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Review of Fruit & Vegetable Food System in South Dakota: Application and Policy Suggestions for Other Rural States

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Insufficient intake of fruits and vegetables has been recognized as a possible reason for dietary deficiencies that contribute to rising chronic health issues and medical costs. Based on data generated by the 2011 Behavioral Risk Factor Surveillance System (BRFSS), South Dakota was listed as one of five states with the lowest daily adult vegetable intake (1.5 times per day). To continue the effort to promote a healthy diet, three independent surveys were developed and distributed to consumers, grocers, and growers (producers) to investigate factors that affected low consumption of fruits and vegetables and to identify opportunities to increase future consumption. To highlight the influences of geographic and socioeconomic disadvantages on fruit and vegetable consumption, the surveys specifically included the consideration of consumers' income; access and preparation of available fruits and vegetables; preparation skills and available time; perceptions of fresh, canned, and frozen products; and knowledge and role fruits and vegetables play in prevention of chronic disease in the sample selection and data analysis. Survey respondents were divided into two regions: non-food desert (Region 1) and food desert (Region 2). This paper provides a summary of the survey results and policy suggestions generated based on our findings.

Keywords: fruit and vegetable consumption, food desert, rural, food system, food supply chain, fresh fruits and vegetables, frozen fruits and vegetables, canned fruits and vegetables, locally grown, local food

Introduction

Insufficient intake of fruits and vegetables has been recognized as one of the possible reasons for dietary deficiencies that contribute to rising chronic health issues and medical costs in the United

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States. A report published by United States Department of Agriculture Economic Research Service (USDA-ERS) indicated that Americans' daily consumption of fruits and vegetables, respectively, were 1.03 cups and 1.58 cups in 2004, while the recommended intakes were 1.80 cups and 2.60 cups, respectively, at the same time (Dong & Lin, 2009). Based on the data generated by the 2011 Behavioral Risk Factor Surveillance System (BRFSS) survey, South Dakota was listed as one of the five states (along with North Dakota, Iowa, Louisiana, and Mississippi) that had daily adult vegetable intakes lower than 1.5 times per day (National Center for Chronic Disease Prevention and Health Promotion [NCCDPHP], 2013a). Regarding fruit, South Dakota adults' median intake was 1.0 cups per day, a slightly higher record than Oklahoma and Mississippi (each had 0.9 cups per day) (NCCDPHP, 2013a).

Several factors potentially contribute to South Dakotans' low fruit and vegetable intake. First, the geographic nature of the state has created uneven access to fresh fruits and vegetables. Because South Dakota has a very limited growing season for fruits and vegetables, the suppliers have to rely on outside resources to fulfill consumers' demand. While residents in the east side of the state have easier access to the fresh fruits and vegetables, residents in the rest of the state live in rural or remote areas that often lack that easy access. Geographic obstacles also make the transportation costs of fruits and vegetables (mostly from other states) higher than usual, which force consumers in these areas to choose between higher unit prices and/or lower quality of fruits and vegetables, as well as limited and sometimes no choices at all. Second, previous studies have suggested a close connection between low income and dietary deficiency (Do et al., 2008). According to the U.S. Census Bureau (2012), South Dakota had a record of per capita income at \$24,925 in 2011, which was \$3,000 lower than the U.S. average. Moreover, South Dakotans' median household income between 2007 and 2011 was \$48,010, while the national average was \$52,762 (U.S. Census Bureau, 2012).

Although the state health department and nutritionists have devoted tremendous efforts in promoting healthy diets, changing dietary habits will need significant time and more effort to see notable results. While the state health department and scholars have recognized the current low fruit and vegetable consumption in South Dakota, little can be found in the literature and government records to provide strong evidence of key reasons for South Dakotans' low fruit and vegetable intakes. The South Dakota Department of Health (2011, 2012) had conducted prior studies regarding consumers' fruit and vegetable consumption. From those studies, many new questions had emerged. It was subsequently determined to embark on a new survey to capture a broader collection of data and more in-depth information related to the production, availability, and consumption of fruits and vegetables in South Dakota.

To continue the effort to promote a healthy diet, increase fruit and vegetable consumption, and identify factors impacting low consumption of fruits and vegetables, the research team collaborated on a food systems review, with an emphasis on local fruit and vegetable

consumption, production, and distribution, including fresh, canned, and/or frozen options. As part of this review project, three independent surveys were developed and distributed to producers, grocers, and consumers to investigate factors that affected low consumption of fruits and vegetables and to identify opportunities to increase future consumption. This paper provides a summary of the survey results and policy suggestions generated based on our findings.

Literature Review

A diet rich in fruits and vegetables has the potential to provide several positive health benefits (Lutfiyya, Chang, & Lipsky, 2012; McCormick, Kattelman, Ren, Richards, & Wells, 2009; NCCDPHP, 2013a, 2013b). Fruits and vegetables contain vital nutrients important to overall health such as folate, potassium, and vitamins A, C, and K (United States Department of Agriculture [USDA], 2010). Consumption of fruits and vegetables has also been linked to lowering the risk of chronic diseases and facilitating weight management (NCCDPHP, 2013b; USDA, 2010). A recent study by Miller and Knudson (2014) indicated that fresh, canned, and frozen vegetables have similar nutrient content, therefore dispelling the myth that fresh produce is healthier. The study also indicated that frozen and canned vegetables, which are often less costly, can be considered part of a healthy diet (Miller & Knudson, 2014).

Fruits and vegetables are low in calories, and when they are cooked or prepared without adding extra fats or sugars, their low calorie counts are beneficial for weight management (USDA, 2010). There is support that suggests consuming at least two-and-a-half cups of fruits and vegetables daily is associated with a reduced risk of certain cancers and cardiovascular disease, including heart attack and stroke (USDA, 2010). Because of these positive health benefits, the 2010 Dietary Guidelines for Americans recommend that Americans increase their fruit and vegetable consumption in order to promote and maintain health (NCCDPHP, 2013b).

Despite growing evidence of health-related benefits, consumption of fruits and vegetables among all U.S. populations is low. On average, adults in the U.S. eat fruit 1.1 times each day and vegetables 1.6 times every day (NCCDPHP, 2013a). These amounts are far below the recommended daily servings for adults: two cups of fruits and two and a half to three cups of vegetables (USDA, 2014). While consumption of fruits and vegetables varies from state to state, studies have found that adults in rural communities are less likely to eat at least five servings daily of fruits and vegetables, and consumption of fruits and vegetables tends to be higher in metropolitan than nonmetropolitan areas (Lutfiyya et al., 2012; Michimi & Wimberly, 2010).

In the U.S., all Midwestern states report lower than national average levels of fruit and vegetable consumption. On average, adults in South Dakota consume fruits and vegetables 1.0 and 1.4 times each day respectively. Adolescents consume fruit 1.0 time daily and vegetables 1.1 times each day. Further, almost 40% of adults and 41% of adolescents report consuming fruit less than

one time per day. Among South Dakota and the surrounding states, adolescent vegetable consumption is lowest in South Dakota and North Dakota (NCCDPHP, 2013a).

There are many factors that contribute to fruit and vegetable consumption. One of these factors is geographic location. Studies across the U.S. have examined the relationship between rural areas and eating behaviors (Larson, Story, & Nelson, 2009; Lutfiyya et al., 2012; Michimi & Wimberly, 2010). Rural populations generally experience higher levels of poverty and have lower levels of education (Liese, Weis, Pluto, Smith, & Lawson, 2007). Lack of education in adults may affect income and poverty level, which directly influence a family's access to affordable fresh fruits and vegetables (Lutfiyya et al., 2012). However, studies conducted outside the Midwest have found that children's diets are not as affected by poverty-related factors as their caregivers' diets (Grutzmacher & Gross, 2011). It is suggested that adults may try to shield children from decreased food access by lessening their own consumption of healthy foods (Grutzmacher & Gross, 2011).

Rural areas may produce fruits and vegetables, but they usually have fewer food stores where residents can purchase healthy items at affordable prices (Liese et al., 2007). Prices in small food and convenience stores are typically higher than at larger grocery stores (Lutfiyya et al., 2012). Larson et al. (2009) indicated rural neighborhoods have far fewer chain supermarkets, leaving rural residents with fewer options within close proximity. Michimi and Wimberly (2010) suggest that it is not simply the distance to the nearest supermarket, but rather, the travel behavior that matters. Rural areas typically do not have public transportation, leaving rural residents to rely on personal vehicles. This could be a problem for low-income households who would not be able to afford the added travel expense. If families are making fewer trips to large supermarkets, then they may be forced to buy food in other, closer stores where processed foods are more affordable (Michimi & Wimberly, 2010). As is expected, low-income households are more likely to purchase "energy-dense, nutrient-poor foods," because they cost less than healthy foods (Grutzmacher & Gross, 2011).

Consumption of fruits and vegetables is an important area for focus as evidence continues to show that diets high in fruits and vegetables are linked to many positive health benefits. In South Dakota, where the consumption levels are lower than the national averages, it is unclear what factors affect these levels. While several national studies have examined different factors that contribute to fruit and vegetable consumption, little research has been conducted within South Dakota and the surrounding states as to why fruit and vegetable consumption remains so low. McCormick et al. (2009) associated lack of knowledge and lack of acceptance of fruits and vegetables to levels of consumption in school-aged children. But to date, no studies have been conducted with adults. Future research examining barriers to fruit and vegetable consumption in South Dakota is needed to develop strategies to improve overall health in the state.

Methods

This study contained three independent surveys (producer, grocer, and consumer) based on the information gathered from conversations between health authorities, stakeholders, Extension specialists, and conclusions from previous studies. To highlight the influences of geographic and socioeconomic disadvantages on fruit and vegetable consumption, the surveys specifically included the consideration of consumers' access to available food in the sample selection and data analysis. Survey respondents were divided into two regions: non-food desert (Region 1) and food desert (Region 2). Food desert areas were defined as "areas with limited access to healthy and affordable food" as based on the Food Access Research Atlas published by the USDA-ERS (2013). Region 1 included locations with less limited access to available food (non-food desert) and Region 2 included locations not included in Region 1 (food desert). In 2013, USDA-ERS abandoned the original "food desert" definition and updated food access information in the new Food Access Research Atlas. However, this study was conducted in 2012, and our definition of Region 1 was based on the original definition of "food desert" by the USDA.

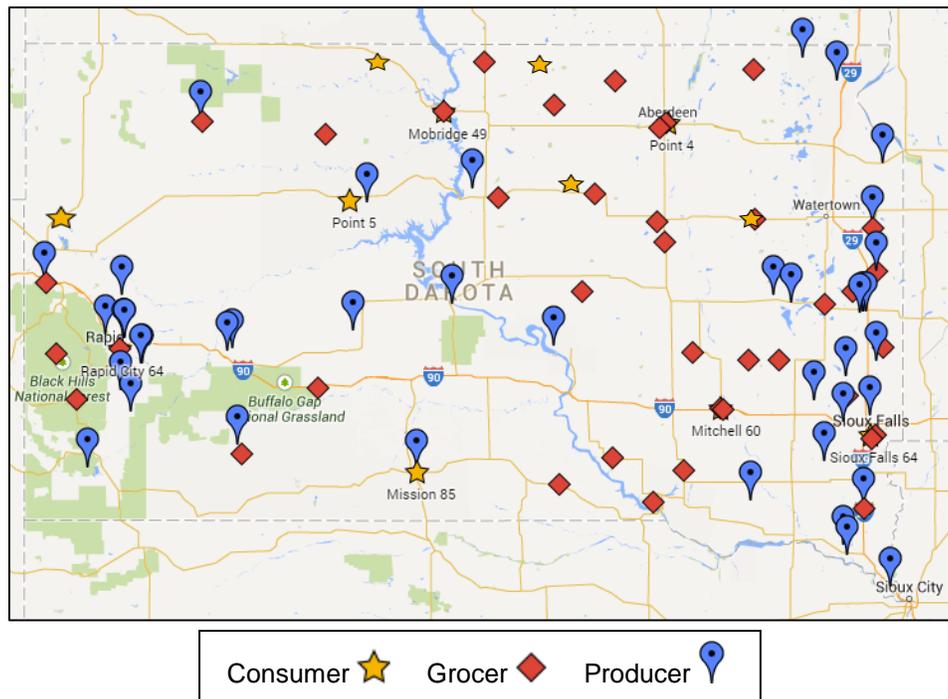
The producer survey was conducted from May to July 2012. In addition to acquiring information regarding local producers' demographics and characteristics, this research also included questions on fruit and vegetable production (including acreages, production methods, and future production plans), marketing, sales, and profitability. Additionally, questions were asked to solicit producers' perceptions of business opportunities in their communities, limitations of fruit and vegetable sales, and government policies that inhibit more fruit and vegetable sales. Survey questionnaires were distributed electronically through a Farmer's Market listserv and Facebook postings. Electronic recipients of the survey questionnaires were informed of the purpose of the study and invited to complete the questionnaires through the web link provided in the cover letter. The research team also distributed hard-copy questionnaires at local farmer's markets and at Local Food Entrepreneur training sessions. Recipients receiving paper copies were provided a cover letter stating the purpose of the study and a self-addressed, stamped return envelope. Recipients were also informed of a \$40 gift card provided to the first 60 producers who returned the completed survey. After discarding surveys with incomplete responses and those completed by out-of-state and non-produce producers, this study obtained a total of 44 usable surveys (See Figure 1).

The grocer survey was conducted from May to July 2012 and focused on collecting information regarding location, scale, and types of grocers; detailed sales information on local produce; and the number of monthly requests grocers received from their customers for locally grown fruits and vegetables. The last part of the survey requested grocers to rate eight selected factors that they believed would potentially limit their willingness or capacity to carry locally grown produce. A total of 319 surveys were distributed through mail to owners or managers of grocery

stores located in South Dakota. The mailing list was originally obtained from Manta.com (an e-commerce web site for business professionals searching) and later edited by Extension Field Specialists and administrative assistants. Recipients were provided with a cover letter stating the purpose of the study and a self-addressed, stamped return envelope. The first 40 recipients to return a completed survey were provided a \$40 gift card. After discarding the incomplete responses, a total of 45 usable surveys (14.4%) were included in the final report and analysis. These 45 grocers closely represented the population distribution of the state of South Dakota (See Figure 1).

The consumer survey was conducted from August to December 2012. The questionnaire was developed to gain insight on South Dakota consumers' basic demographic and socioeconomic backgrounds, health statuses, grocery shopping patterns, eating habits, attitudes towards healthy diet and local food, as well as their perceptions regarding the quality and price of available fruits and vegetables. A total of 595 surveys were distributed through in-person contacts with consumers who shopped at grocery stores located in seven South Dakota communities. Among these seven communities, four were selected from Region 1 (non-food desert) and three were from Region 2 (food desert). The survey provided each participant with a cover letter stating the purpose of the study; a self-addressed, stamped return envelope; and a five-dollar coupon redeemable at the store where the questionnaire was delivered. After discarding the incomplete responses, 445 usable surveys (74.8%) were included in the final report and analysis (See Figure 1).

Figure 1. Consumer, Grower, and Grocer Survey Respondents



The research team transferred all of the completed surveys into aggregated data to ensure the confidentiality of the survey participants. The original data was translated to SAS format data to utilize SAS statistics procedures for further analyses. The researchers hoped to utilize the data gleaned from the survey to develop potential policy suggestions to increase South Dakotans' fruit and vegetable consumption.

Data and Findings

Data Description

The respondents in the producer survey included 44 individuals who were assumed to be local producers and had the role of primary farm manager. Most producers were located in the east and west central parts of the state, with 38 producers located in Region 1, and six producers located in Region 2. Of the respondents located in Region 2, 83.3% were female, while those in Region 1 were more evenly distributed between male and female. The majority of the respondents were Caucasian (84.1%) regardless of the sample location. Survey results indicated Region 1 had 10% of producers who were 26-35 years old, but most of the respondents in this region were 46-65 years old (76.3%). Region 2 had a significant percent (33.3%) of respondents who were 36-45 years, while the rest of the respondents showed a uniform age distribution starting at 46 years and older. Data showed 57.9% of producers in Region 1 and 66.7% in Region 2 had four years of college or higher educational background. We found that 72.7% of the producers had at least one employee or unpaid family member to work on the farm, with a noticeably higher percentage of producers in Region 2 who worked full-time at the farm without any off-farm jobs.

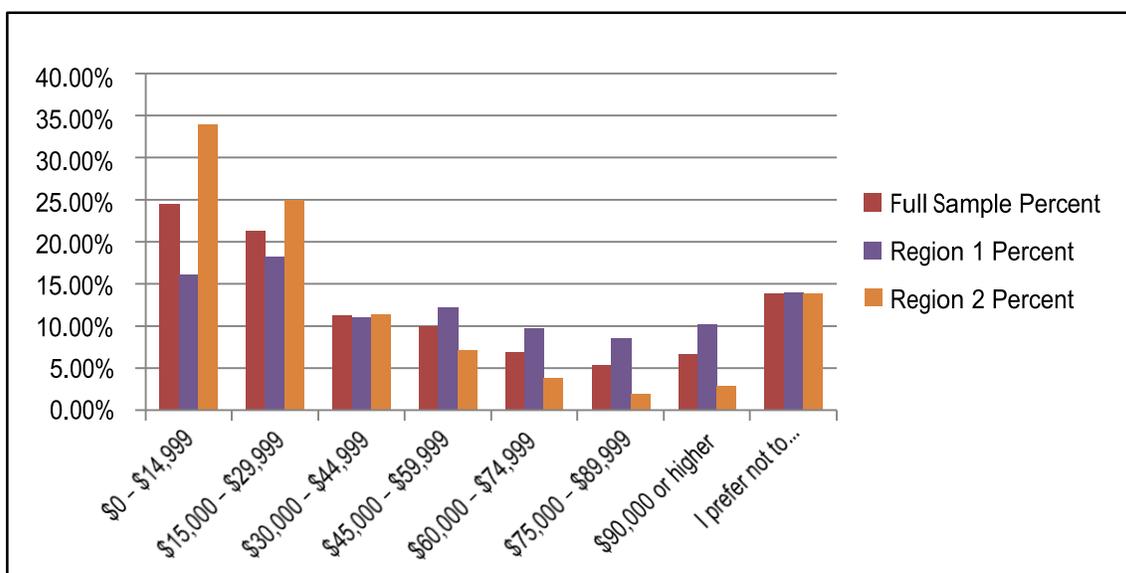
Data from the grocer survey were derived from 45 respondents. Among the total, 25 were located in Region 1, and 17 were located in Region 2, which closely represented the geographical and business nature of the retailers in South Dakota with a higher density of respondents on the eastern side of the state. Results indicated that 60.0% of the stores were local, single-owned; 20.0% being a locally-owned chain with the remainder being regionally- or nationally-owned. The 17 grocers in Region 2 were smaller in business scale and sales records compared to the grocers in Region 1. The majority of grocers had been in the business for more than 20 years, especially those in Region 2 (Region 1 = 42.9%; Region 2 = 52.9%). A majority (64.4%) were over age 46 with only one grocer being under age 35. Grocers in Region 1 were generally larger, and the ownership types were more diverse. Close to half (48.9%) of all respondents were sole decision makers for purchasing/stocking of fresh produce (fruits and vegetables), while 42.2% of the respondents had some role in stocking decisions.

A total of 445 consumer surveys were collected from Region 1 ($n = 237$) and Region 2 ($n = 208$). Consumers in Region 1 were primarily Caucasian (83.5%), with 8.9% classifying themselves as

Native American; while consumers in Region 2 were primarily Native American (72.4%), with 21.9% classifying themselves as Caucasian. We oversampled Native American consumers to allow us to gain more understanding of Native American consumers' characteristics and reasons for low fruit and vegetable consumption since there is a considerable lack of data available.

Overall, consumers in Region 1 were mostly Caucasian and lived in larger communities. About 57.6% of these respondents were married, and on average, supported zero to two dependents. Compared to consumers in Region 2, consumers in Region 1 were fairly older with more education and higher family income (See Figure 2). Data indicated that, compared to Region 2, Region 1 had more respondents, as well as had spouses who were currently employed.

Figure 2. Consumer Survey – Total Family Income



Respondents in food desert locations were younger with 31.4% of these consumers being single. An average consumer in Region 2 supported three or more dependents and was more likely to receive food assistance (i.e., SNAP and/or WIC). Data suggested primary food shoppers for the family were female (71.4%) regardless of location. In general, Region 2 contained a significantly larger percentage of consumers who lived in small towns and faced economic disadvantages as a result of less family income, limited income resources, lower education, lower employment rate, and larger family sizes.

Consumers in Region 2 considered their locally-owned grocery store as the main source for most groceries (local stores = 56.1%; national chain stores = 5.8%; regional chain stores = 10.3%; combined all types of locally-owned stores = 8.3%), while consumers in Region 1 indicated more of a mixed pattern (local stores = 28.6%; national chain stores = 18.3%; regional chain stores = 13.7%). The majority of consumers in both regions made special trips for grocery shopping, with those in Region 1 (63.6%) shopping once or twice a week as compared to

only 48.8% of those in Region 2 (21.6% of consumers in Region 2 shopped three or more times per week). A comparable percentage of consumers in both regions noted they shopped whenever needed (Region 1 = 40.5%; Region 2 = 45.6%).

Including the portion paid by SNAP and WIC, 7.4% of consumers in Region 1 and 10% of consumers in Region 2 spent less than \$40 per week on family food and beverage groceries. The majority of consumers in Region 1 (50.9%) and 40.8% of consumers in Region 2 spent about \$40–120 on food and beverage groceries per week. The data showed that despite the economic disadvantage, a higher percentage of consumers in Region 2 (59.2%) reportedly spent more than \$120 for food and beverage groceries, with 32.7% of Region 2 consumers reportedly spending more than \$200 dollars on food for the family per week. In contrast, Region 1 only had 41.7% of consumers spending more than \$120 per week for food and beverage groceries. A possible explanation for this result might come from the fact that the survey requested respondents to include the food costs paid by SNAP and WIC; the data showed a higher percentage of consumers were recipients of government food assistance programs in Region 2, as well as experienced more limited access to grocery stores with competitive prices.

The survey asked consumers to answer five questions aimed at creating an index to assess their nutrition knowledge. About 81.7% of consumers were able to give two to four correct answers to these questions, with those in Region 1 giving more correct responses than those in Region 2. The survey further asked consumers the key reasons they shop for locally-grown food, including fruits and vegetables. Data indicated the most common reasons consumers purchased locally grown food were 1) better quality, 2) support local community, and 3) lower price (See Table 1).

Table 1. Reasons Consumers Purchased Locally-Grown Food

Common Reason	Full Sample	Region 1 (Non-Food Desert)	Region 2 (Food Desert)
	Rank	Rank	Rank
Better food quality	1	1	1
Support the local community	2	2	2
Lower prices	3	3	3
Food safety	4	5	4
My family likes to visit the local food market	5	4	6
Family members prefer food produced from people we know	6	6	5
I just happened to drive and/or walk by	7	7	7
Word of mouth	8	8	8
Entertainment/experience	9	10	9
Other reasons	10	9	10

The most common reasons that prevented consumers from purchasing more locally grown fruits and vegetables were 1) too expensive; 2) distance or location of the local food markets; 3) limited quantity and options; 4) lack of local food at grocery stores; and 5) business hours are not friendly to consumers' schedule (See Table 2). Price and distance were the top two reasons consumers were discouraged from purchasing more local food for both non-food desert and food desert regions (See Table 2).

Table 2. Reasons Consumers Did Not Purchase Locally Grown Food

Common Reason	Full Sample Rank	Region 1 (Non-Food Desert)	Region 2 (Food Desert)
		Rank	Rank
Too expensive	1	1	2
Distance or location	2	2	1
Could not find locally-grown food at grocery stores	3	4	5
Out of stock and/or short of options	4	5	3
Hours not friendly to my schedule	5	3	7
Not enough choices of fruits and vegetables	6	7	4
I never think about buying at farmer's markets	8	6	9
Prefer to buy all food at supermarkets	9	8	8
I do not trust the quality of food	10	9	11
Other reasons	11	10	12
I do not trust the food sold at local food markets	12	12	10

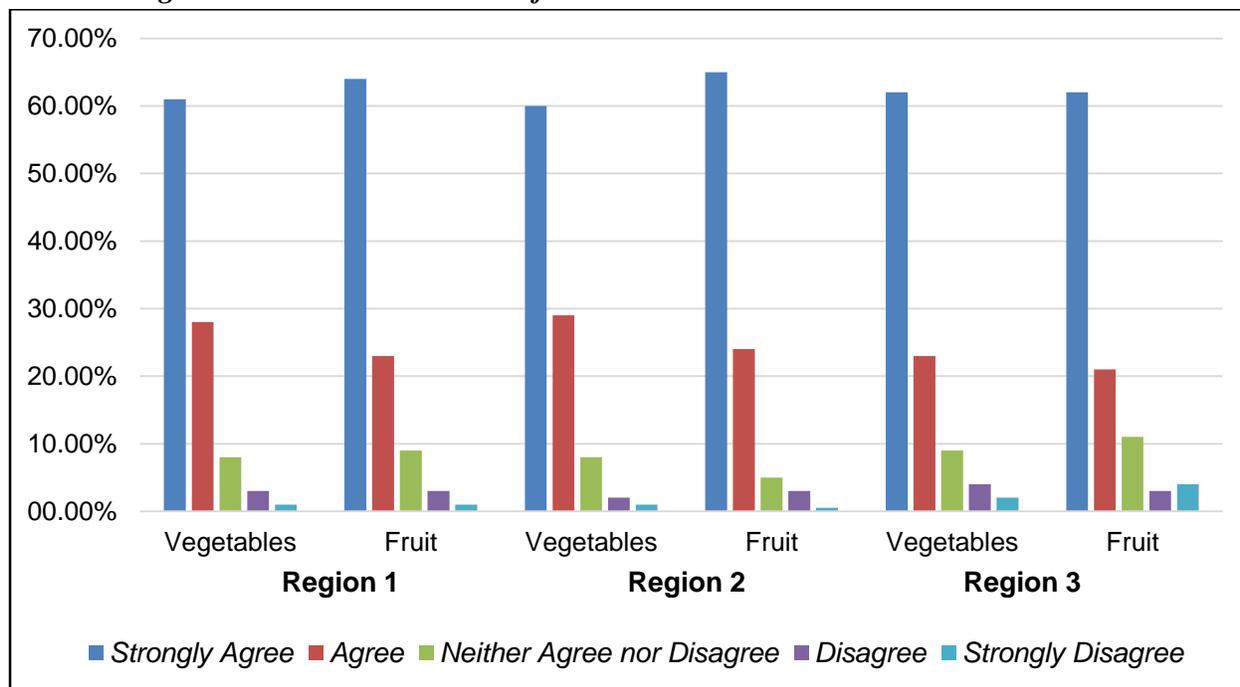
When consumers were asked what motivated them to purchase healthy foods, the top five reasons included 1) healthy food makes consumers feel physically better, 2) nutrition included in healthy food are better, 3) healthy food makes consumer feel mentally better, 4) healthy food tastes better, and 5) healthy food can prevent cancer. The top two reasons consumers reported that discouraged them from purchasing more healthy food were 1) do not trust healthy claims, they just want higher prices; and 2) do not know why healthy food is better.

Fruit and Vegetable Production, Consumption, and Marketing

Data suggested that consumers consumed 1 to 2 cups of both fruits and vegetables every day, with consumers in Region 2 consuming slightly more. A majority of consumers consider the fresh fruits and vegetables they purchased as either *excellent* or *good*. About 50% of consumers noted they traveled less than 15 minutes to stores/locations where they usually purchased fruits and vegetables. A majority of consumers in Region 1 (61.4%) and Region 2 (59.4%) traveled less than 10 minutes, while a small percentage of those in Region 2 (17.4%) had to travel 26 to 30 minutes to locations where they could buy fruits and vegetables.

Consumers in both regions (88.0%) either *strongly agreed* or *agreed* that fresh fruits and vegetables tasted better than canned products (See Figure 3).

Figure 3. Consumer Taste Preference Between Fresh and Canned Products



Consumers were asked to reply to the statement, *Canned fruits and vegetables are as healthy as fresh*. Only about 31.9% (Region 1 = 38.0%; Region 2 = 25.1%) replied *yes*. Furthermore, consumers were asked to respond to the following statement, *I buy fruits and vegetables, but they often go to waste*. Most of consumers' replies ranged from *agree* to *strongly agree* (Region 1 = 83.5%; Region 2 = 82.2%). There was little difference between the respondents regardless of location differences, which suggests the lack of knowledge or capability to plan accordingly to utilize the produce may be a common problem for all South Dakotans.

Data indicated grocers in Region 2 (on or nearby food deserts) had smaller annual fruit and vegetable sales than those in Region 1. In terms of the percentages of sales, all grocers sold the majority of their fruits and vegetables as fresh produce. Grocers in Region 2, compared to those in Region 1, indicated a higher percentage of sales in fresh produce, with consumers in both regions indicating a strong preference for fresh fruit (87.0%) and vegetables (82.1%). Canned produce had a relatively higher percentage of sales in Region 1 than in Region 2, with frozen products having a similarly smaller market share in both regions. Grocers in Region 2 had a noticeably smaller frequency of fresh produce delivery per week than those in non-food desert locations, with 82.3% of the grocers reportedly having two or less deliveries per week. On the contrary, 53.6% of grocers in Region 1 had three or more deliveries per week.

Grocers in both regions were content with the variety and freshness of the fruits and vegetables they provided. Though grocers in Region 2 noted a lower demand for locally-grown fruits and vegetables, 53.6% of them showed interest in offering more locally-grown produce to customers, while a slightly smaller percentage of grocers in Region 1 expressed the same interest (47.1%). Similarly, data suggested that a notable percentage of producers indicated an intention to expand their fruit and vegetable production in the next three years (65.9%), with producers in Region 2 (83.3%) showing higher intention to expand than those in Region 1 (63.2%). In addition, a slightly higher percentage of producers in Region 2 (50%), compared to those in Region 1 (44.7%), intended to install high tunnels in the next year to extend their growing season, which indicated producers' perspective of the expanding fruit and vegetable market in South Dakota.

Grocers were asked about the frequency of requests they receive for locally-grown produce and to list the most commonly requested locally-grown produce items. Just under one-half (46.6%) of the respondents did not receive requests for locally-grown produce, with 58.9% in Region 1 and 32.3% in Region 2 noting such. The top 10 most common requests grocers received included corn, melons, tomatoes, squash, cucumbers, beans, pumpkins, peppers, potatoes, and onions. When grocers were asked whether consumers' home gardens would reduce the sale of fruits and vegetables in the summer months, the majority of grocers *somewhat to strongly agreed* (Region 1 = 75.0%; Region 2 = 76.5%).

Data indicated that grocers and producers both noted increased sales of fruits and vegetables over the past three years. Among producers, 72.2% in Region 1 and 83.3% in Region 2 reported increased sales, and 67.9% of grocers in Region 1 and 70.6% in Region 2 reported increased sales. Data showed most grocers believed their consumers had a basic understanding regarding the benefits of eating fruits and vegetables, but they were less assured whether consumers had an understanding of the role of fruit and vegetable consumption in the prevention of chronic diseases (Region 1 = 67.9%; Region 2 = 70.6%).

Marketing Strategies to Increase Consumption of Fruits & Vegetables

Both the grocer and consumer surveys inquired as to marketing strategies to increase consumption of fruits and vegetables among consumers. Grocers indicated that offering samples with locally-sold produce was the number one marketing strategy, followed by in-store displays with "quick and easy" recipes and offering coupons (See Table 3). Grocers indicated that only "quick and easy" recipes, tip sheets, and on-site cooking classes could be somewhat effective (See Table 3). Furthermore, on average, grocers had an uncertain attitude towards statewide distribution of recipes and incentive items and felt use of social media would not effectively encourage more fruit and vegetable consumption (See Table 3).

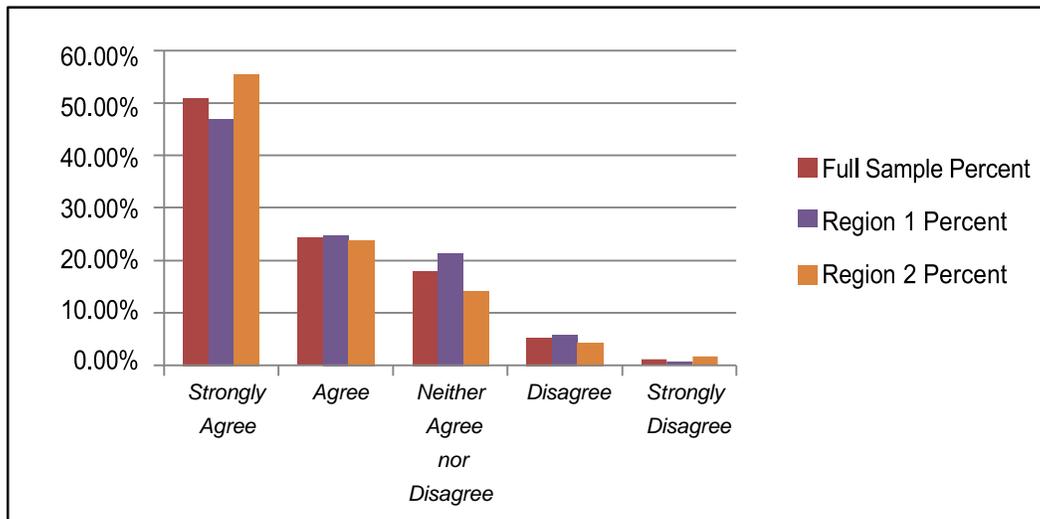
Table 3. Grocers' Strategies to Increase Fruit and Vegetable Consumption

Strategy	Full Sample	Region 1 (Non-Food Desert)	Region 2 (Food Desert)
	Rank	Rank	Rank
Offering samples with locally sold produce	1	1	1
In-store displays which offer coupons and "quick and easy" recipes	2	2	2
Offering only coupons for fruit and vegetable products	3	3	3
Offering only point of purchase "quick and easy" recipes displayed at the sale site of fresh, canned, and frozen fruit and vegetable items	4	5	5
Providing point of purchase "tip" sheets for consumers	5	7	4
Offering on-site cooking classes utilizing fresh, canned, and frozen fruit and vegetable items	6	4	7
Statewide distribution of recipes and incentive items for the purchase of frozen and/or canned items	7	7	6
Providing point of purchase videos (i.e., demonstrating "quick and easy" preparation techniques	8	8	8
Providing statewide distributed tips through social media such as Facebook and Twitter	9	9	9
Offering off-site cooking classes utilizing fresh, canned, and frozen fruit and vegetable items	10	6	10

In a related question, grocers felt that lower prices would be more effective in encouraging consumption as compared to offering coupons. Additionally, most grocers felt that freshness of produce was more of an important factor in consumer purchasing decisions (95.5% *important to very important*). Regarding the value of labeling "locally-grown," a majority of grocers (68.9%) noted that having signage indicating "locally-grown" increased their sales, and an overwhelming majority (91.1%) would display "locally-grown" signage if provided.

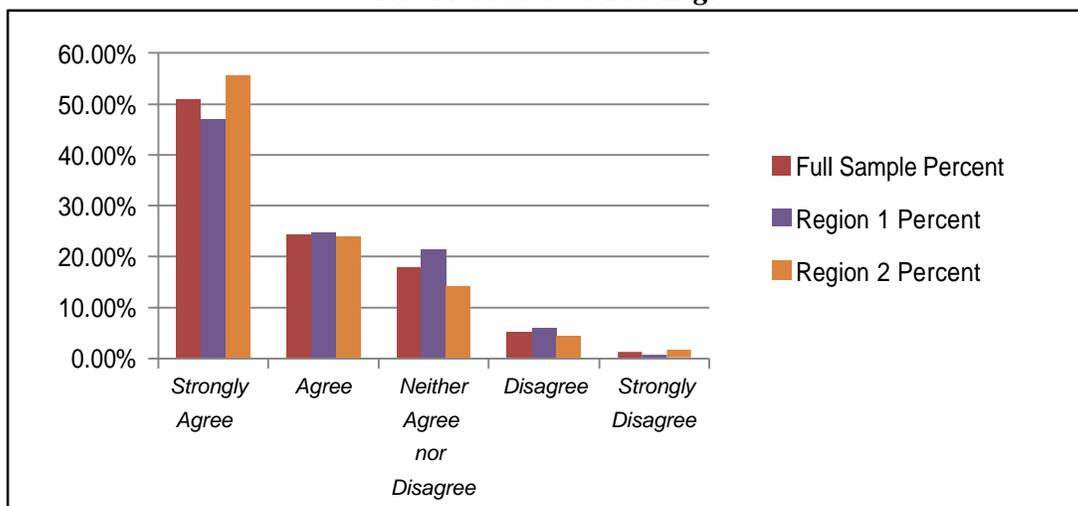
In contrast to results of the grocer survey, consumer survey results showed 70.8% of consumers in Region 1 and 79.0% of consumers in Region 2 either *strongly agreed* or *agreed* that giving out coupons would encourage them to purchase more fruits and vegetables (See Figure 4).

Figure 4. I Would Buy More Fruits and Vegetables If I Had Coupons



When asked if the price of fruits and vegetables was too high even if they had the income, there was a fairly even distribution of *strongly agree* or *agree* (Region 1 = 34.6%; Region 2 = 41.79%), *neither agree nor disagree* (Region 1 = 25.0%; Region 2 = 23.4%), and *strongly disagree* or *disagree* (Region 1 = 40.35%; Region 2 = 34.33%) (See Figure 5).

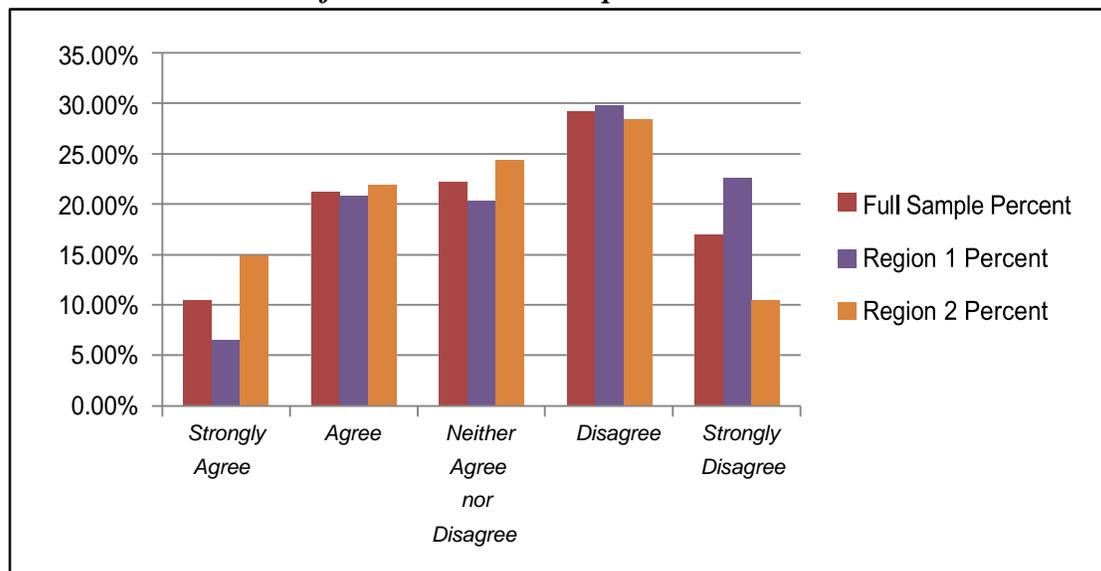
Figure 5. Even If My Family Can Afford Fruits and Vegetables, The Price Is Still Too High



A majority of the consumers seemed to be satisfied with the quality of the fruits and vegetables. About 70% of consumers rated the fruits and vegetables in their grocery stores as *excellent* or *good*. In addition, only about 25.4% *agreed* or *strongly agreed* with the statement, *The reason I do not eat enough fruits and vegetables is because the quality is not worthy of the price*.

Consumer responses to increasing fruit and vegetable consumption, if they knew how to prepare/cook them, was minimal (31.7% either *strongly agreed* or *agreed*) (See Figure 6).

Figure 6. I Would Serve More Fruits and Vegetables If I Knew How To Prepare/Cook Them



Respondents from all three surveys indicated that there are opportunities to increase locally-grown produce sales. Producers indicated that their most commonly selected market opportunities were farmer's markets, friends/neighbors, grocery, retail, co-op stores, K-12 schools, and restaurants. However, other outlets, such as institutions, colleges/universities, nursing homes, off-farm processing, on-farm processing, and distributors were not considered available to the South Dakota producers.

Discussion and Recommendations

This study provides a thorough review of the data collected from a sample of South Dakota producers', grocers', and consumers' demographics regarding their socioeconomic backgrounds, sales, and potential suggestions to increase fruit and vegetable consumption in South Dakota. In addition, information collected included consumers' grocery shopping patterns, eating habits, attitudes towards healthy diet and local food, as well as their perceptions regarding the form (i.e., fresh, frozen, canned), quality, and price of available fruits and vegetables.

The researchers found that there is potential to increase the local market share of locally-grown fruits and vegetables across the state. For example, although 78.6% grocers in Region 1 and 58.8% of grocers Region 2 carried locally-grown fruits and vegetables, about 62.1% of consumers indicated less than 10% of their fruits and vegetables came from local producers. Furthermore, most South Dakota consumers' percentages of locally-grown fruits and vegetables

consumed compared to their total fruit and vegetable consumption was small. It is possible that although consumers purchased locally-grown fruits and vegetables, the total amount they purchased was small, indicating strong evidence to suggest that most South Dakotans still heavily rely on outside resources for local fruit and vegetable consumption. It may also be that the point of purchase site does not provide signage informing consumers that the products are “locally-grown.” Of particular note, grocers felt that home garden production had a significant impact on the purchase of fruits and vegetables in the summer months.

This study found disagreement between grocers and consumers regarding the incentive for more fruit and vegetable consumption. While consumers felt that they would purchase more fruits and vegetables if they had coupons (51% *strongly agree*; 24.4% *agree*), grocers felt that coupons had a limited influence on consumers’ purchasing of fruits and vegetables and that an “everyday low pricing” strategy would have a more positive impact. In addition, 80% of grocers felt that consumers were easily swayed by lower-cost convenience foods with little nutritional value. However, the data reveal mixed messages regarding consumers’ attitude towards low-price strategy. Similar percentages *agreed/strongly agreed* (38%) and *disagreed/strongly disagreed* (36.5%) with the statement, *Even if my family can afford fruits and vegetables, the price is still too high*. Even though the data indicated that economic disadvantage is still an obstacle for increased fruit and vegetable consumption, lowering fruit and vegetable prices also does not guarantee increased consumption. Although macroeconomic factors that enable South Dakotans to improve economic wellbeing are difficult to control, the researchers suggest policymakers consider enhancing the effectiveness of food assistance programs as a powerful tool to encourage more fruit and vegetable consumption. For example, around 25% of the producers indicated that they would accept SNAP benefits from consumers. One might question if South Dakota farmer’s markets would increase sales if they were able to receive electronic benefit cards from SNAP recipients.

As the local food movement becomes more prevalent, this study tried to identify factors to encourage consumers to purchase more locally-grown fruits and vegetables. One note of caution from the consumer survey regarding locally-grown produce was that “high price” was listed as a key reason to discourage consumers from purchasing local food. Consumers also noted the distance or location of local food markets and hours of operation can be vital to their willingness to shop for local food. Consumers in both regions indicated local foods not being found at the grocery store, which highlighted the lack of choice and limited quality, as limiting factors for purchasing locally-grown fruits and vegetables. Lack of reported local food purchases may be a lack of consumer awareness, so the findings from this study encourage grocers to seek out “locally-grown” signage and post it as consumers have expressed strong interests in consuming local fruits and vegetables.

Our survey results highlight the importance of consumers' families and living environment on their fruit and vegetable consumption. For example, a majority of grocers (95.1%) either *agree* to *strongly agree* that family preferences created strong impacts on consumers' fruit and vegetable consumption. Our consumer survey data also hinted a strong connection between family support for fruit and vegetable consumption and higher fruit and vegetable consumption, especially for consumers in Region 2. When developing and marketing educational program/promotion efforts, we encourage entities to target multiple age groups across the lifespan with coordinating messages.

Grocer and consumer survey results showed that 88.9% of grocers and 76.8% of consumers agreed that the amount of time to prepare fruits and vegetables was an important factor to impact consumers' fruit and vegetable consumption. The data also showed that fruits and vegetables purchased often go to waste (82.9% *strongly agree* or *agree*). Additionally, an overwhelming percentage of grocers (93.3%) felt that knowledge of how to prepare fruits and vegetables was *important* (31.1%) to *very important* (22.2%) for the consumer. Therefore, the researchers encourage policymakers to invest more resources in health, nutrition, and food preparation education. There certainly is an opening for educational opportunities for grocers and producers, as well as those in educational fields in terms of educating consumers that fresh, canned, and frozen fruits and vegetables are all nutritious options and for teaching consumers how to prepare and budget their fruit and vegetable consumption. Lastly, data from the grocer and consumer survey indicate the need for educational opportunities to increase the understanding of the role of fruits and vegetables in the prevention of chronic disease.

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