

Psychometric Evidence of the Attitudes Toward Food Scale for Native Hawaiians

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Abstract

Many efforts are being made to promote healthy eating habits and nutrition among Native Hawaiian communities by cultivating positive attitudes toward healthy foods. However, there are limited quantitative scales that have been psychometrically validated with Native Hawaiian communities. This paper examines evidence on the reliability and validity of the Attitudes Toward Food (ATF) scale used with 68 Native Hawaiian adults from Waimānalo who are participating in a backyard aquaponics intervention called Mini Ahupua'a for Lifestyle and Mea'ai through Aquaponics (MALAMA). Exploratory factor analysis (EFA) and internal consistency reliability analysis were conducted to examine the underlying constructs of the ATF scale. Cognitive interviews with 3 MALAMA participants were also conducted to analyze how participants understood, processed, and responded to the scale. Findings from the cognitive interviews provided response-process evidence of validity and acceptability. Findings from the EFA revealed 2 factors. Factor 1 contained items that discussed confidence in preparing and using healthy foods. Factor 2 contained items that involved the consumption of healthy foods. The reliability analysis suggested that the 2 factors of the ATF scale are internally consistent (Cronbach's alpha = 0.79 and 0.71, respectively). Taken together, the evidence provides provisional support for the validity and reliability of the instrument for measuring attitudes among Native Hawaiians from Waimānalo. The ATF scale may be useful for similar health and nutritional programs for Native Hawaiians in Hawai'i. Future studies with larger samples and diverse sources of validity evidence may provide additional support of the scale's validity.

Keywords

nutrition, aquaponics, Hawai'i, rural community, validity

Abbreviations and Acronyms

ATF = Attitudes Toward Food scale
CFA = confirmatory factor analysis
EFA = exploratory factor analysis
FAB = Food Attitudes and Behavior scale
KMO = Kaiser–Meyer–Olkin measure of sampling adequacy
MALAMA = Mini Ahupua'a for Lifestyle and Mea'ai through Aquaponics

Introduction

Native Hawaiians developed a deep understanding of how to manage and maintain Hawai'i's natural resources to feed and perpetuate a healthy and robust population. The values of pono (righteousness) and lōkahi (balance and harmony) ensured the physical, mental, and spiritual parts of the person were in balance.¹⁻³ Western intrusion and the illegal overthrow of the Hawaiian Kingdom in 1893 resulted in drastic changes to the lifestyles, cultural practices, and traditional food systems

of Native Hawaiians.²⁻⁴ Specifically, traditional food staples, which are high in protein and complex carbohydrates and low in fat, were replaced with a highly processed Western diet high in saturated fat, sodium, and sugar.⁵

Presently, Native Hawaiian life expectancy is one of the shortest among the major ethnic groups in Hawai'i, with a 10-year gap compared to Japanese and Chinese residents.^{6,7} Native Hawaiians experience social and health disparities, including chronic diseases related to nutrition and obesity.⁸ Native Hawaiians suffer from high rates of cardiovascular morbidity and mortality and face social determinants and structural barriers that prohibit them from achieving optimal health, such as having the lowest levels of educational attainment, lowest mean income, highest poverty rates, and the highest prevalence of current, everyday smokers compared to White, Japanese, and Chinese adults in Hawai'i.⁸ Native Hawaiians also experience greater difficulty accessing westernized health care services due to socioeconomic disparities, lack of cultural relevance, and institutionalized discrimination.⁹

Efforts have been made to restore Native Hawaiian cultural practices to improve the inequities surrounding health, self-governance, education, and research.¹⁰ Many programs and research studies that integrate the values and practices of traditional food production, such as mālama 'āina (taking care of the land), have been shown to yield promising results in promoting health outcomes with indigenous peoples.¹¹⁻¹⁴ Waimānalo is a rural community with approximately one-third of the residents identifying as Native Hawaiian. Residents of Waimānalo not only experience a lack of personal health services and high rates of economic, cultural, and linguistic barriers to receiving health care, but more than 30% of households are food insecure (ie, limited access to nutritious food) as a result of socioeconomic and other factors.¹⁵ However, there is strong community cohesion and retention of Native Hawaiian values within this community. Mini Ahupua'a for Lifestyle and Mea'ai through Aquaponics (MALAMA) seeks to address these challenges and leverage these strengths by using a backyard aquaponics intervention that integrates Native Hawaiian cultural practices and values. The MALAMA researchers collected clinical health indicators (eg, blood pressure, hemoglobin A1C, cholesterol, and body mass index) and administered a health survey that included the Attitudes Toward Food (ATF) scale to assess the long-term health impact of the intervention.

The Theory of Planned Behavior and the Attitude-Social Influence-Self-Efficacy model have been utilized to study cognitive indicators of eating behaviors.^{16,17} Both theories highlight the intention to consume fruits and vegetables as the most important indicator of fruit and vegetable intake.^{11,12} Attitudes and self-efficacy are additional indicators that predict intention to eat fruits and vegetables.^{16,17} Attitudes are an individual's expectations and evaluations about a health behavior, whereas self-efficacy is the individual's confidence in performing a behavior or the perception that the behavior is within the person's control.^{14,16,18} Research has shown positive attitudes toward fruits and vegetables (ie, people's beliefs that these foods taste good and are beneficial for health, and their confidence in preparing meals with them) are associated with higher fruit and vegetable consumption.¹⁹

Survey instruments for measuring attitudes and self-efficacy with fruit and vegetable intake among adults in the United States exist.¹⁹ However, many have not been tested with Native Hawaiians who may have unique values and lived experiences that shape eating behaviors. For example, healthy eating behaviors among Native Hawaiians are maintained through indigenous values rooted in their relationships with others and their connection to the 'āina (land).¹¹ However, validated instruments for measuring attitudes and self-efficacy toward food among Native Hawaiians are nonexistent. The purpose of this study was to examine the validity and reliability of the ATF scale with a Native Hawaiian community.

Validity is most appropriately evaluated by examining evidence supporting or refuting the intended types of interpretations to be drawn from an instrument.²⁰ There are 4 types of evidence: (1) evidence based on the content, (2) relations with other variables, (3) subjects' response processes, and (4) internal structure.²⁰⁻²² These roughly align with the so-called validity types (content, criterion-referenced, and construct validities).^{21,23-25} Validation tends to be an ongoing process carried out across studies.^{21,26} This study examined evidence based on (1) the response processes ("face validity") and (2) internal structure, whether the correlations among the items reflect the hypothesized dimensional structure. In classical terminology, these 2 evidence types underpin construct validity. Cognitive interviews were conducted to examine response-process validity evidence. Quantitative survey-response data were analyzed to examine evidence based on the internal structure using factor analysis and internal consistency reliability.

Methods

Participants

Participants were recruited through Native Hawaiian organizations and social groups in Waimānalo and given a gift of cultural significance valued at \$10. All participants resided in Waimānalo. The inclusion criteria included (1) be a member of

a family that is of Native Hawaiian ancestry, (2) being aged 18 years or older, (3) living in a home with the space to install and maintain the aquaponics system, and (4) attending 9 workshops to learn how to build and maintain an aquaponics system in their backyards. The first cohort of 10 families was a part of a separate pilot study. Twenty more families were recruited for this study and were randomly assigned to cohort 2 or cohort 3. This study was approved by the University of Hawai'i Institutional Review Board (2019-00092).

Cognitive interviews were conducted with 3 volunteers who were MALAMA participants. They were of varying literacy and educational levels to assess their understanding of the ATF scale. There were 2 males and 1 female with a median age of 50 years. The ATF survey dataset was based on follow-up data for cohort 1, baseline and follow-up data for cohort 2, and baseline data for cohort 3. There were 68 participants aged 21 to 82 years.

Cognitive Interviewing

Cognitive interviewing is a method to inform scale revisions and provide evidence of validity.²⁷⁻²⁹ This method can detect discrepancies between how participants think through survey questions and how the developer(s) had intended them to think through and respond to the questions.²⁷⁻²⁹ Evidence that the participants understand the questions and respond in a way that represents their status on the construct adds support to the scale's validity argument.

Each participant was interviewed one at a time. Field notes were recorded during and after the interviews. The interviews were conducted in Fall 2019 at a community event and lasted approximately 20 minutes. The interviewer used retrospective verbal probes to address comprehension, thought processes, and response processes. The probes were (1) In this question, what does the word "confident" mean to you?, (2) In this question, what does "healthy foods" mean to you?, (3) In this question, what does the word "enjoy" mean to you?, (4) How did you decide your answer to this question?, (5) How easy or hard was it to choose an answer?, (6) Are there any confusing things about this scale?, and (7) What questions do you have about this scale?

Factor Analysis

A polychoric correlation matrix was performed to determine whether the items anticipated for the types of attitudes toward food were related to each other. The polychoric correlation matrix includes estimates of each item's correlation with all other items and is more appropriate than raw data in factor analysis and reliability studies with Likert-type ordinal data.³⁰ The ATF scale was adapted from the Food Attitudes and Behaviors (FAB) Survey, which evaluated several factors related to fruit and vegetable intake among adults (eg, self-efficacy, social support, perceived barriers and benefits of eating fruits

and vegetables, etc).³¹ The present scale modified the attitudes and beliefs section of the FAB Survey by asking questions about self-efficacy and food preferences that are consumed among Native Hawaiians. The ATF scale consisted of 8 items on a 5-point Likert-type scale, in which 1 equals “strongly disagree” and 5 equals “strongly agree.” The 8 items included (1) I feel confident in my ability to prepare a healthy meal, (2) I feel confident in my ability to make la‘au (medicine) with fruits and vegetables, (3) I feel confident in my ability to use fruits and vegetables in my family’s meals, (4) Eating healthy food is important to me, (5) Eating healthy food is important to my family, (6) I enjoy eating fruit, (7) I enjoy eating vegetables, and (8) I enjoy eating fish.

Statistical Analysis

For cognitive interviews, the participant responses were summarized on a question-by-question basis. Interviews were combined to identify major themes and were shared with the MALAMA research team. For the psychometric analysis, the survey data were entered into REDCap (a secured, electronic database) and then exported to R version 3.6.1.³² Because this was an exploratory study to investigate the relationships among the questions with a new instrument, EFA was more appropriate than confirmatory factor analysis (CFA). CFA would be more appropriate if the purpose were to test whether the observed data fit a hypothesized model or there was a strong theory to guide the specification of the factor model.³³ A pairwise case analysis for the EFA was employed on the polychoric correlation matrix, represented as ρ , using the psych package.³⁴ This package used information from the other variables in the matrix when a case was missing any responses. EFA models were estimated to allow the factors to correlate with each other (using promax rotation). The number of factors was determined by examining scree plots and parallel analysis. Factors with eigenvalues greater than 1 were considered meaningful, as eigenvalues correspond with a proportion of total variance that is explained by the factor. For judging whether an item is meaningfully explained by a factor, an arbitrary criterion of at least a 0.40 factor loading, which is common, was established *a priori*.³³ Factor loadings are standardized regression coefficients of how strongly the factor explains an item’s variance. The internal consistency using Cronbach’s alpha was computed from the polychoric matrices for the final constructs. The Cronbach’s alpha and coefficient omega ≥ 0.70 was set as a criterion for satisfactory reliability.³⁵

Results

Sociodemographic Characteristics

The sociodemographic characteristics of the participants are shown in Table 1. The sample was primarily Native Hawaiian (87%) and female (67%). Although participants needed to be from a Native Hawaiian family, non-Hawaiian family members were included to be aligned with the family-oriented nature of

the intervention. The median age was 50 years. The majority of participants had completed high school (39%) or had some college experience (34%).

	n (%)
Sex	
Female	44 (67)
Male	22 (33)
Education	
High school/GED	25 (39)
Some college/vocational/technical/AA	22 (34)
College degree (BA/BS)	9 (14)
Graduate degree (masters, PhD, MD, JD)	9 (14)
Ethnicity^a	
Native Hawaiian	59 (87)
Chinese	28 (41)
Japanese	8 (12)
Filipino	9 (13)
Korean	3 (4)
Portuguese	21 (31)
White	32 (47)
Samoan	3 (4)
Native American	1 (2)
Latino	2 (3)
Other	13 (19)
Age, years (mean [SD]; range)	50.29 (15.31); 21–82
Number living in household (mean [SD]; range)	4.8 (2.3); 1–10

Abbreviations: GED, General Equivalency Diploma; AA, Associate of Arts; BA, Bachelor of Arts; BS, Bachelor of Science; PhD, Doctor of Philosophy; MD, Medical Degree; JD, Juris Doctor; SD, standard deviation.

^a Participants were allowed to report more than 1 ethnicity.

Cognitive Interviews

All 3 participants reported it was easy to comprehend the items and choose a response. The participants’ responses to the probes suggested they could accurately and consistently describe what confidence, healthy foods, and enjoyment meant to them. They reported confidence as being able, capable, or sure of yourself. For example, one participant stated, “My mother was a la‘au practitioner, so I am very confident in my ability to make la‘au.” The participants shared healthy foods, including vegetables, fruits, and foods that are low in sugar and high in protein. They also stated that enjoying food means eating foods that taste good and wanting to eat the meal that was prepared. For example, one participant stated, “Enjoy means flavorful, ‘ono (good). If not, I will not eat it.” No patterns emerged to suggest unexpected thought processes. This evidence supported

the claim that the ATF scale was an acceptable and appropriate mechanism for measuring a participant's attitudes toward food. In other words, the cognitive interviews provided provisional evidence for validity based on the response processes and the content, which are two categories valued in validation practice.²⁰

Exploratory Factor Analysis

Table 2 shows the inter-item polychoric correlation matrix estimated to represent the relationships among the items in the scale. Item 2 was negatively correlated with Item 6. There was also a high correlation between Items 1 and 3 ($\rho = 0.80$) and Items 4 and 5 ($\rho = 0.70$).

	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8
Item 1	1.00	0.57	0.80	0.52	0.36	0.13	0.44	0.34
Item 2		1.00	0.60	0.27	0.06	-0.25	0.25	0.27
Item 3			1.00	0.62	0.45	0.29	0.59	0.35
Item 4				1.00	0.70	0.34	0.57	0.33
Item 5					1.00	0.24	0.46	0.30
Item 6						1.00	0.51	0.41
Item 7							1.00	0.49
Item 8								1.00

Polychoric correlation matrix (ρ) greater than 0.6 is considered elevated correlation.

The Kaiser–Meyer–Olkin measure of sampling adequacy (KMO) and the Bartlett Test of Sphericity identify whether factor analysis is appropriate. If these tests are not met, the correlations among variables are too weak for EFA. The results of both tests supported the factorability; the KMO was 0.69, and the sphericity test was statistically significant ($\chi^2 = 288.7$, $df = 28$, $P < .001$).³⁷

Potential Factor	Eigenvalue ^a	Percentage of Variance	Cumulative Variance
1	3.9	48.7	48.7
2	1.5	19.1	67.8
3	0.9	11.5	79.4
4	0.6	7.6	87.0
5	0.4	5.2	92.1
6	0.3	3.6	95.7
7	0.2	2.8	98.5
8	0.1	1.5	100.0

^aEigenvalues are estimated from the exploratory factor analysis model. Each eigenvalue corresponds with a potential factor, with more salient factors having higher values and explaining more of the total variance in the polychoric correlation matrix. This information aids in determining the number of factors to retain; more than two-thirds of the variance is explained by 2 factors.

Inspection of the parallel analysis and proportion of variance indicated the presence of 2 factors. Table 3 shows there were 2 factors with eigenvalues greater than 1. These 2 factors could explain about 67.8% of the variance. The scree plot was deemed relatively inconclusive as the plot was gradual.

The factor loadings with promax rotation that met the 0.40 criterion are presented in Table 4. Each factor loading was named based on the items grouped in the factor. Factor 1 contained items that addressed the participants' confidence in their ability to prepare and use healthy foods (Items 1, 2, and 3). Factor 2 contained items that involved the participants eating/enjoying healthy foods (Items 4, 5, 6, 7, and 8). There was 1 complex-loading item suggesting all items except Item 6 loaded onto 1 of the 2 factors.

The items' communalities ranged from 0.29 to 0.83 and are interpreted as the proportion of variance in the item explained by the combination of factors (See Table 4). Six communalities exceeded 0.50, suggesting a good association between one another. Items 5 and 8 had the lowest communalities where 60% and 71% of the variance are unique to Item 5 and Item 8, respectively, and not shared with either factor. The correlation between the 2 factors was 0.46, indicating a moderate positive relationship between Factor 1 and Factor 2.

Item	Question	Factor 1: Confidence	Factor 2: Eating/Enjoying Healthy Foods	Communalities
1	I feel confident in my ability to prepare a healthy meal.	0.696	0.221	0.67
2	I feel confident in my ability to make la'au (medicine) with fruits and vegetables.	0.953	-0.285	0.74
3	I feel confident in my ability to use fruits and vegetables in my family's meals.	0.657	0.398	0.83
4	Eating healthy food is important to me.	0.217	0.654	0.61
5	Eating healthy food is important to my family.	No value	0.601	0.40
6	I enjoy eating fruits.	-0.409	0.818	0.53
7	I enjoy eating vegetables.	0.104	0.732	0.62
8	I enjoy eating fish.	0.106	0.480	0.29

^a Factor loadings are interpretable as correlations with a factor. For example, a 0.40 loading indicates 16% of the variable's variance is explained by the factor. This 0.40 criterion was set beforehand to aid interpretation of which items meaningfully load on which factor. Promax rotation was used, which allows the factors to correlate.

^bAn item's communality is the proportion of the item's variance explained by the 2 factors.

Reliability

There was good internal consistency reliability for the set of all 8 items in the ATF scale (Cronbach's alpha = 0.84). Based on the EFA, each factor's reliability was estimated. The reliability of Factor 1 was high enough, whereas Factor 2 was acceptable (Cronbach's alpha = 0.79 and 0.71, respectively). The reliability of both factors was good using coefficient omega at 0.83 and 0.81, respectively.

Discussion

This study examined the psychometric properties of the ATF scale adapted from the FAB Survey specifically for the Native Hawaiian population. Based on the team's knowledge, there has been no literature examining the validity and psychometric properties of a scale for Native Hawaiians.

Findings from this study suggest that the ATF scale was a multidimensional measure with 2 factors present (1) attitudes of the participants' confidence in their ability to prepare and use healthy foods, and (2) attitudes towards consumption/enjoyment of healthy foods by participants and their families. These 2 factors explained 67.8% of the variance and revealed a clear pattern of attitudes toward food that were related to each other, with no evidence of any unrelated construct unduly contributing to participants' responses. There was 1 cross-loading with Item 6, indicating its possible removal. However, the communality was more than 0.50, and its removal may alter the meaning of the scale, thereby weakening the validity from a face and content validity perspective. Variables with communalities < 0.20 are typically removed since the outcome is to explain the variance through common factors.^{37,38} All the items were greater than 0.20, suggesting they should be retained.

The ATF scale had good internal consistency reliability using all 8 items as a single score. With the scores obtained from Factor 1 and Factor 2, there were fewer items in each subscale, thus decreasing the Cronbach alpha values. Nonetheless, the reliability estimates met the criterion for acceptability. The moderate correlation between these 2 factors would be expected in the social sciences and that they involve similar topics about healthy foods but are not identical constructs.³⁸

Through cognitive interviews, this study provided response-process support for the validity and acceptability of the ATF scale. There were rational decision-making processes in choosing responses and good comprehension of the questions. Participants also stated that there was no confusion with the phrasing of instructions or the scale itself. There were no suggestions that could be used to make changes to the scale.

There were some potential limitations. First, this study was based on a relatively small and select population of Native Hawaiians from a specific community. Given the small sample size, multi-group differences were not analyzed. Thus, findings from this study might not be generalizable to Native Hawaiians who reside in communities other than Waimānalo participating in similar health promotion programs. Therefore, more studies should be conducted with other Native Hawaiian communities to further assess the reliability and validity of this scale. A comprehensive validity study includes evidence based on the content, response processes, internal structure, relations with other variables, and consequences.^{27,36,38} This study examined 2 of these sources of evidence, suggesting the findings on validity are supportive but are provisional.

Future studies should expand on this study to determine whether the rewording or removal of Item 6 eliminates any cross-loadings. There needs to be careful consideration by the research team whether the remaining set of items still adequately represents the construct if Item 6 is removed. Therefore, feedback from content experts in the area of Native Hawaiian nutrition is imperative to test the validity of the constructs. Future studies examining this instrument's functioning with a larger sample size or with a different geographic region within the Native Hawaiian population will provide further evidence to support the provisional findings in this study. Future studies can also follow up with CFA to determine the best model fit based on the two-factor structure found in this study. Test-retest reliability should be estimated for this instrument to examine changes in attitudes over time.³³ Furthermore, future studies can address validity evidence based on content, relations with other variables, and consequences.

This study has established provisional evidence of the reliability and validity of the ATF scale to measure attitudes and behaviors related to healthy eating with a specific sample of Native Hawaiian community members. The findings provide support for future use of the ATF scale with other health and nutritional programs in Waimānalo and possibly other Native Hawaiian communities in Hawai'i.

Conflict of Interest

None of the authors identify any conflict of interest.

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