INTERNATIONAL JOURNAL OF CIRCUMPOLAR HEALTH
2024, VOL. 83, 2359164
https://doi.org/10.1080/22423982.2024.2359164

Taylor & Francis
Taylor & Francis Group

ORIGINAL RESEARCH ARTICLE

OPEN ACCESS Check for updates

Fruit and vegetable intake, physical activity, and functional fitness among older adults in urban Alaska

Allexis Mahanna [a], Britteny M. Howell [a,b], Amber K. Worthington [c], Leslie C. Redmond [d] and Vanessa Y. Hiratsuka [b,e]

[a]Population Health Sciences, University of Alaska Anchorage, Anchorage, AK, USA; [b]National Resource Center for Alaska Native Elders, University of Alaska Anchorage, Anchorage, AK, USA; [c]Communication, University of Alaska Anchorage, Anchorage, AK, USA; [d]Agricultural and Food Sciences, University of Manitoba, Winnipeg, MB, Canada; [e]Research, Southcentral Foundation, Anchorage, AK, USA

ABSTRACT
Older adults often face barriers to obtaining recommended diet, physical activity, and fitness levels. Understanding these patterns can inform effective interventions targeting health beliefs and behavior. This cross-sectional study included a multicultural sample of 58 older adults (aged 55+ years, M=71.98) living in independent senior housing in urban Southcentral Alaska. Participants completed a questionnaire and the Senior Fitness Test that assessed self-reported fruit and vegetable intake, physical activity, self-efficacy, and functional fitness. T-tests and bivariate correlation analyses were used to test six hypotheses. Results indicated that participants had low physical activity but had a mean fruit and vegetable intake that was statistically significantly higher than the hypothesized “low” score. Only 4.26% of participants met functional fitness standards for balance/agility, and 8.51% met standards for lower-body strength. However, 51.1% met standards for upper-body strength and 46.8% met standards for endurance The results also indicated that nutrition self-efficacy and exercise self-efficacy were positively related to fruit and vegetable intake and physical activity levels, respectively. Interestingly, income was not related to nutrition or activity patterns. These data complicate the picture on dietary and physical activity patterns for older adults in Alaska and offer recommendations for future health promotion activities.

ARTICLE HISTORY
Received 12 January 2024
Revised 20 May 2024
Accepted 20 May 2024

KEYWORDS
Self-efficacy; senior fitness test; healthy aging; self-reported health behaviors; nutrition; physical activity

Introduction

Every country is experiencing growth in both the size and proportion of the older adult population. In 2020, the number of people aged 60 years and older outnumbered children under the age of 5 years for the first time [1]. In the United States (U.S.), nearly 17% of the population is aged 65 or over [2], and Alaska is the state with the fastest growing proportion of older adults in the country. Between 2010 and 2020, the 65 + year old population in Alaska increased by 73% [3] and makes up more than 20% of the population [4], making Alaska an ideal location to study issues related to healthy aging in the U.S. Studying healthy aging in Alaska can also offer global relevance, as other countries and regions in the Circumpolar North may be experiencing similar issues related to population aging.

As the world population ages faster than ever, people are also living longer, increasing their risk of chronic health conditions such as heart disease, diabetes, dementia, and stroke [5]. Research shows that health behaviors, such as obtaining a healthy diet and adequate exercise, can lower the risk of many chronic conditions [6,7]. For example, an increased intake of fruits and vegetables has been associated with lower mortality, and research shows that a healthy diet can lower cholesterol levels and reduce the risk of hypertension, heart disease, stroke, dementia, and osteoporosis [7–10]. In particular, the Nordic diet has shown benefits in improving functional fitness, with older adults who follow this diet having a reduced likelihood of mobility limitations and difficulties in self-care activities [11]. The Nordic diet has also shown potential neuroprotective benefit, improving brain health due to antioxidant and anti-inflammatory properties [12]. The Nordic diet includes vegetables, legumes, whole grains, and a low intake of sugar-sweetened products; notably it overlaps with some traditional foods for Alaska Native/American Indian (AN/AI) peoples in its

CONTACT Allexis Mahanna ammahanna@alaska.edu Population Health Sciences, University of Alaska Anchorage, 3211 Providence Dr, Anchorage, AK 99508, USA

inclusion of local game meat, shellfish, fish rich in omega-3 fatty acids, and berries [12,13].

However, older adults in the U.S. tend to face barriers in obtaining recommended amounts of fruits (1.5–2 cups) and vegetables (2–3 cups) per day, where only 10–12% of the adult population meets these recommendations. [14,15 These barriers can be due to the high cost of fruits and vegetables, which have increased more rapidly than processed and packaged foods [9,16]. Transportation barriers and having a lower income can make it more difficult for older adults to access grocery stores with fresh fruits and vegetables [9]. Additionally, lower-income older adults perceive fruit and vegetables as less affordable than those with a higher income [17]. Access to fruits and vegetables can be more difficult for Alaskan older adults due to increased costs and potential supply chain interruptions, since 95% of purchased foods are imported to this Circumpolar North location [18,19].

Older adults in the U.S. also fall lower than the recommended physical activity guidelines of 150 minutes of moderate-intensity aerobic activity, muscle-strengthening activities of moderate or greater intensity two or more days a week, and balance training [20]. Nearly 28% of older adults in the U.S. reportedly participated in “no activity beyond baseline activities of daily living” in 2014 [21]. Research shows that physical inactivity can result in a loss of functional fitness [21], which is the capacity to perform normal, everyday activities and can signal an older adult’s ability to remain physically mobile and independent into later life [22]. Between 2017 and 2021, 58% of older adults in Alaska met the aerobic recommendation, 29.5% met muscle strengthening recommendations, and only 22.4% met both aerobic and muscle strengthening recommendations [23].

Research shows that self-efficacy, an individual’s confidence in their ability to exert control over a situation and make plans to achieve an outcome, influences a variety of health behaviours, including dietary intake and physical activity [24,25]. For example, self-efficacy can be a predictor of fruit and vegetable intake, with lower self-efficacy leading to diminished consumption of fruits and vegetables[17,26,27]. Likewise, increased self-efficacy is associated with increased physical activity [28] and functional fitness among older adults [29]. Therefore, older adults with higher self-efficacy are more likely to engage in that activity, making self-efficacy a predictive tool for health behaviors [30,31]. Although self-efficacy has been found to encourage health promotion in older adults [32], perceptions of self-efficacy to obtain a healthy diet, physical activity, and adequate functional fitness may be lower in older adults [33].

Older adult health behaviours in the U.S. are also inextricably linked with income [34]. As briefly mentioned above, the cost of food, especially in the Circumpolar North, can impact what older adults feel comfortable buying, with those in a higher income bracket being more likely to afford higher price items, like fruits and vegetables [9]. In Alaska, roughly 1 in 8 older adults (50+ years old) report food insecurity, or difficulty obtaining desired foods, most of whom live in urban areas [18]. Likewise, income can also have an impact on the ability to be physically active. Research has shown that self-reported physical activity is negatively associated with socioeconomic status among older adults [35]. Therefore, the primary aim of this study is to examine the interplay between diet, exercise, functional fitness, self-efficacy, and income among older adults in an urban Circumpolar environment. Through quantitative analysis and a review of existing research, we seek to elucidate the complex relationships between these variables, and the resulting implications for health beliefs and behaviors among this population.

Study context

Alaska is an ideal location for the study of these complicated relationships between diet, exercise, functional fitness, self-efficacy, and income among older adults. Alaska is the 12th most diverse state in the U.S., with a diversity index of 62.8% [36]. Although the largest group is Whites (not Hispanic or Latinx/e), the second and third largest racial/ethnic groups include AN/AI peoples and those reporting two or more races (not Hispanic or Latinx/e, respectively). Since 43.1% of Alaska’s total 60+ year old population resides in the urban Southcentral region, characterized by rapid growth combined with the unique characteristics of living in the Circumpolar North, it is an important population to better understand [37].

Alaska has conditions much like the rest of the Circumpolar North which impact food intake and physical activity, including extreme winters that can reduce safe access to the outdoors, reduced access to fresh fruits and vegetables, and limited access to comprehensive healthcare and social services [19,38]. Older adults can be disproportionately impacted by these conditions, due to risks that increase with age such as limited mobility, decreased social networks, and other pre-existing vulnerabilities [38]. Living in an urban environment can also limit access to traditional or local foods and valued social networks for Alaska Native Elders [39–41]. Older adults, aging advocates, and providers in urban Alaska have cited a need for safer physical activity opportunities and access to affordable fruits and vegetables year-round [37]. These data and the previous research, reviewed above, provide context for the hypotheses in this study:

H1: Participants will report low fruit and vegetable intake.

H2: Participants will report low physical activity scores.

H3: Participants will not meet the minimum Senior Fitness Test criterion-referenced fitness standards for maintaining physical independence (by age and gender) across the four assessment outcomes (lower-body strength, upper-body strength, endurance, and balance/agility).

H4: Nutrition self-efficacy will be positively related to fruit and vegetable intake.

H5: Exercise self-efficacy will be positively related to physical activity levels.

H6: Participants with higher income (>$25,000) will have higher fruit and vegetable intake and physical activity levels than those with lower income (<$25,000).

Materials & methods

Participants and procedures

A convenience sample of participants aged at least 55 years and living in four independent senior apartment complexes in urban Southcentral Alaska were recruited for an intervention study. Participants (N=58) were recruited through newsletter ads and posted flyers in common areas of their housing communities to participate in the program in December 2022. After providing informed consent, participants completed a baseline questionnaire in January 2023 before beginning the program, the results of which are reported here (see *Howell et al.* [69] for more information on the intervention study). All study protocols and procedures were reviewed and approved by the Alaska Area Institutional Review Board (AAIRB project #2021-08-038) and Southcentral Foundation, the Alaska Native-owned health corporation serving nearly 70,000 AN/AI peoples living in the region.

Measures

Participants completed a self-report questionnaire that assessed fruit and vegetable intake, physical activity levels, health-related self-efficacy, overall health, and demographic variables. Participants also completed the Senior Fitness Test (SFT) to assess functional fitness [42,43].

Fruit and vegetable intake

Fruit and vegetable intake was measured via the NutritionQuest Fruit/Vegetable/Fiber Screener [44]. This screener is comprised of self-reported items and included the stem: "Think about your eating habits over the past year or so. About how often do you eat each of the following foods? Remember breakfast, lunch, dinner, snacks and eating out" followed by seven items designed to assess fruit and vegetable intake (e.g. "any fruit, fresh or canned (not counting juice)", "green salad", and "vegetable soup, or stew with vegetables"). Response options ranged from "0"="Less than one per week" to "5"="2 or more per day". All missing values are coded as "0". Total fruit and vegetable intake was scored as the sum of all seven items (range=0–35), with low intake defined as a score of 0–11.

Physical activity levels

Physical activity levels were measured via the Physical Activity Scale for the Elderly (PASE) [45]. Participants were asked to indicate the frequency (days/week) and duration (hours/day) they participated in 12 different occupational, household, and leisure activities over a one-week period, including walking outside; light, moderate, and vigorous recreational activities; strength exercises; light and heavy housework; repairs, yard work, gardening, and caring for others. Using the original Washburn et al. [45] scoring procedures, each activity type was assigned an empirically derived weight, and frequency/duration was converted to hours per day using the PASE conversion table. The score for each activity type was calculated as the product of those two numbers. The total PASE score was then calculated as the sum of all 12 activity scores (range 0 to 400 or more). PASE has been studied and is recommended for measuring older adult physical activity with sufficient reliability and construct validity even with small sample sizes [46,47].

Nutrition self-efficacy

Nutrition self-efficacy was measured via a subscale of four items from the Self Rated Abilities for Health Practices (SRAHP) with response options ranging from "0"="Not at all" to "4"="Completely" [48]. Items included the stem "I am able to" followed by: (1) Find healthy foods that are within my budget; (2) Figure out how much I should weigh to be healthy; (3); Tell which foods are high in fiber content; and (4) Drink as much water as I need to drink every day. Nutrition self-efficacy was calculated as the sum of these four items, ranging from 0 to 16 (M=11.63; SD=3.63; α=.80).

Exercise self-efficacy

Exercise self-efficacy was measured via a subscale of four items from the Self Rated Abilities for Health Practices (SRAHP) with response options ranging from "0"="Not at all" to "4"="Completely" [48]. Items included the stem "I am able to" followed by: (1) Do exercises that are good for me; (2) Find ways to exercise that I enjoy; (3) Know when to quit exercising; and (4) Keep from getting hurt when I exercise. Exercise self-efficacy was calculated as the sum of these four items, ranging from 0 to 16 (M=11.27; SD=3.92; α=.84).

Functional Fitness

The Senior Fitness Test (SFT) was used to estimate participants' functional fitness, including outcomes such as strength in the arms (upper body), strength in the legs (lower body), endurance, and balance/agility [42,43]. A trained interprofessional team of undergraduate and graduate students administered the SFT to the participants, including taking measurements of the 30-sec chair stand (i.e. lower-body strength), the 30-sec arm curl (i.e. upper-body strength), the 2-min step test (i.e. endurance), and the 8-foot up-and-go test (i.e. balance and agility). Each participant's individual result was compared to criterion-referenced fitness standards for older adults to maintain physical independence, provided for men and women in seven different age groups (60–64; 65–69; 70–74; 75–79; 80–84; 85–89; 90+ years). These fitness standards, based on age and gender, are the minimum scores that indicate the level of fitness older adults need in order to remain physically mobile and independent into later life [42]. These fitness standards can be found in Rikli and Jones [42]. The SFT has reliability and validity indicators of .79–.97 for assessing fitness levels associated with physical independence later in life and has been used in at least 18 other studies to analyze functional fitness metrics among older adult populations [42,49].

Income

Income levels were collected as part of the demographic characteristics measured in this study. They included the following four options: under $25,000; $25,000–$44,999; $45,000-$99,999; and $100,000+. The 2024 U.S. Poverty Guidelines for Alaska are between $18,000-$25,000 per 1- and 2-person households, respectively. Thus, for analysis in this study, "lower income" was considered under $25,000/year [70].

Data analysis

One-sample *t*-tests, independent sample *t*-tests, and bivariate correlation analyses were conducted in SPSS Statistics v27 [68] to test the six hypotheses in this paper. A power analysis was conducted using *G*Power* 3.1.9.7 [50,51] that indicated the required sample size to achieve 80% power at a significance criterion of α=.05 is N=15 for one-sample *t*-tests, N=52 for independent samples *t*-tests, and N=34 for bivariate correlation analyses. Thus, the obtained sample size of N=58 is adequate for all reported analyses.

Results

Participants included N=58 older adults ranging from 57 to 87 years (M=71.98, SD=8.74). Women made up 84.5% of the sample. Additional participant demographic information is displayed in Table 1, below.

A one-sample *t*-test was run to determine whether fruit and vegetable intake among participants was low (H1). The mean fruit and vegetable intake (M=12.41, SD=4.98) was higher than the cut-off of 11, a statistically significant mean difference of 1.41, 95% *CI* (0.10 to 2.72), *t*(57)=2.16, p=.035. Thus, hypothesis one was not supported (see Table 2, below).

Participants' scores on the PASE ranged from 0 to 561.93. A one-sample *t*-test was run to determine whether physical activity among participants was low (H2), which is defined as 0–103 based on the preliminary norms established by the PASE scoring manual [52]. The mean PASE score (M=105.29, SD=100.34) was not statistically significantly higher than 103, with a mean difference of

Table 1. Participant demographics (N=58).

	n	%
Race		
White/Caucasian	39	67.24%
Alaska Native/American Indian	14	24.14%
Asian/Native Hawaiian/Pacific Islander	2	3.4%
Black/African American	8	13.79%
Multiracial (% also included in above numbers)	5	8.62%
Ethnicity		
Hispanic/Latino(a)	3	5.17%
Not Hispanic/Latino(a)	45	77.59%
Missing	10	17.24%
Education Level		
Some high school (grades 9–12)	4	6.90%
High school graduate or GED	10	17.24%
Vocational, technical school, or some college	18	31.03%
College graduate	12	20.69%
Post-graduate degree	6	10.34%
Other	8	13.79%
Income		
Under $25,000	30	51.72%
$25,000–$99,999	22	37.93%
Missing	6	10.34%

2.30, 95% *CI* (−24.09 to 28.68), $t(57)=0.17$, $p=.86$. Thus, hypothesis two was supported (see Table 2, above).

A total of 47 participants completed the SFT (11 participants did not complete the SFT because of illness, physical inability to complete the measurements, or enrolling in the program after SFT data were collected in each community). Of those 47 participants, only 8.51% had scores that were at or above the fitness standards for their gender and age group (H3) for lower-body strength; 51.1% had scores at or above the fitness standards for upper-body strength; 46.8% had scores at or above the fitness standards for endurance; and 4.26% had scores at or above the fitness standards for balance and agility. Hypothesis three was partially supported, as most participants did not meet minimum functional fitness scores (for age and gender) for balance/agility and lower-body strength, however, the outcomes for upper-body strength and endurance were closer to fitness standards for age and gender (see Table 3, below).

Bivariate correlations revealed that nutrition self-efficacy (H4) was positively correlated with fruit and vegetable intake ($r=.33$, $p<.05$) and that exercise self-efficacy (H5) was positively correlated with physical activity levels ($r=.35$, $p<.01$), supporting hypotheses four and five. An independent samples *t*-test revealed that there was no statistically significant difference in fruit and vegetable intake between those with higher income levels ($M=12.31$, $SD=5.43$) compared to those with lower income levels ($M=12.53$, $SD=5.10$), $t(50)=0.15$, $p=.88$ (H6). Likewise, an independent samples *t*-test also revealed that there was no statistically significant difference in physical activity scores on the PASE between those with higher income levels ($M=118.18$, $SD=132.88$) compared to those with lower income levels ($M=98.16$, $SD=79.21$), $t(50)=0.68$, $p=.50$; thus, hypothesis six was not supported.

Discussion

This study's aim is to evaluate the relationships between diet, exercise, functional fitness, self-efficacy, and income among older adults in an urban Circumpolar environment. We found that older adults had higher than hypothesized fruit and vegetable intake. Participants did report low physical activity scores as hypothesized, with the mean activity not statistically significantly higher than the low threshold. While a majority of participants (between 91% and 95%) did not meet ideal functional fitness scores, as established by the Senior Fitness Test, for balance/agility and lower-body strength, nearly half of participants did meet standards for upper-body strength (51.1%) and endurance (46.8%). Nutrition self-efficacy and exercise self-efficacy were positively correlated with fruit and vegetable intake and physical activity levels, respectively. Finally, there was no statistically significant difference in fruit and vegetable intake or physical activity between higher income (>$25,000) and lower income (<$25,000) groups.

Nutrition and physical activity in the Circumpolar North are valuable to understand since many health outcomes can directly benefit from adoption of improved behaviors. In Alaska between 2017 and 2021, 31.8% of older adults had 2+ daily servings of fruit or fruit juice, 14.5% of older adults had 3+ daily servings of vegetables, and 16.3% of older adults had 5 + daily servings of fruit and vegetables, suggesting low overall intakes [23]. However, the mean fruit and vegetable intake in our sample was not considered "low" on the self-report questionnaire. This means that hypothesis one was not supported, but this outcome does not necessarily mean that the older adults in this study meet the recommended intake amount for fruit and vegetables, as per the U.S. Department of Agriculture dietary recommendations for seniors [15]. Research has found that men reportedly consume fewer fruit and

Table 2. Results of One-sample *t*-tests for Fruit/Vegetable Intake & Physical Activity.

Variable	Mean (SD)	Low Score	Mean Difference	t (df)	p-value*	95% C.I.
Fruit & Vegetable Intake	12.41 (4.98)	0–11	1.41	t(57)=2.16	.035*	0.10–2.72
Physical Activity	105.29 (100.34)	0–103	2.30	t(57)=0.17	.86	−24.09–28.68

*Indicates statistical significance.

Table 3. Results of Senior Fitness Test Standards.

Variables	Test	Unit	Range of Minimum Fitness Standards	% of Participant Scores Meeting Fitness Standards
Upper-Body Strength	Arm Curls	# of curls	11–17	51.1%
Lower-Body Strength	Chair Stands	# of stands	9–17	8.51%
Endurance	Step Test	# of steps	60–106	46.8%
Balance & Agility	Up-and-Go Test	seconds to finish	4.8–8	4.26%

Minimum fitness standards listed include the possible range for all age groups by gender [42]. See full list of fitness standards in Rikli and Jones [42]. To determine % of scores within the standards, each participant was measured only against their age and gender standards.

vegetables daily than their women counterparts [9,53], but this study was unable to explore this directly due to an insufficient number of male participants. Increased fruit and vegetable intake promotes healthy aging, minimizes development and impact of chronic conditions, and offers many health benefits from the increased consumption of phytochemicals, which can lower oxidative stress and inflammation [54]. Eating habits that encourage increased intake of fruit and vegetables, like the Nordic diet, should continue to be discussed with older adults [11,12]. While it is promising to see that the older adults within this study on average ate more than a "low" number of fruits and vegetables, this should still be an area of focus for interventions and future research. Additionally, since these adults had self-selected to be part of this study population, there is a potential that these higher rates are related to their interest in being part of the intervention program aimed at improving these behaviors.

The nutrition transition, or the replacement of traditional, subsistence foods with a processed Western diet, is also associated with lower diet quality and subsequent chronic diseases. While it was not measured as part of this study, it has been shown that traditional foods for AN/AI peoples are less accessible in urban areas than they are in rural Alaskan environments [55–57]. Traditional foods are important for psychological, social, cultural, and physical health; associated with improved health outcomes, better lipid profiles, lower risk of heart disease, and higher intake of valuable nutrients [13]. Working to understand the components of nutritional profiles for different cultural and racial groups in the urban Circumpolar North will inform what older adult needs exist, and how policy and regulation changes at state and federal program levels can be enhanced to support traditional food security [58].

Only 22.4% of Alaskan older adults meet the aerobic and strengthening recommendations [23]; therefore, physical activity and functional fitness were hypothesised to be low in the sample. Indeed, we found that the mean Physical Activity Scale for the Elderly (PASE) score was not statistically significant from the cut-off, meaning the sample had low physical activity patterns. Having a higher PASE score has been found to be significantly correlated with better health, due to reduced chronic health conditions, ranging from musculoskeletal to cardiovascular to mental/emotional [45,59]. In other research utilising the PASE, having a higher income resulted in higher mean PASE scores [60]. However, in this sample PASE scores were not associated with higher income. In general, the PASE can be a valuable measure to understand health outcomes for older populations from a different perspective, but older age can lead to a decrease in PASE scores, so the age of a cohort should be considered during analysis.

As shown in hypothesis 3, older adults in this study had better outcomes for meeting fitness standards at/above their gender and age group with upper-body strength (51.1%) and endurance strength (46.8%), but very few individuals met fitness standards for lower-body strength (8.51%) or balance and agility (4.26%). The restrictions that older adults experienced (and continue experiencing) due to COVID-19 include limited access to ventilated indoor areas in which to walk and perform exercise [61]. This restriction of movement, especially in the Circumpolar North environment where much of the winter proves difficult to get outside, can lead to reduced balance and lower-body strength and increased falls. Balance is a vital component of older adult health and requires the use of many different muscles in the whole body [20]. Focusing on improving balance could similarly improve lower-body strength. Older adults may lack lower-body strength and balance if they are sedentary or have poorer functional performance in the lower body [22]. By focusing on multicomponent physical activity that includes aerobic and strengthening activities, older adults could improve lower-body strength and balance, with a goal to incorporate these activities regardless of weather or other environmental obstacles [20]. Early identification of upper- and lower-body functional impairments among aging adults in the Circumpolar North may inform interventions to prevent or delay functional disability in community-dwelling older Alaskans.

Identifying the relationship between self-efficacy, health indicators, and health behaviors in the context of aging is also important to inform future health research and interventions for community-dwelling older adults. Considering that self-efficacy can be a predictive concept for fruit and vegetable consumption and physical activity [17,26–28,30,31], this is an important component of behavior modifications for healthy aging. The results from this study support the existence of these relationships for older adults in urban Alaska, with nutritional self-efficacy positively correlated with fruit and vegetable intake and exercise self-efficacy positively correlated with physical activity levels. Healthy aging interventions which focus on nutrition and/or physical activity should also support participant self-efficacy, due to the potential ramifications of increased self-efficacy improving health outcomes across a range of behaviors.

However, those with higher income levels were not found to have better physical activity or fruit/vegetable intake. Individuals with a higher income in this study did have a slightly higher average level of physical activity (118.18) compared to those at a lower income level (98.16), a mean difference of 20.02, although this was not statistically significant. A majority of the individuals in this study (n=30) had an income below $25,000 per year. Nearly 10% of Alaskans aged 65 years and over are estimated to live below the poverty line; furthermore, nearly 9,500 seniors in Southcentral Alaska receive low to moderate income senior benefits as of October 2022 [37]. This provides insight into the financial needs of older adults in Alaska, particularly those in the Southcentral region, which encompasses a significant amount of all older adults in Alaska. Income can be a powerful demographic characteristic in understanding health barriers and outcomes. Though a statistically significant finding was not apparent in this study, this relationship should still be considered in future studies with a larger population size and with more diversity of income across the population.

Alaskan seniors are more likely to report poor health outcomes and less likely to report excellent health status as compared to seniors in the contiguous U.S.; Alaska has the second lowest health-related quality of life score as compared to all other states [38,62,63]. Living in a rural area has been found to be protective against adverse health outcomes, apart from obesity [62]. Working to understand the impacts that the urban environment has on older adults is the best way to tailor effective interventions to improve health outcomes for this growing and structurally underserved community.

Limitations and future directions

While this study adds to the limited literature on Alaskan older adult populations, which can inform health program development and implementation, it also has limitations that should be taken into consideration. It is cross-sectional, so as a snapshot in time, it cannot assess incidence nor conclude causal relationships. There was a small sample size of 58 participants, and while this was adequate for the analyses conducted as found by a power analysis, it nonetheless makes it difficult to ensure the population is truly represented. Since this was a convenience sample, generalizability may be further limited. Given that our study had an overrepresentation of females (84.5% of the sample), the conclusions drawn from these data may not provide an accurate portrayal of both genders. Other relevant limitations include the social determinants of health that are covariable and/or confounders in the health outcomes discussed above. While causal relationships were not presented, the associations discussed above do not include all potential factors that could influence their relationship.

Additionally, these data include self-report measures which may not represent the participants' actual behaviours, due to recall and response bias. This is particularly true for older adults, who may have decreased working memory capacity (including cognitive reasoning, attention, and memory) and may have comprehension challenges and/or difficulties responding to question formats (open ended vs. closed ended; rating scales; question order) [64]. Accuracy of self-reporting is also related to the self-relevance of the subject matter, so the relevance of the question to each participant may alter the reliability of their answer. While some studies found self-reported physical activity quantity and fruit and vegetable intake were over-reported and sedentary time was under-reported when compared to objective measures, other studies and a systematic review have not found clear patterns in self under/over reporting [65–67]. The Self Rated Abilities for Health Practices (SRAHP) scale was designed for participants with disabilities [48]. Though many study participants could have disabilities, as is common in older adult populations, it is notable that scores from the SRAHP scale could have a ceiling effect for non-impaired adults. The modified (shortened) SRAHP utilised in this study could have altered reliability and validity of the original tool. Additionally, the dietary screener used in this study combined fruits and vegetables into one score, and thus we were unable to determine if each separately meets the national recommendations.

Future work should recruit more participants, utilize a random sampling method, and obtain an even distribution of males and females to further evaluate the trends. We also recommend the use of more objective measures to validate self-report measures in dietary intake and physical activity patterns. Additionally, temporality and casual relationships using longitudinal designs are needed to determine mediating pathways across the life course to support health outcomes of older adults.

Conclusion

The results of this study offer an in-depth view into some of the relationships between fruit and vegetable intake, physical activity, functional fitness, self-efficacy, and income for a multicultural group of older adults in urban Alaska. By analyzing these relationships, we can offer deeper insight on the overlapping factors that impact health beliefs and behaviors in this population. Considering the high ratio of older adults, and the diversity present in the Southcentral region of Alaska, these data can inform researchers and community members alike in better understanding community factors that may or may not impact healthy aging. The complicated picture of relationships explained above showcases the importance of research to inform an understanding of multicultural, urban, and older adult populations in the Circumpolar North, going beyond the rural research commonly associated with the region.

The results from this study offer several practical implications, building on existing research in the field. While older adults in this study demonstrated higher than anticipated fruit and vegetable intake, their intake level was still fairly low, highlighting a continued area for intervention. It is concerning that a significant number of participants did not meet functional fitness standards for balance/agility (4.26%) and lower-body strength (8.51%). Considering the valuable role balance and lower-body strength have in preventing falls, this is another potential target for intervention. In contrast, the fact that nearly half of participants met standards for upper-body strength (51.1%) and endurance (46.8%) signifies an area of resilience. By focusing on physical fitness, and emphasizing areas where individuals have demonstrated strength, older adults can attain a sense of accomplishment which may encourage their continued adherence to physical activity. Our study supported the evidence that positive correlations exist between self-efficacy and health behaviors, specifically relating to nutritional and exercise self-efficacy. This underscores the importance of fostering self-efficacy beliefs for older adults, to promote healthier lifestyle choices. Overall, these data provide practical insights for designing tailored health interventions aimed at improving functional fitness, promoting healthier diets, and enhancing self-efficacy beliefs among older adults in urban Circumpolar environments. Such interventions can contribute to overall well-being and resilience of this population.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The work was supported by the National Institute of General Medical Sciences [P20GM103395]; National Institute on Aging [R15AG072369].

ORCID

Allexis Mahanna http://orcid.org/0009-0006-0695-1765
Britteny M. Howell http://orcid.org/0000-0002-9724-5367
Amber K. Worthington http://orcid.org/0000-0001-8405-2542
Vanessa Y. Hiratsuka http://orcid.org/0000-0002-4234-9441

References

[1] World Health Organization. W. H. Organization; 2022. Ageing and health. [Fact Sheet]. Available from: https://www.who.int/news-room/fact-sheets/detail/ageing-and-health

[2] Caplan Z. U.S. Older Population Grew from 2010 to 2020 at Fastest Rate Since 1880 to 1890. U.S. Census Bureau; 2023. Available from: https://www.census.gov/library/stories/2023/05/2020-census-united-states-older-population-grew.html

[3] Administration on Aging. 2021 Profile of Older Americans. 2022. Available from: https://acl.gov/sites/default/files/Profile%20of%20OA/2021%20Profile%20of%20OA/2021ProfileOlderAmericans_508.pdf

[4] Alaska Commission on Aging. Alaska Mental Health Trust; 2023a. Alaska Commission on Aging 2023. [Presentation]. Available from: https://alaskamentalhealthtrust.org/wp-content/uploads/2020/07/ACOA-Presentation-1.24.23-REVISED.pdf

[5] Boersma P, Black LI, Ward BW. Prevalence of Multiple Chronic Conditions Among US Adults, 2018. Prev Chronic Dis. 2020 Sept 17;17:E106. doi: 10.5888/pcd17.200130

[6] Devon AD, Christopher P, Susheel PP, et al. Diet and exercise in the management of obstructive sleep apnoea and cardiovascular disease risk. Eur Respir Rev. 2017;26(144):160110. doi: 10.1183/16000617.0110-2016

[7] Maresova P, Javanmardi E, Barakovic S, et al. Consequences of chronic diseases and other limitations associated with old age – a scoping review. BMC Public Health. 2019 Nov 1;19(1):1431. doi: 10.1186/s12889-019-7762-5

[8] Boeing H, Bechthold A, Bub A, et al. Critical review: vegetables and fruit in the prevention of chronic diseases. Eur J Nutr. 2012 [2012 09 1];51(6):637–663. doi: 10.1007/s00394-012-0380-y

[9] Nicklett EJ, Kadell AR. Fruit and vegetable intake among older adults: A scoping review. Maturitas. 2013 [2013 08 1];75(4):305–312. doi: 10.1016/j.maturitas.2013.05.005

[10] Wang DD, Li Y, Bhupathiraju SN, et al. Fruit and Vegetable Intake and Mortality. Circulation. 2021 [2021 04 27];143(17):1642–1654. doi: 10.1161/CIRCULATIONAHA.120.048996

[11] Perälä MM, von Bonsdorff MB, Männistö S, et al. The Healthy Nordic Diet and Mediterranean Diet and Incidence of Disability 10 Years Later in Home-Dwelling Old Adults. J Am Med Dir Assoc. 2019 May;20(5):511–516.e511. doi: 10.1016/j.jamda.2018.09.001

[12] Jafari RS, Behrouz V. Nordic diet and its benefits in neurological function: a systematic review of observational and intervention studies. Front Nutr. 2023;10:1215358. doi: 10.3389/fnut.2023.1215358

[13] Howell BM, Fried R, Hiratsuka V. The importance of traditional foods and subsistence activities for healthy aging in Alaska Native communities. In: Howell BM, and Harrod R, editors. Anthropological perspectives on aging. Gainesville, FL: University of Florida Press; 2023. p. 152–171. doi: 10.5744/florida/9780813069593.003.0010
[14] Lee SH, Moore LV, Park S, et al. Adults meeting fruit and vegetable intake recommendations - United States, 2019. MMWR Morb Mortal Wkly Rep. 2022 Jan 7;71(1):1–9. doi: 10.15585/mmwr.mm7101a1
[15] U.S. Department of Agriculture & U.S. Department of Health and Human Services. Dietary Guidelines for Americans, 2020-2025. 9th ed. 2020. https://www.dietaryguidelines.gov/sites/default/files/2021-03/Dietary_Guidelines_for_Americans-2020-2025.pdf
[16] Stotz SA, Brega AG, Gonzales K, et al. Facilitators and barriers to healthy eating among American Indian and Alaska Native adults with Type 2 d: Stakeholder perspectives. Curr Dev Nutr. 2021 [2021 5 14];5(15):22–31. doi: 10.1093/cdn/nzaa114
[17] Jiang Q, Francis SL, Chapman-Novakofski KM, et al. Perceived environmental supports for fruit and vegetable consumption among older adults in the US. Nutr Health. 2021 [2021 10 1];27(3):309–319. doi: 10.1177/0260106021993749
[18] Gundersen C, Strayer M, Dewey A, et al. Map the Meal Gap 2023: an Analysis of County and Congressional District Food Insecurity and County Food Cost in the United States in 2021. 2023. Available from: https://map.feedingamerica.org/county/2021/overall/alaska
[19] University of Alaska Fairbanks. Alaska Food Policy Council, & 2022 Governor's Task Force on Food Security and Independence. Alaska Food Security and Independence Task Force 2022 Report. 2023. Available from: https://alaska-food-systems-soa-dnr.hub.arcgis.com/documents/6f7cda90d3df4e2e9c0300cbc30925a4/explore
[20] Piercy KL, Troiano RP, Ballard RM, et al. The physical activity guidelines for Americans. JAMA. 2018;320(19):2020. doi: 10.1001/jama.2018.14854
[21] Watson KB, Carlson SA, Gunn JP, et al. Physical inactivity among adults aged 50 years and older—United States, 2014. Morbidity Mortality Weekly Rep. 2016;65(36):954–958. doi: 10.15585/mmwr.mm6536a3
[22] Cadore EL, Rodríguez- MañMañAs L, Sinclair A, et al. Effects of Different Exercise Interventions on Risk of Falls, Gait Ability, and Balance in Physically Frail Older Adults: A Systematic Review. Rejuvenation Res. 2013 [2013 04 1];16(2):105–114. doi: 10.1089/rej.2012.1397
[23] Alaska Department of Health. Alaska BRFSS Data Center; 2023. Available from: https://alaska-dph.shinyapps.io/BRFSS/_w_fd6c2915/#tab-9794-2
[24] Scult M, Haime V, Jacquart J, et al. A healthy aging program for older adults: effects on self-efficacy and morale. Adv Mind Body Med. 2015 Winter;29(1):26–33.
[25] Tan FCJH, Oka P, Dambha-Miller H, et al. The association between self-efficacy and self-care in essential hypertension: a systematic review. BMC Fam Pract. 2021;22(1):1–12. doi: 10.1186/s12875-021-01391-2
[26] Głąbska D, Guzek D, Groele B, et al. Fruit and Vegetable Intake and Mental Health in Adults: A Systematic Review. Nutrients. 2020 [2020 1 1];12(1):115. doi: 10.3390/nu12010115
[27] Salehi L, Eftekhar H, Mohammad K, et al. Consumption of fruit and vegetables among elderly people: a cross sectional study from Iran. Nutr J. 2010 [2010 1 13];9(1):2. doi: 10.1186/1475-2891-9-2
[28] Anderson ES, Winett RA, Wojcik JR, et al. Social cognitive mediators of change in a group randomized nutrition and physical activity intervention: social support, self-efficacy, outcome expectations and self-regulation in the guide-to-health trial. J Health Psychol. 2010 Jan;15(1):21–32. doi: 10.1177/1359105309342297
[29] Doba N, Tokuda Y, Saiki K, et al. Assessment of Self-Efficacy and its Relationship with Frailty in the Elderly. Int Med. 2016;55(19):2785–2792. doi: 10.2169/internalmedicine.55.6924
[30] Chen X, Yang S, Zhao H, et al. Self-efficacy, exercise anticipation, and physical activity in elderly: Using Bayesian Networks to elucidate complex relationships. Patient Prefer Adherence. 2022 [2022 7 28];16:1819–1829. doi: 10.2147/PPA.S369380
[31] McAuley E, Szabo A, Gothe N, et al. Self-efficacy: Implications for Physical Activity, Function, and Functional Limitations in Older Adults. Am J lifestyle Med. 2011 [2011 7];5(4):361–369. doi: 10.1177/1559827610392704
[32] Whitehall L, Rush R, Górska S, et al. The General Self-Efficacy of Older Adults Receiving Care: A Systematic Review and Meta-Analysis. Gerontologist. 2021;61(6):e302–e317. doi: 10.1093/geront/gnaa036
[33] Easom Leisa R. Concepts in Health Promotion: Perceived Self-efficacy and Barriers in Older Adults. J Gerontol Nurs. 2003 [2003 05 1];29(5):11–19. doi: 10.3928/0098-9134-20030501-05
[34] Qin Y, Cowan AE, Bailey RL, et al. Usual nutrient intake and dietary quality of low-income U.S. older adults. Applied Eco Perspectives Pol. 2023 [2023 03 1];45(1):317–335. doi: 10.1002/aepp.13328
[35] Stalling I, Albrecht BM, Foettinger L, et al. Associations between socioeconomic status and physical activity among older adults: cross-sectional results from the OUTDOOR ACTIVE study. BMC Geriatr. 2022 [2022 05 6];22(1):396. doi: 10.1186/s12877-022-03075-7
[36] U.S. Census Bureau. Racial and Ethnic Diversity in the United States: 2010 Census and 2020 Census [Census Data]. 2020. Available from: https://www.census.gov/library/visualizations/interactive/racial-and-ethnic-diversity-in-the-united-states-2010-and-2020-census.html
[37] Alaska Commission on Aging. Alaska Commission On Aging (AcoA) Senior Snapshot Older Alaskans In 2022. 2023b. Available from: https://health.alaska.gov/acoa/Documents/ACoA_seniorsnapshot_2022.pdf
[38] Foutz JD, Cohen SA, Cook SK. Challenges and barriers to health care and overall health in older residents of Alaska: evidence from a national survey. International Journal Of Circumpolar Health. 2016 [2016 01 31];75(1):30348. doi: 10.3402/ijch.v75.30348
[39] Lewis JP. Successful Aging through the Eyes of Alaska Natives: Exploring Generational Differences Among Alaska Natives. J Cross Cult Gerontol. 2010 [2010 12 1];25(4):385–396. doi: 10.1007/s10823-010-9124-8
[40] Redwood DG, Day GM, Beans JA, et al. Alaska Native traditional food and harvesting activity patterns over 10 years of follow-up. Curr Dev Nutr. 2019;3(11):nzz114. doi: 10.1093/cdn/nzz114

[41] Walch A, Bersamin A, Loring P, et al. A scoping review of traditional food security in Alaska. Int J Circumpolar Health. 2018;77(1):1419678. doi: 10.1080/22423982.2017.1419678

[42] Rikli RE, Jones CJ. Development and Validation of Criterion-Referenced Clinically Relevant Fitness Standards for Maintaining Physical Independence in Later Years. Gerontologist. 2013a;53(2):255–267. doi: 10.1093/geront/gns071

[43] Rikli RE, Jones CJ. Senior Fitness Test Manual. Vol. 2. United Kingdom: Human Kinetics; 2013. p. 186.

[44] Block G, Gillespie C, Rosenbaum EH, et al. A rapid food screener to assess fat and fruit and vegetable intake. Am J Preventive Med. 2000 [2000 05 1];18(4):284–288. doi: 10.1016/S0749-3797(00)00119-7

[45] Washburn RA, Smith KW, Jette AM, et al. The physical activity scale for the elderly (PASE): Development and evaluation. J Clinical Epidemiol. 1993 [1993 02 1];46 (2):153–162. doi: 10.1016/0895-4356(93)90053-4

[46] Sattler MC, Jaunig J, Tösch C, et al. Current Evidence of Measurement Properties of Physical Activity Questionnaires for Older Adults: An Updated Systematic Review. Sports Med. 2020 [2020 07 1];50(7):1271–1315. doi: 10.1007/s40279-020-01268-x

[47] Washburn RA, McAuley E, Katula J, et al. The physical activity scale for the elderly (PASE): evidence for validity. J Clin Epidemiol. 1999 [1999 7];52(7):643–651. doi: 10.1016/s0895-4356(99)00049-9

[48] Becker H, Stuifbergen A, Oh HS, et al. Self-rated abilities for health practices: A health self-efficacy measure. Health Values: J Health Behav Edu Promot. 1993;17(5):42–50.

[49] Galhardas L, Raimundo A, Del Pozo-Cruz J, et al. Physical and Motor Fitness Tests for Older Adults Living in Nursing Homes: A Systematic Review. Int J Environ Res Public Health. 2022 Apr 21;19(9):5058. doi: 10.3390/ijerph19095058

[50] Faul F, Erdfelder E, Buchner A, et al. Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. Behav Res Methods. 2009;41 (4):1149–1160. doi: 10.3758/BRM.41.4.1149

[51] Faul F, Erdfelder E, Lang A-G, et al. G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behav Res Methods. 2007;39(2):175–191. doi: 10.3758/BF03193146

[52] New England Research Institutes. Physical activity scale for the elderly: administration and scoring instruction manual [Manual]. 1991. Available from: https://meetinstrumentenzorg.nl/wp-content/uploads/instrumenten/PASE-handl.pdf

[53] Vogt T, Gustafsson PE. Disparities in fruit and vegetable intake at the intersection of gender and education in northern Sweden: a cross-sectional study. BMC Nutr. 2022 [2022 12 12];8(1):147. doi: 10.1186/s40795-022-00641-5

[54] Brewer D, Dickens E, Humphrey A, et al. Increased fruit and vegetable intake among older adults participating in Kentucky's congregate meal site program. Edu Gerontolo. 2016 [2016 11 1];42(11):771–784. doi: 10.1080/03601277.2016.1231511

[55] Johnson J, Nobmann ED, Asay E. Factors related to fruit, vegetable and traditional food consumption which may affect health among Alaska Native People in Western Alaska. Int J Circumpolar Health. 2012 [2012 01 31];71 (1):17345. doi: 10.3402/ijch.v71i0.17345

[56] Lewis JP, Kim SM, Asquith-Heinz Z, et al. Cyclical Migration in Alaska Native Elders and Its Impact on Elders' Identity and Later Life Well-Being. J Gerontol B. 2023;79(3):gbad072. doi: 10.1093/geronb/gbad072

[57] Walch A, Loring P, Johnson R, et al. A scoping review of traditional food security in Alaska. Int J Circumpolar Health. 2018 [2018 01 1];77(1):1419678. doi: 10.1080/22423982.2017.1419678

[58] Walch A, Bersamin A. Traditional food intake is positively associated with diet quality among low-income, urban Alaska Native women. J Hunger Environ Nutr. 2020;15 (2):264–272. doi: 10.1080/19320248.2019.1619648

[59] Chad KE, Reeder BA, Harrison EL, et al. Profile of physical activity levels in community-dwelling older adults. Med Sci Sports Exerc. 2005 [2005 10];37(10):1774–1784. doi: 10.1249/01.mss.0000181303.51937.9c

[60] Logan S, Gottlieb B, Maitland S, et al. The Physical Activity Scale for the Elderly (PASE) Questionnaire; Does it Predict Physical Health? Int J Environ Res Public Health. 2013 [2013 08 30];10(9):3967–3986. doi: 10.3390/ijerph10093967

[61] Felipe SGB, Parreira Batista P, da Silva CCR, et al. Impact of COVID-19 pandemic on mobility of older adults: A scoping review. Int J Older People Nurs. 2022 [2022 8 8];18(1):e12496. doi: 10.1111/opn.12496

[62] Cohen SA, Talamas AX, Sabik NJ. Disparities in social determinants of health outcomes and behaviours between older adults in Alaska and the contiguous US: evidence from a national survey. Int J Circumpolar Health. 2019 [2019 01 1];78(1):1557980. doi: 10.1080/22423982.2018.1557980

[63] Kachan D, Tannenbaum SL, Olano HA, et al. Geographical Variation in Health-Related Quality of Life Among Older US Adults, 1997-2010. Prev Chronic Dis. 2014;11:E110. doi: 10.5888/pcd11.140023

[64] Knäuper B, Carrière K, Chamandy M, et al. How aging affects self-reports. Eur J Ageing. 2016 [2016 06 1];13 (2):185–193. doi: 10.1007/s10433-016-0369-0

[65] Egele VS, Kiefer LH, Stark R. Faking self-reports of health behavior: a comparison between a within- and a between-subjects design. Health Psychology Behav Med. 2021 [2021 01 1];9(1):895–916. doi: 10.1080/21642850.2021.1991803

[66] Prince SA, Adamo KB, Hamel M, et al. A comparison of direct versus self-report measures for assessing physical activity in adults: a systematic review. Int J Behav Nutr Phys Act. 2008 [2008 01 1];5(1):56. doi: 10.1186/1479-5868-5-56

[67] Prince SA, Cardilli L, Reed JL, et al. A comparison of self-reported and device measured sedentary behaviour in adults: a systematic review and meta-analysis. Int J Behav Nutr Phys Act. 2020 [2020 12 1];17(1). doi: 10.1186/s12966-020-00938-3

[68] IBM Corp. IBM SPSS Statistics for Windows. Version 27.0 [software]. Armonk, NY: IBM Corp; 2020.

[69] Howell, BM, Worthington, AK, Redmond, LC, et al. A university student-led hope-based intervention improves fruit and vegetable intake, functional fitness, and BMI among older adults in urban Alaska. In preparation. n.d.

[70] U.S. Department of Health and Human Services. Poverty Guidelines for Alaska 2024. 2024. https://aspe.hhs.gov/topics/poverty-economic-mobility/poverty-guidelines