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THE COMPARISON OF BODY COMPOSITION, EATING HABITS, EXERCISE
HABITS, AND HIGH RISK BEHAVIOR IN A TRI-RACIAL GROUP OF DIVISION I
COLLEGIATE FEMALE ATHLETES

By

Yi-Tzu Kuo

A DISSERTATION

Submitted to the Faculty
of the University of Miami
in partial fulfillment of the requirements for
the degree of Doctor of Philosophy

Coral Gables, Florida

May 2012

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The Comparison of Body Composition, Eating Habits, Exercise Habits, and High Risk Behavior in A Tri-racial Group of Division I Collegiate Female Athletes

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Abstract of a dissertation at the University of Miami.

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Introduction: Given the increased participation in competitive sports and athletics among women, there is a greater number of issues related to body weight concerns, eating and exercise habits, as well as high risk behaviors, which are particularly evident in female athletes. There are also many more minority women participating in competitive sports, presenting a greater need to examine these issues among a more diverse population of competitive female athletes. Hispanic American (HA) athletes in particular, represent a growing segment of the athletic population that is in need of more information regarding their exercise-related behaviors. The aim of this study was to compare and examine body composition, eating habits, exercise habits, and high risk behavior patterns in a tri-racial group of Caucasian American (CA), African American (AA), and HA athletes. **Methods:** A total of 168 female collegiate athletes were recruited for study which included 82 CA athletes, 35 AA athletes, and 51 HA athletes. Physical characteristics including body mass index (BMI), waist circumference (WAIST), and percent body fat were examined in all athletes. In addition, all athletes completed a self-administered modified Youth Risk Behavior Survey and Eating Attitudes Test – 29 (EAT-26). Logistic regression analyses was used to determine the influence of BMI and race on categorical variables related to body weight concerns,

eating and exercise habits, and high risk behaviors. **Results:** BMI significantly contributed to the variance in categorical variables related to body weight concerns ($p < 0.01$ for all), eating habits ($p < 0.05$), scores on the EAT-26 ($p < 0.001$), and high-risk behaviors ($p < 0.05$ for all). Race significantly contributed to the variance in physical characteristics ($p < 0.01$ for all) and categorical variables related to body weight concerns ($p < 0.05$ for all), eating habits ($p < 0.05$ for all), exercise habits ($p < 0.05$ for all), and high risk behaviors ($p < 0.05$ for all). BMI and race together contributed significantly to the variance in categorical variables related to body weight concerns ($p < 0.01$ for all), eating habits ($p < 0.01$), exercise habits ($p < 0.01$), and high risk behaviors ($p < 0.05$ for all).

Conclusion: Our study demonstrated that BMI significantly contributed to behavioral characteristics associated with body weight concerns, eating and exercise habits, as well as high-risk behaviors. This is similar to what has been found in non-athletic adolescent girls and young adult women. Specifically, HA female athletes demonstrated significantly different behavior characteristics than CA and AA female athletes. Our study reinforces the need for more research in this growing segment of minority athletes.

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LIST OF ABBREVIATIONS

AA: African American

ANOVA: Analysis of variance

BMI: Body mass index

CA: Caucasian American

CDC: Center for Disease Control and Prevention

EAT-26: Eating Attitudes Test - 26

HA: Hispanic American

SPSS: Statistical Package for the Social Sciences

TV: Television

WAIST: Waist circumference

WHO: World Health Organization

CHAPTER 1: INTRODUCTION

In 1970s, a federal anti-discrimination law called Title IX was implemented, which mandated nondiscrimination and equal opportunity for both sexes in admissions, access, and treatment in all educational programs offered by institutions receiving federal funds. Before the implementation of Title IX, women and girls were excluded from participating in traditionally male-dominated jobs and sports. With the exception of teaching, nursing, social work, and library science, women were accepted on a limited basis into the more male-dominated fields. Since the establishment of Title IX in the 1970s, women's participation in sports has dramatically increased in the 1980s and 1990s. Today, more than ever, girls participating in physical activities are no longer considered "tom boys" but rather role models. Girls and women are increasingly involved in sports that have traditionally been considered out of bounds for women, including football, lacrosse, ice hockey, basketball, and soccer. Concomitant with the increased number of female athletes in sports, there has been a parallel increase in the number of female sports medicine physicians and exercise physiologists (Drinkwater, 2000). Interestingly, many of these women had their first experience in sports as athletes.

Regardless of gender or type of sport involvement, studies have repeatedly shown the extensive cardiovascular, physiological, and psychological benefits associated with exercise at various level of participation. Researchers have shown that women significantly benefit from exercise, showing decreased risk of hypertension, type II diabetes, and obesity and its co-morbidities (Pate et al, 1995). Furthermore,

improvements in physical fitness derived from sport participation have been associated with decreased mortality, improved psychological outlook and more positive mood states (Goodwin 2003). Studies have indicated that women who do engage in organized sports are at lower risk for depression. They also possess a more positive self-image (Putukian, 2001; Schmalz et al., 2007). Thus, participation in sports and physical activities are found to be inversely associated with unhealthy behaviors and sedentary lifestyle characteristics.

Despite the overwhelming benefits of sports participation and exercise, Nattiv and Puffer (1991) have also documented negative consequences of a more active lifestyle. A higher prevalence of high risk behaviors have been found in athletes compared to non-athletes. Athletes are reported to consume a significantly greater quantity of alcohol in one sitting compared to their non-athletic peers. They frequently drive while intoxicated or under the influence of drugs, and use seatbelts less frequently. Kokotailo et al in 1996 confirmed that regardless of gender, athletes are more likely to engage in unsafe sexual practices, and use tobacco or snuff when compared to non-athletic counterparts. Furthermore, Green et al. (2001) indicated that the majority of collegiate athletes engage in substance abuse, especially alcohol and this is observed regardless of ethnicity. The constant pressure to perform at high competitive levels concomitant with media attention may drive athletes more so than sedentary individuals to take more high risk chances (Byrn and McLean, 2002). Thus, more efforts should be undertaken to identify high-risk behaviors in competitive athletes in order to develop better preventative efforts.

Eating disorders constitute yet another high risk behavior reported more in athletes than non-athletes (Rhea, 1999; Reinking and Alexander, 2005; Torstveit and

Sundgot-Borgen, 2005). Rouveix and colleagues in 2004 reported a higher incidence of weight and diet concerns in a group of female athletes when compared to non-athletes. Furthermore, Thiel and colleagues (1993) and DePalma et al. (1993) have shown that individuals participating in activities that stress low body weight and a slim shape for performance appear to be at greater risk for eating disorders than those whose sport does not demand leanness for performance. As a result, clinicians and researchers have documented the rise in clinical eating disorders and weight concerns that are impacting a large number of female athletes (Holm-Denoma et al., 2009). Interestingly, racial differences exist in the prevalence of eating disorders. Rhea and colleagues (1999) reported a higher risk of eating disorders among Caucasian-American (CA) and Hispanic-American (HA) female athletes. Consequently, more time and effort may be necessary to identify risk factors for eating disorders and other adverse health-related conditions in a more diverse population of competitive female athletes. Specifically, HA females may provide a more pressing group of women athletes requiring further study.

Disordered eating and other high risk behaviors may be rooted in issues related to body satisfaction, self-esteem and body image. Low self-esteem and negative body image marked by body dissatisfaction are commonly observed in eating disorders (Garner, 1991). Engel et al. for example, reported self-esteem to be a significant predictor of disordered eating behaviors among female athletes (2003). Unfortunately, many of the earlier studies have been conducted in predominately CA populations and to a lesser extent, African-American (AA) populations. Today, sports participation includes a wide diversity of ethnic and racial groups. Previous studies have demonstrated that AA women actually evidence more positive body satisfaction and lower drive for thinness

than CA women (Abrams et al., 1993; Chandler et al., 1994; Striegel-Moore and Smolak, 1996). In a study by Abood and Chandler (1997), AA women weighing approximately ten pounds more than their Caucasian counterparts, did not appear to experience the same level of body dissatisfaction as CA women did. This has been confirmed by Johnson et al, in 2004 who showed that CA athletes were more preoccupied with thinness, showing greater body dissatisfaction than AA athletes. Far less information can be found in HA athletes. As early as the 1990's, the number of minority athletes, particularly HA athletes at the collegiate level has been steadily rising (Rhea 1999). Today, minority athletes comprise more than 57% of the current collegiate athlete population in the United States (NCAA Student-Athlete Ethnicity Report 2010). Recently, our HA constituency has become the largest minority population in the United States (US Census Bureau, 2008). This supports the need for more research in this minority group. In the limited research conducted in this group, HA women were similar to CA women showing greater body dissatisfaction (Erickson et al., 2009). Given the paucity of information in this growing segment of our population, more research is necessary to gain insight into behavioral issues and concerns in HA female athletes of today. The purpose of this study is to examine body composition, body weight concerns, eating and exercise habits, and relative risk behaviors in a diverse racial group of CA, AA, and HA female collegiate athletes.

CHAPTER 2: METHODS

Participants

This study solicited eligible collegiate female athletes from local Division I Research universities including University of Miami and Florida International University. Female athletes were recruited through advertisement flyer of the study which was posted throughout the athletic department buildings (including locker rooms, athletic training room, meeting rooms, and offices). A total of 189 athletes completed the modified youth high risk behavior survey, 43.4% CA athletes, 18.5% AA athletes, 27.0% HA athletes, 2.6% Asian American athletes, and 8.5% athletes of other races. A total of 21 athletes were not eligible to participate for the study since they were not of CA, AA, or AA racial backgrounds, leaving a total of 168 participants. Athletes who were pregnant or who were listed as injured, red-shirted, or on probation at the time of data collection, were not eligible to participate.

Data Collection

Prior to data collection, the study procedure was explained to participants and all subjects were evaluated for BMI, fat distribution, percent body fat, and behavioral measures. The BMI was calculated by using the formula of weight (in pounds) divided by the square of height (in inches), and then multiplied by 703, $[(\text{weight} / \text{height}^2) \times 703]$. The waist circumference (WAIST) was measured using a spring-tension measuring tape, marking a point on each side of the waist midway between the last palpable rib and the iliac crest (WHO, 1989). The percent body fat was evaluated by measuring the thickness of three skin sites using a Lange skinfold caliper to measure the triceps, anterior thigh, and

abdomen. Percent body fat was derived from the formula developed by Jackson & Pollock (1978). All skinfold measurements were taken by the same investigator. Triceps measurements were taken using a vertical skinfold on the posterior humerus, one half of the distance between the posterior aspect of acromion process of the scapula and the apex of the superior and posterior aspect of olecranon process of the ulnar. The anterior thigh measurements were also taken using a vertical skinfold one half the distance between the midpoint of anterior superior iliac spine anteriorly and midpoint of the superior aspect of the patella. The abdominal measurement was taken using a vertical skinfold pinch one inch laterally from the center of the navel. All three sites were identified and measured according to Wilmore et al. (1969) with intra-observer coefficient of reliability of 98%.

Participants also completed two paper based and self-administered questionnaires; an Eating Attitudes Test – 26 (EAT-26) (Garner et al., 1982) and a modification of the Youth High Risk Behavior Survey consisting of 49 items (CDC, 2005). The EAT-26 has been shown to be a valid and reliable measure of risk of eating disorders (Garner et al., 1985 and CDC 1992). The Youth High Risk Behavior Survey has been widely used since 1990 and shown to be a reliable indicator of relevant health behaviors with Kappa coefficient of 72% (Brener et al., 1985).

Statistical Analysis

Mean values and standard deviations were determined for each racial group for all physical variables and compared among groups using an analysis of variance (ANOVA). Tukey's post hoc analysis was performed to determine significant differences among racial groups. Descriptive analysis was also performed to examine the distribution of

athletes in different racial groups among different sport classifications. Logistic multiple regression analysis was used to determine the independent contribution of physical characteristics and race to four domains: body weight concerns/behaviors, eating habits/EAT-26, physical activities/habits, and high risk behaviors. BMI showed a greater contribution to the variance than either WAIST or percent body fat in every one of the four domains examined. Since BMI contributed most to the variance in each of the four domains, it was used as one of the predictors in the model. Race also contributed significantly to the variance in the aforementioned domains and was examined along with BMI to determine its contribution to the variance in the model. Finally, BMI and race were added together to examine the sum of both in their contribution to the variance in the model. There was no BMI by race interaction for any dependent variables examined in the study. Although the EAT-26 survey is a numerical scale, the scores were categorized into two groups; those scoring below 20 and those scoring 20 and above. These two categories were selected since a score of 20 or above reflect greater risk of developing clinical eating disorders. Linear regression was also performed on the EAT-26 survey since it contained numerical values, and results confirmed the logistic regression analysis. A total of 11 questions from the Youth High Risk Behavior Survey were removed due to the fact that there was insufficient statistical power to assess predictor variables. This occurred when the cell with cell size fell to less than five. Specifically, three questions were removed from the section assessing body weight concerns and eight questions were removed from the section on high risk behaviors. All analyses were performed using SPSS statistical program (version 18.0 for window; SPSS, Chicago, IL). A p value of ≤ 0.05 was accepted as significant.

CHAPTER 3: RESULTS

Two Division I research universities, University of Miami and Florida International University, were used to obtain data on competitive female athletes. A total of 168 eligible competitive athletes (43.4% CA athletes, 18.5% AA athletes, 27.0% HA athletes) completed the modified youth high risk behavior survey as part of the study.

The physical characteristics (means and \pm SD) of the participants are presented in **Table 1**. Results for the entire sample, showed a mean age of 19 years, mean height of 168.7 cm, mean weight of 65.6 kg, mean BMI of 22.9 kg/m², mean percent body fat of 26.3%, and mean WAIST of 30.6 inches for the entire sample. Although there were no significant differences in BMI, HA athletes were significantly shorter than CA and AA athletes ($p < 0.001$ and $p < 0.001$ respectively), and weighed significantly less than CA and AA athletes ($p < 0.05$ and $p < 0.001$ respectively). Body composition differences were also significant in that AA athletes had a lower percent body fat compared to the other groups ($p < 0.05$ for both). Upon further examination, significant differences were found in triceps and thigh measurements between groups ($p < 0.000$ and $p < 0.002$ respectively). More specifically, AA athletes were found to have significantly lower triceps and thigh measurements than both CA and HA athletes. There were no other significant differences among groups for any other variables.

As shown in Table 2, is a descriptive analysis of subjects by race participating in different sport classifications. These classifications included, non-aesthetic and non-weight classification, non-aesthetic and speed oriented classification, and aesthetic and weight classification. Accordingly it can be demonstrated that the majority of CA, AA, HA athletes participated in the non-aesthetic and non-weight classified sport at 67%,

51%, and 55% respectively for CA, AA, and HA athletes. The minority of subjects participated in aesthetic and weight classified sports. However, CA athletes had the largest representation in this category at 13%. Among non-aesthetic and speed oriented sports, AA athletes had largest representation at 49% and HA athletes had the second largest representation at 43%. Interestingly, CA athletes had the lowest representation in the non-aesthetic and speed oriented category at 20%.

As shown in **Table 3**, are the differences with respect to BMI and race regarding weight concerns or actions taken regarding weight. BMI significantly contributed to how athletes described their weight ($p<0.001$), actions taken regarding their weight ($p<0.001$), their intention to lose weight using exercise ($p<0.001$), and eating practices to control weight ($p<0.004$). In each case, as BMI went up, concerns and actions regarding weight increased. Race significantly contributed to the use of exercise to lose weight ($p<0.040$) and to the habit of eating less food to keep from gaining weight ($p<0.046$) as a group. Although aforementioned significant differences by race were found for each question, a Tukey's test comparing each group to the other failed to indicate race differences among groups. This may be related to the loss of power upon dividing the entire sample into three groups. All significant findings for BMI remained significant when race was added to the model. This is due to the strength of the relationship between BMI and body weight concerns/behaviors for the entire sample.

The contribution of BMI and race to the prediction of eating habits and EAT-26 were presented in **Table 4**. BMI significantly and positively contributed to the prediction of the number of times green salad was consumed in the past 7 days ($p<0.014$) and the outcome of the EAT-26 Behavior survey ($p<0.000$). Therefore, as BMI increased, the

number of days of green salad consumption increased and the score of EAT-26 survey increased. When race was added to the model, only consumption of green salad was significant ($p < 0.007$). Race contributed significantly to the amount of vegetables consumed ($p < 0.000$) and the amount of milk consumed ($p < 0.041$) in the past 7 days. Specifically, HA athletes consumed more vegetables in the last 7 days than AA athletes ($p < 0.000$), whereas, CA athletes consumed more milk in the last 7 days than HA athletes ($p < 0.041$). When BMI was added to the model, there were no longer differences in weekly consumption of either vegetables or milk among groups. Interestingly, neither BMI nor race significantly contributed to fruit or fruit juice consumption.

The contribution of BMI and race to the prediction of physical activities and habits are presented in **Table 5**. BMI did not contribute significantly to the prediction of any variables in Table 4, except for the number of hours spent watching television (TV) on a school night ($p < 0.002$). Results showed that the higher the BMI, the more hours the athletes spent watching TV during a school night. Race contributed significantly to the prediction of whether or not athletes engaged in physical activities that made them sweat or breathe hard ($p < 0.041$ and $p < 0.026$ respectively). Specifically, HA athletes participated in more physical activities that made them sweat and breathe hard in the past 7 days than AA athletes ($p < 0.041$), whereas CA athletes participated more often in physical activities for 30 minutes that did not make them sweat or breathe compared to HA athletes ($p < 0.026$). Adding BMI to the model, did not result in significant differences among groups to aforementioned physical activity questions. The only significance found with BMI and race included in the model was the number of hours

spent watching TV during a school night ($p < 0.004$). This again, was driven by the strong contribution of BMI with respect to TV viewing.

The contribution of BMI and race to the prediction of high risk behaviors in athletes are presented in **Table 6**. The higher the BMI, the more likely athletes were to be found riding in a car driven by someone who had been drinking alcohol in the past 30 days ($p < 0.040$), spending time consuming alcohol on or off campus property in the past 30 days ($p < 0.014$), and carrying a weapon in the past 30 days ($p < 0.008$). BMI also contributed positively to the number of times using marijuana in a lifetime ($p < 0.046$) and the number of sexual partners in a period of 3 months ($p < 0.003$). Thus, competitive athletes possessing a higher BMI, showed a greater risk of demonstrating aforementioned high risk behaviors. When adding race to BMI in the model, significant differences remained with regard to carrying a weapon in the past 30 days ($p < 0.016$), number of alcoholic drinks consumed in the past 30 days ($p < 0.011$), and number of times using marijuana in a lifetime ($p < 0.045$). Significance in BMI and race with respect to aforementioned behaviors, were driven by the strength of BMI in this relationship.

Interestingly, race did not significantly contribute to any of the outcomes in high risk behaviors, with the exception of age at which athletes first smoked a whole cigarette ($p < 0.028$) and the number of sexual partners in the past 3 months ($p < 0.028$). Specifically, HA athletes were more likely to smoke a whole cigarette for the first time between the ages of 12 and 17 than AA athletes. They also had more sexual partners in the past 3 months than CA athletes. When adding BMI to the aforementioned model, there were no longer significant differences among groups for age at which one smoked a cigarette for the first time. Differences in the number of sexual partners remained

significant among groups, indicating that both a higher BMI and being Hispanic significantly contributed to this high risk behavior. Neither BMI nor race contributed to the prediction of questions regarding wearing helmets or seatbelts, driving a car when the athlete has had an alcoholic drink, physical fights on or off campus, and being physically hurt by someone.

In summary, our results showed that both BMI and/or race significantly predicted variables related weight concerns/behaviors, eating habits, exercise habits, and high risk behaviors in competitive female collegiate athletes.

CHAPTER 4: DISCUSSION

Past research has indicated a higher prevalence of eating disorders, reduced percent body fat, and more aberrant eating habits among athletes compared to the general population (Johnson et al., 1999; Torstveit and Sungot-Borgen, 2005). Unfortunately, previous studies have focused upon CA and/or AA athletes. Few studies to date have examined or compared HA athletes to other racial groups. The primary aim of this study was to compare body composition, eating habits, exercise habits, and high risk behaviors among female CA, AA, and HA competitive collegiate athletes.

Although no differences in BMI were found among our competitive athletes, evaluation of percent body fat did yield significant racial differences among groups. AA athletes had lower peripheral fat (specifically triceps and thigh regions) than CA and HA athletes. This is similar to what has been demonstrated in non-athletic adolescent female populations. A study by Bray (2001) showed that in non-athletic AA girls, greater trunkal fat and reduced extremity fat has been observed concomitant with a higher trunk to extremity ratio in comparison to CA girls. Although trunkal fat was not measured in the present study, lower peripheral fat was demonstrated in competitive AA athletes. In agreement with previous research in non-athletic adolescents (Robinson et al. 1996), CA and HA athletes had similar fat patterning compared to each other and significantly different fat patterning compared to AA athletes.

One well known limitation of using BMI to indicate body fat is that it is a correlate and not a measure of body fat. It has also been shown to be a less accurate index of body fat in athletic or more muscular populations (Prentice and Jebb 2001; U.S. DHHS 2001). The fact that BMI was not significantly different among our ethnic groups

yet percent body fat was, supports limitations to using BMI as an index of percent body fat in competitive female athletes.

Interestingly, BMI significantly contributed to how athletes described their weight and actions taken toward weight control. Similar to previous studies of non-athletic adolescents (Colabianchi et al. 2001, Shisslak et al. 2006, Gil et al. 1994), our findings suggest that the higher the BMI, the greater the weight concerns and preoccupation with weight. Our study also demonstrated that the higher the BMI, the more likely the athlete is to exercise in order to keep from gaining weight. Thus our findings support the alarming reoccurring trend of weight concern and weight preoccupation with increasing BMI in collegiate athletes. Although our study did show differences by race using exercise to lose weight or to keep from gaining weight, upon further examination, no significant racial differences were observed. This may be due to the reduced sample size or lack of power when dividing the sample for further analysis.

The increased risk of developing disordered eating in athletes compared to non-athletes has been demonstrated in previous studies (Rhea, 1999; Reinking and Alexander, 2005). Engel et al. (2003) concluded that the increased risk was associated with the athlete's chosen sport and their perception of normative diet and weight control practices within their chosen sport. Low body fat in competitive sports demanding speed as well as sports requiring aesthetic appeal may be advantageous while at the same time posing greater risk for developing unhealthy eating behaviors (Williams et al. 2003, Pernick et al. 2006, and Reinking, and Alexander, 2005). In our study, HA athletes consumed significantly more food than AA athletes and CA athletes consumed more milk than HA athletes. Among all of our competitive athletes, the higher the BMI, the greater the food

consumption, and the higher the EAT-26 scores. Research has previously shown that BMI is highly correlated with food consumption and disordered eating in non-athletic adolescent girls (Sim and Zeman 2006). Although only 4% of our athletes had EAT-26 scores associated with clinical risk for eating disorders and only 18% of athletes had BMI's outside healthy range (18.5 kg/m^2 to 24.9 kg/m^2), our findings confirmed that increases in BMI were related to increased food consumption and greater risk of eating disorders. More than 37% of the variance in BMI contributed to the variance in EAT-26 scores which was significant. Thus, even among competitive athletes who, for the most part fall within a normal BMI range, the positive relationship between BMI and scores on the EAT-26 remain significant.

Collegiate athletes are constantly under pressure to perform well due to scholarship commitments, pressure from coaches, or simply the passion to excel in their sport. As a result, many athletes frequently look for ways to improve their performance. The pressure of today's sports has put many young competitors in situations which often contribute to extreme diet, exercise, or weight issues. In the previous seven days, HA athletes were most likely to participate in exercise that made them sweat and breathe hard exceeding that of AA athletes whereas CA athletes were least likely to behave in the same manner. Similar to our findings, Colabianchi (2006) reported that non-athletic adolescent HA girls were mostly likely to exercise with the purpose of losing weight than CA or AA adolescent girls. Furthermore, a study by Pernick et al. (2006) showed Hispanic high school female athletes were at greater risk for developing unhealthy eating habits to lose weight than AA athletes which they attributed to peer influences and cultural background. Although the present study did not find racial differences in eating

disorder risk among groups, HA athletes did indicate they ate and exercised more in the previous week to lose weight. Investigators have attributed this to the fact that HA women with a higher BMI are more ashamed of their appearance than AA women and that this is influenced by how long they had resided in the United States. The combination of peer pressure, cultural background, and acculturation in HA girls may account for their feeling more pressure to perform well or look a certain way. Although neither peer pressure nor acculturation were measured in the present study, it may be beneficial to obtain such information especially among competitive athletes of different racial backgrounds (Breitkopf, Littleton, and Berenson, 2007). It is important to note that although the majority of CA, AA, and HA athletes participated in non-aesthetic and non-weight classified sports, a larger percentage of AA and HA athletes participated in non-aesthetic and speed oriented sports than CA athletes. Even more interesting is the fact that the lowest participation in aesthetic and weight classified sports was found among the AA and HA athletes. Specifically, zero percent of the AA athletes and only 2% of the HA athletes participated in this category of sports.

Given the concerns regarding the rise in body weight and obesity among adolescents in the United States during the past 30 years, an extensive amount of research has examined TV viewing in relation to these problems. Previous studies have shown a direct association between the amount of TV viewing and BMI or obesity in children and adolescents (Gortmaker et al. 1996 and Dennison et al. 2002). Specifically, each hourly increment in TV viewing is associated with a 2% increase in the prevalence of obesity (Andersen et al. 1998; Robinson and Killen, 1995; Dietz and Gortmaker, 1985). Research in our competitive athletes reaffirms the strong relationship between TV

viewing and BMI independent of ethnicity and even among competitive athletes with a normal BMI levels.

Independent of obesity issues, there is genuine concern regarding the strong relationship between high risk behaviors and morbidity and mortality in young adults (Peters et al., 1998 and Levy and Knight, 2008). Hingson (2009) estimated that, in 2001, nearly 600,000 college students were injured due to alcohol-related injuries. In the present study, the higher the BMI, the more likely the athlete would ride in a car with someone who had been drinking alcohol or carry a weapon themselves in the last 30 days. BMI was also associated with drinking more alcoholic beverages and using marijuana in the past 30 days. Previous studies have shown that alcohol use is positively associated with increased BMI in non-athletic adolescents (Liu et al. 2010 and Fonseca et al. 2005). The present study reaffirmed and extended the relationship between BMI and alcohol consumption to occur among competitive collegiate athletes as well.

Rhea (1999) suggested that HA adolescent girls are more likely to adopt societal values about attractiveness and thinness than CA girls. This can lead to more aberrant behaviors and more extreme practices in order to fit into mainstream society. Others have also reported that, HA women feel more unaccepted by mainstream society and suffer from lower self-esteem which can lead to a higher risk of engaging in unhealthy behaviors (Grossman et al. 1985). Our study confirms this in that HA athletes were more likely to smoke cigarettes at a younger age than AA athletes and more likely to have a greater number of sexual partners than CA athletes. Findings also showed that both a higher BMI and being Hispanic were significantly related to the number of sexual partners one had within the last three months. These results highlight the fact that high

risk behaviors related to BMI need to be addressed in college-age competitive athletes, particularly HA athletes.

There are several limitations that need to be addressed in this study. First, our study used a self-administered high risk behavior survey and EAT-26 questionnaire which may result in less accurate results and under-reporting. Second, the sample size was small and because the study was restricted to competitive athletes playing in the Division I schools, relatively few institutions could be solicited to participate in the study, thereby limiting power. Our power analysis showed a required sample size of 264 subjects; however, only 168 subjects were recruited for this study. Furthermore, among schools that were solicited, athletes with a history of eating disorders or other problems may not have elected to participate. Third, the study was conducted during the pre-season physical examination rather than mid-season, which may have influenced our findings. The sample also included competitive athletes from a variety of different sports. Thus, athletes whose performance was based on speed and power were combined with athletes whose sport demanded specific technical skills as well as those whose sport demanded greater aesthetic qualities. This may have influenced the relationship between BMI and unhealthy eating habits or previous physical activities. Although the majority of CA, AA, and HA athletes participated in non-aesthetic and non-weight classified sports, a larger percent of AA and HA athletes were represented in non-aesthetic and speed oriented sports than CA athletes. Additionally, AA and HA athletes had the smallest representation in aesthetic and weight classified sports. Unfortunately, due to limitations in power, investigators were not able to determine the influence of sport classification in relation to BMI and race, on several significant outcomes. Finally,

acculturation, self-esteem, and peer acceptance were not measured in the present study and may have contributed valuable information given our sample demographics and findings.

In summary, our results provided evidence that BMI is related to behavioral characteristics encompassing body weight concerns, eating habits, TV viewing, and risk taking in competitive female athletes. This is similar to what has been found in non-athletic adolescents and young adults. In addition, our study highlighted racial differences in physical characteristics, exercise habits, and eating behaviors among collegiate athletes which again, were similar to what is observed in non-athletes of similar or younger ages. The fact that HA athletes demonstrated significantly different behavioral characteristics than CA and AA athletes regarding eating and exercise habits as well as high risk behaviors, reinforces the need for more information in the growing segment of minority athletes. The present study represents an important first step in the recognition and identification of relevant behavioral differences in a tri-racial sample of competitive collegiate female athletes.

Table 1. Physical Characteristics (means and standard deviations, SD) of Subjects by Group, Caucasian American (CA), African American (AA), and Hispanic American (HA) (n = 168).

	Means ± SD				
	Total (n=168)	CA (n=82)	AA (n=35)	HA (n=51)	P*
Age (years)	19±1.4	19±1.3	19±1.4	19±1.5	0.713
Height (cm)	168.7±8.9	171.2±8.9	171.2±8.1	164.1±7.4	0.000
Weight (kg)	65.6±12.3	66.5±12.1	70.2±14.8	61.0±9.1	0.002
BMI (kg/m²)	22.9±3.2	22.8±3.2	23.8±3.9	22.6±2.7	0.193
% Body Fat	26.3±4.8	27.2±4.8	24.1±5.8	26.3±3.6	0.006
WC (inches)	30.6±3.5	31.1±3.4	30.3±4.6	30.1±2.8	0.242

**BMI, body mass index [(weight/height²) x 703]; WC, waist circumference
* differences among groups based on ANOVA**

Table 2. Racial Distribution by Sport Classifications (n=168).

	Sport Classifications			Total
	Non-aesthetic* Non-weight classified	Non-aesthetic** Speed oriented	Aesthetic*** Weight classified	
Caucasian-American	55	16	11	82
African-American	18	17	0	35
Hispanic-American	28	22	1	51
Total	101	55	12	168

* Classifications include: Basketball, Soccer, Tennis, Golf, Mascot, Softball, and Volleyball.

**Classifications include: Swimming and Track and Field.

***Classifications include: Cheerleading, Dance, Diving, and Rowing.

Table 3. Contribution of body mass index (BMI) and race to the prediction of body weight concerns/behaviors for the entire sample (n = 168).

Question Outcome*	Predictor	R²	P**
How do you describe your weight? Underweight, About the right weight, or Overweight	BMI	0.240	0.000
	Race	0.007	NS
	BMI + Race	0.247	0.000
Which of the following are you trying to do about your weight? Lose weight, Gain weight, Stay the same, Not trying to do anything	BMI	0.140	0.000
	Race	0.023	NS
	BMI + Race	0.163	0.000
During the past 30 days, did you exercise to lose weight or keep from gaining weight?	BMI	0.110	0.001
	Race	0.046	0.040
	BMI + Race	0.156	0.000
During the past 30 days, did you eat less food, calories, or foods low in fat to lose weight to keep from gaining weight?	BMI	0.075	0.004
	Race	0.050	0.046
	BMI + Race	0.125	0.003

*Questions derived from 2005 Youth Risk Behavior Survey

**Logistic regression analysis using BMI, race, and the combination of both

Table 4. Contribution of body mass index (BMI), and race to the prediction of eating habits and the Eating Attitudes Test – 26 (EAT-26) for the entire sample (n = 168).

Question Outcome*	Predictor	R ²	P**
During the past 7 days, how many times did you drink 100% fruit juice such as orange juice, apple juice, or grape juice?	BMI	0.006	NS
	Race	0.006	NS
	BMI + Race	0.012	NS
During the past 7 days, how many times did you eat fruit? (not counting fruit juice)	BMI	0.007	NS
	Race	0.063	NS
	BMI + Race	0.070	NS
During the past 7 days, how many times did you eat green salad?	BMI	0.044	0.014
	Race	0.088	NS
	BMI + Race	0.126	0.007
During the past 7 days, how many times did you eat other vegetables? (not counting green salad)	BMI	0.021	NS
	Race	0.094	‡0.000
	BMI + Race	0.115	NS
During the past 7 days, how many glasses of milk did you drink?	BMI	0.000	NS
	Race	0.038	†0.041
	BMI + Race	0.038	NS
EAT-26 Behavior Survey	BMI	0.137	0.000
	Race	0.001	NS
	BMI + Race	0.138	NS

*Questions derived from 2005 Youth Risk Behavior Survey

**Logistic regression analysis using BMI, race, and the combination of both

† Significant difference between CA and HA athletes (p<0.05)

‡ Significant difference between HA and AA athletes (p <0.01)

Table 5. Contribution of body mass index (BMI) and race to the prediction of physical activities/habits for the entire sample (n = 168).

Question Outcome*	Predictor	R²	P**
On how many of the past 7 days did you exercise or participate in physical activities for at least 20 minutes that made you sweat and breathe hard?	BMI	0.008	NS
	Race	0.048	‡0.041
	BMI + Race	0.056	NS
On how many of the past 7 days, did you participate in physical activities for at least 30 minutes that did not make you sweat or breathe hard?	BMI	0.012	NS
	Race	0.063	†0.026
	BMI + Race	0.075	NS
On how many of the past 7 days, did you do exercise to strengthen or tone your muscles?	BMI	0.002	NS
	Race	0.000	NS
	BMI + Race	0.002	NS
On an average school day, how many hours do you watch TV?	BMI	0.062	0.002
	Race	0.017	NS
	BMI + Race	0.079	0.004

*Questions derived from 2005 Youth Risk Behavior Survey

**Logistic regression analysis using BMI, race, and the combination of both

†Significant difference between CA and HA athletes (p<0.05)

‡Significant difference between HA and AA athletes (p<0.05)

Table 6. Contribution of body mass index (BMI) and race to the prediction of high risk behaviors for the entire sample (n = 168).

Question Outcome*	Predictor	R²	P**
When you rode a bicycle during the past 12 months, how often did you wear a helmet?	BMI	0.009	NS
	Race	0.004	NS
	BMI + Race	0.013	NS
How often do you wear a seat belt when riding in a car driven by someone else?	BMI	0.011	NS
	Race	0.011	NS
	BMI + Race	0.022	NS
During the past 30 days, how many times did you ride in a car or other vehicle driven by someone who had been drinking alcohol?	BMI	0.031	0.040
	Race	-0.018	NS
	BMI + Race	0.013	NS
During the past 30 days, how many times did you drive a car or other vehicle when you had been drinking alcohol?	BMI	0.008	NS
	Race	0.026	NS
	BMI + Race	0.034	NS
During the past 30 days, on how many days did you carry a weapon such as a gun, knife, or club?	BMI	0.123	0.008
	Race	0.022	NS
	BMI + Race	0.145	0.016
During the past 12 months, how many times were you in a physical fight on or off school property?	BMI	0.034	NS
	Race	0.039	NS
	BMI + Race	0.073	NS
During the past 12 months, did anyone ever hit, slap, or physically hurt you on purpose?	BMI	0.010	NS
	Race	0.019	NS
	BMI + Race	0.029	NS
Have you ever tried cigarette smoking, even one or two puffs?	BMI	0.017	NS
	Race	0.054	NS
	BMI + Race	0.071	NS
How old were you when you smoked a whole cigarette for the first time?	BMI	0.019	NS
	Race	0.075	‡0.028
	BMI + Race	0.094	NS
During your life, on how many days have you had at least one drink of alcohol?	BMI	0.004	NS
	Race	0.055	NS
	BMI + Race	0.059	NS

How old were you when you had your first drink of alcohol other than a few sips?	BMI	0.000	NS
	Race	0.019	NS
	BMI + Race	0.019	NS
During the past 30 days, on how many days did you have at least one drink of alcohol either on or off school property?	BMI	0.042	0.014
	Race	0.006	NS
	BMI + Race	0.048	0.011
During your life, how many times have you used marijuana?	BMI	0.025	0.046
	Race	0.015	NS
	BMI + Race	0.040	0.045
How old were you when you tried marijuana for the first time?	BMI	0.025	NS
	Race	0.013	NS
	BMI + Race	0.038	NS
Have you ever had sexual intercourse?	BMI	0.002	NS
	Race	0.013	NS
	BMI + Race	0.015	NS
During the past 3 months, with how many people did you have sexual intercourse?	BMI	0.101	0.003
	Race	0.063	†0.028
	BMI + Race	0.164	0.003

*Questions derived from 2005 Youth Risk Behavior Survey

**Logistic regression analysis using BMI, race, and the combination of both

†Significant difference between CA and HA athletes (p<0.05)

‡ Significant difference between HA and AA athletes (p<0.05)

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