

Interrelationships of Exercise, Nutrition and Smoking Behaviors among College Students

Erica R. Scioli¹, Henry B. Biller², Joseph S. Rossi², Deborah Riebe³, and Anthony Scioli⁴

¹*VA Boston Healthcare System, Research Division*

²*University of Rhode Island, Department of Psychology*

³*University of Rhode Island, Department of Kinesiology*

⁴*Keene State College, Department of Psychology*

Abstract

Obesity and smoking continue to be some of the nation's top health concerns. This study explored the interrelationships among exercise, nutrition and smoking behaviors among young college adults. Undergraduate psychology students (N=612) completed an internet survey that included measures of exercise, nutrition and smoking behaviors. Analyses revealed that more males were exercising while more females were eating nutritiously. The Transtheoretical Model constructs stage of change for exercise and eating nutritiously were significantly related. There were no significant differences found for smoking behavior across the stages of change for exercise or nutrition. Health professionals and researchers should not assume that regular exercise is associated with a non-smoking status or that a non-smoking status is associated with consuming a more nutritious diet. Further research and intervention is strongly urged targeted towards both men and women among the young college adult population.

© 2009 Californian Journal of Health Promotion. All rights reserved.

Keywords: Obesity, Exercise, Nutrition, Smoking, College Students, Transtheoretical Model

Introduction

Literature Review

Although late adolescence is a time period during which individuals are especially preoccupied with their appearance, obesity is increasingly prevalent among young college adults (Mokdad, et al., 2001; Mokdad, Dietz, Bowman, Marks & Koplan, 2000).

Obesity is a consequence of genetic predispositions as well as the interaction of environmental factors and poor eating and exercise habits. Furthermore, the roots of obesity can begin as early as childhood and adolescence (Weiss, 2006). There is a definite need for more research involving young college adults with respect to exercise and nutritional habits that may interfere with the development of a healthy lifestyle.

According to the Centers of Disease Control and Prevention (CDC) and the American College of Sports Medicine (ACSM), moderate physical activity is defined as physical activity at an intensity level that causes light sweating or a slight to moderate increase in breathing or heart rate, and they give the recommendation of thirty minutes, 5 days per week for health (Physical Activity Guidelines for Americans, 2008). Some examples of moderate physical activity include walking at a 3-4.5 mph pace, playing golf, gardening or yard work, swimming for recreation or bicycling. Vigorous physical activity is defined as planned or structured exercise that results in a significant increase in heart rate, and the recommendation for vigorous physical activity is a minimum of twenty minutes, three times per week. Some examples of vigorous physical activity include race walking or walking at a 5 mph pace, engaging in

heavy yard work, participating in high impact aerobic dancing, swimming continuous laps, scuba diving or bicycling uphill.

It is well documented that participation in vigorous activity provides health benefits such as a reduction in risk for chronic disease and premature mortality as well as enhanced physical fitness. Regular moderate activity has more recently been recognized as providing overall health benefits such as greater protection from the development of chronic illness and adverse health consequences (McCormack & Giles-Corti, 2004).

Among college students, consistent exercise is associated with increased fitness, self-esteem, ability to cope with stress and improved mood and anxiety (Plante, Gores & Brecht, 2007; Maltby & Day, 2001).

Men and women often exercise for different reasons. Women are more likely to exercise because of concerns with their weight and general appearance while men are more likely to engage in fitness-related activities because of concerns for their fitness, performance, competition and social recognition (Kilpatrick, Hebert & Bartholomew, 2005). Such extrinsic motives for exercise can lead to exercise overuse. Therefore, it is important to acknowledge that exercise overuse can lead to staleness, burnout and addiction, all of which are associated with both mental and physical exhaustion, chronic injury as well as social and emotional distress. These negative effects of exercise dependence override the many benefits exercise has to offer to college students (Biddle & Mutrie, 2008; Hays, 2002).

The current guidelines established by the CDC and the ACSM recommend a combination of regular moderate and vigorous physical activity as well as muscle strengthening for adults, up to five days a week (Pate, Pratt & Blair, 1995). However, Kilpatrick, Hebert and Bartholomew (2005) report that the frequency and intensity of physical activity significantly decreases from high school to college. Specifically, 65% of high school students are engaging in regular vigorous exercise while 26% are participating in moderate

activity. In comparison, only 38% of college students participate in regular vigorous activity while 20% participate in regular moderate activity. It is important that balanced, health benefitting levels of exercise, in accordance with the CDC and ACSM guidelines, be promoted among college students.

There is increasing evidence that a diet rich in fruits and vegetables is associated with reductions in mortality rates, cardiovascular disease (CVD) and some forms of cancer (McKevith, Kelly, Stanner, Hughes & Buttriss, 2003). Furthermore, fruit and vegetable consumption is associated with reductions in the incidence of diabetes, chronic obstructive pulmonary disease (COPD) as well as hypertension (McKevith, Kelly, Stanner, Hughes & Buttriss, 2003). However, many college students may not be eating an adequate amount of fruits and vegetables to experience current and long-term health benefits. In fact, most college students are not meeting the guidelines, set forth by the National Cancer Institute, of five fruits and vegetables per day. Racette, Deusinger, Strube, Highstein and Deusinger (2005) found that more than 50% of the students were in the precontemplation stage for adopting healthier eating behaviors, defined as consuming a minimum of five fruits and vegetables per day and limiting their fast food consumption. These students were not thinking about making healthier eating choices at anytime in the near future.

College students are in a period of transition from late adolescence to young adulthood. As they achieve greater independence, their lifestyle habits, including their nutritional habits, may change (Larson, Neumark-Sztainer, Harnack et al, 2008). According to Gores (2008), college students' move away from their restrictive home environment to a buffet style of eating that are found in most college dining halls and are therefore at an increased risk of gaining weight. Furthermore, Gores indicates that college students are a vulnerable population such that they are at high risk for the beginning stages of serious health problems such as obesity. "The era of youth as a protective factor seems to be ending, today's adolescents will be obese from

an even younger age, leading to earlier and more severe complications such as heart disease, joint disease and diabetes (Gores, 2008, p. 5).”

Another major health concern is the prevalence of cigarette smoking among teenagers and young college adults. Although smoking rates in college students have begun to decrease, it is only a modest decline and is still a cause for concern (Rigotti, Moran & Wechsler, 2005). The recent literature indicates that 23% of high school and 10% of middle school students smoke (Choi & Jo Harris, 2003). Data provided by the American College Health Association identified smoking rates of college students ranging from 20-33% (Clarkin, Tisch & Glicksman, 2008). Taken together, these smoking patterns highlight the importance of continued smoking cessation efforts, targeted towards both male and female college students.

Research Purpose

There is insufficient research and few health promotion efforts focusing on college-age adults. In part, this may be due to the belief that this age cohort enjoys optimal, or near optimal, levels of health. Young college adults also tend to perceive themselves as invulnerable to illness (Fletcher, Bryden, Schneider, Dawson, & Vandermeer, 2007). However, the previously noted exercise, nutrition and smoking data clearly shows that a large proportion of young college adults continue to engage in high-risk behaviors that may predispose them to a variety of health problems later in life.

Exercise may act as a catalyst for engaging in other healthy behaviors (Biller, 2002). For example, those who participate in regular exercise are more likely to be non-smokers. At the same time, smoking cessation has been associated with adherence to a low fat diet. (Bock, Marcus, Rossi & Redding, 1998). What remains to be studied is whether other health behavior may also be related either directly to exercise or indirectly through smoking cessations or other mediating variables. With this in mind, since 2002, a special interest group has been developed at the Society for Behavioral Medicine towards the development of a science for multiple health behavior change for overall

health promotion and disease management (Prochaska, Spring & Nigg, 2008). This group represents the future of health behavior change as it recognizes the importance of a more holistic approach, advocating for more research focused on the study and treatment of multiple health behaviors.

The present study was designed to explore interrelationships involving exercise and other health-related behaviors, specifically, fruit and vegetable consumption and smoking status, in a college age population. On a more general level, we hoped to respond to the call for further research on multiple health behaviors, as well as the dearth of data regarding the health behaviors of college age adults. We hypothesize that young college adult who exercise regularly would be more likely to eat nutritiously and not smoke.

The Transtheoretical Model

The Transtheoretical Model (TTM) posits that health behavior change involves progress through five stages: precontemplation, contemplation, preparation, action, and maintenance (Prochaska & Velicer, 1997). Individuals at the precontemplation stage have no intention of making a positive change within the next 6 months. In contrast, those at the contemplation stage are seriously intending on making such a change at some point within the next six months. During the preparation stage, individuals become committed to making a significant change sometime within the next 30 days. Those in the action stage have already made a significant change for up to six months. To be in the maintenance stage, individuals must have maintained the positive change for at least six months.

Presuming that exercise can be considered a significant factor in promoting healthy behavior in other domains, it was hypothesized that individuals who engaged in regular exercise, those in the action or maintenance stage, would be more likely to eat nutritiously and not smoke (i.e., be in the action or maintenance stages of healthy nutrition or smoking cessation). The TTM stages of change algorithms were chosen for the assessment of these variables as their

measures have demonstrated strong reliability and validity and are in accordance with the national guidelines for exercise and nutrition (Rossi, Greene, Rossi et al., 2001; DiClemente, Prochaska, Fairhurst, Velicer, Velasquez, & Rossi, 1991; Schumann et al., 2002). Furthermore, investigating the stages of change for each of these variables allowed us to gain an overall sense of their degree of readiness to change with respect to exercise, healthy nutrition, or smoking cessation.

We hypothesize the following:

1. Those in the “active” stages for exercise (action and maintenance) will be more likely to be in the “active” stages for fruit and vegetable consumption (action and maintenance) as compared to those in the “non-active” stages for exercise (precontemplation through preparation).
2. Those in the “active” stages for exercise (action and maintenance) will be less likely to be in the “non-active” stages of smoking cessation (precontemplation through preparation) as compared to those in the “non-active” stages for exercise (precontemplation through preparation). Those who never smoked will not be included as they do not fall into a specific category of smoking cessation stage of change.
3. Those in the “non-active” stages of change for smoking cessation (precontemplation through preparation) will be less likely to be in the “active” stage of fruit and vegetable consumption (action and maintenance) as compared to those in the “active” stages of change for smoking cessation (action and maintenance).

Method

Study design, sample and data collection

The 578 participants were recruited from among those enrolled in undergraduate Psychology classes at a university in the Northeast. Students were provided with a brief description of the study and told that they would receive additional course credit, as part of a research requirement, if they completed the Internet survey. Those who did not want to participate in the research project were given an alternative assignment to

obtain additional course credit to meet their research requirement. The data set included 443 women (76.7%) and 135 men (23.3%). This proportion is similar to the overall gender distribution among psychology majors (75% female and 25% male) at the university. Almost 95% of the students were either 18 (69.9%) or 19 (23.9%) years old. The ethnic distribution of participants was similar to the general student population (84.4% in study vs. 75.9%, Caucasian; 5.2% vs. 3.9%, Latino; 3.9% vs. 4.0%, African American; 3.2% vs. 3.7%, Asian) (Table 1).

Table 1. Participant Ethnicity

Ethnicity	f	%
African American	22	3.9%
Asian	18	3.2%
White	471	84.4%
Latino	29	5.2%
Native American	2	0.4%
Other	16	2.9%

Measures

The present study incorporated TTM staging measures to identify and categorize where each participant was functioning according to exercise (Schumann et al., 2002), fruit and vegetable consumption (Rossi et al., 2001), and smoking behavior (DiClemente et al., 1991). There is considerable evidence for the reliability and validity of all three staging measures (Hall & Rossi, 2008). For this study, the stages of change measures were used to categorize each participant into their stage of change for exercise, nutrition and smoking status. These variables were assessed and then interpreted in comparison to one another. To account for exercise intensity based on the CDC and ACSM guidelines of vigorous, moderate and mild intensity of exercise, the Godin Leisure-time Exercise Questionnaire (GLTEQ) was used. The reliability coefficients (alpha) for this measure are .83 and .85 (Godin & Shephard, 1985).

The TTM exercise measure was comprised of eight items. Examples of these items were: Do you currently engage in regular exercise (at least four times per week for 30 or more minutes per session)? Do you intend to engage in regular exercise in the next 6 months? Do you intend to

engage in regular exercise in the next 30 days? The GLTEQ was comprised of five items which asked the participant to add up the total number of times they engaged in physical activity for each category of intensity: strenuous, moderate and mild. The TTM fruit and vegetable measure was comprised of four items. Examples of these items were: Have you been eating 5 or more servings of fruits and vegetables a day for more than 6 months?; Do you intend to start eating 5 or more servings of fruits and vegetables a day, in the next 30 days? The TTM smoking measure was comprised of ten items. Examples of these items included: Are you seriously considering quitting within the next six months?; Are you planning to quit within the next 30 days?; In the last year, how many times have you quit for at least 24 hours? Another item on the survey was "Were you ever a smoker?" This item was used to classify participants into a category of "never smokers."

An online survey was constructed, consisting of a brief demographics section, the three stages of change measures, and the GLTEQ. The survey was administered over the Internet, and took less than an hour to complete. A link to the survey was established on the university website for each psychology course that required research participation. Upon completion of the survey, a confirmation page appeared as receipt of an individual's participation. To ensure students were not taking the survey more than once, their confirmation page was only accepted one time for course credit and each participant's Internet "IP" address could be identified. All aspects of the study were approved by the university's institutional review board.

Statistical Tests Used

Since the TTM stages of change constructs can be conceptualized as both rank ordered intervals along a motivational continuum as well as individual stages, the present study incorporated nonparametric statistics such as the Mann-Whitney U-test and the chi square test. The analyses for each hypothesis involved a three-step process. First, three separate Mann-Whitney U-tests were computed to assess gender differences across the three health behavior stages of change (exercise, nutrition and

smoking cessation). If there were no significant gender differences found, the male and female data was combined and subsequent analyses were run on this larger sample. If gender differences were found, subsequent analyses were run separately for both males and females. Regardless of whether or not gender differences emerged, the next step in the data analysis involved collapsing the first three stages (precontemplation through preparation) to form a "non-active" (pre-action) stage. Individuals in stages 4 and 5 (action and maintenance) were combined to form an "active" stage. Next, chi-square analyses were run to address the three primary hypotheses guiding the present research. For example, hypothesis one was evaluated by comparing the active and non-active exercisers with respect to the number of individuals falling into either the active or non-active healthy nutrition stage of change. Hypothesis two was evaluated by comparing the active and non-active exercisers with respect to the number of individuals classified as active or non-active in smoking cessation. Hypothesis three was evaluated by comparing individuals active and non-active in smoking cessation with respect to the number of individuals classified as active or non-active in fruit and vegetable consumption. Finally, to confirm the statistical results from the previous two steps, logistic regression for each hypothesis was performed.

Results

Descriptive Statistics

Approximately half of the entire sample reported exercising regularly. On average, the exercise population was physically active three days per week for forty-eight minutes per session. According to the GLTEQ, the exercise participants were engaging in strenuous activity two-and-a-half times per week, moderate activity three times per week and mild activity five times per week. Looking across the stages of change for exercise, a greater proportion of individuals were in the active stages of change. Specifically, the percentage of individuals not regularly engaged in exercise (non active stages) was 48.8% (n=279) while the percentage in the active stages was 51.2% (n=293) of the sample (Table 2).

Table 2. Participants at Different Stages of Change for each Target Health Behavior

Domain	Precontemplation	Contemplation	Preparation	Action	Maintenance	Total
Exercise	9.1% n=52	8.9% n=51	30.8% n=176	15.9% n=91	35.3% n=202	100% N=572
Female	8.4% n=37	9.6% n=42	34.5% n=151*	14.6% n=64*	32.9% n=144	100% N=438
Male	11.2% n=15	6.7% n=9	18.7% n=2	20.1% n=27	43.3% n=58	100% N=134
Fruit & Veggie	24.8% n=139	19.8% n=111	13.9% n=78	17.8% n=100	23.7% n=133	100% N=561
Female	21% n=90	21.1% n=91	15.5% n=67	18.3% n=79	24.1% n=104	100% N=431
Male	38% n=49**	15.4% n=20**	8.5% n=11	16.2% n=21	22.3% n=29	100% N=130
Non-Smoking	3.5% n=20	8.9% n=50	3.7% n=21	19.9% n=112	2.3% n=13	N=216
Female	3.9% n=17	9.0% n=39	4.1% n=18	21.2% n=92	2.5% n=11	N=177
Male	2.3% n=3	8.5% n=11	2.3% n=3	15.4% n=20	1.5% n=2	N=39
					61.8% n=348***	N=564
					59.3% n=257***	N=434
					70% n=91***	N=130

*= significant difference for female in preparation and action stage of change for exercise

**=significant difference for male in precontemplation and contemplation stage of change for fruit & vegetable consumption

***= proportion of participants who never smoked cigarettes in their lifetime, classified as “never smokers”

More than half of the sample was not consuming an adequate amount of fruits and vegetables per day (minimum of five). Specifically, the percentage of participants not meeting the nutrition guidelines, those in the non-active stages, was 58.5% (n=328). The percentage of participants meeting the nutrition guidelines, those in the active stages, was 41.5% (n=233) (Table 2).

Another item on the survey was “Were you ever a smoker?” This item was used to classify participants into a category of “never smokers.” Approximately 60.2% of the individuals were classified as “never smokers” and thus did not

fall into a specific “stage of change.” There was a smaller percentage of present smokers, those in the “non-active” stages [16.1% (n=91)], as compared to “active stages” or smoke-free participants [22.1% (n=125)]. Of those identified in the “non-active” stages, a sizable proportion was thinking about or planning to quit within the next month to six months [12.6% (n=71)]. However, a very small percentage of the smoking population had been smoke free for six months or longer [2.2% (n=13)] (Table 2).

Primary Results

The first hypothesis was the following: Those in the “active” stages for exercise will be more

likely to be in the “active” stages for fruit and vegetable consumption as compared to those in the “non-active” stages for exercise. The results revealed a significant gender difference for exercise stage of change, $z(572)=2.25$, $p<.05$. A follow-up chi square analysis revealed a significant difference in exercise stages of change as compared to fruit and vegetable stages of change for women, $\chi^2(1)=23.92$, $p<.001$, but

not for men, $\chi^2(1)=0.004$, $p>.05$. Specifically, a greater proportion of women in the “active” exercise stages of change (action and maintenance) were also in the “active” fruit and vegetable stages of change (action and maintenance) as compared to the “non-active” exercise stages (precontemplation through preparation) (Table 3).

Table 3. Exercise X Fruit and Vegetable stage: Hypothesis #1 Results

Gender	χ^2	Fruit & Vegetable		
		Exercise	Non-Active	Active
Women	$\chi^2(1)=23.92$ $p<.001^*$	Non-Active	69.2% (n=155)	30.8% (n=69)
		Active	45.7% (n=93)	54.2% (n=110)
Men	$\chi^2(1)=0.004$ $p>.05$	Non-Active	60.9% (n=28)	39.1% (n=18)
		Active	61.4% (n=51)	38.6% (n=32)

* = reached significance

To confirm these results, a logistic regression was performed. For the fruit and vegetable stage of change it was found that both gender and exercise were significantly associated with being in the “active” stages of fruit and vegetable consumption. Women in the “active” stages of change for exercise were more likely to be in the “active” stages of fruit and vegetable consumption (AOR=2.66, 95% CI=1.79-3.95, $p<.01$). For males, there was no significant difference with respect to exercise and fruit and vegetable stages of change ($p>.05$).

The second hypothesis was the following: Those in the “active” stages for exercise will be less likely to be in the “non-active” stages of smoking cessation as compared to those in the “non-active” stages for exercise. Chi square analyses did not reveal a significant relationship for exercise and smoking cessation stages of change for either men, $\chi^2(2) = 0.28$, $p>.05$, or women, $\chi^2(2) = 0.20$, $p>.05$ (Table 4). A logistic regression analysis was performed and was not

found to be statistically significant ($p>.05$), indicating that the exercise and gender predictor variables did not reliably distinguish between active and non-active stages of smoking cessation. These results are consistent with the previous analyses.

The third hypothesis was the following: Those in the “non-active” stages of change for smoking cessation will be less likely to be in the “active” stage of fruit and vegetable consumption as compared to those in the “active” stages of change for smoking cessation. Across smoking stages of change there were no gender effects, $z(564) = 1.95$, $p > .05$.

Furthermore, there was no significant difference between individuals in the “active” and “non-active” smoking stages of change with respect to nutrition stages of change, $\chi^2(2) = 0.93$, $p>.05$ (Table 5). A logistic regression analysis was performed and was not found to be statistically significant, ($p>.05$), indicating that the smoking

cessation and gender predictor variables did not reliably distinguish between active and non-active stages of fruit and vegetable consumption.

These results are consistent with the previous analyses.

Table 4. Exercise X Smoking Cessation stage: Hypothesis #2 Results

Gender	χ^2	Non-Smoking			
		Follow-up	Exercise	Non-Active	Active
Women	$\chi^2(2)=0.20$ $p > .05$	Non-Active	17.7% (n=40)	24.3% (n=55)	58.0% (n=131)
		Active	16.7% (n=34)	23.2% (n=47)	60.1% (n=122)
Men	$\chi^2(2)=0.28$ $p > .05$	Non-Active	12.8% (n=6)	14.9% (n=7)	72.3% (n=34)
		Active	13.4% (n=11)	18.3% (n=15)	68.3% (n=56)

Table 5. Smoking Cessation Stage X Fruit & Vegetable Stage for Women and Men (combined): Hypothesis #3 Results

χ^2	Smoking Cessation	Fruit & Vegetable	
		Non-Active	Active
$\chi^2(2)=0.93, p > .05$	Non-Active	61.8% (n=55)	38.2% (n=34)
	Active	59.8% (n=73)	40.2% (n=49)
	Never Smokers	56.7% (n=191)	43.3% (n=146)

Secondary Results

Since there were gender differences across the exercise stages of change, follow-up chi squares were conducted to assess the nature of this difference. A follow-up chi square analysis revealed a significant gender difference between the preparation and action stages, $\chi^2(1)=9.15, p < .01$. Approximately equal numbers of men were in either the preparation (48.1 %, n=25) or action stage (51.9 %, n=27). Whereas approximately two-and-a-half times as many women were in the preparation stage (70.2%, n=151) as compared to the action stage (29.8 %, n=64).

Also, since there was no pre-planned assessment for gender differences specific to the nutrition stages of change, a Mann-Whitney U-Test and follow-up chi square tests were performed to better understand the nature of these stages with respect to gender. A significant gender difference for nutrition stage of change was found, $z(561) = 2.34, p < .05$. A follow-up chi square analysis revealed a significant gender difference between the pre-contemplation and contemplation stages, $\chi^2(1) = 9.17, p < .01$. Approximately equal numbers of women were in either the precontemplation (49.7%, n=90) or contemplation (50.3%, n=91) stage. Whereas

approximately two and half times as many men were in the precontemplation stage (71%, n=49), as compared to the contemplation stage (29%, n=20).

Discussion

Summary of Findings

There was partial support for the first hypothesis. Physically active women were also likely to consume a minimum of five fruits and vegetables a day as compared to the non-active women. However, there was no difference in the amount of fruit and vegetable consumption for men across the exercise stages. In fact, the results from the secondary analyses revealed that two and a half as many males were in the precontemplation stage for nutrition as compared to the contemplation stage. Furthermore, looking across all of the nutrition stages of change for men (Table 2), the majority of male participants were in the precontemplation stage (38%). Perhaps a proportion of the proactive TTM intervention efforts, aimed at increasing students' readiness to adopt an adequate amount of fruits and vegetables in their daily diet, could be targeted to young college men.

The second hypothesis was not supported. Exercise stage of change and smoking behavior were not significantly different. These findings may have been due to the fact that there was such a low rate of reported smoking among the participants. Specifically, 60.2% of participants reported that they never smoked while 22.1% of previous smokers were either in the action or maintenance stage for quitting. Since a larger proportion of exercisers in the maintenance stage had a non-smoking status as compared to the action stage, these findings suggest that long-term exercise may be a gateway variable for smoking cessation for many individuals.

On the other hand, those in the active stages for exercise were as likely to be smokers as compared to those in the non-active stages for exercise. Approximately 16% (n=45) of the exercisers were classified as smokers while 17% of the non-exercisers were classified as smokers. For those individuals who are currently

exercising and smoking, approximately 69% (n=31) were classified in the maintenance stage for exercise. For this subpopulation of exercise participants, exercise is not acting as a gateway variable for smoking cessation. Since exercise and smoking are contradictory behaviors, further research is needed to better understand the paradox of the physically active smoker and identify the reasons why they are engaging in both contradictory behaviors simultaneously. Since young college adults tend to be preoccupied with their appearance, perhaps the physically active smokers are engaging in exercise for extrinsic reasons such as body image dissatisfaction. In fact, half of this population reported being more motivated to look good rather than for health concerns.

The third hypothesis was also not supported. Those who were smoking were not less likely to consume a minimum of five fruits and vegetables a day as compared to non-smokers. Since some people smoke due to a perception that it helps to control body weight (Clark, Hays, Vickers, et al., 2005), these individuals may also be engaging in these behaviors due to an extrinsic focus on body weight and appearance and not for health reasons.

Finally, secondary analyses revealed a gender difference between the preparation and action stages for exercise. While there were an equal number of men in the preparation and action stages for exercise, two and a half times more women were in the preparation stage (70.2%) as compared to action (29.8%). This suggests that while women may be ready to engage in regular exercise, they may be having difficulty in being able to become regularly active. Furthermore, a greater number of men were in the maintenance stage (68.2%) as compared to the action stage (31.8%). Although there were a greater number of women in maintenance (69.2%) as compared to action (30.8%), there was a significantly greater amount in preparation (70.2%). These findings are not surprising given that the motives for exercise for men and women differ. Women are more likely to exercise because of concerns with their weight and general appearance while men are more likely to engage in fitness related activities because of concerns for their fitness,

performance, competition and social recognition (Kilpatrick et al, 2005). Women's motives may represent a greater degree of extrinsic motivation and may be more associated with stress, thus resulting in less enjoyment from the exercise activity itself. Even though extrinsic motivations may initially motivate one to start exercise, it is not enough for long-term exercise maintenance (Maltby & Day, 2001). Women who are in exercise maintenance may be at risk for relapsing to a less active stage of exercise if their initial motives for exercise were primarily extrinsic. As stated previously, a recent study by Scioli et al. (2009) found that participants in the maintenance stage for exercise had higher levels of intrinsic motivation than the precontemplation through action stages of change. However, those in the maintenance stage for exercise still had measurable levels of extrinsic motivation, putting them at risk for relapsing to a less or "non active" stage of exercise (precontemplation through preparation).

These findings indicate that young college women represent an important population for further research and intervention in order to develop effective strategies to transform initial extrinsic motives for exercise into intrinsic motivation through internalization of intrinsically-related environmental support. For example, advertisements that focus on the potential fun and enjoyment that results from engaging in exercise can be an effective way to start. These messages could serve to counteract the many unhealthy societal messages targeted towards women for exercising for extrinsic reasons such as weight loss. Perhaps a proportion of the TTM interventions that highlight social support could be targeted towards young college women. For example, a women's health facility could be set up that encourages young women to exercise by engaging in physical activities that they enjoy or a women's walking or running group could be started. Since they will be exercising with all women, they may feel more social support to stay active thereby deriving more enjoyment from the activity itself. Further research is needed in this area to determine the types of physical activities women enjoy doing while at

the same time contributing to their overall health and well-being.

Limitations

As with all studies, there are limitations. First, this is a convenience sample which limits applicability to other populations. Second, this survey was based upon self-report. Due to social desirability, individuals tend to over-report physical activity and fruit and vegetable intake as well as not identify themselves as a smoker if they "socially smoke", particularly among the adolescent and young adult population (Adams, Matthews, Ebbeling, et al, 2005; Casagrande, Wang, Anderson & Gary, 2007; Dolcini, Adler & Ginsburg, 1996). The results of this study should be interpreted with these possibilities in mind.

Extending our social desirability concerns further, perhaps the participants were not as active as they identified themselves to be. Although our results showed approximately half of the sample were exercising, there may actually be less than half of the population engaged in regular exercise. Additionally, since fruit and vegetable intake tends to be over-reported and given that more than half of the population was not meeting the nutrition guidelines, perhaps even more of the population is struggling with their fruit and vegetable consumption. Finally, since this study identified a large proportion of non-smokers in action and maintenance as well as "never smokers", perhaps these results are similarly biased and a greater percentage of the population are struggling with their smoking behaviors. These limitations further highlight the importance of using multiple assessment methods, including behavioral observations or peer reports and targeting research and intervention efforts towards the young college student population in order to help them adapt a healthy lifestyle pattern of health benefitting levels of exercise, nutrition and smoking cessation behaviors.

Finally, this was an Internet study, a relatively new method of research which could include additional bias and limit the generalizability of the findings. However, increasing evidence

suggests that use of the Internet as a research tool has more advantages than disadvantages, even when compared to comparable paper and pencil tests, requiring less follow-up time and resulting in higher completion rates (Ritter, Lorig, Laurent & Matthews, 2004). Moreover, in the present study, many of the participants reported in the feedback section of the survey that they were more likely to be honest in their self-report because it was an Internet study. Additionally, they enjoyed the flexibility the Internet provided. Further research regarding the impact of social desirability in self-report of health behaviors on the Internet is needed. It is hoped that this study will encourage further use of the Internet as a research tool.

Implications

The findings of the present study are in line with previous research in that only about half of the participants were actively exercising. (McArthur & Raedeke, 2008; Steptoe, Wardle & Fuller, 1997). A large proportion of participants were in the preparation stage, those who were seriously thinking about engaging in regular exercise within the next month. This finding suggests that participants have already begun to make small changes in order to begin exercising and may start to do so with adequate environmental and social supports in place. The TTM framework includes the constructs of processes of change to explain the processes of individual's behavior change. Social liberation is one of TTMs cognitive process of change, and it fosters an increased sense of awareness of the individual's environmental context (Prochaska, Velicer, DiClemente and Fava, 1988). Social liberation can be used to facilitate individual's movement towards the action stage of change (Wadsworth & Hallam, 2007). For example, the individual interested in quitting smoking may notice that there are "no smoking" signs in public buildings, socially liberating the person to move towards a non-smoking status. With respect to exercise adoption, the TTM can be instrumental in setting up a campus environment that fosters social liberation by encouraging students to engage in a regular, healthy level of exercise. For example, advertisements reinforcing exercise for fun and enjoyment could be set up around campus and healthy exercise statements could be posted on

the college website. With such encouragement, those that are in the preparation stage for exercise may become more motivated to take action upon experiencing this level of social liberation. Additionally, those in the precontemplation and contemplation stages may start thinking more about getting ready to exercise.

The higher percentage of participants in the "non-active" stages of change for fruit and vegetable consumption (precontemplation through preparation) is also consistent with the literature. Young college adults are less likely to include the recommended amounts of fruits and vegetables in their diet (Racette, Deusinger, Strube, Highstein & Deusinger, 2005). There is a need for more proactive interventions highlighting the current and long-term health benefits of consuming an adequate amount of fruits and vegetables to the young college adult population. The TTM process of change, consciousness raising, is geared towards increasing the individual's awareness of the need to change their unhealthy behavior and is associated with the earlier or "non active" stages of change (precontemplation through preparation) (Di Noia, Schinke, Prochaska & Contento, 2006).. Newspaper or campus website posting across the college campus can help to raise students' awareness about the importance of incorporating enough fruits and vegetables in their diet in order to experience current and long term health benefits. With enough of these advertisements, their readiness to change may be accelerated such that they may start to think about fruit and vegetables more. Along with being exposed to cafeterias on campus that offer healthy food choices, the students may further increase their readiness to change by considering choosing more fruits and vegetables at meal times.

Although there was a greater proportion of non-smokers in this population, an extremely small percentage of participants were classified in the maintenance stage of smoking cessation (2.2%). Combined with the findings that a larger proportion of participants were in the action stage for smoking cessation (19.9%) indicates that this population is motivated to become

smoke free and is successful in moving to the action stage however is struggling in their ability to maintain their smoke-free status for a significant period of time (six months or more). This finding is also consistent with the literature suggesting that young adults who smoke are interested in quitting however they are more likely to relapse than older individuals (VanderVeen, Cohen, Cukrowicz & Trotter, 2008). The TTM can also be used to help young college students hoping to stay smoke-free by having the campus environment operate as a form of stimulus control, a behavioral process of change used in the action and maintenance stages (Prochaska et al., 1988). Stimulus control helps the individual regain a sense of control over their unhealthy behavior and be able to maintain their change in this behavior. For example, the person may remove things from their home that reminded them of the unhealthy behavior. With respect to college students, the selling of cigarettes on campus could be stopped and only allowing certain designated smoking areas for smokers could be established. This way, it will help the student be able to apply their own stimulus control and refrain from buying cigarettes as it will be difficult for current smokers to consistently smoke on campus while also being difficult for recent quitters (those in the action stage) to relapse. Furthermore, it will also be difficult for the “never smokers” to begin smoking if they were starting to think about smoking in the near future.

From this study, we may conclude that it is important for health professionals and researchers to not assume that regular exercise is directly associated with a non-smoking status and that a non smoking status is directly associated with consuming a more nutritious diet. Unfortunately, young people continue to engage in unhealthy lifestyle behaviors that could have a serious impact on their future well-being (Eriksen, Natvig, Rutle & Bruusgaard, 1999). These findings highlight the importance of developing a theory of multiple health behavior change which is a primary goal of SBM’s special interest group discussed previously.

For the future, the best way to help explain why individuals who are physically active are also smoking may be to integrate behavior change theories that focus on both intrinsic and extrinsic motivation for exercise. Self-Determination theory (SDT) posits that intrinsic and extrinsic motivations are not mutually exclusive (Deci & Ryan, 1985). According to this theory, extrinsic motivation is engaging in an activity to obtain some external reward. Intrinsic motivation is engaging in an activity for the inherent enjoyment of the activity itself and in the absence of an external contingency. With respect to exercise, extrinsic motivation could be considered one’s desire to lose weight or to gain a more attractive appearance while intrinsic motivation could be considered one’s desire to engage in the physical activity because they enjoy it. Scioli, Biller, Rossi and Riebe (2009) found that even though individuals in exercise maintenance had higher levels of intrinsic motivation, they still had some degree of extrinsic motivation. Furthermore, they found that the exercise maintainers who smoke had a higher degree of extrinsic motivation than exercise maintainers who did not smoke, putting them at risk for relapsing to a less or “non-active” stage of exercise. Perhaps this subpopulation of exercisers needs an additional intervention that focuses on increasing levels of intrinsic motivation for exercise in order to help them sustain exercise maintenance as well as increasing their readiness to quit smoking. For example, advertisements that focus on the enjoyment of exercise while also highlighting that one can be active with more ease by quitting smoking, thereby enjoying it more and experiencing more of the mental and physical health benefits. Clearly, further research is needed in this area.

Since this sample was primarily female, young college women need to be a target of further intervention and research in order to help them establish healthy behaviors for health benefitting reasons and not for destructive or extrinsic reasons, such as body image dissatisfaction. Nevertheless, men were also found to be struggling with adoption of nutrition health behaviors. Therefore, further research and

intervention is strongly urged, involving both men and women college age adults. These efforts could serve to help those engaging in unhealthy behaviors increase in their readiness to adopt healthy lifestyle choices and to help those who are engaging in healthy behaviors transform their initial extrinsic motives into intrinsic motives for long-term maintenance and promotion of overall physical and mental well-being. The TTM stages, the associated processes of change and self-determination theory, may constitute an effective, integrative approach that can guide further research as well as informing the design of assessments and interventions with this and other populations.

The integration of self-determination theory (SDT) with the transtheoretical model of health behavior change (TTM) may allow a focus on a level of change relating to internal perceptions and motivational factors. Integrating SDT based measures could aid in assessing, tracking and capturing an individual's internal change processes in conjunction with TTM model based interventions. With more precise measurement of the internal change process, interventions could target both environmental influences as well as the individual's underlying motivations. Such an approach is likely to improve the quality of interventions, leading to more lasting behavioral changes.

References

- Adams, S.A., Matthews, C.E., Ebbeling, C.B., Moore, C.G., Cunningham, J.E., Fulton, J. & Hebert, J.R. (2005). The Effect of social desirability and social approval on self-report of physical activity. *American Journal of Epidemiology*, 16(4), 389-398.
- Biddle, S.J.H & Mutrie, N. (2001). *Psychology of physical activity: Determinants, well-being and interventions*. New York, NY, US: Routledge.
- Biller, H.B. (2002). *Creative fitness: Applying health psychology and exercise science to everyday life*. Westport, Connecticut: Auburn House.
- Bock, B.C., Marcus, B.H., Rossi, J.S., & Redding, C.A. (1998). Motivational readiness for Change: Diet, exercise and smoking. *American Journal of Health Behavior*, 22(4), 248-258,
- Buckworth, J., Lee, R.E., Regan, G., Schneider, L.K., DiClemente, C.C. (2007). Decomposing intrinsic and extrinsic motivation for exercise: Application to stages of motivational readiness. *Psychology of Sport and Exercise*, 8, 441-461.
- Casagrande, S.S., Wang, Y., Anderson, C., & Gary, T.L. (2007). Have Americans increased their fruit and vegetable intake?: The trends between 1988-2002. *American Journal of Preventive Medicine*, 32(4), 257-263.
- Centers for Disease Control and Prevention (CDC) (2008). *Physical activity guidelines for Americans*. Retrieved August, 20, 2009, from <http://www.health.gov/paguidelines/pdf/paguide.pdf>.
- Choi, W.S., Jo Harris, K. (2003). Predictors of smoking initiation among college-bound high school students. *Annals of Behavioral Medicine*, 26(1) 69-74.
- Clark, M.M., Hays, J.T., Vickers, K.S., et al. (2005). Body image treatment for weight concerned smokers: A pilot study. *Addictive Behaviors*, 30, 1236-1240.
- Clarkin, P.F., Tisch, L.A., & Glicksman, A.S. (2008). Socioeconomic correlates of current and regular smoking among college students in Rhode Island. *Journal of American College Health*, 57(2), 183-190.
- Deci, E.L., & Ryan, R.M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum Publishing Corporation.
- DiClemente, C.C., Prochaska, J.O., Fairhurst, S.K., Velicer, W.F., Velasquez, M.M., & Rossi, J.S. (1991). The process of smoking cessation: An analysis of precontemplation, contemplation and preparation stages of change. *Journal of Consulting and Clinical Psychology*, 59, 295-304.

- Di Noia, J., Schinke, S.P., Prochaska, J.O., & Contento, I.R. (2006). Application of the Transtheoretical model to fruit and vegetable consumption among economically disadvantaged African American adolescents: Preliminary Findings. *American Journal of Health Promotion*, 20(5), 342-348.
- Dolcini, M.M., Adler, N.E., & Ginsberg, D. (1996). Factors influencing agreement between self-reports and biological markers of smoking among adolescents. *Journal of Research on Adolescence*, 6(4), 515-542.
- Eriksen W., Natvig B., Rutle O., & Bruusgaard D. (1999) Smoking and the functional status of young college adults. *Scandinavian Journal of Primary Health Care*, 17, 174-179.
- Fletcher, P.C., Bryden, P.J., Schneider, M.A., Dawson, K.A., & Vandermeer, A. (2007). Health issues and service utilization of university students: Experiences, practices and perceptions of students, staff and faculty. *College Student Journal*, 41(2), 1-12.
- Godin, G., & Shephard, R.J. (1985). A simple method to assess exercise behavior in the community. *Canadian Journal of Applied Sport Science*, 10(3), 141-146.
- Gores, S.E. (2008). Addressing nutritional issues in the college-aged client: Strategies for the nurse practitioner. *Journal of the American Academy of Nurse Practitioners*, 20, 5-10.
- Hall, K.L., & Rossi, J.S. (2008). Meta-analytic examination of the strong and weak principles across 48 health behaviors. *Preventive Medicine*, 46, 266-274.
- Ingledeu D.K.S.G. (2002). Effects of body mass and body image on exercise motives in adolescence. *Psychology of Sport and Exercise*, 3, 323-338.
- Kilpatrick, M., Hebert, E., & Bartholomew, J. (2005). College students' motivation for physical activity: differentiating men's and women's motives for sport participation and exercise. *Journal of American College Health*, 54(2), 87-94.
- Larson, N.I., Neumark-Sztainer, D.R., Harnack, L.J., Wall, M.M., Story, M.T. & Eisenberg, M.E. (2008). Fruit and vegetable intake correlates during the transition to young adulthood. *American Journal of Preventive Medicine*, 35(1), 33-37.
- Maltby, J. & Day, L. (2001). The relationship between exercise motives and psychological well-being. *Journal of Psychology*, 135(6), 651-661.
- McArthur, L.H. & Raedeke, T.D. (2009). Race and sex differences in college student physical activity correlates. *American Journal of Health Behavior*, 33(1), 80-90.
- McCormack, G. & Giles-Corti, B. (2004). Does participation in recommended levels of vigorous-intensity physical activity decrease participation in moderate-intensity physical activity. (2004). *Journal of Physical Activity and Health*, 1, 45-55.
- McKevith, B., Kelly, C., Stanner, S., Hughes, J., & Buttriss (2003). The food standards agency's antioxidants in food programme- a summary. *Journal of Human Nutrition and Dietetics*, 16, 257-263.
- Mokdad A.H.F., Bowman E.S., Dietz B.A., William H., Vinicor F., Bales V.S., Marks J.S. (2001). Prevalence of obesity, diabetes, and obesity-related health risk factors. *Journal of the American Medical Association*, 289(1), 76-79.
- Mokdad A.H.F., Dietz, M.K., Bowman, W.H., Marks, B.A., & Koplan J.P. (2000). The continuing epidemic of obesity in the United States. *Journal of the American Medical Association*, 284(13), 1650-1651.
- Pate, P.R., Pratt, M., Blair, S.N., et al. (1995). Physical Activity and public health: A recommendation from the centers for disease control and prevention and the American college of sports medicine. *Journal of the American Medical Association*, 273, 402-407.
- Plante, T.G., Gores, C. & Brecht, C. (2007). Does exercise enhance the psychological benefits of exercise for women? *International Journal of Stress Management*, 14(1), 88-98.
- Prochaska, J.J., Spring, B., & Nigg, C.R. (2008). Multiple health behavior change research: An introduction and overview. *Preventive Medicine*, 46, 181-188
- Prochaska, J.O., Velicer, W.F., DiClemente, C.C., & Fava, J.L. (1988). Measuring the processes of change: Applications to the cessation of smoking. *Journal of Consulting and Clinical Psychology*, 56, 520-528..

- Prochaska J.O., & Velicer W.F. The Transtheoretical model of health behavior change (1997). *American Journal of Health Promotion*, 12(1), 38-48.
- Racette, S.B., Deusinger, S.S., Strube, M.J., Highstein, G.R. & Deusinger, R.H. (2008). Changes in weight and health behaviors from freshman through senior year of college. *Journal of Nutrition Education and Behavior*. 40(1), 39-42.
- Rigotti, N., Moran, S.E., Wechsler, H. (2005). US college students' exposure to tobacco promotions: Prevention and association with tobacco use. *American Journal of Public Health*, 95(1), 18-144.
- Ritter, P., Lorig, K., Laurent, D., & Matthews, K. (2004). Internet versus mailed questionnaires: A randomized comparison. *Journal of Medical Internet Research*, 6(3).
- Rossi S.R., Greene G.W., Rossi J.S., Plummer B.A., Benisovich S.V., Keller S., et al. (2001). Validation of decisional balance and situational temptations measures for dietary fat reduction in a large school-based population of adolescents. *Eating Behaviors*, 2, 1-18.
- Schumann, A., Nigg, C.R., Rossi, J.S., Jordan, P.J., Norman, G.J., Garber, C.E., Riebe, D., & Benisovich, S.V. (2002). Construct validity of the stages of change of exercise adoption for different intensities of physical activity in four samples of differing age groups. *American Journal of Health Promotion*, 16, 280-287.
- Scioli, E.R., Biller, H.B., Rossi, J.S. & Riebe, D. (2009). Personal motivation, exercise and smoking behaviors among young adults. *Behavioral Medicine*, 35, 57-64.
- Steptoe A.D.S., Wardle J., Fuller R., Holte A., Justo J, & Sanderman R.W.L. (1997). Leisure-time physical exercise: Prevalence, attitudinal correlates and behavioral correlates among young Europeans from 21 countries. *Preventive Medicine*, 26, 845-853.
- VanderVeen, J.W., Cohen, L.M., Cukrowicz, K.C., & Trotter, D.R.M. (2008). The role of impulsivity on smoking maintenance. *Nicotine and Tobacco Research*, 10(8), 1397-1404.
- Wadsworth, D.D., & Hallam, J.S. (2006). The use of the processes of change Across the exercise stage of change and across varying intensities and frequencies of exercise behavior. *American Journal of Health Promotion*, 21(5), 426-429.
- Weiss, R, Rax, H. (2006). Focus on childhood fitness, not just fatness. *Lancet*, 368 (9532), 261-262.
- Zabinski M.F, Calfas K.J., Gehrman C.A., Wilfley D.E., Sallis J.F. (2001). Effects of a physical activity intervention on body image. *Annals of Behavioral Medicine*, 23(4), 247-252.

Author Information

Erica R. Scioli, Ph.D.*
Clinical Psychologist and Project Coordinator
VA Boston Healthcare System, Research Division
Women's Health Science Division,
National Center of PTSD
150 South Huntington Avenue
Boston, MA 02130
Phone: (857) 364-5696
Facsimile: (857) 364-4408
Email: EricaRose.Scioli@va.gov

Henry Biller, Ph.D.
Professor of Clinical Psychology
University of Rhode Island
Department of Psychology

Joseph S. Rossi, Ph.D.

Professor and Director of Research
University of Rhode Island
Cancer Prevention Research Center
Department of Psychology

Deborah Riebe, Ph.D.
Professor and Department Chair
Department of Kinesiology
University of Rhode Island

Anthony Scioli, Ph.D.
Professor of Clinical Psychology
Keene State College, University System of NH
Department of Psychology

* corresponding author