Gardening for Health: Patterns of Gardening and Fruit and Vegetable Consumption on the Navajo Nation

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Abstract

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ABSTRACT:

The Navajo Nation represents a significant proportion of the American Indian/Alaskan Native population that is disproportionately affected by diet-related chronic diseases. Emerging evidence suggests that community gardening can improve health through increased access to, and consumption of, fruits and vegetables. The purpose of this study was to assess the patterns of gardening and fruit and vegetable consumption among residents in two communities on the Navajo Nation, using survey data from participants in a pilot community garden health intervention (N=106). We found that on average participants gardened 7.3 times per month and consumed 2.4 fruits and vegetables per day. Most participants reported low levels of self-efficacy (77%) and behavioral capability (83%) related to gardening. Lack of time (N=51) and financial barriers (N=50) were the two greatest barriers identified by respondents. There was a positive association between fruit and vegetable consumption and gardening frequency. Further evaluation and research is needed better understand how gardening can increase healthy eating among residents of the Navajo Nation.

Keywords: Native American health; gardening; fruit and vegetable consumption; community health assessment

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Introduction

Diabetes, obesity, and certain cancers disproportionately affect American Indians and Alaskan Native (AI/AN) populations in the United States (1). Between 1996 and 2006, the adjusted prevalence of type 2 diabetes among AI/AN increased by 26.9 percent from 6.7 percent to 8.5 percent, while the adjusted prevalence of obesity increased by 25.3 percent from 24.9 percent to 31.2 percent (2). AI adults have the highest age-adjusted rates for cardiovascular disease, diabetes, and obesity of any racial or ethnic group and the age-adjusted rates of diabetes among AI/AN are 2.4 to more than 6 times the rate of the general US population (3).

As the largest[1] federally recognized AI tribe in the US (3), the Navajo Nation represents a significant proportion of the AI/AN population that is disproportionately affected by chronic disease and their comorbidities. Reflecting trends in the health of the AI/AN population overall, Navajos are more likely to be obese than any other racial group in the US (4). The estimated prevalence of overweight among Navajos between 2004-2007 was 82.4 percent, with an obesity prevalence rate of 49.6 percent, and a type 2 diabetes prevalence rate of 10.9 percent in 2008, which was 1.85 times higher than the rate for the whole population (all races[2]) in the same year (4).

Nutrition plays an important role in the pathogenesis of diabetes, obesity, and cardiovascular disease (1, 2, 3, 4, 5). The Academy for Nutrition and Dietetics notes that up to 50% of chronic disease mortality is attributable to lifestyle factors that can be changed, such as modifying eating and physical activity patterns that contribute to obesity (5). Ballew et al. (11) studied the dietary patterns of 946 non-pregnant Navajos and found participants' diets to be energy dense and nutrient poor (49), which may

[1] The Navajo Nation spans 43,452 km^2 across New Mexico, Arizona, and Utah, with an estimated on-reservation population of >250,000 individuals.

[2] Data included AI/AN, Asian or Pacific Islander, Native Hawaiian, and Black or African American

predispose them to diet-related chronic diseases. The study found the median intakes of vitamin A, vitamin E, vitamin B6, folate, calcium, and magnesium to be below the RDA for both men and women in all age groups with fruit and vegetable (FV) consumption averaging less than once per person per day (11).

There is a small body of research on the efficacy of nutrition interventions on the Navajo Nation. A 2015 systematic review of health interventions addressing metabolic syndrome[3] found 19 studies that focused on nutrition as an intervention to lower some components of metabolic syndrome in Navajos (4). The intervention designs were heterogeneous, integrating a combination of cooking demonstrations, physical activity, counseling, and classroom-style education. Nava et al. found that 11 of the 19 studies resulted in statistically significant improvements in at least one of the following measures of metabolic syndrome: weight, body mass index, blood pressure, triglycerides, high density lipoproteins (HDL), or fasting blood glucose (4).

Absent from the 19 studies reviewed by Nava et al. was garden interventions as a way to promote healthy behaviors and decrease chronic disease risk. Garden interventions conducted in non-Native American populations, particularly those in community spaces, have been shown to have a positive association with health outcomes, such as increased vegetable intake (12, 13), reductions in HgbA1c (14) and decreased body-mass index (15). Weltin and Lanvin found that if at least one member of a household participated in a community garden, those living in the household consumed more FV on average and were 3.5 times more likely to consume FV than those without a gardening member (14). Zick et al. reported a 1.84 and 2.36 reduction in BMI for women and men, respectively, who participated in community gardening for at least one year between 2001 and 2010 compared to neighbors who did

[3] A condition characterized by a constellation of metabolic irregularities including impaired fasting blood glucose, elevated triglycerides, low HDL, central obesity, and/or elevated blood pressure (4)

not (15). Several studies have also found that community gardens improved neighborhood social capital by fostering intergenerational and cross-cultural interactions, enabling the sharing of food production knowledge, improving neighborhood aesthetics, and decreasing crime (16, 17).

Further research on community garden-based health interventions, specifically in the Navajo population, could lead to a better understanding of their potential benefits to members of the Navajo Nation. The cultural connection Navajos have to the land and agriculture suggests garden interventions may be efficacious (6, 18, 19, 20, 21). Qualitative research on culturally relevant approaches to AI healing and well-being found that traditional Diné (Navajo) teachings and practices emphasize Diné people gain strength from the land; using the land as a teaching tool for survival (18, 19). In addition, a study by Setala et al. found that among 44 self-identified Navajo farmers, the majority (100 percent and 98 percent, respectively) felt farming was important for maintaining Navajo tradition and upholding Navajo culture (2). While these qualitative measures show promise for the suggested benefits of community gardening on the Navajo Nation, no studies have assessed the association between gardening and health in Navajos in larger samples.

In order to understand whether gardening is an effective tool for improving healthy eating and reducing chronic disease among Navajos, further research is needed to assess the behavioral and environmental factors that may shape their gardening behaviors. Social Cognitive Theory highlights the multiple influences on health behavior change and posits that self-efficacy and behavioral capability are important in determining an individual's ability to adopt and maintain a healthy behavior (22). Cullen et al. hypothesized that personal factors such as self-efficacy, preferences, and outcome expectations are linked to increased FV intake-related skills and FV intake (23). Furthermore, Grier et al. identified that using community gardens to increase access to FV has been effective in increasing fruit and vegetable self-efficacy and preference (34). As measures of behavioral capability—knowledge, attitudes, and

behaviors related to FV consumption and gardening may be mediators to diet-related behavior change (23). Thereby, understanding Navajo knowledge and attitudes about gardening and eating behaviors is essential to developing interventions that reduce their risk of chronic disease.

Specific Aims

This study was the first of its kind to assess factors that affect individual's gardening behaviors in two distinct communities on the Navajo Nation. The aim of the current research was to establish the prevalence of gardening on the Navajo Nation. This study also sought to identify factors that influence the frequency of gardening on the Navajo Nation. Specifically, this study aimed to determine whether gardening self-efficacy, behavioral capability, social norms, and specific barriers were associated with frequency of gardening. The final aim of this study was to assess whether frequency of gardening was associated with fruit and vegetable consumption. The data presented in this paper can be used to inform the development and implementation of future research on garden-based health interventions in AI/AN populations.

This research was part of the Yeego[4] Gardening Project—a community garden-based pilot intervention developed and implemented through an ongoing partnership between members of the Navajo Nation, New Mexico State University Agriculture Science Center (NMSU-ASC) and the Fred Hutchinson Cancer Research Center (FHCRC). The project began in 2014 and at the time of this analysis had completed its second year in a three-year pilot study. The long range goal of this public health intervention was to improve FV consumption and general health among residents in two communities of the Navajo Nation.

[4] Pronounced "*yay-go"*

Methods

Study Design

This study was a cross-sectional analysis that examined factors influencing gardening among members of the Navajo Nation. Participants were recruited and asked to complete an interviewer-administered survey developed using frameworks from existing surveys informed by social cognitive theory and other behavior change models. The survey contained 36 items measuring: socio-demographic characteristics (7 items), dietary behaviors (13 items), self-efficacy (2 item), social norms (2 items), barriers to gardening (3 items), gardening behaviors (6 items), and intentions to garden (3 item). The survey was administered in an interview-format by two NMSU staff members and two interns from San Juan College. All interviewers completed the National Institute of Health (NIH) Human Subjects Training and were trained by the lead researchers on interviewing procedures.

Recruitment for participation occurred at community centers, chapter houses, and local businesses in two cities on the Navajo Nation; Crownpoint, New Mexico and Shiprock, New Mexico, where the Yeego Garden intervention was implemented. Recruitment was also conducted over the phone and through e-mail. A sample of 106 self-identified Navajos were recruited to participate in the current research. Inclusion criteria for study participation were: 1) aged above 18 years, 2) self-identified as a member of the Navajo Nation. Surveys from only one participants per household were included in the analyses.

Survey participation occurred at the same time point as recruitment and after informed consent was provided by each respondent. The majority of interviews were conducted in person by study staff members of the Navajo Nation. A small number were conducted over the phone. All surveys were conducted in English, however two respondents used Navajo interpreters. Interviews lasted between 15

and 25 minutes and respondents received a $10 gas or hardware store gift certificate as an incentive upon completion.

Data was compiled and organized by a member of FHCRC research team and a data release agreement was signed before being sent for cleaning and analysis by the current research. Descriptive analyses and hypothesis testing were performed on survey data using the Small STATA statistical software package version 14.1 (StataCorp. LP, College Station, TX, USA). Two sample t-tests with α=0.05 were used to identify associations between gardening frequency and the behavioral indicators[5].

Measures

Fruit and vegetable consumption was measured using one question from the Seattle 5 A Day studies (50, 51). Respondents reported daily FV consumption by selecting a whole numerical option between zero and ten or with an "11 or more" choice.

There was one item measuring frequency of gardening on a per day, week, or month basis during any one-month period in the previous growing season. During analysis, frequency was standardized into a per month basis, in addition to being dichotomized into either "less than 4 times per month" or "4 more times per month" categories.

Self-efficacy was measured in two questions about respondents' levels of confidence in their ability to eat FV daily and perform garden tasks. Response options, included: "Not at all confident," "Somewhat confident," or "Very confident." During analysis, self-efficacy was dichotomized. Respondents who reported "not at all confident" or "somewhat confident" where assigned to the "low confidence" category, while "very confident" responses were assigned to the "high confidence" category.

[5] Gardening self-efficacy, behavioral capability, and social norms, and FV consumption.

Similar to the measures of self-efficacy, there were two items measuring behavioral capability; one for FV preparation and the other for gardening tasks. For both items, response options included "Not at all," "A little," or "A lot". Responses were dichotomized into "low capability" and "high capability" during analysis using the same qualifying criteria as the self-efficacy categories.

One item on the survey was used to measure social/gardening norms based on whether respondents knew people who gardened. Response options included, "not true," "somewhat true," or "very true." Those who reported "not true," or "somewhat true" were recoded into a "low norm" category, while "very true" responses were assigned to the "high norm" category.

There were three items measuring barriers to gardening. The item that measured financial barriers allowed respondents to identify the degree to which five specific garden costs (water, tools, irrigation systems, fencing materials, and gas) are a concern. Respondents could select one of the following three options: "not at all," "a little," or "a lot." In analysis, financial barriers were dichotomized. Those who responded with "a little" or "a lot" for any of the five cost barriers where categorized as having experienced financial barriers to gardening. The remaining two items asked respondents to select one environmental and one social barrier to gardening from a list of options. The options in both the environmental and social barriers questions were informed by focus groups, which had previously identified the most significant barriers to gardening on the Navajo Nation[1]. Response options included lack of space, insects or pests, weeds, low temperatures, wind gusts, animals, or other. During analysis, "insects or pests" and "animals" were recoded into an "insects and animals" category, and "low temperatures" and "wind gusts" were recoded into an "adverse weather" category. Response options for social barriers included lack of time, physical impairment, lack of social support, or other factors that made participants less likely to garden.

There were seven items to collect demographic data, which included age, gender, marital status, race, ethnicity, education level, language capabilities, and employment status.

Results

Of the 106 participants, most were female (66%), AI/AN (97%), and had completed some college or held a college degree (65%) (Table 1). The average age of respondents was 39.9 years and most were employed (54%). The average gardening frequency within the entire study population was 7.3 times per month. The majority (54%) of participants were non-gardeners[6] (figure 1). Among those that gardened at least once in the past growing season (n=48), the average gardening frequency was 16.1 times per month and the majority (83%) reported gardening more than 4 times per month. Participants reported consuming an average of 2.4 servings of fruits and vegetables per day.

Table I. Demographic characteristics of survey respondents (N=106)

	N	%
Average Age (years)	39.9	±15.2
Gender		
Female	70	66
Male	36	34
Race		
American Indian/Alaskan Native	103	97
Other	3	3
Education		
<High school/GED	4	4
High school diploma/GED	33	31
Some college/college degree	68	65
Employment Status		
Employed	57	54
Unemployed	18	17
Student	18	17
Retired	6	6
Other	7	7

[6] gardened zero times in a one-month period of the past growing season.

Gardening Characteristics		
Non-gardeners (zero times/month)	58	54
Gardeners (≥1 time/month)	48	45
Gardening Frequency		
Average monthly frequency	7.3	±13.8
Less than 4 times per month	76	72
4 or more times per month	30	28
Gardening Self-Efficacy		
Low confidence	82	77
High confidence	24	3
Gardening Behavioral Capability		
Low capability	88	83
High capability	18	17
Gardening Norms		
Low	84	79
High	22	21
Fruit and Vegetable (FV) Consumption		
Average daily consumption	2.4	±1.6
0-1 times per week	36	34
2-3 times per week	52	50
4-5 times per week	12	12
> 5 times per week	5	5
FV Self-Efficacy		
Low confidence	45	42
High confidence	61	58
FV Behavioral Capability		
Low capability	42	40
High capability	64	60

Figure 1. Monthly frequency of gardening amongst all participants (N=106)

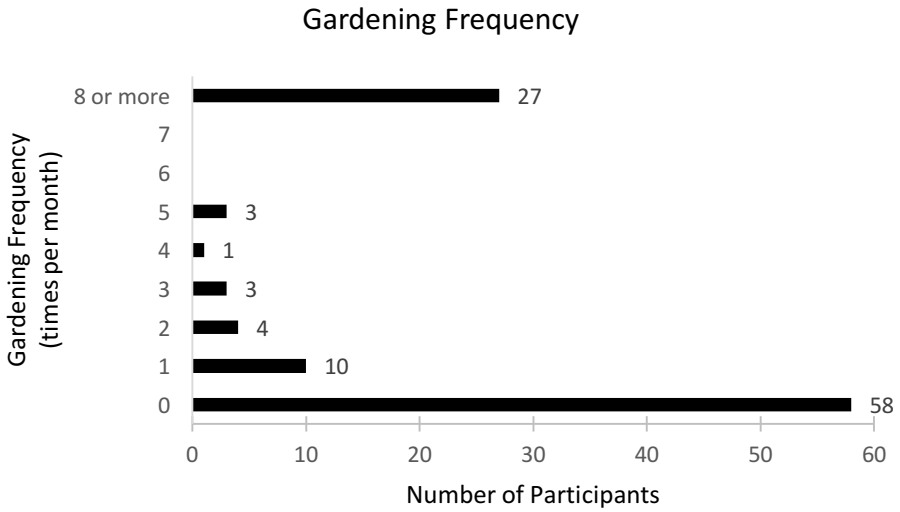


Table 2 shows the associations between average daily FV consumption and self-efficacy and behavioral capability. A majority (58%) of respondents reported low self-efficacy[7] to consume FV daily. FV consumption was lower (1.8 servings/day) amongst the low self-efficacy group, compared to the high self-efficacy group (2.8 servings/day) (p=<0.01). A majority (60%) of respondents reported high capability in preparation of FV. Amongst those who reported high behavioral capability, their FV consumption was significantly more than (3.0 servings/day) the average amount of those in the low capability group (1.5 servings/day) (p=<0.01).

Table 2. Average daily fruit and vegetable (FV) consumption by level of self-efficacy and behavioral capability (N= 106)

Theoretical Mediators	N	%	Daily FV	Difference and 95% CI	*p value*
FV Self-Efficacy					
Low confidence	45	42	1.8	0.97	<0.01
High confidence	61	58	2.8	(0.4, 1.6)	
FV Behavioral Capability					
Low capability	42	40	1.5	1.47	<0.01
High capability	64	60	3.0	(0.9, 2.0)	

[7] Low self-efficacy: low or somewhat confident

Behavioral predictors of gardening and their associations with gardening frequency are reported in Table 3. The majority of the study population reported low gardening self-efficacy (77%), behavioral capability (83%), and norms (79%). Those who reported low self-efficacy gardened 5.8 times/month, while those with high self-efficacy gardened 12.4 times/month (p=0.04). Similarly, gardening frequency was higher amongst those who reported high behavioral capability (13.3 times/month) compared those who reported low capability (6.1 times/month) (p=0.04). Though it was not statistically significant, gardening frequency was also higher in the group with higher gardening norms (9.3 times/month) than those in the group with low norms (6.8 times/month) (p=0.4).

Table 3. Frequency of gardening by level of self-efficacy, behavioral capability, and social norms (N=106)

Theoretical Mediators	N	%	Gardening (times/month)	Difference and 95% CI	*P* value
Gardening Self-Efficacy					
Low confidence	82	77	5.8	6.6 (0.4, 13.0)	0.04
High confidence	24	23	12.4		
Gardening Behavioral Capability					
Low capability	88	83	6.1	7.3 (0.3, 14.3)	0.04
High capability	18	17	13.3		
Gardening Norms					
Low norm	84	79	6.8	2.6 (4.0, 9.1)	NS
High norm	22	21	9.3		

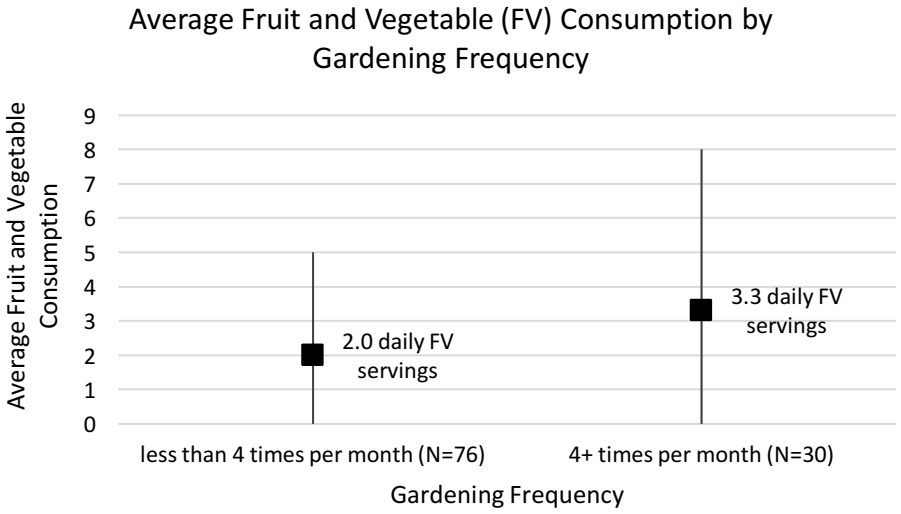
Lack of time (49%), financial barriers (47%), and insects and animals (42%) were the three most commonly reported barriers to gardening among participants (Table 4). Gardening frequency varied depending on which barriers participants identified. Lack of space (4.5 times/month) and lack of time (6.2 times/month) were associated with the lowest levels of gardening.

Table 4. Frequency of gardening by barriers (N=106)

Theoretical Mediators	N	%	Gardening (times/month)	Difference and 95% CI
Barriers to Gardening				
Lack of time	51	49	6.2	1.1 (-3.1, 1.0)
Financial barriers	50	47	9.5	4.2 (-9.5, 1.1)
Insects and animals	44	42	7.6	0.47 (-5.9, 5.0)
Lack of social support	22	21	6.5	0.36 (-7.4, 6.6)
Lack of space	17	16	4.5	-3.3 (-3.9, 10.6)
Weeds	12	11	9.3	2.2 (-10.6, 6.2)
Adverse weather	12	11	7.1	0.24 (-8.2, 8.7)

We also assessed whether fruit and vegetable consumption varied by gardening frequency (Figure 2). Daily fruit and vegetable consumption was the highest (3.3 servings/day) among those gardening 4 or more times per month (72%). In comparison, participants who gardened less than 4 times per month (28%) consumed an average of 2.0 servings of fruits and vegetables per day.

Figure 2. Average daily fruit and vegetable (FV) consumption by frequency of gardening (N= 106)



Discussion

This study is one of the first to describe gardening behaviors among residents of the Navajo Nation. Our research provides a profile of gardening on the Navajo Nation that allows us to begin to understand the gardening and garden-based interventions can be used to promote health. The following section highlights key findings related to theoretical mediators and barriers to gardening and the implications of this research.

A large proportion of the participants reported no gardening in the past growing season, suggesting gardening is not yet a normative health behavior on the Navajo Nation. The low levels of reported self-efficacy, behavioral capability, and social norms related to gardening may explain the low prevalence of gardening on the Navajo Nation. Despite low levels of gardening, there was a positive association between self-efficacy and behavioral capability to garden and gardening frequency, which may indicate that interventions aimed at addressing these theoretical mediators may lead to an increase in gardening in this population.

Among those who identified as gardeners (n=48), the average frequency of gardening was 16.1 times per month, or more than two times per week. In comparison, a study by Barnidge et. al. (30)

surveyed known community gardeners in rural Missouri (n=141) and found that 63.8% gardened at least once a week, while 29.8% gardened less than once a week. Within our subpopulation of gardeners (n=48), 83% gardened four or more times a month, or roughly once a week, demonstrating a higher proportion of high frequency gardeners than the Barnidge et. al. study.

Understanding the unique barriers to gardening within this population can provide insight into things to address in interventions to promote gardening. Lack of time (49%), cost (47%), and insects and animals (42%) were the most frequently identified barriers to gardening, however there seemed to be no correlation between the prevalence of a specific barrier and gardening frequency. Time and cost are two commonly cited barriers to accessing healthy food both on the Navajo Nation (3,9,10) and in the general population (44).

Similar to the findings on FV consumption on the Navajo Nation by Ballew et. al. (44), the current study found daily FV consumption to be relatively low (2.4 servings/day). However, the majority reported high levels of self-efficacy (58%) and behavioral capability (60%) in regards to FV consumption and preparation. There also appeared to be a trend in gardening frequency and FV consumption, although the study's sample size is too small to draw a definitive correlation.

Limitations

There are several limitations to the current study. Data collection was limited to two communities on the Navajo Nation, a geographic area that spans more than three different states. As such, our sample may not be representative of communities in other parts of the Navajo Nation. The study areas were selected according to close proximity to the NMSU Agriculture Science Center and participant surveying occurred at chapter houses, community centers, and other public areas near two

community gardens. The latter may limit the generalizability of our population to those who accessed these public spaces on data collection days.

Future Research and Implications

Developing an effective garden-based health intervention for members of the Navajo Nation appears to require a focus on building individual's confidence in their ability to prepare, maintain, and cultivate a garden, regardless of whether it is a community- or home-based garden. Building self-efficacy and behavioral capability through both didactic and experiential garden education that is rooted in traditional Navajo growing practices may be an effective model for increasing gardening as a health practice[1]. Nevertheless, addressing the time and cost constraints of this disproportionately resource-poor population may be a significant barrier, as gardening can require substantial time and money. A community garden model—where resources such as land, tools, water, and even produce can be shared communally—may be a more feasible intervention design than individual/home-based gardens. Future research should focus on corroborating the associations found and evaluating the direction of the causal relationship between gardening and fruit and vegetable consumption across the Navajo Nation. In addition, we want to understanding best practices to developing and implementing garden interventions based to the variation in demographics, climate, and terrain in different regions of the reservation.

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