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INFLUENCERS AND BARRIERS TO CONSUMPTION OF HEALTHFUL DIETS IN
RURAL YOUTH IN CONTEXT OF THE BIOECOLOGICAL MODEL

BY

MEGAN BREN

A thesis submitted in partial fulfillment of the requirements for the

Master of Science

Major in Nutrition, Exercise and Food Science

Specialization in Nutritional Sciences

South Dakota State University

2016

INFLUENCERS AND BARRIERS TO CONSUMPTION OF HEALTHFUL DIETS IN RURAL YOUTH IN
CONTEXT OF THE BIOECOLOGICAL MODEL

This thesis is approved as a creditable and independent investigation by a candidate for the Master of Science in Nutrition, Exercise, and Food Science degree and is acceptable for meeting the thesis requirements for this degree. Acceptance of this does not imply that the conclusions reached by the candidates are necessarily the conclusions of the major department.

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ABSTRACT

INFLUENCERS AND BARRIERS TO CONSUMPTION OF HEALTHFUL DIETS IN
RURAL YOUTH IN CONTEXT OF THE BIOECOLOGICAL MODEL

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The purpose of this study is to determine influencers and barriers to healthful dietary intake in rural youth in context of the bioecological model. Four focus groups as part of Ignite, a tri-state, five-year, community based participatory research (CBPR) intervention were conducted with 6th to 8th grade adolescents from an economically disadvantaged community of rural South Dakota. Results were categorized into the context of the bioecological model. Within the model, the process, person, context and time (PPCT) design with the three types of personal characteristics were used to describe the framework in which the systems are embedded. Focus group content themes were then categorized into the appropriate systems within the bioecological model. Focus group results show that the top attributes when making a food choice are taste, quick, convenient, appearance, and craving. The results from the focus group also indicate that adolescents have adequate knowledge on healthy and unhealthy foods. Adolescents desire to have more input on decisions made in their immediate environment. Barriers to healthy food consumption include lack of convenient, prepared, tasteful choices in their environment. Interventions focusing in improving healthful food consumption in adolescents need to include environmental and policy changes in the school and community food systems. Interventions should reflect the translation of knowledge into healthy behavior through environment and policy.

CHAPTER 1

INTRODUCTION

In the past two decades the prevalence of childhood obesity has significantly increased worldwide.¹ In the United States, one out of every third child is considered overweight or obese.¹ Childhood obesity continues into adulthood increasing the risk of developing diseases like diabetes and cardiovascular diseases.² Childhood obesity prevention is paramount because it is more difficult to change habits formed over a long period of time.²

Factors that contribute to childhood obesity include genetics, nutrition, exercise, and the environment.² There is a growing consensus among researchers that there is a need for sustainable interventions using a multi-level community based model⁴. Multi-level interventions that focus on the environment and policy may be more effective than individually focused interventions.³ A multi-level approach to obesity is designed to change the way people live and work to support healthier environments.⁴

In order to understand this phenomenon the bioecological theory and its model have been used widely in research as framework for interventions using a multi-level lifestyle change for communities.^{2,5,6} Studies using the bioecological model as framework for lifestyle interventions hold promise for developing effective childhood obesity interventions in understudied and rural communities.^{5,6}

The ecology of human development is the scientific study of growing adolescents and their immediate systems that show a direct effect on youth development.⁷ The model is affected by the various relationships between these systems, and by the larger contexts in which the systems are embedded.^{2,4} The model's systems include the

individual/microsystem, mesosystem, exosystem, macrosystem and chronosystem.

Factors within these systems that affect childhood obesity are the child's characteristics, the family and school environment, and policy.^{2,4}

The individual is defined as the child's demographics such as age, sex, and ethnicity.⁷ The individual is found in the microsystem and the system is defined as the child's immediate surroundings including family, school, peer, and friends.⁸ The mesosystem is the child's connection between two or more subjects in the microsystem that does not involve the individual themselves such as the interaction between the parents and school, peers and school, or family and healthcare system.⁸ The exosystem is the system that has an effect on the individual but does not have direct contact with the individual; which includes parent's job, environmental barriers, policy, school policy, marketing, and advertising.⁸ Macrosystem is the outer level and has indirect influence on the individual's development such as culture, values, customs, and laws.⁸ Chronosystem is defined as time and the physiological and environmental changes that occur with aging; this includes the era of the childhood obesity epidemic in America.⁸

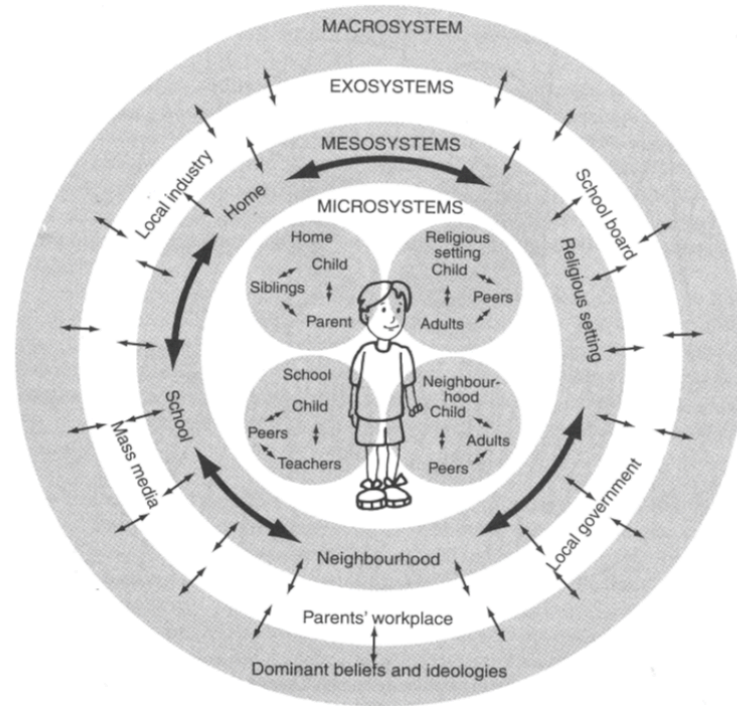


Figure 1. The ecological approach, which hypothesizes the layers of influence on a young child's development. (Picture scanned from Penn, H. 2005. Understanding early childhood education, Issues and controversies).⁹

The bioecological model is the framework in which we describe the results from the focus groups. A model that shows the impact of a individual's biology and connection between the environment and a child's development.⁷ There are four defining properties of the bioecological model: process, person, context, and time (PPCT).⁷ The PPCT framework helps differentiate and cateroize the various factors of an individuals development. The *process* is the core of the model demonstrating the interactions between an adolescent and their environment.⁷ Also referred to as *proximal processes*, defined as the primary mechanisms producing human development that occur on a regular basis over an extended period of time.⁷ However, the characteristics and genetics of a *person* influence the interactions in the proximal process and how the person

interprets the *context*, also known as the environment of the process.⁷ The *time* periods is where the development takes place.⁷

The *person* is the most important aspect of influencing development. The three types of person characteristics that affect the proximal processes including: dispositions, resources, and demand.⁷ First, *dispositions* (temperament, personality) are the proximal processes or environment in which interactions will take place.⁷ Second, the person's ability, experience, knowledge and skills are called *resources* that are essential for the functioning of proximal processes.⁷ Lastly, *demand* to encourage or discourage actions from the social environment that can promote or disrupt the action of proximal process.⁷ A combination of all three aspects of the person decipher their development in the proximal processes.⁷ The bioecological systems and four defining properties are the framework for defining the adolescent influencers and barriers in this study.

The adolescents in this study are in a rural *context* or environment. Each system (microsystem, mesosystem, macrosystem, exosystem, and chronosystem) within the model provides insight on the impact of the context on an individuals' development.⁷ For example, the prevalence of obesity is higher in rural communities when compared to urban due to barriers such as access to healthful food and physical activity opportunities.¹⁰ Although genetics and behavioral influence may cause a predisposition to obesity, environmental factors strongly influence adolescents through energy, nutrient, and dietary intake.¹¹ Adolescents food and exercise characteristics may be influenced through parent modeling, school and peer environment, and societal influences such as culture, religious practice, and media.¹¹ Effective prevention strategies need to incorporate the individual, family, social, and community structure. Therefore, the

purpose of this study is to determine influencers and barriers in rural youth consumption of healthful diet in context of the bioecological model.

CHAPTER 2

LITERATURE REVIEW

In 2013 there was an estimated 42 million overweight children under the age of five world wide.¹² Childhood obesity in the United States has increased significantly in the past three decades and now effects one out of every third child.¹ Overweight and obese children are more likely to be overweight as adults.¹² Overweight children have an increased likelihood of developing diseases like diabetes and cardiovascular diseases at a younger age.¹² Youth today are developing disease earlier than ever before and may be leading to economic consequences in upwards of \$14.1 billion dollars in medical costs annually.¹³

Obesity is a largely preventable disease causing detrimental effects on the economy and health of individual's worldwide.¹² The facts indicate that decreasing childhood obesity needs to be a high priority. Therefore, the World Health Organization (WHO) has declared childhood obesity as a global epidemic and one of the most serious challenges of the 21st century.¹²

The purpose of this literature review is to summarize the importance of community based, multi-level interventions that utilize the bioecological model theory. The theory is used to establish influencers and barriers in rural youth consumption of healthful diets.

Bioecological Model

No single factor has been identified in research showing a significant difference in long term child weight management.⁸ However, a study by Wifley and colleagues reports the use of the bioecological model as framework to implement long-term healthful

lifestyle interventions.¹⁴ The use of the bioecological model provides the basic framework for directing future research in finding solutions for childhood obesity in understudied populations.^{6,15}

In this paper, the ecology of human development is the scientific study of growing adolescents and their immediate systems that show a direct effect on youth development.⁷ The adolescents in the bioecological model are affected by the various relationships between these systems, and by the larger contexts in which the systems are embedded.^{2,4} The model's systems include the individual/microsystem, mesosystem, exosystem, macrosystem and chronosystem.¹⁶ Factors within these systems that affect childhood obesity are the child's characteristics, the family and school environment, and policy.^{2,4}

The individual is defined as the child's demographics such as age, sex, and ethnicity.⁷ The individual is found in the microsystem and is defined as the child's immediate surroundings including family, school, peer, and friends.⁸ The mesosystem is the child's connection between two or more subjects in the microsystem that does not involve the individual, such as the interaction between the parents and school, peers and school, or family and healthcare system.⁸ The exosystem is the system that has an effect on the individual but does not have direct contact with the individual; which includes parent's job, environmental barriers, policy, school policy, marketing, and advertising.⁸ Macrosystem is the outer level and has indirect influence on the individual's development such as culture, values, customs, and laws.⁸ Chronosystem is defined as time and the physiological and environmental changes that occur with aging; this includes the era of the childhood obesity epidemic in America.⁸

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The *person* is the most important aspect of influencing development, there are three types of person characteristics that affect the proximal processes including: dispositions, resources, and demand.⁷ First, *dispositions (temperament, personality)* set up the proximal processes or environment in which interactions will take place.⁷ Second, the person's ability, experience, knowledge and skills are called *resources* that are essential for the functioning of proximal processes.⁷ Lastly, *demand* to encourage or discourage actions from the social environment that can promote or disrupt the action of proximal process.⁷ The combination of all aspects of the person decipher the development of the proximal processes.⁷ The bioecological systems and four defining properties are the framework for defining the adolescent influencers and barriers in this study.

The bioecological framework shows the connection between relationships among the systems that impact a child's development and health.¹⁷ This framework is important to aid in the development of sustainable interventions that focus on the connection between adolescents and their environment.^{5,17,18}

Community Based Participatory Research

Community based participatory research (CBPR) combines systematic review, community participation, and interventions to address health problems collaboratively.¹⁹ CBPR includes community member participation in defining the environmental and policy issues, interpreting the data findings, and implementing an intervention that is deemed appropriate within their community.¹⁹ Community members assist researchers in discovering the communities needs and wants, also revealing preexisting solutions that the research may not have known of otherwise.²⁰ The CBPR methodology allows the researcher to explore each system within the bioecological model.²¹ The use of CBPR is important in understanding the complexity of childhood obesity in underserved communities to insure sustainable long-term policy and environmental changes.^{19,22}

Many recent studies conducted on the prevention of childhood obesity focus on single system interventions like school policy.¹ For example, Masse and colleagues conducted a study with semi-structured interviews in 50 schools on the effectiveness of public policy targeting school settings.²³ The study found decreased revenues from school lunches due to students going off site for unhealthy foods. Also, school officials found it difficult to implement policy guidelines per lack of understanding of the guidelines.²³ Finally, the results of the study found the policy was lacking support from school staff and students to promote an environmental change.²³ There is insufficient evidence within the literature that school-based, nutrition-education interventions alone are effective in preventing childhood obesity.²⁴ However, research shows that using community and environmental interventions may create sustainable interventions for healthy lifestyle change.^{1,20,25}

Shape up Somerville, a CBPR study included children grades 1 to 3 in three Massachusetts's communities that looked at specific changes before, during and after school environments and healthful eating.²⁰ The study found a significant impact on overall overweight/obesity prevention and demonstrated promise for preventing childhood obesity using sustainable, multi level, community-based model and reinforcing the need for policy and environmental interventions.²⁰

A study done by Kemner and colleagues evaluated a program utilizing CBPR; the results showed that with collaborative community efforts there was an increase in implementation of policy, environmental changes, and planning sustainability.²⁵ Instead of taking away the community's power and forcing a lifestyle upon them, the use of CBPR interventions empower the community and children.²⁶ Children often have little power in their own lives, so making children feel empowered to make decisions in their own life can be very fulfilling.^{26,3} Especially during the developmental age of 11 to 13 years when children strive for more independence, autonomy and less parental control.⁴

CBPR gives community members a voice to provide a sense of empowerment in the community and thus enhancing the sustainability of interventions.^{10,25-28} CBPR methodology may also aid in determining specific influencers and barriers to a healthy environment.²⁰ The community members assist in uncovering untapped information and services.²⁰

CBPR assists in identifying influencers and barriers to establish multi-level lifestyle changes in children.² A meta-analysis of 14 articles looked at the effectiveness of physical activity, diet and behavioral treatment as interventions for childhood obesity.¹⁴ The study concluded that interventions that focus on lifestyle changes for prevention of

overweight youth are more effective in treatment of childhood obesity in the short term when compared to information only interventions.¹⁴ The authors also concluded that identifying influencers and barriers to healthful food consumption in overweight youth may assist in establishing long term sustainable lifestyle interventions.¹⁴

The use of CBPR is important in understanding the complexity of childhood obesity and insures sustainable long-term policy and environmental changes.^{19,22} CBPR empowers children with a voice to establish a more effective and sustainable intervention.²⁷ CBPR is one methodology that incorporates these multi-level interventions to specifically accommodate understudied intervention groups.^{20,29}

Rural Environment

Factors that may effect childhood obesity are family and school environment, socioeconomic status, and policies impacting food behavior and physical activity.^{2,4} It is reported that the prevalence of obesity is higher in rural communities when compared to urban and may be attributed to barriers such as access to healthful food and physical activity opportunities.¹⁰

Lobstein and colleagues reported that children residing in rural areas are in need of custom efforts specific to their environment to overcome barriers of childhood obesity.¹ Rural areas have a higher prevalence of obesity when compared to urban areas due to more perceived barriers.¹⁰ Rural areas may have low food availability, limited access to quality healthful food, and fewer opportunities to be physically active.¹⁰ Research shows that children in rural areas perceive healthy food as limited in their community.⁵ In order to decrease barriers children suggest increased availability of healthful foods and access to a community garden.⁵

In a study done by Yousefian and colleagues, many rural areas were defined as having low food availability and considered food deserts.³⁰ Food availability is defined as having retail food outlets that sell quality, affordable and nutritious foods.³⁰ A food desert is defined as communities that have limited access to affordable and healthful quality foods.³⁰ The study found the perception of barriers within these rural community were cost of food, travel, and low food quality.³⁰ Also, adolescents and adults perceive healthy food to be more expensive, including many low income families who believe they can not afford to buy their family healthy meals because of the extra expense.³¹ Thus, the authors recommended that interventions should include multi-level strategies to include policy change to help define the best intervention for a rural community.⁵

Advertising and Marketing

Children today are exposed to a great deal of commercials and advertisements; however, adolescent targeted advertisements are majorily for high sugar, low nutrient dense foods.²⁶ With the advance of technology there may be more chances for marketing exposure to children.¹ One study identified that television viewing was inversely associated with fruit and vegetable intake.³² Food industries that sell high calorie, low nutrient dense foods provide the majority of food based commercial advertising and marketing to children.¹ However, if children were exposed to advertisements of fruits and vegetables this may lower the average individual caloric intake by almost 1800 calories per year.³³

Many company marketing strategies involve text and images directed at children to influence purchases.³⁴ Many high calorie, low nutrient dense foods like cereals and fruit snacks are advertised as “fun foods” by adding a mascot or cartoon character.

However, the same results are shown when fruits and vegetables are advertised as “fun food”.³⁵ Fruits and vegetables with cartoon character media branding increased consumption in children when compared to no branding.³⁶

Grocery stores have a large impact on marketing and purchasing of unhealthy foods and may have a large impact on obesity.³⁴ Grocery and convenient store’s in-store marketing directed at children is of large concern, especially high sugar cereals with mascots.³⁶ Many products targeted at children are also found strategically placed on lower shelves that are closer to eye level with children.³⁴

Children may be able to overcome marketing schemes with the assistance from their parents. An environment of parent-child grocery shopping trips may increase the child’s food interest and help children make better choices when shopping on their own.³⁷ One study reported 50% of children that accompanied their parents while grocery shopping initiated a food request and out of those requests 55% asked for sweets or snacks.³⁷ From those sweets or snack child requests, 47.8% of parents said no by either ignoring the request or explaining why they can not have the item.³⁷ Results shows that interventions using parent-child shopping can be considered a learning opportunity for the child.³⁷

However the research is still unclear if making a policy change intervention including taxing unhealthy food, decreasing amount of allowed high fat and high sugar advertising will be perceived positively by parents, children, and the community.^{33,38}

Focus groups

Research has identified the use of focus groups as an effective method to obtaining adolescent perceived barriers and influencers of healthful food consumption.³⁹

Adolescent perceived barriers to healthful eating are lack of time, availability to healthful foods, cost, convenience, taste, social factors, and lack of concern for the healthful eating recommendations.^{40,41}

According to Croll and colleagues, adolescents have a significant amount of knowledge regarding healthful foods; identifying healthful foods as fruits, vegetables, meat, water, dairy, rice and pasta.⁴⁰ Adolescents perceive unhealthy foods as high-salt, high-carbohydrate and low nutrient dense foods.³⁹

School and School Lunch Policy

As a response to the childhood obesity epidemic there has been many changes made involving school policy.²³ Schools are targeted for policy change because they are the easiest to regulate on a large scale and school lunch provides students with one third of their daily calorie intake.⁴² However, the effectiveness of policy change to increase adolescent fruit and vegetable consumption is greatly dependent on implementation.²³

A study was conducted in 7th-12th grade students to increase convenience, attractiveness, and youth acceptance of fruits and vegetables.⁴³ School lunchroom policies made changes to increase convenience including: placement of fruit next to the cash register, 100% fruit juice next to the ice-cream, salads in see-through to-go containers, and a 'healthy convenience line' that serves healthful foods.⁴³ Changes made to improve attractiveness of fruits and vegetables included: a lunch menu posted with a radiant variety of fruits and vegetables, vegetables with descriptive names, and fresh fruit displayed in attractive bowl or tiered stands.⁴³ To increase the youth acceptance of fruit and vegetable consumption signs were placed around the cafeteria stating: 'last chance for fruit', 'no veggie? How about...?' and verbal prompts made by cafeteria staff, "would

you like to try...?”⁴³ The study found these tactics had a significant increase on students consumption of fruits and vegetables.⁴³

Other ways to make vegetables more attractive, according to Wansink and colleagues, is to give the dish an attractive name.³⁸ Their study found giving vegetables more attractive names doubled the intake of vegetable consumption when compared to a generic name in elementary schools.³⁸ In another study Wansink and colleagues found a 71% increase of apple sales in schools that pre-sliced their apples when compared to whole apples in the control.⁴⁴ The study results showed in a low-cost economical change that increased the consumption of healthful foods and decrease waste in schools.⁴⁴

Adolescent Food Preference & Parent Influence

Adolescent consumption of fruits and vegetables are contributed to psychosocial and environmental factors.⁴⁵ Parents consumption of fruits and vegetables are shown to directly effect the childs’ intake of fruits and vegetables.⁴⁵ There is also evidence that parents nutrition/food knowledge has a direct coorelation with the childs’ consumption of fruits and vegetables.^{32,45}

Home food environment was identified as a major contributor to adolescent consumption of fruits and vegetables.⁴⁶ A supportive home environment with available and prepared fruits and vegetables promote child consumption; although, if the food does not ‘taste good’ to their preference the child may not eat the prepared or available fruit/vegetable.⁴⁶ Taste was identified by children as the number one influencer for the consumption of both healthful and unhealthful foods.⁴⁶ However, in many households parents provide unhealthy food because children prefer the taste.³¹

Taste is shown to have a large impact on unhealthy food cravings; however, perception may be equally as important on food cravings.⁴⁷ A study conducted on adults show that providing negative messaging on unhealthy food actually increased their desire for unhealthy foods.⁴⁷ However, providing both positive and negative messaging on unhealthy food the participants were more likely to avoid the unhealthy options.⁴⁷ Results show the need for an increase in positive messaging on healthful food items than focusing on the negatives of unhealthy food.⁴⁷

The literature review shows the use of a multisystem community-based model to reinforce the need for policy and environmental interventions shows the most promise in the prevention of childhood obesity.^{3,24,25,48} The bioecological framework is vital to aid in the development of sustainable interventions that focus on the connection between adolescents and their environment.^{5,17,18} This study will set the stage for identifying adolescent influencers and barriers to healthful dietary intake in order to develop a sustainable intervention.

CHAPTER 3
MANUSCRIPT
ABSTRACT

The purpose of this study is to determine influencers and barriers to healthful dietary intake in rural youth in context of the bioecological model. Four focus groups as part of Ignite, a tri-state, five-year, community based participatory research (CBPR) intervention were conducted with 6th to 8th grade adolescents from an economically disadvantaged community of rural South Dakota. Results were categorized into the context of the bioecological model. Within the model, the process, person, context and time (PPCT) design with the three types of personal characteristics were used to describe the framework in which the systems are embedded. Focus group content themes were then categorized into the appropriate systems within the bioecological model. Focus group results show that the top attributes when making a food choice are taste, quick, convenient, appearance, and craving. The results from the focus group also indicate that adolescents have adequate knowledge on healthy and unhealthy foods. Adolescents desire to have more input on decisions made in their immediate environment. Barriers to healthy food consumption include lack of convenient, prepared, tasteful choices in their environment. Interventions focusing in improving healthful food consumption in adolescents need to include environmental and policy changes in the school and community food systems. Interventions should reflect the translation of knowledge into healthy behavior through environment and policy.

INTRODUCTION

In the past two decades the prevalence of childhood obesity has significantly increased worldwide.¹ In the United States, one out of every third child is considered overweight or obese.¹ Childhood obesity continues into adulthood increasing the risk of developing diseases like diabetes and cardiovascular diseases.² Childhood obesity prevention is paramount because it is more difficult to change habits formed over a long period of time.²

Factors that contribute to childhood obesity include genetics, nutrition, exercise, and the environment.² There is a growing consensus among researchers that there is a need for sustainable interventions using a multi-level community based model⁴. Multi-level interventions that focus on the environment and policy may be more effective than individually focused interventions.³ A multi-level approach to obesity is designed to change the way people live and work to support healthier environments.⁴

In order to understand this phenomenon the bioecological theory and its model have been used widely in research as framework for interventions using a multi-level lifestyle change for communities.^{2,5,6} Studies using the bioecological model as framework for lifestyle interventions hold promise for developing effective childhood obesity interventions in understudied and rural communities.^{5,6}

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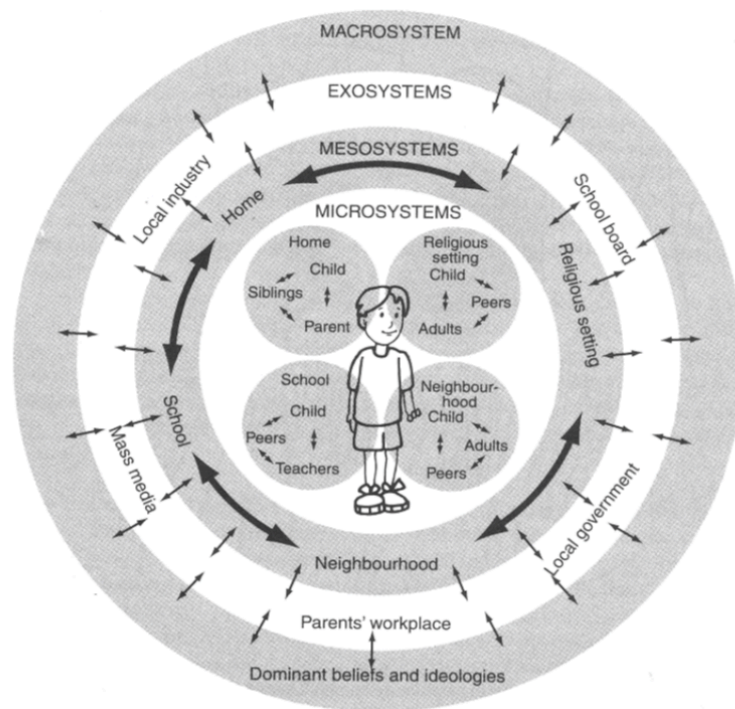


Figure 1. The ecological approach, which hypothesizes the layers of influence on a young child's development. (Picture scanned from Penn, H. 2005. Understanding early childhood education, Issues and controversies).⁹

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The adolescents in this study are in a rural *context* or environment. Each system (microsystem, mesosystem, macrosystem, exosystem, and chronosystem) within the model provides insight on the impact of the context on an individuals' development.⁷ For example, the prevalence of obesity is higher in rural communities when compared to urban due to barriers such as access to healthful food and physical activity opportunities.¹⁰ Although genetics and behavioral influence may cause a predisposition to obesity, environmental factors strongly influence adolescents through energy, nutrient, and dietary intake.¹¹ Adolescents food and exercise characteristics may be influenced through parent modeling, school and peer environment, and societal influences such as culture, religious practice, and media.¹¹ Effective prevention strategies need to incorporate the individual, family, social, and community structure. Therefore, the

purpose of this study is to determine influencers and barriers in rural youth consumption of healthful diet in context of the bioecological model.

METHODS

The data presented in this paper was collected at baseline as part of Ignite, a tri-state, five year, CBPR intervention with local Extension personnel partnering with community steering committees. The group developed obesity prevention programming to 6th to 8th grade youth in communities of minorities and/or economically disadvantaged communities. This paper focuses on the results from one of the rural communities in South Dakota.

Communities who met the standards of “low-income” and/or “minority” definitions established by the research team and Cooperative Extension Services were invited to participate. To be qualified as low income, the community had to meet one of the following qualifications: county/community poverty level was higher than the state average, county/community percentage of those who qualify for free or reduced-priced school lunches was higher than the state average, or the majority (51 percent and above) of county/community residents qualified for free or reduced priced school lunches. “Minority” definitions were met if the county/community had higher than the state average of non-Caucasian residents or the majority of the consisted of non-Caucasian residents.

The study participants were recruited from respective schools within the selected communities. Participants include assenting 6th to 8th grade youth with parental consent. Institutional Review Board (IRB) approval and subject consent/assent was obtained in accordance with the policy statements of the Human Subjects Committees at South Dakota State University (SDSU).

Study personnel (Extension specialist (MZ)), youth development specialists (AMD), and state coordinator (KK) conducted four focus groups during the school day. The focus groups had 10, 8, 8, and 6 adolescents per group with a total of 32 participants, 16 females and 16 males. Participants were queried for their top 3 attributes that are important when making a food choice, what they like to eat, why they like these foods, what they think makes fruits and vegetables healthy, if they wanted to eat more fruits and/or vegetables could they do it, and what school can do to help students eat healthier. Focus groups were audio recorded and transcribed. The transcripts were coded independently by two researchers and coded to consensus for content analysis using the Nvivo software (QRS International, 2015).

Results were categorized into the context of the bioecological model; categorization of the systems was done by MB and checked by AMD (expert). In the results the PPCT framework was used to distinguish the various factors that influenced the adolescents. Thus, three types of person characteristics that affect the proximal processes (dispositions, resources, and demand) were used as a category of influencers. Adolescent focus group responses are labeled person or youth characteristic because they are based from bioecological resources (genetics, experience & knowledge). Focus group content themes were then categorized into the appropriate system within the bioecological model: individual (child), microsystem, mesosystem, exosystem, macrosystem, and chronosystem.

RESULTS

Adolescent Food Preference Influencers

Adolescents reported taste, convenience, quick, craving and appearance as influencers of food choices (Table 1). Foods made available by parents and school were identified as factors that influence adolescent consumption of healthful foods.

Adolescents reported their parents do the majority of the grocery shopping.

Influencers of adolescent food preference in the exosystem include: local industries, media, school food policy, accessibility of food in restaurants and grocery stores. 'Ken's' is a local grocery/convenience store located across the street from the school. Adolescents reported eating high calorie, fried food options from 'the warmer' for a 'quick and convenient' meal or snack.

When adolescents were asked why they like these (unhealthful) foods adolescents responded, "they have a dollar menu" and "cheap and fast". However, when asked "why don't they like fruits and vegetables" a common theme was expensive, "fresh fruit is really expensive". Results show fast food restaurants use the "dollar menu" as a marketing strategies to influence adolescent food preference.

Many of these factors can be contributed to the chornosystem with this day in age focus on how to get information faster, meals faster, and everything 'on-the-go'. These results show that having convenient and quick meals and snacks are important to the children of this generation. Adolescent's definition of convenient is, "...means it's right in the palm of your hand" and their definition of quick is, "...is something you can whip up fast."

Table 1. Adolescent food preferences in context of the bioecological model

Question	Theme	Adolescent quotes	PPCT – Person/Youth Characteristic	Systems
Attributes that are important when making food choices	Taste, quick, convenient, appearance, and craving	<p>“Taste, quick, and convenient”</p> <p>“Taste, appearance and convenient”</p> <p>“Taste, quick, and craving”</p> <p>“Taste, craving and appearance”</p>	Disposition & Demand	<p>Microsystem: Personal preference, food made available by parents, food made available at school</p> <p>Mesosystem: Parents shop at grocery store</p> <p>Exosystem: Local grocery stores, media promotes convenient and fast food</p> <p>Chronosystem: Era of ‘on-the-go’ foods</p>
Things the youth like to eat	High calorie, high sodium foods, fast food	<p>“Big Mac”</p> <p>“Chicken Nuggets”</p> <p>“Pizza”</p> <p>“Spaghetti”</p> <p>“Definitely tacos”</p> <p>“Cheeseburgers”</p> <p>“Taco Tuesday”</p> <p>“99 cent nugget Tuesday”</p>	Disposition	<p>Microsystem: Personal preference, parents dietary intake, food made available by parents</p> <p>Exosystem: Accessibility of food and restaurants, media promotes convenient and fast food</p> <p>Chronosystem: Era of ‘on-the-go’ foods</p>
	High sugar food	“Poptarts”	Disposition	<p>Microsystem: Personal preference, parents dietary intake, food made available by parents</p>

				Exosystem: Accessibility of food Chronosystem: Era of 'on-the-go' foods
	Energy drinks	"Energy drinks"	Disposition	Microsystem: Personal preference, parents dietary intake, food made available by parents Exosystem: Accessibility of food
	Home prepared meals	"I live on a farm so we usually have like nice thick hamburgers, and then you go to a fast food place and it's like not the same"	Disposition & Resources	Microsystem: Personal preference, parents dietary intake, food made available by parents
	Fruit, vegetables and raw vegetables	"I enjoy vegetables" "I love asparagus it's so good" "Yeah fruits are more sweet" "Yeah a lot of people like fruit" "I enjoy broccoli but a lot of kids don't" Vegetable preference: "I would have to say just straight up"	Disposition	Microsystem: Personal preference, parents dietary intake, food made available by parents, food made available at school Exosystem: Accessibility of food in grocery stores
Why they like these foods	Tastes good, appearance	"Taste and look good"	Disposition	Microsystem: Personal preference, parents dietary intake
	Smell	"Smells good"	Disposition	Microsystem: Personal preference
	Easy	"They're easy to	Demand	Microsystem:

		make you only have to take the wrapper off”		Personal preference, food made available by parents, adolescents and grocery store Mesosystem: Parents interaction at the grocery store Chronosystem: Era of processed foods
	Quick, travels well	“Usually we’re on the go and we want it to be quick”	Demand	Microsystem: Personal preference, child and school, child and activities Chronosystem: Processed food
	Preparation	“Will eat vegetables... when my mom makes them”	Resources & Demand	Microsystem: Personal preference, food made available by parents
	Cheap	“They have a dollar menu” “Cheap and fast” “Sometimes money, instead of going out to eat somewhere expensive, sometimes its just like we go to like places where we can get a cheap slice of pizza or hamburger or something”.	Disposition & Demand	Microsystem: Personal preference Exosystem: Media showing fast food as cheap food, food policy Macrosystem: Fast food beliefs
	Unhealthful food tastes better	“I think the fact that you know they’re not healthy for you makes you think they taste a lot better then they actually do”	Disposition	Microsystem: Personal preference Macrosystem: Fast food beliefs

Adolescent Food Knowledge

Adolescents perceive what makes fruit and vegetables healthy is ‘how the food is prepared, have nutrients, and natural/no additive/no preservatives’ (Table 2). Fresh is perceived as healthy, “especially out of my mother’s garden”. Within the microsystem the participants know something is healthy by what they have heard and reported they receive most nutrition information from their parents. Adolescents rely on their parents and peers for nutrition information, “no preservatives, my cousins are big on that”.

Adolescents correctly identify healthy and unhealthy foods. Adolescents identify fast food as ‘not good for them, but they eat it anyway.’ However, participants stated they do not like to eat out all of the time (Table 2).

Table 2. Adolescent food knowledge in context of the bioecological model

Question	Theme	Adolescent Quote	PPCT – Person/Youth Characteristics	System
What they think makes fruits and vegetables healthy	How it is prepared	“Its the way it’s cooked”	Resources (Knowledge and skill)	Microsystem: Youth knowledge
	Nutrients	“Because you can make something, like a really healthy vegetable, unhealthy just by adding a bunch of ingredients to it” “Vitamins found in them” “Not as much like fat “ “Cause the nutrients in them”	Resources (Knowledge and skill)	Microsystem: Youth knowledge
	Nutrients	“I cant think of biology right now but it is unsaturated”	Resources (Knowledge and skill)	Microsystem: Youth knowledge Exosystem: School education (curriculum)
	They are natural, no additives or preservatives	“And how it’s processed, before it gets to stores and stuff” “Because they’re a natural plant” “Not as many like sugars or preservatives in them” “They don’t have anything like modified in it”	Resources (Knowledge and skill)	Microsystem: Youth knowledge
	What they’ve heard	“Parents say they are” “No preservatives, my cousins are big on that”	Resources (Knowledge and skill)	Microsystem: Youth knowledge, parent and child interaction, family and child interaction

Adolescent Food Strategies for Healthful Eating

Adolescents identified strategies to help their friends eat healthy (Table 3).

Adolescent strategies on how the school can help students eat healthier include engaging the student council on policy. Adolescents want involvement in the policy process and currently have limited control in their school food environment. Adolescents say an increase in the variety and appearance of school lunch would increase the consumption of healthy food items.

Adolescents were also concerned about the quantity of food received at lunch and desired more food at school lunch. At the time of the focus groups the school lunch had changed their policies to be in compliance with the meal pattern requirements for USDA's National School Lunch Program. These standards required more vegetables to be served and students had to pay for a second portion of the entrée.⁴² Prior to these changes students were receiving second portions without additional charges.

Table 3. Adolescent food strategies for healthful eating in the bioecological model

Question	Theme	Adolescent Quote	PPCT – Person/Youth Characteristics	Systems
If they wanted to eat more fruits and/or vegetables, they could do it	Yes, they would eat more	“At school lunch”	Disposition & Demand	Microsystem: Youth and school, food made available at school Exosystem: School lunch policy
	Yes, by having them more available	“Usually eat veggies at lunch”	Disposition & Demand	Microsystem: Youth and school, food made available at school Exosystem: School lunch policy
	No, none at home	“Cause I don’t have it at home”	Disposition & Demand	Microsystem: Child and parent, parent’s dietary intake, food made available at home Mesosystem: Parents interaction at the grocery store
	Parents buy groceries	“Mom buys groceries” “Parents buys groceries”	Disposition & Demand	Microsystem: Child and Parent, parent’s dietary intake Mesosystem: Parents interaction at the grocery store
What schools can do to help students eat healthier	Peer pressure	“tell them you’ve tried it before and that it tastes good”	Disposition	Microsystem: Individual and peer interactions
	Engage student council for input	“student council”	Disposition & Demand	Microsystem: Youth and school staff interaction Mesosystem: Peers and school interactions Exosystem: School lunch policy
	More food at school	“...if they gave you more food at lunch,	Disposition & Demand	Microsystem: Youth and school

	lunch	kids wouldn't always go home and be hungry and eat bad stuff"		interaction Exosystem: School lunch policy
	Allow healthy snacks, make healthy snacks available (vending, snack program),	"...vending machines"	Disposition & Demand	Microsystem: Youth and school interaction Exosystem: School lunch policy
	Force students to take healthy foods	"...not giving them an option to take it but either way they won't eat it."	Disposition & Demand	Microsystem: Youth and school interaction Exosystem: School lunch policy
	Offer more variety	"...change up the options every day." "putting different things out there"	Disposition & Demand	Microsystem: Youth and school interaction Exosystem: School lunch policy
	Hide them in foods	"Hide the vegetables in the food"	Disposition & Demand	Microsystem: Youth and school interaction Exosystem: School lunch policy
	Serve food that students like	"Making healthy food, spicing it up in a way like, making it taste.... you get an apple and it's just an apple nobody want to eat, you want stuff that is more appetizing...".	Disposition & Demand	Microsystem: Youth and school interaction Exosystem: School lunch policy
	Nutrition education (hands on, glitzy education, posters/videos)	"...if someone puts facts on something... like I didn't know eating bananas helped..."	Resources	Microsystem: Youth and school interaction Exosystem: School lunch policy

DISCUSSION

Microsystem

The focus groups results found the influencers to healthful food consumption in adolescents within the microsystem include taste, convenience, quick, appearance and cravings. Taste was the most common theme in adolescent responses. Adolescent's perceive that unhealthy food tastes better, "I think the fact that you know they're not healthy for you makes you think they taste a lot better then they actually do". A study conducted on adults show that providing negative messaging on unhealthy food actually increased their desire for unhealthy foods.⁴⁷ However, providing both positive and negative messaging on unhealthy food the participants were more likely to avoid the unhealthy options.⁴⁷ Showing the participants perspective that unhealthy food tastes better and is more appealing than healthy food may start in youth and the continue into adulthood.⁴⁷

Youth preference is identified as a disposition caused by genetics, personality, and proximal process interactions. Change in the youth perspective and proximal process interactions on the taste and stigma surrounding healthful foods may lead to higher consumption of healthful food.

Adolescents perceive healthful food as less appealing than unhealthy foods. An adolescent strategy from Table 3 says, "making healthy food, spicing it up in a way like, making it taste.... you get an apple and it's just an apple nobody want to eat, you want stuff that is more appetizing...". Another way to make vegetables more attractive, according to Wansink and colleagues, is to give the dish an attractive name.³⁸ Their study

found that elementary schools giving the vegetable a more attractive name doubled the intake of vegetable consumption when compared to a generic name.³⁸

Youth identified parents as both influencer and barrier to healthful eating “...will eat veg when my mom makes them” and when asked if they could eat more fruits and vegetables “no, none at home.” The results show that youth desire healthful food but it is not always made available by the parents.

Results show youth have limited availability of healthful food. Adolescent identified strategies for increasing fruit and vegetables consumption include making more healthful food options available at home and decreased unhealthy options like high sodium, high calorie, low nutrient dense foods. However, results also show a youth demand for more home prepared meals and convenient food to avoid unhealthy options. Making fruits and vegetables more accessible to youth at home can be done by preparation to make them on-the-go. Preparation consists of cutting fruits and vegetable and using easy to grab containers. Evidence shows that by putting the unhealthy foods in hard to reach places, or stored away in cupboards and displaying healthful options on the counters could increase healthful food consumption.⁴⁹

Youth identified school lunch as a strategy to eat more fruits and vegetables. The interaction between youth and school lunch is in the microsystem as it pertains to what food children have available in their immediate environment. A study was conducted in 7th-12th grade students to increase convenience, attractiveness, and youth acceptance of fruits and vegetables.⁴³ School lunchroom made changes to increase convenience including: specific placement of the fruits next to the cash register, 100% fruit juice next to the ice-cream, salads in see-through to-go containers, and a ‘healthy convenience line’

for healthful foods.⁴³ Changes made to improve attractiveness of fruits and vegetables included: lunch menu posted with nice colors of fruits and vegetables, vegetables with descriptive names, and fresh fruit displayed in attractive bowl or tiered stands. To increase the youth acceptance of fruit and vegetable consumption signs were placed around the cafeteria stating: ‘last chance for fruit’, ‘no veggie? How about...’ and verbal prompt by cafeteria staff “would you like to try...?”⁴³ The study found the results of these tactics had a significant increase in student consumption of both fruit and vegetables.⁴³

The results show that increasing the appeal and convenience of fruits and vegetables in schools may increase fruit and vegetable consumption in students. Adolescents reported they are more likely to eat healthful foods if they are convenient and quick to account for school and after school activities. Making healthful food ready and ‘at hand’ for most adolescents will make the difference between grabbing a bag of chips or a fruit/vegetable. Adolescents reported if the fruit or vegetable were not prepared or ‘ready to eat’ they probably would choose an alternative option. Making fruits and vegetables ‘ready to eat’ may increase healthful food choices in adolescent.

School interventions include the school cutting or peeling fruits and vegetables to make them more convenient. Wansink and colleagues found a 71% increase of apple sales in schools that bought pre-sliced or sliced their apples compared to a whole apple in the control.⁴⁴ The study results showed in a low-cost economical change that increased the consumption of healthful foods and decrease waste in schools.⁴⁴

In respect to nutrition schools provide both school food and nutrition education. Current research is showing that adolescents have sufficient nutrition knowledge;

however, adolescents have a hard time following Dietary Guideline recommendations.⁴¹ In Table 2 adolescents define unhealthful food as high sodium/calorie and high sugar foods and beverages. They define healthful foods as fruits, vegetables, grains and dairy. The results indicate that knowledge is not an adolescent barrier when it comes to making healthful food decisions. Adolescents can correctly identify healthful and unhealthful foods. However, the children are asking for more information on why healthful foods are helpful for the body; and report they are more likely to eat healthful food if they know why it is good for you.

Adolescents receive food knowledge from family members, peers and the school. Adolescents know fruits and vegetables have nutrients, but are lacking why they are important. By providing deeper meaning to adolescents from 6th to 8th grade on how healthful foods are beneficial in their everyday life may increase their intake. There is currently no research looking at this type of education to increase fruit and vegetable consumption. Interventions should reflect the translation of knowledge into healthy behavior through environment and policy⁴¹.

It is also important that adolescents are getting valid nutrition information from their parents and peers. If parents are misinformed the youth may receive the incorrect message. To ensure adolescents are getting valid nutrition information sending brochures (healthful recipes, nutrition information) home with the adolescents. Also providing community cooking classes for both the adolescent and the parent could incorporate some meaningful nutrition information and increase healthful food intake. All interventions in the microsystem should correlate with other systems in order to make long-term change in the community.

Mesosystem

Parents and their interaction in the grocery store are considered the mesosystem because they are two subjects within the adolescent's microsystem. Results show parents are the primary grocery shoppers that may or may not involve the child's input. An environment of parent-child grocery shopping may increase the child's food interest and help children make better choices when shopping on their own.³⁷ In a study 50% of children that accompanied their parents while grocery shopping initiated a food request and out of those requests 55% asked for sweets or snacks. From those sweets or snack child requests, 47.8% of parents said no by either ignoring the request or explaining why they can not have the item.³⁷ This shows that interventions using parent-child shopping is considered a learning opportunity for the child.³⁷

Also in the results of the mesosystem includes adolescent peers and policy change. Adolescents want to engage their student council in future school lunch policy change. Empowering the students to assist in policy change may increase acceptance of the policy. Children often have little control in their lives, using interventions to make students feel empowered to make healthful decisions in their own lives and can be very fulfilling.²⁶

Exosystem

Media including commercial and marketing play a large role within the child's exosystem in influencing food consumption. Appearance and cravings were identified as influencers when deciding what to eat. Many company marketing strategies involve text and images directed at children to influence purchases.³⁴ Many high calorie, low nutrient dense foods like cereals and fruit snacks are advertised as "fun foods" by adding a mascot

or cartoon character. However, the same results are shown when fruits and vegetables are advertised as “fun food”. Fruits and vegetables with cartoon character media branding increased consumption in children when compared to no branding.³⁶ Results show that adolescents demand foods that are socially and visually attractive. Interventions to advertise healthful food as “fun foods” may change youth perspective on healthful foods and increase their overall consumption of fruits and vegetables.³⁴

Results show media influences adolescents to purchase unhealthful items due to cheap and easy meals. Local industries are creating a barrier for healthful food consumption by providing unhealthful food choices at a much lower price. However, in contrast, current research indicates there is not a positive weight loss outcome for “fat” tax or “soda” tax.⁵⁰ Additionally, there are few if any marketing strategies that promote fruits and vegetables as being cheap; for example a dollar bin of fruits or vegetables. More research needs to be conducted looking at advertising seasonal fruits and vegetables as being affordable options.

In the exosystem the results show that media influences adolescents’ food consumption in rural communities but also shows food availability in the grocery/convenient stores is vital. Food availability at local grocery stores are shown to have a large impact on BMI.³⁴ The amount of shelf space available of high calorie, low nutrient dense foods had a positive association with higher BMI for local residents.³⁴ Fresh and healthful food availability at the grocery store has an influence on healthful food consumption, especially in rural areas where healthful food availability is limited for an affordable price. However, in the exosystem the adolescents have no direct correlation with the policies that influence fresh and healthful food available at the grocery store.

Grocery store and convenience stores are apart of providing a healthful environment for adolescents to be able to make healthful decisions. The results show that adolescents make a lot of purchases from the ‘warmer’ at the local grocery store because it is quick and easy. The grocery store should provide healthy choices at a reduced price by using discount coupons for healthy items to meet the demand of easy, convenient, and cheap.³⁵ Interventions should empower adolescent and parents to advocate for quality fruits and vegetables in the grocery store for a competitive price to the unhealthy ‘warmer’ items. The community could also start more farmers markets that are year round to support local business.³⁵

Results show adolescents demand to participate in the policy making process and currently have no input in the school lunch policy. Results in Table 3 show that adolescent strategies are similar to the new school lunch program policies for example “force students to take healthy food”. The school lunch policy states children must have specific amounts of every food group on their plate, possibly making them take a portion of food they will not eat.⁴² Empowering the students to have a voice in school lunch policy may increase the acceptance of the policy. Interventions allowing communities to implement policies that fit their individual needs may increase acceptance; however, there is no current research on the topic but research has shown that specific policies that fit a communities needs have more success.

Macrosystem

The macrosystem involves the beliefs, ideologies and culture of the individual’s environment. Results show that rural adolescents believe unhealthy food tastes better than healthful food. Adolescents are quick to say their peers do not like healthful food,

for instance “I like broccoli but a lot of kids don’t.” It is the ideology that adolescents do not like vegetables. This ideology may come from children being forced or persuaded to eat these vegetables from an early age and the pressure may have caused a negative relationship with vegetables.⁵¹

It is important to look at the big picture of the bioecological model and all the systems involved. Not only does adolescent perspective of healthful foods need to change but the food perspective of the community and its environment. The grocery stores need to work with the community to lower healthful food costs to demolish the healthy food is expensive ideology. Results show that adolescents perceive only unhealthy food as being cheap and contribute to the ideology.

Chronosystem

The results reflect the time or era in which these adolescents live. Adolescents today most likely perceive food differently than adolescents 50 years ago. Results show that adolescents are a part of an era of processed food/fast food over homemade meals. A busier lifestyle with two working parents and single parenting that makes quick, easy, and convenient major attributes that influence food preference.

At the time of the focus groups the school lunch program had changed their policies to be in compliance the meal pattern requirements for USDA’s National School Lunch Program. These standards required more vegetables to be served and students had to pay for a second portion of the entrée.⁴² Prior to these changes students were receiving second portions without additional charges.

CONCLUSION

Results show the largest influencers to healthful food consumption in adolescent in a rural community are taste, convenience, quick, appearance and craving. Using strategies and interventions in each system contribute to changing adolescent's overall perception of healthful eating. Changes in the microsystem include increasing fruit and vegetable availability in the homes, healthy on-the-go options, and appealing names for adolescents by parents and school. Changes in the mesosystem include increasing the amount of child-parent grocery shopping to increase learning opportunities for choosing healthful options. Exosystem interventions includes changes in school policy and the marketing/advertising of healthful foods. Overall, it is important to change adolescent perception of healthful food to increase the acceptance in the macrosystem. When implementing change it is important to address the choronosystem. Adolescents live in an era of processed/fast food and an increased prevalence of childhood obesity.

Adolescents disposition includes their temperament, personality, and bioecological make up that influences their food likes and dislikes. They are at a disadvantage to the consumption of healthful food because they are surrounded by high calorie, high sugar, high sodium, low nutrient dense foods that are cheap, easy and convenient. Furthermore, most adolescents believe that unhealthy food tastes better than healthy food and taste has been identified as one of the most influential aspects of food choice. It is important that adolescent's environment and policies promotes healthful eating to change the perception of healthy food.

During school lunch adolescents demand for more food, increased variety, foods they like, to 'hide them in foods' or force them to take healthful options. Students want to

be involved in assisting other students eat healthier at schools. Empowering the students in policy may increase receptiveness of the policies.

Adolescents identified resources they need available to them in order to make healthful food choices. Focus group results show they have general nutrition knowledge but are lacking the more detailed elements of why nutrients are beneficial to their body.

Although, the study results are limited to one rural community with low economic status and may not be generalized to other populations, the results show that adolescents (6th to 8th grade) in a rural environment have many influencers and barriers to healthful eating within all systems of the bioecological model. There is a correlation between all systems and immediate change cannot be made to the person or proximal process without changes to all process systems. It is vital to promote healthy food choices in all the systems of a child's environment to enforce a sustainable lifestyle change. The bioecological model theory should be used to identify influencers and barriers in rural communities to assess the need.

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