

**DISSERTATION**

**EXAMINING THE APPLICATION OF THE  
TRANSTHEORETICAL MODEL OF CHANGE FOR  
FRUIT AND VEGETABLE CONSUMPTION AMONG COLLEGE STUDENTS**

Submitted by

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In partial fulfillment of the requirements

for the degree of Doctorate of Philosophy

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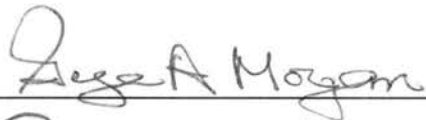
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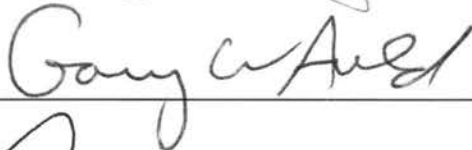
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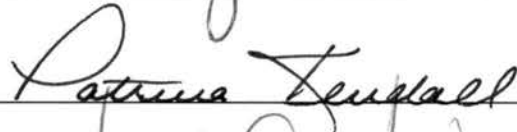
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**EXAMINING THE APPLICATION OF THE TRANSTHEORETICAL MODEL  
OF CHANGE FOR FRUIT AND VEGETABLE CONSUMPTION AMONG  
COLLEGE STUDENTS** BE ACCEPTED AS FULFILLING IN PART  
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## **ABSTRACT OF DISSERTATION**

### **EXAMINING THE APPLICATION OF THE TRANSTHEORETICAL MODEL OF CHANGE FOR FRUIT AND VEGETABLE CONSUMPTION AMONG COLLEGE STUDENTS**

Nutrition education messages about the adequate amount of fruits and vegetables in the diet have the potential to disseminate information the optimum level of fruit and vegetable intake to the population. However, this potential will be effective, only if the audience incorporates these messages. To facilitate the acceptance of nutrition education messages, we need to understand the process of behavior change across different behaviors and cultural/ethnic groups.

The main purpose of this study was to examine the applicability of the Transtheoretical Model for fruit and vegetable eating behavior in male North American, Latino and Asian college students at Colorado State University. First, a 40-item scale was developed to measure the processes of change. Second, stages of change for eating five fruits and vegetables a day were assessed. Third, the relationship between stages of change and processes of change constructs for fruit and vegetable consumption was examined.

Results showed that the developed scale was reliable and valid for the target population. Most of the participants were classified as in the preparation or contemplation stages of change, and the stage classification was significantly related to

the participant's cultural/ethnic background. North American and Latino participants were predominantly in preparation while Asian participants were in precontemplation. In addition, the North American and Latino groups used less processes of change (stimulus control, dramatic relief and environment reevaluation) than the Asian group. The relationship between stages of change and processes of change indicated that generally the processes of change scores for fruit and vegetable intake were lower in early stages of change than in later stages of change. The finding that each cognitive/experiential composite score was higher than behavioral composite scores across stages of change did not agree with most studies in smoking, but agreed with some studies on diet and exercise.

Although more research needs to focus on the applicability of the stages of change and processes of change constructs, the present study provides partial evidence of the value of the Transtheoretical Model in fruit and vegetable eating behavior in the nutrition education arena.

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# **CHAPTER I**

## **INTRODUCTION**

### **The Problem**

Unhealthy diets have been estimated to contribute to approximately 35% of all cancers (U.S. Department, 1998; Doll et al, 1981; Willet, 1990; Ziegler, 1991). Several studies have shown a strong inverse association between the amounts of fruits and vegetables consumed and risk of various cancers (e.g. lung, stomach, colon, prostate). Thus, diets rich in fruits and vegetables may protect against some kinds of cancer and heart disease (Willet and Trichopoulos, 1996; Havas, et al., 1994). It is thought that micronutrients found in fruits and vegetables such as B-Carotene, phytochemicals, Vitamins E and C can inhibit cancer initiation (Steimets & Potter, 1996, Willet et al., 1990, Ziegler, 1991). In addition, fruits and vegetables contain no cholesterol and most of them are fat free (Cullen et al., 1998).

Based on this evidence, many organizations, including the National Cancer Institute, the U.S. Department of Agriculture, and the American Cancer Society, have recommended that fruit and vegetable consumption be five or more servings a day (Cox and colleagues, 1998; Havas et al., 1994). International organization such as World Health Organization (WHO) also have been advocating the fruit and vegetable

consumption of 400 g per day or about 7% of the total caloric intake (World Health Organization, 1990).

Public health programs aimed at combating chronic diseases will have to encourage healthy diet habits such as adequate fruit and vegetable consumption and other healthy lifestyle behavior as a major focus (Lechener et al., 1998). However, according to Lechener and researchers (1998), target populations can be conceptualized as involving a heterogeneous mixture of individuals with different degrees of readiness to change. These differences in readiness of change require different intervention strategies.

Understanding the characteristics of the different individuals and subgroups in the population, behavioral risks factors, including the readiness to change, processes or strategies used to change, is one of the most important challenges in designing effective interventions. (Laforge et al., 1999).

According to Brug et al (1998), to improve the effectiveness of promoting interventions in nutrition, we need to understand the process of behavior change. More specifically, to promote a person's behavior change, interventions should be based on insights into how they change their behavior (Glanz et al., 1994). In addition, Sims and Contento (1998) emphasize the importance of the theory-based interventions to promote behavior change.

One leading model to explain and promote behavior change is the Transtheoretical Model (Steptoe et al., 1996; Lechner et al., 1998). This model proposes that people progress from one stage to the next (precontemplation to contemplation to preparation to action and maintenance) using a variety of coping strategies, or processes



of change. As individual progress through the stages, their reliance on specific processes of change shifts (Prochaska and DiClemente, 1986).

The processes of change represent both cognitive and behavioral activities relevant for a particular behavior change (DiClemente and Prochaska, 1985). Experiential processes are used more frequently at earlier stages of change, and behavioral processes are used more frequently at later stages of change (Snow, and researchers, 1994; Prochaska and others, 1991).

The Transtheoretical Model was initially developed to explain how smokers stopped smoking on their own in a clinical context (Prochaska et al., 1992; Kristeller et al., 1992). In recent years, however, the stages of change constructs have been widely applied in the context of other health-related behaviors (Sigman-Grant, 1996). Studies in the area of the exercise adoption made by Lee et al. (1993) and Marcus and others (1992, 1993), as well as studies done in blood donation (Chandler and Ferguson, 1996) are some examples.

Related to the health-related dietary change, we can mention the studies of Hargreaves et al. (1999), Brug et al. (1997), Steptoe et al. (1996), Sporny et al. (1995), and Rossi et al. (1990) where they investigated fat reduction; the study of Glanz et al (1994) related to fiber intake; the study of Campbell et al. (1994) on fruits and vegetables, and the weight-loss study done by Suris et al (1998).

It is opportune to emphasize that in the mentioned studies and a great number of the other studies, the authors have investigated the construct of stages of change. Few studies have examined the construct of processes of change in the nutritional area. Some

of these are the studies of the Lamb and Joshi (1996), Nigg and Courneya (1998), Rossi (1994) and Perz and Carbonari (1996).

With regard to improving fruits and vegetables eating behavior, until the present, only one study investigating the processes of change has been detected. This limitation makes it difficult to apply strategies and techniques - the processes of behavior change - to individuals by health care providers to modify their consumption of fruits and vegetables.

In addition, studies have not investigated the relationship between stages and processes of change for fruits and vegetables in the context of a diverse population of males Latino, American and Asian college students. Furthermore, there is little research comparing the constructs of the model in specific cultures (Suris et al., 1998). It is possible that various cultures may use different processes of change more than others. Some processes may be more readily accepted by cultures while others are more problematic (Suris, et al., 1998). In addition, cultural differences may also influence stage classification (Laforge et al., 1999). To circumvent these limitations, the following research was developed.

### **Purpose of the Study**

The purpose of this study was to extend the research on the application of Transtheoretical Model of Change (TTM) constructs for fruits and vegetables consumption among male American, Asian, and Latino college students. The study used the two major constructs of the TTM: stage of behavior change and processes of change.

The criteria behavior was the consumption of the recommended number of servings of fruits and vegetables as described in the Food Guide Pyramid.

The study also examined if other variables such as age, and number of servings people think they should have in a day predicted someone's stage of change. These additional variables, which are not currently Transtheoretical Model constructs, were investigated in the context of this model to increase our understanding of the problem of low fruit and vegetable consumption. Furthermore, these additional variables could provide support to make comparisons with other studies of behavior change predictors. Other variables such as educational level, ethnicity, annual income, and amount of money to spend on food were measured for the purpose of describing the population characteristics.

### **Objectives of the Study**

1. To determine the stage of change to eat five fruits and vegetables a day among male Latino, American and Asian college students
2. To develop a scale to measure processes of change among Latino, American and Asian college students
3. To investigate the relationship of stages of change and processes of change
4. To investigate the association of stages of change and demographics/personal characteristics

### **Hypothesis of the Study**

The hypotheses investigated were:

1. Participants in a higher stage of change would consume more fruits and vegetables than participants in a lower stage.
2. Different cultures would have different stages of change for eating five or more fruits and vegetables.
3. Different cultures would have different processes use for eating five or more fruits and vegetables.
4. Participants in later stages of change would have greater use of the processes of change for eating 5 or more fruit and vegetable than those in early stages.

### **Significance of the Study**

The relevance of this research is that if the key components of the model can be adapted to fruit and vegetable consumption in different cultures, then it will permit future interventions to promote successful fruit and vegetable intake via specific stage process-based interventions.

### **Delimitations and Limitations**

This study is delimited to three cultural groups: Latino, Asian and American college students from Colorado State University that live in Apartment Life Complex. This study is also delimited to adult men between the ages of 18 and 60 years old since most of the studies about health-related behaviors have been developed among women. So, there is a need for research on males.

## **Dissertation Organization**

The organization of the present dissertation consists of an abstract and six chapters, with the first chapter presenting an introductory and overall view of the work to be developed. The literature review, characterized in the second chapter, addresses the Transtheoretical Model of Behavior Change through the following topics: research with stages of change constructs, research with processes of change constructs, the relationship between stages and processes of change for fruit and vegetable consumption, the personal characteristics associated with fruit and vegetable consumption, and also the recommendations in terms of the adequate amount of fruits and vegetables.

The next three chapters consist of manuscripts. The first manuscript is titled "Development of a scale for measuring processes of change constructs for fruits and vegetables." The second manuscript is titled "Stages of readiness to consume fruits and vegetables among North American, Latino and Asian college students." The third manuscript is titled "Stages of change and processes of change for fruit and vegetable consumption among North American, Latino and Asian college students." Chapter VI presents the summary, conclusions and recommendations.

## **CHAPTER II**

### **LITERATURE REVIEW**

#### **Introduction**

The literature review addresses the research on the stages and processes of change constructs for healthy related behaviors, and specifically, as listed below, will contain the following sections:

- A. Transtheoretical Model of Behavior Change
- B. Research with Stages of Change for Fruits and Vegetables
- C. Research with Stages of Change for Other Health-Related Behaviors
- D. Research with Stages of Change for Health-Related Behaviors Among Cultural/Ethnic Groups
- E. Research with Processes of Change Constructs
- F. Relationship Between Stages and Processes of Change
- G. Demographic and Personal Characteristics Associated with Fruit and Vegetable Consumption and Stages of Change
- H. Consumption Patterns of Fruits and Vegetables
- I. Recommendations for Fruit and Vegetable Intake

## **Transtheoretical Model of Behavior Change**

The Transtheoretical Model (TTM), commonly known as the stages of change Model, emerged during the late 1970s from a comparative analysis of 18 leading therapy systems, when James Prochaska and Carlo DiClemente (1983, 1982) observed common change elements among these systems. This finding set the stage for integrating the many psychotherapy change models into one comprehensive change model, with the term “transtheoretical” implying that a number of theories can be applied to help people change their behavior.

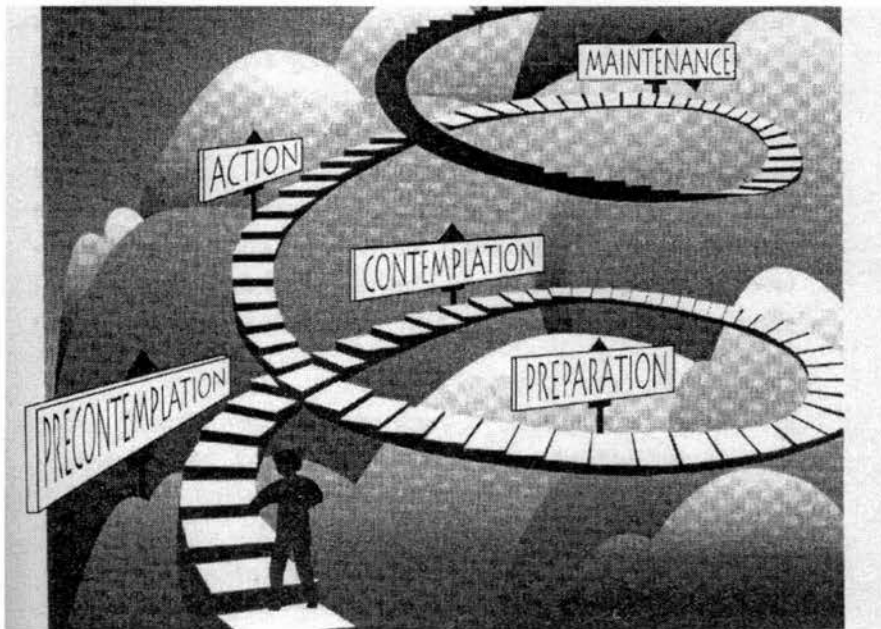
Although initially focused on how people intentionally changed their addictive behaviors such as smoking (Fava and others, 1995; Prochaska et al., 1991) the model has expanded to explain initiation, adoption and maintenance of positive health behaviors such as dietary change, mammography screening, and exercise (Prochaska and Velicer, 1997; Prochaska and DiClemente, 1985). The Transtheoretical Model has two main constructs, the stages of change and processes of change, which will now be described.

### **Stages of Change**

Prochaska & Velicer (1997) stated that the stages of change designate a temporal dimension that recognizes the dynamic nature of behavior change and the developmental sequences of movement toward change, with the concept of stages falling between temporary and ever changing states and traits in terms of tendency or disposition.

As shown in Figure 2.1, stages can be stable over time and yet dynamic and open to change. Based in the 1997 work of Prochaska et al., each stage can be briefly described as follows.

- 1) Precontemplation: where one has no intention to change the behavior in terms of a foreseeable future, which is generally defined as within the next six months, and also the individuals in this stage are unaware, discouraged or defensive about the behavior change.
- 2) Contemplation: one is aware of the problem and is thinking about taking action within the next 6 months
- 3) Preparation: one intends to take action within the next thirty days.
- 4) Action: one has successfully modified the problem behavior for a period of less than six months. Others recognize overt efforts and visible action.
- 5) Maintenance: one has maintained the behavior change for more than six months and continues working toward relapse prevention. In fact, Prochaska et al. (1997) has suggested that relapse is seen as part of the maintenance stage and the current model conceptualizes the stages of change as a spiral pattern in which individuals frequently relapse and recycle through the stages.



**Figure 2.1.** Stages of Change Spiral (Prochaska et al., 1995).



## Processes of Change

The processes of change comprise the second dimension of change in the Transtheoretical Model. Processes of change involves experiential/cognitive and behavioral coping strategies, techniques and interventions that enable individuals to successfully change or modify their behavior.

Analysis of innumerable techniques applied by various therapies including behavioral, cognitive existential, experiential, gestalt, humanistic, interpersonal, psychodynamic, and radical therapies, led Prochaska and Velicer (1997) and Prochaska and colleagues (1984, 1982) to the identification of a common core of ten processes of change. The term transtheoretical is a reflection of how these ten processes represent strategies and techniques used across many theories of psychotherapy and behavior change. For example, Freudian theory places great emphasis on consciousness raising, a cognitive process, while in the Skinnerian theory, emphasis is placed on management, known as a behavioral process.

These processes cluster into two second order groups of factors as defined by Prochaska and colleagues (1988):

- 1) Experiential/cognitive, which are those that rely on verbal interaction or affective activities) and
- 2) Behavioral processes, defined by those that rely on behavioral manipulation and involve more specific observable behaviors.

Most processes, however, reflect both experiential (cognitive) activities and behavioral activities (Prochaska et al., 1988). The five experiential/cognitive) processes are:

- 1) Consciousness raising: increasing one's awareness of the problem behavior by gathering information to increase understanding, knowledge, and feedback about self and problem.
- 2) Dramatic relief: experiencing and expressing feelings about one's problems and solutions.
- 3) Environmental reevaluation: assessing how one's problem affects physical condition and social environment.
- 4) Self-reevaluation: assessing one's feelings and thoughts about oneself with respect to a problem.
- 5) Social liberation: increasing available alternatives for non-problem behaviors in society.

In terms of the five behavioral processes, they are:

- 1) Self-liberation: choosing and commitment to act or belief in one's ability to change.
- 2) Contingency (reinforcement) management: rewarding one's self or being rewarded by others for making changes.
- 3) Helping relationships: being open and trusting about problems with someone who cares.
- 4) Counter conditioning: substituting alternatives for problem behaviors.
- 5) Stimulus control: avoiding or countering stimuli that elicit or trigger problem behaviors.

The relationship between the stages and processes of change is a key element of the Transtheoretical Model. The processes are used differentially through the various

stages. During precontemplation, individuals use the processes significantly less than people do in other stages. Individuals in the contemplation stage are most open to experiential processes like consciousness-raising techniques, dramatic relief and environmental reevaluation. As people move into the preparation stage, they focus on the experiential processes like self-reevaluation and also begin to use some of the behavioral processes.

In the action stage, people are using less of the experiential processes and concentrating more on the behavioral processes of self-liberation, helping relationships. Finally, in the maintenance stage people will continue to focus on behavioral processes, but will be using the processes less often (Prochaska and colleagues, 1991, 1986; Rossi and researchers, 1988).

### **Research with Stages of Change for Fruits and Vegetables**

Laforge and researchers (1994), in one the first studies to examine stages of change in relation to fruit and vegetable consumption, found strong linear relationship between consumption of fruits and vegetables and stages of change toward adoption of five or more servings of fruit and vegetable a day ( $p < .0001$ ). The more advanced stage the participants were in, the greater was the reported daily fruit vegetable consumption in the Food Behavior Checklist score that represents the number - maximum of four - of fruit or vegetable items eaten yesterday. The distribution of the Food Behavior Checklist fruit and vegetable score was 11.5% (0 score); 22.9% (1 score); 27.5% (2 score); 27.3% (3 score) and 10.8% (4 score). The percent of individuals in precontemplation was 38%,

in contemplation was 28.6%, while the percent of individuals in preparation, action and maintenance was 18.5%, 1.7% and 13.1% respectively.

Another early study investigating the relationship of number of servings of fruits and vegetables and stages of change was conducted in a population of adult workers by Glanz et al. (1994). Results show that the consuming of servings of fruits and vegetables to individual in precontemplation, contemplation, preparation, action and maintenance stages were respectively: 1.69; 1.75; 2.06; 2.15 and 3.11. This pattern of association was similar for fiber intake where individuals in precontemplation stage had an intake of 6.29 g/1,000 Kcal, in contemplation stage—6.48/1,000 Kcal; in preparation stage—6.91 g/1000 Kcal; in action stage—7.69 g/1,000 Kcal, and in maintenance—9.81 g/1,000 Kcal.

Brug, et al. (1997) examined whether significant differences in attitude, self-efficacy, perceived intake compared to others, and consumption level existed across the five stages of change with respect to fruit and vegetable consumption. Fruits and vegetables intake was found to be significantly higher in action and maintenance stages (4.0 and 2.9 servings, respectively) as compared to the other three early stages (1.0 to 1.6). The distribution of the stages for vegetable consumption of the total sample was 6% in precontemplation, 8% in contemplation, 33% in preparation, 5% in action, and 48% in maintenance stages. A similar distribution was found for fruit consumption.

A study by Campbell and colleagues (1998) with respect to fruit and vegetable consumption among rural African Americans, found that mean fruit and vegetable consumption among participants in the pre-action stages (precontemplation, contemplation, and preparation) was 3.3 to 3.5 servings compared with 6.5 daily servings

for individuals in the action and maintenance stages. Of the total sample, 23.7% were in the precontemplation stage, 3.3% in contemplation, 65.1% in preparation, 1.1% in action, and 6.8% in maintenance.

Campbell et al. (1999) also reports results of a study at work site in Arizona targeting predominantly males where workers in precontemplation and contemplation / preparation stages of change consume less (2.2 and 2.1 respectively) servings of fruits and vegetables than workers in action / maintenance (5.6 servings).

In another study in adult patients recruited from four family practices in central North Carolina, Campbell and researchers (1994) found that precontemplators consumed significantly fewer fruits and vegetables ( $3.1 \pm .19$  servings/day) than did participants in the action stage of change ( $3.9 \pm 0.24$  servings/day).

With respect to stages of change for fruits and vegetables, it can be observed that the participants in different studies are in great number in the early or in preparation stages, while fewer participants are in the later stages of change particularly in action stage of change. Additionally, it can be said that the maintenance stage was the one with most servings of fruits and vegetables followed by action and preparation.

### **Research with Stages of Change for Other Health-Related Behaviors**

A study developed by Ounpuu and colleagues (2000) with women living in Guelph, Ontario, showed that fat intakes were lower among those in the action and maintenance stages than among those in the preparation, contemplation, and precontemplation stages. More than 40% of those in the action and maintenance stages consumed more than 30% of energy as fat. Mean fat intakes and SD by stage-of-change

group were  $24.0 \pm 4.4\%$  for lower-fat maintenance,  $35.5 \pm 3.8\%$  for higher-fat maintenance, and  $38.2 \pm .2\%$  for precontemplation.

Curry et al. (1992) assessed stage of dietary fat reduction and its association when used as a staging instrument to categorize people into five stages, and they found in general that individuals in stage I (precontemplation) were consuming significantly more fat than those in either stages 4 or 5 (action or maintenance). Percent of calories from fat was significantly related to stage of change ( $p < 0.001$ ).

Studies carried out by Greene et al. (1994) had an objective to develop an algorithm to assess stages of change for reducing dietary fat intake to 30% of energy or less in two sample population groups. The first sample was a random sample of 614 adults who answered a mailed questionnaire, and the second sample was a convenience sample of 130 faculty, staff and graduate students. The results showed that people in pre-action stages of change consumed markedly more fat than people did in the action or maintenance stages.

Categorizing people with their own staging instrument, Glanz et al. (1994) found that those in the final maintenance stage were consuming less percentage of energy from fat (31.74 %) than those in the action stage (37.44%), who were in turn consuming less fat (mean percent of energy from fat of 39, 53) than those in earlier stages of change.

The stages-of-change construct was applied to assess the readiness for dietary fat reduction in a postal survey of adults in South London. The percentage of respondents falling into each stage was as follow: precontemplation 35.1%; contemplation 12.7%; preparation 4.1%; action 5.5%, and maintenance 42.5% (Steptoe et al., 1996). A

consistent association between stage of change and dietary fat intake was observed in this study.

The relationship between stage of change and fat intake was assessed by analysis of variance, with stage and gender as the factors between subjects. The main effect of stage was significant for total fat, general food fat, milk fat and fat from spreads ( $p < 0.001$ ). In no case did stage interact with gender. For each variable there was a relatively orderly association between stage and fat intake, with lower scores in the more advanced stages. In terms of absolute levels of fat consumption, it is interesting to note that 75.8 percent of people in the maintenance and 70.0 percent in the action stage had total fat scores of less than 30. The corresponding proportion of individuals in the precontemplation stage was only 32.3 per cent.

Rossi et al. (1993) evaluated distributions for four different staging algorithms for dietary fat reduction and compared the findings across three samples in New England using in-person, mail, and telephone methods. The distributions differed between the algorithms and, telephone methods. The distributions differed between the algorithms and, in all four algorithms, dietary fat consumption levels decreased with successive stages of change.

With no exception and independently of the sampling technique, the results are very conclusive in the sense that the level of fat intake is increasingly less as one advances from the early stages to the later stages of action and maintenance.



### **Research with Stages of Change for Health-Related Behaviors Among Cultural/Ethnic Groups**

The stage of change or readiness distributions for reducing the amount of stress in daily life was compared between American and Australian adult population. (Laforge et al., 1999). Results show that Australian participants were more likely to be in precontemplation and less likely to be in the maintenance stage for stress reduction than were Americans participants. Americans respondents were approximately twice as likely to fall into the maintenance category, and the Australian respondents were about one-third again as likely to be in the precontemplation stage.

Only about one-fifth of the American sample and one-third of the Australian respondents were classified in contemplation, preparation, or action stages. The distributions in these stages were more similar within than between cultural groups samples, suggesting that cultural differences between Americans and Australian participants may influence stage classification for stress reduction.

Campbell et al. (1999) found that in worksites at Arizona, Hispanics were in contemplation/preparation for eating fruits and vegetables category (46.1%) compared to non-Hispanic white and African American workers that were in precontemplation or action/maintenance for eating fruits and vegetables (58.0% and 51.7% respectively).

Sorensen and colleagues (1998) assessed readiness for eating fruits and vegetables in a sample of community healthy center employees. Results show that from all (n = 728) white employee participants, 52.0% were in preparation, 32.9% were in precontemplation/contemplation, and 15.0% were in action/maintenance. From all (n = 263) Hispanic participants, 24.7% were in precontemplation/contemplation, 68% were in preparation, and 18.0% were in action/maintenance. Related to black



participants, the proportion of participants that were in precontemplation/contemplation, preparation and action/maintenance was respectively, 25.7%, 66.3% and 7.9%.

Studies done in a sample of predominantly white or Asian undergraduate and graduate students from three colleges in Connecticut found that most participants were in contemplation stage of exercise (Rosen et al, 2000). The distribution of the readiness for exercise in this population was 45 participants (31%) in the precontemplation stage, 55 (37%) in the contemplation stage, and 34 (23%) in the preparation stage.

The only study found that applied the stages of change in a population totally Asian was developed among a sample of 101 subjects Chinese Singaporeans by Ling and colleagues (2000). Using its own algorithm, subjects were classified as being in the pre-action stage for having adequate fruit and vegetables if they were consuming more than 3.75 servings or fewer, and as meeting the action stage criteria if consuming more than 3.75 servings.

Those in pre-action stages were further classified in the precontemplation stage if they had no intention to increase intake during the next 6 months; and in the contemplation stage if they intended to increase intake in the next six months. The authors found that individuals were predominantly in maintenance (78%) stage of change for eating more than 3.75 (criteria behavior) servings of fruits and vegetables.

The stages-of-change construct was applied to readiness for dietary fat reduction in a postal survey in the British adult population from South London. The percentage of respondents falling into each stage was as follows: precontemplation—35.1 percent, contemplation—12.7 percent, preparation—4.1 percent, action—5.5 percent, and maintenance—42.5 percent (Steptoe et al., 1996).

Studies about low-fat diets in a population of predominantly white Americans (89.6%) participating in a folk music festival found that 22% of the sample were in precontemplation, 13 % in contemplation, 5% in decision or preparation, 19% in action and 41% in maintenance (Bowen et al., 1994).

Subjects were staged in a similar manner to Curry et al. (1992) that assessed stage of fat reduction with two predominantly white samples in the state of Washington. They found consistent results across the two samples, gender differences in stage (more females in later stages), and significant associations between stage of dietary fat reduction and percent of calories from fat.

Also Boyle et al. (1998) in a predominantly white (95%) random sample of 8,000 HMO members found that a large proportion of the sample were in either action or maintenance stages (86%), while 6% were precontemplators and 4.2% were contemplators for fruit and vegetable intake.

Baronoviski et al. (1998) analyzed meal and day of week patterns of consumption of fruit and vegetable and fat related practices among elementary school teachers. When day was the unit of analysis, ethnicity was associated only with low-fat practices, fried, and high-fat foods. Euro-Americans tended to report more low-fat foods practices, while African-Americans tended to report more frying and eating more high-fat foods.

Most of the studies showed that the stages of action/maintenance have more than 50 percent of participants from the same culture. In an inter-cultural and ethnic comparison there is a trend that shows that the Hispanic/Australian cultures are in the earlier stages when compared to American/Asian cultures.

## **Research with Processes of Change Constructs**

### Processes of Change Use in Different Cultures

According to Lamb and Joshi (1996), there are four processes of change that Prochaska et al. (1992) argues to operate most powerfully at the four stages transitions. Lamb and colleagues (1996) investigated those four processes of change in a study for dietary fat reduction in a sample of 133 young English adults. The authors found that two of the processes (consciousness raising and self-liberation) could, between them, distinguish all five stages of change. The results suggest that fewer processes may be involved in dietary reduction in this population and that the pattern may not be identical to that reported by Prochaska and his colleagues in other cultural groups.

In the Treat Well 5-A-Day study that is part of the National Cancer Institute's 5-a-Day for Better Health Initiative, the relationship between social support (helping relationship) and readiness to make dietary changes was investigated. Sorensen and colleagues (1998) found that household support was significantly higher among Hispanics or African Americans among other ethnic groups, and this remained significant when other characteristics were controlled.

Due to a limited amount of studies investigating processes of change in different cultures, there is a need for further research so clear inferences can be taken.

### **Relationship Between Stages and Processes of Change**

Recently, Chung and Herr (2001) developed a study on fruits and vegetables designed to examine the relationship of processes of change and stages of change in a

convenience sample of a 294 collegiate young adults where 81% were female and 86% were white. From factor analysis, seven constructs were identified: health concerns, self-reevaluation, social liberation, health commitment/action, interpersonal control, external reinforcement and helping relationship. Results show that for both fruits and vegetables, those in action and maintenance stages had higher scores for health/commitment/action processes compared to those in early stages ( $p < 0.001$ ).

Another recent study that approached the relationship between processes of change and stages was developed by Ounpuu et al. (2000) to test the validity of staging methodology for dietary fat reduction by examining cognitive profiles of persons classified in these groups: precontemplation, lower-fat maintenance ( $\leq 30\%$  of energy as fat), and higher-fat maintenance ( $> 30\%$  of energy as fat). These authors hypothesized that mean fat intakes would be lower among subjects classified in the preparation, action and maintenance stages than subjects classified in preaction stages (precontemplation/contemplation).

Results were in the hypothesized direction; women in the maintenance stage had more frequent use of processes of change (e.g. consciousness raising use was  $52.6 \pm 10.4\%$ ) than subjects classified in the precontemplation stage (e.g. consciousness raising use was  $43.9 \pm 8.9\%$ ).

Greene and researchers (1999, 1994) reported that results of their studies in the processes of change for dietary fat reduction showed that use of all process is low in the precontemplation stage. Use of experiential processes increased sharply through preparation, peaked in action, and then decreased. Behavioral process use remained low through contemplation, and then it rose sharply through action before decreasing.

Although use of fat-reducing behaviors continued to rise through maintenance, the processes' use decreased in that stage. Processes used were high in the preparation stage, and the maximal process use occurred in action, which may explain why such a small proportion of the population is observed in that stage.

A major finding of the Sorensen and researchers (1998) was that coworker support was significantly associated with stage of readiness to increase fruit and vegetable consumption. Co-worker support was highest among those preparing to increase consumption and significantly distinguished between persons in precontemplation/contemplation and those in preparation. The authors suggest that the lack of coworker support may be a factor contributing to the lower motivation to change among precontemplators and contemplators.

Lamb and Joshi (1996), in studying processes of change in dietary fat reduction, focused on four processes which Prochaska and DiClement argue operate most powerfully at the four different stage transitions. Results showed that two of the processes (consciousness raising and self liberation) could distinguish all five stages from each other. The two processes had their decisive impact in the predicted order, consciousness raising discriminating between earlier stages, and self-liberation distinguishing between later stages. The two processes, self-reevaluation and helping relationships, did not discriminate among people at different stages.

The relationship between of stages of change and frequency of using processes was also evident in a study in a preliminary evaluation of the processes of changing to a low-fat diet study (Bowen et al., 1994). The use of any processes increased through the four stages. There was clearly variability in the use of processes for subjects at each of

the stages. Individuals in precontemplation used most processes less frequently than individuals in the other stages.

Several of the processes (e.g. environmental re-evaluation, nutritional strategies – items from stimulus control and counter conditioning and consciousness raising) particularly increased in use through the four stages. Dramatic relief and behavioral strategies (items from stimulus control and counter conditioning) were used most frequently in the action stage. Social liberation was used frequently through all the stages while environmental strategies were used relatively infrequently. Social support (helping relationship and reinforcement management) was used most frequently during stages 3 and 4, those stages that involve actual behavior change (Bowen et al., 1994).

The studies indicated that usually the individuals at the maintenance/action stages used the processes more frequently than those in the earlier stages, and also that the support from outside one's self is very important.

### **Demographic and Personal Characteristics Associated with Fruit and Vegetable Consumption and Stages of Change**

A number of studies have examined demographics variables in relation to fruit and vegetable intake or stages of change. Laforge and others (1994) examined age, gender, education, marital status, employment outside of home, child in home, obesity, health status, who food shops and who prepares food. The results indicated that males, those with less than 17 years of education and those with children living at home were significantly more likely to consume two or fewer servings of fruit and vegetable per day. No other significant differences were found with any other variables.

Education was a strong predictor of consuming two or fewer servings for fruits and vegetables. Individuals with less than 17 years of education were more likely to consume two or less servings than individuals with more education.

Campbell et al. (1994) examined psychosocial predictors and found social support, and belief about the number of fruits and vegetables needed for good health were all positively associated with stages of change.

Brug and researchers (1995) and Campbell et al. (1994) found younger participants consumed significantly fewer fruits and vegetables than individuals in the action stage and older participants. Boyle et al. (1998) found that readiness to eat more fruit and vegetables was associated with age ( $F [4,5834] = 59.94, p < 0.0001$ ) among HMO members in four North Carolina family practices. Hargreaves and Shlundt (1999) also found significant ( $p < 0.05$ ) association between age and stage of change. Younger participants were more likely to be in precontemplation, contemplation, and preparation, whereas older participants were more likely to be in the maintenance stage.

Among eight study sites (Arizona, Louisiana, Massachusetts, Maryland, Minnesota, North Carolina and Washington) in the National 5-a-Day Fruits and Vegetables for Better Health, being female was consistently associated with more advanced stage of change (Campbell et al., 1994). Younger participants were more likely to be in the contemplation/preparation stage in four of the sites (Arizona, Massachusetts, North Carolina, and Washington). In contrast, in the churches of the North Carolina counties, adults in contemplation/preparation stages had mean years of 49.4 (0.3) while participants in precontemplation stage were 56.2 (0.6).



In all eight sites, there were a strong and consistent relationship ( $p < 0.0001$ ) between knowledge regarding the number of fruit and vegetable servings recommended for good health and stages of change. In fact, individuals in later stages of change had more knowledge about the number of recommended servings than individuals in earlier stages. For example, in Massachusetts community health centers, 23.7 %, 41.8% and 83.2 % of adults respectively in precontemplation, contemplation/preparation and action/maintenance know the number of servings needed for good health (Campbell et al, 1999).

Data from Department of Health and Human Services Baseline Survey of the 5 A Day for Better Health Program show that mean consumption of adult men and women (18-60 years) of 5 or more servings of fruit and vegetable was respectively 17% and 25% (Federation of American Societies for Experimental Biology, Life Sciences Research office, 1995; Subar et al., 1995; Patterson et al., 1990).

In all sites there was a strong and consistent relationship ( $p < 0.001$ ) between knowledge regarding the number of fruit and vegetable servings recommended for good health and stages of change. Higher proportions of participants in the action/maintenance stage knew the 5-a-Day recommendation compared to those in an early stage (Campbell et al., 1999).

Income is other factor that is associated with stage of readiness to change. In a study done by Sorensen et al. (1998), controlling for education and others covariates, increasing household income was associated with decreased odds of being in preparation compared to precontemplation/contemplation. The differing associations of income to



readiness to change underline the importance of disaggregating the components of socioeconomic status (Adler et al., 1994).

In the Working Well study, a randomized, prospective field experiment that includes companies and workers with a broad geographic and industrial diversity, found that older workers were significantly less likely to be precontemplators and significantly more likely to be in action or maintenance stages for both fat and fiber ( $p < 0.001$ ). A higher percentage of the most highly educated respondents were in the action stage for fat intake (41.2%) and fiber (27.6%).

Results of a study investigating psychosocial factors influencing fruit and vegetable consumption (Laforce et al., 1994) found that participants with children living at home were more likely to eat 2 or fewer servings of fruits and vegetables than were respondents without children living at home. Years of education were a strong predictor of the likelihood of usually consuming 2 or fewer servings of fruits and vegetables and no significant differences were found by age group or who in the household shops for groceries most of the time.

Different results were found by Glanz et al. (1994) where older workers and those with more formal education were significantly less likely to be precontemplators and significantly more likely to be in action or maintenance stages for both fat and fiber ( $p < 0.001$ ). A higher percentage of the most highly educated respondents were in the maintenance stage for both behaviors.

The consumption patterns of fruits and vegetables is very clear to indicate that the younger person has a smaller intake of fruits and vegetables, and individuals in earlier stages of change also has a lower consumption. Education, age and income had a

positive relationship in terms of knowledge of fruits and vegetables servings recommended for good health.

### **Consumption Patterns of Fruits and Vegetables**

Data from a national survey in 1991 indicated that the average consumption of fruits and vegetables was 3.4 servings, with only 23% of the American population consuming five or more servings of fruits and vegetables on any given day (Subar et al., 1995; Serdula et al., 1995).

In Arizona adult consumption of fruits and vegetables has shown a downward trend in the past 2 years from 24.3% in 1996 to 19.3% in 1998 while in Connecticut adult baseline of consumption of fruit and vegetable in 1993 was 2.5 servings well below the goals of Year 2010 “5 a Day” goal.

Studies done by Subar and researchers (1995) and Serdula et al. (1995) reported that young adult Hispanics consumed the lowest intakes of fruits and vegetables when compared to Whites or African Americans. Latinos showed considerable drop in the intake of fruit and vegetable from 4.7 servings in 1995 to 3.9 servings in 1997 according Forester et al. (1999). In the 1997 California dietary Practices Survey, 65% of Latinos were not eating the recommended 5 servings of fruit and vegetables a day.

In terms of Brazil, Monteiro and colleagues (2000) found that the relative importance of fruits and vegetables in the total availability of energy had a slight decrease. In 1988 the percent was 0.6 percent for vegetables and 3.2 percent for fruits, while in 1996 these numbers were 0.5 and 3.0, respectively, for vegetables and fruits.

## **Recommendations for Fruit and Vegetable Intake**

Advice to increase intake of fruits and vegetables is based on epidemiological studies indicating that an eating pattern high in fruits and vegetables is protective against cancer and cardiovascular disease (Appel et al., 1997; Deckelbaum et al., 1999).

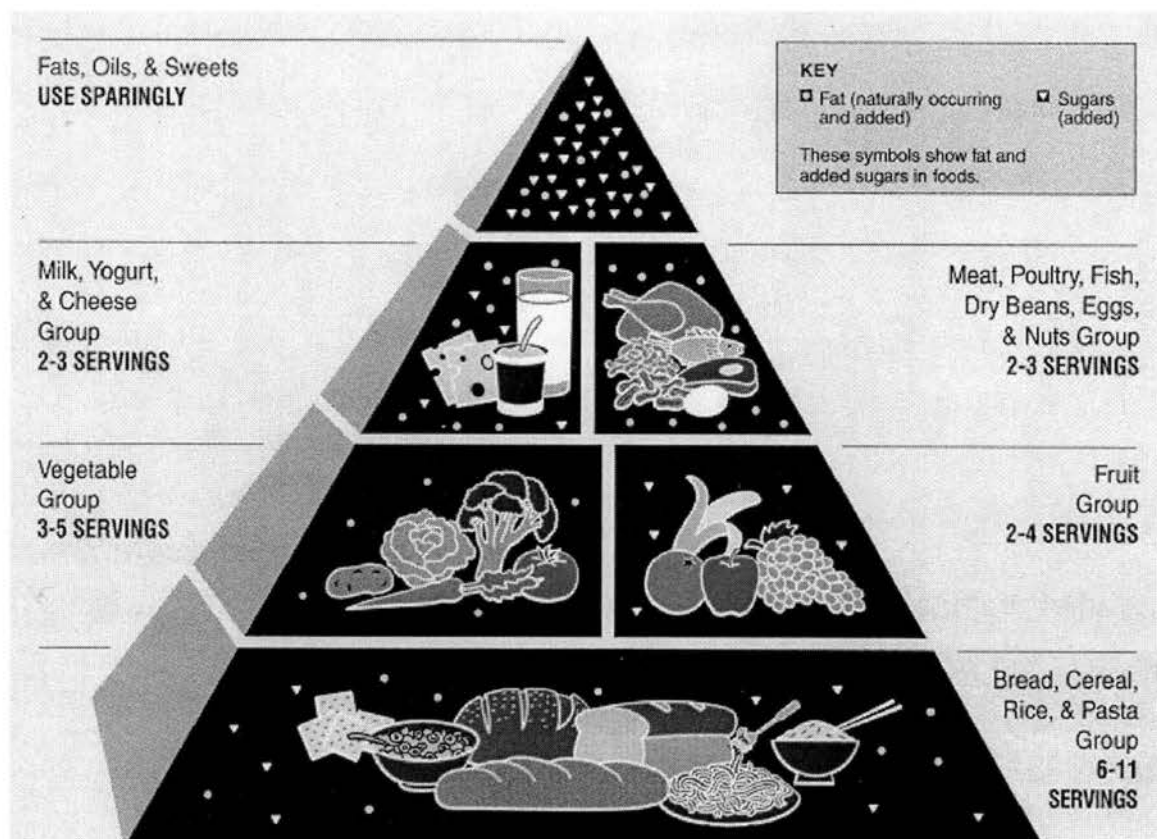
Microconstituents in vegetables and fruits likely to protect against cardiovascular disease, cancer, and stroke are antioxidants such as flavonoid, vitamin C and carotenoids (Van Duyn, 2000).

According to the World Cancer Research Fund and American Institute for Cancer Research (WCRF and AICR, 1997), the evidence is convincing that diets rich in fruits and vegetables protect against cancer of the mouth, stomach, and lung. colon and rectum, pancreas, bladder and breast. To illustrate, the WCRF and AICR report results of select case-control and cohort studies investigating lung cancer and vegetable intake. In these studies, the relative risk of lung cancer decreased by about 50% as the intake of vegetables (e.g. carrots, cruciferous like cabbage) increased from 150g/day to 400g/day. In other words, an intake of vegetables greater than 400g/day always is associated with a lower risk than 100g/a day or less. Another example reported by WCRF and AICR is the relationship between stomach cancer and fruit intake. An intake of more than 150g/day of fruits (citrus and deep-yellow-orange ones) is always associated with a lower risk than 100g/day or less (WCRF/AICR, 1997). In short, according to WCRF and AICR, diets rich in fruits and vegetables (more than 400g/day) could prevent at least 20% of all cancer incidences.

Based on these evidences and for cancer prevention, the American Cancer Institute for Cancer prevention established a goal of eating 400g to 800g (15 to 30 oz) of

a variety of fruit and vegetable, which translates to five to ten servings of fruits and vegetables daily (WCRF/AICR, 1997). Also, international organizations such as the World Health Organization (WHO) have been stimulating the fruit and vegetable intake of 400g per day or about 7% of the total caloric intake (World Health Organization, 1990).

Recommendations for fruit and vegetable intake are expressed in numbers of daily servings (USDA/DHHS, 2000). The 2000 U.S. dietary guidelines for fruits and vegetables recommends 3-5 servings of vegetables and vegetable juices and 2-4 servings of fruits and fruits juices each day, depending on level of caloric intake. The Food Guide Pyramid (Figure 2.2) developed by USDA/DHHS (1992) illustrates the dietary guidelines and helps individuals choose what and how many servings to eat from each food group.



**Figure 2.2.** Food Guide Pyramid (USDA, DHHS, 1992).

According to USDA/DHHS (2000), a serving can be defined as follows:

Fruit Group

- 1 medium apple, banana, orange, pear
- ½ cup of chopped, cooked, or canned fruit
- ¾ cup of fruit juice

Vegetable Group

- 1 cup of raw leafy vegetables
- ½ cup of other vegetables-cooked or raw
- ¾ cup of vegetable juice

# **CHAPTER III**

## **DEVELOPMENT OF SCALE FOR MEASURING PROCESSES OF CHANGE CONSTRUCTS FOR FRUITS AND VEGETABLES EATING BEHAVIOR**

### **Abstract**

Constructs of the Transtheoretical Model of Behavior Change such as stages of change have been applied in the context of unhealthy and healthy behaviors. Related to the processes of change constructs, little research has been conducted in the nutritional arena. The main objective of this study was to develop a reliable paper-pencil measure for assessing the processes of change for fruit and vegetable eating behavior by establishing content validity for an initial pool of items and establishing the internal consistency for each process of change scale. Thus, the current investigation focused on instrument development and a pilot test in a convenience sample of forty-five Latino, American and Asian students from Colorado State University. Items were developed for measuring each specific process of change from the processes of Transtheoretical Model of Behavior Change within a context of fruits and vegetables. Items were developed based on theory and items adapted from previous scales related to the smoking cessation, changing to a low fat diet, and exercise adoption. A pool of 137 items was developed and submitted to content analysis by a panel of five experts. Based on at least three (60%) judges agreeing that an item assessed the same process, 100 items were

maintained. Principal component analysis (PCA), Cronbach's alpha and content analysis were the criteria used to reduce the number of items from 100 to 40. A valid and reliable scale was obtained with a total of four items for each of the ten processes of change. The internal consistency reliability range was .79 to .98, and component loadings were, in most of the cases, greater than 0.6.

### **Introduction**

Understanding the dietary change process of the general population is important to the development of effective public health nutrition intervention (Sorensen, et al., 1998). Prochaska and DiClemente's Transtheoretical Model can be useful for understanding dietary behavior change (Prochaska and colleagues, 1983). The two major dimensions of the model are: stages of change and processes of change. The stages of change represent a temporal dimension that allows us to segment and understand when particular shifts in intentions, attitudes, and behaviors occur. In the model, each stage of change represents a period of time as well as set of tasks needed for movement to the next stage (Prochaska et al., 1992).

#### **Stages of Change**

The authors suggest that individuals pass through a series of five stages when attempting to change their behavior. The first stage is called precontemplation. In this stage there is no intention to change behavior in the foreseeable future. Many people in this stage are unaware of their behavior problem. The second stage is contemplation. People in this stage are aware that a behavior problem exists and are seriously thinking

about overcoming it, but have not yet made a commitment to take action. The third stage is preparation, during which are thinking to take action in the next month and have begun to take some actions to change their behavior. The next stage is action, where individuals have modified their behavior for a period of one day to six months. Action requires considerable commitment of time; energy and behavior modifications made in this stage tend to be most visible. The final stage, maintenance, is the stage in which people work to prevent relapse and consolidate the gains attained during action. People are usually in the maintenance stage if they have changed their behavior for a period of time longer than six months.

Processes of change are the activities, experiences and thoughts that individuals pass through during the five stages when attempting to change their behavior (Prochaska and Velicer, 1997). Processes of change enable us to understand how these shifts occur. The processes of change have been divided into two-second order factors:

Cognitive/Experiential Processes and Behavioral Processes

#### Cognitive/Experiential Processes and Behavioral Processes

Cognitive/experiential processes involve more internal changes in an individual's attitudes, including consciousness raising, dramatic relief, self-reevaluation, environmental reevaluation and social liberation. Consciousness raising involves increasing information about the self and the problem. Dramatic relief involves experiencing and expressing feelings about oneself with respect to the problem behaviors. Environmental reevaluation involves assessment of how one's problem affects the



personal and physical environment. Social liberation involves increasing alternative behaviors available in society (Prochaska et al., 1992).

Behavioral processes are defined by overt activities that individuals perform to alter their problem behavior. These processes include counterconditioning, stimulus control, contingency management, self-liberation, and helping relationships (Prochaska et al., 1997). Counterconditioning involves the substitution of alternatives for problem behaviors. Stimulus control involves avoiding or countering stimuli that elicit problem behavior. Contingency management process focuses on reinforcement and contingencies to change the occurrence of a behavior. Self-liberation involves choosing and committing to act or believing in the ability to change. Helping relationships involve being open and trusting with people who care (Prochaska et al., 1992)

A key element of the Transtheoretical Model is the relationship between stages and processes of change. The processes are used differentially through the various stages. During precontemplation, individuals use processes significantly less than people in other stages. Individuals in the contemplation stage are most open to experiential processes such as consciousness raising techniques, dramatic relief and environmental reevaluation (Prochaska and DiClemente, 1984).

Constructs of the Transtheoretical Model of Behavior Change such as stages of change have been investigated in the context of numerous health-related behaviors. To illustrate, we can mention the weight loss studies of Suris et al. (1998), the fat reduction studies of Brug et al. (1997) and Steptoe et al. (1996), and the fruit and vegetable studies of Campbell et al. (1994). Less research has been conducted in the nutritional arena related to processes of change constructs. Only one study was found specifically related

to fruit and vegetable eating behavior (Chung et al., 2001). In addition, scales for measuring the processes of change constructs for fruit and vegetable eating behavior across gender and cultural/ethnic group could not been located.

Evidence of studies suggest that women were more likely than men to be in the maintenance stages of change, whereas men were more likely than women to be in precontemplation stage (Curry and others, 1992). Other studies show that the readiness distribution to reduce the amount of stress in daily life can differ among cultural groups. Australians participants were more likely to be in precontemplation and less to be in the maintenance stage in stress reduction than American participants.

Studies also show that processes of change such as helping relationship are not the same to different cultural/ethnic groups. For example, Sorensen and colleagues (1998) found that household support was significantly higher for those of Hispanics or African Americans than for those of other cultural/ethnic groups. Some differences in constructs use (stages and processes) across gender and cultural/ethnic group suggest that different nutrition education approach can be necessary. Thus, the necessity to develop a scale that assesses specifically processes of change for fruits and vegetable in male from different cultural/ ethnic population is warranted.

Therefore, the objective of this study was to develop a valid and reliable paper-pencil measure for the processes of change for fruit and vegetable eating behavior for a diverse cultural/ethnic groups. The development of such a scale would be valuable for nutrition educators addressing the challenges of increasing a person's fruit and vegetable intake.

## **Methods**

### Subjects

In a cross-sectional design, a survey was given to students at Colorado State University. The participants in this study consisted of a convenience sample of subjects who anonymously agreed to participate in an instrument development study concerned with fruit and vegetable eating behavior. The subjects were 15 Latino, 15 Asian and 15 North American males older than 18 years who were conveniently sampled from the population of students at Colorado State University.

### Procedure

Potential participants were contacted personally at the library and computer laboratories of Colorado State University in May 2001. Subject participation in this study was anonymous and without remuneration. Return of the completed survey was considered consent to participate in this study that was approved by Human Subjects Committee at Colorado State University. Completion of all information took an average of 20 minutes. Some participants received a return-addressed stamped envelope and 45 usable surveys were used for analysis.

### Processes of Change Instrument

The components of the processes of change for fruit and vegetable eating behavior scales (Appendix E) were developed as an assessment tool for measuring the experiential/cognitive and behavioral coping strategies and techniques that individuals

engage when attempting to eat five or more fruits and vegetables a day – the criteria behavior.

Procedures (Prochaska et al., 1988) similar to those used to develop an original processes instrument for smoking behavior were followed in developing the processes of change for eating five or more fruits and vegetables a day. In the present study, initially, a nutritionist and psychologist developed a pool of 137 items. The items were developed based on a similar instrument designed for smoking cessation (Prochaska et al., 1988).

The reliability and validity of processes of change instruments in the smoking area are well established (Prochaska and colleagues, 1988; Prochaska and DiClemente, 1985; DiClemente and Prochaska, 1982). Reliability is an index of how much random error is in the measurement. According to Windsor et al. (1994), “reliability coefficients are highest (1.0) if no error exists and lowest (0.0) when there is only error.”

Ten four-item processes scales developed for smoking cessation presented coefficient alphas ranging from 0.69 to 0.92. The authors (Prochaska et al., 1988) considered these coefficients acceptable for a four-item scale. The Processes of Change Questionnaire developed by Prochaska and colleagues (1988) has been validated on a sample of smokers and ex-smokers (Prochaska and DiClemente, 1985) and a sample enrolled in a behavioral weight control program in the work site (Prochaska et al., 1992).

The items of fruit and vegetable processes of change instrument also were based on Marcus' (1992) exercise adoption scale; on Rossi's fat reduction scale (1994), and Bowen's (1994) low fat diet scale. In the Marcus' study, coefficient alpha range from 0.73 to 0.89, with the exception of social liberation process, which presented an alpha of 0.62. In the Bowen et al. (1994) study, the reliability coefficients ranged from 0.88 for

dramatic relief to 0.96 for nutritional strategies. According to the authors, these coefficients indicate that all scales had good or excellent reliability estimates.

For this study, it was also necessary to generate new items for the fruit and vegetable processes instrument due to the uniqueness of the area in which the model was to be used. A qualitative review of the generated items was conducted focusing on the scale pool content validity, reading level, expression clarity, and use of unambiguous language. The items were submitted for content analysis and face validity to a panel of five experts: two nutritional specialists in Cooperative Extension, a research nutritionist, a nutritional epidemiologist, and a clinical nutritionist.

Content validity assesses the degree to which the substance or content of the measure is representative of the universe of content being measured (Kerlinger, 1986). Content validity, as defined by Cronbach (1972), refers to whether the items adequately cover the domain of interest, as well as the set of behavior implied by the scores. Content validity involves a judgment as to whether the instrument samples all the important content areas relevant to a particular domain. The experts were provided with 137 items and the definition of each processes of change (Sigman-Grant, 1996; Prochaska et al., 1992). They were asked to rate the items on one of the ten processes of change. Items that had three agreements (60%) were maintained for further analysis.

Then, a total of 100 items were selected for inclusion in a pilot test. Using a five point Likert response format (1= never, to the 5 = repeatedly), subjects were asked to rate how often in the last month they made use of thought, experience, or activity expressed by each statement during the last month. The processes of change evaluated included

experiential/cognitive and behavioral processes. The five experiential/cognitive processes evaluated were:

- a) Consciousness raising (CR): increasing awareness of the benefits of high fruit and vegetable consumption through information seeking and use of feedback;
- b) Dramatic relief (DR): using a strong motivational experience or event occurring in the environment as a means of changing the consumption of fruit and vegetable;
- c) Environmental reevaluation (ER): assessing the impact of engaging in unhealthy habits, such as not eating fruit and vegetable, on others or the environment;
- d) Self-reevaluation (SR): cognitively reassessing one's self image of changing the habits of not eating enough fruit and vegetable;
- e) Social liberation (SL): becoming aware of changes in the environment, such as social changes (e.g. more fruit and vegetable in restaurants menus) that provide additional alternatives for changing fruit and vegetable eating behaviors.

The five behavioral processes evaluated were:

- a) Self-liberation (SL): using willpower, affirming the commitment to change or maximizing chance to eat more fruit and vegetable;
- b) Reinforcement management (RM): using positive consequences for changing the consumption of fruit and vegetable (e.g., reward by others) as a means to increase the likelihood of eating enough fruits and vegetables

- c) Counter conditioning (CC): substituting a new behavior or competing behavior, such as eating fruits and vegetables, for problem behavior such as eating sweets;
- d) Helping relationship (HR); utilizing the support of others to consume fruit and vegetable
- e) Stimulus control (SC): decreasing the likelihood of the problem behavior (not eating enough fruits and vegetable) | occurring by avoiding situations that trigger it;

Face validity of the instrument was assessed by asking experts for their opinions and by asking participants for comments. The main idea was to assess whether and how instruments items were understood. Based on these inputs, necessary modifications in wording were done.

### Analytic Approach

Principal components analysis (PCA) was run for each process separately. Principal component analysis using SPSS version 10.0 (SPSS, Inc., 2000) was conducted to set criteria for reduction and modification of the pool of 100 items for the Processes of Change scale. Seven of the ten scales produced two components each. A loading greater than or equal to 0.60 on the first component indicated that the item was eligible for inclusion. However, when the 0.60 criteria resulted in a scale with fewer than four items for each processes of change scale, this criterion was relaxed to .45 in order to include additional items on the scale. This criterion is similar to one used by Bowen and researchers (1994). The scales produced include one to five components each.

Another criteria for items inclusion on the processes of change scales, was the coefficient alpha reliabilities. This coefficient was assessed for internal consistency using Cronbach's alpha. According to Gliner and Morgan (2000), Cronbach's alpha is the appropriate method to determine inter-item reliability when each item on the test has multiple choices, such as Likert Scale options. Pedhazur and Schmelkin (1991) refer to internal consistency as the measure of choice for estimating reliability.

Internal consistency measures the extent to which performance on any one item of an instrument subscale is a good indicator of performance on any other item in the same subscale. Moreover, the internal consistency approach to the estimation of reliability is based on the idea that the items of a subscale of the instrument measure the same phenomenon. Although there are several analytic approaches, the most widely used estimation of internal consistency reliability is Cronbach's alpha (Windsor et al., 1994).

Using Cronbach's alpha, items were dropped one by one until the best four items to retain for each subscale were supported by content analysis, where the clarity and distinctiveness of the items was emphasized. Thus, the final decision of an inclusion for each item was based on combined results of the principal component analysis, alpha coefficients and content analysis.

## **Results**

### **Personal Characteristics**

Table 3.1 gives the demographic characteristics of the study participants. Overall, participants were predominantly thirty years old or less (69%), had graduate status (54.6%), did not have children at home and had a yearly income of less than \$10,000 (48.5%). In



addition, most of the participants (56.8) knew the recommended number of servings good for health.

**Table 3.1.** Personal Characteristics of Participants.

| <b>Characteristics</b>          | <b>N</b>  | <b>(%)</b>   |
|---------------------------------|-----------|--------------|
| <b>Age</b>                      |           |              |
| 19 – 29                         | 31        | 69.0         |
| 30 –                            | 10        | 22.1         |
| 40 –                            | 3         | 6.7          |
| > 50                            | 1         | 2.2          |
| <i>Total</i>                    | <i>45</i> | <i>100.0</i> |
| <b>College Status</b>           |           |              |
| Undergraduate                   | 20        | 45.5         |
| Graduate                        | 24        | 54.5         |
| <i>Total</i>                    | <i>44</i> | <i>100.0</i> |
| <b>House with Children</b>      |           |              |
| Yes                             | 3         | 6.7          |
| No                              | 42        | 93.3         |
| <i>Total</i>                    | <i>45</i> | <i>100.0</i> |
| <b>Servings Good for Health</b> |           |              |
| 0                               | 1         | 2.3          |
| 1 – 2                           | 2         | 4.5          |
| 3 – 4                           | 16        | 36.4         |
| 5 – 6                           | 21        | 47.7         |
| 7 – 8                           | 4         | 9.1          |
| <i>Total</i>                    | <i>44</i> | <i>100.0</i> |
| <b>Household Income</b>         |           |              |
| Under \$10,000                  | 17        | 39.5         |
| \$10,000 – \$19,999             | 11        | 25.6         |
| \$20,000 – \$29,999             | 6         | 14.0         |
| \$30,000 – \$39,999             | 9         | 9.3          |
| <i>Total</i>                    | <i>43</i> | <i>100.0</i> |

### Processes of Change Scale

After the best four items for each process of change were selected, principal components analysis, Cronbach's alpha, and content analysis were rerun separately for each scale. Tables 3.2 and 3.3 present component loading and alpha coefficient reliability for each scale. The reliability range was from 0.74 to 0.91. The majority of estimates were 0.80 or above with only the self-liberation and helping relationship scale producing estimates in the 0.70 to 0.80 ranges.

**Table 3.2.** Results of Principal Component Analysis and Alphas for Cognitive/Experiential Processes of Change.

| Processes of Change                                                                                                                                          | Loading | Alpha Coefficient |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------|
| <b>Consciousness raising</b>                                                                                                                                 |         | .83               |
| Q33 I look for information on how to eat more F&V                                                                                                            | .85     |                   |
| Q37 I think about information in articles / advertisements on how to eat more F&V                                                                            | .85     |                   |
| Q44 I read about eating more F&V                                                                                                                             | .79     |                   |
| Q9 I pay close attention to television programs and advertisements about diets rich in F&V                                                                   | .77     |                   |
| <b>Dramatic relief</b>                                                                                                                                       |         | .91               |
| Q43 Cancer statistics incidence related to poor dietetics habits such as low F&V diet makes me feel sad                                                      | .87     |                   |
| Q73 It upsets me to remember studies about illnesses associated with not eating F&V                                                                          | .86     |                   |
| Q86 I do not feel good when I hear stories about the consequences of not eat enough F&V                                                                      | .85     |                   |
| Q31 I react emotionally to warnings about not eating F&V                                                                                                     | .67     |                   |
| <b>Environmental reevaluation</b>                                                                                                                            |         | .82               |
| Q13 I think if I eat F&V it will prevent me from becoming a burden to the health care system                                                                 | .90     |                   |
| Q7 I think about the need for more people to understand the importance of a high F&V diet                                                                    | .86     |                   |
| Q1 I stop to think about how many people would benefit from having a diet that includes F&V                                                                  | .73     |                   |
| Q61 I realize that if I don't eat F&V, I may get ill and be a problem to people close to me                                                                  | .63     |                   |
| <b>Self-reevaluation</b>                                                                                                                                     |         | .81               |
| Q89 Not eating enough servings of F&V daily goes against my view of myself as healthy person                                                                 | .82     |                   |
| Q94 I reassess the fact that being content with myself includes changing my eating habits to include eating five or more servings of F&V a day               | .80     |                   |
| Q78 I consciously struggle with the issue of not eating at least five servings of F&V a day because it contradicts my view of myself as a responsible person | .80     |                   |
| Q84 When I realize I have not eaten enough F&V I become concerned about my health                                                                            | .77     |                   |
| <b>Social liberation</b>                                                                                                                                     |         | .83               |
| Q83 Many restaurants now provide more opportunities to eat F&V                                                                                               | .87     |                   |
| Q98 I notice restaurant's menus that give me options to eat a variety of F&V                                                                                 | .86     |                   |
| Q82 Supermarkets are making it easier for consumers to buy a variety of F&V                                                                                  | .82     |                   |
| Q92 F&V are more available in cafeterias, schools, work places, and sports events                                                                            | .70     |                   |

**Table 3.3.** Results of Principal Component Analysis and Alphas for Behavioral Processes of Change.

| Processes of Change                                                                                                        |  | Loading | Alpha Coefficient |
|----------------------------------------------------------------------------------------------------------------------------|--|---------|-------------------|
| <b>Self-liberation</b>                                                                                                     |  |         | .74               |
| Q58 I tell myself I can choose to eat more F&V                                                                             |  | .79     |                   |
| Q96 I rely on my willpower to get myself to eat more F&V                                                                   |  | .79     |                   |
| Q70 I make commitments to decrease my health risks by eating F&V                                                           |  | .73     |                   |
| Q5 I believe that if I try hard enough I can eat more F&V                                                                  |  | .69     |                   |
| <b>Reinforcement management</b>                                                                                            |  |         | .80               |
| Q50 If I eat F&V, I find that my intestinal function becomes better                                                        |  | .79     |                   |
| Q14 I do something nice for myself when I make efforts to eat F&V                                                          |  | .79     |                   |
| Q52 I reward myself when I eat F&V                                                                                         |  | .77     |                   |
| Q53 I try to think of eating F&V as a good way to get nutrients that my body needs                                         |  | .72     |                   |
| <b>Helping relationship</b>                                                                                                |  |         | .77               |
| Q3 I associate with people who help me eat F&V                                                                             |  | .94     |                   |
| Q66 I have someone who helps me prepare F&V                                                                                |  | .88     |                   |
| Q2 I try to eat with people who are also working on eating more F&V                                                        |  | .87     |                   |
| Q36 I spend time with people who encourage me to eat F&V                                                                   |  | .86     |                   |
| <b>Counterconditioning</b>                                                                                                 |  |         | .73               |
| Q68 Rather than viewing eating F&V as simply another rule to follow, I try to do it as my special opportunity to avoid fat |  | .84     |                   |
| Q76 when and tempted not eat F&V during a meal I try to eat them first                                                     |  | .84     |                   |
| Q71 I find that a good way to eat F&V is not to buy sweets                                                                 |  | .78     |                   |
| Q77 I try to eat F&V in place of less healthy food                                                                         |  | .78     |                   |
| <b>Stimulus control</b>                                                                                                    |  |         | .83               |
| Q38 I try to ignore some programs and events that don't promote F&V eating habits                                          |  | .89     |                   |
| Q88 I tend to avoid people who do not eat a healthy diet (rich in F&V)                                                     |  | .83     |                   |
| Q54 I try to put posters / pictures of F&V at home to remind me to eat them                                                |  | .83     |                   |
| Q67 I avoid restaurants that don't offer F&V on the menu                                                                   |  | .69     |                   |

## **Discussion**

This study has presented the development of an instrument that measures the processes of change to eating five fruits and vegetables a day. The processes of change measured by this instrument are: consciousness raising, dramatic relief, self-reevaluation, environmental reevaluation, social liberation, counter conditioning, stimulus control, contingency management, self-liberation, and helping relationships.

The reliability range (0.74 to 0.91) for the subscales found in this study can be considered more than satisfactory. Nunnally et al. (1978) states that early in the research process on predictor tests of a construct, subscales having reliabilities of a least 0.70 are satisfactory.

In the Marcus and colleagues (1992) study, coefficient alpha range from 0.73 to 0.89, with the exception of social liberation process, which presented an alpha of 0.62. In the Bowen et al. (1994) study, the reliability coefficients ranged from 0.88 for dramatic relief to 0.96 for Nutritional Strategies. According to the authors, these coefficients indicate that all scales had good or excellent reliability estimates.

Principal component analysis, Cronbach's coefficient alpha and content analysis results suggested that the Processes of Change Instrument developed represents a reliable instrument for measuring processes of change for fruits and vegetables consumption. The existence of this instrument presents opportunities for future studies and intervention development.

Further investigation must be done to assess the validity and reliability of the processes scale developed in this study in other populations because the instrument developed was specific for male North American, Latino and Asian college students.

Thus, these processes of change scale should be tested and modified if necessary to determine their usefulness in other groups of people.

## **CHAPTER IV**

# **STAGES OF CHANGE TO CONSUME FRUITS AND VEGETABLES AMONG NORTH AMERICAN, LATINO, AND ASIAN COLLEGE STUDENTS**

### **Abstract**

The consumption of fruits and vegetables is considered to have a protective effect against different types of cancer that may be attributed to several factors including a variety of antioxidants and anti-carcinogenic compounds that are present in fruits and vegetables. Information about stages of readiness to eat fruits and vegetables in a diverse population can help in targeting campaign efforts of nutrition education. This study investigated the stages of change to eat five or more fruits and vegetables a day in a convenience sample of 250 Latino, North American and Asian male college students at Colorado State University. It was hypothesized that participants in the higher stages of change were consuming more fruits and vegetables than participants in lower stages of change. Another hypothesis was that different cultural/ethnic groups would present different stages of change to consume five or more fruits and vegetables a day. Also this study investigated the relationship between stages of change and personal variables. The Stages of Change Model was applied to participant responses to categorize them by stage of change to consume five fruits and vegetables a day. Analysis of variance was used to

investigate the differences between the stages of change and consumption of fruits and vegetables. Chi-square statistic was used to investigate the relationship between cultural/ethnic groups and stages of change to consume five fruits and vegetables a day. Analysis of the main effects in ANOVA showed that stages of change were significantly associated with food frequency scores  $\{F(2,241) = 22.405, p < 0.001\}$  and the post-hoc least square deviation (LSD) indicated that participants in action/maintenance stages consumed more servings of fruits and vegetables ( $8.3 \pm 0.5$ ) than participants in precontemplation/contemplation ( $4.1 \pm 0.4$ ) and preparation ( $5.2 \pm 0.3$ ) stages. Chi-square analysis indicated that there was a significant relationship between stages of change to consume fruits and vegetables and cultural/ethnic background ( $\chi^2 = 11.65, p < 0.05$ ). North American and Latino students were more likely to be in preparation stages while Asian students were in earlier stages of change such as precontemplation/contemplation. Stages of change was significantly correlated with knowledge about the number of servings of fruit and vegetable a person should eat ( $\rho = 0.46, p < 0.001$ ) and income ( $\rho = 0.165, p < 0.05$ ). No other significant correlations between stages of change and personal variables. These findings suggest that nutrition education should consider the parameters of the stages of change as well as the cultural/ethnic origins.

### **Introduction**

Fruit and vegetable consumption is considered to have a protective effect against different types of cancer that may be attributed to a several factors, including provision of a variety of antioxidants and anti-carcinogenic compounds (Willet & Trichopoulos, 1996; Havas et al., 1994; Block and others, 1992; and Ziegler, 1991). Based on this evidence,

many organizations, including the World Cancer Research Fund & American Institute for Cancer Research, the U.S Department of Agriculture and World Health Organization (WHO) have recommended the fruit and vegetable consumption of at least 400 g per day. This level translates to about five fruits and vegetables a day (World Cancer Research fund & American Institute for Cancer Research, 1997; Havas et al., 1994; and World Health Organization, 1990).

Thus, public health programs aimed at combating chronic disease will have as a major focus to encourage healthy dietary habits, such as, eating five fruits and vegetables a day and other healthy lifestyle behavior (Lechener et al., 1998). However, according to Lechener and colleagues (1998), target populations can be conceptualized as involving a heterogeneous mixture of individuals with different degrees of readiness to adopt a specific behavior.

The Stages of Change Model suggests a framework for classifying people for readiness to adopt healthy eating habits (DiClemente and Prochaska, 1998; Prochaska et al., 1997). A core construct in this model is stage of change, which consists of five stages: precontemplation (no intent to make changes toward a desired behavior); contemplation (considering a change); preparation (actually planning change); action (actively changing) and maintenance (maintaining desired behavior).

Some researchers have studied the relationship between stages of change and consumption of fruits and vegetables with the intention to validate the stages of change as a valuable marker of actual consumption of fruits and vegetables. One of the first studies to examine stages of change in relation to fruit and vegetable consumption was conducted by Laforge and his fellow researchers (1994). These authors found a strong linear



relationship between consumption of fruits and vegetables and stages of change toward adoption of consuming five or more servings of fruit and vegetable a day ( $p < 0.0001$ ). The more advanced stage the participants were in, the greater was the reported daily fruit vegetable consumption score in the Food Behavior Checklist score.

Another early study investigating the relationship of number of servings of fruits and vegetables and stages of change was conducted in a population of adult workers by Glanz et al. (1994). Results from his studies show that the number of servings of fruits and vegetables consumed by individuals in precontemplation, contemplation, preparation action and maintenance stages were respectively: 1.69; 1.75; 2.06; 2.15 and 3.11 servings.

Brug and others (1998) examined whether significant differences in attitude, self-efficacy, and perceived intake compared to others, and consumption level existed across the five stages of change with respect to fruit and vegetable consumption. Fruit and vegetable intake was found to be significantly higher in action and maintenance stages (4.0 and 2.9 servings, respectively), than intake levels in the three earliest stages (1.0 to 1.6).

A study by Campbell and colleagues (1998) with respect to fruit and vegetable consumption among rural African Americans, found that mean fruit and vegetable consumption among participants in the pre-action stages (precontemplation, contemplation, and preparation) was 3.3 to 3.5 servings compared with 6.5 daily servings for individuals in the action and maintenance stages.

Campbell et al. (1999) also report results of a study at a predominantly male work site in Arizona. According to this report, workers in precontemplation, and

contemplation / preparation stages of change consume less (2.2 and 2.1 respectively) servings of fruits and vegetables than workers in action/maintenance (5.6 servings). In another study, adult patients were recruited from four family practices in central North Carolina. Campbell and researchers (1994) found that precontemplators consumed significantly fewer fruits and vegetables ( $3.1 \pm 0.19$  servings/day) than did participants in the action stage of change ( $3.9 \pm 0.24$  servings a day).

Researchers also have explored the construct of readiness to change among a diverse cultural/ethnic population with the intention of increasing understanding of the characteristics of the different individuals and subgroups in the population that may require different intervention strategies.

Campbell and colleagues (1999) found that in worksites at Arizona, Hispanics were most likely to be in contemplation/ preparation stages for eating fruits and vegetables (46.1%) compared to white and black American workers, who were in precontemplation or action/maintenance for eating fruits and vegetables (58.0% and 51.7% respectively).

In a baseline study, Sorensen and researchers (1998) assessed readiness for eating fruits and vegetables in a sample of community healthy center employees. Results showed that non-Hispanic white employee participants ( $n = 728$ ), 52.0% were in preparation, 32.5% were in precontemplation/contemplation, and 15% were in action/maintenance stages. Hispanic participants ( $n = 263$ ) were classified as precontemplation/ contemplation (24.7%), preparation (68.0%) and action/maintenance (18.0%). Related to African American participants, the proportion of participants that

were in precontemplation/contemplation, preparation and action/maintenance was respectively 25.7%, 66.3% and 7.9%.

Boyle et al. (1998) studied a predominantly (95%) white random sample of 8,000 HMO members. They found that a large proportion of the sample were in either action or maintenance stages (86%), while 6% were precontemplators and 4.2% were contemplators for eating fruit and vegetable.

The only study that applied the stages of change in a totally Asian population was developed with a sample of 101 Chinese Singaporeans by Ling and others (2000). Using its own algorithm, subjects were classified as being in the pre-action stage for having adequate fruit and vegetable intake if they were consuming 3.75 servings or less, and as meeting action criteria if they were consuming more than 3.75 daily servings. Those in pre-action stages were further classified in the precontemplation stage if they had no intention to increase their fruit and vegetable intake during the next 6 months; and in the contemplation stage if they intended to increase their intake in the next six months. The authors found that individuals were predominantly (78%) in maintenance stage of change for eating more than 3.75 (criteria behavior) servings of fruit and vegetable per day.

Even though the relationship between stages of change for fruit and vegetable consumption has been investigated by some researchers, there is still a lack of this kind of study applied to college students. In addition, there are few studies applying the Stages of Change Model for investigating cultural differences (Suris et al., 1998). According to Laforge and colleagues (1999), cultural differences may influence stage classification. Another point is that most of the studies applying the Stages of Change Model have been conducted predominantly with women, so the need is for more study of males.

In the present study, the relationship between stages of change and fruit and vegetable consumption in male Latino, North American and Asian college students was investigated. It was hypothesized from the literature that participants in higher stages of change would consume more fruits and vegetables than participants in lower stages. It was also hypothesized that different cultural ethnic groups would have different stages of change for eating five or more fruits and vegetables daily.

## **Methods**

### Research Design

In a cross-sectional design, a self-administered survey was used to collect data on stages of change, consumption of fruits and vegetables and personal characteristics of male college students.

### Participants

Survey respondents were 250 male Latino, North American and Asian college students, between 18 and 60 years old from the Apartment Life Complexes at Colorado State University. Participants were selected from four sites in the Apartment Life System: University Village (n = 114, 45.6%), Aggie Village (n = 90, 36%), International House (n = 27, 10.8%) and Lory Apartments (n = 19, 7.6%). .

### Sampling and Recruitment

Convenience sampling of male Latino, North American and Asian students was used for this study. Subjects were recruited by the researcher from June to August 2001. The recruitment process consisted of a letter of explanation attached to the survey and delivered by personal contacts in the Apartment Life Communities. The participant's address was obtained from Apartment Life records and a stamped, return envelope was enclosed to facilitate response. The survey was confidential, and upon completion of the survey, the participant placed it in a large envelope until all the data were entered and analyzed.

### Instrument

Four sections from a more extensive survey were used in this study: the first section measured the participant's stage of change; the second section requested personal /demographic information, such as education, age, educational status, and annual income; the third section measured participant's acculturation level; and the last section measured fruit and vegetable consumption. The Human Research Committee/Office of Regulatory Compliance approved the survey.

### Stage Categorization

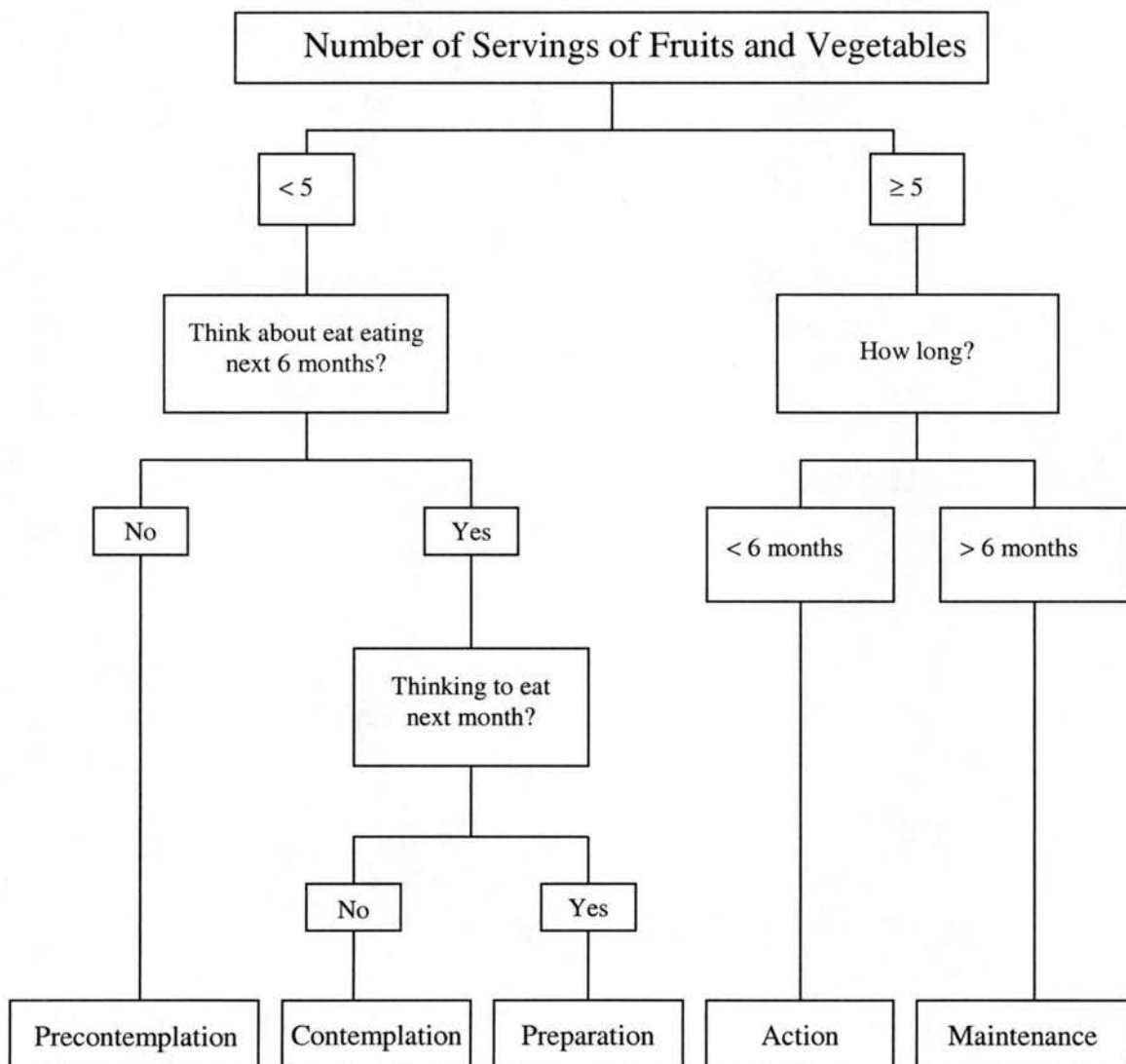
Stages of change were measured via a specific set of questions, which has been validated in similar 5 A Day studies (Campbell et al., 1998; Thompson et al., 1994). Four questions measured the stage of readiness to increase fruit and vegetable consumption:

- 1) "How many servings of fruits and vegetables do you eat each day?" This question evaluated whether the participant was eating five or more servings of fruits and vegetables per day. The survey provided the definition of a serving of fruits and vegetables according to the to participants, based on the suggested serving size specified on the Food Guide Pyramid.
- 2) "About how long have you been eating this number of daily servings of fruits and vegetables?" This question defined duration of the participant's behavior.
- 3) "Are you seriously thinking about eating more servings of fruits and vegetables starting sometime in the next six months?" The participant's responses to this question characterized a willingness to increase the intake of fruits and vegetables.
- 4) "Are you planning to eat more servings of fruits and vegetables during the next months?" Responses to this question permitted evaluation of the participant's intention to eat fruits and vegetables in a foreseeable future.

The following algorithm (Figure 4.1) was used to assigning participants to the appropriate stage of change:

- If the answer to question one was 5 or greater, and answer to question two was greater than 6 months, the participants were assigned to the maintenance stage.
- If the answer to question one was 5 or greater, and answer to question two was 6 months or less, they were assigned to action stage.
- If the answer to question one was less than 5, answer to question three was "yes," and answer to question four was "yes," they were assigned for preparation stage.

- If the answer to question one was less than 5, answer to question three was “yes,” and answer to question four was “no,” they were assigned to contemplation stage.
- If the answer to question one was less than 5, and answer to question three was “no,” they were assigned to the precontemplation stage.



**Figure 4.1.** Stages of Change Algorithm for Fruits and Vegetables Intake.

### Dietary Assessment

Fruit and vegetable intake over the past month was calculated using a short seven-item food frequency questionnaire, which was modeled on the 5-A Day For Better Health Initiative (Havas et al., 1994; Thompson and others, 1994). The seven-item food frequency questionnaire asked how often the respondents ate or drank specific foods (e.g., 100% orange juice or grapefruit juice) over the past month and how many servings of fruits and vegetables they had eaten in the past month.

Response options were: “not at all”; “one to three times last month”; “one to two times per week”; “three to four times per week”; “five to six times per week”; “one time per day”; “two times per day”; “three or more times per day”; “four times per day”; and “five or more times per day.” The seven items were summed to calculate average daily consumption. Values ranged from 0 (0 per day for each of the seven items) to 35 (5 per day for each of the seven items) servings of fruits and vegetables a day.

In this study, the external validation of the stages of change measure for fruits and vegetables for the participants was provided by comparing the dietary fruit and vegetable consumption and the stage of change algorithm.

### Personal Characteristics

Some items asked participants about personal characteristics. These items were based on previous studies (Krebs-Smith et al., 1995; Brug et al., 1998; Laforce et al., 1994) and included the following questions:

1) Do you now live in a household with children? 2) How many servings of fruits and vegetables do you think a person should eat each day for good health? 3) What is



your college status? 4) When were you born? 5) Which of the following categories best describes your yearly household income? and 6) How long have you been living in the United States?

### Acculturation

The eight items for each acculturation scale used for this study was modified from a 21-item scale developed for and validated for the Hispanic population (Cuellar et al., 1980) and Asian (Suinn and Lew, 1987) populations. The Latino and Asian acculturation scales assessed language, food preferences and self-identification. In order to check the validity of the items during the pilot test of the instrument, the subject's total score on the scales were correlated with time spent living in the United States. Spearman rho correlations were significant for the Latinos ( $\rho = 0.54$ ,  $p < 0.05$ ) and Asians acculturation scales ( $\rho = 0.79$ ,  $p < 0.01$ ).

This procedure is reported by Marin and researchers (1987) as a common way to test a scale's validity, and it was also used by Suinn & Lew (1987) and by Cuellar and colleagues (1980) in their original scale developmental studies. Sample participants were asked: 1) what language can you speak? 2) What language do you prefer? 3) Do you read (options were Asian/Latin origin language and/or English) language? 4) Do you write (options were Asian/Latin origin language and/or English) language; 5) In what language do you think? 6) What is your food preference at home? 7) What is your food preference in restaurants? 8) How would you rate (the options were very Asian or Latino; mostly Asian or Latino; bicultural; mostly westernized; very westernized) yourself?

The total score was the sum of all eight multiple-choice items that were circulated by respondents. The score was based on a five-point scale (1 = very Asian or very Latino to 5 = very anglicized). The average score was the total score divided by eight and it was equal to the subject's acculturation rating score.

### Statistics Analysis

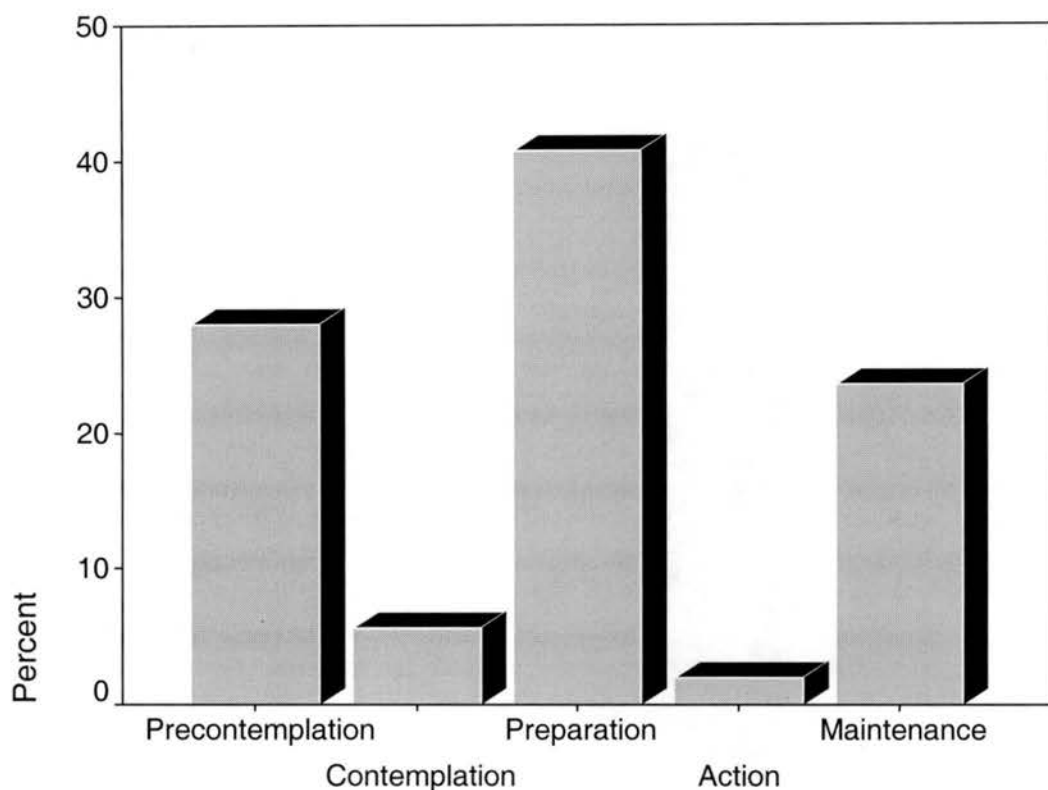
One-way analysis of variance was conducted to investigate the relationship between stages of change and fruit and vegetable consumption. Chi-square analysis was conducted to investigate the relationship between cultural/ethnic origin and stages of change. The relationship between personal variables and stages of change was investigated through Spearman rho correlation.

## **Results**

### Stages of Change Distribution

The stage distribution using the stages of change algorithm resulted in three main stages: precontemplation (n = 70, 28%), preparation (n = 102, 40%) and maintenance (n = 59, 23 %). Just 14 (5.6%) participants were in contemplation and 5 (2.0 %) of the participants were in action stages of change (Figure 4.2).

Thus, following the procedures of Sorensen and colleagues' (1998), the stages of change were combined in three categories for data analysis: precontemplation was included with contemplation and action was included with maintenance.



**Figure 4.2.** Stages of Change Distribution.

#### Stages of Change and Fruit and Vegetable Consumption

Table 4.1 shows that there was not a significant interaction between stages of change and cultural/ethnic group on fruits and vegetables consumption frequency means ( $p = 0.26$ ). Looking at the main effect of stage of change, there was a significant difference between the stages of change for fruit and vegetable intake according to frequency means,  $\{F(2,241) = 22.405, p < 0.001\}$ . Participants in action/maintenance stages of change consumed more fruits and vegetables ( $LSM = 8.0 \pm 0.5$ ) than participants in precontemplation/contemplation stages of change ( $LSM = 4.0 \pm 0.4$ ).

Participants in action/maintenance stages of change also consumed more fruits and vegetables ( $LSM = 8.0 \pm 0.5$ ) than participants in preparation stages of change ( $LSM = .5.2 \pm 0.3$ ). Eta for stage of change was 0.4, which according to (Cohen, 1988) is between a medium and large effect. There was no significant main effect of cultural/ethnic group on fruit and vegetable consumption  $\{F(2,241) = 0.952, p = 0.39\}$ .

**Table 4.1.** Two Way Analysis of Variance Comparing Stages of Change and Ethnicity on Fruit and Vegetable Consumption.

| Variable and Source                  | df | MS      | F       | $\eta^2$ |
|--------------------------------------|----|---------|---------|----------|
| Stage of Change                      | 2  | 242.073 | 22.405* | .16      |
| Cultural/Ethnic Group                | 2  | 10.288  | 0.952   | .01      |
| Stage $\times$ Cultural/Ethnic Group | 4  | .320    | 1.342   | .02      |

Note:  $\eta = .4$  = effect size.

\*  $p < .005$

#### Stages of Change and Cultural/Ethnic Groups

Table 4.2 shows the chi-square analysis of stages of change and cultural/ethnic groups. Results indicated a significant difference among participants in precontemplation/contemplation, preparation and action/maintenance stages of change for fruit and vegetable consumption and participant's cultural/ethnic origin (North American, Asian and Latino). While North Americans and Latinos were more likely to be in preparation stages of change, Asians presented more even distribution across the stages. The distribution of the cultural/ethnic groups across the stages of change to consume fruits and vegetables is shown in Figure 4.3.

**Table 4.3.** Chi-square Analysis of Stages of Change and Cultural/Ethnic Groups.

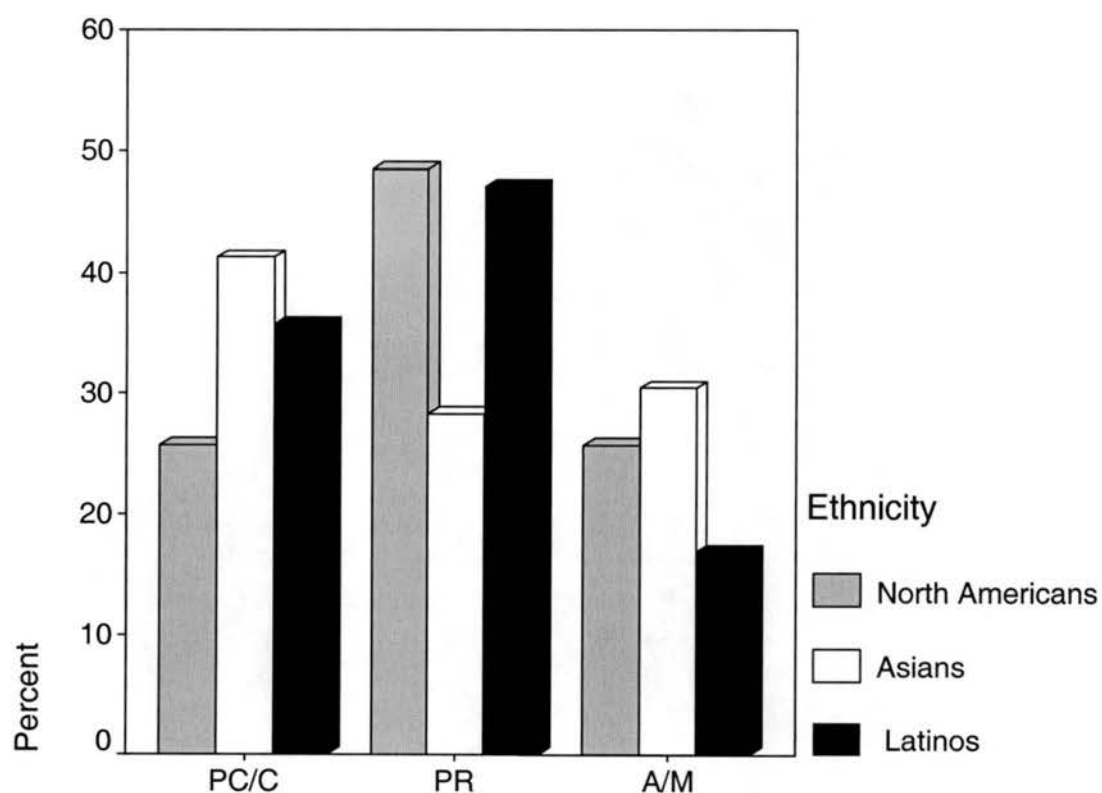
| <i>Cultural/Ethnic Group</i> | <i>Stages of Change</i> |         |         | $\chi^2$ |
|------------------------------|-------------------------|---------|---------|----------|
|                              | PC/C (%)                | PR (%)  | A/M (%) |          |
| North Americans<br>(n = 105) | 27 (11)                 | 51 (20) | 27 (11) | 11.65*   |
| Asians<br>(n = 92)           | 38 (15)                 | 26 (10) | 28 (11) |          |
| Latinos<br>(n = 53)          | 19 (8)                  | 25 (10) | 9(4)    |          |

\* p < 0.05

PC/C = precontemplation/contemplation

PR = preparation

A/M = action/maintenance



**Figure 4.3.** Stages of Change and Cultural/Ethnic Groups.

### Stages of Change and Personal Characteristics

The distribution of selected personal characteristics by stages of change is shown in Table 4.3. Some significant correlations among variables were found. Spearman rho correlation found significant correlation between knowledge regarding the number of fruit and vegetable servings recommended for good health and stages of change ( $\rho = 0.458, p < 0.001$ ). More participants in action/maintenance stages of change knew about the recommended number of fruits and vegetables recommended for good health than participants in preaction stages of change such as precontemplation/contemplation. There was also significant correlation between income and stages of change ( $\rho = 0.165, p < 0.05$ ).

The correlations for other personal variables such as presence of child at home ( $\rho = 0.115, p = 0.7$ ); age ( $\rho = 0.04, p = 0.5$ ) and acculturation level for Latino ( $\rho = 0.024, p = 0.87$ ) and Asian ( $\rho = 0.056, p = 0.596$ ) college students were not significantly correlated with stages of change. Significant correlation displayed between acculturation and length of residency in the United States ( $\rho = 0.27, p < 0.001$ ) supports acculturation scales validation.

**Table 4.3.** Distribution of Selected Personal Characteristics by Stages of Change.

| <b>Characteristics</b>                                              | <b>PC/C</b><br>N (%)<br>84 (34) | <b>PR</b><br>N (%)<br>102 (41) | <b>A/M</b><br>N (%)<br>64 (26) |
|---------------------------------------------------------------------|---------------------------------|--------------------------------|--------------------------------|
| <b>Knowledge of number of servings (F/V) needed for good health</b> |                                 |                                |                                |
| Don't Know                                                          | 60 (71)                         | 51 (50)                        | 9 (14)                         |
| Know                                                                | 24 (29)                         | 51 (50)                        | 55 (86)                        |
| <b>Child at home</b>                                                |                                 |                                |                                |
| Yes                                                                 | 31 (37)                         | 37 (36)                        | 34 (53)                        |
| No                                                                  | 53 (63)                         | 65 (64)                        | 30 (47)                        |
| <b>Income</b>                                                       |                                 |                                |                                |
| < \$10,000                                                          | 13 (16)                         | 16 (16)                        | 7 (11)                         |
| \$10,000-\$14,999                                                   | 22 (27)                         | 19 (20)                        | 2 (3)                          |
| \$15,000-\$19,999                                                   | 11 (13)                         | 23 (24)                        | 16 (26)                        |
| \$20,000-\$24,999                                                   | 16 (19)                         | 4 (4)                          | 12 (20)                        |
| \$25,000-\$29,999                                                   | 8 (10)                          | 16 (16)                        | 8 (13)                         |
| \$30,000-\$34,999                                                   | 12 (15)                         | 19 (20)                        | 15 (25)                        |
| > \$35,000                                                          | --                              | --                             | 1 (2)                          |
| NA                                                                  | 2                               | 5                              | 3                              |
| <b>Latino acculturation</b>                                         |                                 |                                |                                |
| Very Latino                                                         | 1 (5)                           | 2 (8)                          | 1 (11)                         |
| Mostly Latino                                                       | 16 (84)                         | 17 (68)                        | 8 (89)                         |
| Bicultural                                                          | 2 (10)                          | 6 (24)                         | --                             |
| NA                                                                  | 65                              | 77                             | 55                             |
| <b>Asian acculturation</b>                                          |                                 |                                |                                |
| Very Asian                                                          | 4 (10)                          | 4 (15)                         | 5 (18)                         |
| Mostly Asian                                                        | 32 (84)                         | 20 (77)                        | 22 (78)                        |
| Bicultural                                                          | 2 (5)                           | 1 (4)                          | 1 (3)                          |
| Mostly Westernized                                                  | --                              | 1 (4)                          | --                             |
| NA                                                                  | 46                              | 76                             |                                |
| <b>Age</b>                                                          |                                 |                                |                                |
| 18-28                                                               | 32 (39)                         | 46 (45)                        | 21 (33)                        |
| 29-38                                                               | 35 (42)                         | 37 (36)                        | 25 (40)                        |
| 39-48                                                               | 14 (17)                         | 14 (14)                        | 13 (20)                        |
| 49-58                                                               | 2 (2)                           | 5 (5)                          | 4 (6)                          |
| NA                                                                  | 1                               |                                | 1                              |

PC/C = precontemplation/contemplation stages of change

PR = preparation stages of change

A/M = action/maintenance stages of change

NA = not applicable

## Discussion

The present study found a high proportion of subjects in preparation stage of change and very low proportion of subjects in action stage. These results are consistent with research on fruits and vegetables where Brug and colleagues (1998) found 33% of their sample were in preparation while only 5% were in action stage of change.

Campbell and researchers (1998) also found 65% of individuals in preparation and 1.1% in action. This high proportion of individuals in preparation stage of change is also consistent with results of other health related behaviors such as physical activity (Nigg et al., 1998), and fat intake (Curry and researchers, 1992). For example, Nigg and colleagues (1998) in a study in exercise adoption found that almost one third (29%) of subjects were in preparation.

In this study, the finding that the plurality (40.8%) of college students were in preparation stage of change indicates a high interest in starting to consume more fruits and vegetables. Furthermore, this result suggests that nutrition education efforts should concentrate mainly on helping college students to reach the action stage of change.

The very low proportion of subjects in action stage of change is also consistent with results of several studies (Campbell et al., 1998; Brug et al., 1997; and Laforge and others, 1994). However, the stage distribution of subjects in contemplation stage found in this study differed from earlier studies by Laforge and researchers (1994), where they found that 29% of individuals were in contemplation stage. This result may be suggestive of social desirability effects resulting from nutrition education letter in this population.



Stages of change and fruit and vegetable consumption were significantly associated, with participants in early stages of change (precontemplation/contemplation) consuming less (average of consumption of servings = 4.1) fruits and vegetables than participants in late stages of change (action/maintenance). The average of fruit and vegetable consumption (8.0 servings) of participants in action/maintenance stages was practically twice times that of participants in early stages. These differences are consistent with results of other studies that investigated stages of change for fruit and vegetable consumption. For example, these results are similar to those of Glanz and colleagues' (1994) investigation of the relationship of number of servings of fruits and vegetables and fiber intake with stages of change in a population of adult workers. It should be noted that the finding that individuals in preparation were consuming about five servings of fruits and vegetables as measured by seven-item food frequency questionnaire was not expected. However, this finding could be due to the lack of accuracy of the food frequency questionnaire that tends to overestimate the amount of foods consumed.

Glanz et al. (1994) found that the mean of the number of servings of fruits and vegetables for participants in precontemplation/contemplation was 1.72 daily servings, while subjects in action/maintenance stages had an average of consumption of 2.63 servings per day. Fiber intake also was lower in precontemplation/contemplation (6.38g/1000 kcal) and higher in action/maintenance (8.75 g/1000 Kcal).

The present study found that a majority of white Americans (51%) were in the preparation stage of change. This result is similar to Sorensen and colleagues' studies (1998) where 52.0% of the whites participants were in preparation stages of change. This

result is not consistent with findings of Campbell and colleagues (1999) and Boyle and researchers (1998). These authors found that white or white and black Americans were predominantly in action/maintenance stages. It should be emphasized however, that in the above mentioned studies, subjects were exposed to systematic nutrition education activities and the findings may be partly attributed to the interventions. To our knowledge, college students that live in communities have not been exposed to a systematic nutrition education intervention.

Latinos were predominantly in preparation (47.2%) and precontemplation (35.9%) stages of change. This finding is consistent with Sorensen and researchers (1998) where Hispanics were in higher number in preparation (68%) and precontemplation (25%). Campbell and colleagues (1999) also found that more Hispanics in worksites in Arizona were in contemplation/preparation (46.1%) stages of change.

Asian students were predominantly (41.3%) in precontemplation/contemplation stages of change. These results are similar to results reported in studies developed in a population of Asian and white American college students, where 68% of the participants were in precontemplation/contemplation stages (Rosen et al., 2000). The results of the present study do not agree with studies by Ling et al. (2000), who found that 58% of Asian individuals were in maintenance stage of change.

It is opportune to mention, however, that in the Ling and colleagues studies the criteria behavior used to classify individuals in action or maintenance stages of change was 3.75 servings of fruits and vegetables. This criteria behavior differs from the criteria

of five fruits and vegetables used in the present study. This difference in criteria behavior makes it impossible to offer a clear comparison between the results.

The significant difference between knowledge regarding the number of fruit and vegetable servings recommended for good health and stages of change in this study is consistent with results of Krebs-Smith et al. (1995) that found that this knowledge was an important determinant of increased consumption of fruits and vegetables in the target population. Other studies investigating the impact of feedback on dietary intake patterns found that information about recommended consumption levels for fruit and vegetables could promote substantial changes in consumption (Brug et al., 1998).

In this study, income was another variable that was correlated with stages of change. This correlation is consistent with studies by Sorensen and researchers (1998). Stages of change for participants without children living at home were not significantly different from those of participants with children living at home. This result is not consistent with studies by Laforge and others (1994), who found that participants with children living at home were likely to eat two or fewer servings of fruits and vegetables than were respondents without children living at home. A concern expressed by Laforge and researchers (1994) regarding their results is applicable in this study also. Namely, participants with children should be eating more fruits and vegetables since their eating habits will influence the formation of their children's food habits.

No significant correlations were found in this study for age and stages of change. This finding is not consistent with results of Hargreaves and Shlundt (1999); Boyle et al. (1998); Van Duyn and others (1998); and Glanz and researchers (1994). These authors found that younger participants were less likely to be in precontemplation and

significantly more likely to be in action or maintenance stages. However, in some of the mentioned studies, there were participants under 18 years old, whereas in the present study participants were all over 18 years old.

Stages of change were not significantly correlated to Latino and Asian acculturation level. Results related to Latinos are consistent with Suris and researchers (1998) who also found no significant difference between acculturation and stages of change  $\{F(4,73) = 2.37, p = 0.06\}$  in a Mexican American population. In addition, these authors found that less acculturated individuals were more likely to be in precontemplation stage of change. In the present study, however, Latinos in all stages of change were in highest number in the "very Latino category" category ( $n = 34, 64.1\%$ ). It is possible, that significant differences could have been found if the number of Latino participants had been larger with more subjects in each stage of change. Studies investigating the relationship between stages of change and acculturation in Asians were not found, which makes it impossible to compare the results found in this study with others researches. Major limitation of the acculturation scales is that they do not separate each of the Asian groups (Chinese, Japanese, Korean, etc.) and Latino groups (Mexicans, Brazilians, etc.).

Other limitations of this study should be noted: First, this study was developed in a well educated population of North Americans, Asians, Latino college students, under representing less educated individuals or other students of Indian or Middle-East descent. Second, the fruit and vegetable intake was measured by a short seven-item food frequency questionnaire rather than detailed food records. A third limitation of this study is that stage of change classification was based on self-report. Future studies, should try

to include in the stages of change algorithm a more objective measure such as results of diet analysis.

### **Implications For Research And Practice**

Significant differences between participants in different stages of change and consumption of fruits and vegetables tend to support the validity of the stages of change construct. Differences between cultural/ethnic groups and stages of change suggest that nutrition education messages should be tailored specifically for Asian participants, while current nutrition education messages can simultaneously address Latino and Caucasian American participants. Furthermore, nutrition education messages should include feedback for participants about the recommended number of fruits and vegetables that is optimum for good health. Future studies should include a systematic evaluation of cultural differences before the development of behavioral interventions for minority ethnic groups.

## **CHAPTER V**

# **STAGES OF CHANGE AND PROCESSES OF CHANGE FOR FRUIT AND VEGETABLE CONSUMPTION AMONG NORTH AMERICAN, LATINO AND ASIAN COLLEGE STUDENTS**

### **Abstract**

The purpose of this research was to examine the relationship between the stages of change and processes of change constructs for fruit and vegetable consumption among male North American, Asian and Latino college students. It was hypothesized that participants in later stages of change would have greater use of the processes of change for eating five or more fruits and vegetables than those in early stages. Also, it was hypothesized that different cultures would have different process use patterns for eating five or more fruits and vegetables a day. In a cross sectional design, a survey was delivered to college students conveniently selected from Apartment Life Complex at Colorado State University. A total of 250 usable surveys were returned. The stages of change for fruits and vegetables were assessed by the 5 A Day for Better Health Initiative algorithm. The processes of change scale for measuring fruit and vegetables consumption behavior was developed in a previous study. This scale measured the five experiential/cognitive and five behavioral processes of change recognized in the Transtheoretical Model of Change and consisted of four items for each processes of

change. Cronbach's alpha reliability ranges for the processes of change scale were from 0.66 for 0.86. Analysis of covariance was performed with each of the ten processes of change as the dependent variable, stages of change and cultural groups as independent variables and age as covariate. There were no significant interactions between stages of change and cultural/ethnic groups. There were, however, significant main effects for stages of change and cultural/ethnic groups. The stages of change were significantly related to all 10 processes of change investigated in the hypothesized manner. The significance level range for these main effects was from  $p < 0.05$  to  $p < 0.001$  and the effect size range was 0.18 (small effect size) to 0.3 (medium effect size). Also, different cultural/ethnic groups had some difference in processes of change use by ANCOVA. North American participants used significantly less dramatic relief ( $p < 0.05$ ), environment reevaluation ( $p < 0.05$ ), and stimulus control processes than Asian participants. Latinos used significantly ( $p < 0.05$ ) less stimulus control than Asian participants. Results of MANCOVA indicated that stages of change were significantly associated with the summary dependent variables of cognitive/experiential and behavioral processes of change (Willk's lambda = 6.33,  $p < 0.001$ ). MANCOVA contrasts found significant differences in cognitive/experiential processes use among precontemplation/contemplation ( $p < 0.001$ ) and precontemplation/contemplation and preparation ( $p < 0.001$ ). Paired t tests showed that cognitive/experiential processes use was higher than behavioral processes use among participants. The relationship among stages and processes of change are consistent with previous studies using the Transtheoretical Model in the nutritional area.

Key words: stages of change, processes of change, fruit and vegetable consumption

## **Introduction**

Stages of change and processes of change constructs are the “heart” of the Transtheoretical Model (TTM) of Behavior Change (Prochaska et al., 1997). This model, originally developed by Prochaska and DiClemente (1984, 1982), within a clinical context to describe the process of behavior change in addictive behaviors such as smoking, has been expanded to explain initiation, adoption and maintenance of positive health behaviors such as dietary change, mammography screening, and exercise (Prochaska et al., 1997).

There are five stages of change that composes the model: precontemplation (no intention to make a change), contemplation (considering a change), preparation (making small change), action (actively engaging in a new behavior), and maintenance (sustaining change over time).

Another dimension of the model, processes of change, involves cognitive/experiential and behavioral coping strategies; techniques that enable individuals to successfully change or modify their behavior (Prochaska et al., 1988). The five cognitive/experiential processes are defined as follows:

- 1) **Consciousness raising:** increasing one’s awareness of the problem behavior by gathering information to increase understanding, knowledge, and feedback about self and problem.
- 2) **Dramatic relief:** experiencing and expressing feelings about one’s problems and solutions.



- 3) Environmental reevaluation: assessing how one's problem affects physical condition and social environment.
- 4) Self-reevaluation: assessing one's feelings and thoughts about oneself with respect to a problem.
- 5) Social liberation: increasing available alternatives of no problem behaviors in society.

The five behavioral processes are:

- 1) Self-liberation: choosing and commitment to act or belief in one's ability change.
- 2) Contingency (reinforcement) management: rewarding one's self or being rewarded by others for making changes.
- 3) Helping relationships: being open and trusting about problems with someone who cares.
- 4) Counter conditioning: substituting alternatives for problem behaviors.
- 5) Stimulus control: avoiding or countering stimuli that elicit or trigger problem behaviors.

The relationship between the stages and processes of change is a key element of the Transtheoretical Model. The processes of change used by an individual to move toward change depend on his or her stage of change for the behavior of interest (Prochaska and researchers, 1986, 1984). Cognitive processes are emphasized in the earlier, preaction stages of change, whereas, behavioral processes are emphasized in the preparation, action and maintenance stages of change (Ounpuu and others, 2000; Prochaska et al., 1997, 1991).

Studies have recently applied the model in the nutritional arena. However few studies have investigated the relationship between stages of change and processes of change in the nutritional area. Some of these studies are those conducted by Greene and colleagues (1994) and Rossi et al. (1994) in dietary fat reduction, where they found that use of any process are low in the precontemplation stage. Use of experiential processes increase sharply through preparation, peak in action then decrease. Behavioral process use remains low through contemplation, and then rises sharply through action before decreasing.

Similar results to the above mentioned studies were found by Ounpuu and colleagues (2000). Ounpuu et al. (2000) detected that a target population of women in the maintenance stage of change had more frequent use of processes of change than the women classified in the precontemplation stage.

The relationship between of stages of change and frequency of using processes is also evident in a study investigating preliminary evaluation of the processes of changing to a low-fat diet (Bowen et al., 1994). The use of any process increased through the four stages and there was clearly variability in the use of processes for subjects at each of the stages.

Individuals in precontemplation used processes less frequently than individuals in the other stages. Several of the processes (e.g. environmental re-evaluation, nutritional strategies that included items from stimulus control, counter conditioning and consciousness raising) increased in use through the four stages. Dramatic relief and behavioral strategies (items from stimulus control and counter conditioning) were used most frequently in the action stage. Social liberation was used frequently through all the

stages while environmental strategies were used relatively infrequently. Social support (helping relationship and reinforcement management) was used most frequently during the preparation and action stages, those stages that involve actual behavior change.

Just two studies were identified with regard to improving fruit and vegetable consumption behavior. One of them was developed by Sorensen and researchers (1998), which focused on the relationship between the processes, co-worker support, and stage of readiness to increase fruit and vegetable consumption. The authors found that co-worker support was highest among those preparing to increase consumption and significantly distinguished between persons in precontemplation/contemplation and those in preparation.

The other study (Chung and Herr, 2001) found that those in action and maintenance stages of change had higher scores for health/commitment/action process (self-liberation, counter conditioning and stimulus control) compared to those in preaction stages.

There are, also, few studies investigating the relationship between stages of change and processes of change in specific cultural groups. Results from studies developed by Sorensen and researchers (1999, 1998) showed that household support was significantly higher for Hispanic or African Americans than those of other ethnic groups. This relationship remained significant when other characteristics were controlled. Results from a study in English adults (Lamb & Joshi, 1996) showed that from four processes investigated, two processes, consciousness raising process and self-liberation distinguished all five stages. These results suggest that fewer processes may be involved in dietary reduction in this population and that the pattern may not be identical to that

reported by Prochaska and his colleagues in other cultural groups. It is possible that various cultures may use different processes of change more than others, and some processes may be more readily accepted by cultures while others are more problematic (Suris et al., 1998).

The purpose of this study was to investigate the relationship of stages of change and processes of change for fruit and vegetable consumption behavior among several cultural groups. It was hypothesized that individuals in higher stages of change in terms of eating five or more servings of fruits and vegetables a day would have greater use of the processes of change than those in earlier stages. Another hypothesis was that different cultures would have different process use patterns for eating five or more fruits and vegetables a day.

## **Methods**

### **Research Design**

This research used the Transtheoretical Model of Behavior Change (Prochaska & DiClemente, 1984) to conduct a cross-sectional investigation on fruit and vegetable consumption. A between group factorial design (3×3) was used to investigate the relationship between stages of change and processes of change. Specifically, this study had three cultural/ethnic groups (North American, Latino and Asian) and three different stages of change (precontemplation/contemplation, preparation, and action/maintenance).

## Participants

The participants consisted of a convenience sample of 250 male Latino, North American and Asian college students with ages above 18 and less than 60 years old who live in the Apartment Life Complex at Colorado State University. College students are an appropriate target audience for future nutrition education because their lives are in transition, and they have the potential for positive changes (Wong et al., 1999).

Participants were selected from three sites in the Colorado State University Apartment Life Complex: University Village (n = 114, 45.6%); Aggie Village (n = 90, 36%); International House (n = 27, 10.8%); and Lory Apartments (n = 19, 7.6%); which reflect an intense diversity of population and relatively high concentration of Latino and Asian students.

## Sampling and Recruitment

Convenience sampling of male Latinos, North Americans and Asians was used for this study. The researcher recruited subjects from June to August 2001 by means of a letter attached with the survey (Appendix A) and delivered by personal contacts in the Apartment Life Complex. The participant's address was obtained from Apartment Life records and a stamped, return envelope was enclosed to facilitate a response.

## Survey Procedures

In the process of writing survey items, some aspects considered were the mode of administration, design visualization, question construction, response format, question placement, and questionnaire length. As an illustration, the self-administered

questionnaire was chosen as the way to administer the questionnaire because this procedure permits the participants to complete it at their convenience (Bailey et al., 1978). This consideration is important in the case of college students because they will be at home and available at different times.

The other advantage of the self-administered survey, according to Bailey and colleagues (1978), is that the interviewer bias is avoided. Another aspect was the response format in which the closed-end questions were used because the same author affirms that the target population could perceive this type of questions as easier to answer. In addition, in this specific instance, due to language barriers, the answers to closed-ended questions are easier to analyze.

A survey with different acculturation scales for each cultural/ethnic group was developed (Appendices B, C and D). The survey was confidential and approved by the Human Research Committee at Colorado State University. Upon the respondent's completion of the survey, it was placed in a large envelope until data were entered and analyzed.

### Stage Categorization

Stages of change were measured via a specific set of questions validated in similar 5 A Day studies (Campbell and others, 1998; Havas and colleagues, 1995; and Thompson et al., 1994). The survey provided the definition of a serving of fruits and vegetables to participants, according to suggestions of the Food Guide Pyramid (Food Guide Pyramid/U.S. Department of Agriculture, 1992). Four questions measured the stage for readiness to increase fruits and vegetable:

- 1) “How many servings of fruits and vegetables do you eat each day?” This initially evaluated whether participants were eating 5 or more servings of fruits and vegetables per day.
- 2) “About how long have you been eating this number of daily servings of fruits and vegetables?” This defined the participant’s duration of the behavior.
- 3) “Are you seriously thinking about eating more servings of fruits and vegetables starting sometime in the next six months?” This characterized the participant’s willingness to increase one’s intake of fruits and vegetables.
- 4) “Are you planning to eat more servings of fruits and vegetables during the next month?” This evaluated the participant’s intention to eat fruits and vegetables in the near future.

The following algorithm was used to assigning participants for stage of change:

- Action if the answer to question one was 5 or greater, and answer to question two was 6 months or less;
- Maintenance stage if the answer to question one was 5 or greater, and answer to question two was greater than 6 months;
- If the answer to question one was less than 5, answer to question three was “yes,” and answer to question four was “yes,” they were assigned to the preparation stage.
- If the answer to question one was less than 5, answer to question three was “yes,” and answer to question four was “no,” they were assigned to the contemplation stage.
- Precontemplation if the answer to question one was less than 5, and answer to question three was “no.”

### Processes of Change

Forty items were designed to capture the ten processes thought by Prochaska and DiClemente to be involved in the process of behavior change. Each of one the cognitive/experiential processes of change (consciousness raising, dramatic relief, self reevaluation, environment reevaluation and social liberation) was evaluated by a subscale of four items. In the same way, each of the behavioral process (self-liberation, counter conditioning, stimulus control, helping relationship and reinforcement management) was assessed using four items sub-scales. Detailed information about the development of the processes of change scale is described in Chapter III.

A five-point response scale was used (never, seldom, occasionally, often, repeatedly). Answers were assigned values ranging from 1 (never) to 5 (repeatedly) with scores ranging from 4 to 20 for each subscale. Averaging scores within each process subscale yielded participant's scores on each process of change.

### Reliability Processes of Change Scale

Cronbach's alpha reliability for the processes of change scale for fruits and vegetables in this study ranged from 0.66 to 0.86 (Oliveira and researchers, 2001). The reliability for each processes of change use was as: consciousness raising (0.86), dramatic relief (0.79), environmental reevaluation (0.70), self-reevaluation (0.80), social liberation (0.69), self-liberation (0.75), reinforcement management (0.72), helping relationship (0.74), counterconditioning (0.75), and stimulus control (0.66). The reliability indices can be considered good in a four items scale.



### Statistical Analysis

Ten analysis of covariance (ANCOVA), controlling for the potential confounding factor of age, were used to determine differences in each processes of change use among Latino, North American and Asian college students in different stages of change. Age was used as covariate because it was the only demographic variable related to processes of change.

Second, a multivariate analysis of covariance (MANCOVA) was conducted using age as covariate, ethnicity and stage of change for fruit and vegetable consumption as the independent variables. The cognitive/experiential and behavioral summary processes of change scores were the two dependent variables for MANCOVA. These summary variables were each the sum of the five appropriate processes.

The purpose of this analysis was to obtain overall how different cultural groups in different stages of change use the two groups of processes of change. Furthermore, these analyses permitted the researcher to determine if results found for increasing fruit and vegetable consumption were similar to those found in the fat reduction arena. According to Nicol and Pexman (1999), the multivariate analysis of variance is an "extension of the analysis of variance to the situation in which there is more than one dependent variable and it is used to analyze the difference between two or more group means.

Finally, paired t tests were performed to compare the summary cognitive/experiential and behavioral processes of change use by participants. These comparisons of the processes summary scores were made separately for student in each stage of change.

## Results

### Personal Characteristics

The personal characteristics of respondents and the distribution of the scores are summarized in Table 4.1. Latinos comprised 21% (n=53) of the sample, while North Americans comprised 42% (n=105), and Asians comprised 37% (n= 92).

The sample's mean age was 32 years {standard deviation (SD) = 7.8; range = 18 - 53}. The reported income of the sample was likewise relatively low, particularly for North Americans, many of whom were undergraduate students. Only one participant (0.4%) reported income of \$35,000 or more, and it should be noted that 4% (n = 10) of respondents did not answer the income item. Approximately, half of the respondents (50.4%, n = 126) were part time undergraduate students.

**Table 5.1.** Personal Characteristics of Participants.

| Characteristics                 | Latinos |      | North Americans |      | Asians |      |
|---------------------------------|---------|------|-----------------|------|--------|------|
|                                 | N       | %    | N               | %    | N      | %    |
|                                 | 53      | (21) | 105             | 42   | 92     | 36.8 |
| <b>College Status</b>           |         |      |                 |      |        |      |
| Full-time undergraduate student | 4       | 7.5  | 40              | 38.1 | 11     | 12.0 |
| Part-time undergraduate student | -       |      | 3               | 2.9  | -      |      |
| Full-time graduate student      | 36      | 68   | 40              | 38.1 | 50     | 54.3 |
| Part-time graduate student      | 2       | 4    | 2               | 1.9  | 4      | 4.3  |
| Other (Post doc)                | 11      | 21   | 20              | 19.0 | 27     | 29.3 |
| <b>Age</b>                      |         |      |                 |      |        |      |
| 18 - 28                         | 16      | 30   | 62              | 59.6 | 21     | 23.0 |
| 29 - 38                         | 22      | 41.5 | 27              | 25.9 | 48     | 57.7 |
| 39 - 48                         | 12      | 23   | 7               | 6.7  | 22     | 24.2 |
| 49 - 58                         | 3       | 6    | 8               | 7.7  | -      |      |
| Missing                         |         |      | 1               |      | 1      |      |
| <b>Yearly Income</b>            |         |      |                 |      |        |      |
| Under \$10,000                  | 4       | 7.5  | 22              | 21.3 | 10     | 11.9 |
| \$10,000 - \$14,999             | 11      | 20.8 | 19              | 18.4 | 13     | 15.5 |
| \$15,000 - \$19,999             | 13      | 24.5 | 24              | 23.3 | 13     | 15.5 |
| \$20,000 - 24,999               | 2       | 3.8  | 16              | 15.5 | 14     | 16.7 |
| \$25,000 - \$29,000             | 11      | 20.7 | 11              | 10.7 | 10     | 11.9 |
| \$30,000 - \$34,000             | 12      | 22.6 | 11              | 10.7 | 23     | 23.7 |
| Above \$35,000                  | -       |      | -               |      | 1      | 1.2  |
| Missing                         |         |      | 2               |      | 8      |      |
| <b>Living Arrangement</b>       |         |      |                 |      |        |      |
| University Village              | 33      | 62.3 | 22              | 20.9 | 57     | 62.0 |
| Aggie Village                   | 11      | 20.7 | 22              | 20.9 | 2      | 2.2  |
| International House             | 3       | 5.7  | 48              | 45.7 | 33     | 35.8 |
| Lory Apartments                 | 6       | 11.3 | 13              | 12.4 | -      |      |

### Stages of Change

The stage of change construct was measured using the gold standard of eating five or more fruits and vegetables a day. This is considered a clear and easy goal to make it possible for people to evaluate their behavior more accurately and reduce the discrepancy between objectively assessed intake and self-reported intake (Povey and colleagues, 1992). Respondents in the precontemplation stage comprised 28.0% (n = 70) of the sample, the contemplation stage comprised 5.6% (n = 14), the preparation stage

comprised 40.8% (n = 102), the action stage comprised 2.0% (n = 5) and the maintenance stage comprised 23.6% (n = 59). Due to the low number of participants in precontemplation and contemplation, these two stages were collapsed into one stage. In the same way, the action and maintenance stages were collapsed. The preparation stage was kept as a separate category because, according to Sorensen and researchers (1998), individuals in preparation stages are more receptive to health education messages.

### Analysis of Covariance Results

Analysis of covariance (ANCOVA), controlling for age, was conducted to investigate differences in processes of change use scores of North Americans, Asians and Latinos in different stages of change (precontemplation/contemplation, preparation and action/maintenance). There were no significant interactions between stage of change and ethnicity for any of the five cognitive/experiential processes of change (consciousness raising, dramatic relief, environment reevaluation, self-reevaluation and social liberation) or five behavioral processes of change use (self-liberation, reinforcement management, helping relationship, counter conditioning, and stimulus control). There were, however, significant main effects for stages of change and ethnicity, which will be discussed separately in the next two sections.

1) *Stages of change main effects on the processes of change.* There were significant relationships between stages of change and all 10 processes of change. The results of the main effect of stage of change, the significance level for each process of change the differences in processes of change using mean and standard deviation scores of

participants in precontemplation/contemplation, preparation, and action/maintenance stages of change are shown in Table 5.2.

**Table 5.2.** Processes of Change Use According to Stages of Change<sup>1</sup>.

|                               | Overall<br>F | Stages of Change        |                        |                        |
|-------------------------------|--------------|-------------------------|------------------------|------------------------|
| Processes of Change           | (df = 2,238) | PC/C<br>n = 82          | PR<br>n = 102          | A/M<br>n = 62          |
|                               |              | LSM ± SEM               |                        |                        |
| <b>Cognitive/experiential</b> |              |                         |                        |                        |
| Consciousness raising         | 10.79***     | 2.0 ± .10 <sup>ab</sup> | 2.5 ± .09 <sup>a</sup> | 2.6 ± .13 <sup>b</sup> |
| Dramatic relief               | 4.76**       | 2.1 ± .10 <sup>ab</sup> | 2.4 ± .09 <sup>a</sup> | 2.5 ± .12 <sup>b</sup> |
| Environment reevaluation      | 6.48**       | 2.5 ± .09 <sup>ab</sup> | 2.8 ± .08 <sup>a</sup> | 3.0 ± .12 <sup>b</sup> |
| Self-reevaluation             | 6.68**       | 2.2 ± .10 <sup>ab</sup> | 2.6 ± .09 <sup>a</sup> | 2.7 ± .12 <sup>b</sup> |
| Social liberation             | 4.09*        | 2.8 ± .09 <sup>ab</sup> | 3.0 ± .08 <sup>a</sup> | 3.1 ± .11 <sup>b</sup> |
| <b>Behavioral</b>             |              |                         |                        |                        |
| Self-liberation               | 11.32***     | 2.4 ± .09 <sup>ab</sup> | 3.0 ± .08 <sup>a</sup> | 2.9 ± .12 <sup>b</sup> |
| Reinforcement management      | 7.16**       | 2.7 ± .10 <sup>ab</sup> | 3.0 ± .09 <sup>a</sup> | 3.3 ± .13 <sup>b</sup> |
| Helping relationship          | 6.26**       | 1.9 ± .09 <sup>ab</sup> | 2.2 ± .08 <sup>a</sup> | 2.4 ± .12 <sup>b</sup> |
| Counter conditioning          | 11.25**      | 2.2 ± .10 <sup>ab</sup> | 2.8 ± .09 <sup>a</sup> | 2.8 ± .12 <sup>b</sup> |
| Stimulus control              | 3.43*        | 1.7 ± .08 <sup>a</sup>  | 1.8 ± .07 <sup>b</sup> | 2.0 ± .10 <sup>a</sup> |

<sup>1</sup>ANCOVA, controlling for age

PC/C = Precontemplation/contemplation

PR = Preparation

A/M = Action/ Maintenance

\*\*\* p < 0.001, \*\* p < 0.01, \* p < 0.05

Same superscript letter means significant difference and different superscript letter means no significant difference.

Least Square Mean (LSM) was measured in a five point Likert Scale (1 = never, 5 = repeatedly)

In general, participants in precontemplation/contemplation used less of any process of change than participants in preparation stage. Also, participants in precontemplation/contemplation used less of any process of change than participants in action/maintenance stages of change. No significant difference was found between preparation and action/maintenance stages of change.

2) *Cultural/ethnic main effects on the processes of change.* There were some differences in ethnicity (North Americans, Asians and Latinos) for two of the cognitive/experiential processes of change (dramatic relief and environment reevaluation). ANCOVA found significant differences in dramatic relief process use. Post hoc tests indicated that North American participants used significantly less dramatic relief process than Asian <sup>Latinos?</sup> participants.

ANCOVA also found significant difference in environment reevaluation process score use. <sup>Latinos initially</sup> Post hoc tests indicated that Asian students used significantly more environment reevaluation process than North Americans. There were no other differences in cognitive/experiential process score use in North Americans, Asians and Latinos.

For the behavioral processes, the only significant analysis of ANCOVA was for the stimulus control process score use among the ethnicities. Asians used significantly more stimulus control than North Americans and Latinos. Table 5.3 shows the processes of change according to cultural/ethnic groups.

**Table 5.3.** Processes of Change According to Cultural/ Ethnic Groups<sup>1</sup>.

| Processes of Change           | Overall<br>F<br>(2,238) | Cultural/Ethnic Group  |                        |                         |
|-------------------------------|-------------------------|------------------------|------------------------|-------------------------|
|                               |                         | North American         | Latino                 | Asian                   |
|                               |                         | LSM ± SEM              |                        |                         |
| <b>Cognitive/Experiential</b> |                         |                        |                        |                         |
| Consciousness raising         |                         | 2.3 ± .09 <sup>a</sup> | 2.4 ± .01 <sup>b</sup> | 2.3 ± .14 <sup>c</sup>  |
| Dramatic relief               | 3.81*                   | 2.1 ± .09 <sup>a</sup> | 2.5 ± .09 <sup>b</sup> | 2.3 ± .13 <sup>a</sup>  |
| Environment reevaluation      | 3.84*                   | 2.6 ± .09 <sup>a</sup> | 2.9 ± .09 <sup>a</sup> | 2.8 ± .13 <sup>b</sup>  |
| Self- reevaluation            |                         | 2.4 ± .09 <sup>a</sup> | 2.7 ± .09 <sup>a</sup> | 2.5 ± .13 <sup>b</sup>  |
| Social liberation             |                         | 3.1 ± .08 <sup>a</sup> | 2.9 ± .08 <sup>b</sup> | 3.0 ± .12 <sup>c</sup>  |
| <b>Behavioral</b>             |                         |                        |                        |                         |
| Self liberation               |                         | 2.9 ± .09 <sup>a</sup> | 2.9 ± .09 <sup>b</sup> | 2.6 ± .13 <sup>c</sup>  |
| Reinforcement Management      |                         | 2.8 ± .09 <sup>a</sup> | 2.9 ± .09 <sup>b</sup> | 3.2 ± .13 <sup>c</sup>  |
| Helping relationship          |                         | 2.2 ± .09 <sup>a</sup> | 2.3 ± .09 <sup>b</sup> | 2.1 ± .13 <sup>c</sup>  |
| Counter conditioning          |                         | 2.5 ± .09 <sup>a</sup> | 2.7 ± .09 <sup>b</sup> | 2.6 ± .13 <sup>c</sup>  |
| Stimulus control              | 8.07**                  | 1.6 ± .07 <sup>a</sup> | 2.0 ± .07 <sup>b</sup> | 1.7 ± .10 <sup>ab</sup> |

<sup>1</sup>ANCOVA, controlling for age

PC/C = Precontemplation/contemplation

PR = Preparation

A/M = Action/ Maintenance

\*\* p < 0.01, \* p < 0.05

Same superscript letter means significant difference and different superscript letter means no significant difference.

Least Square Mean (LSM) was measured with a five point Likert Scale (1 = never, 5 = repeatedly)

### Multivariate Analysis of Covariance Results

Multivariate analysis of covariance (MANCOVA) results indicated that stages of change are significantly associated with the summary dependent variables, cognitive/experiential and behavioral processes (Wilks' lambda = 6.33,  $p < 0.001$ ). Univariate analysis show that both summary cognitive/experiential processes scores ( $F = 11.15$ ,  $p < 0.001$ ) and summary behavioral processes score ( $F = 11.99$ ,  $p < 0.001$ ) were significantly associated with the stages of change. No significant differences were found for cultural/ethnic group on stages of change. Also, there were no significant interactions between cultural/ethnic group and stage of change. Table 5.4 provides the estimated marginal mean, and standard error for the main effect of stages of change. The behavioral summary scores were lowest for individuals in the precontemplatin stage, were highest for individuals in the action/maintenance stages of change.

**Table 5.4.** Contrasts Means and Standard Error for the Main Effects of Stages of Change.

| Processes of Change    | Stages of Change   |                   |                   |
|------------------------|--------------------|-------------------|-------------------|
|                        | PC/C<br>n = 82     | PR<br>n = 102     | A/M<br>n = 62     |
|                        | Contrasts/ Means   |                   |                   |
| Cognitive Experiential | 11.5 <sup>ab</sup> | 13.5 <sup>a</sup> | 14.0 <sup>b</sup> |
| Behavioral             | 11.0 <sup>ab</sup> | 12.8 <sup>a</sup> | 13.6 <sup>b</sup> |

<sup>1</sup>ANCOVA, controlling for age

PC/C = Precontemplation/contemplation

PR = Preparation

A/M = Action/ Maintenance

Same superscript letter means significant difference and different superscript letter means no significant difference.

Means measured using the sum of five point Likert Scale (1 = never, 5 = repeatedly). So, the scores could range from 5 to 25.



MANCOVA contrasts showed that the cognitive/experiential processes summary scores for fruit and vegetable intake were significantly different between precontemplation/contemplation and preparation ( $p < 0.001$ ), and also between precontemplation/contemplation and maintenance ( $p < 0.001$ ). In addition, for behavioral processes, results of the multivariate analysis of covariance contrasts found a significant difference between precontemplation/preparation and preparation ( $p < 0.001$ ), and between precontemplation/contemplation and action maintenance ( $p < 0.001$ ) stages of change. Contrasts were based on comparisons of summary scores for the five cognitive/experiential and the five behavioral processes. Thus, summary scores can range between 5 and 25.

#### Comparison of Cognitive and Behavioral Processes

Paired  $t$  tests were performed to compare participant's cognitive/experiential processes summary score with their behavioral processes summary score (Table 5.4).  
 Paired  $t$  tests showed significant difference for all three stages of change

**Table 5.5.** Cognitive/Experiential and Behavioral Processes of Change Differences for Stages of Change Use.

| Stages of Change                   | Processes of Change                     |                             |            |      |
|------------------------------------|-----------------------------------------|-----------------------------|------------|------|
|                                    | Cognitive/Experiential<br>Mean $\pm$ SD | Behavioral<br>Mean $\pm$ SD | $t$ (df)   | $p$  |
| Precontemplation/<br>Contemplation | 11.5 $\pm$ 3.2                          | 10.9 $\pm$ 3.1              | 2.99 (83)  | .004 |
| Preparation                        | 13.4 $\pm$ 3.1                          | 12.8 $\pm$ 3.1              | 2.73 (101) | .008 |
| Action/Maintenance                 | 14.2 $\pm$ 3.8                          | 13.7 $\pm$ 3.6              | 2.22 (63)  | .030 |

Even though the difference between the means was small,  $t$  is highly significant and the effect size was at least medium because the scores were highly correlated.

### **Discussion**

This study presents an attempt to examine the association of two main constructs of the Transtheoretical Model of Behavior Change. The primary objective was to investigate differences in processes of change scores among North American, Latino, and Asian college students in different stages of behavior change.

It was hypothesized that participants in later stages of change would have greater use of the processes of change for eating five or more fruits and vegetables than those in early stages. Also, it was hypothesized that different cultures would have different processes use patterns for eating five or more fruit and vegetable a day.

Results from factorial ANCOVA of the relationship among the TTM constructs indicated that processes of change scores differed with stages of change. Generally, all the processes of change scores for fruit and vegetables intake were lower in early stages of change than in later stages of change. The basic pattern of process found in the present study was similar to those found in smoking cessation studies, indicating some agreement in the ways that individuals participate in the two behavior change pathways. Studies by Sorensen and researchers (1998) also showed that co-worker support was highest among those preparing to increase fruit and vegetable consumption and significantly distinguished between individuals in precontemplation/contemplation.

The results are similar those of the studies in low fat diet developed by Greene et al. (1994) and studies in the processes of change for dietary fat reduction done by Rossi

and colleagues (1994), where the cognitive and behavioral processes presented low use in early stages, increased in preparation, and peaked in action.

These results are similar but not identical because Rossi and colleagues (1994) and Greene and others (1994) also found that processes use is low between precontemplators and contemplators. In our study, we couldn't analyze this difference because the precontemplation and contemplation stages were collapsed due to the low number of participants in the contemplation stage. In this way, differences in cognitive/experiential and behavioral processes use could not be investigated. To illustrate these differences, Prochaska and colleagues (1992) state that at the transition between precontemplation and contemplation, individuals emphasize information and consciousness raising; helping relationship is emphasized in the transitions to action and maintenance stages. It should be noted that the lower use of processes of change in precontemplation/contemplation stages could be a factor contributing to lower motivation to change among precontemplators and contemplators (Sorenson et al., 1998).

The finding that all cognitive/experiential processes of change summary scores were higher than behavioral processes of change summary scores was somewhat unexpected. Research with these constructs has shown that, cognitive/experiential process of change is emphasized in the early stages of change and behavioral processes are used more in the late stages of change (Prochaska and Velicer, 1997; Prochaska et al., 1991). Research also, indicates that behavioral process use is low until the preparation stages of change (Greene et al., 1994). However, Lamb and Joshi (1996) provide some evidence that cognitive processes use can be different for different behaviors.

In addition, across the studies the structure of the processes of change have not been consistent as the structure of the stages and fewer processes or evidence for one or two more processes have been detected in some behaviors (Prochaska & Velicer, 1997). It is likely that fewer processes of change can be used to some behaviors. This is affirmed by the results of Prochaska and Velicer (1997). To illustrate, Rakowski et al. (1996, 1992), while investigating the applicability of the Transtheoretical Model to screening mammography, found that 3 processes of change emerged from data on 105 women, age 40 and older, recruited from their worksite. One process represents having made a commitment to regular mammograms, the second appears to tap a tendency to seek information and communicate with others, and a third seems to reflect a readiness to think about mammography in terms beyond one's own screening status. Prochaska and Velicer (1997) still warn of the complexity of integrating ten processes across the stages for behaviors other than smoking and the necessity of more basic research for utilizing the processes of change in studying different behaviors.

There are some studies that suggest that cognitive/experiential processes may be used in different stages than they are in smoking cessation (Bowen and researchers, 1994; Gorely et al., 1995; Marcus and others, 1992). For example, Rosen (2000) reports that cognitive/experiential processes for exercise adoption, were most frequently used during action/maintenance stages, which may reflect differences between ceasing an addictive behavior and initiating health-enhancing behavior. Smoking cessation involves quitting a poor behavior, while beginning to exercise requires re-initiating a new behavior. This continual renewal of purpose may be helped by continuing to think about the benefits of exercising (Rosen, 2000).

Dietary changes involve aspects similar to both smoking cessation and exercise adoption in that it involves both ending a negative behavior (e.g. eating a low amount of fruits and vegetables) and adopting new behavior (e.g. eating five fruits and vegetables a day). However, according to Rosen (2000), it appears that people use cognitive processes during action and maintenance at least as much as they use them during earlier stages of diet change. To illustrate, although consciousness raising (information seeking) has usually been thought in earlier stages of change (Prochaska and colleagues, 1992), active dieters continue to seek recipes and other nutritional information (Rosen et al., 2000). These findings challenge the assumption that the relationship of processes with stages is the same for all health issues (Rosen et al., 2000)

Results of the present study indicate that Asians differ in stages of change from North Americans and Latinos; this suggesting that cultural differences can affect the TTM constructs. For example, Kearney et al. (1999) noted large between-country differences (in stage distribution) with three-fold differences in the precontemplation stage (Ireland and Italy 15% versus Greece and Portugal 46%).

### **Implications For Research And Practice**

The different use of some processes by Asians, North Americans, and Latinos suggest some caution against including different cultural groups in the same study. Another option is to include them in the studies and control for cultural differences.

Dramatic relief, environment reevaluation and stimulus control processes of change were higher in Asians than in North Americans. These results suggest that Asians may be expressing more of their feelings related to the consequences of a diet poor in

fruit and vegetables diet (such as illness) than North American participants. In addition, Asians may be more worried about getting sick and being a problem to close people since they are not in their homeland as Americans are. The finding that stimulus control is higher for Asians than for North Americans and Latinos may suggest that Asians may have more control of their fruit and vegetable serving sizes and regular meals than other groups.

Lastly, individuals are using more behavioral processes or activities to alter their behavior related to eating five fruits and vegetables than are using cognitive processes. This implies that interventions at all stages should preferably find ways to teach individuals how to increase their abilities to avoid unwanted stimulus; give rewards for their adequate behavior (they expect that will happen), and to involve a support team (friends, family) in nutrition education activities.

More research is needed to investigate whether there are differences between cognitive/experiential and behavioral processes of change use between precontemplation and contemplation, and between action and maintenance stages of change

As they stand, the results of the current study imply that a different pattern of process use occurs for eating five fruits and vegetables a day than for some other behaviors. This can partially explain the complexity of the dietary behavior where all types of processes are involved.

## **CHAPTER VI**

### **CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS**

#### **Conclusions**

This research focused on the study of the fruits and vegetables and the importance of assessing cultural differences on behaviors using the Transtheoretical Model of Behavior Change that includes both stages of change and processes of change. Much of the information obtained in the present study has been missing from the design of previous investigations and will be important in the design of the future studies and nutrition education efforts.

This study produced one of the first instruments for assessing processes of change construct for fruit, and vegetable consumption for Asian, Latino and North American college students. The instrument consisted of one valid and reliable 40 items scale for measuring processes of change in a diverse cultural group of the students. It was demonstrated that use of the processes of change varied with the different stages of change consistent with Transtheoretical. In fact, in early stages of change the processes of change were used less than in later stages. In other words, precontemplators /contemplators were found to use processes the least while action/maintenance individuals used them the most. This finding demonstrated that the processes of change

scale are externally valid. This partially supports the application of the Transtheoretical Model to fruits and vegetables. However, the lack of significant difference between participants in preparation stages and participants in action/maintenance stages on processes of change use it was not expected. It is possible that low number of individuals in action stage could have affected this result. Multivariate ANOVA demonstrated that cognitive/experiential processes use was higher than behavioral processes across the stages. This suggests that the type of processes used for eating fruits and vegetables can be different than for other behaviors such as smoking. In addition, the challenges posed by different health behavior problems are diverse and this makes it difficult to obtain uniform results across domains.

The significant relationship between stages of change on fruits and vegetables consumption as measured by food frequency questionnaire, provided support for use of the fruit and vegetable algorithm. The distribution across the stages showed that individuals were in different stages of readiness to eat five fruits and vegetables a day. The higher percentage of individuals was in preparation, followed by precontemplators, and much smaller percentages in contemplation and action stages of change. The frequency of cultural/ethnic groups across the stages showed that North Americans and Latinos were in preparation while Asians were in precontemplation/contemplation. The knowledge regarding the number of fruit and vegetable servings recommended for good health and the individual's income were significantly related to stages of change. These findings suggest that nutrition education should consider the parameters of the readiness to change as well as the participant's cultural/ethnic origin and their income. Nutrition



education should also include feedback for participants concern with the recommended number of fruits and vegetables that is adequate for optimal nutrition.

### **Implications For Nutrition Education**

Some participants for health nutrition education can be derived from this study. Increasing fruits and vegetables intake should be included as a target goal in health communication activities designed to improve or maintenance health status for North American, Latino and Asian college students. It should also be included as a preventive strategy in health communication programs target to high school students. Nutrition education campaigns should also utilize this knowledge as a motivational factor of benefit for increasing fruit and vegetable intake. There was a trend with certain processes of change for Asian cultural ethnic group. Nutrition education can be more efficacious to focus on these processes (stimulus control, environment reevaluation, dramatic relief).

### **Recommendations**

It is recommended to repeat this study with sample of least of 500 students from the to facilitate analyses using chi-square and ability to split the sample for validity analyses between cultural groups across all stages of change.

It is recommended that contemplation and action stages of change be over sampled to eliminate some of the problems inherent in performing a number of statistical analyses using small, unequal and discrepant stage of change cell size.

It is also recommended that efforts be made to ensure that approximately equal numbers of participants are represented by ethnical groups when recruitment individuals.

To facilitate the recruitment processes, it is recommended that future studies use incentives such as prizes or other tangible benefits to facilitate recruitment efforts.

The present study used a cross sectional design that while useful, provides information of fruits and vegetables frozen over time. Thus, it is recommended that future studies use a longitudinal design that will help to better understand the processes of change use across fruit and vegetable eating behavior.

A more precise measurement to determine fruit and vegetable intake, such as a food frequency questionnaire, should be added to the algorithm to be an objective measure of a person's stage of change.

Cultural variability such as those reported in this study suggests the necessity of developing culturally specific nutrition education materials.

Given this empirical evidence for a relationship between stages of change and cultural/ethnic group, future research involving diverse cultural/ethnic groups should utilize cultural/ethnic group category as a criterion for sample selection, instead of just demographic variables.

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## **APPENDIX A**

### **RECRUITMENT AND COVER LETTER**



Department of Food Science  
and Human Nutrition

Fort Collins, Colorado 80523-1571  
(970) 491-6535  
FAX: (970) 491-7252

Dear College Student:

I am a doctoral student in Nutrition Science at Colorado State University. I am requesting your participation in my research on consumption of fruits and vegetables behavior for my dissertation. Part of my study is to develop and to test a survey that deals with practices of eating fruits and vegetables. Your participation would involve responding to the enclosed survey. The survey contains behavioral practices, dietary issues that deal with knowledge, attitudes, and intentions related with your habits of eating fruits and vegetables, and questions about yourself. You are eligible to participate in this study if you are over 18 years and under 60 years.

The information supplied by your participation in this research study will provide important information about dietary practices. This will help nutritionists plan better ways to help people consume fruits and vegetables.

I realize that you are a busy person. If you would be willing to take the time to complete the questions in this survey, I would be most grateful. It should take approximately 20 minutes to complete all the items in the survey. All of the information from you as an individual will be kept completely confidential. You will be identified by number only. I would like to emphasize that your participation in this study is voluntary. If you choose to participate in this study, please complete all of the questions on the survey and mail them back to me in the self-addressed envelope provided.

If you have any questions, please contact me any time by phone at 491-8802. My adviser is Dr. Jennifer Anderson in the Department of Food Science and Human Nutrition. She also may be contacted by phone at 491-7334 if you have any further questions.

Thank you for your time and consideration.

Sincerely,

A handwritten signature in cursive script that reads "Maria Oliveira".

Maria Oliveira, M.S., Ph.D. Candidate  
Department of Food Science and Human Nutrition  
College of Applied Human Sciences

## **APPENDIX B**

### **SURVEY FOR NORTH AMERICAN CULTURAL/ETHNIC GROUP**

Code #: \_\_\_\_\_

## SURVEY ABOUT FRUITS AND VEGETABLES

This survey will ask you questions related with your fruits and vegetables eating behavior. It is divide into four parts. There are no right or wrong answers. If you are not sure about an item, just answer to the best of your ability. Please complete the entire survey. Thank you for your participation.

PART A: This part consists of questions about your fruit and vegetable consumption. Please keep in mind that:

|                                                                                                                              |                                                                     |
|------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| 1 serving of <u>vegetables</u> = 1 cup leafy raw vegetables;<br>½ cup cooked or raw vegetables or<br>¾ cup (vegetable) juice | 1 serving of <u>fruits</u> = medium piece or<br>¾ cup (fruit) juice |
|------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|

Please circle the appropriate answer

1. How many servings of fruits and vegetables do you eat each day?

0      1-2      3-4      5-6      7-8      9-10      11 or more

2. About how long have you been eating this number of daily servings of fruits and vegetables?

Less than one month      1 - 3 months      4 - 6 months      More than 6 months

3. Are you seriously thinking about eating more servings of fruits and vegetables starting sometimes in the next six months?

Yes (go to question 4)      No (skip question 4)

4. Are you planning to eat more servings of fruits and vegetables during the next month?

Yes      No

**PART B:** The following part of the survey, are about things people do when they are trying to change their diets. As you read the statements below, think of any similar experiences you may currently be having or have had in the past month. Then, circle the number that shows how often you made use of the thought, experience or situations described by each statement with regard to your fruits and vegetables (F&V) eating habits.

|                                                                        |
|------------------------------------------------------------------------|
| 1 = Never   2 = Seldom   3 = Occasionally   4 = Often   5 = Repeatedly |
|------------------------------------------------------------------------|

Never   Seldom   Occasionally   Often   Repeatedly

|                                                                                                         |   |   |   |   |   |
|---------------------------------------------------------------------------------------------------------|---|---|---|---|---|
| 1. I stop to think about how many people would benefit from having a diet that includes F&V             | 1 | 2 | 3 | 4 | 5 |
| 2. I try to eat with people who are also working on eating more F&V                                     | 1 | 2 | 3 | 4 | 5 |
| 3. I associate with people who help me eat more F&V                                                     | 1 | 2 | 3 | 4 | 5 |
| 4. I believe that if I try hard enough I can eat more F&V                                               | 1 | 2 | 3 | 4 | 5 |
| 5. I think about the need for more people to understand the importance of a high F&V diet               | 1 | 2 | 3 | 4 | 5 |
| 6. I pay close attention to television programs and advertisements about diets rich in F&V              | 1 | 2 | 3 | 4 | 5 |
| 7. I think if I eat F&V it will prevent me from becoming a burden to the health care system             | 1 | 2 | 3 | 4 | 5 |
| 8. I do something nice for myself when I make efforts to eat F&V                                        | 1 | 2 | 3 | 4 | 5 |
| 9. I react emotionally to warnings about not eating F&V                                                 | 1 | 2 | 3 | 4 | 5 |
| 10. I look for information on how to eat more F&V                                                       | 1 | 2 | 3 | 4 | 5 |
| 11. I spend time with people who encourage me to eat F&V                                                | 1 | 2 | 3 | 4 | 5 |
| 12. I think about information in articles / advertisements on how to eat more F&V                       | 1 | 2 | 3 | 4 | 5 |
| 13. I try to ignore some programs and events that don't promote F&V eating habits                       | 1 | 2 | 3 | 4 | 5 |
| 14. Cancer statistics incidence related to poor dietetics habits such as low F&V diet makes me feel sad | 1 | 2 | 3 | 4 | 5 |
| 15. I read about eating more F&V                                                                        | 1 | 2 | 3 | 4 | 5 |
| 16. If I eat F&V, I find that my intestinal function becomes better                                     | 1 | 2 | 3 | 4 | 5 |
| 17. I reward myself when I eat F&V                                                                      | 1 | 2 | 3 | 4 | 5 |
| 18. I try to think of eating F&V as a good way to get nutrients that my body needs                      | 1 | 2 | 3 | 4 | 5 |



|                                                                                                                                                              | Never | Seldom | Occasionally | Often | Repeatedly |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|--------------|-------|------------|
| 19. I try to put posters / pictures of F&V at home to remind me to eat them                                                                                  | 1     | 2      | 3            | 4     | 5          |
| 20. I tell myself I can choose to eat more F&V                                                                                                               | 1     | 2      | 3            | 4     | 5          |
| 21. I realize that if I don't eat F&V, I may get ill and be a problem to people close to me                                                                  | 1     | 2      | 3            | 4     | 5          |
| 22. I have someone who helps me prepare F&V                                                                                                                  | 1     | 2      | 3            | 4     | 5          |
| 23. I avoid restaurants that don't offer F&V on the menu.                                                                                                    | 1     | 2      | 3            | 4     | 5          |
| 24. Rather than viewing eating F&V as simply another rule to follow, I try to do it as my special opportunity to avoid fat                                   | 1     | 2      | 3            | 4     | 5          |
| 25. I make commitments to decrease my health risks by eating F&V                                                                                             | 1     | 2      | 3            | 4     | 5          |
| 26. I find that a good way to eat F&V is not to buy sweets                                                                                                   | 1     | 2      | 3            | 4     | 5          |
| 27. It upsets me to remember studies about illnesses associated with not eating F&V                                                                          | 1     | 2      | 3            | 4     | 5          |
| 28. When I am tempted not eat F&V during a meal I try to eat them first                                                                                      | 1     | 2      | 3            | 4     | 5          |
| 29. I try to eat F&V in place of less healthy food                                                                                                           | 1     | 2      | 3            | 4     | 5          |
| 30. I consciously struggle with the issue of not eating at least five servings of F&V a day because it contradicts my view of myself as a responsible person | 1     | 2      | 3            | 4     | 5          |
| 31. I do not feel good when I hear stories about the consequences of not eat enough F&V                                                                      | 1     | 2      | 3            | 4     | 5          |
| 32. Supermarkets are making it easier for consumers to buy a variety of F&V                                                                                  | 1     | 2      | 3            | 4     | 5          |
| 33. Many restaurants now provide more opportunities to eat F&V                                                                                               | 1     | 2      | 3            | 4     | 5          |
| 34. When I realize I have not eaten enough F&V I become concerned about my health                                                                            | 1     | 2      | 3            | 4     | 5          |
| 35. I tend to avoid people who do not eat a healthy diet (rich in F&V)                                                                                       | 1     | 2      | 3            | 4     | 5          |
| 36. Not eating enough servings of F&V daily goes against my view of myself as healthy person                                                                 | 1     | 2      | 3            | 4     | 5          |
| 37. F&V are more available in cafeterias, schools, work places, and sports events                                                                            | 1     | 2      | 3            | 4     | 5          |
| 38. I reassess the fact that being content with myself includes changing my eating habits to include eating five or more servings of F&V a day               | 1     | 2      | 3            | 4     | 5          |
| 39. I rely on my willpower to get myself to eat more F&V                                                                                                     | 1     | 2      | 3            | 4     | 5          |
| 40. I notice restaurant's menus that give me options to eat a variety of F&V                                                                                 | 1     | 2      | 3            | 4     | 5          |

PART C: These items are about personal characteristics. Please answer the following questions as accurately as possible.

1. Do you now live in a household with children? ☐ Yes ☐ No

2. How many servings of fruits and vegetables do you think a person should eat each day for good health?  
(Please, write a number or 0 in the blank) \_\_\_\_\_

3. What is your college status?

☐ Full-time undergraduate student ☐ Full-time graduate student ☐ Other (Describes) \_\_\_\_\_  
☐ Part-time undergraduate student ☐ Part-time graduate student \_\_\_\_\_

4. When were you born? \_\_\_\_\_(month) / \_\_\_\_\_(day) / \_\_\_\_\_/ (year)

5. Which of the following categories best describes your yearly household income?

☐ Under \$10,000 ☐ \$20,000 - \$24,999  
☐ \$10,000 - \$14,999 ☐ \$25,000 - \$29,000  
☐ \$15,000 - \$19,999 ☐ \$30,000 - \$34,999

6. Which is your cultural / racial / ethnic / group?

☐ American Indian or Alaska Native  
☐ Asian  
☐ Black or African American  
☐ Hispanic or Latino  
☐ Native Hawaiian or Other Pacific Islander  
☐ White

PART D. The next seven questions provide a simple way to know how many servings of fruits and vegetables (F&V) you normally eat. Please put an "x" in box showing how often you ate or drank each of these items of food in the past month.

| Food item                                          | About <u>how often</u> did you eat or drink these foods in the past month? |                     |                    |                    |                    |                |                 |                 |                 |                         |
|----------------------------------------------------|----------------------------------------------------------------------------|---------------------|--------------------|--------------------|--------------------|----------------|-----------------|-----------------|-----------------|-------------------------|
|                                                    | Never                                                                      | 1-3 times per month | 1-2 times per week | 3-4 times per week | 5-6 times per week | 1 time per day | 2 times per day | 3 times per day | 4 times per day | 5 or more times per day |
| 100% Orange juice or grapefruit juice              |                                                                            |                     |                    |                    |                    |                |                 |                 |                 |                         |
| Other 100% fruit juices, not counting fruit drinks |                                                                            |                     |                    |                    |                    |                |                 |                 |                 |                         |
| Green salad with or without other vegetables       |                                                                            |                     |                    |                    |                    |                |                 |                 |                 |                         |
| French fries or fried potatoes                     |                                                                            |                     |                    |                    |                    |                |                 |                 |                 |                         |
| Baked, boiled or mashed potatoes                   |                                                                            |                     |                    |                    |                    |                |                 |                 |                 |                         |

| Food item                                                                                  | About how many <u>servings</u> of these foods did you eat in the past month? |               |              |              |              |           |           |           |           |                   |
|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|---------------|--------------|--------------|--------------|-----------|-----------|-----------|-----------|-------------------|
|                                                                                            | Never                                                                        | 1-3 per month | 1-2 per week | 3-4 per week | 5-6 per week | 1 per day | 2 per day | 3 per day | 4 per day | 5 or more per day |
| About how many servings of <u>vegetables</u> did you eat, not counting salads or potatoes? |                                                                              |               |              |              |              |           |           |           |           |                   |
| About how many servings of <u>fruit</u> did you eat, not counting juices?                  |                                                                              |               |              |              |              |           |           |           |           |                   |

Remember!

1 serving of vegetables = 1 cup leafy raw vegetables;

½ cup cooked or raw vegetables or

¾ cup (vegetable) juice

1 serving of fruits = medium piece or

¾ cup (fruit) juice

*Thank you again for completing this survey!*

## **APPENDIX C**

### **SURVEY FOR LATINO CULTURAL/ETHNIC GROUP**

Code #: \_\_\_\_\_

## SURVEY ABOUT FRUITS AND VEGETABLES

This survey will ask you questions related with your fruits and vegetables eating behavior. It is divide into five parts. There are no right or wrong answers. If you are not sure about an item, just answer to the best of your ability. Please complete the entire survey. Thank you for your participation.

PART A: This part consists of questions about your fruit and vegetable consumption. Please keep in mind that:

|                                                                                                                              |                                                                     |
|------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| 1 serving of <u>vegetables</u> = 1 cup leafy raw vegetables;<br>½ cup cooked or raw vegetables or<br>¾ cup (vegetable) juice | 1 serving of <u>fruits</u> = medium piece or<br>¾ cup (fruit) juice |
|------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|

Please circle the appropriate answer

1. How many servings of fruits and vegetables do you eat each day?

0      1-2      3-4      5-6      7-8      9-10      11 or more

2. About how long have you been eating this number of daily servings of fruits and vegetables?

Less than one month      1 - 3 months      4 - 6 months      More than 6 months

3. Are you seriously thinking about eating more servings of fruits and vegetables starting sometimes in the next six months?

Yes (go to question 4)      No (skip question 4)

4. Are you planning to eat more servings of fruits and vegetables during the next month?

Yes      No

**PART B:** The following part of the survey, are about things people do when they are trying to change their diets. As you read the statements below, think of any similar experiences you may currently be having or have had in the past month. Then, circle the number that shows how often you made use of the thought, experience or situations described by each statement with regard to your fruits and vegetables (F&V) eating habits.

|                                                                        |
|------------------------------------------------------------------------|
| 1 = Never   2 = Seldom   3 = Occasionally   4 = Often   5 = Repeatedly |
|------------------------------------------------------------------------|

Never   Seldom   Occasionally   Often   Repeatedly

|                                                                                                         |   |   |   |   |   |
|---------------------------------------------------------------------------------------------------------|---|---|---|---|---|
| 1. I stop to think about how many people would benefit from having a diet that includes F&V             | 1 | 2 | 3 | 4 | 5 |
| 2. I try to eat with people who are also working on eating more F&V                                     | 1 | 2 | 3 | 4 | 5 |
| 3. I associate with people who help me eat more F&V                                                     | 1 | 2 | 3 | 4 | 5 |
| 4. I believe that if I try hard enough I can eat more F&V                                               | 1 | 2 | 3 | 4 | 5 |
| 5. I think about the need for more people to understand the importance of a high F&V diet               | 1 | 2 | 3 | 4 | 5 |
| 6. I pay close attention to television programs and advertisements about diets rich in F&V              | 1 | 2 | 3 | 4 | 5 |
| 7. I think if I eat F&V it will prevent me from becoming a burden to the health care system             | 1 | 2 | 3 | 4 | 5 |
| 8. I do something nice for myself when I make efforts to eat F&V                                        | 1 | 2 | 3 | 4 | 5 |
| 9. I react emotionally to warnings about not eating F&V                                                 | 1 | 2 | 3 | 4 | 5 |
| 10. I look for information on how to eat more F&V                                                       | 1 | 2 | 3 | 4 | 5 |
| 11. I spend time with people who encourage me to eat F&V                                                | 1 | 2 | 3 | 4 | 5 |
| 12. I think about information in articles / advertisements on how to eat more F&V                       | 1 | 2 | 3 | 4 | 5 |
| 13. I try to ignore some programs and events that don't promote F&V eating habits                       | 1 | 2 | 3 | 4 | 5 |
| 14. Cancer statistics incidence related to poor dietetics habits such as low F&V diet makes me feel sad | 1 | 2 | 3 | 4 | 5 |
| 15. I read about eating more F&V                                                                        | 1 | 2 | 3 | 4 | 5 |
| 16. If I eat F&V, I find that my intestinal function becomes better                                     | 1 | 2 | 3 | 4 | 5 |
| 17. I reward myself when I eat F&V                                                                      | 1 | 2 | 3 | 4 | 5 |
| 18. I try to think of eating F&V as a good way to get nutrients that my body needs                      | 1 | 2 | 3 | 4 | 5 |

|                                                                                                                                                              | Never | Seldom | Occasionally | Often | Repeatedly |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|--------------|-------|------------|
| 19. I try to put posters / pictures of F&V at home to remind me to eat them                                                                                  | 1     | 2      | 3            | 4     | 5          |
| 20. I tell myself I can choose to eat more F&V                                                                                                               | 1     | 2      | 3            | 4     | 5          |
| 21. I realize that if I don't eat F&V, I may get ill and be a problem to people close to me                                                                  | 1     | 2      | 3            | 4     | 5          |
| 22. I have someone who helps me prepare F&V                                                                                                                  | 1     | 2      | 3            | 4     | 5          |
| 23. I avoid restaurants that don't offer F&V on the menu.                                                                                                    | 1     | 2      | 3            | 4     | 5          |
| 24. Rather than viewing eating F&V as simply another rule to follow, I try to do it as my special opportunity to avoid fat                                   | 1     | 2      | 3            | 4     | 5          |
| 25. I make commitments to decrease my health risks by eating F&V                                                                                             | 1     | 2      | 3            | 4     | 5          |
| 26. I find that a good way to eat F&V is not to buy sweets                                                                                                   | 1     | 2      | 3            | 4     | 5          |
| 27. It upsets me to remember studies about illnesses associated with not eating F&V                                                                          | 1     | 2      | 3            | 4     | 5          |
| 28. When I am tempted not eat F&V during a meal I try to eat them first                                                                                      | 1     | 2      | 3            | 4     | 5          |
| 29. I try to eat F&V in place of less healthy food                                                                                                           | 1     | 2      | 3            | 4     | 5          |
| 30. I consciously struggle with the issue of not eating at least five servings of F&V a day because it contradicts my view of myself as a responsible person | 1     | 2      | 3            | 4     | 5          |
| 31. I do not feel good when I hear stories about the consequences of not eat enough F&V                                                                      | 1     | 2      | 3            | 4     | 5          |
| 32. Supermarkets are making it easier for consumers to buy a variety of F&V                                                                                  | 1     | 2      | 3            | 4     | 5          |
| 33. Many restaurants now provide more opportunities to eat F&V                                                                                               | 1     | 2      | 3            | 4     | 5          |
| 34. When I realize I have not eaten enough F&V I become concerned about my health                                                                            | 1     | 2      | 3            | 4     | 5          |
| 35. I tend to avoid people who do not eat a healthy diet (rich in F&V)                                                                                       | 1     | 2      | 3            | 4     | 5          |
| 36. Not eating enough servings of F&V daily goes against my view of myself as healthy person                                                                 | 1     | 2      | 3            | 4     | 5          |
| 37. F&V are more available in cafeterias, schools, work places, and sports events                                                                            | 1     | 2      | 3            | 4     | 5          |
| 38. I reassess the fact that being content with myself includes changing my eating habits to include eating five or more servings of F&V a day               | 1     | 2      | 3            | 4     | 5          |
| 39. I rely on my willpower to get myself to eat more F&V                                                                                                     | 1     | 2      | 3            | 4     | 5          |
| 40. I notice restaurant's menus that give me options to eat a variety of F&V                                                                                 | 1     | 2      | 3            | 4     | 5          |

PART C: These items are about personal characteristics. Please answer the following questions as accurately as possible.

1. Do you now live in a household with children? ☐ Yes ☐ No
2. How many servings of fruits and vegetables do you think a person should eat each day for good health?  
(Please, write a number or 0 in the blank) \_\_\_\_\_
3. What is your college status?  
☐ Full-time undergraduate student ☐ Full-time graduate student ☐ Other (Describes) \_\_\_\_\_  
☐ Part-time undergraduate student ☐ Part-time graduate student \_\_\_\_\_
4. When were you born? \_\_\_\_\_(month) / \_\_\_\_\_(day) / \_\_\_\_\_/ (year)
5. Which of the following categories best describes your yearly household income?  
☐ Under \$10,000 ☐ \$20,000 - \$24,999  
☐ \$10,000 - \$14,999 ☐ \$25,000 - \$29,000  
☐ \$15,000 - \$19,999 ☐ \$30,000 - \$34,999
6. How long have you being living in the United States? \_\_\_\_\_ Year (s) and \_\_\_\_\_ month (s)
7. Since you came to the United States your consumption of fruits has  
☐ Increased ☐ Decreased ☐ It is the same
8. Since you came to the United States your consumption of vegetables has been  
☐ Increased ☐ Decreased ☐ It is the same

PART D: These items have the purpose of collecting information related to your language and food. Please, circle the one answer, which best describes you.

1. What language can you speak?
  1. Latin origin only (for example, Portuguese, Spanish, etc)
  2. Mostly Latin origin, some English
  3. Latin origin and English about equally well (bilingual)
  4. Mostly English, some Latin origin
  5. Only English
2. What language do you prefer?
  1. Latin origin only (for example, Portuguese, Spanish, etc)
  2. Mostly Latin origin, some English
  3. Latin origin and English about equally well (bilingual)
  4. Mostly English, some Latin origin
  5. Only English



3. Do you read

1. only a Latin origin language (for example, Portuguese, Spanish, etc)
2. a Latin origin language better than English
3. both Latin origin and English equally well
4. English better than a Latin origin language
5. only English

4. Do you write

1. only a Latin origin language (for example, Portuguese, Spanish, etc)
2. a Latin origin language better than English
3. both Latin origin and English equally well
4. English better than a Latin origin language
5. only English

5. In what language do you think?

1. Only in Latin origin language
2. Mostly in Latin origin language
3. Equally in English and Latin origin language
4. Mostly in English
5. Only in English

6. What is your food preference at home?

1. Exclusively Latino/Hispanic food
2. Mostly Latino/Hispanic, some American
3. About equally Latino/Hispanic and American
4. Mostly American food
5. Exclusively American food

7. What is your food preference in restaurants?

1. Exclusively Latino/Hispanic food, some American
2. Mostly Latino/Hispanic food, some American
3. About equally Latino/Hispanic and American
4. Mostly American food
5. Exclusively American food

8. How would you rate yourself?

1. Very Latino/Hispanic
2. Mostly Latino/Hispanic
3. Bicultural
4. Mostly Westernized
6. Very Westernized

PART E. The next seven questions provide a simple way to know how many servings of fruits and vegetables (F&V) you normally eat. Please put an "x" in box showing how often you ate or drank each of these items of food in the past month.

| Food item                                          | About <u>how often</u> did you eat or drink these foods in the past month? |                              |                             |                             |                             |                         |                          |                          |                          |                                     |
|----------------------------------------------------|----------------------------------------------------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-------------------------------------|
|                                                    | Never                                                                      | 1-3<br>times<br>per<br>month | 1-2<br>times<br>per<br>week | 3-4<br>times<br>per<br>week | 5-6<br>times<br>per<br>week | 1<br>time<br>per<br>day | 2<br>times<br>per<br>day | 3<br>times<br>per<br>day | 4<br>times<br>per<br>day | 5 or<br>more<br>times<br>per<br>day |
| 100% Orange juice or grapefruit juice              |                                                                            |                              |                             |                             |                             |                         |                          |                          |                          |                                     |
| Other 100% fruit juices, not counting fruit drinks |                                                                            |                              |                             |                             |                             |                         |                          |                          |                          |                                     |
| Green salad with or without other vegetables       |                                                                            |                              |                             |                             |                             |                         |                          |                          |                          |                                     |
| French fries or fried potatoes                     |                                                                            |                              |                             |                             |                             |                         |                          |                          |                          |                                     |
| Baked, boiled or mashed potatoes                   |                                                                            |                              |                             |                             |                             |                         |                          |                          |                          |                                     |

| Food item                                                                                  | About how many <u>servings</u> of these foods did you eat in the past month? |                     |                    |                    |                    |                 |                 |                 |                 |                            |
|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|---------------------|--------------------|--------------------|--------------------|-----------------|-----------------|-----------------|-----------------|----------------------------|
|                                                                                            | Never                                                                        | 1-3<br>per<br>month | 1-2<br>per<br>week | 3-4<br>per<br>week | 5-6<br>per<br>week | 1<br>per<br>day | 2<br>per<br>day | 3<br>per<br>day | 4<br>per<br>day | 5 or<br>more<br>per<br>day |
| About how many servings of <u>vegetables</u> did you eat, not counting salads or potatoes? |                                                                              |                     |                    |                    |                    |                 |                 |                 |                 |                            |
| About how many servings of <u>fruit</u> did you eat, not counting juices?                  |                                                                              |                     |                    |                    |                    |                 |                 |                 |                 |                            |

Remember!

|                                                                                                                              |                                                                     |
|------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| 1 serving of <u>vegetables</u> = 1 cup leafy raw vegetables;<br>½ cup cooked or raw vegetables or<br>¾ cup (vegetable) juice | 1 serving of <u>fruits</u> = medium piece or<br>¾ cup (fruit) juice |
|------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|

*Thank you again for completing this survey!*

## **APPENDIX D**

### **SURVEY FOR ASIAN CULTURAL/ETHNIC GROUP**

Code #: \_\_\_\_\_

## SURVEY ABOUT FRUITS AND VEGETABLES

This survey will ask you questions related with your fruits and vegetables eating behavior. It is divide into five parts. There are no right or wrong answers. If you are not sure about an item, just answer to the best of your ability. Please complete the entire survey. Thank you for your participation.

PART A: This part consists of questions about your fruit and vegetable consumption. Please keep in mind that:

|                                                                                                                              |                                                                     |
|------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| 1 serving of <u>vegetables</u> = 1 cup leafy raw vegetables;<br>½ cup cooked or raw vegetables or<br>¾ cup (vegetable) juice | 1 serving of <u>fruits</u> = medium piece or<br>¾ cup (fruit) juice |
|------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|

Please circle the appropriate answer

1. How many servings of fruits and vegetables do you eat each day?

0      1-2      3-4      5-6      7-8      9-10      11 or more

2. About how long have you been eating this number of daily servings of fruits and vegetables?

Less than one month      1-3 months      4-6 months      More than 6 months

3. Are you seriously thinking about eating more servings of fruits and vegetables starting sometimes in the next six months?

Yes (go to question 4)

No (skip question 4)

4. Are you planning to eat more servings of fruits and vegetables during the next month?

Yes

No

PART B: The following part of the survey, are about things people do when they are trying to change their diets. As you read the statements below, think of any similar experiences you may currently be having or have had in the past month. Then, circle the number that shows how often you made use of the thought, experience or situations described by each statement with regard to your fruits and vegetables (F&V) eating habits.

|                                                                        |
|------------------------------------------------------------------------|
| 1 = Never   2 = Seldom   3 = Occasionally   4 = Often   5 = Repeatedly |
|------------------------------------------------------------------------|

|                                                                                                         | Never | Seldom | Occasionally | Often | Repeatedly |
|---------------------------------------------------------------------------------------------------------|-------|--------|--------------|-------|------------|
| 1. I stop to think about how many people would benefit from having a diet that includes F&V             | 1     | 2      | 3            | 4     | 5          |
| 2. I try to eat with people who are also working on eating more F&V                                     | 1     | 2      | 3            | 4     | 5          |
| 3. I associate with people who help me eat more F&V                                                     | 1     | 2      | 3            | 4     | 5          |
| 4. I believe that if I try hard enough I can eat more F&V                                               | 1     | 2      | 3            | 4     | 5          |
| 5. I think about the need for more people to understand the importance of a high F&V diet               | 1     | 2      | 3            | 4     | 5          |
| 6. I pay close attention to television programs and advertisements about diets rich in F&V              | 1     | 2      | 3            | 4     | 5          |
| 7. I think if I eat F&V it will prevent me from becoming a burden to the health care system             | 1     | 2      | 3            | 4     | 5          |
| 8. I do something nice for myself when I make efforts to eat F&V                                        | 1     | 2      | 3            | 4     | 5          |
| 9. I react emotionally to warnings about not eating F&V                                                 | 1     | 2      | 3            | 4     | 5          |
| 10. I look for information on how to eat more F&V                                                       | 1     | 2      | 3            | 4     | 5          |
| 11. I spend time with people who encourage me to eat F&V                                                | 1     | 2      | 3            | 4     | 5          |
| 12. I think about information in articles / advertisements on how to eat more F&V                       | 1     | 2      | 3            | 4     | 5          |
| 13. I try to ignore some programs and events that don't promote F&V eating habits                       | 1     | 2      | 3            | 4     | 5          |
| 14. Cancer statistics incidence related to poor dietetics habits such as low F&V diet makes me feel sad | 1     | 2      | 3            | 4     | 5          |
| 15. I read about eating more F&V                                                                        | 1     | 2      | 3            | 4     | 5          |
| 16. If I eat F&V, I find that my intestinal function becomes better                                     | 1     | 2      | 3            | 4     | 5          |
| 17. I reward myself when I eat F&V                                                                      | 1     | 2      | 3            | 4     | 5          |
| 18. I try to think of eating F&V as a good way to get nutrients that my body needs                      | 1     | 2      | 3            | 4     | 5          |

|                                                                                                                                                              | Never | Seldom | Occasionally | Often | Repeatedly |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|--------------|-------|------------|
| 19. I try to put posters / pictures of F&V at home to remind me to eat them                                                                                  | 1     | 2      | 3            | 4     | 5          |
| 20. I tell myself I can choose to eat more F&V                                                                                                               | 1     | 2      | 3            | 4     | 5          |
| 21. I realize that if I don't eat F&V, I may get ill and be a problem to people close to me                                                                  | 1     | 2      | 3            | 4     | 5          |
| 22. I have someone who helps me prepare F&V                                                                                                                  | 1     | 2      | 3            | 4     | 5          |
| 23. I avoid restaurants that don't offer F&V on the menu.                                                                                                    | 1     | 2      | 3            | 4     | 5          |
| 24. Rather than viewing eating F&V as simply another rule to follow, I try to do it as my special opportunity to avoid fat                                   | 1     | 2      | 3            | 4     | 5          |
| 25. I make commitments to decrease my health risks by eating F&V                                                                                             | 1     | 2      | 3            | 4     | 5          |
| 26. I find that a good way to eat F&V is not to buy sweets                                                                                                   | 1     | 2      | 3            | 4     | 5          |
| 27. It upsets me to remember studies about illnesses associated with not eating F&V                                                                          | 1     | 2      | 3            | 4     | 5          |
| 28. When I am tempted not eat F&V during a meal I try to eat them first                                                                                      | 1     | 2      | 3            | 4     | 5          |
| 29. I try to eat F&V in place of less healthy food                                                                                                           | 1     | 2      | 3            | 4     | 5          |
| 30. I consciously struggle with the issue of not eating at least five servings of F&V a day because it contradicts my view of myself as a responsible person | 1     | 2      | 3            | 4     | 5          |
| 31. I do not feel good when I hear stories about the consequences of not eat enough F&V                                                                      | 1     | 2      | 3            | 4     | 5          |
| 32. Supermarkets are making it easier for consumers to buy a variety of F&V                                                                                  | 1     | 2      | 3            | 4     | 5          |
| 33. Many restaurants now provide more opportunities to eat F&V                                                                                               | 1     | 2      | 3            | 4     | 5          |
| 34. When I realize I have not eaten enough F&V I become concerned about my health                                                                            | 1     | 2      | 3            | 4     | 5          |
| 35. I tend to avoid people who do not eat a healthy diet (rich in F&V)                                                                                       | 1     | 2      | 3            | 4     | 5          |
| 36. Not eating enough servings of F&V daily goes against my view of myself as healthy person                                                                 | 1     | 2      | 3            | 4     | 5          |
| 37. F&V are more available in cafeterias, schools, work places, and sports events                                                                            | 1     | 2      | 3            | 4     | 5          |
| 38. I reassess the fact that being content with myself includes changing my eating habits to include eating five or more servings of F&V a day               | 1     | 2      | 3            | 4     | 5          |
| 39. I rely on my willpower to get myself to eat more F&V                                                                                                     | 1     | 2      | 3            | 4     | 5          |
| 40. I notice restaurant's menus that give me options to eat a variety of F&V                                                                                 | 1     | 2      | 3            | 4     | 5          |

PART C: These items are about personal characteristics. Please answer the following questions as accurately as possible.

1. Do you now live in a household with children? ☐ Yes ☐ No
2. How many servings of fruits and vegetables do you think a person should eat each day for good health?  
(Please, write a number or 0 in the blank) \_\_\_\_\_
3. What is your college status?  
☐ Full-time undergraduate student ☐ Full-time graduate student ☐ Other (Describes) \_\_\_\_\_  
☐ Part-time undergraduate student ☐ Part-time graduate student \_\_\_\_\_
4. When were you born? \_\_\_\_\_ (month) / \_\_\_\_\_ (day) / \_\_\_\_\_ (year)
5. Which of the following categories best describes your yearly household income?  
☐ Under \$10,000 ☐ \$20,000 - \$24,999  
☐ \$10,000 - \$14,999 ☐ \$25,000 - \$29,000  
☐ \$15,000 - \$19,999 ☐ \$30,000 - \$34,999
6. How long have you been living in the United States? \_\_\_\_\_ Year (s) and \_\_\_\_\_ month (s)
7. Since you came to the United States your consumption of fruits has  
☐ Increased ☐ Decreased ☐ It is the same
8. Since you came to the United States your consumption of vegetables has been  
☐ Increased ☐ Decreased ☐ It is the same

PART D: These items have the purpose of collecting information related to your language and food. Please, circle the one answer, which best describes you.

1. What language can you speak?
  1. Asian only (for example, Chinese, Japanese, Korean, Vietnamese, etc)
  2. Mostly Asian, some English
  3. Asian and English about equally well (bilingual)
  4. Mostly English, some Asian
  5. Only English
2. What language do you prefer?
  1. Asian only (for example, Chinese, Japanese, Korean, Vietnamese, etc)
  2. Mostly Asian, some English
  3. Asian and English about equally well (bilingual)
  4. Mostly English, some Asian
  5. Only English

3. Do you read

1. only a Asian language (for example, Chinese, Japanese, Korean, Vietnamese, etc)
2. a Asian language better than English
3. both Asian and English equally well
4. English better than a Asian language
5. only English

4. Do you write

1. only a Asian language (for example, Chinese, Japanese, Korean, Vietnamese, etc)
2. a Asian language better than English
3. both Asian and English equally well
4. English better than a Asian language
5. only English

5. In what language do you think?

1. Only in Asian language
2. Mostly in Asian language
3. Equally in English and Asian language
4. Mostly in English
5. Only in English

6. What is your food preference at home?

1. Exclusively Asian food
2. Mostly Asian food, some American
3. About equally Asian and American
4. Mostly American food
5. Exclusively American food

7. What is your food preference in restaurants?

1. Exclusively Asian food, some American
2. Mostly Asian food, some American
3. About equally Asian and American
4. Mostly American food
5. Exclusively American food

8. How would you rate yourself?

1. Very Asian
2. Mostly Asian
3. Bicultural
4. Mostly Westernized
6. Very Westernized



**PART E.** The next seven questions provide a simple way to know how many servings of fruits and vegetables (F&V) you normally eat. Please put an "x" in box showing how often you ate or drank each of these items of food in the past month.

[illegible][illegible]

**Remember!**

|                                                                                                                              |                                                                     |
|------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| 1 serving of <u>vegetables</u> = 1 cup leafy raw vegetables;<br>½ cup cooked or raw vegetables or<br>¾ cup (vegetable) juice | 1 serving of <u>fruits</u> = medium piece or<br>¾ cup (fruit) juice |
|------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|

*Thank you again for completing this survey!*

## **APPENDIX E**

### **COMPONENTS OF THE PROCESSES OF CHANGE FOR FRUIT AND VEGETABLE EATING BEHAVIOR SCALES**

**Table E.1.** Results of Principal Component Analysis with Loadings for Consciousness Raising Process of Change.

| Consciousness Raising                                                                      | Loadings |     |
|--------------------------------------------------------------------------------------------|----------|-----|
| Q20 I look for information related with to eating F&V on daily basis                       | .84      |     |
| Q9 I pay close attention to television programs and advertisements about diets rich in F&V | .71      | .31 |
| Q37 I spent time with people who encourage me to eat F&V                                   | .70      | .43 |
| Q33 I look for information on how to eat more F&V                                          | .69      | .39 |
| Q44 I read about eating more F&V                                                           | .68      | .54 |
| Q6 I pay attention to articles and other information I think about eating F&V              | .58      |     |
| Q62 I try to learn more about why F&V are good for me                                      | .47      | .85 |
| Q59 I recall information people had personally given me on the benefits of eating F&V      |          | .83 |
| Q47 I read about eating F&V in attempt to learn about then                                 | .50      | .59 |
| Q72 I think about what I see on TV in regard to the health benefits of eating F&V          | .53      | .58 |

**TABLE E.2.** Results of Principal Component Analysis with Loadings for Dramatic Relief Process of Change.

| <b>Dramatic Relief</b> |                                                                                                     | <b>Loadings</b> |     |
|------------------------|-----------------------------------------------------------------------------------------------------|-----------------|-----|
| Q42                    | Remembering studies about illness associated with not eating enough F&V upsets me                   | .85             |     |
| Q73                    | It upsets me to remember studies about illnesses associated with not eating F&V                     | .76             | .30 |
| Q43                    | Cancer statistics incidence related to poor dietetics habits such as low F&V diet makes me feel sad | .75             | .40 |
| Q31                    | I react emotionally to warnings about not eating F&V                                                | .71             |     |
| Q21                    | I look for information related to eating F&V on daily basis                                         | .69             | .58 |
| Q86                    | I do not feel good when I hear stories about the consequences of not eat enough F&V                 | .63             | .58 |
| Q15                    | I am afraid of the consequences to my health if I do not eat F&V                                    |                 | .89 |
| Q90                    | I get upset when I realize that people that I love could have better health if they eat F&V         | .41             | .72 |
| Q11                    | I get upset when I see people close to me who could benefit from eating F&V but chose not eat them  | .31             | .50 |

**Table E.3.** Results of Principal Component Analysis with Loadings for Environment Reevaluation Process of Change.

| <b>Environment Reevaluation</b> |                                                                                                                | <b>Loadings</b> |     |
|---------------------------------|----------------------------------------------------------------------------------------------------------------|-----------------|-----|
| Q13                             | I think if I eat F&V it will prevent me from becoming a burden to the health care system                       | .83             | .31 |
| Q7                              | I think about the need for more people to understand the importance of high F&V diet                           | .82             | .31 |
| Q1                              | I stop to think about how many people would benefit from having a diet that includes F&V                       | .80             |     |
| Q61                             | I realize that if I don't eat F&V, I may get ill and be a problem to people close to me                        | .45             |     |
| Q35                             | Eating five or more servings fo F&V a day can make me a positive role model for others                         |                 | .40 |
| Q80                             | Some of the people close to me might eat F&V if I did                                                          | .40             | .71 |
| Q100                            | I am considering the belief that my adoption of a diet that includes F&V might influence others to do the same |                 | .68 |
| Q45                             | Health care costs could be reduced if more people ate more F&V                                                 |                 | .61 |

**Table E.4.** Results of Principal Component Analysis with Loadings for Self-reevaluation Process of Change.

| Self-reevaluation                                                                                                                                            | Loadings |     |     |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----|-----|-----|
| Q78 I consciously struggle with the issue of not eating at least five servings of F&V a day because it contradicts my view of myself as a responsible person | .77      |     |     |     |
| Q89 Not eating enough servings of F&V daily goes against my view of myself as healthy person                                                                 | .75      | .31 |     |     |
| Q75 I assess my self-concept in terms of the foods I eat                                                                                                     | .71      |     |     |     |
| Q94 I reassess the fact that being content with myself includes changing my eating habits to include eating five or more servings of F&V a day               | .66      | .51 |     |     |
| Q84 When I realize I have not eaten enough F&V I become concerned about my health                                                                            | .65      | .37 |     |     |
| Q30 I judge myself as wrong when I don't eat enough F&V                                                                                                      | .64      |     |     | .47 |
| Q91 Not eating enough F&V in my diet goes against my view of myself as a healthy person                                                                      | .57      | .44 |     |     |
| Q85 I think that eating enough F&V will make me a healthier person                                                                                           |          | .83 |     |     |
| Q69 I think about unhealthy foods I eat                                                                                                                      |          | .81 |     |     |
| Q93 I think I am healthier when I eat F&V                                                                                                                    | .32      | .80 | .89 |     |
| Q40 I reevaluate whether I am using F&V in my recipes                                                                                                        |          |     | .87 |     |
| Q56 My habits of not eating F&V daily are inadequate                                                                                                         |          |     |     | .80 |
| Q16 I have assessed that I can improve my diet by eating more F&V                                                                                            |          | .33 |     | .56 |

**Table E.5.** Results of Principal Component Analysis with Loadings for Social Liberation Process of Change.

| Social Liberation                                                                 | Loadings |     |
|-----------------------------------------------------------------------------------|----------|-----|
| Q41 I find society more supportive of F&V availability                            | .81      |     |
| Q57 I find society changing in ways that make it easier for me to eat more F&V    | .81      |     |
| Q10 I find society change in ways that make it easier for me to eat more F&V      | .76      |     |
| Q97 Health-related organizations now encourage more use of F&V in our society     | .67      |     |
| Q83 Many restaurants now provide more opportunities to eat F&V                    |          | .88 |
| Q82 Supermarkets are making it easier for consumers to buy a variety of F&V       |          | .84 |
| Q98 I notice restaurant's menus that give me options to eat a variety of F&V      |          | .83 |
| Q92 F&V are more available in cafeterias, schools, work places, and sports events | .45      | .56 |

**Table E.6.** Results of Principal Component Analysis with Loadings for Self-liberation Process of Change.

| <b>Self-liberation</b>                                                | <b>Loadings</b> |     |
|-----------------------------------------------------------------------|-----------------|-----|
| Q5 I believe that if I try hard enough I can eat more F&V             | .78             |     |
| Q96 I rely on my willpower to get myself to eat more F&V              | .75             |     |
| Q58 I tell myself I can chose to eat more F&V                         | .73             | .33 |
| Q51 I talk myself into eating more F&V                                | .57             | .51 |
| Q60 I believe that I can eat five or more servings of F&V per day     |                 | .84 |
| Q28 I tell myself I an able to eat five or more servings of F&V a day |                 | .60 |
| Q70 I make commitments to decrease my health risks to eating F&V      | .47             | .57 |



**Table E.7.** Results of Principal Component Analysis with Loadings for Reinforcement Management Process of Change.

| Reinforcement Management                                                                               | Loadings |     |
|--------------------------------------------------------------------------------------------------------|----------|-----|
| Q5 I believe that if I try hard enough I can eat more F&V                                              | .81      |     |
| Q53 I try to think of eating F&V as a good way to get nutrients that my body needs                     | .76      |     |
| Q14 I do something nice for myself when I make efforts to eat F&V                                      | .68      | .31 |
| Q24 When I eat F&V, I tell myself that I am being good to myself by taking care of my body in this way | .67      |     |
| Q52 I reward myself when I eat F&V                                                                     | .66      | .35 |
| Q26 I expect other people to praise me when I eat F&V                                                  |          | .88 |
| Q65 My family praises me for eating F&V                                                                |          | .83 |

**Table E.8.** Results of Principal Component Analysis with Loadings for Helping Relationship Process of Change.

| Helping Relationship |                                                                          | Loadings |     |
|----------------------|--------------------------------------------------------------------------|----------|-----|
| Q3                   | I associate with people who help me eat F&V                              | .89      |     |
| Q2                   | I try to eat with people who are also working on eating more F&V         | .85      |     |
| Q36                  | I spend time with people who encourage me to eat F&V                     | .81      | .31 |
| Q66                  | I have someone who helps me prepare F&V                                  | .75      | .40 |
| Q48                  | I have someone who listens when I need to talk about changing what I eat | .60      |     |
| Q22                  | I have someone I can rely on to support my decision to eat more F&V      | .50      | .46 |
| Q12                  | My family or friends encourage me to eat F&V                             |          | .90 |
| Q87                  | I have someone who encourages me to eat F&V                              | .38      | .77 |
| Q29                  | I talk with friends of family members about eating more F&V              | .44      | .69 |

**Table E.9.** Results of Principal Component Analysis with Loadings for Counter Conditioning Process of Change.

| <b>Counter Conditioning</b> |                                                                                                                        | <b>Loadings</b> |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------|-----------------|
| Q68                         | Rather than viewing eating F&V as simply another rule to follow, I try to do it as my special opportunity to avoid fat | .78             |
| Q71                         | I find that a good way to eat F&V is not to buy sweets                                                                 | .77             |
| Q76                         | When I am tempted not eat F&V during a meal I try to eat them first                                                    | .76             |
| Q77                         | I try to eat F&V in place of less healthy food                                                                         | .76             |
| Q49                         | When I do not want to eat F&V I try to make different recipes to help me eat them                                      | .76             |
| Q81                         | Instead of eat savory snacks; I try to eat F&V                                                                         | .76             |
| Q79                         | I try to give myself alternatives of different kinds of F&V so I will keep eating them                                 | .73             |
| Q95                         | When I am tempted to eat fat rich foods or sweets, I eat F&V                                                           | .72             |
| Q99                         | I try to replace the sweets that I eat with F&V                                                                        | .71             |
| Q55                         | I try to substitute my habits of not buying enough F&V for buying more F&V                                             | .65             |

**Table E.10.** Results of Principal Component Analysis with Loadings for Stimulus Control Process of Change.

| Stimulus Control                                                                                                         | Loadings |     |     |     |     |
|--------------------------------------------------------------------------------------------------------------------------|----------|-----|-----|-----|-----|
| Q38 I try to ignore some programs and events that don't promote F&V eating habits                                        | .87      |     |     |     |     |
| Q34 I have notes at home to remind me of the benefits of eating F&V daily                                                | .87      |     |     |     |     |
| Q54 I try to put posters / pictures of F&V at home to remind me to eat them                                              | .85      |     |     |     |     |
| Q88 I tend to avoid people who do not eat a healthy diet (rich in F&V)                                                   | .71      |     |     | .36 |     |
| Q74 I remove foods from my refrigerator to make room for F&V                                                             | .67      | .51 |     |     |     |
| Q67 I avoid restaurants that don't offer F&V on the menu                                                                 | .52      |     |     | .35 | .45 |
| Q25 I pass by eating places that do not encourage me to eat                                                              | .44      |     | .36 |     |     |
| Q46 I plan my meals in advance so I am able to eat more                                                                  |          | .77 |     |     |     |
| Q19 I bring F&V to work or others places, in case they are not available there                                           |          | .75 |     | .33 |     |
| Q27 I try to remember to have three vegetables with my main meal, and one fruit with my breakfast and another for desert | .33      | .61 | .36 |     |     |
| Q64 I do not go to the bakery court at the supermarket because I need to buy more F&V                                    | .38      | .48 |     | .44 |     |
| Q23 I make F&V available to myself, I will eat them                                                                      |          |     | .85 |     |     |
| Q63 I try to have F&V available at home to remind me to eat them                                                         |          | .37 | .70 |     |     |
| Q32 I buy F&V to help me to follow an F&V eating plan                                                                    | .37      | .43 | .65 |     |     |
| Q18 I avoid snack machine to encourage myself to eat more F&V                                                            |          |     |     | .85 |     |
| Q8 I avoid having savory snacks, chocolates or candies at home as way to eat healthier foods such as F&V                 |          |     |     | .80 |     |
| Q4 I write down F&V in my grocery list as way to avoid not following a fruit and vegetable eating plan                   |          |     |     |     | .79 |