

# Relationship Between Health Behaviors and Obesity in a Sample of Hawai'i's 4 Most Populous Ethnicities

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## Abstract

*Proactive health behavior change and maintenance are essential for preventing obesity and other lifestyle diseases. Few studies have examined the relationship between eating behavior and physical condition among multiethnic samples. In this study, ethnic differences were examined to obtain basic data on health education for improvement of obesity in Hawai'i. The intake of fruits and vegetables and exercise habits in each of the transtheoretical model stages of change were evaluated in the 4 most populous ethnic groups in Hawai'i in terms of how the participants' health behaviors were associated with obesity. The participants comprised 2795 white, Native Hawaiian, Filipino, and Japanese adults (age range, 18–55 years). There are 4 main findings of this study. First, there were differences in fruit and vegetable intake and exercise habits in each transtheoretical model stage among the ethnic groups. Second, there were differences in attitudes regarding nutrition and healthy food intake and self-efficacy regarding exercise in each ethnic group. Third, items that have the potential to improve obesity in the theory of planned behavior differed, particularly among men, in the 4 ethnic groups. Finally, a low percentage of participants recognized that the recommended number of servings of fruits and vegetables was 5 or more. Education for men may be particularly important. The findings indicate that modified health education approaches may be needed in accordance with the ethnicity of the population.*

## Keywords

obesity, health behavior, ethnic groups, Hawai'i

## Abbreviations

BMI = body mass index

OR = odds ratio

TPB = theory of planned behavior

TTM = transtheoretical model

## Introduction

Obesity is a chronic disease that is strongly associated with increased mortality and morbidities including certain types of cancers, cardiovascular disease, diabetes mellitus, hypertension, and stroke. The World Health Organization defines an overweight status in adults as a body mass index (BMI) of 25 to 29 kg/m<sup>2</sup> and obesity as a BMI of >30 kg/m<sup>2</sup>,<sup>1</sup> and improvements in the proportions of individuals within these categories have been sought. Positive health behavior change and maintenance are essential for preventing obesity and other lifestyle diseases. When implementing health education in nutrition and exercise for improvement of obesity, it is important to understand the participants' health behavior. In Hawai'i, the characteristics of each ethnic group must be understood because the participants are composed of multiple ethnic groups. Previous studies of

residents of Hawai'i have shown differences among multiethnic cohorts in dietary intake,<sup>2,3</sup> obesity,<sup>2,4,5</sup> and lifestyle diseases.<sup>6,7</sup> However, few studies have examined the relationship between eating behavior and exercise among multiethnic samples.

Food choices are reportedly influenced by biological factors; experiential factors; personal factors such as personal beliefs, attitudes, knowledge, and skills; social norms; and environmental factors.<sup>8</sup> The theory of planned behavior (TPB) and the transtheoretical model (TTM) are health behavior theories that are frequently used to explain health behaviors.<sup>9,10</sup> The TPB posits that attitudes, subjective norms, and perceived behavioral control influence intention. Therefore, an individual's attitude towards the behavior, the approval of the behavior by social contacts, and the individual's perceived ability to control the behavior are important in assessing how likely he or she is to perform the behavior.<sup>9</sup> The TTM integrates the stage of change, process of change, and self-efficacy.<sup>10</sup> The 5 stages of change are precontemplation (no intent to take action within the next 6 months), contemplation (intent to take action within the next 6 months), preparation (intent to take action within the next 30 days, with some behavioral steps in this direction already taken), action (overt change in behavior for ≤6 months), and maintenance (overt change in behavior for >6 months).<sup>10</sup> Identifying the participant's stage and taking an approach tailored to the situation are effective in health education.

The present study was performed to assess differences in ethnic groups by nutrition and physical activity behavior and related theoretical constructs. Questions and data were extracted from nutrition, exercise, and tobacco surveys administered to residents of Hawai'i. These data were (1) intake of fruits and vegetables and level of exercise in each TTM stage and (2) items related to eating behavior in the TPB. The relationship between these behaviors and obesity was compared among ethnic groups, and the characteristics of each ethnic group were identified.

## Methods

### Procedure and Sample

From January 2010 to January 2011, a survey of nutrition, exercise, and tobacco was conducted using a computer-aided, random-number-dial telephone interview survey of adults aged 18 to 55 years living in Hawai'i; the details of that survey have been described elsewhere.<sup>11,12</sup> Briefly: A professional survey firm in Honolulu generated simple random samples for the entire

household population of Hawai‘i or any segment of that population. The sample size of 3600 interviews in qualified households was stratified across the islands as follows: 1800 from O‘ahu, 600 from Hawai‘i, 600 from Kaua‘i, 500 from Maui, 75 from Moloka‘i, and 25 from Lana‘i. The survey response rate was 16.2%. All interviewers for this project were diligently trained, informed consent was obtained via telephone, and all responses were self-reported. Interviews and data entry were conducted with a computer-assisted telephone interview system using programmable software that included error-editing routines to protect against interviewer errors.

In the current study, a secondary analysis was conducted using data from that survey from members of the 4 most populous ethnic groups in Hawai‘i: white (n = 1111), Native Hawaiian (n = 584), Filipino (n = 508), and Japanese (n = 592). All procedures were approved by the University of Hawai‘i Committee on Human Subjects.

### Demographics

Participants were asked a series of demographic-related questions regarding their age, sex, ethnicity, height, weight, education, and income. The ethnic groups were classified by confirming the participants’ ethnicity. First, an interviewer asked about their ethnic group. If more than one ethnic group was reported, the interviewer asked with which ethnic group they

most closely identified. If the participants could not answer, the ethnicity was classified as mixed and was not included in this analysis. Education was classified as  $\leq 12$ th grade, 1 to 3 years of college, and  $\geq 4$  years of college. Income was assessed by the total annual household income before taxes for 2009 and was classified as  $\leq \$24,999$ ,  $\$25,000$  to  $\$49,999$ , and  $\geq \$50,000$ . Education and income were classified using the Behavioral Risk Factor Surveillance System and previous reports.<sup>13-15</sup>

### Health Behaviors

Participants were asked questions about eating 5 or more servings of fruits and vegetables and engaging in regular physical activity in each TTM stage of change, knowledge of the health expert-recommended number of servings of fruits and vegetables (ie, 5 or more servings), and their current health behaviors. One serving was defined as 1/2 cup of cooked vegetables, 1 cup of salad, a piece of fruit, or 3/4 cup of 100% juice. Regular physical activity was defined as the performance of physical activity for  $\geq 30$  minutes per day on at least 5 days per week. This activity level is enough to increase a person’s heart rate and/or respiratory rate. Items related to current health behaviors were their nutritional attitude, perceived behavioral control regarding nutrition, healthy eating behavior, and self-efficacy regarding exercise. Questions about their current health behaviors and knowledge of the recommended number of servings are shown in Table 1.

Table 1. Questions and Scales of Nutritional Attitude, Perceived Behavioral Control Regarding Nutrition, Healthy Eating Behaviors, Self-efficacy Regarding Exercise, and Knowledge of Recommended Number of Servings		
Category	Questions	Scales
Nutritional attitude	1) Eating more fruits and vegetables would be expensive.	1 (strongly agree) to 5 (strongly disagree)
	2) Preparing and cooking vegetables is time-consuming.	
	3) Meal planning for my family is difficult if I try to prepare more vegetable dishes.	
Perceived behavioral control regarding nutrition	1) How much control do you have over the number of servings of fruits and vegetables you eat each day?	1 (very little control) to 5 (complete control)
Healthy eating behaviors	1) When I eat at restaurants, I choose healthy options.	1 (strongly disagree) to 5 (strongly agree)
	2) How often do you eat foods that are high in fiber?	1 (never) to 5 (always)
	3) How would you describe your intake of refined grains such as white rice, white bread, and pasta?	1 (very high) to 5 (very low)
	4) How often do you eat at fast food restaurants, drive-ins, or lunch wagons?	1 (almost every day) to 6 (almost never)
Self-efficacy regarding exercise	1) How confident are you that you can exercise even when it is raining?	1 (not at all confident) to 4 (very confident)
	2) How confident are you that you can exercise even when you are under a lot of stress?	
	3) How confident are you that you can exercise even when you feel you don’t have time?	
Knowledge of recommended number of servings	1) How many servings of fruits and vegetables should be consumed each day?	Number of servings

## Data Analysis

Differences in BMIs and health behaviors were compared using Tukey's multiple comparison test, and differences in the composition of participants, stage of change, and knowledge of recommended number of servings were compared using the  $\chi^2$  test. Multivariable logistic regression models were conducted in which the dependent variables were obesity (BMI of  $\geq 30$  kg/m<sup>2</sup>) or non-obesity and the independent variables were health behaviors (i.e., nutritional attitude, perceived behavioral control, eating behavior, and self-efficacy regarding exercise). Age was controlled for as a confounder. Odds ratios (ORs) and 95% confidence intervals were also calculated. The internal consistency of the scales was analyzed using Cronbach's alpha. All data were analyzed using IBM SPSS Statistics software version 19 (IBM Corp., Armonk, NY, USA). Statistical significance was designated as  $P < .05$ .

## Results

### Participants' Demographic Characteristics and BMI

Table 2 shows the participants' demographics. There were significant differences in age, education, and income across the 4 ethnic groups ( $P < .05$ ). Ages ranged from 18 to 55 years, with participants aged  $\geq 40$  years constituting a higher percentage among white and Japanese men and women than among Native Hawaiian and Filipino participants. Native Hawaiian men and women had a higher percentage of  $\leq 12$ th grade and a lower percentage of  $> 4$  years of college than did the other ethnic groups. Conversely, white and Japanese men and women showed the opposite results. Native Hawaiian women had a higher percentage of income  $< \$24,999$  and Japanese men and women had a higher percentage of income  $> \$50,000$  than did the other ethnic groups. When the data in Table 2 were compared with the American Community Survey 2009 Hawai'i Selected Population Profiles (3-Year Estimates), comparison was not possible under the same conditions, and the trends were not aligned.<sup>16</sup>

Table 3 shows the BMIs for men and women. The BMIs of Native Hawaiian men and women were significantly higher than those of other ethnic groups.

### Servings of Fruits and Vegetables and Regular Physical Activity

Table 4 shows the proportions of participants with 5 or more servings of fruits and vegetables in each TTM stage. There were significant differences in fruit and vegetable intake in each stage across the 4 ethnic groups ( $P < .05$ ). The sum percentage of optimal intake in the action and maintenance stages were higher in white men and women than in other ethnic groups. However, the proportions of optimal intake in these stages were lower in Japanese men and women. The percentage of optimal intake in the precontemplation stage was higher in Japanese

men and women than in other ethnic groups. The percentage of optimal intake in the preparation stage was higher in Filipino men and women.

Table 5 shows the performance of regular physical activity in each TTM stage. There were significant differences in regular physical activity in each TTM stage across the 4 ethnic groups ( $P < .05$ ). The sum percentage of regular physical activity in the action and maintenance stages was higher in white, Native Hawaiian, and Filipino men than in Japanese men. Among women, the sum percentage of regular physical activity in the action and maintenance stages were highest for white participants, followed by Native Hawaiians, Filipino, and Japanese. In both men and women, regular physical activity in the precontemplation stage was higher in Japanese participants than in the other ethnic groups.

Table 6 shows the participants' knowledge of the recommended servings of fruits and vegetables. There were significant differences in this knowledge across the 4 ethnic groups ( $P < .05$ ). The percentage of 5 or more servings was 54.6% in white men and 76.8% in white women, which were higher than in other ethnic groups. In men, the percentage of 5 or more servings in Native Hawaiian, Filipino, and Japanese was 37.9%, 37.0%, and 42.1%, respectively, and that in women was 57.3%, 52.3%, and 60.7%, respectively.

### Health Behavior and Logistic Regression Models

Table 7 compares the nutritional attitudes, perceived behavioral control regarding nutrition, healthy eating behaviors, and self-efficacy regarding exercise among the ethnic groups. White men and women scored higher on most behavioral scales than did other ethnic groups. Filipino and Japanese men and women tended to score lower on most scales; particularly, Filipino participants scored significantly lower in perceived behavioral control regarding nutrition than did other ethnic groups ( $P < .05$ ). Native Hawaiian men and women showed no difference in self-efficacy regarding exercise compared with white participants, and they scored significantly higher than Filipino and Japanese men and women ( $P < .05$ ). The internal consistency for nutritional attitudes, healthy eating behavior, and self-efficacy regarding exercise was 0.56, 0.61, and 0.66, respectively.

Table 8 shows the results of the logistic regression analysis examining the relationship between healthy behavior and obesity. Among men, the OR of perceived behavior control regarding nutrition and self-efficacy regarding exercise in white participants was 0.75 and 0.70, respectively ( $P < .05$ ). The OR of self-efficacy regarding exercise in Native Hawaiian men, healthy eating behavior in Filipino men, and perceived behavior control regarding nutrition in Japanese men was 0.62, 0.40, and 0.71, respectively ( $P < .05$ ). Among women, the OR of healthy eating behavior in white, Native Hawaiian, and Japanese participants was 0.47, 0.63, and 0.51, respectively ( $P < .05$ ). No significant differences were found for Filipino women.

Table 2. Demographic Characteristics of the Participants in Different Ethnic Groups										
	Men					Women				
	White	Native Hawaiian	Filipino	Japanese	P-Value	White	Native Hawaiian	Filipino	Japanese	P-Value
Participants (n)	441	206	197	251		670	378	311	341	
<b>Age (years)</b>										
18–29	23.6%	29.6%	33.5%	25.1%	< .05	14.0%	27.2%	26.0%	18.5%	< .05
30–39	17.2%	22.8%	22.8%	13.1%		16.9%	20.6%	23.5%	13.5%	
40–49	30.6%	30.1%	28.9%	27.9%		35.1%	30.2%	32.5%	35.5%	
50–55	28.6%	17.5%	14.7%	33.9%		34.0%	22.0%	18.0%	32.6%	
<b>Education</b>										
≤12th grade	24.1%	54.6%	43.1%	21.9%	< .05	18.8%	44.0%	32.5%	15.5%	< .05
1–3 years of college	28.2%	26.3%	29.4%	32.7%		31.1%	32.8%	30.9%	27.0%	
>4 years of college	47.6%	19.0%	27.4%	45.4%		50.1%	23.3%	36.7%	57.5%	
<b>Income</b>										
<\$24,999	16.1%	17.6%	13.9%	8.8%	< .05	11.8%	23.6%	15.7%	5.5%	< .05
\$25,000–\$49,999	12.9%	14.2%	21.4%	15.3%		18.5%	20.2%	22.5%	14.0%	
>\$50,000	71.1%	66.2%	64.8%	75.9%		67.9%	56.2%	61.8%	80.5%	

Table 3. Body Mass Index (kg/m<sup>2</sup>) Among Different Ethnic Groups

	White	Native Hawaiian	Filipino	Japanese
Men	26.7 ± 5.3 <sup>b</sup>	30.0 ± 6.8 <sup>a</sup>	27.5 ± 5.3 <sup>b</sup>	27.7 ± 5.2 <sup>b</sup>
Women	25.2 ± 5.1 <sup>b</sup>	28.9 ± 8.2 <sup>a</sup>	25.6 ± 5.1 <sup>b</sup>	24.6 ± 4.9 <sup>b</sup>

Values are presented as mean ± standard deviation. <sup>a,b</sup>Values with different superscript letters are significantly different at  $P < .05$ .

Table 4. Proportions of Participants with Intake of 5 or More Servings of Fruits and Vegetables in Each Transtheoretical Model Stage Among Different Ethnic Groups

	White	Native Hawaiian	Filipino	Japanese	P-Value
<b>Men</b>					
Precontemplation	29.9%	24.9%	17.1%	44.7%	< .05
Contemplation	5.6%	6.5%	6.4%	7.3%	
Preparation	14.6%	25.4%	36.4%	19.5%	
Action	12.1%	15.4%	15.5%	8.5%	
Maintenance	37.8%	27.9%	24.6%	19.9%	
<b>Women</b>					
Precontemplation	14.8%	17.5%	16.7%	32.7%	< .05
Contemplation	4.4%	7.0%	5.4%	5.4%	
Preparation	17.7%	27.2%	31.4%	24.7%	
Action	13.1%	17.7%	13.7%	9.5%	
Maintenance	50.0%	30.6%	32.8%	27.7%	

Table 5. Proportions of Participants with Regular Physical Activity in Each Transtheoretical Model Stage Among Different Ethnic Groups					
	White	Native Hawaiian	Filipino	Japanese	P-Value
<b>Men</b>					
Precontemplation	12.3%	9.4%	8.2%	18.4%	< .05
Contemplation	10.2%	12.8%	13.4%	16.8%	
Preparation	11.6%	13.3%	12.4%	14.8%	
Action	6.5%	12.8%	22.2%	11.5%	
Maintenance	59.4%	51.7%	43.8%	38.5%	
<b>Women</b>					
Precontemplation	8.9%	9.2%	13.9%	21.3%	< .05
Contemplation	10.9%	16.6%	18.6%	21.9%	
Preparation	14.1%	17.9%	20.7%	17.7%	
Action	11.8%	19.3%	15.6%	10.5%	
Maintenance	54.2%	37.0%	31.2%	28.5%	

Table 6. Proportions of Participants with Knowledge of Recommended Number of Servings of Fruits and Vegetables Among Different Ethnic Groups					
	White	Native Hawaiian	Filipino	Japanese	P-Value
<b>Men</b>					
0–4 servings	45.3%	62.1%	63.0%	57.9%	< .05
5 servings	30.1%	19.2%	19.3%	22.9%	
≥6 servings	24.5%	18.7%	17.7%	19.2%	
<b>Women</b>					
0–4 servings	23.1%	42.8%	47.7%	39.3%	< .05
5 servings	44.4%	32.2%	30.9%	39.6%	
≥6 servings	32.4%	25.1%	21.4%	21.1%	

Table 7. Attitude, Perceived Behavioral Control, Behavior, and Self-Efficacy Among Different Ethnic Groups				
	White	Native Hawaiian	Filipino	Japanese
<b>Men</b>				
Nutritional attitude	3.6 ± 1.0 <sup>a</sup>	3.4 ± 1.0 <sup>ab</sup>	3.3 ± 1.1 <sup>b</sup>	3.4 ± 1.0 <sup>ab</sup>
Perceived behavioral control regarding nutrition	4.5 ± 0.9 <sup>a</sup>	4.3 ± 1.0 <sup>ab</sup>	3.8 ± 1.2 <sup>c</sup>	4.1 ± 1.1 <sup>b</sup>
Healthy eating behavior	3.7 ± 0.7 <sup>a</sup>	3.3 ± 0.7 <sup>b</sup>	3.4 ± 0.6 <sup>b</sup>	3.3 ± 0.6 <sup>b</sup>
Self-efficacy regarding exercise	3.2 ± 0.7 <sup>a</sup>	3.2 ± 0.7 <sup>a</sup>	2.9 ± 0.7 <sup>b</sup>	2.9 ± 0.7 <sup>b</sup>
<b>Women</b>				
Nutritional attitude	3.5 ± 0.9 <sup>a</sup>	3.4 ± 1.0 <sup>ab</sup>	3.3 ± 1.1 <sup>b</sup>	3.3 ± 1.0 <sup>b</sup>
Perceived behavioral control regarding nutrition	4.7 ± 0.7 <sup>a</sup>	4.4 ± 1.0 <sup>b</sup>	4.1 ± 1.1 <sup>c</sup>	4.5 ± 0.8 <sup>b</sup>
Healthy eating behavior	4.1 ± 0.7 <sup>a</sup>	3.6 ± 0.7 <sup>b</sup>	3.7 ± 0.6 <sup>b</sup>	3.5 ± 0.7 <sup>b</sup>
Self-efficacy regarding exercise	3.1 ± 0.7 <sup>a</sup>	2.9 ± 0.8 <sup>a</sup>	2.7 ± 0.8 <sup>b</sup>	2.7 ± 0.8 <sup>b</sup>

Values are presented as mean ± standard deviation. <sup>a-c</sup>Values with different superscript letters are significantly different at  $P < .05$ . A higher value for nutritional attitude indicates greater support for intake of fruits and vegetables. A higher value for perceived behavioral control regarding nutrition indicates the ability to control intake of fruits and vegetables. A higher value for healthy eating behavior indicates healthier food and shopping choices. A higher value for self-efficacy regarding exercise indicates confidence in performing exercise. These scales are shown in Table 1.

Table 8. Association of Body Mass Index and Health Behavior After Adjustment for Age in Different Ethnic Groups												
	White			Native Hawaiian			Filipino			Japanese		
	OR	95% CI	P-Value	OR	95% CI	P-Value	OR	95% CI	P-Value	OR	95% CI	P-Value
<b>Men</b>												
Nutritional attitude	1.30	0.98–1.72	.065	0.86	0.63–1.17	.322	0.88	0.63–1.23	.446	1.11	0.81–1.54	.516
Perceived behavioral control regarding nutrition	0.75	0.58–0.99	.039	0.88	0.65–1.19	.395	1.07	0.78–1.46	.698	0.71	0.54–0.94	.018
Healthy eating behavior	0.73	0.51–1.03	.076	0.79	0.51–1.23	.297	0.40	0.21–0.77	.006	0.98	0.57–1.67	.927
Self-efficacy regarding exercise	0.70	0.50–0.99	.047	0.62	0.40–0.96	.034	1.60	0.92–2.81	.099	0.72	0.47–1.12	.143
<b>Women</b>												
Nutritional attitude	1.21	0.94–1.55	.132	0.88	0.70–1.10	.255	0.97	0.70–1.36	.867	1.13	0.81–1.58	.472
Perceived behavioral control regarding nutrition	0.79	0.61–1.02	.071	0.91	0.72–1.14	.403	0.83	0.60–1.14	.253	0.86	0.59–1.25	.428
Healthy eating behavior	0.47	0.34–0.65	0	0.63	0.44–0.92	.015	0.91	0.50–1.67	.767	0.51	0.30–0.85	.010
Self-efficacy regarding exercise	0.86	0.65–1.16	.326	0.82	0.61–1.10	.184	0.81	0.51–1.31	.394	0.78	0.51–1.19	.251

OR, odds ratio; CI, confidence interval

## Discussion

In this study, ethnic features were examined to obtain basic data on health education for improvement of obesity in Hawai‘i. The intake of fruits and vegetables and regular physical activity were evaluated in each TTM stage, as well as items related to health behaviors and obesity in the TPB in the 4 most populous ethnic groups. Several studies have shown that obesity rates are higher among Native Hawaiians than in other ethnic groups.<sup>2,4,5</sup> In this study, the BMIs of Native Hawaiian men and women were significantly higher than those of white, Filipino, and Japanese participants.

In a previous report, each stage was numerically coded, and the intake of 5 or more servings of fruits and vegetables in each TTM stage was evaluated using scores for each ethnic group.<sup>3</sup> In the present study, however, the percentage of participants with 5 or more servings of fruits and vegetables and regular physical activity in each TTM stage is shown to more comprehensively illustrate the situation of the participants. The ethnic groups showed significant differences in this study. The percentages of white men and women taking 5 or more servings of fruits and vegetables were higher in the action and maintenance stages than those in the other ethnic groups, but Japanese men and women showed opposite results. Furthermore, the percentages of Japanese men and women engaging in regular physical activity in the action and maintenance stages were also lower than those in the other ethnic groups.

Negative attitudes can reportedly be modified to positive through direct measure of the TPB on physical activity by giving participants effective health information.<sup>17</sup> In this study, health behaviors among ethnic groups were compared. The items differed among the ethnic groups, and the results of white participants were clearly differentiated. Additionally, men and women showed similar trends for TPB items in each ethnic group.

When the relationship between these items and BMI was analyzed by logistic regression, the results differed between men and women in each ethnic group. Among women, white, Native Hawaiian, and Japanese participants had similar results, and healthy eating behavior might help to improve obesity. Men showed different results depending on ethnicity.

A study that examined multi-ethnic diets using a quantitative food frequency survey suggested that healthy diets were associated with reduced all-cause mortality in men and women as well as reduced cardiovascular disease and cancer risk.<sup>18</sup> Healthy eating choices, such as eating fruits and vegetables, choosing healthy foods, and eating foods with high fiber content, have the potential to prevent diseases as well as obesity. However, another study showed that healthy or unhealthy dietary intake patterns were not significantly associated with the BMI or diabetes mellitus.<sup>19</sup> A specific amount of dietary intake was not investigated here, and so a definitive conclusion cannot be given. Future studies should examine the relationship between health behaviors and actual nutrient intake.

In the questionnaire in this study, it was initially assumed that fruit and vegetable intake would be low if participants agreed that the price of fruits and vegetables is high, that it takes time to prepare vegetable dishes, and that meal planning is difficult. However, if the participants understood the value of fruit and vegetable intake, it may be considered that the intake did not decrease. For this reason, future studies should also examine items such as attitude and actual intake. Cronbach's alpha was inadequate, resulting in unreliability. Questions with a high Cronbach's alpha could give more reliable results.

With respect to the characteristics of each ethnic group, in white men and women, the sum percentages of white men and women taking 5 or more servings of fruits and vegetables in the action and maintenance stages were higher than those of other ethnic groups, and all TPB items also showed higher scores. Perceived behavior control regarding nutrition and self-efficacy regarding exercise among white men and healthy eating behavior among white women might help to improve obesity. Native Hawaiian men and women had higher values for self-efficacy regarding exercise. Self-efficacy regarding exercise in Native Hawaiian men and healthy eating behavior in Native Hawaiian women might also help to improve obesity. Conversely, the BMI of Filipino and Japanese participants was not different from that of white participants. However, Filipino men and women had significantly lower values of perceived behavior control regarding nutrition than did other ethnic groups. Additionally, healthy eating behavior in Filipino men might help to improve obesity. Japanese and Filipino men and women tended to have lower TPB values than white and Native Hawaiian men and women. Thus, it is necessary to understand that differences exist among ethnic groups and to conduct health education tailored to individual ethnic groups.

Five or more servings of fruits and vegetables per day have been recommended.<sup>20</sup> In the present study, the percentage of white men and women taking the recommended 5 or more servings of fruits and vegetables per day was high (>50% of men and >70% of women). In other ethnic groups, however, this percentage was lower (about 40% of men and 50%–60% of women). Specific education on how much should be taken is necessary, and this seems to be especially important in men.

A limitation of this research is that income and educational background were not examined in relation to BMI. Obesity is reportedly associated with a low income and educational background, and health literacy scores are associated with a high income and higher education.<sup>21,22</sup> In this study, the examination including income and educational background clarified the factor for obesity improvement. Moreover, the questionnaire of this study was not able to grasp the detailed nutrient quantity. A previous study of the ethnic differences in nutritional levels showed that the average energy intake of Native Hawaiians was about 1.2 times higher for men and about 1.3 times higher for women compared with Japanese Americans and Caucasians.<sup>2</sup> Nutrient levels were not examined in the present study, preventing definitive conclusions from being drawn. However, examination of nutrient levels will clarify what types of health behaviors are associated with the BMI, enabling the establishment of a specific approach to improvement of obesity. Data was also collected from 2010–2011 and these findings may be different in the current population.

There are 4 main findings of this study. First, there were differences in fruit and vegetable intake and exercise habits in each TTM stage among the ethnic groups. Second, there were differences in attitudes regarding nutrition and healthy food intake and self-efficacy regarding exercise in each ethnic group. Third, items that have the potential to improve obesity in the TPB differed particularly among men in the 4 ethnic groups. Finally, a low percentage of participants recognized that the recommended number of servings of fruits and vegetables was 5 or more. Education for men may be particularly important. The findings indicate that modified health education approaches may be needed in accordance with the ethnicity of the population.

### **Conflict of Interest**

Neither of the authors identifies any conflict of interest.

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