UNDERSTANDING FEMALE COLLEGIATE ATHLETES' INTENTIONS TO CONSUME SPORTS SUPPLEMENTS: AN APPLICATION OF THE THEORY OF PLANNED BEHAVIOR

A Dissertation

by

JEFF MICHAEL HOUSMAN

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 2006

Major Subject: Health Education

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ABSTRACT

Understanding Female Collegiate Athletes' Intentions to Consume Sport Supplements: An Application of the Theory of Planned Behavior.

(May 2006)

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The Dietary Supplements Health and Education Act (DSHEA) of 1994 made safety and efficacy testing of dietary supplements the responsibility of the consumer. Currently, there exists little data on safety and efficacy of supplements, and there is virtually no data regarding safety and efficacy of supplements in individuals under the age of 18 years. Sales indices suggest sports supplement consumption continues to increase among young athletes, and research indicates young athletes have become the key target for marketing. Additionally, pressures to achieve greater athletic performance or an ideal body image are strong motivators for young athletes. These factors create an environment in which adolescents are likely to consume dangerous sports supplements without being aware of risks associated with supplements. This study was conducted as an attempt to understand factors that motivate young athletes to consume sports supplements.

The sample for this study consisted of 207 female collegiate athletes participating in basketball, soccer, cross country, volleyball, and swimming during the 2005-2006 NCAA season. A survey instrument containing four scales measured participants' behavioral intention, attitude, subjective norms, and perceived behavioral control regarding the consumption of sports supplements. Behavioral intention, attitude, subjective norms, and perceived behavioral control are Theory of Planned Behavior (TPB) components that, in theory, measure an individual's internal motivations for performance of a behavior. The dependent variable was defined as the intention to consume sports supplements (Behavioral Intention), and attitude, subjective norms and perceived behavioral control were predictor variables.

Findings from this study revealed a poor fit for the TPB measurement model. However, the components of the TPB were able to explain 61% of variance in behavioral intention. Additionally, subjective norms were the strongest predictor and perceived behavioral control the weakest. Furthermore, the average female collegiate athlete did not regularly consume sports supplements. Participants claiming to use sports supplements regularly indicated weight loss and gain, fat loss and looking better as primary motivations for consumption. Results indicated the TPB was able to explain a considerable amount of variance in intention to consume sports supplements with body image concerns being primary motivators.

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

The purpose of this research is to investigate use of sports supplements and factors that influence the likelihood a female collegiate athlete will consume or abstain from consuming sports supplements. Applications of the Theory of Planned Behavior to dietary and other health related behaviors will be discussed. Additionally, the effectiveness of the Theory of Planned Behavior to predict consumption of sports supplements by female collegiate athletes will be assessed. Finally, possible uses of information gained through understanding and tracking sports supplement consumption will be offered.

Dietary and Sports Supplements

With an increased emphasis on nutrition as a factor in disease prevention, dietary supplement use among the United States population is growing (USFDA, 1994). Dietary supplements are defined by the United States Food and Drug Administration (USFDA) as "Vitamins and minerals, amino acid products, and all other types of dietary supplement products, including nonessential chemical compounds, herbs without a documented history of traditional food use, plant extracts, and animal extracts (USFDA Dietary Supplement Task Force Final Report, 1994, p. 12)." The Dietary Supplements

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This dissertation follows the style of *Health Education & Behavior*.

Health and Education Act (1994) expanded the definition of dietary supplements and opened the market to new ingredients that would have otherwise required safety testing. Since 1994, the supplement industry has been self-regulating.

In recent years the use of all classifications of nutritional supplements has increased (Dodge, Ford, & Perko, 2003; Yu, Ghandour, & Huang, 2000; Metzl, Small, Levine, & Gershal, 2001; Delbeke, 2003; Bell, Dorsch, McCreary, & Hovey, 2004; Dunn et al, 2001). Recently, interest in consumption of sports supplements has risen as athletes such as Mark McGuire and Jason Giambi admitted using these substances to increase there performance. Mark McGuire's use of the prohormone Andro (androstendione) received a great deal of attention during his record breaking home run season (Perko, 1999). As the number of athletes participating in competitive sports increases, it is likely rates of sports supplement consumption will also rise (Perko, 1999).

Significance of the Problem

Dietary supplements became easily accessible in 1994 with the passing of the Dietary Supplement Health and Education Act (DSHEA). The DSHEA allows dietary supplements to remain in the marketplace unless they are proven dangerous. It is the responsibility of the consumer to understand the risks of the supplements and perform safety testing. No pre-market clearance to test the product is required by law before a product can be placed on the shelves of local stores (Dodge, Ford, Perko, 2003).

Although it is difficult to determine the exact rate of dietary/sports supplement consumption, studies and sales provide an indication. Surveys from 1970 to 1992 have

shown dietary supplements are consumed daily or occasionally by 35-60% of the adult U.S. population (USFDA, 1994; CDC,1997). The latest national data provided by the NHANES III survey (1988-1994) revealed 40% of students consume at least one dietary supplement. In a meta-analysis of 51studies, Sobal and Marquart (1994) states 46% of 10, 274 male and female athletes consume some form of a dietary supplement. Furthermore, In the United States, dietary supplement consumption is prevalent among certain subgroups, most notably, women (Koplan, Annest & Layde, 1986; Stewart, McDonal & Shucker , 1985; Conner, 2005), adult and adolescent athletes (Sobal & Marquart, 1994), and older people (Koplan, Annest & Layde, 1986). Reasons for dietary supplement consumption include need for more energy, to stay healthy, and to fight osteoporosis. The most common reason given among adult and adolescent athletes was to improve performance.

Sobal and Marquart (1994) reported and exponential increase in sport supplements since the early 1980's with 46% of male and female athletes consuming dietary supplements. Females (44%) are more likely than males (35%) to consume a dietary supplement, and non-Hispanic white persons (43%) were more likely to take dietary supplements than non-Hispanic black persons (30%). Furthermore, financial income and education level are positively related to dietary supplement consumption. Adolescents use dietary supplements to increase performance, prevent and treat illness, and for health growth (Perko, 1999). Four out of five students say they would use dietary supplements if they were tested, safe, and beneficial to their health (Perko, 1999).

In most cases, the efficacy of dietary supplements has not been shown scientifically. In 1992 the FDA called for stringent testing guidelines as death from hypertoxicity, allergic reaction, abuse, and disability, including hospitalization was reported (Huxtable, 1992; Kamb et al., 1992; Swygert et al., 1990; Abelson, 1991; Ropp, 1992; Slaving, Lanners, & Engstrom, 1988). Furthermore, the FDA made 20 recommendations for regulating dietary supplements (USFDA, 1994). In a comprehensive review of clinical trials published between 1962 and 1992 related to claims regarding dietary supplements, Barron and VanScoy (1993) revealed no published scientific evidence supporting claims of 42% of the products. Only four of 19 were associated with any documented human trials. Six of 19 had some clinical animal of human studies, but these products were marketed in a misleading manner. However the passing of DSHEA allows continued sale of dietary supplements without testing. In more recent studies, the efficacy of products such as creatine and ephedra has been tested. In a meta-analysis of creatine performance studies, Branch (2003) reported strength gains of only two to four percent among individuals consuming creatine. In a meta-analysis of ephedra studies concerning the efficacy and safety of ephedra, Shekelle, Hardy and Morton (2003) reported average intial weight loss of individuals consuming ephedra at one half to one kilogram per month as compared to those not consuming ephedra. However, long term weight loss was not significantly different. Although many recent studies have shown most dietary supplements to be ineffective, sales of creatine, amino acids, and protein continue to rise.

Medical evidence suggests only certain subgroups of people need dietary supplements, such as increased iron for pregnant women, special formulas for infants and small children, folate for women of child bearing years, and calcium for adolescent girls and young women (Perko, 1999). Potential risks of dietary supplement use include toxicity, allergic reactions, side effects of caffeine containing products, and many unknown side effects. In some instances, insect hormones, prescription medications, and animal glandular material have been found within dietary supplements (Philen, Ortiz & Faulk, 1992). Furthermore, use of ergogenic aids could lead to a stepping stone pattern in which individuals advance to more dangerous substances like steroids (Sobal & Marquart, 1994). Several studies have indicated limited nutrition knowledge among individuals ages 15 to 24 along with a need for nutrition education regarding the use of nutrition supplements (Kim & Keen, 1999; Little, Perry & Volpe, 2002; Sobal & Marquart, 1994; Sossin et al., 1997; Thomsen & Newton, 2005).

Recently ephedra containing products have been removed from the marketplace (USFDA, 2003). However, the removal was spurred by several deaths of professional athletes, Korey Stringer and Steve Belcher, as well as adolescents. In 1989, the FDA forced a recall of products containing the amino acid L-tryptophan after the deaths of 32 people were linked to its use (Cowart, 1992). L-tryptophan was marketed as relief for depression, insomnia and a hypnotic weight loss agent (Abelson, 1991; Swygert et al., 1990). In 1989 an epidemic of eosinophilia-myalgia, a disease that can cause paralysis, reached an epidemic level. The death of individuals taking ephedra and L-tryptophan

products and side effects from several other sports supplements suggests a need for rigorous testing prior to the sale of dietary supplements.

Need for the Study

Dietary supplement sales indicate a rise in consumption. In 1999, a report from the United States Food and Drug Administration estimated 1997 sales of dietary supplements totaled $10.3 billion. Sports supplements sales were approximately $927 million. Top dietary supplement manufacturers estimated revenue from dietary supplement sales at $6,050 million for 1997. Dietary supplement sales from 2003 indicate another increase of five percent from 2002. Estimates of retail sales of dietary supplements vary widely, however, most sources agree the industry is growing rapidly and will continue to do so in the future. Because consumer demand has increased greatly, larger pharmaceutical companies are entering the market, often by buying supplement firms. Recent surveys suggest magazines and product labels were the top 2 sources of supplement information for college women, followed by friends and parents (Dunn, Eddy & Wang, 2001). Furthermore, Dodge, Ford and Perko (2003) suggested female athletes are quickly becoming the most targeted population for supplement companies. With the influx of females participating in competitive sports, this subgroup is a concern for health professionals.

Over 6.6 million young athletes participate in some form of supervised sport and many continue actively through college Blue Cross/Blue Shield, 2003). As a result, sports are becoming increasingly competitive. As young athletes compete for positions

on their teams and for scholarships, many will attempt to gain every advantage possible. Consumption of sports supplements is a popular avenue for athletes to gain a competitive advantage. As previously mentioned, individual studies and supplement sales records continue to show growth in supplement consumption. Policies regarding supplement testing, distribution, and sales create and environment in which young athletes are vulnerable to marketing techniques and pressures to attain athletic success or an ideal physical appearance. Combined with a lack of clinical safety and efficacy data on sports supplements, these factors make this an area of concern for health professionals and creates a need to understand factors that influence the consumption of sports supplements by young athletes. This research was an attempt to use the Theory of Planned Behavior (TPB) to understand sports supplement use by female collegiate athletes.

Theoretical Background

The Theory of Planned Behavior (TPB) provided the framework and foundation for this research. The theory is used to analyze and explain intrapersonal motivating factors to predict intention to perform a specific behavior. In this study, beliefs about sports supplement consumption, perception of subjective norms regarding sports supplement consumption, and perceived control over sports supplement consumption were used to predict female collegiate athletes' intentions to consume sports supplements.

According to Ajzen (1988), there are four constructs attributed to performance of a behavior. These are attitude toward a behavior, perceived social norms with regard to the behavior, perceived behavioral control with regard to the behavior, and behavioral intention to perform the behavior (see Figure 1).

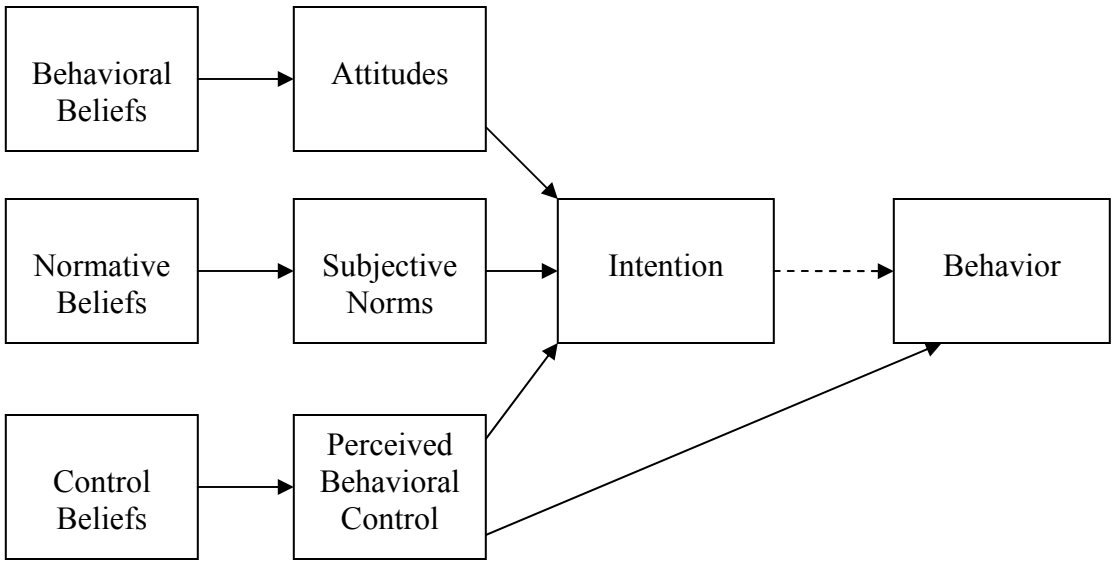

Figure 1. Model of the theory of planned behavior.

Manuscript Overview

As sports supplement use has increased and adverse effects have been reported, it has become necessary to understand motivations for consumption of these substances. Health professionals continue to use theory to understand health behaviors and use this knowledge to develop programs in an attempt to improve the health of the nation and population subgroups within the nation. This manuscript contains three papers related to

the investigation of factors surrounding sports supplements and the use of theory to understand consumption of sports supplements by athletes:

- Applications of the Theory of Planned Behavior to Health Behaviors
- Efficacy of the Theory of Planned Behavior in Prediction Consumption of Sports Supplements in Female Collegiate Athletes
- Dietary and Sports Supplements: The Need for a Systematic Tracking System

CHAPTER II

APPLICATIONS OF THE THEORY OF PLANNED BEHAVIOR TO HEALTH BEHAVIORS

Introduction

The applications of social psychological theories to health-related behaviors have increased over the past few decades (Conner & Sparks, 2005; Godin & Kok, 1996). This increase in popularity, which seems to have continued to date, has coincided with the need to use theory to understand individual, social, and environmental influences on health behavior. Understanding factors influencing health behaviors allows health educators and other health professionals to develop programs and policies to assist individuals in leading a healthier lifestyle. This paper includes a review of applications of the Theory of Planned Behavior (TPB) to health behaviors including drug use, sexual behavior, physical activity, screening behavior, risk-related behaviors, and dietary behaviors. Additionally, the usefulness of the TPB in the burgeoning subject of dietary supplements will be addressed. Finally, a discussion of strengths and weaknesses of the TPB, and emerging additional predictors that may offer greater insight into dietary supplement consumption.

History of the Theory of Planned Behavior

The Theory of Planned Behavior (TPB; Ajzen, 1988, 1991) is an extension of the earlier Theory of Reasoned Action (TRA; Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980), which continues to be used to predict behavior. Historically, the TRA performed

well with behaviors under volitional control. However, with behaviors in which control was not completely volitional, the constructs of the TRA were vulnerable to outside influences (Godin & Kok, 1996). Thus, Ajzen (1988) proposed an additional construct of perceived behavioral control (PBC) to account for environmental influences on behavior.

The TPB is considered a deliberative model in which an individual's attitude towards a behavior is formed only after careful consideration of available information (Conner & Sparks, 2005). The TRA and TPB originated from Fishbein's work on psychological processes in which attitudes cause behaviors. Previously, Peak (1955) introduced the concept of behavioral intention and generated an explanation of conditions under which attitude-behavior relationships might be expected to be strong. The principle of compatibility holds that each attitude and behavior has four elements: action, target, context, and time. The relationship between attitude and behavior will be greatest when both are measured to the same degree of specificity with respect to each element (Ajzen & Fishbein, 2005). Therefore, a behavior consists of (1) an action (behavior), (2) performed on or toward a target or object, (3) in a particular context, (4) at a specified time or occasion. For example, an athlete wanting to improve their performance may (1) consume (2) a supplement (3) in the kitchen (4) immediately after a workout. According to Ajzen (1988), studying health behaviors usually involves a general class of behaviors (e.g. physical activities) or the repeat performance of a single behavior. Given that attitude and behavior are most strongly related when each are measured to the same degree, general attitudes should predict general behaviors and

specific attitudes should predict specific behaviors (Conner & Sparks, 2005). It is important to consider the four elements of compatibility when developing measures for components of the TPB.

The Theory of Planned Behavior

The ultimate goal of the TPB is to predict and understand human behavior. The TPB focuses on theoretical constructs that are concerned with individual motivational factors (behavioral intention) as determinants of the likelihood of performing a specific behavior. The TPB includes measures of attitude (BA), social normative perceptions (SN), and perceived behavioral control (PBC) that determine behavioral intention (BI). Behavioral intention in turn leads to a behavior. The TPB (Ajzen, 1988), an extension of the TRA, includes an additional construct concerned with perceived control over performance of a behavior. Both theories assume that all other factors including demographics and environment operate through the model constructs and do not independently contribute to explaining the likelihood of performing a behavior.

Behavioral Intention

The Theory of Planned Behavior (see Figure 2) assumes the immediate determinant of behavior is one's intention to perform a behavior. Ajzen and Fishbein (1980) have postulated this assumption on the strength of the intention-behavior correlation to other antecedent factors. Consistently, intention is found to be the best predictor of behavior with correlations between 0.72 and 0.96 for behaviors under

complete volitional control. Two factors, the interval between intention and behavior and assessment of all behavior alternatives, have the greatest influence on the accuracy of the intention-behavior prediction. In general, as time between intention and behavior increases, the accuracy of

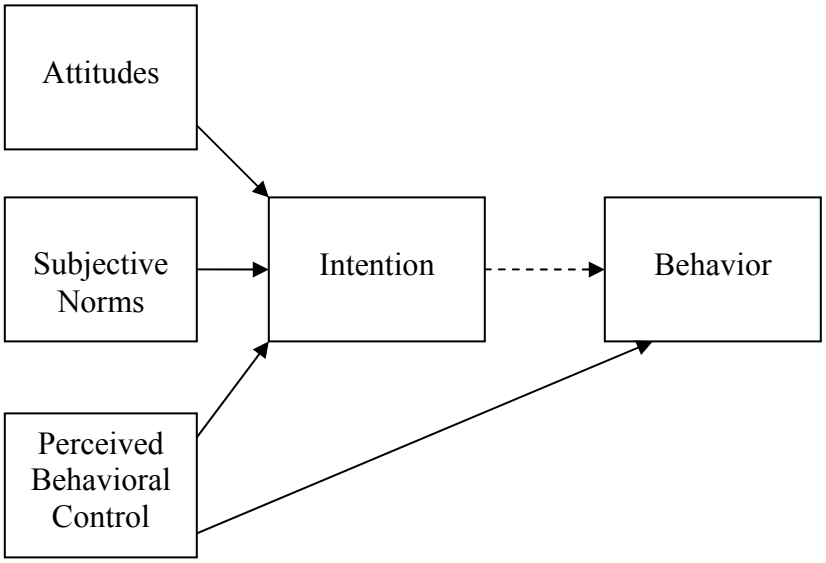

Figure 2. The theory of planned behavior.

behavior prediction decreases. Thus, to increase intention prediction accuracy, the investigator must determine individuals' intentions at all levels. Ajzen and Fishbein (1980) stated intention is a direct function of two independent factors: attitude toward a behavior and perceived subjective norms regarding a behavior. These three constructs combine to form the TRA. Subsequent research suggested the TRA was less effective in prediction behaviors not under complete volitional control. Ajzen (1988, 1991)

proposed the addition of perceived behavioral control as a fourth construct. This construct is assumed to capture environmental influences on an individual's behavior.

According to Ajzen and Fishbein (1980) and Ajzen (1988, 1991), the formula representing the TPB can be presented in the following form:

$$BI = w_1A + w_2SN + w_3PBC$$

where BI = behavior intention, A = attitude toward a behavior, SN = subjective norm, and w1, w2 and w3 are empirically determined weights.

Determinants of Behavioral Intention

Attitude

According to the TPB, an individual's attitude affects their intention to perform a behavior. Additionally, an individual's intention to perform a behavior is affected by their attitude toward the behavior. An individual's attitude (A) toward a behavior is a function of an individual's belief that performing a behavior will lead to a particular outcome and the individual's evaluation of that outcome. A person's attitude will vary depending on their evaluation of the probability of a positive or negative outcome (expectancy value). Thus, if an individual expects performance of a behavior will likely lead to a positive outcome, they are more likely to intend to perform the behavior. Within the theoretical framework of the TPB, attitude is the sum of expectancy-value products over the possible consequences:

$$A = \sum_{i=1}^{i=p} b_i * e_i$$

where b_i is the belief that performing a behavior leads to a consequence, i, e_i is the evaluation of consequence i, and p is the number of possible consequences.

Subjective Norms

Perceived subjective norms (SN) also inform intention. Subjective norms are a function of an individual's normative beliefs, which are a person's perceptions of social pressures to perform or abstain from performing a behavior. Normative beliefs are affected by presence of significant others (i.e. parents, coaches, teammates) and the individual's motivation to comply with the wishes of significant others. Thus, if an individual believes significant others want them to perform a behavior, and the individual is motivated to comply, it is expected the individual will intend to perform the behavior. Within the theoretical framework of the TPB, social norms are quantified by the sum of an individual's normative beliefs (nb) multiplied by their motivation to comply (mc) across the number of significant others (q):

$$SN = \sum_{j=1}^{j=q} nb_j * mc_j$$

where j is a specific significant other

Perceived Behavioral Control

Perceived behavioral control (PBC), according to the TPB, is a function of an individual's control beliefs and the power of those beliefs. Control beliefs consist of the frequency of occurrence of factors likely to facilitate or inhibit a behavior and the perception of the extent to which factors might facilitate or inhibit performance of the behavior. Thus, if factors likely to facilitate a behavior are frequent and perceived as

powerful, an individual would be expected to intend to perform the behavior. Within the theoretical framework of the TPB, perceived behavioral control is quantified by multiplying the frequency of occurrence of a control factor by the perception of the power of the factor to facilitate or inhibit the behavior:

$$PBC = \sum_{k=1}^{k=r} c_k * p_k$$

where PBC is perceived behavioral control, c_k is the perceived frequency of occurrence of a factor (k), p_k is the perceived power of the factor, and r is the number of control factors.

Methods

The Theory of Planned Behavior has been used to explain a wide range of health-related behaviors such as automobile safety, addictive behaviors, medical screening behavior, exercise behavior, sexual behavior, and dietary behavior. A review of these applications and the effectiveness of the TPB in predicting behavior are presented below.

Peer-reviewed literature applying the Theory of Planned Behavior to health-related behaviors from 1980 to 2005 was attained using on-line search engines (MEDLINE, ERIC, PsycINFO, and PsycLIT) (see Table 1).

Overview of the Theory of Planned Behavior and Health Behaviors

To date, several meta-analytic reviews of the TPB have been reported including several general reviews such as Ajzen (1991), Armitage and Conner (2001), and

Trafimow (2002). Additionally, Godin and Kok (1996) reviewed only health-related behaviors and several studies reviewed the application of the TPB to specific health behaviors (Blue, 1995; Hausenbals et al., 1997; Hagger et al., 2002), Sheeran & Taylor, 1999; Albarracin, Johnson & Fishbein, 1999). Health behaviors reviewed included drug use, sexual behavior, physical activity, screening behavior, risk-related behavior and dietary behavior.

Physical Activity

The TPB has helped explain exercise behavior. Kerner and Kurrant (2003) investigated psychosocial correlates to high school girls' leisure time physical activity. The constructs of the TPB were positively associated with high school girls intention to perform leisure time physical activity ($R^2 = .517$). Blanchard et al. (2003) examined the affect of moderating factors on the TPB's efficacy in explained exercise behavior. Attitude, norms, and perceived control explained 7.07% of the within participant variance. Also, gender and ethnicity were significantly associated with attitudes providing a moderator effect. Thus, ethnicity and gender must be considered when developing exercise interventions.

The most comprehensive review of the TPB and physical activity was conducted by Hagger, Chatzisarantis and Biddle (2002), and included a review of 72 independent studies. Across studies, The TPB explained 45% of variance in behavioral intention and 27% of exercise behavior. The strongest predictors were attitude ($r = 0.48$) and perceived behavioral control ($r = 0.44$). Perceived social norm was the overall weakest predictor ($r = 0.25$). McEachan, Conner and Lawton (2005) summarized 47 studies and

reported the TPB explained 40% of behavioral intention and 33% of exercise behavior. Again, perceived behavioral control (r = 0.47) and attitude (r = 0.46) were the strongest predictors with perceived social norm being the weakest (0.26).

Drug Use

McEachan, Conner and Lawton (2005) reported meta-analytic results of 18 studies regarding licit and illicit drug use. Overall, the TPB was able to explain a weighted average of 53% of variance in behavioral intention and 39% of variance in behavior regarding drug use. Perceived behavioral control was the strongest predictor (r = 0.55), attitude the second (r = 0.52), and perceived social norms the weakest (r = 0.43).

Sexual Behavior

In a review of the TPB and sexual behavior, McEachan, Conner and Lawton (2005) reported on safe sex behaviors (n = 8) and condom use (n = 9). Across theses studies, the TPB accounted for a weighted average of 49% of variance in behavioral intention with attitude being the strongest predictor (r = 0.43), perceived social norm the second strongest predictor (r = 0.38), and perceived behavioral control being the weakest (r = 0.35).

Table 1. Predictive weights and effect sizes for the theory of planned behavior applied to health behaviors

		Correlations			Regression Coefficients				
Study	Behavior	Attitude	Subjective Norm	Perceived Behavioral Control	Attitude	Subjective Norm	Perceived Behavioral Control	R^2 (Intention)	R^2 (Behavior)
McEachan, Conner, Lawton	(Meta-analytic review of TPB and health behavior)								
	a. Drug use (n=18)	x	x	x	0.52	0.43	0.55	0.53	0.39
	b. Sexual behavior (n=17)	x	x	x	0.43	0.38	0.35	0.49	0.28
	c. Physical activity (n=47)	x	x	x	0.46	0.26	0.47	0.40	0.33
	d. Screening behaviors (n=12)	x	x	x	0.56	0.34	0.43	0.44	0.16
	e. Risk-related behaviors (n=6)	x	x	x	0.50	0.51	0.66	0.54	0.39
Beale, Manstead	Limiting infants sugar intake	x	x	x	x	x	x	x	x
	a. at baseline	0.32	0.17	0.27	0.26**	0.10	0.22**	0.16	x
	b. 1 to 4 weeks later	0.43	0.26	0.38	0.35**	0.08	0.27**	0.27	x
Brug et al	Consuming	x	x	x	x	x	x	x	x
	a. boiled vegetables	0.17	0.09	0.34	0.11*	0.03	0.31**	0.13	x
	b. salads	0.30	0.19	0.35	0.19**	0.12	0.27**	0.17	x
	c. fruit	0.17	0.06	0.69	0.00	0.02	0.69**	0.47	x
Madden et al	Avoiding caffeine	x	x	x	x	x	x	0.66	x
	Taking vitamin supplements	x	x	x	x	x	x	0.44	x

Table 1 Continued

		Correlations			Regression Coefficients				
Study	Behavior	Attitude	Subjective Norm	Perceived Behavioral Control	Attitude	Subjective Norm	Perceived Behavioral Control	R^2 (Intention)	R^2 (Behavior)
Sparks et al	Eating whole wheat bread	0.50	0.12	0.14	0.51***	0.06	0.02	0.25	x
	Eating sweet biscuits	0.46	0.08	0.12	0.47***	0.07	0.15	0.24	x
Sparks, Shepherd	Consuming organic vegetables	0.38	0.30	0.27	0.20**	0.18*	0.26	0.41	x
Oygard, Rise	Eating healthier food	0.51	0.23	0.37	x	x	x	0.32	x
Lucidi et al	Using doping substances	x	x	x	x	x	x	0.54	x
Astrom, Rise	Eating healthier food	x	x	x	0.18	0.03	0.38	0.52	x
Povey et al	Eating healthier food	0.36	0.26	0.46	0.46***	0.12*	0.22***	0.42	0.15
Backman et al	Healthy dietary behavior	0.54	0.51	0.46	0.29***	0.26***	0.21***	0.42	0.17
Astrom	Sugar snack consumption	x	x	x	0.53*	0.09*	0.24*	0.58	0.05
Masalu, Astrom	Sugar restriction	x	x	x	0.15**	0.41**	0.11*	0.25	x
Conner et al	Dietary supplements	x	x	x	0.43*	0.16*	0.13*	0.75	x
Conner et al (2001)	Dietary supplements	0.78	0.69	0.49	0.54***	0.28***	0.17***	0.70	x

Table 1 Continued

		Correlations			Regression Coefficients				
Study	Behavior	Attitude	Subjective Norm	Perceived Behavioral Control	Attitude	Subjective Norm	Perceived Behavioral Control	R^2 (Intention)	R^2 (Behavior)
Rah et al	Consuming soy products	0.57**	0.37**	0.33**	x	x	x	0.48	0.49
Kim et al	Dairy consumption	0.42***	0.33***	0.48***	0.38	0.11	0.30	0.42	0.39
Sjoberg, Kin, Reicks	Fruit and vegetable consumption	0.46***	0.36***	0.53***	0.29	0.13	0.41	0.40	0.18
Verbeke, Vackier	Fish consumption	0.49	0.39	0.50	0.21	0.18	0.27	0.31	0.07
Lien, Lytle, Komro	Fruit and vegetable consumption	0.13	0.34	0.33	x	x	x	0.31	x
Kassam et al	Soft drink consumption	0.76***	0.42***	0.57***	0.76***	0.14***	0.24***	0.64	0.28

* $p<.05$
** $p<.01$
*** $p<.001$

Screening Behaviors

In a review of 12 studies, McEachan, Conner and Lawton (2005) investigated uses of the TPB in predicting screening behaviors including testicular self exam (n = 5), cervical screening (n = 2), or health screening (n = 5). The TPB was able to explain 44% of behavioral intention and 16% of behavior with attitude being the strongest predictor (r = 0.56). Perceived behavioral control was the second strongest (r = 0.43), and perceived social norm the weakest (r = 0.34).

Risk-related Behaviors

The TPB has been applied to several risk-related behaviors such as safe riding of motorcycles, risk-related driving violations, and sun protective behaviors. The TPB has also been used to explain compliance or non compliance with speed limits. McMillan and Conner (2003) examined impact of gender and passengers on drivers' intentions to break the speed limit. The TPB explained 45 percent of the variance associated with intention to break the speed limit. In addition, males reported significantly more normative pressure than females. In a similar study, Elliot, Armitage, and Baughan (2003) compliance with speed limits with the TPB, demographic data, and previous behavior. Attitude, norms, and perceived control was positively associated with a drivers' intention to break the speed limit ($R^2 = .49$). Prior behavior along with the TPB explained 76 percent of variance associated with intention to break the speed limit.

In a meta-analytic review, McEahan, Conner and Lawton (2005) reported on several risk-related behaviors including bike riding safety (n = 3), car driving behaviors

(n = 1), or sun protective behaviors (n = 2). Across studies, the TPB predicted 54% of behavioral intention and 39% of behavior with perceived behavioral control being the strongest predictor (r = 0.66), perceived social norm the second strongest (r = 0.51), and attitude the weakest (r = 0.50). Wittenbraker, Gibbs and Kahle (1983) and Trafimow and Fishbein (1995) used the TPB to investigate intentions to use seatbelts. Participants in both studies were psychology students. Results revealed that manipulation of attitudes influenced a student's intention to perform attitudinal control behaviors. Also, regression analyses supported prediction of intentions to wear seatbelts by attitudes and subjective norms.

Dietary Behavior

The TPB has been applied sparingly to behaviors such as fruit, vegetable and sugar consumption, and rarely to dietary supplement use. The TPB has been successful in explaining a large amount of variance in other health related behaviors and could provide insight into factors that motivate dietary supplement consumption. First, an examination of the use of the TPB with dietary behaviors will be offered. Several prospective studies have used the TPB to examine eating behaviors including sugar intake, healthy eating, consumption of fruit and vegetables, whole wheat, soy products and fish.

Astrom (2004) used structural equation modeling to test the TPB in prediction of sugar consumption among adolescents whereas Masalu and Astrom (2003) and Beale and Manstead (1991) used regression analyses to explore sugar restriction. Astrom (2004) reported a good fit with sample data (χ^2=1.29, df =2, NFI = 0.97, RMSEA =

0.054). Additionally, the TPB was able to explain 58% of variance in behavioral intention with past behavior contributing an additional 5% of behavioral intention variance. Past behavior is sometimes used in conjunction with the TPB to improve predictive ability. Attitude (53%) was the strongest predictor of intention and subjective norms (9%) the weakest. Masalu and Astrom (2003) reported the TPB constructs were able to account for 25% of behavioral intention in sugar restriction. Subjective norms (41%) was the strongest predictor and perceived behavioral control (11%) the weakest. Beale and Manstead (1991) reported the constructs of the TPB explained 27% of variance in intention to restrict sugar consumption. Attitudes ($\beta = .35$) was the strongest predictor and subjective norms ($\beta = .08$) the weakest. Across sugar related studies, attitude appears to be the strongest predictor with subjective norms and perceived behavioral control being weaker. Additionally, the TPB was able to explain 25-58% of variance in intention to consume or restrict sugar.

Several authors have examined the ability of the TPB to predict healthy eating behaviors such as general healthy eating, eating a low fat diet, fruit, vegetable, fish and soy consumption Povey et al (2000), Backman et al (2002), Oygard and Rise (1996), Astrom and Rise (2001) and Conner, Norman and Bell (2002) explored intention to eat healthy foods. Povey, Conner and Sparks (2000) found the TPB constructs were able to predict 42% of variance in behavioral intention to eat healthy foods with attitude (50%) being the strongest predictor and subjective norms (11%) weakest. Backman, Haddad and Lee (2002) reported 65% of variance in intention to eat a healthful diet explained by the TPB constructs. Attitude (55%) was the strongest predictor and subjective norms

(35%) the weakest. In a study of young adults intention to eat healthier food, Oygard and Rise (1996) reported the construct of the TPB explained 32% of variance in behavioral intention. Attitude (51%) was the strongest predictor and subjective norms (23%) the weakest. Astrom and Rise (2001) reported on intention of young adults to eat healthy food. The TPB was able to explain 52% of variance in intention with perceived behavioral control ($\beta = 0.56$) being the strongest predictor and subjective norms ($\beta = 0.05$) the weakest. Conner, Norman and Sparks (2002) reported the TPB was able to explain 20% of variance in intention to eat healthy in a sample of health promotion clinic attendees. Attitude ($\beta = 0.29$) was the strongest predictor and subjective norms ($\beta = -0.13$) the weakest. Across general healthy eating studies, attitude seems to be the best predictor with subjective norms being the weakest predictor. Additionally, the TPB was able to explain 20-65% of variance in behavioral intention to eat healthy foods.

In addition to studies examining general healthy eating, several authors have used the TPB in an attempt to predict consumption of specific types of food. Sjoberg, Kim and Reicks (2004) and Lien, Lytle and Komro (2002) measured the ability of the TPB to predict fruit and vegetable consumption. Sjoberg, Kim and Reicks (2004) reported the TPB was able to explain 40% of intention to consume fruit and vegetables and 18% of reported fruit and vegetable consumption in a sample of older adults (77 years of age). Perceived behavioral control (53%) was the strongest predictor of intention and subjective norms (36%) the weakest. In a study of young adults' consumption of fruit and vegetables, Lien, Lytle and Komro (2002) reported the TPB was able to explain 31% and 7% of variance in behavioral intention and behavior

respectively. Subjective norms (34%) was the strongest predictor of intention and attitude (13%) the weakest.

Verbeke and Vackier (2005) measured the ability of the TPB to predict fish consumption, and Rah et al (2004) used the TPB to predict consumption of soy products. Verbeke and Vackier (2005) reported the TPB was able to explain 31% of the variance in intention to consume fish among a cross sectional sample. Perceived behavioral control (51%) was the strongest predictor and subjective norms (29%) the weakest. Rah, Hasler and Painter (2004) examined soy product consumption in a sample of California residents. The TPB was able to explain 48% of variance in behavioral intention with attitude (57%) being the strongest predictor and perceived behavioral control (33%) the weakest. Across fruit, vegetable, fish and soy consumption studies, the TPB was able to predict 31-48% of variance in behavioral intention. As with general healthy eating behavior, attitude and subjective norms were most often the strongest and weakest predictors, respectively.

In the most comprehensive review of the TPB and health behaviors to date, McEachen, Conner and Lawton (2005) used weight averages to provide an overview of the effectiveness of the TPB. McEachen, Conner and Lawton (2005) reported that across studies, the TPB was able to predict 39% of behavioral intention with attitude (31%) being the strongest predictor and subjective norms (12%) being the weakest predictor. Perceived behavioral control contributed 23% to behavioral intention prediction.

Conclusions from the Review of the TPB and Health Behaviors

The TPB has been used to predict a variety of health behaviors. Across studies, the TPB has been successful in explaining a considerable amount of variance in behavioral intention. However, McEachan, Conner and Lawton (2005) found significant variance between studies and behaviors. The TPB variables explained the most variance in behavioral intention in drug use and risky behaviors (53-54%) and the least in physical activity and dietary behavior (40-41%). Furthermore, attitude was the strongest predictor of behavioral intention for sexual, dietary and screening behaviors, and perceived behavioral control was the strongest predictor for drug use, physical activity, and risky behaviors. McEachan, Conner and Lawton (2005) also reported the TPB variables were able to explain the most variance (39%) for drug use and risky behaviors and the least amount of variance for screening and dietary behaviors (16-22%). In general, behavioral intention and perceived behavioral control have been strong predictors for all health behaviors with behavioral intention explaining the most variance in behavior.

Dietary Supplements and the TPB

Although numerous studies have focused on using the TPB to explain dietary behaviors, few have attempted to examine consumption of dietary supplements. The Dietary Supplement Health and Education Act (DSHEA) made safety and efficacy testing the responsibility of the consumer, and dietary supplement surveys and sales records indicate consumption of these substances continues to increase. Conner,

Norman and Bell (2002) stated reasons for consuming dietary supplements is likely to be complex by combining social, psychological, and economic factors Additionally, authors such as Dodge, Ford and Perko (2003) and Perko (1999) have called for the use of theory to examine consumption of dietary supplements as a way to understand the complexities of supplement consumption. Dodge, Ford and Perko (2003) stated the TPB is an appropriate model to assist health professionals in developing interventions aimed at dietary supplement consumption. However, a review of literature revealed only one study using the TPB specifically to predict dietary supplement consumption. Conner, Norman and Bell (2002) reported the TPB was able to explain 70% of variance in intention to consume sports supplements among a sample of women. Attitude ($r = 0.78$) was the strongest predictor of intention and perceived behavioral control ($r = 0.49$) the weakest. These results seem promising considering this is one of the first studies to use the TPB to predict dietary supplement consumption. The TPB seems to be well suited to address concerns related to explanation of influences on dietary supplement consumption. More research is necessary to determine if the TPB can consistently predict intention to consume or consumption of dietary supplements across varying populations. With the minimal amount of research using theory to understand dietary supplement consumption, it seems appropriate to pursue this line of research.

Additional Predictors

Although the TPB performed quite well in an initial dietary supplement study, several authors have suggested the predictive ability of the TPB can be improved with

addition of several variables. Ajzen (1991) suggested the TPB is open to inclusion of additional constructs, "The theory of planned behavior is, in principle, open to the inclusion of additional predictors if it can be shown that they capture a significant proportion of variance in intention or behavior after the theory's current variables have been taken in to account" (p. 199). There are four constructs which seem to add to the predictive ability of the TPB: anticipated affective reactions, moral norms, self-identity, and past behavior. Each construct will be discussed and theoretical and empirical justifications will be offered.

Anticipated Regret

Anticipated regret is the negative, cognitive-based emotion experienced when we realize or imagine that the present situation could have been better had we acted differently (Conner & Sparks, 2005). Because emotional outcomes commonly affect decision making (Van der Plight & de Vries, 1998), anticipated regret can affect an individual's performance or non-performance of a behavior.

Richard, Van der Plight and de Vries (1996) and Sheeran and Orbell (1999) demonstrated that anticipated regret is distinct from the components of the TPB, and explains a significant amount of variance in health behaviors including eating junk food, consuming soft-drinks and alcohol. In a meta-analytic review of TPB studies using anticipated regret, Sandberg and Conner (2005) reported a correlation between anticipated regret and behavioral intention to be 47%. Additionally, anticipated regret was able to explain an additional seven percent of variance in behavioral intention.

Further studies demonstrating independent effects of anticipated regret are required to verify these findings.

Moral Norms

Ajzen (1991) described moral norms as an individual's perception of the moral correctness or incorrectness of performing a behavior. Additionally, Ajzen (1991) suggested that moral norms directly influence behavioral intention, and work in parallel with attitude, subjective norms, and perceived behavioral control. In a study of dishonest actions, Beck and Ajzen (1991) found moral norms increased amount of variance explained by three to six percent and made significant contribution to prediction of intention. In a review of 11 TPB studies, Conner and Armitage (1998) found correlation between moral norms and behavioral intention to be 50%. Furthermore, moral norms added an average of four percent to variance explained in behavioral intention. These findings suggest moral norms may add predictive ability to the TPB when studying behaviors where moral considerations are important (Conner & Sparks, 2005).

Self-identity

Self-identity may be defined as the salient part of an actor's self which relates to a particular behavior (Conner & Sparks 2005). It reflects the extent to which an actor sees him or herself fulfilling the criteria for any societal role. Several authors have used self-identity in conjunction with the TPB variables. In a study of six TPB studies,

Conner and Armitage (1998) reported a correlation of 27% between self-identity and behavioral intention and an additional one percent of variance explained. Ajzen and Fishbein (2005) found similar results, but suggested self-identity may be best used as an alternative measure of behavioral intention. In contrast, Sparks and Shepard (1992) found self-identity made significant contributions to variance explained in behavioral intention. Despite these conflicting reports, authors such as Conner and Sparks (2005) have suggested self-identity may provide additional predictions for certain behaviors. Further research is needed to determine behaviors or conditions under which self-identity adds to the predictive ability of the TPB.

Past Behavior

Sutton (1994) has argued that many behaviors are determined by one's previous behaviors rather than cognitions as described in the TPB. For example, Mullen, Hersey and Iverson (1987) found past behavior to be the best predictor or future behavior across several studies. Ajzen (1991) argues the effects of past behavior should be mediated by perceived behavioral control and that repetition of behavior should lead to enhanced perceptions of control.

In an empirical review of TPB studies using past behavior, Conner and Armitage (1998) found large correlations between past behavior and future behavior, behavioral intention, attitude, and perceived behavioral control. Conner, Warrant and Close (1999) also reported an average increase of seven percent in variance explained for behavioral intention across 12 studies. Additionally, past behavior was able to explain an additional

13% of variance in behavior when controlling for the TPB variables. Although past behavior has increased predictive ability when used with the TPB variables, Conner and Sparks (2005) states we must be careful not to give past behavior the same status as other TPB variables because it is clear past behavior cannot be used to explain future performance of an action. Sutton (1994) suggests habit may be one way to conceptualize this effect. Furthermore, Ajzen (2002) stated "Weaker effects of past behavior are observed when measure of intention and behavior are matched on the principle of compatibility, and experience of a behavior may lead to a change in intentions and a reverting to a previous pattern of behavior" (Ajzen & Fishbein 2005).

Discussion

Researchers in health professions often use theory to understand and predict behavior (Conner & Sparks, 2005). The expectation is that theory will provide predictive power and we will be able to understand behaviors and implement interventions as needed. Expectations are not different when using the Theory of Planned Behavior (TPB).

Although the TPB is expected to help predict health behavior, there are factors which may influence its effectiveness. When investigators comply with the principle of compatibility or specificity, intention-behavior relationships should be strong. However, health professionals are often more interested in general or regular behavior patterns. For example, attitudes towards purchasing foods produced by certain technologies may well be affected by more general attitudes towards these technologies as well as by

attitudes towards specific purchase behaviors, especially if attitudes towards purchase focus on the outcomes of purchase (Conner & Sparks 2005). Individuals' attitudes may also vary with subgroups of any particular health behavior (i.e. physical activity). An individual may have a positive attitude toward exercising on a stationary bike, but a negative attitude toward running on a treadmill. Therefore, when studying physical activity, the predictive ability of the TPB may be affected by the questions asked. Furthermore, Lord, Lepper and Mackie (1984) stated that attitudes toward targets will only correspond with actual behaviors if the attitude target matches the person's perception of the attitude target. When a person's perception of a target differs greatly from the reality of the target, the attitude-behavior relationship will likely be weak.

This review of studies regarding the TPB and health behaviors may provide health professionals with an increased understanding of health behaviors and the effectiveness of the TPB in predicting these behaviors. Although the TPB has consistently been able to explain large amounts of variance in behavioral intention, it seems to be limited in predicting actual behavior. In many cases behavioral intention has not led to actual behavior (see Table 1). The exact cause of this discrepancy is unclear, although it has been suggested the TPB does not account for all influences in our environment.

Conner and Sparks (2005) suggest the number and power of influences within our social environment are large and ever changing. Because the TPB deals with perceptions of control, any environmental influence on behavior that does not impinge on a person's perception of control will not be accessible to analysis using the TPB. As

evidenced by earlier discussion of additional variables, health behaviors need to be understood and predicted not only through the variables of the TPB, but also through social pressure or context (e.g. regret, moral norms, self-identity), and past behavior. While the TPB is concerned with proximal psychological influences on behavior, we have to recognize the broader social structure with which these influences develop (Conner & Sparks 2005). Ecological models may provide the best approach to address the short comings of the TPB.

Ecological models are comprehensive models that are multifaceted, concerned with environmental change, behavior, and policy that help individuals make healthy lifestyle choices (Glanz, Rimer & Lewis, 2002). A defining feature of an ecological model is that it takes into account the physical environment and its relationship to people and the individual, interpersonal, organizational and community levels. The TPB seems to have difficulty accounting for the pressures of the physical environment (i.e. factors not within an individual's control) whereas ecological models are prefaced on the concept that behavior is affected by interpersonal, social, cultural, and physical environment variables. Additionally, these variables interact and relationships between these variables are ever changing. It has been suggested the addition of variables (i.e. anticipated regret, moral norms, self-identity and past behavior) would increase the predictive ability of the TPB. These variables would seem to fit into the structure of an ecological model. Health professionals may find greater success understanding and predicting health behavior using the TPB within the structure of an ecological model (i.e.

use the TPB to measure individual characteristics) and incorporate additional measures to assess interpersonal, organizational and community variables.

Conclusion

This paper included a literature review of TPB applications to health behaviors, possible usefulness of the TPB in understanding dietary supplement consumption, and a discussion of limitations of the TPB. The effectiveness of the TPB to predict behavior varied widely across health behaviors. These variations may be explained by measurement difficulty, inappropriate application of the TPB (i.e. not using the principle of compatibility), or the apparent inability of the TPB to account for environmental influences.

Despite these limitations, the only cited study using the TPB to predict dietary supplement consumption explained 70% of variance in behavioral intention. Hence, use of the TPB to understand factors that influence consumption of dietary supplements, appears to be appropriate. Furthermore, using additional variables (e.g. anticipated regret, self-identity, moral norms, past behavior) should strengthen the ability of the TPB to predict supplement consumption and increase our knowledge of influences on use of these substances. Using the TPB in the framework of other models (i.e. ecological models) may help identify factors outside the TPB model and explain variance in behavior created by non-cognitive factors.

Finally, the TPB seems to do quite well in predicting intention, but previous studies have shown intention does not always lead to behavior. Environmental factors affect the transfer of intention to behavior. Hence, future studies using the TPB to

understand dietary and other health behaviors should include measures to account for factors outside the realm of cognitive functions. The TPB remains a useful theory for understanding health behaviors and its enhancement through additional variables can only make previous and future findings more meaningful.

CHAPTER III

EFFICACY OF THE THEORY OF PLANNED BEHAVIOR IN PREDICTING SPORTS SUPPLEMENT CONSUMPTION IN FEMALE COLLEGIATE ATHLETES

Introduction

Recent studies suggest consumption of all classifications of dietary supplements, including sports supplements has increased (Dodge, Ford & Perko, 2003; Yu, Ghandour & Huang, 2000; Metzl, Small & Levine, 2001). Several factors make collegiate athletes particularly vulnerable to possible dangers inherent to consumption of dietary supplements. Athletic and academic responsibilities place a great deal of pressure on collegiate athletes. Many athletes are looking for a competitive edge and some may turn to sports supplements to gain an advantage over their opponents. Several instances of adverse effects related to use of sports supplements have been reported and regulation of these substances is virtually non existent. Considering the lack of regulation and seemingly increasing rates of consumption, it has become necessary to understand behavioral factors influencing consumption of sports supplements. Theory provides an avenue to assess these factors. Few studies have attempted to use theory to understand or predict consumption of supplements and none have focused on the female collegiate athlete population. Therefore, the purpose of this study was to test the ability of the Theory of Planned Behavior to predict consumption of sports supplement by female collegiate athletes.

Dietary Supplements

Because dietary supplement terminology varies from study to study, direct comparison is often difficult. Therefore, for purposes of this paper, it is necessary to define several classifications of dietary supplements.

- Dietary supplements are defined by the Food and Drug Administration as "a product (other than tobacco) intended to supplement the diet that bears or contains one or more of the following ingredients: a vitamin, mineral, herb or other botanical, an amino acid, a dietary substance for use by humans to supplement the diet by increasing total daily intake, or a concentrate, metabolite, constituent, extract or combination of these ingredients."
- Sports supplements are a type of dietary supplement and consist of over-the-counter products (e.g. Androstenedione, Creatine, Ephedra) used to increase athletic ability or performance (e.g. muscle size and strength, speed, body composition).
- Sports supplements should be differentiated from performance enhancing drugs. Performance enhancing drugs (PED) are ***illegal*** substances used by athletes to increase physical performance (e.g. stimulants, anabolic steroids).

Dietary and Sports Supplement Consumption

Although it is difficult to determine the exact rate of supplement use, it appears consumption of dietary supplements is increasing. In the most recent national survey (NHANES III) daily or occasional consumption of dietary supplements was

approximately 60% (Sobal & Marquart, 1994; CDC, 1997). Survey results also indicated athletes are more likely to consume dietary supplements than the average adult or adolescent (Koplan, Annest & Layde, 1986; Stewart, McDonal & Shucker, 1985). A meta-analysis of 51 studies indicated an exponential increase in sports supplement use since the early 1980's with up to 46% of male and female athletes consuming dietary supplements on a regular basis (Sobal & Marquart, 1994). Furthermore, there was a five fold increase in use of herbal remedies between 1990 and 1997 (Muller & Clauson, 1997), and 30% of all teenagers in the United States have used a dietary supplement (Kleinman, 2002).

Only recently have studies focused on sports supplement use among women and few have included female athletes. However, a recent study suggests the rate of sports supplements use is increasing in this group (Perko, 1999). Creatine is the most popular sports supplement among young athletes (Metzl, Ghandour & Huang, 2000). In a survey of five New York suburb schools, athletes in all sports admitted trying creatine with as many as 9.3% currently supplementing with creatine. These results contradict earlier beliefs that creatine is taken more often by males participating in strength sports such as football or weight lifting (Metzl, Ghandour & Huang, 2000). Furthermore, several studies have indicated an increase in consumption of one particular supplement (Andro) among teenage athletes following Mark McGuire's admission the he used the supplement before and during his record breaking season (Delbeke, Van Eenoo & Thyne, 2003). Because prohormones are not technically steroids, they are sold over-the-counter, making them an easily accessible sports supplement. In addition, survey results of a

convenience sample of high school students indicated an increase in consumption of all dietary supplements, including sports supplements among adolescents (Bell, Dorsch & McCreary, 2004). Protein powder and creatine were the most popular sports supplements, and few differences were found between age groups or genders. The gap in rate of consumption between males and females seems to be closing rapidly.

Dietary and Sport Supplement Sales

Dietary supplement sales are another indicator suggesting a steady rise in supplement consumption. The USFDA estimated 1997 sales of dietary supplements totaled $10.3 billion (Saper, Kales & Paquin, 2004). Sports supplements (a subclass of dietary supplements) sales were approximately $927 million in 1997. In the same year, top dietary supplement manufacturers estimated revenue from dietary supplement sales at $6.05 Billion (Saper, Kales & Paquin, 2004). Consumers spent over $16.8 billion for vitamins, minerals, herbs, and specialty supplements in 2000. Retail sales of weight-loss supplements were estimated to be more than $1.3 billion in 2001 representing a 127% increase from sales in 2000. Depending on the source, estimates of retail sales of dietary supplements vary, however most data indicate the industry is growing rapidly and will continue to do so in the future (Saper, Kales & Paquin, 2004). As the number of individuals exposed to dietary and sports supplements increases, it is becoming more important to understand influences that impact and individual's decision to use sports supplements.

Implications

Over 6.6 million young athletes participate in some form of supervised sport and many continue actively through college (Beck & Ajzen, 1991). As a result, sports are becoming increasingly competitive. As young athletes compete for positions on their teams and for scholarships, many will attempt to gain every advantage possible. Consumption of sports supplements is a popular avenue for athletes to gain a competitive advantage. As previously mentioned, individual studies and supplement sales records continue to show growth in supplement consumption. Policies regarding supplement testing, distribution, and sales create an environment in which young athletes are vulnerable to marketing techniques and pressures to attain athletic success or an ideal physical appearance. Combined with a lack of clinical safety and efficacy data on sports supplements, these factors make this an area of concern for health professionals and creates a need to understand factors that influence the consumption of sports supplements by young athletes. This study was an attempt to use the Theory of Planned Behavior (TPB) to understand sports supplement use by female collegiate athletes.

The Theory of Planned Behavior

The applications of social psychological theories to health-related behaviors have increased over the past few decades (Conner & Sparks, 2005). This increase in popularity has coincided with the need to use theory to understand individual, social, and environmental influences on health behavior. Understanding the factors influencing health behaviors allows health educators and other health professionals to develop

programs and policies to assist individuals in leading a healthier lifestyle. The TPB has been used to examine multiple health behaviors including drug use, sexual behavior, physical activity, screening behavior, risk-related behaviors, and dietary behaviors. The present study attempts to assess the efficacy of the TPB in predicting sports supplement consumption among a sample of female collegiate athletes.

The ultimate goal of the TPB (see Figure 3) is to predict and understand human behavior. The TPB focuses on theoretical constructs that are concerned with individual motivational factors (behavioral intention) as determinants of the likelihood of performing a specific behavior. The TPB includes measures of attitude (A), social normative perceptions (SN), and perceived behavioral control (PBC) that determine behavioral intention (BI). Behavioral intention in theory leads to a behavior. The TPB (Ajzen, 1988) is an extension of the Theory of Reasoned Action (TRA) rather than an independent theory that includes an additional construct concerned with perceived control over performance of a behavior. The TPB assumes that all other factors including demographics and environment operate through the model constructs and do not independently contribute to explaining the likelihood of performing a behavior.

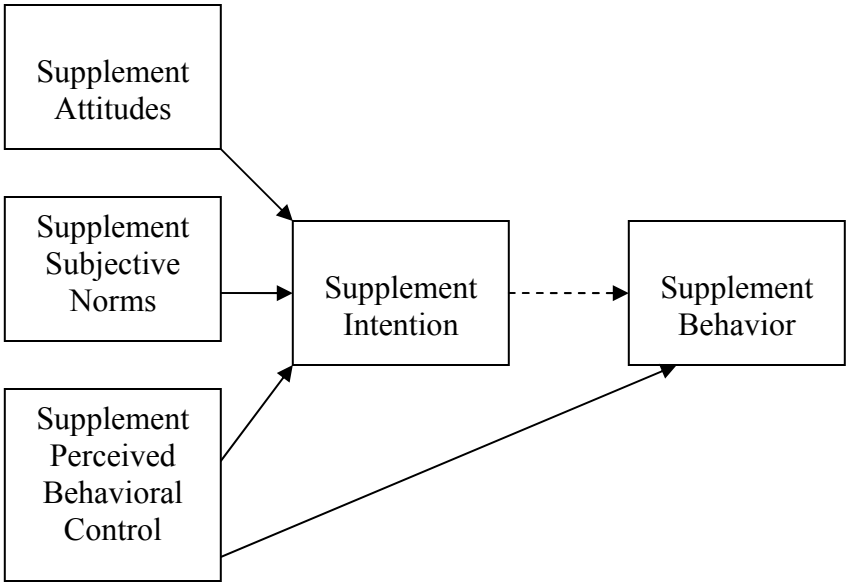

Figure 3. Proposed Theory of Planned Behavior Model.

The TPB has four guiding constructs: (1) attitude toward the behavior (A) – whether an individual views the behavior as positive or negative, (2) subjective norms (SN) – an individual's perception of what other persons think about the individual performing the behavior and his/her motivation to comply, (3) perceived behavioral control (PBC) – perception that the individual has control over performing a behavior, and (4) behavioral intention (BI) – the individual's intent to perform or not perform the behavior based on the weight of the first three constructs. The TPB depicts behavior as a linear regression function: $B = w_1BI + w_2PBC$, where w_1 and w_2 are empirically determined weights.

Behavioral Intention

The TPB assumes the immediate determinant of behavior is one's intention to perform a behavior. Ajzen and Fishbein (1980) have postulated this assumption on the strength of the intention-behavior correlation to other antecedent factors. Consistently, intention is found to be the best predictor of behavior with correlations between 0.72 and 0.96 for behaviors under complete volitional control. Two factors, the interval between intention and behavior and assessment of all behavior alternatives, have the greatest influence on the accuracy of the intention-behavior prediction. In general, as time between intention and behavior increases, the accuracy of behavior prediction decreases. Thus, to increase intention prediction accuracy, the investigator must determine individuals' intentions at all levels. Ajzen (1988, 1991) proposed the addition of perceived behavioral control as a fourth construct. This construct is assumed to capture environmental influences on an individual's behavior.

According to Ajzen and Fishbein (1980) and Ajzen (1988, 1991), the formula representing the Theory of Planned Behavior can be presented in the following form:

$$BI = w_1A + w_2SN + w_3PBC$$

where BI = behavior intention, A = attitude toward a behavior, SN = subjective norm, and w1, w2 and w3 are empirically determined weights.

Determinants of Behavioral Intention

Attitude

According to the Theory of Planned Behavior, an individual's attitude affects their intention to perform a behavior. An individual's attitude (A) toward a behavior is a function of an individual's belief that performing a behavior will lead to a particular outcome and the individual's evaluation of that outcome. A person's attitude will vary depending on their evaluation of the probability of a positive or negative outcome (expectancy value). Thus, if an individual expects performance of a behavior will likely lead to a positive outcome, he or she is more likely to intend to perform the behavior. Within the theoretical framework of the TPB, attitude is the sum of expectancy-value products over the possible consequences:

$$A = \sum_{i=1}^{i=p} b_i * e_i$$

where b_i is the belief that performing a behavior leads to a consequence, ej is the evaluation of consequence i, and p is the number of possible consequences.

Subjective Norms

Perceived subjective norms (SN) also inform intention. Subjective norms are a function of an individual's normative beliefs, which are a person's perceptions of social pressures to perform or abstain from performing a behavior. Normative beliefs are affected by presence of significant others (i.e. parents, coaches, teammates) and the individual's motivation to comply with the wishes of significant others. Thus, if an individual believes significant others want them to perform a behavior, and the

individual is motivated to comply, it is expected the individual will intend to perform the behavior. Within the theoretical framework of the TPB, social norms are quantified by the sum of an individual's normative beliefs (nb) multiplied by their motivation to comply (mc) across the number of significant others (q):

$$SN = \sum_{j=1}^{j=q} nb_j * mc_j$$

where j indicates a single significant other.

Perceived Behavioral Control

Perceived behavioral control (PBC), according to the TPB, is a function of the product of an individual's control beliefs and the power of those beliefs. Control beliefs consist of the frequency of occurrence of factors likely to facilitate or inhibit a behavior and the perception of the extent to which factors might facilitate or inhibit performance of the behavior. Thus, if factors likely to facilitate a behavior are frequent and perceived as powerful, an individual would be expected to intend to perform the behavior. Within the theoretical framework of the TPB, perceived behavioral control is quantified by multiplying the frequency of occurrence of a control factor by the perception of the power of the factor to facilitate or inhibit the behavior:

$$PBC = \sum_{k=1}^{k=r} c_k * p_k$$

where PBC is perceived behavioral control, c_k is the perceived frequency of occurrence of a factor (k), p_k is the perceived power of the factor, and r is the number of control factors.

The TPB has been used to examine a wide variety of health behaviors some of which have been targeted dietary behaviors. These behaviors including consumption of fruit and vegetable (Burg et al, 2003), caffeine (Madden, Ellen & Ajzen, 1992), soy (Rah, Hasler & Painter, 2004), fish (Verbeke & Vackier, 2005), and soft drinks (Kassam, Lee & Modeste, 2003). However, the use of TPB to investigate determinants of sports supplement consumption is a new application of the model (see Figure 4). The purpose of this research was to measure the "fit" of the TPB model with regard to sports supplement consumption among female collegiate athletes.

Research Questions

To further understand intrapersonal motivating factors associated with dietary and sport supplements consumption, the following research questions were examined:

- Does a female collegiate athlete's attitude regarding supplement consumption affect her intention to consume supplements?
- Does a female athlete's perception of subjective norms regarding supplement consumption affect her intention to consume supplements?
- Does a female athlete's perception of behavioral control regarding supplement consumption affect her intention to consume supplements?
- Do the constructs of the Theory of Planned Behavior (attitude, subjective norm, and perceived behavioral control) predict a female athlete's intention to consume supplements?

- Does the proposed structural model (TPB) "fit" when applied to the consumption of sports supplements by female collegiate athletes (Figure 4)?

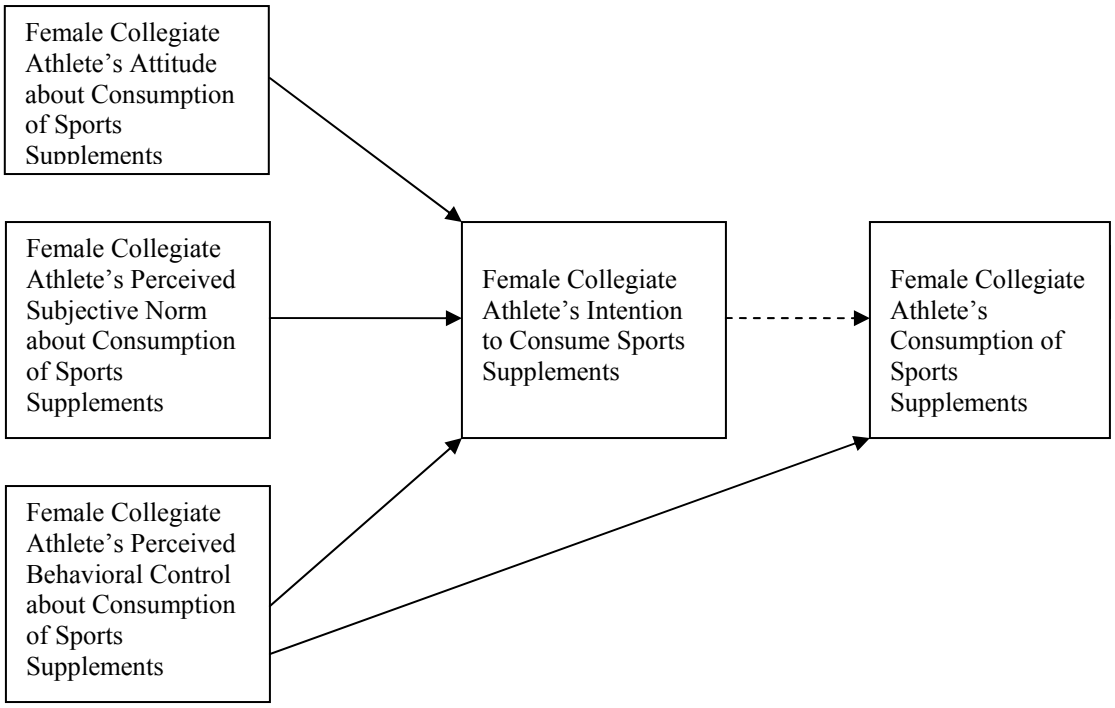

Figure 4. Female Collegiate Athletes' Intention to Consume Sports Supplements: A Logic Model Adapted from the Theory of Planned Behavior.

Methods

Participants

The population of interest for this study was female collegiate athletes at division one universities. For this study 644 female athletes in the big 12 conference participating in basketball, cross country, soccer, volleyball, and swimming during the 2005-2006 season were surveyed using an internet survey (see Table 2). According to

Dillman (2000), researchers should expect a response rate of approximately 30% on surveys distributed. Thus, a sample of 644 female collegiate athletes was surveyed to ensure 200 completed surveys required for analysis using structural equation modeling (Hu & Bentler, 1998; Fan, Thompson & Wang, 1999). The participants (N=207) were 92% white, 4% African American, 2% Asian American, and 2% Hispanic. Twenty six percent of participants reported consuming sports supplements at some time (currently or in the past) and 74% reported never using sports supplements.

Table 2. Female participation in selected big 12 universities

Universities	Basketball	Cross Country	Soccer	Volleyball	Swimming	Total
University A	11	15	21	12	N/A	59
University B	11	11	20	14	22	78
University C	11	14	21	10	31	87
University D	11	10	N/A	16	N/A	37
University E	12	16	22	12	26	88
University F	8	10	23	13	N/A	54
University G	14	21	26	N/A	N/A	61
University H	15	N/A	21	11	31	78
University I	15	15	29	14	29	102
Total	108	112	183	102	139	**644**

*** N/A = Not available**

Data Collection

The protocol for this study was reviewed and approved by the institutional review board at Texas A&M University (See Appendix X). The sample of female collegiate athletes was surveyed using web-based survey. Female athlete's names were acquired by downloading 2005-2006 rosters from official university athletics websites.

Email addresses were acquired via online student directories from official university websites. Three universities were excluded from the study because student email addresses were not available online. All female athletes in the sample received a series of four emails (see Appendix B) requesting their participation in this study. Of the 644 female athletes receiving email requests to participate in the survey, 207 completed the survey yielding a response rate of 32.1% (see Table 3). Several coaches and one university restricted their teams from completing the survey. Thus, the response rate may be artificially low and less representative of the population.

Table 3. Female Participation and response rate for selected sports at big 12 universities

	Basketball	Cross Country	Soccer	Volleyball	Swimming	Total
Number of Players	108	112	183	102	139	644
Surveys Completed	19	57	67	32	32	207
Response Rate (%)	17.6	50.9	36.6	31.4	23.0	32.1

Survey Instrument

The instrument used in this study was developed using scales from two previously established instruments. Scales from the Survey to Predict Adolescent Athletes Supplement Use (SPADDSU) (Perko, 1999) were used to measure attitudes (10 items), perceived social norms (14 items), and intentions (14 items) regarding consumption of dietary supplements. A scale from Conner's (2001) Dietary Supplement Questionnaire was used to measure perceived behavioral control (11 items) regarding consumption of dietary supplements. The SPADDSU was developed and tested on two

occasions yielding reliability coefficients of 0.94 and 0.89. The scale for perceived behavioral control was also developed and tested earlier yielding a reliability coefficient of 0.76.

The instrument was reviewed by a panel of experts to determine the survey's appropriateness for the female collegiate athlete population. The wording of several questions was adjusted for age appropriateness and several questions were added at the suggestion of panel experts. A pilot study was conducted with 26 Big 12 tennis athletes and each scale was tested for internal consistency and factorial structure. Pilot data yielded cronbach alpha reliability measures of 0.95 for the behavioral intention scale, 0.90 for the attitudes scale, 0.82 for the subjective norms scale, and 0.81 for the perceived behavioral control scale. Because the reliability measurements and factor analysis were adequate, no changes were made to the instrument.

Variables

The model for this study contained 4 variables (see Table 4): intention, attitudes, subjective norms, and perceived behavioral control. Each scale for this study utilized a 5-point likert type scale with responses ranging from "strongly disagree" to "strongly agree" scored one to five, respectively. Intention to consume sports supplements was assessed with 14 items. Cronbach's alpha for these items was 0.96. Attitude regarding consumption of sports supplements was assessed with 10 items. Cronbach's alpha for these items was 0.90. Subjective norms regarding consumption of sports supplements was assessed with 14 items. Cronbach's alpha for these items was 0.92. Perceived

behavioral control regarding consumption of sports supplements was assessed with 11 items. Cronbach's alpha for these items was 0.76. Each variable was quantified by summing all items into a single score. Scale scores for intention, attitudes, perceived social norms, intention, and perceived behavioral control ranged from 14 to 70, 10 to 50, 14 to 70, 11 to 55, respectively.

Table 4. Reliability for female collegiate athletes supplement survey

Scale	Items	Cronbach's Alpha
Behavioral Intention	1-14	0.96
Behavioral Attitude	15-24	0.90
Subjective Norms	25-38	0.92
Perceived Behavioral Control	39-50	0.76

Statistical Analyses

Relationships between attitudes, perceived social norms, perceived behavioral control, and intention regarding consumption of sports supplements were analyzed using general linear model methods. The "fit" of the Theory of Planned behavior regarding consumption of sports supplements by female collegiate athletes was measured using a structural equation model analysis. All statistical analyses were performed using SPSS (Statistical Package for the Social Sciences) version 13.0 and AMOS version 5.0. AMOS was used to perform structural equation modeling (SEM) to estimate the predictive ability of the TPB. AMOS requires missing data (approximately 2%) to be replaced prior to analysis. Missing data were imputed using NORM and required 17 iterations for convergence. To determine the goodness of fit (GFI), the following measures are reported: the chi-square statistics with its degree of freedom (DF), the

normal fit index (NFI), and the room mean square error of approximation (RMSEA). A commonly used fit criteria is the χ^2/df ratio which should be less than 2 to represent acceptable fit to observed data. The NFI describes the overall proportion of explained variance and should be greater than 0.95, whereas the RMSEA is adjusted for model complexity and should be less than 0.08 (Byrne, 2001).

The sample was screened for multicollinearity using Pearson product-moment correlations (see Table 5) of predictor variables (Tabachnick & Fidel, 2001). Multicollinearity was not detected in the correlations matrix as associations between variables ranged from 0.52 to 0.79. All correlations were significant at the 0.01 level, and all correlations were below 0.90 indicating no multicollinearity (Tabachnick & Fidell, 2001).

Independent t-tests were conducted to determine differences in sports supplement consumption by sport, classification, race, and age. Results indicated no significant differences in consumption patterns of supplements by female athletes based on these categories. Pearson's r correlations for observed variables ranged from 0.52 to 0.80 and were significant at the 0.01 level.

Table 5. Pearson's product-moment correlations of predictor variables

	Behavioral Intention**	Attitude***	Subjective Norms***	Perceived Behavioral Control***
Attitude	.0650*	1.000	0.734*	0.556*
Subjective Norms	0.793*	0.734*	1.000	0.560*
Perceived Behavioral Control	0.515*	0.556*	0.560*	1.000

* Significant at 0.01 level
**Dependent variable
***Predictor variable

As no agreed-upon model fit standard exists, several indices were used to estimate the fit of the measurement model. A structural model of the TPB was tested using maximum likelihood estimates. The number of participants (N=207) was relatively low, therefore observed variables were used for path analyses estimates. The use of non-latent variables does not allow for control of measurement error in path coefficients which might inflate construct relationships. Attitudes, subjective norms, perceived behavioral control, and behavioral intention were hypothesized to be correlated and these relationships were measured using observed variables.

Results

The χ^2/df ratio of 77.461 and RMSEA of 0.609 were high whereas the NFI of 0.833 and goodness-of-fit (GFI) of 0.865 were low indicating an unacceptable fit. Figure 5 shows the TPB model with best fit and its path coefficients. Attitudes, subjective norms and perceived behavioral control explained 61 percent of variance in behavioral intention

(R^2= 0.61). Subjective norms was the strongest predictor of behavioral intention whereas perceived behavioral control was the weakest. Attitudes ($p<.05$) and subjective norms ($p<.001$) were found to be significant predictors of behavioral intention, but perceived behavioral control ($p<.136$) was not. Further regression analyses (see Figure 6) yielded and effect size of 18% for behavior with behavioral intention being the strongest predictor (β=.23) and perceived behavioral control the weakest (β=.01).

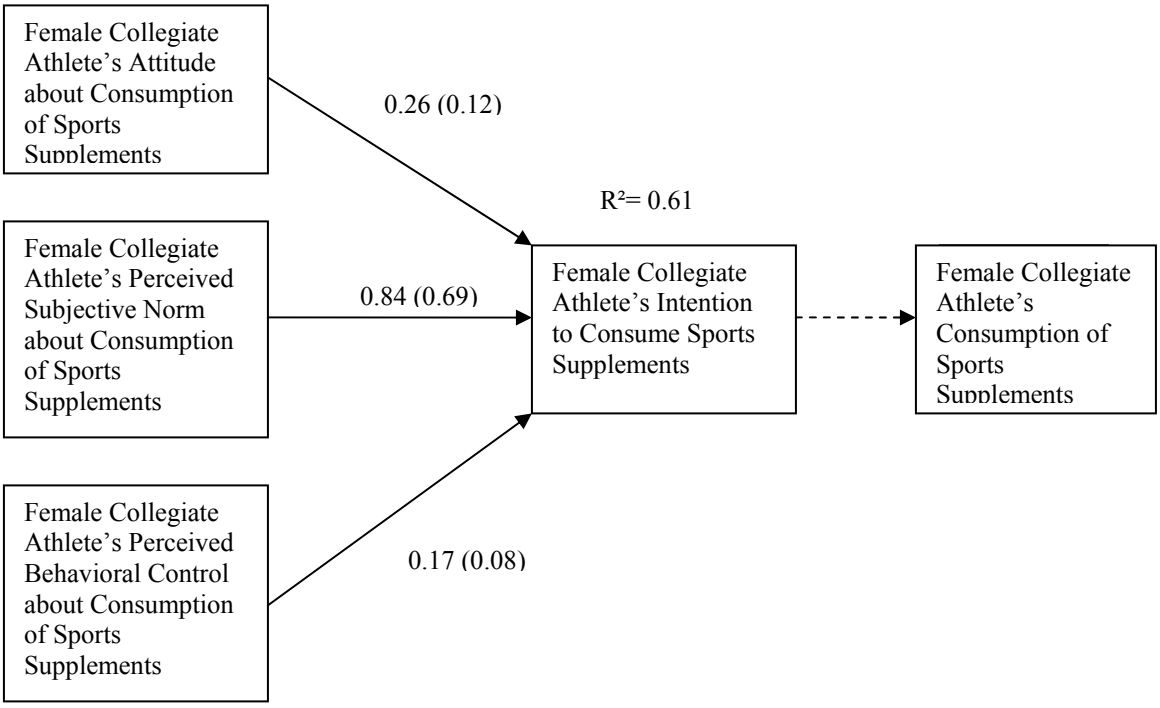

Figure 5. Structural equation measurement model for female collegiate athletes' sports supplement consumption.

Table 6. Central tendency and normality of the theory of planned behavior variables

Variable	Mean	SD	Skewness	SE	Kurtosis	SE
Behavioral Intention	31.76	14.2	0.34	0.17	-0.95	0.34
Behavioral Attitude	22.70	6.71	-0.04	0.17	-0.40	0.34
Subjective Norms	39.51	11.17	-0.01	0.17	-0.78	0.34
Perceived Behavioral Control	29.13	6.59	-0.69	0.17	0.244	0.34

Discussion

This research used the TPB to predict intention to consume sports supplements by female collegiate athletes during the 2005-2006 seasons. The TPB was found to be predictive of intention to consume sports supplements, explaining 61% of behavioral intention. However, structural equation modeling using maximum likelihood estimates indicated a poor fit for the sample. Although the model was not a good fit, the nonnormality (see Table 6) of the perceived behavioral control variable (c.r. -4.005) and the small sample size (N=207) may have adversely affected the chi-square statistic and fit indices (RMSEA, NFI, GFI).

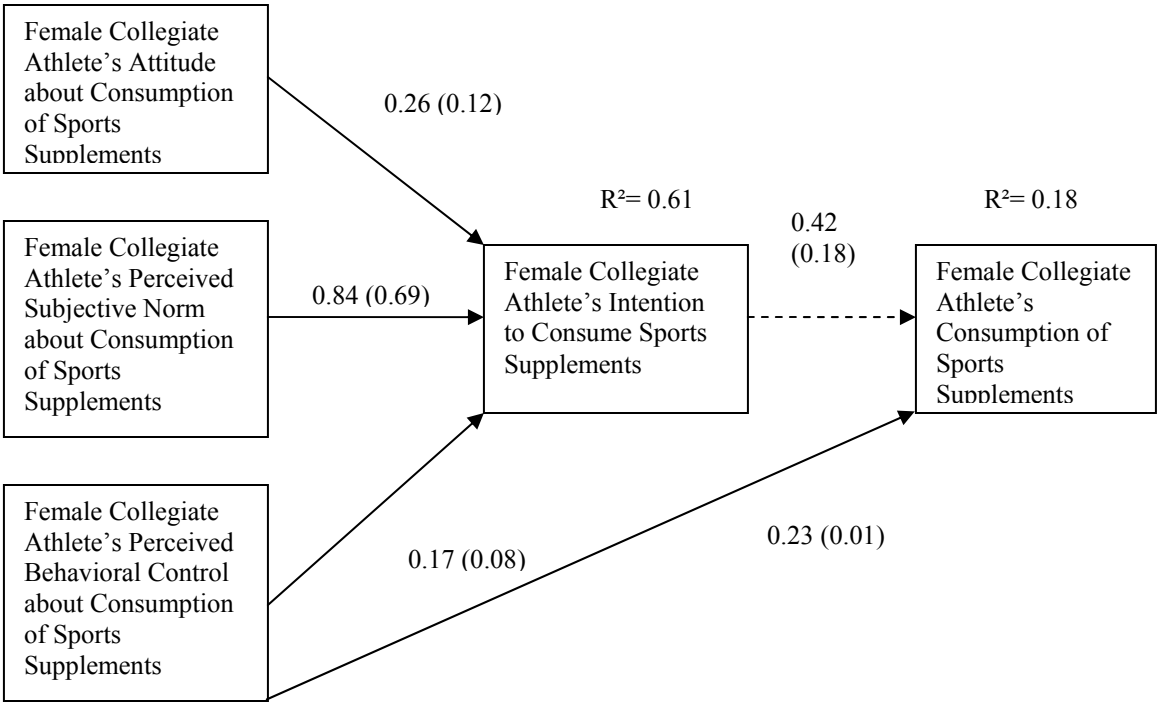

Figure 6. Supplement consumption regressed on the Theory of Planned Behavior.

Because there are few published studies utilizing SEM to measure the fit of the TPB regarding sports supplements (or other dietary supplements), it is difficult to compare these findings. However, the predictive ability of TPB has been assessed using multiple regression with a range of dietary behaviors. In a meta-analytic study, McEachan, Conner and Lawton (2005) found twenty two prospective studies using the TPB to examine various eating behaviors including sugar intake (n = 4), consumption of fruit and vegetables (n = 5), healthy eating (n = 5), taking dietary supplements (n = 2), eating whole wheat (n = 1), eating soy products (n = 1), soft drink consumption (n = 1), and eating fish (n = 1). Across studies, the TPB was able to predict 41% of behavioral intention with attitude (r = 0.47) being the strongest predictor and perceived behavioral control (r = 0.36) being the weakest predictor. Subjective norms were the second

strongest predictor (r = 0.40). In one of the few published studies using the TPB to predict supplement consumption, Conner, Kirk, Cade and Barrett (2001) reported the TPB constructs explained 70% of variance in behavioral intention to consume dietary supplements by women in England. Similar to findings by McEachan, Conner and Lawton (2005), attitude (β = 0.54) was the strongest predictor, subjective norms (β = 0.28) the second strongest, and perceived behavioral control (β = 0.07) the weakest. Results of the present study concur with prior studies, and the TPB model was able to explain 61% of variance in behavioral intention. However, unlike previous studies, subjective norms (β = .69) emerged as the strongest predictor, attitude (β = .12) the second strongest and perceived behavioral control (β = 0.08) the weakest. The lack of impact of perceived behavioral control is consistent with previous studies, however the lack of impact of attitudes is unclear since it suggests that behavioral intention is most strongly controlled by the perception of what is normal and not the attitude towards supplements.

Together, these findings suggest that for female collegiate athletes, subjective norms may be of greatest importance when forming behavioral intention to consume sport supplements. Because this is the first known study to have used the TPB to predict sports supplement consumption among collegiate female athletes, it is important to note the possible effect of the team concept. When forming perceptions of norms, it is possible female athletes view the behavior of their teammates and coaches as "normal" rather than friends, family and other acquaintances. Teams are generally tight knit groups and college athletes can spend up to 20 hours a week practicing with one another.

It is possible their perceptions of what is "normal" are directly and greatly influenced by their teammates and coaches. Furthermore, if a coach were to supply sports supplement to their athletes, it is very likely that consumption of sports supplements would be considered a norm. These considerations may account for the strong relationships between subjective norms and behavioral intention in this study. The results of this study suggest attitudes and perceived behavioral control have little affect of behavioral intention for female collegiate athletes. Hence, interventions aimed at sports supplement consumption among female collegiate athletes may need to focus on athletes' perception of normative behavior.

The use of the TPB to predict sports supplement consumption is somewhat new and further exploration of this topic seems warranted. With female participation in sports continuing to grow, it is becoming more important to understand influencing factors associated with young female athletes' consumption of sports supplements. The TPB seems able to explain a great deal of variance in behavioral intention to consume supplements. In the future, researcher should explore measurement models with and without the suggested additional variables to compare and create greater understanding predictors of sports supplements consumption. Furthermore, researchers should be sure to report standardized regression and SEM weights and effect sizes to allow for comparison of predictive ability of the TPB and additional constructs.

Limitations and Future Directions

A number of methodological and statistical limitations to the reported research should be considered. First, the sample studied was one of convenience which may have resulted in weakened relationships between variables. The sample was mostly white (92%) and several teams and one school restricted their athletes from completing the survey. Additionally, the focus on self-report data may have opened the research to biases. Further research into this topic would benefit from using a more diverse, randomized sample.

Another possible limitation was identified with data normality measurements. Data analyses revealed normality concerns for the perceived behavioral control variable. Skewness (-0.682) and kurtosis (0.209) measurements indicated acceptable data normality, however a critical ratio of -4.005 may indicate an underestimate of variance in the perceived behavioral control variable (Tabachnick & Fidell, 2001). Combined with the relatively small sample size (N=207), possible normality problems may have adversely affected the chi-square statistic and fit indices (RMSEA, NFI, GFI). AMOS has the ability to perform SEM using nonnormal data, however a small sample size decreases its effectiveness. Data were examined for outliers, but a sample size of at least 200 is required to perform SEM (Hu & Bentler, 1998), thus removal of outliers was ruled out. An attempt to correct the normality problems was made using a maximum likelihood bootstrap transformation, but data did not converge. This may indicate the seemingly high kurtosis critical ratio is acceptable for these data (Tabachnick & Fidell, 2001). Therefore, the analyses were performed using nonnormal data possibly causing

inaccuracies in the chi-square statistic and fit indices. Future studies would benefit from a large sample size (N >500). A larger sample size would allow for more adjustments and transformations to data and would also allow for the creation of latent variables with the TPB constructs.

Finally, only observed variables were used to calculate the structural equation measurement model. Latent variables (which require a larger sample size) tend to yield better SEM measurement models creating better model fit by allowing variables to share error variance (Hu & Bentler, 1998). Attitude, subjective norms, and perceived behavioral control variables can be utilized as latent variables by breaking variables into subcomponents. Attitude is a function of behavioral beliefs (perceived likelihood of an outcome and evaluation of the outcome), subjective norms is a function of normative beliefs (perceptions of whether significant others believe you should perform a behavior and desire to comply with these wishes), and perceived behavioral control is a function of control beliefs (frequency of occurrence of factors likely to facilitate a behavior and perception of the extent to which factors might facilitate the behavior). Using latent variables would create a more in depth model of the TPB and possible provide a greater understanding of factors influencing sports supplements consumption among female collegiate athletes.

To create latent variables for the TPB constructs, instrument measurement scales need to be developed and enhanced. In the present study, attitude, subjective norms and perceived behavioral control variables were measure using individual measurement scales. To create latent variables for the TPB constructs, individual scales must be

developed for each component of behavioral beliefs, normative beliefs and control beliefs. Researcher should be careful in developing scales to create an instrument that will produce valid and reliable data for the desired population. Solid instrumentation is an important aspect of gaining a greater understanding of factors influencing consumption of sports supplements by female collegiate athletes.

Conclusion

The purpose of this study was to assess the ability of the TPB construct to predict behavioral intention to consume sports supplements among female collegiate athletes. Additionally, the fit of a measurement model of the TPB applied to sports supplement consumption among female collegiate athletes was assessed. Attitude and subjective norms were adequate predictors of behavioral intention. However, perceived behavioral control contributed little to the predictive ability of the TPB. Additionally, the model did not exhibit a good fit for this sample. A small sample size, nonnormal data, and use of observed variables may have contributed to the poor fit. Despite these limitations, this study supports the applicability of the TPB to intended consumption of sports supplement by female collegiate athletes. The large effect size produced by the measurement model suggests that refinement of measurement and sample procedure could produce better results. Additionally, these findings support to the predictive validity of the TPB scales and points to the possible usefulness of the model for health educational purposes. To maximize the usefulness of the TPB and SEM in future studies, appropriate samples sizes should be used and measured variable selections should be

improved to allow formation of latent variables for model constructs. Finally, addition of variables to the TPB (such as using the TPB in the context of an ecological model) should be explored to improve predictive ability.

CHAPTER IV

DIETARY AND SPORTS SUPPLEMENTS: THE NEED FOR A SYSTEMATIC TRACKING SYSTEM

Introduction

Recent studies suggest consumption of all classifications of dietary supplements, including sports supplements has increased (Dodge, Ford & Perko, 2003; Yu, Ghandour & Haung, 2000; Metzl, Small & Levine, 2001). Several factors make adolescents particularly vulnerable to possible dangers inherent to consumption of dietary supplements. The purpose of this paper is to examine factors associated with adolescent consumption of dietary and sports supplements, and to suggest the need to establish a system to track consumption rates, and synthesize safety and efficacy data.

Dietary Supplements

Because dietary supplement terminology varies from study to study, direct comparison is often difficult. Therefore, for purposes of this paper, it is necessary to define several classifications of dietary supplements.

- Dietary supplements are defined by the Food and Drug Administration as "a product (other than tobacco) intended to supplement the diet that bears or contains one or more of the following ingredients: a vitamin, mineral, herb or other botanical, an amino acid, a dietary substance for use by man to supplement the diet by increasing total daily intake, or a concentrate, metabolite, constituent, extract or combination of these ingredients."

- Sports supplements are a type of dietary supplement and consist of over-the-counter products (e.g. Androstenedione, Creatine, Ephedra) used to increase athletic ability or performance (e.g. muscle size and strength, speed, body composition).
- Sport supplements should be differentiated from performance enhancing drugs. Performance enhancing drugs (PED) are ***illegal*** substances used by athletes to increase physical performance (e.g. stimulants, anabolic steroids).

Dietary Supplement Consumption

Although it is difficult to determine the exact rate of supplement use, it appears consumption of dietary supplements is increasing. In the most recent national survey (NHANES III) daily or occasional consumption of dietary supplements was approximately 60% (Sobal & Marquart, 1994; CDC, 1997). Survey results also indicate adult and adolescents athletes are more likely to consume dietary supplements than the average adult or adolescent (Koplan, Annest & Layde, 1986; Stewart, McDonal & Shucker, 1985). A meta-analysis of 51 studies indicated an exponential increase in sports supplement use since the early 1980's with up to 46% of male and female athletes consuming dietary supplements on a regular basis[8]. Furthermore, there was a five fold increase in use of herbal remedies between 1990 and 1997 (Muller & Clauson, 1997), and 30% of all adolescents in the United States have used a dietary supplement (Kleinman, 2002).

Sports Supplements

Prior to 1995, few studies focused on sports supplement use among adolescent athletes (Perko, 1999), however several recent studies suggest the rate of sports supplements use is increasing in this age group. Creatine is the most popular sports supplement among young athletes (Metzl, Small & Levine, 2001). In a survey of five New York suburb schools, adolescent athletes in all sports admitted trying creatine with as many as 9.3% currently supplementing with creatine. These results contradict earlier beliefs that creatine is taken only by adolescents in strength sports such as football or weight lifting. Furthermore, several studies have indicated an increase in prohormone consumption among teenage athletes following Mark McGuire's admission of Andro use (Delbeke, Van Eenoo & Thyne, 2003). Because prohormones are not technically steroids, they are sold over-the-counter, making them easily accessible sport supplement. Survey results of a convenience sample of high school students indicated an increase in consumption of all dietary supplements, including sports supplements among adolescents (Bell, Dorsch & McCreary, 2004). Additionally, protein powder and creatine were the most popular sports supplements. Again, few differences were found between age groups or genders.

Dietary and Sport Supplement Sales

Dietary supplement sales are another indicator suggesting a steady rise in supplement consumption. The USFDA estimated 1997 sales of dietary supplements totaled $10.3 billion (USFDA, 1999. Sports supplements sales were approximately $927

million. Top dietary supplement manufacturers estimated revenue from dietary supplement sales at $6.05 Billion for 1997, and consumers spent over $16.8 billion for vitamins, minerals, herbs, and specialty supplements in 2000. Retail sales of weight-loss supplements were estimated to be more than $1.3 billion in 2001 representing a 127% increase from sales in 2000. Depending on the source, estimates of retail sales of dietary supplements vary, however most data indicate the industry is growing rapidly and will continue to do so in the future. As the number of individuals exposed to dietary and sports supplements increases, it is becoming more important to track consumption rates and to monitor efficacy and adverse effects associated with supplements.

Safety, Efficacy, and Marketing

Since the mid 1990's, dietary supplements have essentially been unregulated creating a "buyer beware" atmosphere. Lack of pre-market safety and efficacy testing and misleading marketing techniques are cause for concern. A review of clinical trials published from 1962 to 1992 revealed no scientific evidence supporting claims of 42% of products (Barron & VanScoy, 1993). Only four of 19 were associated with documented human trials, and only six of 19 products were associated with animal trials. This study illustrates the nature of supplements testing in which supplements are placed into the market before their safety or efficacy is confirmed.

In April 2004, supplements containing ephedra were banned after the deaths of several professional athletes (Tim Belcher, Korey Stringer) and adolescent athletes deaths were attributed to adverse effects related to ephedra. The FDA called the

supplements containing ephedra "too risky," and noted it may have serious adverse physical effects, including death, for anyone with a known or unknown cardiovascular condition. In addition to physical harm, data from a recent study suggests ephedra also may be associated with psychological conditions such as psychosis, depression, sleep disturbance, and suicidal thoughts (Maglione, Miotto & Iguchi, 2005). Although ephedra products are not currently sold, the ban was recently overturned by a federal judge. This decision may allow these products to re-enter the marketplace. Circumstances surrounding the sale and ban of ephedra-containing products illustrate the poor safety procedures of the supplement industry and the dangerous safety policies of the FDA. Supplements are sold with little or no pre-market safety testing and only occasionally banned after severe consequences such as death. For example, it is likely that ephedra would continue to be sold if not for the high profile deaths of professional athletes.

In addition to safety concerns, supplement efficacy is rarely confirmed prior to sale. As mention previously, most supplements have little or no data on human subjects to support their claims (Barron & VanScoy, 1993). Creatine and ephedra are the most studied sports supplements. Recent studies on these popular sports supplements indicate individuals using creatine do see gains in strength and weight, and individuals using ephedra see initial weight loss (Ransone, Lefavi & Jacobson, 2002; Shekelle, Hardy & Morton, 2003; Ciocca, 2005). However, gains in strength in individuals using creatine are usally small, only 2-4 percent more than those not using creatine. These data also indicate creatine is mostly effective for very short, very intense activities. Research also

suggests some of the weight gain in individuals using creatine can be attributed to water retention giving the false impression of increased muscle mass (Ransone, Lefavi & Jacobsen, 2002; Shekelle, Hardy & Morton, 2003). Creatine and ephedra have a considerable amount of clinical trial data to support their claims of muscle gain and weight loss. However, data suggest in many cases these products have only limited short-term effects. Most supplements are not examined with scrutiny, and supplements that have clinical data generally show little or no efficacy. This suggests the risks may far outweigh any possible rewards gained from supplement consumption.

In addition to safety and efficacy concerns created by the lack of supplement regulation, marketing of dietary and sport supplements is often misleading. Even if a supplement has proven clinical efficacy and safety, lack of standardization creates an environment where the quality of supplements is not guaranteed. Cases of mislabeling, misidentification of ingredients, contamination with heavy metals, pesticides or herbicides have been reported (Catlin, Leder & Ahrens, 2000; Green, Catlin & Starcevic, 2001). In a recent study, 20% of supplements analyzed were contaminated with heavy metals, and 50% of the contaminated products were marketed for children and adolescents (Saper, Kales & Paquin, 2004). This would not be acceptable for any other food product distributed for consumption by the American public. Furthermore, although the Dietary Supplement Health and Education Act (DSHEA) prevents supplement labels from claiming to diagnose or treat specific illnesses, they can claim to improve specific biological functions such as increase strength or boost metabolism (Thomson & Newton, 2005). Most individuals, especially adolescents do not have

knowledge of these policies and marketing techniques. Thus they are more vulnerable to this type of deception and likely to believe statements printed on supplement labels.

Adolescents and Supplements

Although the safety of dietary and sports supplements is a concern for all age groups, adolescents may be at greater risk. Adolescents are a key target for dietary and sports supplement marketing (Cowart, 1992; Friedl, Moore & Marchitelli, 1992; Lightsey & Attaway, 1992; Pearl, 1991), and claims of gains in muscular size and strength, improved performance, and energy are especially appealing to this group (Grunewald & Baiely, 1993; Philen, Ortiz & Auerbach, 1992). Additionally, adolescents have easy access to dietary and sports supplements and are less likely to understand risks associated with their consumption (Gardiner, 2005). Doctors suggest some risks are unique to younger people such as incorrect dosing, side effects, dietary supplement interactions, and severe allergic reactions (Gardiner, 2005). To date there are no data available on the efficacy and safety in children and adolescents of widely used performance-enhancing substances (AAP, 2005). Furthermore, dosing instructions are often intended for individuals 18 years of age and older. Some doctors have suggested large doses of supplements can lead to serious adverse effects among children and adolescents (AAP, 2005).

Another concern regarding adolescents and supplements is the adolescent preoccupation with appearance (Terney & McLain, 1990). Adolescents are constantly bombarded with images of thin, beautiful women and muscular and lean men on television, in magazines, and on the internet. The constant pressures to maintain a

certain image creates an environment in which adolescents may take unnecessary risks. Personal rewards perceived from enhancing size, strength, stamina, or improving body build can be strong motivators (Bahrke, Yesalis & Kopstein, 2000; Goldberg, Elliot & Clarke, 1996; Kindlundh, Isacson & Berglund, 1999). In fact recent studies revealed a surprising 30% to 40% of adolescents taking dietary and sports supplements do not participate in a school sport (Bahrke, Yesalis & Kopstein, 2000; DuRant, Escobedo & Health, 1995; Jones, Atter & George, 1999). The most common reasons given for supplement use are to enhance sports performance and improve appearance (Bahrke, Yesalis & Kopstein 2000). This suggests supplements that are marketed to improve sports performance are being used by non-athletes to enhance physical attributes, and indicates a negative body image may be a key factor in consumption of supplements by adolescents.

Implications

Over 6.6 million young athletes participate in some form of supervised sport and many continue actively through college (Blue Cross/Blue Shield, 2003). As a result, sports are becoming increasingly competitive. As adolescent athletes compete for positions on their teams and for scholarships, many will attempt to gain every advantage possible. Consumption of sports supplements is a popular avenue for athletes to gain a competitive advantage. As previously mentioned, individual studies and supplement sales records continue to show growth in supplement consumption. Policies regarding supplement testing, distribution, and sales create and environment in which adolescents

are vulnerable to marketing techniques and pressures to attain athletic success or an ideal physical appearance. When combined with a lack of clinical safety and efficacy data on adolescents and supplements, these factors make this an area of concern for health professionals.

Dietary Supplement Tracking

Currently, several longitudinal studies provide inconsistent or incidental tracking of consumption of dietary/sports supplements: the National Health and Nutrition Examination Survey (NHANES), the Youth Risk and Behavior Survey (YRBS), and the NCAA Study of Substance Use Habits of College Student-Athletes. Although the NHANES III survey did not ask about specific supplements, some respondents voluntarily reported taking products such as botanical products, sports drinks, amino acids, metabolites, and biologic extracts. The most recent survey, NHANES IV includes a limited number of sports supplements, but data are not yet available. While the YRBS tracks illegal substances such as amphetamines and steroids, it does not track dietary or sport supplement consumption. The NCAA Study of Substance Use Habits of College Student-Athletes survey contains questions regarding consumption of amphetamines, anabolic steroids, and some dietary and sports supplements (NCAA, 2001). In 1997, supplements containing ephedra were first included, and in 2001 the survey was expanded to include "other dietary supplements." However, inquiries of specific dietary or sports supplements or side effects were not included. Although these surveys give some indication of dietary supplement consumption, they do not include specific dietary

or sports supplements. Furthermore, these surveys are not consistent or routine in their approach making trend analysis difficult.

Development of a Systematic Tracking System

Current information regarding the use of dietary and sport supplement use is irregular and inconsistent. A systematic method to track dietary and sports supplement consumption among adolescents is needed. A system which would synthesize side effects and other complications related to supplements would assist health professionals in informing and protecting adolescents from possible dangers. Because supplements are numerous, the task of tracking may seem difficult. However, most dietary and sports supplements can be placed into general categories by purpose: strength/power gain (i.e. creatine and andro), weight loss (stimulants), increase energy (stimulants), and recovery (protein and amino acids).

Tracking could be accomplished through several methods including additions to existing surveys such as Youth Risk and Behavior Surveillance Survey (YRBSS) or National Health and Nutrition Examination Survey (NHANES), beginning a long term tracking system similar to NIDA's Monitoring the Future (MTF), or by independent research. Tracking will enable health professionals to have consistent and credible information on trends of use and adverse events related to various types of sports supplements. In addition, tracking will help shed light on the determinants of dietary and sport supplement use and yield important information about mediating and moderating influences of the behavior. Furthermore, these data may lead to development of programs aimed at reduction of sport supplement use among adolescents.

Conclusion

In a recent position statement, the American Academy of Pediatrics strongly condemned use of performance-enhancing substances and vigorously endorsed efforts to eliminate their use among children and adolescents (AAP, 2005). However, the temptation of using performance-enhancing substances as shortcuts to improving athletic performance or even to enhance physical appearance is very seductive to adolescents (Congeni & Miller, 2002). Winning brings admiration from peers, praise from parents and coaches, and opportunities to compete at the next level. Adolescents also see professional athletes winning gold medals or breaking records only to have them relinquished after admitting use of sport supplements (Congeni & Miller, 2002). From an adolescent's perspective, the prospects for success in sports often outweigh the prospects for serious medical complications from use of performance-enhancing substances (AAP, 2005). Thus, it has become necessary to track consumption rates and adverse effects related to supplements. Monitoring consumption trends and synthesis of data regarding adverse effects related to supplements will provide consistent and credible information to health professionals. This information would be useful to health educators, coaches, trainers, and medical professionals to educate themselves and adolescents about possible dangers and side effects of supplements.

Because the FDA will only occasionally ban a supplement after severe adverse effects are reported and confirmed, health professionals must be the first line of defense. Health professionals need to develop programs aimed specifically at reducing supplement consumption rates among adolescents. Adolescents must be educated and

presented with evidence of efficacy or side effects related to supplements. Additionally, health and physical educators must be prepared to offer proper strength training and conditioning programs, and dietary guidelines as alternatives to supplement consumption. To be effective, these programs must be specific to adolescent desires of strength or slimness. Simply saying supplements are harmful and giving general strength training and dietary guidelines is not enough. Additionally, research suggests coaches, parents, and athletic trainers are the most significant influence on adolescent intentions to consume supplements (Dunn, Eddy & Wang, 2001). Therefore coaches, parents, athletic trainers, and health and physical educators should be prepared with information and methods that can be used to discuss supplement use with adolescents. Furthermore, school administrators should monitor athletic programs to monitor potential conflicts of interest (such as ensuring that a coach's desire to win does not affect their judgment when informing athletes about supplement consumption).

Health care professionals are another source of supplement information for adolescents. Health care professionals need to be able to rely on scientific research when available, stay on current trends in adolescent supplement use, and discuss individual concerns when they arise (Congeni & Miller, 2002). Unfortunately, little credible data are currently available. A tracking system to gather consumption rates and adverse effects regarding supplements would provide physicians and public health professionals with information required to confidently address adolescent concerns about supplement consumption. The pre-participation physical presents an excellent opportunity for health professionals to discuss supplement concerns with adolescents

and parents (Gardiner, 2005). Again, health care professionals must be prepared to offer alternatives to supplement use.

As youth and high school sports become more competitive, athletes will use various methods to gain an advantage over their competitors. Non-athlete adolescents will continue to search for methods to attain the ideal body size and shape. This desire to compete or gain a certain physical appearance will lead many adolescents to supplement consumption. Health professionals should address this issue with reliable and credible information. A system to track consumption rates among adolescents and adverse effects associated with supplements will allow health professional to determine positive and negative effects related to supplements. With this information, physicians, coaches, athletic trainers, parents, and health educators can guide athletes away from unproven and dangerous supplements, while maintaining open and honest lines of communication, and more serious health risks may be prevented (AAP, 2005; Gardiner, 2002).

CHAPTER V

CONCLUSION

The purpose of this research was to investigate use of sports supplements and factors that influence the likelihood a female collegiate athlete will consume or abstain from consuming sports supplements. Additionally, the effectiveness of the Theory of Planned Behavior to predict consumption of sports supplements by female collegiate athletes was assessed. This chapter presents a summary of findings and a discussion of implications of findings.

Supplement Policies, Sales and Consumption

Dietary supplements became easily accessible in 1994 with the passing of the Dietary Supplement Health and Education Act (DSHEA). The DSHEA allows dietary supplements to remain in the marketplace unless they are proven dangerous. It is the responsibility of the consumer to understand the risks of the supplements and perform safety testing. No pre-market clearance to test the product is required by law before a product can be placed on the shelves of local stores (Dodge, Ford, Perko, 2003). Potential risks of dietary supplement use include toxicity, allergic reactions, side effects of caffeine containing products, and many unknown side effects. In some instances, insect hormones, prescription medications, and animal glandular material have been found within dietary supplements (Philen, Ortiz, & Faulk, 1992).

Although medical evidence suggests only a few subgroups of people (increased iron for pregnant women, special formulas for infants and small children, folate for

women of child bearing years, and calcium for adolescent girls and young women) require supplementation, research suggests rates of dietary and sports supplements continue to rise (Sobal & Marquart, 1994; CDC, 1997; Branch, 2003; Skelle, Hardy & Morton, 2003). Dietary supplement sales records also indicate a rise in consumption (USFDA, 1999). The increase in consumption of sports supplements seems to coincide with an increase in sports participation among adolescents and young adults.

Over 6.6 million young athletes participate in some form of supervised sport and many continue actively through college (Blue Cross/Blue Shield, 2003). As a result, sports are becoming increasingly competitive. As young athletes compete for positions on their teams and for scholarships, many will attempt to gain every advantage possible. Consumption of sports supplements is a popular avenue for athletes to gain a competitive advantage. Policies regarding supplement testing, distribution, and sales create and environment in which young athletes are vulnerable to marketing techniques and pressures to attain athletic success or an ideal physical appearance. The environment surrounding dietary and sports supplements policies and use creates a need to understand factors that influence the consumption of sports supplements by young athletes.

Discussion of Findings

This research explored factors that influenced consumption of sports supplements by female collegiate athletes. The TPB was used to attempt to understand internal motivations for using sports supplements. In contrast to many studies using the TPB to

measure dietary behaviors, results from the structural equation model indicated subjective norms (r = 0.84) to be the strongest predictor of intention to consume sports supplements. Additionally, attitude (r = 0.26) and perceived behavioral control (r = 0.17) also contributed to intention to consume sports supplements. This seems to indicate participants were greatly influenced by their perception of normality within their group. Furthermore, the relatively small contribution of the perceived behavioral control component seems to indicate control perceptions were not a major factor in intention to consume sports supplements. Furthermore, structural equation model analysis revealed the χ^2/df ratio of 77.461 and RMSEA of 0.609 were too high and the NFI of 0.833 and goodness-of-fit (GFI) of 0.865 were too low indicating an unacceptable fit. Attitudes, subjective norms and perceived behavioral control explained 61 percent of variance in behavioral intention (R^2= 0.61). Although the model was not a good fit, normality concerns regarding the perceived behavioral control variable (c.r. -4.005) and the small sample size (N=207) may have adversely affected the chi-square statistic and fit indices (RMSEA, NFI, GFI).

In addition to assessing the TPB model, participants were asked to indicate their motivations for using sports supplements. Previously published reasons for dietary supplement consumption include need for more energy and to stay healthy (CDC, 1997). Additionally, published motivations for sports supplement consumption among adolescent male athletes were to gain strength and muscle and to improve sports performance (Dunn, Eddy & Wang, 2001). In the present study however, female athletes indicated weight loss, weight gain, losing body fat and looking better as

motivations for consumption of sport supplements. The least given response was to improve sports performance. This may indicate female collegiate athletes' consumption of sport supplements was motivated by body image concerns rather than athletic performance.

Recommendations for Future Research

The use of the TPB to predict sports supplement consumption is somewhat new and further exploration of this topic seems warranted. With female participation in sports continuing to grow, it is becoming more important to understand influencing factors associated with young female athletes' consumption of sports supplements. Although the TPB measurement model did not product a good fit, the TPB seems able to explain a great deal of variance in behavioral intention to consume supplements. The large effect size produced by the measurement model suggests that refinement of measurement and sample procedure could produce better results. In the future, researcher should explore measurement models with and without additional variables to compare and create greater understanding predictors of sports supplements consumption. Furthermore, a larger and randomly selected sample may produce a better fit and further insight into factors influencing supplement consumption. Additionally, researchers should be sure to report standardized regression and SEM weights and effect sizes to allow for comparison of predictive ability of the TPB and additional constructs.

To maximize the usefulness of the TPB and SEM in future sports supplement studies, appropriate samples sizes should be used and measured variable selections

should be improved to allow formation of latent variables for model constructs. Responses from the present study's sample indicate additional items regarding body image should be included when studying female athletes. Finally, addition of variables to the TPB (such as using the TPB in the context of an ecological model) should be explored to improve predictive ability.

Final Thoughts

The current environment surrounding sports competition is one in which cheating, including use of performance enhancing substances, is acceptable as a means for athletic success. Professional athletes and Olympians are frequently exposed and these behaviors seem to have filtered into participants in youth and collegiate sports. The desire to win has become stronger than the desire to remain healthy and live a full life. It is time to reintroduce ethical competition to young athletes and promote the health and learning aspects of sports participation. Perhaps these findings will contribute to an understanding of internal motivations regarding the consumption of sports supplements by a female athlete, and lead to interventions to steer her away from unnecessary use of these substances.

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APPENDIX A

GLOSSARY OF SELECTED TERMS

GLOSSARY OF SELECTED TERMS

Dietary supplements are defined by the Food and Drug Administration as “a product (other than tobacco) intended to supplement the diet that bears or contains one or more of the following ingredients: a vitamin, mineral, herb or other botanical, an amino acid, a dietary substance for use by man to supplement the diet by increasing total daily intake, or a concentrate, metabolite, constituent, extract or combination of these ingredients.”

Sports supplements are a type of dietary supplement and consist of over-the-counter products (e.g. Androstenedione, Creatine, Ephedra) used to increase athletic ability or performance (e.g. muscle size and strength, speed, body composition).

Performance enhancing drugs (PED) are ***illegal*** substances used by athletes to increase physical performance (e.g. stimulants, anabolic steroids).

Structural Equation Modeling is a collection of statistical techniques that allow a set of relationships between one or more independent variables to be examined

Dietary Supplement Health and Education Act (DSHEA) allows dietary supplements to bear "statements of support" that: (a) claim a benefit related to classical nutrient deficiency disease; (b) describe how ingredients affect the structure or function of the human body; (c) characterize the documented mechanism by which the ingredients act to maintain structure or function; and (d) describe general well-being from consumption of the ingredients. The statement "calcium builds strong bones and teeth" is said to be a classic example of an allowable structure/function statement for a food. What constitutes an allowable statement for a supplement has not been established either by law or by regulation.

Observed Variable: Variable that is quantified by direct measurements; sometimes called a measured variable.

Latent Variable: Variable this is quantified by combining several observed variables; sometimes called an unobserved variable.

Theory of Planned Behavior focuses on theoretical constructs that are concerned with individual motivational factors as determinants of the likelihood of performing a specific behavior.

Behavioral Intention is the perceived likelihood of performing a behavior.

Behavioral Attitude is the overall evaluation of performing a behavior.

Subjective Norms is the belief about whether most people approve or disapprove of the behavior.

Perceived Behavioral Control is the overall measure of perceived control over performing an behavior.

Chi square is a non-parametric test of statistical significance for bivariate tabular analysis.

Goodness-of-Fit-Index (GFI) is an estimation criteria that indicates the fit of a structural equation model. Acceptable fit is usually greater than 0.95.

Normed-Fit-Index (NFI) is an estimation criteria that indicates the fit of a structural equation model. Acceptable fit is usually greater than 0.95

Root-Mean-Square-Error-of-Approximation (RMSEA) is an estimation criteria that indicates the fit of a structural equation model. Acceptable fit is usually less than 0.08.

APPENDIX B

EXPANDED STUDY METHODOLOGY

Participants

The population of interest for this study was female collegiate athletes at division one universities. For this study 644 female athletes in the big 12 conference participating in basketball, cross country, soccer, volleyball, and swimming during the 2005-2006 season were surveyed using an internet survey. According to Dillman (2000), researchers should expect a response rate of approximately 30% on surveys distributed. Thus, a sample of 644 female collegiate athletes was surveyed to ensure 200 completed surveys required for analysis using structural equation modeling (Hu & Bentler, 1998; Fan, Thompson & Wang, 1999). The participants (N=207) were 92% white, 4% African American, 2% Asian American, and 2% Hispanic. Twenty six percent of participants reported consuming sports supplements at some time (currently or in the past) and 74% reported never using sports supplements.

Data Collection

The protocol for this study was reviewed and approved by the institutional review board at Texas A&M University. The sample of female collegiate athletes was surveyed using web-based survey. Female athlete's names were acquired by downloading 2005-2006 rosters from official university athletics websites. Email addresses were acquired via online student directories from official university websites. Three universities were excluded from the study because student email addresses were not available online.

All female athletes in the sample received a series of four emails requesting their participation in this study. If the athlete decided to complete the survey, a link within

the email sent the participant to a website which contained an information sheet. The information sheet served to inform the participant about the study and any possible dangers of completing the survey. If the participant decided to continue onto the survey, a link at the bottom of the information sheet sent the participant to an online server where the instrument was housed (www.surveymonkey.com). Following the survey, the participant clicked a link to indicate completion of the survey. The survey data were stored on the surveymonkey server and were downloaded at the end of the study.

Of the 644 female athletes receiving email requests to participate in the survey, 207 completed the survey yielding a response rate of 32.1%. Several coaches and one university restricted their teams from completing the survey. The university contacted the principle investigator through the institutional review board and requested he no longer send emails to their athletes. Additionally, the principle investigator received several emails from potential participants indicating that their coaches restricted their participation in the study. Thus, the response rate may be artificially low and less representative of the population.

Variables

The model for this study contained 4 variables: intention, attitudes, subjective norms, and perceived behavioral control. Each scale for this study utilized a 5-point likert type scale with responses ranging from “strongly disagree” to “strongly agree” scored one to five, respectively. Intention to consume sports supplements was assessed with 14 items. Cronbach’s alpha for these items was 0.96. Attitude regarding

consumption of sports supplements was assessed with 10 items. Cronbach's alpha for these items was 0.90. Subjective norms regarding consumption of sports supplements was assessed with 14 items. Cronbach's alpha for these items was 0.92. Perceived behavioral control regarding consumption of sports supplements was assessed with 11 items. Cronbach's alpha for these items was 0.76. Each variable was quantified by summing all items into a single score. Scale scores for intention, attitudes, perceived social norms, intention, and perceived behavioral control ranged from 14 to 70, 10 to 50, 14 to 70, 11 to 55, respectively.

Statistical Analyses

Relationships between attitudes, perceived social norms, perceived behavioral control, and intention regarding consumption of sports supplements were analyzed using general linear model methods. The "fit" of the Theory of Planned behavior regarding consumption of sports supplements by female collegiate athletes was measured using a structural equation model analysis. All statistical analyses were performed using SPSS (Statistical Package for the Social Sciences) version 13.0 and AMOS version 5.0. AMOS was used to perform structural equation modeling (SEM) to estimate the predictive ability of the TPB. AMOS requires missing data (approximately 2%) to be replaced prior to analysis. Missing data were imputed using NORM and required 17 iterations for convergence. To determine the goodness of fit (GFI), the following measures are reported: the chi-square statistics with its degree of freedom (DF), the normal fit index (NFI), and the room mean square error of approximation (RMSEA). A

commonly used fit criteria is the χ^2/df ratio which should be less than 2 to represent acceptable fit to observed data. The NFI describes the overall proportion of explained variance and should be greater than 0.95, whereas the RMSEA is adjusted for model complexity and should be less than 0.08 (Byrne, 2001).

The sample was screened for multicollinearity using Pearson product-moment correlations of predictor variables (Tabachnick & Fidel, 2001). Multicollinearity was not detected in the correlations matrix as associations between variables ranged from 0.52 to 0.79. All correlations were significant at the 0.01 level, and all correlations were below 0.90 indicating no multicollinearity (Tabachnick & Fidell, 2001).

Independent t-tests were conducted to determine differences in sports supplement consumption by sport, classification, race, and age. Results indicated no significant differences in consumption patterns of supplements by female athletes based on these categories. Pearson's r correlations for observed variables ranged from 0.52 to 0.80 and were significant at the 0.01 level.

As no agreed-upon model fit standard exists, several indices were used to estimate the fit of the measurement model. A structural model of the TPB was tested using maximum likelihood estimates. The number of participants (N=207) was relatively low, therefore observed variables were used for path analyses estimates. The use of non-latent variables does not allow for control of measurement error in path coefficients which might inflate construct relationships. Attitudes, subjective norms, perceived behavioral control, and behavioral intention were hypothesized to be correlated and these relationships were measured using observed variables.

STUDY TIMELINE

February 4, 2005	Propose research study to dissertation committee
March 2005	Received IRB Approval
April 21, 2005	Sent survey instrument to panel of experts for review
May 15, 2005	Received instrument adjustment recommendations
July 13, 2005	Begin pilot data collection
August 5, 2005	End pilot data collection
August 2005	Pilot study data analysis and instrument adjustment
September 21, 2005	Begin final study data collection
October 15, 2005	End final study data collection
November/December 2005:	Analysis of sample data
December 2005/February 2006:	Compose manuscript from data findings
March 1, 2006:	Defend research with dissertation committee

EMAIL COMMUNICATIONS

Prenotice Letter Email

Hi Female Athlete,

A few days from now you will receive via email a request to complete a brief on-line survey for an important research project being conducted at Texas A&M University. It concerns the experience of female athletes participating in (sport) at Big 12 universities.

I am writing in advance because we have found student-athletes like to know ahead of time that they will be contacted. This study is an important one that will help researchers understand who participates in women's basketball in the Big 12 conference, and whether or not they use sports supplements to improve their performance.

As a thank you for completing the survey, you will be entered into a drawing giving you a chance to win an Apple Ipod or a cosmetics package. Thank you for your time and consideration. It's only with the generous help of student-athletes like you that our research can be successful.

Sincerely,

Jeff M. Housman
PhD Candidate
Texas A&M University

Survey Request Email

Hi Female Athlete,

I am writing to ask your help in a study of (sport) athletes in the Big 12 Conference. This study seeks to learn more about sports supplement consumption among female collegiate athletes. Results from this study will provide researchers with an understanding of circumstances surrounding use of sports supplements. Your participation is voluntary and your answers are confidential and anonymous. Unfortunately, I have learned I will not be able to offer any reward/prize for your participation. Accepting a prize may cause NCAA eligibility problems, and I certainly would not want to cause you to lose any eligibility based on this survey.

If you have any questions or comments about this study you can contact me by phone at 979-862-1728, or by email at jhousman@hlkn.tamu.edu. Thank you for your help in this very important study. To complete the survey, please click on the link: http://tamusupplementsurvey.tamu.edu

Sincerely,

Jeff Housman
Ph.D. Candidate
Texas A&M University

Reminder Email

Hi Female Athlete,

Last week you received an email seeking views on sports supplements. The email contained a link that sent you to a web survey. If you have already completed the survey, please accept my sincere thanks. If not, please do so today.

I am especially grateful for your help because it is only by asking student-athletes like you to share your experiences that I can understand factors that motivate female collegiate athletes to consume sports supplements.

If you would like to complete the survey, please click on the following link: http://tamusupplementsurvey.tamu.edu

If you have any problems reaching the survey, please contact me at jhousman@hlkn.tamu.edu, or 979.862.1728.

Sincerely,

Jeff Housman
Ph.D. Candidate
Texas A&M University

Thank You Email

Hi Female Athlete,

Over the last two weeks you have received several emails seeking views on sports supplements. I appreciate your willingness to consider my request as I attempt to understand supplement use by female collegiate student-athletes. Thank you very much for completing the survey and helping with my thesis project.

If you have any questions of concerns, please contact me at jhousman@hlkn.tamu.edu, or 979.862.1728.

Sincerely,

Jeff Housman
Ph.D. Candidate
Texas A&M University

APPENDIX C

FINAL SURVEY INSTRUMENT

FEMALE COLLEGIATE ATHLETES SPORTS SUPPLEMENT SURVEY

The instrument used in this study was developed using scales from two previously established instruments. Scales from the Survey to Predict Adolescent Athletes Supplement Use (SPADDSU) (Perko, 1999) were used to measure attitudes (10 items), perceived social norms (14 items), and intentions (14 items) regarding consumption of dietary supplements. A scale from Conner's (2001) Dietary Supplement Questionnaire was used to measure perceived behavioral control (11 items) regarding consumption of dietary supplements. The SPADDSU was developed and tested on two occasions yielding reliability coefficients of 0.94 and 0.89. The scale for perceived behavioral control was also developed and tested earlier yielding a reliability coefficient of 0.76.

The instrument was reviewed by a panel of experts to determine the survey's appropriateness for the female collegiate athlete population. The wording of several questions was adjusted for age appropriateness and several questions were added at the suggestion of panel experts. A pilot study was conducted with 26 Big 12 tennis athletes and each scale was tested for internal consistency and factorial structure. Pilot data yielded cronbach alpha reliability measures of 0.95 for the behavioral intention scale, 0.90 for the attitudes scale, 0.82 for the subjective norms scale, and 0.81 for the perceived behavioral control scale. Because the reliability measurements and factor analysis were adequate, no changes were made to the instrument.

Panel of Experts

Mike Perko, Ph.D.
Associate Professor
University of Alabama

Rachel Olander
Director
Center for Drug Free Sport

Todd Bartee, Ph.D.
Associate
University of Wyoming

Priscilla Clarkson, Ph.D.
Associate Professor
University of Massachusetts

Charles Yesalis, Ph.D.
Professor
Penn State University

Mark Conner, Ph.D.
Professor
University of Leeds

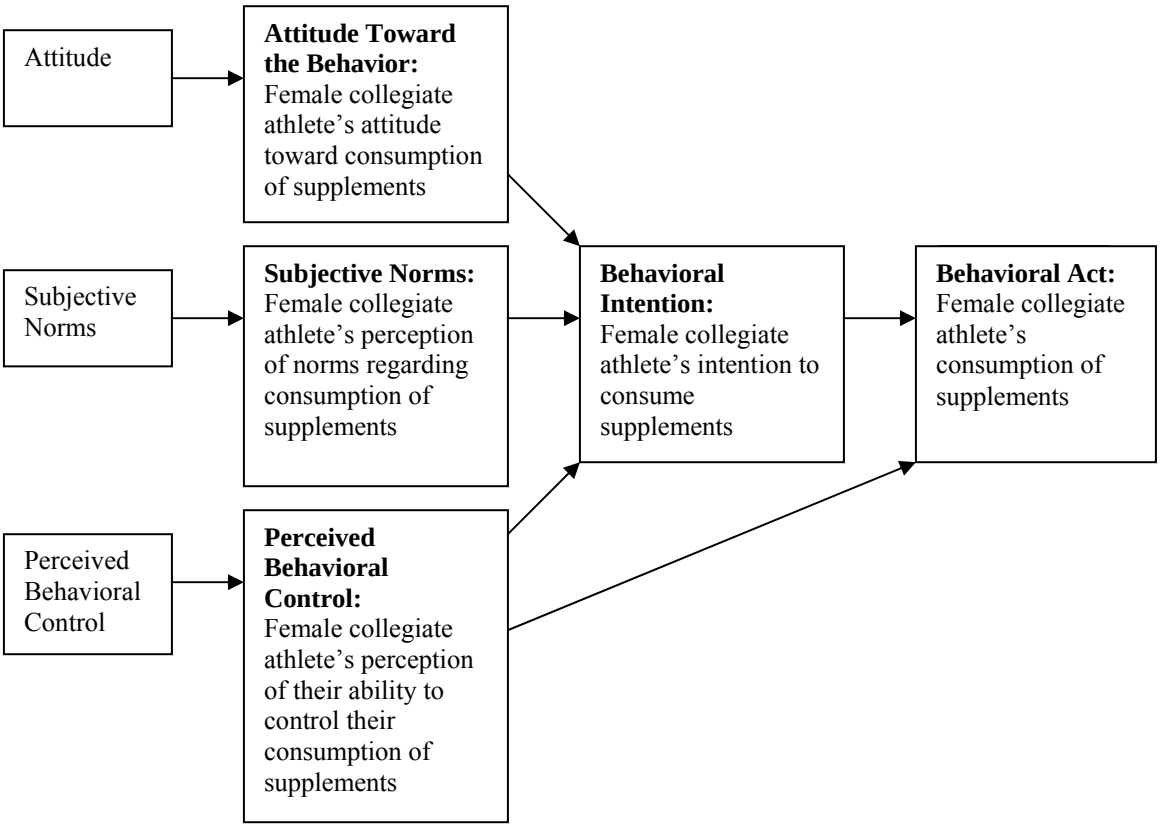
Bob Lefavi, Ph.D.
Professor
Armstrong Atlantic State University

Linn Goldberg, M.D.
Professor
Oregon Health Science University

Mike Dunn, Ph.D.
Assistant Professor
Middle Tennessee State University

Expert Panel Letter

The Theory of Planned Behavior proposes that a person's intention to perform a specific behavior can be predicted from the person's general attitude toward that behavior, their perceived subjective norm regarding that behavior, and their perceived behavioral control over that behavior. This intention to perform the behavior will predict the subsequent behavioral act. The Theory of Planned Behavior is outlined below:



The population for this dissertation is female athletes participating in basketball, cross country, soccer, and volleyball in the Big 12 Conference. I am using scales from two previously published instruments: the Survey to Predict Adolescent Athlete's Dietary Supplement Use or SPAADSU[1] and the Dietary Supplement Questionnaire.[2] Although both have previously produced reliable data (cronbach's alpha 0.76 to 0.94), each was used in a different population. The next step in the process is to have a panel of professionals with expertise in dietary supplements, college health, nutrition, and test construction review this instrument for appropriateness in surveying female collegiate

athletes. You have been recommended to me as someone with expertise in the above fields who would be able to provide assistance in this effort.

I have provided an evaluation form (in Microsoft Word) for each question in the instrument. In the hope that you decide or have the time to assist me, I ask that you read each question and then fill out the corresponding evaluation questions. Questions 1-13 represent **Behavioral Intention**, questions 14-23 represent **Attitudes** towards the behavior, questions 24-36 represent **Subjective Norms**, and questions 37-42 represent **Perceived Behavioral Control**. Feel free to complete the evaluation in MS Word and email it back to me. If you would rather write directly on the evaluation, please mail or fax the completed evaluation to me. All contract information may be found below. This survey will be an internet survey. It is located at http://smrg.tamu.edu/selectsurveyASPAdvanced/TakeSurvey.asp?PageNumber=1&SurveyID=121. Please copy and paste this link so you may view the survey as it is intended for those participating in the study.

Please return the completed evaluation to me in 3 weeks time (approximately May 17, 2005). If you have any questions please do not hesitate to call (979.847.9587) or email me (jhousman@hlkn.tamu.edu) at your convenience.

Sincerely,

Jeff M. Housman
Doctoral student in health education
Department of Health and Kinesiology
Texas A&M University
MS 4243
College Station, TX 77843-4243
Phone: 979.847.9587
Email: jhousman@hlkn.tamu.edu
Fax: 979.847.8987

1. Perko, M.A. (1999). Development of a theory-based instrument regarding adolescent athletes and dietary supplements. *Journal of Health Studies*, 15(2), 71-80.
2. Conner, M., Kirk, S.F., Cade, J.E., & Barrett, J.H. (2001). Why do women use dietary supplements? The use of the theory of planned behavior to explore beliefs about their use. *Social Science and Medicine*, 52, 621-633.

Proposed Sports Supplement Survey Instrument and Expert Panel Evaluation Form

College Athletes and Dietary Supplements Survey

Panel of Experts Evaluation

Section I

For each question, please circle the number that most accurately applies to you.

1. I would use dietary supplements to improve my sports performance.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:

Is the question misleading in any way? (Y/N) ____.
Comments:_____.

Additional Comments:

2. I would use dietary supplements to improve my general health rather than for sports performance.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) ____.
Comments:_____.

Additional Comments:

3. I would use dietary supplement if my coach gave them to me.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

4. I would use dietary supplements if my parent(s) or guardian were taking them.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

5. I would use dietary supplements if an athletic trainer gave them to me.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

6. I would ask my coach if dietary supplements are safe.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

7. I would ask my coach if dietary supplements work.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

8. I would ask my parent(s) or guardian(s) if dietary supplements are safe.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

9. I would ask my parent(s) or guardian if dietary supplements work.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

10. I would use dietary supplements that I know work.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

11. I would use dietary supplements that I know were tested and safe.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

12. I would use dietary supplements if I could afford to buy them.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

13. I would use dietary supplements if my parent(s) or guardian(s) bought them for me.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

14. Taking dietary supplements is safe because they are tested by scientists.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

15. Taking dietary supplements would give me more energy.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

16. Taking dietary supplements would help prevent my getting a cold or the flu.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

17. Taking dietary supplements would help all athletes do better in sports.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

18. Taking dietary supplements is a safe way for athletes to improve sports performance.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

19. Taking dietary supplements is a good way to build muscles.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

20. Athletes my age need dietary supplements to improve sports performance.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

21. Athletes my age need dietary supplements for general health reasons.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

22. Dietary supplements are safe because professional athletes take them.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

23. Dietary supplements work because professional athletes take them.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.

Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

24. My coach would support my using dietary supplements to improve sports performance.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) _____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

25. My coach would support my using dietary supplements for general health reasons.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) _____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

26. My parent(s) or guardian(s) would support my using dietary supplements for general health reasons.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

27. My parent(s) or guardian would support my using dietary supplements for better sports performance.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

28. My teammates would support my using dietary supplements for better sports performance.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

29. My teammates would support my using dietary supplements for general health reasons.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

30. My doctor would support my using dietary supplements to improve sports performance.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

31. My doctor would support my using dietary supplements for general health reasons.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.

Comments:_____.

Additional Comments:

32. My team's athletic trainer(s) would support my using dietary supplements to improve sports performance.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) _____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

33. My team's athletic trainer(s) would support my using dietary supplements for general health reasons.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) _____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

34. Generally speaking, I want to do what my parent(s) or guardian(s) want me to do.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) _____.

Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

35. Generally speaking, I want to do what my coach wants me to do.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

36. Generally speaking, I want to do what my doctor wants me to do.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

37. There are plenty of opportunities for me to take dietary supplements.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.

Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

38. If I wanted to, I could easily take dietary supplements from now on.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

39. If you tried, it is likely you would be able to take dietary supplements from now on.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

40. For me, taking dietary supplements is easy.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.

Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

41. There are factors outside my control that could cause me to taking dietary supplements.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

42. I do not have control over whether or not I take dietary supplements from now on.

Strongly agree 5 4 3 2 1 Strongly disagree

Question is worded concisely. (Y/N) ____.
Comments: _____.

Age appropriate language is used. (Y/N) ____.
Comments:_____.

Is the question misleading in any way? (Y/N) _____.
Comments:_____.

Additional Comments:

Comment regarding the construction (or overall feel) of the instrument:

Positives:

Negatives:

Suggestions:

Final Version of Survey Instrument

Female Collegiate Athletes Sports Supplements Survey

Section I

For each question, please indicate the number that most accurately applies to you.

1. I intend to use sports supplements to improve my sports performance during the current/upcoming season.

Strongly agree 5 4 3 2 1 Strongly disagree

2. I intend to use sports supplements to improve my general health rather than for sports performance during the current/upcoming season.

Strongly agree 5 4 3 2 1 Strongly disagree

3. I intend to use sports supplements to enhance my physical appearance during the current/upcoming season (Item Added).

Strongly agree 5 4 3 2 1 Strongly disagree

4. I intend to use sports supplement if my coach gives them to me during the current/upcoming season.

Strongly agree 5 4 3 2 1 Strongly disagree

5. I intend to use sports supplements if my parent(s) or guardian give them to me during the current/upcoming season.

Strongly agree 5 4 3 2 1 Strongly disagree

6. I intend to use sports supplements if my strength coach gives them to me during the current/upcoming season.

Strongly agree 5 4 3 2 1 Strongly disagree

7. I intend to ask my coach if sports supplements are safe.

Strongly agree 5 4 3 2 1 Strongly disagree

8. I intend to ask my coach if sports supplements work.

Strongly agree 5 4 3 2 1 Strongly disagree

9. I intend to ask my parent(s) or guardian(s) if sports supplements are safe.

Strongly agree 5 4 3 2 1 Strongly disagree

10. I intend to ask my parent(s) or guardian if sports supplements work.

Strongly agree 5 4 3 2 1 Strongly disagree

11. I intend to use sports supplements that I know work.

Strongly agree 5 4 3 2 1 Strongly disagree

12. I intend to use sports supplements that I know were tested and safe.

Strongly agree 5 4 3 2 1 Strongly disagree

13. I intend to use sports supplements if I could afford to buy them.

Strongly agree 5 4 3 2 1 Strongly disagree

14. I intend to use sports supplements if my parent(s) or guardian(s) buy them for me.

Strongly agree 5 4 3 2 1 Strongly disagree

15. Taking sports supplements is safe because they are tested prior to sell.

Strongly agree 5 4 3 2 1 Strongly disagree

16. Taking sports supplements intend to give me more energy.

Strongly agree 5 4 3 2 1 Strongly disagree

17. Taking sports supplements intend to help prevent my getting a cold.

Strongly agree 5 4 3 2 1 Strongly disagree

18. Taking sports supplements would help all athletes do better in sports.

Strongly agree 5 4 3 2 1 Strongly disagree

19. Taking sports supplements is a good way for athletes to improve sports performance.

Strongly agree 5 4 3 2 1 Strongly disagree

20. Taking sports supplements is a good way to build muscles.

Strongly agree 5 4 3 2 1 Strongly disagree

21. Athletes need sports supplements to improve sports performance.

Strongly agree 5 4 3 2 1 Strongly disagree

22. Athletes need sports supplements for general health reasons.

Strongly agree 5 4 3 2 1 Strongly disagree

23. Sports supplements are safe because professional athletes take them.

Strongly agree 5 4 3 2 1 Strongly disagree

24. Sports supplements taken by professional athletes work.

Strongly agree 5 4 3 2 1 Strongly disagree

25. My coach would support my using sports supplements to improve sports performance.

Strongly agree 5 4 3 2 1 Strongly disagree

26. My coach would support my using sports supplements for general health reasons.

Strongly agree 5 4 3 2 1 Strongly disagree

27. My parent(s) or guardian(s) would support my using sports supplements for general health reasons.

Strongly agree 5 4 3 2 1 Strongly disagree

28. My parent(s) or guardian would support my using sports supplements for better sports performance.

Strongly agree 5 4 3 2 1 Strongly disagree

29. My teammates would support my using sports supplements for better sports performance.

Strongly agree 5 4 3 2 1 Strongly disagree

30. My teammates would support my using sports supplements for general health reasons.

Strongly agree 5 4 3 2 1 Strongly disagree

31. My doctor would support my using sports supplements to improve sports performance.

Strongly agree 5 4 3 2 1 Strongly disagree

32. My doctor would support my using sports supplements for general health reasons.

Strongly agree 5 4 3 2 1 Strongly disagree

33. My team's strength coach(s) would support my using sports supplements to improve sports performance.

Strongly agree 5 4 3 2 1 Strongly disagree

34. My team's strength coach(s) would support my using sports supplements for general health reasons.

Strongly agree 5 4 3 2 1 Strongly disagree

35. Generally speaking, I want to do what my parent(s) or guardian(s) want me to do.

Strongly agree 5 4 3 2 1 Strongly disagree

36. Generally speaking, I want to do what my coach wants me to do.

Strongly agree 5 4 3 2 1 Strongly disagree

37. Generally speaking, I want to do what my doctor wants me to do.

Strongly agree 5 4 3 2 1 Strongly disagree

38. Generally speaking, I want to do what my strength coach(s) want me to do (Added Item).

Strongly agree 5 4 3 2 1 Strongly disagree

39. There are plenty of opportunities for me to take sports supplements.

Strongly agree 5 4 3 2 1 Strongly disagree

40. If I wanted to, I could take sports supplements at any time (Added Item).

Strongly agree 5 4 3 2 1 Strongly disagree

41. If I wanted to, I could easily take sports supplements from now on.

Strongly agree 5 4 3 2 1 Strongly disagree

42. If you tried, it is likely you would be able to take sports supplements from now on.

Strongly agree 5 4 3 2 1 Strongly disagree

43. For me, taking sports supplements is easy.

Strongly agree 5 4 3 2 1 Strongly disagree

44. There are factors outside my control that could cause me to taking sports supplements.

Strongly agree 5 4 3 2 1 Strongly disagree

45. I do not have control over whether or not I take sports supplements from now on.

Strongly agree 5 4 3 2 1 Strongly disagree

46. It is difficult for me to take sports supplements when my teammates are not (Added Item).

Strongly agree 5 4 3 2 1 Strongly disagree

47. It is difficult for me to take sports supplements without my coach's permission (Added Item).

Strongly agree 5 4 3 2 1 Strongly disagree

48. It is difficult for me to take sports supplements without my athletic trainer's assistance (Added Item).

Strongly agree 5 4 3 2 1 Strongly disagree

49. It is difficult for me to take sports supplements correctly without my strength coach's assistance (Added Item).

Strongly agree 5 4 3 2 1 Strongly disagree

50. It is easy for me to take sports supplements because I take them at the same time everyday (Added Item).

Strongly agree 5 4 3 2 1 Strongly disagree

Section II

Please complete the following questions.

1. What is your age today? (Circle one)

   18 19 20 21 22 23 24 25 26

2. What is your classification? (Circle one)

   Freshman Sophomore Junior Senior

3. Which of the following best describes your ethnic background? (Check one)

   _____American Indian _____Black or African-American

   _____White or Caucasian _____Hispanic or Mexican-American

   _____Oriental or Asian-American _____Other_____.

4. In what sports or sports do you participate?

   _____Basketball _____Cross Country

   _____Soccer _____Volleyball

   _____Tennis _____Swimming

5. Do you take one or more sports supplements? (Check one)

   _____Yes, I currently take them on a regular basis

   _____No, I used to them but stopped

_____No, but I have tried them once or twice

_____No, I have never tried them.

6. If you answered yes to question 5, what supplements do you take?

7. If you answered "yes" to question 5, what is your reason for taking sports supplements? (Check all that apply)

_____Gain weight _____Lose weight

_____Gain muscle size _____Gain strength

_____Play sports better _____Look better

_____For energy _____Lose body fat

_____General health _____Not sure

_____Other_____.

APPENDIX D

PILOT STUDY

PILOT STUDY METHODOLOGY

A pilot study to test the reliability and validity of the survey instrument was conducted in the summer of 2005. Twenty-six female tennis players were surveyed to determine behavioral intention, attitudes, subjective norms and perceived behavioral control regarding consumption of sports supplements. Participants names were downloaded from official university athletic website and participant email addressed were retrieved using student email directories on official university website. Participants received a series of 5 emails requesting completion of the survey. If the athlete decided to complete the survey, a link within the email would lead the athlete to an information page. The information page informed the participant about the study and discussed any possible risks of completing the survey. Another link on the information page led to the survey which was housed on the surveymonkey server (www.surveymonkey.com).

Participants received a series of 5 emails from July 15, 2005 through August 5, 2005. On August 6, 2005, the survey was closed and data were downloaded from the surveymonkey server. Reliability and validity analyses were performed on sample data including cronbach's alpha and factor analysis. Statistical analyses indicated satisfactory levels of reliability (see Table 7) and factor analyses were acceptable.

Table 7. Pilot study scale reliability for the female collegiate athletes sports supplement survey

Scale	Items	Cronbach's Alpha
Behavioral Intention	1-14	0.9501
Behavioral Attitude	15-24	0.9034
Subjective Norms	25-38	0.8155
Perceived Behavioral Control	39-49	0.8053

Pilot Prenotice Email

Hi Female Athlete,

A few days from now you will receive via email a request to complete a brief on-line survey for an important research project being conducted at Texas A&M University. It concerns the experience of female athletes participating in tennis at Big 12 universities.

I am writing in advance because we have found student-athletes like to know ahead of time that they will be contacted. This study is an important one that will help researchers understand who participates in women's tennis in the Big 12 conference, and whether or not they use sports supplements to improve their performance.

Thank you for your time and consideration. It's only with the generous help of student-athletes like you that our research can be successful.

Sincerely,

Jeff M. Housman

Pilot Survey Request Email

Hi Female Athlete,

I am writing to ask your help in a study of tennis athletes in the Big 12 Conference. This study seeks to learn more about sports supplement consumption among female collegiate athletes. Results from this study will provide researchers with an understanding of circumstances surrounding use of sports supplements. Your participation is voluntary and your answers are confidential and anonymous. Results will be released in summaries and no individual's answers will be identified.

If you have any questions or comments about this study you can contact me by phone at 979-847-9587, or by email at jhousman@hlkn.tamu.edu. Thank you for your help in this very important study. To complete the survey, please click on the link: http://tamusupplementsurvey.tamu.edu

Sincerely,

Jeff Housman
PhD Candidate
Texas A&M University

Pilot First Reminder Email

Hi Female Athlete,

Last week an email requesting your opinions on sports supplements was sent to you. Your name was drawn from the official athletic website at your university.

If you have already completed the survey, please accept my sincere thanks. If not, please do so today. I am especially grateful for you help because it is only by asking people like you to share your experiences that I can understand collegiate female athletes' attitudes regarding sports supplements.

If you have any difficulty opening the survey, please email me at jhousman@hlkn.tamu.edu or call me at 979-847-9587.

Thanks Again,

Jeff Housman
PhD Candidate
Texas A&M University

Pilot Second Reminder Email

Hi Female Athlete,

You have recently received several emails requesting your opinions on sports supplements was sent to you. Your name was drawn from the official athletic website at your university.

If you have already completed the survey, please accept my sincere thanks. If not, please do so today. I am especially grateful for your help because it is only by asking people like you to share your experiences that I can understand collegiate female athletes' attitudes regarding sports supplements. You can complete the survey by clicking on the following link: http://tamusupplementsurvey.tamu.edu

If you have any difficulty opening the survey, please email me at jhousman@hlkn.tamu.edu or call me at 979-847-9587.

Thanks Again,

Jeff Housman
PhD Candidate
Texas A&M University

Pilot Thank You Email

Hi Female Athlete,

I would like to thank you for your participation in my thesis survey. The information I gained from your answers will greatly increase my chances of producing a successful thesis. Good luck with your studies and upcoming season. If you have not completed the survey and would like to, please click on the following link: http://tamusupplementsurvey.tamu.edu The survey will remain open until Friday, August 12th.

Thanks again for all your time and effort.

Sincerely,

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VITA

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PROFESSIONAL EXPERIENCE

2005 **Lecturer**
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2002-2006 **Graduate Assistant**
Physical Education Activity Program
Texas A&M University

2000-2002 **Teacher**
Cypress-Fairbanks High School
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PUBLICATIONS

Housman, J. M., & Dorman, S. (2005). The Alameda County Study: A systematic, chronological review. *American Journal of Health Education*, 36(5), 302-308.

PRESENTATIONS

Housman, J. M. Dorman, S (2006, April). *Applications of the Theory of Planned Behavior to Consumption of Dietary Supplements and Other Health-related Behaviors*. American Alliance for Health, Physical Education, Recreation, and Dance (AAHPERD) National Convention. Salt Lake City, UT. (accepted for presentation)