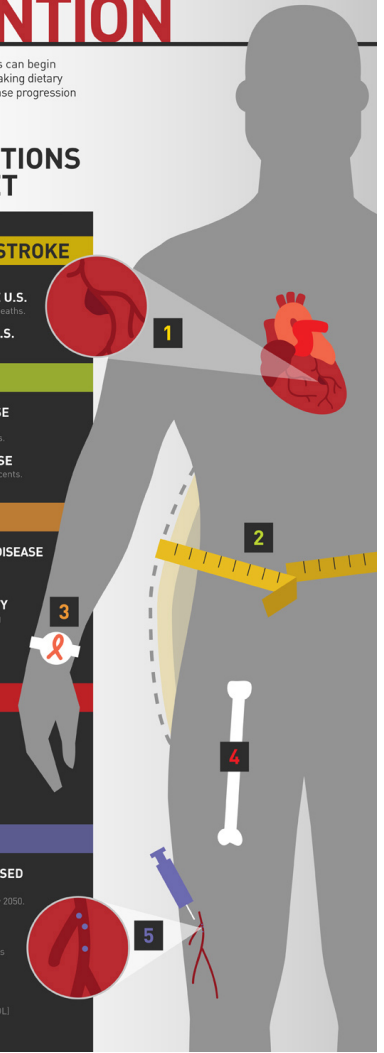
5. DIABETES

18+ MILLION U.S. ADULTS DIAGNOSED WITH TYPE 2 DIABETES IN 2008
Diabetes prevalence is projected to reach 33% by 2050.

12.7% OF 12-19 YEAR OLDS HAVE METABOLIC SYNDROME
which predisposes them to risk of Type 2 diabetes in young adulthood and beyond.

PREDICTORS OF TYPE 2:

- Obesity
- Family history
- High triglyceride levels
- High blood pressure
- Low high-density (HDL) cholesterol



Source: Association of Dietetics and Nutrition

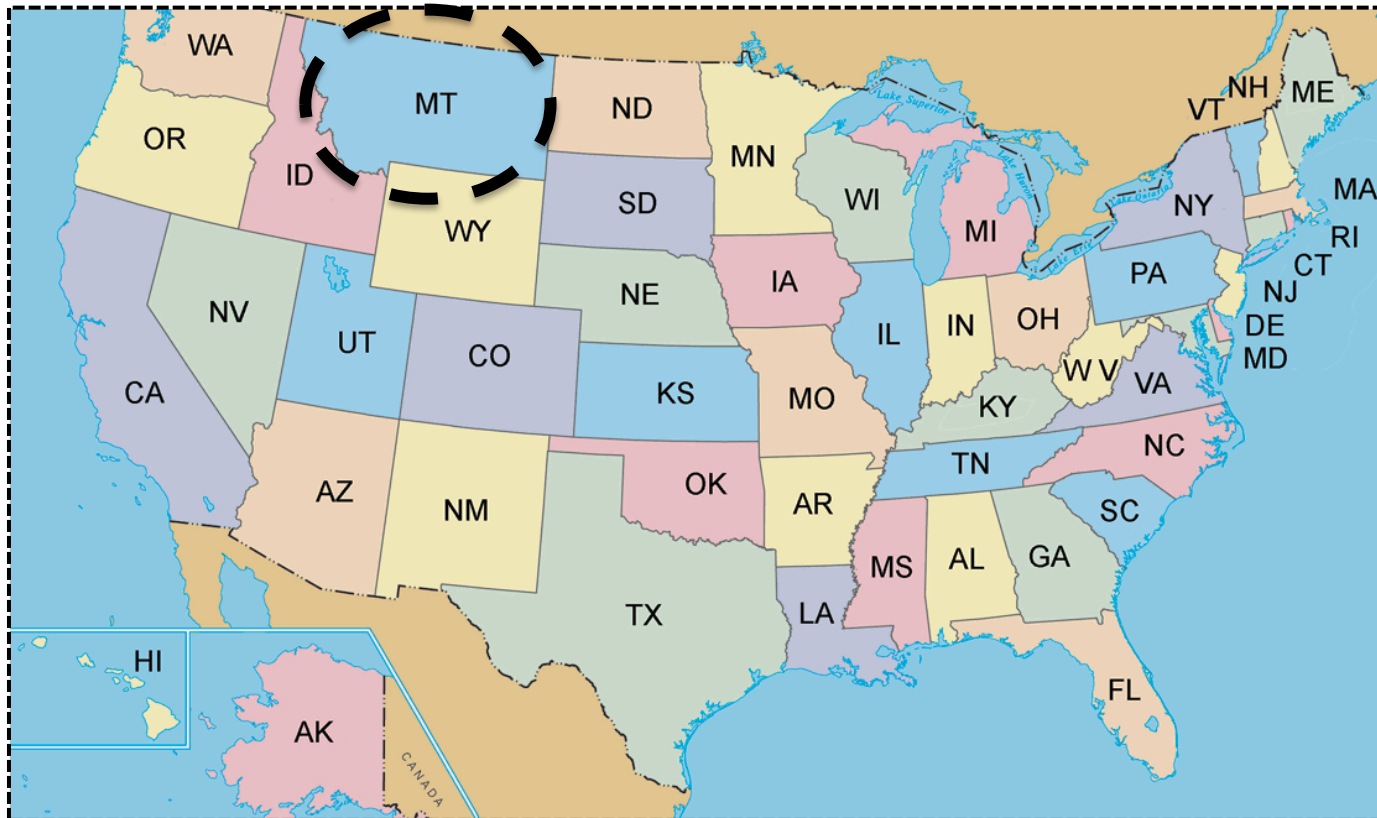


2. Food and Health in a Food Environment Context



Depending upon the context, food environments influence what food is available, affordable, convenient, desirable, and quality. Foods consumed produce an overall dietary quality (nutrient or energy dense) and ultimately influence health outcomes.

Where is Montana?

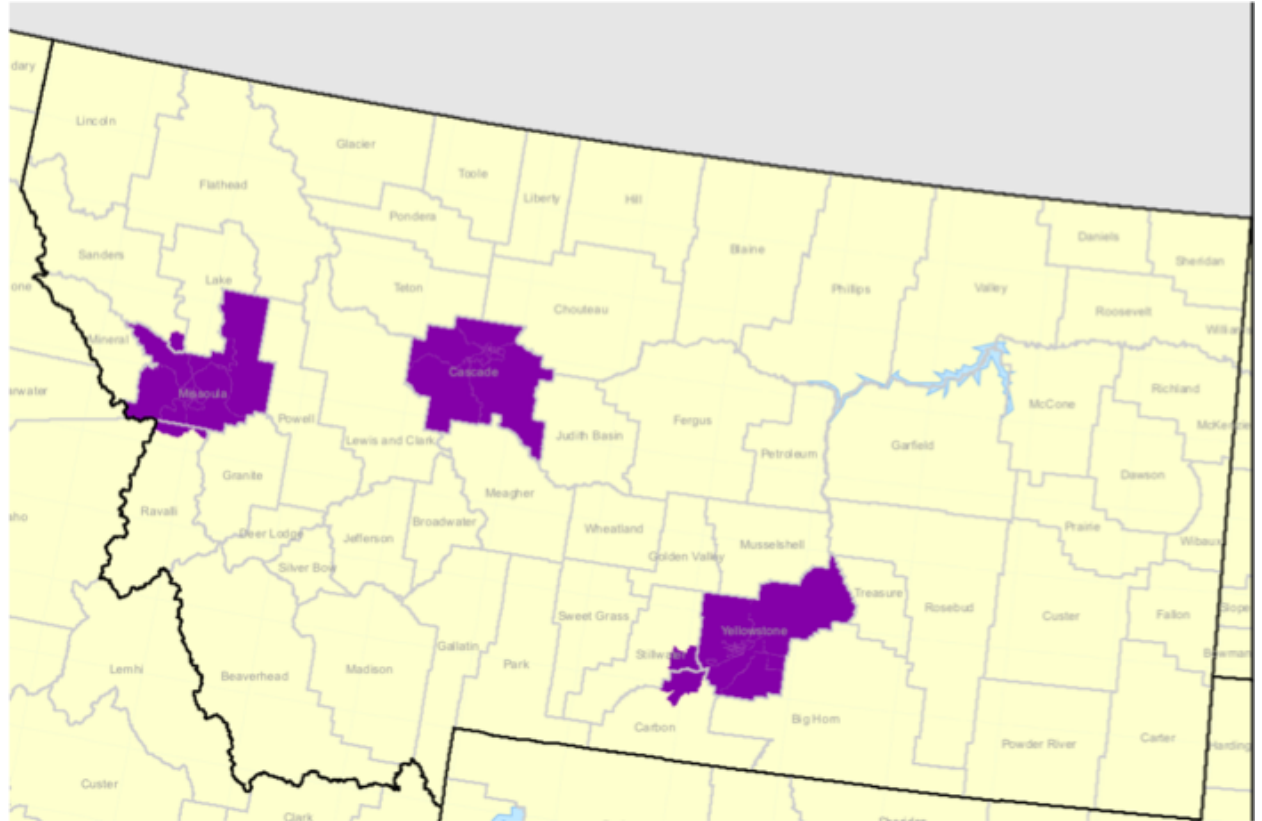
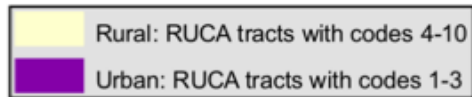


Characterizing Montana



Rurality of Montana

Rural definition based on Economic Research Service Rural-Urban Commuting Areas (RUCA)



Source: ers.usda.gov

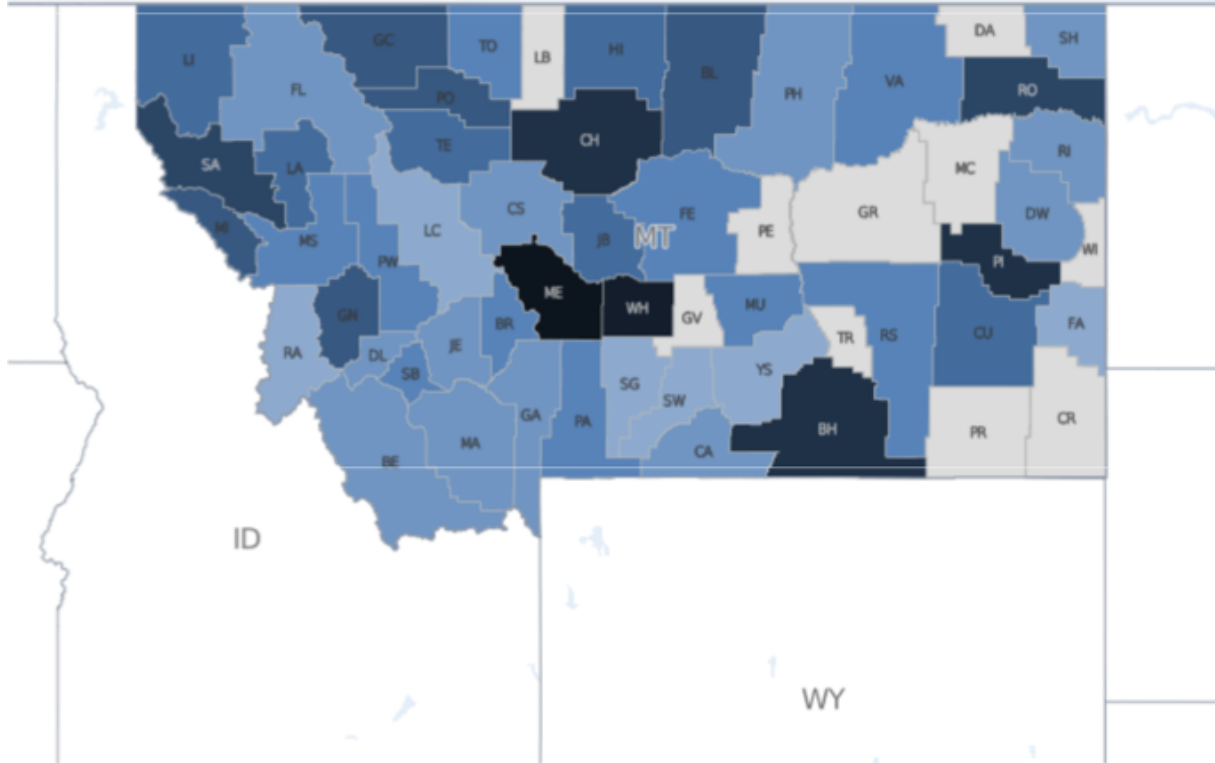


Montana Food Environment

County Health Rankings & Roadmaps

Building a Culture of Health, County by County

A Robert Wood Johnson Foundation program



HEALTH FACTORS

FOOD ENVIRONMENT INDEX

Summary Information

Range in Montana (Min-Max):	2.9-8.5
Overall in Montana:	7.2
Top U.S. Performers:	8.4 (90th percentile)

BEST  WORST MISSING 



Montana Food Environment

County Health Rankings & Roadmaps

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HEALTH FACTORS FOOD ENVIRONMENT INDEX

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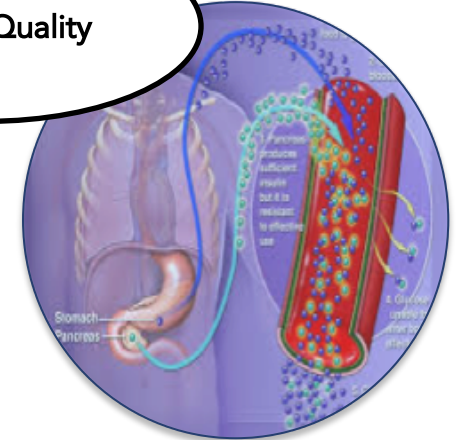
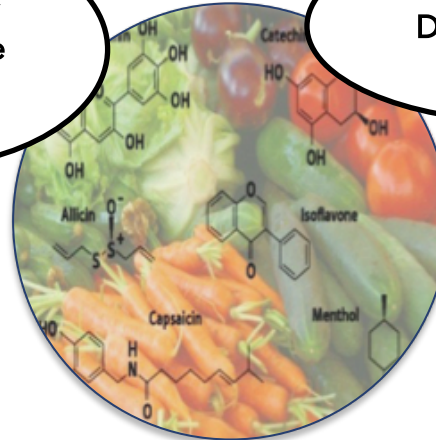
Montana Food Environment

Urban

Rural

Availability
Affordability
Convenience
Desirability
Quality

Dietary Quality



Specific Aims

- (1) Assess disparities in food environments
- (2) Evaluate the impact of foods selected in the food environment on dietary quality
- (3) Apply findings to design and implement interventions to improve dietary quality through participatory approaches
- (4) Assess the interactive effects interventions on food, food environments, and health
- (5) Identify effective policies and influence their implementation for improved food, food environments, and health outcomes



MEASURES

Food Environment

Validated Survey Measures

Quality Testing

Validated Nutrient Index Scores

Foods

Food Waste

Individual Dietary Intake

Qualitative Interviewing

Health

Food Security

Body Mass Index

Chronic Diseases

Secondary Data



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(1) Assess disparities in food environments

(2) Evaluate the impact of foods selected in the food environment on dietary quality

(3) Apply findings to design and implement interventions to improve dietary quality through participatory approaches



MEASURES

Food Environment

Validated Survey Measures

Quality Testing

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Food Waste

Individual Dietary Intake

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Chronic Diseases

Secondary Data

Characterize the Food Environment

Method: Nutrition Environment Measures Survey for Stores

Measure Complete

Nutrition Environment Measures Survey (NEMS)
Measure #1: MILK

Rater ID: Store ID: -=-

Date: // Grocery Store Convenience Store Other
Month Day Year

Marking Instructions

Please use a pencil or blue or black ink. Correct ● Incorrect ⊗ ⊘ ⊙ ⊚

A. Reference Brand

1. Store brand (preferred) Yes No

2. Alternate Brand Name:

Comments: _____

B. Availability Comments: _____

1. a. Is low-fat (skim or 1%) available? Yes No

b. If not, is 2% available? Yes No NA

2. Shelf space (measure only if low fat milk is available)

Type	Pint	Quart	Half gallon	Gallon
a. Skim	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
b. 1%	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
c. Whole	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>



Characterize the Food Environment

Findings: Significant differences in NEMS–S scores for quality of fruits and vegetables

Availability, Price, and Quality of Fruits and Vegetables in 12 Rural Montana Counties, 2014

Carmen Byker Shanks, PhD; Selena Ahmed, PhD; Teresa Smith, PhD;
Bailey Houghtaling, BS; Mica Jenkins, BS; Miranda Margetts, MS, LLM;
Daniel Schultz, BS; Lacy Stephens, BS

Table 2. Analysis of Variance of NEMS–S Scores for Fruits and Vegetables by County Rurality Measured by 2013 Rural Urban Continuum Code (n = 20), Study on Availability, Price, and Quality of Fruits and Vegetables, Montana, 2014

RUCC ^a	NEMS–S Score, Mean (SD)			
	Total ^b	Availability ^c	Price ^d	Quality ^e
3	28.7 (7.4)	22.7 (2.5)	3.7 (4.7)	5.7 (0.6)
6	28.2 (5.5)	18.5 (5.2)	3.7 (2.5)	6.0 (0)
7	14.7 (17.5)	9.0 (11.5)	2.0 (3.5)	3.7 (3.2)
8	25.5 (4.7)	19.5 (2.6)	2.5 (1.3)	3.5 (2.6)
9	21.8 (2.2)	15.8 (4.1)	2.5 (3.0)	3.5 (1.3)



Characterize the Food Environment

Method: The Produce Desirability Tool (ProDes)



Montana State University Food and Health Lab Produce Desirability (ProDes) Tool

INSTRUCTIONS

Rank the sensory desirability of each sample produce item on a scale from 0 to 6.

0 = Not Desirable and 6 = Most Desirable

The ProDes Tool asks users to assess desirability of fruits and vegetables based on five observational sensory measures:

overall desirability
visual appeal
touch and firmness
aroma
size

Indicate your ranking by circling the appropriate number for each sample item.

1. OVERALL DESIRABILITY

Overall, **how desirable** is this fruit compared to your perception of a high-quality fruit?

Apple # 1	0	1	2	3	4	5	6
Apple # 2	0	1	2	3	4	5	6



Characterize the Food Environment

Findings: Total ProDes Score and Rurality

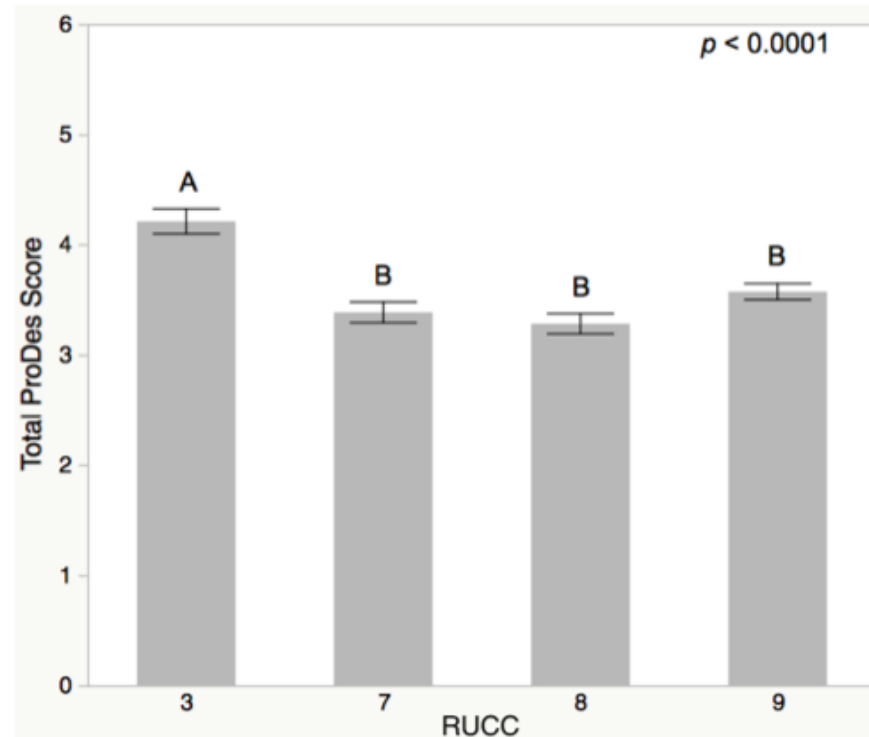
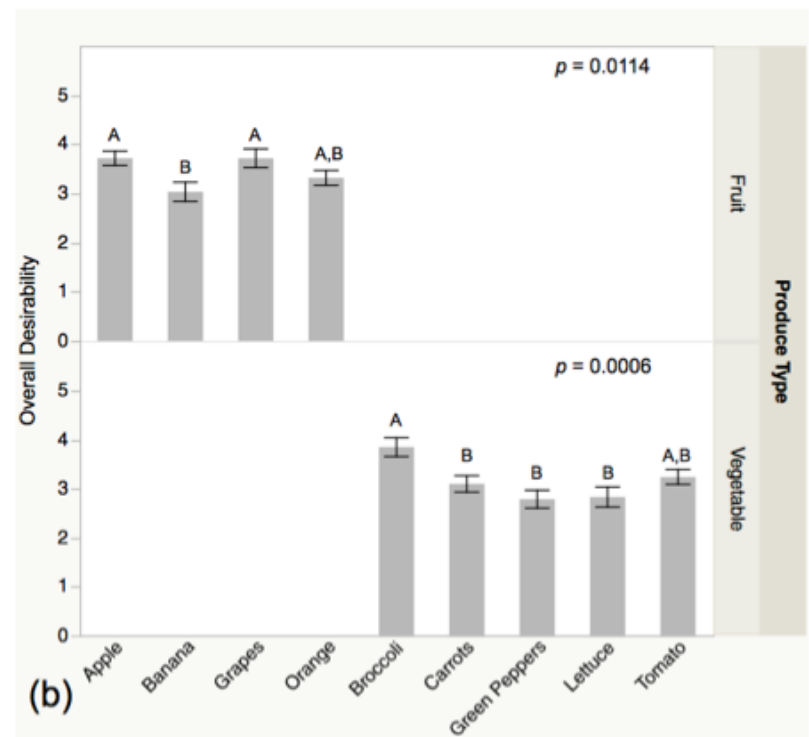
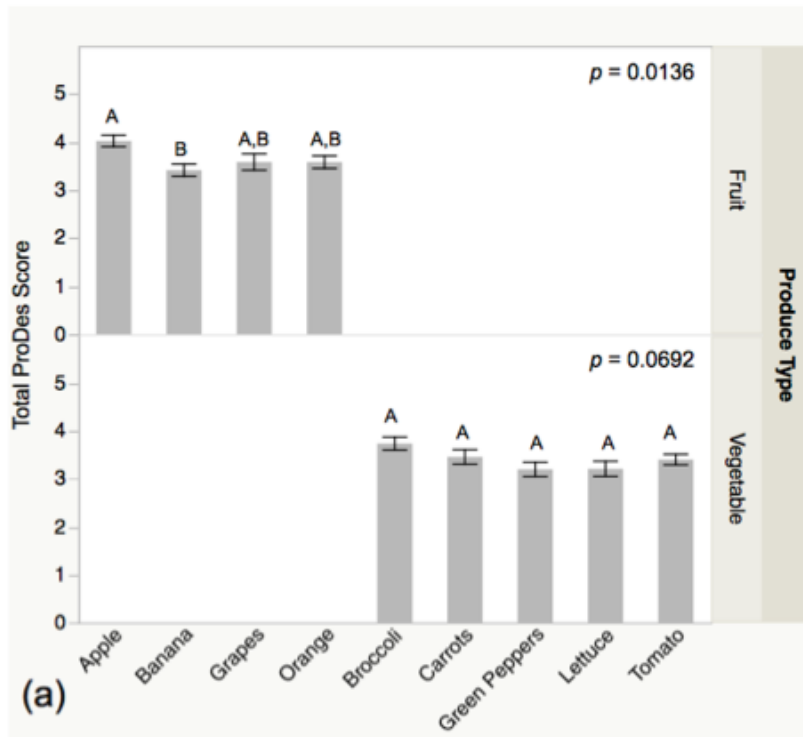


Fig. 2 Total ProDes scores by Rural to Urban Continuum Code (RUCC). Analysis of Variance found significant differences in the means Total ProDes scores on the 7-point scale on the basis of rurality as determined by the USDA RUCC. RUCC ranges from 1 through 3 are classified as metro (urban) and 4 through 10 are classified as non-metro (rural). RUCC levels not connected by the same letters in the graph have significantly different means while RUCC levels that have different letters above the bar in the graph are statistically different. Each bar is constructed using one standard error from the mean

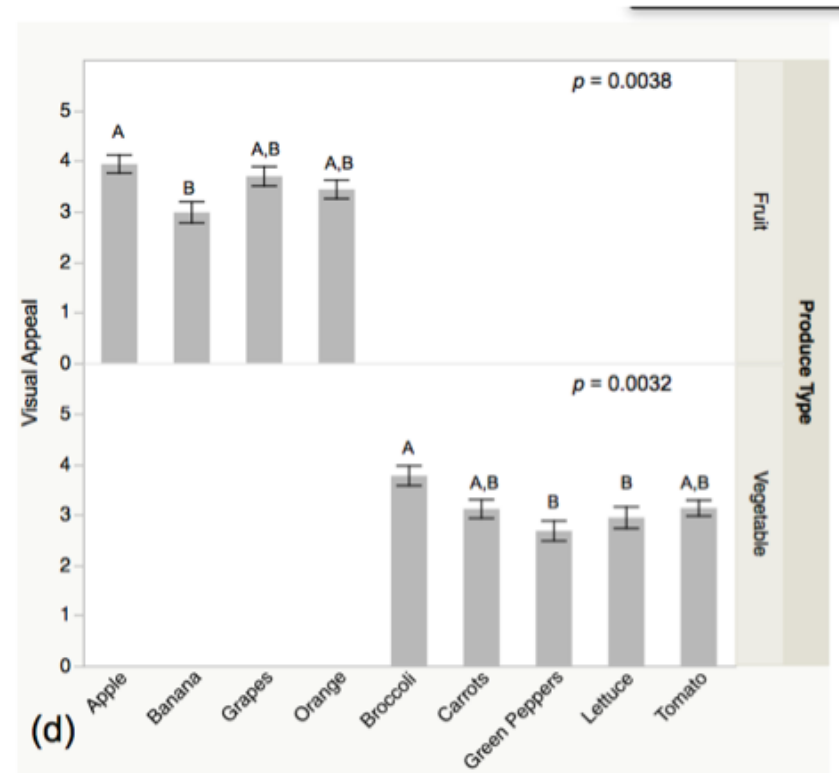
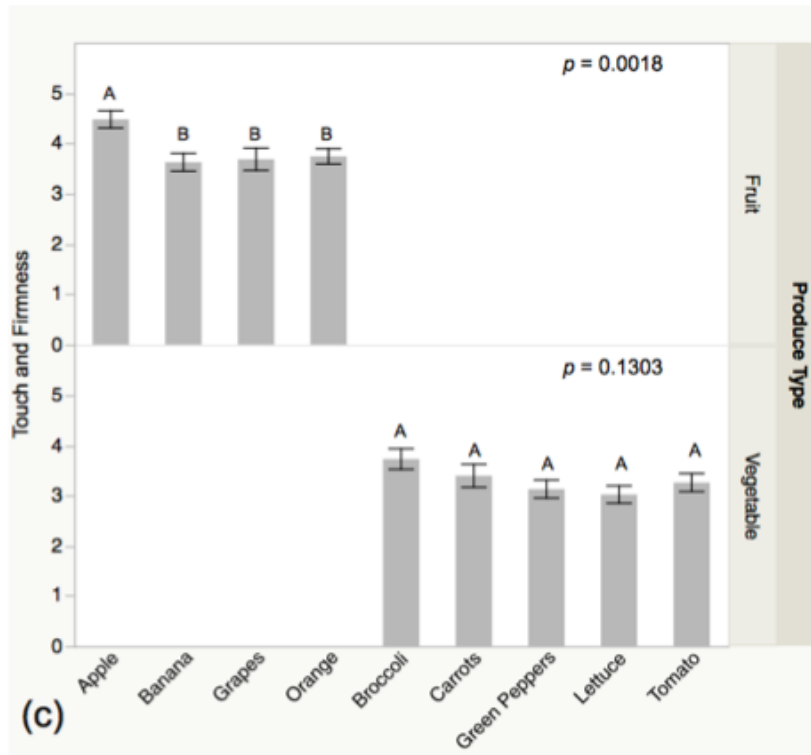
Characterize the Food Environment

Findings: Total Pro Des Score , Overall Desirability for Fruits and Vegetables



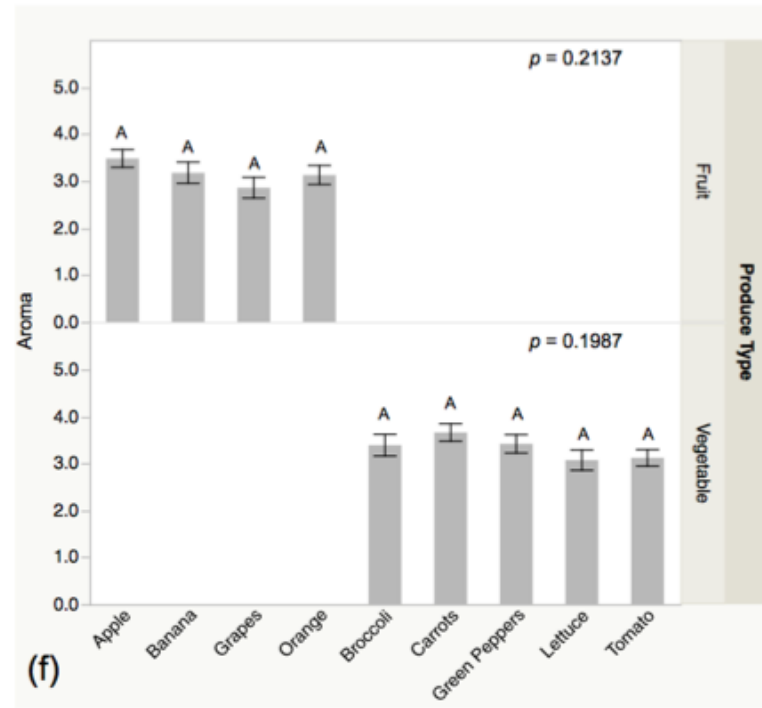
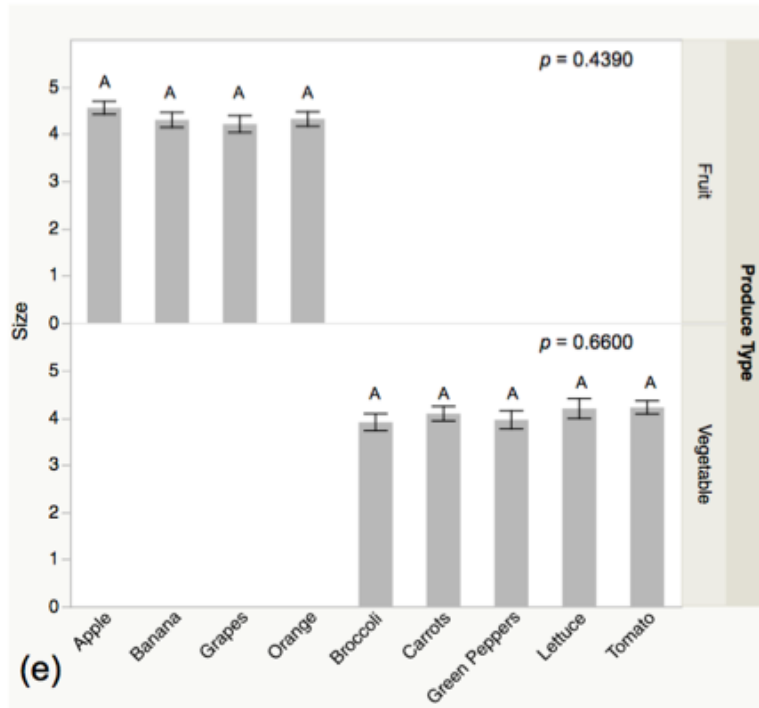
Characterize the Food Environment

Findings: Touch and Firmness and Visual Appeal for Fruits and Vegetables



Characterize the Food Environment



Findings: Size and Aroma for Fruits and Vegetables



Characterize the Food Environment

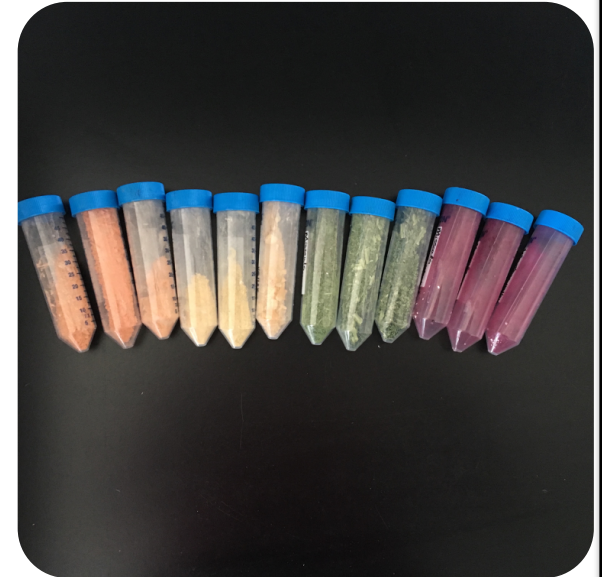
Method: Total Phenolic Concentration as a Measure of Produce Quality

Quality of Vegetables Based on Total Phenolic Concentration Is Lower in More Rural Consumer Food Environments in a Rural American State

Selena Ahmed *  and Carmen Byker Shanks 



Spectrophotometric Folin-Ciocalteu reagent method



Characterize the Food Environment

Phenolic Compounds in Food

An Overview

Chi-Tang Ho

Phenolic compounds including simple phenols and phenolic acids, hydroxycinnamic acid derivatives and flavonoids are bioactive substances occurring widely in food plants. Phenolic compounds are closely associated with the sensory and nutritional quality of fresh and processed plant foods. The enzymatic browning reaction of phenolic compounds, catalyzed by polyphenoloxidase, could cause the formation of undesirable color and flavor and the loss of nutrient in fruits and vegetables. Many phenolic compounds in plants are good sources of natural antioxidants. It is a great interest in recent years that many phenolic compounds in foods have inhibitory effects on mutagenesis and carcinogenesis.

Characterize the Food Environment

“The phenolic class of phytochemicals has been identified to play an important role in FV quality through an influence on flavor, appearance, health-promoting attributes, and stability.”

Example: anthocyanins
(Ahmed and Byker Shanks, 2017)



Characterize the Food Environment

Findings: FV Total Phenolic Scores and Rurality

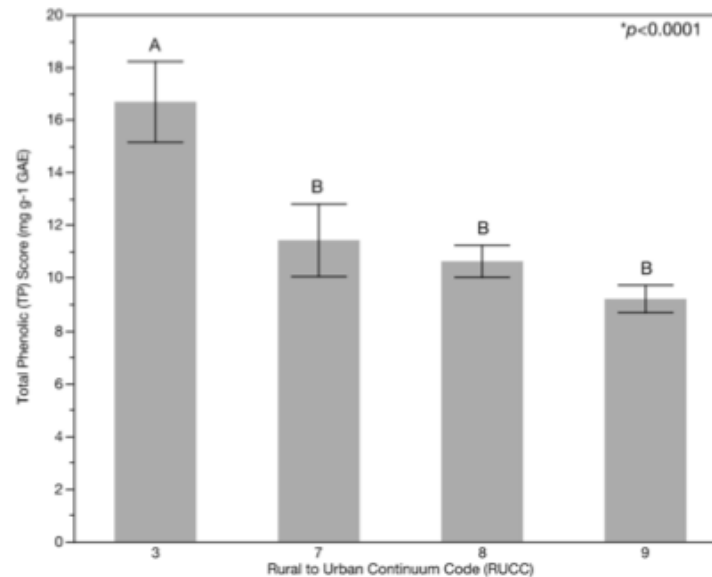


Figure 1. Variation of combined fruit and vegetable (FV) quality based on FV total phenolic (TP) scores with rurality. FV quality as determined by FV total phenolic (TP) scores is lower in more rural areas (higher rural urban continuum codes (RUCC) represent more rural areas). RUCC codes that have the same letter (A or B) above the standard error bar in the graph show no statistical difference while RUCC codes that have different letters above the bar in the graph are statistically different. Each error bar is constructed using one standard error from the mean.



Characterize the Food Environment

Findings: Vegetable Total Phenolic Scores and Rurality

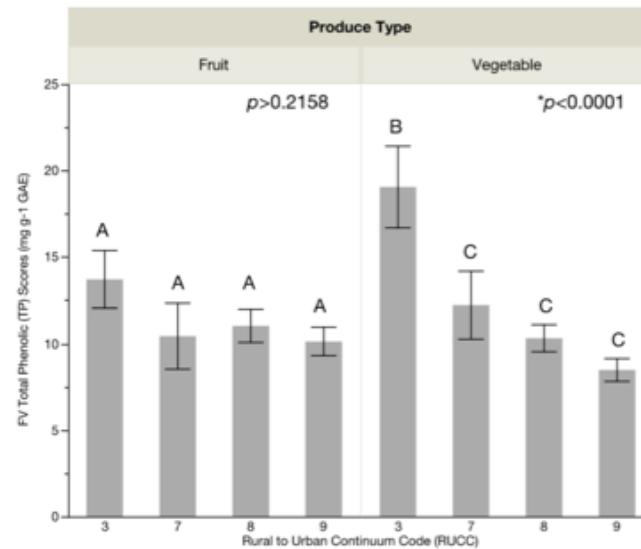


Figure 2. Variation of fruit quality and vegetable quality based total phenolic (TP) scores with rurality. No significant difference was found in fruit quality based on TP scores with rurality. Vegetable quality as determined by vegetable total phenolic (TP) scores is lower in more rural areas (higher rural urban continuum codes (RUCC) represent more rural areas). RUCC codes that have the same letter (A or B) above the standard error bar in the graph show no statistical difference while RUCC codes that have different letters above the bar in the graph are statistically different. Each error bar is constructed using one standard error from the mean.



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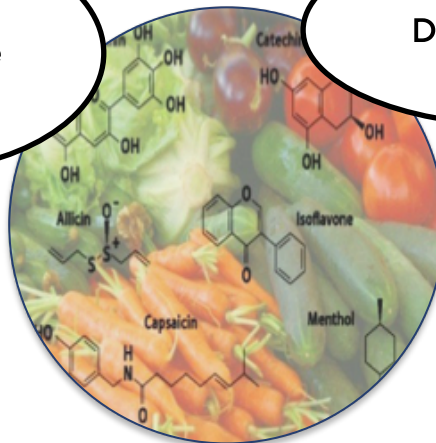
Food and Health in the Food Environment Context of the Montana Food Environment

Urban

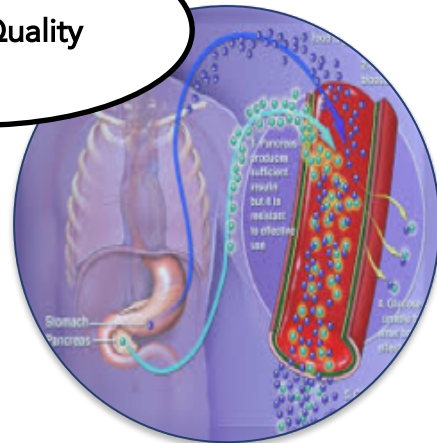
Rural



Availability
Affordability
Convenience
Desirability
Quality



Dietary Quality



Eat Fresh and Local at Commodities

(Food Distribution Program on Indian Reservations (FDPIR))



Photo credit: Bozeman Community Food Coop

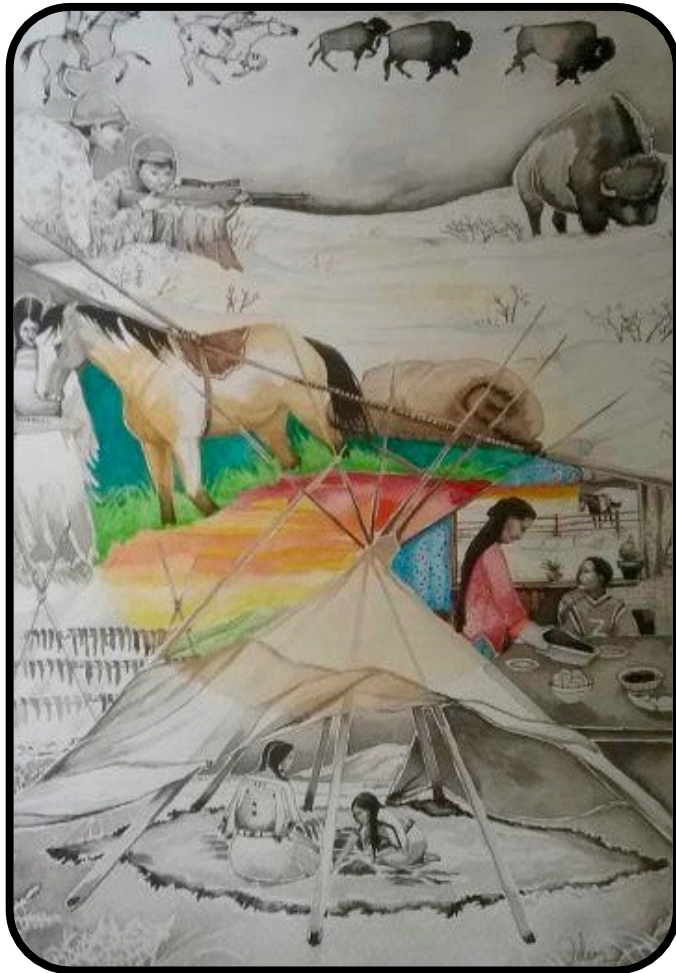
Fruits and
Vegetables

Skill
Building

Nutrition
Education



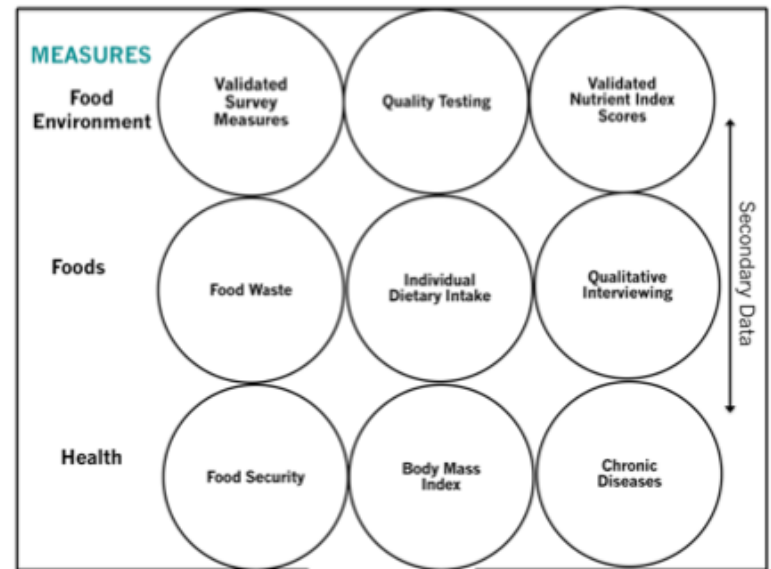
Findings



Food Security

Body Mass
Index

Chronic
Diseases



- (1) Understand the mechanisms that produce nutrient dense food choices, healthy food environments, and positive health outcomes.
- (2) Establish evidence based interventions to be utilized across communities that simultaneously improve food, food environments, and health outcomes.
- (3) Identify effective policies and influence their implementation for improved food, food environments, and health outcomes.



The Future of Food Environments



Let's Collaborate

cbykershanks@montana.edu



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