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Relationship between self concept, eating behavior, and gymnastic success of female collegiate gymnasts from Big Ten Conference teams

Ubbes, Valerie Ann, Ph.D.
The Ohio State University, 1988
RELATIONSHIP BETWEEN SELF CONCEPT, EATING BEHAVIOR, AND GYMNASTIC SUCCESS OF FEMALE COLLEGIATE GYMNASTS FROM BIG TEN CONFERENCE TEAMS

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Doctor of Philosophy Degree in the Graduate School of the Ohio State University

By

Valerie A. Ubbes, B.S., M.Ed.

* * * * *

The Ohio State University

1988

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DEDICATION

This work is dedicated to my best friend and husband, Bill, for his incredible insight and assistance with this two-year research project. He challenged my thinking, urged for clarity and efficiency in my writing, and proofread my work ad infinitum. Without Bill's patience and encouragement during weekends, late nights, and mutual vacations, my goal to succeed at Ohio State University would have been even more difficult.
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Finally, I wish to thank the athletic directors of the Big Ten Conference who recognized the value of this study, thus allowing me to survey their women's gymnastic teams. The commitment of the Big Ten gymnastic coaches and the willingness of their gymnasts to participate in this study have helped to advance research on the psychological and physiological characteristics of female collegiate gymnasts.
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CHAPTER I
INTRODUCTION

Female collegiate gymnasts are constantly bombarded with decisions about their psychological readiness, about their physiological training, about their diet and nutrition, about their personal health, about their academics, about their emotions, about their social life, and about their career goals. Indeed, individual gymnasts deal with these situations in different ways. Those who adapt best to the constantly changing psychological, physiological, emotional, and social factors of sport become the most successful.

In order to define gymnastic success from a psychological and physiological perspective, a few behavioral factors must be isolated. For example, self concept, a psychological factor, and eating behavior, a physiological factor, may help to explain success in the sport of gymnastics. Equally important are the relationships which may exist between self concept and gymnastic success, between eating behavior and gymnastic success, and between self concept and eating behavior. Understanding the interdependence of these variables will serve as a basis for describing successful gymnasts. Ultimately, this knowledge will benefit athletes and coaches in the preparation stages of training and the performance stages of competition.
Fitts (1972) stated: "...in all helping professions, and throughout behavioral science, there is a continuing need for better criteria -- indices that facilitate the understanding and prediction of human behavior."

Harris (1982) contended that "the coach must learn to identify behaviors that affect performance." Similarly, Seeman (1959) suggested that coaches are responsible for helping their athletes reach their optimal potential:

There is ample support for the perspective that the whole is more than the sum of its parts, that each of the domains -- cognitive and affective -- must be integrated for the athlete to reach full potential. Considerations must be given to academic achievement and self-concept, as well as to physical adeptness.

A total approach to gymnastics requires the synergistic coordination of psychological, physiological, emotional, and social factors. To anticipate and control these holistic factors is an ambitious goal, but not an impossible one. There is a need for establishing criteria whereby gymnastic coaches can predict the success of their individual athletes, and ultimately the success of their gymnastic teams. Coaches who are holistic educators can help their gymnasts by focusing their efforts toward recognizing, developing, and manipulating the factors predictive of gymnastic success. In some cases this can be evaluated on a group basis, but in most cases it would be done on an individual basis.
Rinke (1986) defined holistic education as:

... a functional, integrated, and generalized model of education which focuses on the whole teaching/learning situation, and varies the teaching/learning strategy to meet the needs of the learner, the teacher, and the situation, in an effort to attain educational outcomes which are greater than the sum of the parts.

There is little information available on the positive eating behavior of athletes, and in particular, gymnasts. No studies have examined the relationship of self concept and eating behavior as predictors of gymnastic success.

Statement of the Problem

The problem to be explored by this study is the relationship between self concept, eating behavior, and gymnastic success of female collegiate gymnasts from Big Ten Conference teams.

Purposes of the Study

The first purpose of this study is to describe and explain the relationship between self concept, eating behavior, and gymnastic success of female collegiate gymnasts from Big Ten Conference teams. A second purpose of the study is to isolate selected rival variables which might contaminate the explanation of the dependent variable, gymnastic success. The final purpose of the study is to predict how the two main independent variables, self concept and eating behavior, along with other independent variables, will help to explain and predict gymnastic success of Big Ten Conference gymnasts and teams.
Significance of the Problem

Gymnastics has evolved into a highly competitive and physically demanding sport due to advances in coaching techniques, earlier training ages of gymnasts, improved biomechanical analyses, and changes in equipment design, to name a few. As will become evident from the research reviewed in Chapter II, the need to train the multi-dimensional gymnast from a holistic perspective has not been recognized.

This investigation will describe some psychological, physiological, and behavioral aspects of gymnastics, then will explain how these factors might contribute to success. In this ex post facto research, the independent variables will be statistically analyzed to determine if the dependent variable, success, can be predicted. Morgan (1979) warned that psychological data used to predict athletic success should be used in concert with other information, such as physiological and biomechanical variables. He stated:

In terms of prediction it appears that psychological data can be used to identify successful and unsuccessful candidates from the onset. However, the precision afforded by such prediction is far from perfect (about 70 percent), and the present state of the art does not justify selection based upon psychological data alone. Psychological data, however, when employed in concert with other input variables, should serve to enhance prediction.

If this research study determines that gymnasts in the Big Ten Conference have significantly low self concepts, then coaches might respond by offering mental health and stress management training for their respective gymnasts and teams. Additionally, if this study determines that gymnasts in the Big Ten Conference have significantly poor eating behaviors, then coaches might respond by offering nutrition sessions in conjunction with pre-season training. Ultimately, if this
study determines that gymnasts in the Big Ten Conference exhibit positive self concepts and/or good eating behaviors as a collective group, then future investigations may highlight the exemplary role models of these collegiate gymnasts.

Research Questions and Hypotheses

This study will investigate three major research questions and six major research hypotheses. The research questions seek to explain the relationship between the independent variables and the dependent variable, whereas the research hypotheses seek to explain how one dependent variable is a function of several independent variables.

The independent variables, both primary and secondary, are as follows. Primary independent variables are: (1) Self Concept, and (2) Eating Behavior. The secondary independent variables are: (1) School Rank, with four levels: freshman, sophomore, junior, and senior; (2) Scholarship Status, with three levels: in-state athletic scholarship, out-of-state athletic scholarship, and non-scholarship; (3) Birth Order, with four levels: first born, middle born, last born, and only child; and, (4) Big Ten School Status with six levels: Michigan State University, The Ohio State University, University of Illinois, University of Iowa, The University of Michigan, and University of Minnesota. In addition, there are several rival variables regarding gymnastic training and eating behavior.

The dependent variable, gymnastic success, will be measured during the competitive season by obtaining Seasonal Average Scores on five competitive events: vault, uneven bars, balance beam, floor exercise,
and all around. Seasonal Average Scores on each event will be divided to form three groups: (1) top 33% of scorers in the vault, uneven bars, balance beam, floor exercise, and all around, (2) middle 33% of scorers in the vault, uneven bars, balance beam, floor exercise, and all around, and (3) bottom 33% of scorers in the vault, uneven bars, balance beam, floor exercise, and all around. In order to differentiate between successful and unsuccessful gymnasts, only the top and bottom Seasonal Average Scores will be statistically analyzed for the analysis of variance; thus, the middle one-third of Seasonal Average Scores will not be used. However, all Seasonal Average Scores for vault, uneven bars, balance beam, floor exercise, and all around will be manipulated for Pearson product moment correlations, multiple regression statistics, and discriminant analysis statistics. In addition, Seasonal Average Scores for each Big Ten team will be computed.

The major research questions will be:

1. Are there relationships between gymnastic scores and Total Positive Scores on the Tennessee Self Concept Scale among Big Ten gymnasts who competed on the vault, uneven bars, balance beam, floor exercise, or all around?

2. Are there relationships between gymnastic scores and Food Choice Inventory scores among Big Ten gymnasts who competed on the vault, uneven bars, balance beam, floor exercise, or all around?
3. Is there a relationship between scores on the Tennessee Self Concept Scale and scores on the Food Choice Inventory among Big Ten Gymnasts?

The major research hypotheses (in null form) will be:

1. There will be no significant differences between gymnasts in the top 33% and bottom 33% of Seasonal Average Scores from VAULT and the following variables:
   A. School Rank: freshman, sophomore, junior, or senior
   B. Scholarship Status: in-state athletic scholarship, out-of-state athletic scholarship, or non-scholarship
   C. Birth Order: first born, middle born, last born, or only child
   D. School Status: affiliation to one of the six Big Ten gymnastic teams
   E. Self Concept: Total Positive Score of the Tennessee Self Concept Scale
   F. Eating Behavior: "Will Eat" Scale of the Food Choice Inventory

2. There will be no significant differences between gymnasts in the top 33% and bottom 33% of Seasonal Average Scores from UNEVEN BARS and the following variables:
   A. School Rank: freshman, sophomore, junior, or senior
   B. Scholarship Status: in-state athletic scholarship, out-of-state athletic scholarship, or non-scholarship
   C. Birth Order: first born, middle born, last born, or only child
   D. School Status: affiliation to one of the six Big Ten gymnastic teams
E. Self Concept: Total Positive Score of the Tennessee Self Concept Scale
F. Eating Behavior: "Will Eat" Scale of the Food Choice Inventory

3. There will be no significant differences between gymnasts in the top 33% and bottom 33% of Seasonal Average Scores from BALANCE BEAM and the following variables:
   A. School Rank: freshman, sophomore, junior, or senior
   B. Scholarship Status: in-state athletic scholarship, out-of-state athletic scholarship, or non-scholarship
   C. Birth Order: first born, middle born, last born, or only child
   D. School Status: affiliation to one of the six Big Ten gymnastic teams
   E. Self Concept: Total Positive Score of the Tennessee Self Concept Scale
   F. Eating Behavior: "Will Eat" Scale of the Food Choice Inventory

4. There will be no significant differences between gymnasts in the top 33% and bottom 33% of Seasonal Average Scores from FLOOR EXERCISE and the following variables:
   A. School Rank: freshman, sophomore, junior, or senior
   B. Scholarship Status: in-state athletic scholarship, out-of-state athletic scholarship, or non-scholarship
   C. Birth Order: first born, middle born, last born, or only child
   D. School Status: affiliation to one of the six Big Ten gymnastic teams
   E. Self Concept: Total Positive Score of the Tennessee Self Concept Scale
F. Eating Behavior: "Will Eat" Scale of the Food Choice Inventory

5. There will be no significant differences between gymnasts in the top 33% and bottom 33% of Seasonal Average Scores from ALL AROUND and the following variables:

A. School Rank: freshman, sophomore, junior, or senior

B. Scholarship Status: in-state athletic scholarship, out-of-state athletic scholarship, or non-scholarship

C. Birth Order: first born, middle born, last born, or only child

D. School Status: affiliation to one of the six Big Ten gymnastic teams

E. Self Concept: Total Positive Score of the Tennessee Self Concept Scale

F. Eating Behavior: "Will Eat" Scale of the Food Choice Inventory

6. Between gymnasts who ranked in the top 33% of Seasonal Average Scores and those who ranked in the bottom 33% of Seasonal Average Scores on vault, uneven bars, balance beam, floor exercise, or all around, there will be no significant differences in these descriptive characteristics:

A. Training

The Collegiate Gymnastics Profile will seek information on training variables. These rival variables are:

(1) number of training months per year in gymnastics

(2) years of competitive experience in gymnastics

(3) total years of gymnastic participation, including competitive experience

(4) number of competitions per season attended by one or both parents
(5) number of competitions per season attended by a close friend of either sex

B. Eating Behavior

The Collegiate Gymnastics Profile will seek information on eating behavior. These rival variables are:

(1) number of gymnasts who sought professional help for symptoms of anorexia nervosa
(2) number of gymnasts who sought professional help for symptoms of bulimia
(3) number of gymnasts who sought professional help for symptoms of overweight
(4) number of gymnasts who were satisfied with their eating habits
(5) number of gymnasts who were satisfied with their body weight
(6) number of gymnasts who were satisfied with their body fat

The Eating Awareness Inventory will seek information on eating behavior. These rival variables are:

(1) number of morning meals eaten in a typical week
(2) number of midday meals eaten in a typical week
(3) number of evening meals eaten in a typical week
(4) typical habits concerning the largest meal of the day

Limitations of the Study

The results of this study will be limited to female collegiate gymnasts from Big Ten Conference teams. The teams surveyed will be: Michigan State University, The Ohio State University, University of Illinois, University of Iowa, The University of Michigan, and University
of Minnesota. The University of Wisconsin declined to participate in the study. Purdue University, Northwestern University, and University of Indiana do not have women's gymnastic teams.

Since this study investigates gymnasts at NCAA Division I institutions in the midwestern United States, the results of the study cannot be generalized to gymnasts of different status or to gymnasts from different geographical locations.

Assumptions

In carrying out this research, the following assumptions are made:

1. Gymnasts will understand directions and terminology of the Collegiate Gymnastics Profile (CGP), the Tennessee Self Concept Scale (TSCS), the Food Choice Inventory (FCI), and the Eating Awareness Inventory (EAI).

2. Gymnasts will complete the CGP, the TSCS, the FCI, and the EAI honestly with low response error.

Definition of Terms

The following terms, which appear throughout the study, are defined as follows:

Big Ten Conference: A midwestern athletic conference comprised of ten land-grant universities, which began athletic programs for men in 1895 and for women in 1981. Seven of ten institutions in the Big Ten Conference recognize women's gymnastics as a varsity sport. These institutions are: Michigan State University, The Ohio State University,
Birth Order: The order of birth within a family unit: first born, middle born, last born, or only child.

Eating Behavior: In this study, eating behavior will be evaluated by the "Will Eat" category of the Food Choice Inventory, which consists of 25 High Nutrient Foods, 15 Low Nutrient Foods, and 40 Total Foods. Other descriptive data on five selected eating practices (when, where, with whom, how, and why) will be gathered from the Eating Awareness Inventory. Richards (1982) defined eating behavior as "what a person will or will not do to consume food".

Gymnastic Events: In women's gymnastics, there are four competitive events: vault, uneven bars, balance beam, and floor exercise. A fifth event, all around, is contested when individual gymnasts compete in all four competitive events during any one meet. The all around score is then tallied by summing the scores of the four competitive events.

Gymnastic Success: Seasonal Average Scores serve as the measure of the dependent variable, gymnastic success. Seasonal Average Scores for each gymnast competing in the different gymnastic events (vault, uneven bars, balance beam, floor exercise, or all-around) are compiled during the competitive season by the researcher, who receives weekly meet results from Big Ten gymnastic coaches.

Scholarship Status: Financial support that is offered to Big Ten gymnasts as one of the following: in-state athletic scholarship or out-of-state athletic scholarship. Non-scholarship athletes do not receive financial support.
School Rank: The rank at which gymnasts are enrolled in school: freshman, sophomore, junior, or senior.

Seasonal Average Score: Gymnastic rules require that the two highest scores from "home" competitions and the two highest scores from "away" competitions comprise the Seasonal Average Score. Therefore, the Seasonal Average Score consists of four scores from each of the gymnastic events for individual gymnasts or entire gymnastic teams.

Self Concept: In this study, self concept is evaluated by the Total Positive Score of the Tennessee Self Concept Scale (Appendix A). Pituch, Grube, and Whiteman (1986) defined self concept as "all the internal beliefs and attitudes an individual holds about the self. These attitudes and beliefs determine who we are, what we think we are, what we do, and what we become."

Training: The act of practicing gymnastic skills.

Summary

This chapter provided a general introduction, a statement of the research problem, purposes of the study, and the significance of the research problem. The need for research to survey the psychological (self concept) and physiological (eating behavior) aspects of gymnastics was emphasized. Three major research questions were formulated to explain the relationship between the independent and dependent variables. In addition, six major research hypotheses were formulated to explain how one dependent variable was a function of several independent variables. The independent variables are self concept, eating behavior, school rank, scholarship status, birth order, and school status. The dependent
variable, gymnastic success, is measured by Seasonal Average Scores from five different gymnastic events: vault, uneven bars, balance beam, floor exercise, and all around. A limitation of the study is the fact that only female collegiate gymnasts, who were members from six of seven Big Ten gymnastic teams, participated.
CHAPTER II
REVIEW OF LITERATURE

This chapter, divided into four major sections, is a review of literature highlighting self concept, birth order, and eating behavior. The first section describes research pertinent to self concept and health behavior, self concept and athletics, self concept and athletic success, plus related studies of gymnastic success. The second section describes research pertinent to birth order and self concept. The third section describes research pertinent to eating behavior and self concept, plus eating behavior and gymnastic success. The fourth section is an overall summary of the chapter.

Self Concept

For the purposes of this study, a literature review of self concept is centered primarily around the Tennessee Self Concept Scale, which was devised by Fitts (1964). The Tennessee Self Concept Scale is an instrument which consists of 100 self-descriptive statements to which subjects respond "completely true" to "completely false" on a five-point Likert scale. Ten of the 100 statements measure defensiveness and constitute a Self Criticism Score. The other 90 statements measure two dimensions of Self: (1) an internal frame of reference measuring
Identity Self, Judging Self, and Behavioral Self, and (2) an external frame of reference measuring Physical Self, Moral-Ethical Self, Personal Self, Family Self, and Social Self. All statements are scored and summed to provide the Total Positive Score, a measure of general self concept. High scores represent high self concepts whereas low scores represent low self concepts.

Norms for the Tennessee Self Concept Scale were developed from a sample of 626 people, ranging in age from 12 to 68 years. According to Fitts (1964),

There were approximately equal numbers of both sexes, both Negro and white subjects, representatives of all social, economic, and intellectual levels and educational levels from sixth grade through the Ph.D. degree.... The evidence so far suggests that there is no need to establish separate norms by age, sex, race, or other variables.

Self Concept and Health Behavior

In 1972, Fitts noted that "In general, and other things being equal, the more optimal the individual's self concept the more effectively he [she] will function." Combs and Snygg (1959) maintained that self concept could not be measured at all, only inferred from behavior. They suggested that families made the greatest influence on self concept. This was supported by Searles (1963), who showed that college students with supportive family relationships had higher self concepts and tended to be less critical of themselves. Mordecai, Cole, and Airhihenburva (1987) determined that individuals who lacked social support from their families and peers often had low self concepts, leading to suicides, substance abuse, eating disorders, and mental illness.
Aristotle (Zilboorg, 1941) emphasized that health was an interrelationship of the body and emotions. He said: "Probably all the afflictions of the soul are associated with the body—anger, gentleness, fear, pity, courage, and joy—as well as loving and hating; for when they appear, the body is also affected."

In his text, Mechanic (1968) reported that "...discomforting life situations (i.e., stress) play a role in causing or contributing to the occurrence of illness...". Jordan (1970) suggested that individuals with poor self concepts often responded to stressful situations with psychosomatic symptoms. He stated:

For example, if an individual accepts himself [herself] positively and is confident of his [her] ability to handle and face a situation, then there will be little or no need for him [her] to adjust to the situation by means of psychosomatic symptoms. On the other hand, if an individual views himself [herself] negatively and is unsure of himself [herself] in a similar situation, then responding with psychosomatic symptoms is one means of adjusting or facing the situation for him, or a legitimate excuse for avoiding the situation.

Schalon (1968) found that college students with high self concepts were better able to handle stressful situations than students with low self concepts. Treffert (1980) summarized the literature concerning self concept and health behavior when he said "...the bottom line of most personal health problems is faulty self concept".

Peterson-Martin and Cottrell (1987) investigated the relationship of self concept, personal values, and health behavior in male and female community college students. In this study, self concepts were measured by the Index of Adjustment and Values, and personal values were assessed by the Rokeach Values Survey. A positive correlation was found between self concept scores and health behavior scores, suggesting that as the
former increased so did the latter. Self concept explained 8.4 percent of the variance. In addition, subjects who placed a high value on health tended to practice more positive health behaviors than subjects who placed a lower value on health.

Quindlen (1983) found a significant positive relationship ($r = +.579$) between self concept and health practices of selected students ($N = 105$) at Auburn University. Total Positive Scores from the Tennessee Self Concept Scale were used to measure self concepts, and scores on the Baum Health Practice Inventory were used to measure health practices. Raimy (1971) stated that "self concept not only influences behavior but is itself altered and restructured by behavior and unsatisfied needs."

**Self Concept and Athletics**

Vincent (1976) investigated whether differences in self concept existed between college female athletes and nonathletes, college female physical education majors and general education students, and college females who had and had not participated in high school athletics. In this study, 460 women completed the Tennessee Self Concept Scale, which measured three internal frames of reference (identity, self-satisfaction, and behavior), and five external frames of reference (physical self, moral-ethical self, personal self, family self, and social self). For the internal frames of reference, all groups scored highest in identity, followed by behavior, then self satisfaction. For the external frames of reference, all groups scored highest in family self and lowest in personal self. In short, Vincent's study found that both female
nonathletes from high school and physical education majors from college scored the highest in self concept.

Young (1981) found that college basketball players \((N = 66)\) scored significantly higher than high school basketball players \((N = 107)\) on the Total Positive Score of the Tennessee Self Concept Scale and five of the twelve subscales: self satisfaction, behavior, physical self, moral-ethical self, and family self.

Snyder and Kivlin (1975) studied the psychological well-being and body image of female athletes, female nonathletes, female gymnasts, and female basketball players. The athletes had higher scores than the nonathletes on both measures of psychological well-being and body image. On psychological well-being items, gymnasts had higher scores than basketball players, but the differences were not significant. Overall, there were significant differences between the groups on four of the 25 body image items, but the results were inconclusive. Although not significant, the basketball players showed more positive responses in psychological well-being than the gymnasts on 16 of the 25 items.

In contrast, Ibrahim and Morrison (1976) found no differences in self concept between male and female athletes from high school and college \((N = 100)\) and nonathletes \((N = 100)\). Using the Tennessee Self Concept Scale, the researchers showed that regardless of competitive level or sex, athletes scored less than average on physical self, moral-ethical self, personal self, family self, and social self.

In her study of 308 female nonathletes and 301 female athletes from basketball, track and field, volleyball, swimming, diving, and softball teams, Corbett (1981) found no significant difference between the groups
on the physical self score of the Tennessee Self Concept Scale. Both groups scored below the norm on behavior, moral-ethical self, self criticism, and general self concept.

Using the Total Positive Score and twelve subscale scores of the Tennessee Self Concept Scale, Dowd (1979) showed that no significant differences in self concept existed between scholarship and non-scholarship athletes when analyzed by scholarship status, by sport, by playing status, by year in school, or by age.

Spicer (1982) used an independent t-test to determine if there was a difference between scholarship and non-scholarship basketball players (N = 36) who were given the Tennessee Self Concept Scale. No significant differences in Total Positive Scores were found, but significant differences in personal self (external frame of reference) and identity self (internal frame of reference) were noted with the non-scholarship group rating themselves higher.

In research with younger athletes, Mogil (1983) found significant differences in the self concepts of seventh and eighth graders with the former having higher self concepts. Eighth grade nonathletes had significantly lower self concept scores than seventh grade nonathletes. Overall, there were no significant differences between: (1) athletes and nonathletes when seventh and eighth grades were combined, (2) athletes and nonathletes in seventh grade, and (3) eighth grade athletes who were 12, 13, and 14 years old. The Tennessee Self Concept Scale was used as the evaluative instrument, for which there were no norms for young children.
Brookover, Erikson, and Joiner (1967) claimed that "It is the individual's interpretation of the expectations and acts of others which most influence his/her behavior." In a study which investigated whether coaches influenced the self concept of their athletes, Green (1980) found that athletes were influenced by the expectations and leadership styles of their coaches. He suggested that coaches should utilize both authoritative and democratic coaching methods to maximize the self concepts of their athletes. In addition, Green warned that coaches could lower an athlete's self concept when using negative reinforcement. He explained: "As a result, the self-evaluation of the athlete might be expected to be low, especially if the athlete was highly motivated to perform well."

Using the Tennessee Self Concept Scale, Gotcher (1975) studied the self concepts of female collegiate athletes (N = 45) in tennis, softball, basketball, volleyball, and badminton. No significant differences were found between the self concepts of starting athletes and substitute athletes nor between members of team and individual sports. In addition, no significant differences were found between the self concepts of athletes and their coaches' ratings of their individual performances.

Bash (1972) studied 139 male basketball players from the Eastern College Athletic Conference, and found that winning teams had greater changes in self concept than members of losing teams. In addition, pre-test to post-test scores from the Tennessee Self Concept Scale failed to correlate with self concept scores as rated by the players' coaches.
Self Concept and Athletic Success

Proctor (1978) conducted a meta-analysis of literature from 1963 to 1978 to seek the physiological and psychological predictors of athletic success. He argued:

In both male and female sports, all coaches are confronted with the problem of predicting success among athletes. The coaches ability to select the best athlete is tested during the recruiting season and when selecting the final competitive team...any individual who is in the position of trying to predict future success of others [should] use as many different measures as possible, and not to [sic] base any decision on one measurement or even one set of measurements.

Hall, Church, and Stone (1980) suggested that "sport psychologists need to put forth greater effort toward isolating and investigating relevant, appropriate personality traits or states according to the demands of specific sports." Williams (1963) claimed that "No one factor has been isolated to provide us with a prognostic device for predicting success in any sport. Present evidence indicates that an individual becomes a successful athlete through a complex integration of many factors, both physical and psychological."

Harris (1982a) advocated that maximizing the mental skills of sport precedes the maximizing of the physical skills of sport. She stated: "All athletes should develop mental skills along with physical skills if they are to reach their full potential. Once an athlete learns to master the mental state, it is possible to maximize physical talent."

Green (1980) claimed that there was a relationship between self concept and athletic success. He stated: "In an athletic setting, an athlete who has encountered continual defeats may be expected to develop a negative attitude toward his [her] own performance. Conversely, an athlete who is consistently successful may have more favorable attitudes
toward him/herself and others." Dumas (1970) described an individual with poor self concept: "A person who doubts himself [herself] is like a man [woman] who would enlist in the ranks of his [her] enemies and bear arms against himself [herself]. He [she] makes his [her] failure certain by himself [herself] being the first person to be convinced of it."

Purkey (1970) advocated that "Just as poor performance lowers self-regard, successful performance raises it." Roth (1959) noted that "In terms of their conception of self, individuals have a definite investment to perform as they do. With all things being equal, those who do not achieve, choose not to do so, while those who do achieve, choose to do so."

In general, researchers have explored many psychological factors related to athletic success, including the following: self esteem, self confidence, self acceptance, self perception, self assurance, and sense of well being. The literature also has reported self concept studies of various populations: athletes and nonathletes from high schools and colleges, athletes from team sports and individual sports, and female and male athletes and nonathletes. In some cases, as research narrowed its focus to study one sport or one group of athletes, differences in psychological factors were harder to find. Morgan (1979) stated that "There has been an extensive debate in sport psychology concerning the extent to which athletes of differing ability level within a sport possess similar or different personality structures."

Harris (1982b) contended that "When male and female athletes are scored on the same scales and compared to the same norms, their behaviors are more alike than different. This would suggest that
behaviors that are demanded for successful participation in sports competition are not linked with one's sex." She continued, "Athletes, some of whom are male and some of whom are female, appear to be more alike than different behaviorally...Behaviors such as self-esteem and components of achievement motivation appear to be more related to one's behavioral frame of reference than one's gender."

Siegel and Newhof (1984) extended this reasoning to factors other than gender. They found that individuals who attained collegiate varsity status were more homogeneous as a group regardless of their competitive level, their years of experience, their hours of practice, or their age. They stated that "...by the time, one attains collegiate varsity status, lesser and more highly skilled participants have had many similar experiences, and possibly through the long process of sport socialization, have acquired similar values toward participation."

Vealy (1986) reported that sport research was divided into self efficacy, perceived competence, expectancy, and self confidence. Fodero (1980) claimed that achievement motivation was an important trait variable in sport psychology. According to Cox (1985), the label "trait" defined an athlete's predisposition to behave in a certain way regardless of the situation, whereas the label "state" defined an athlete's specific psychological mood that was situation-specific and somewhat transitory in nature. Using this terminology, self concept also could be labeled a "trait" variable.

Morgan (1979) has argued that "It would not be appropriate, therefore, to rely on a state, trait, or state trait model (narrow or broad) alone in attempting to predict behavior. It is quite obvious
that numerous physiological variables, for example, play a profound role in sport performance." Thus, a multi-dimensional model consisting of psychological variables and physiological variables would predict success the best.

Highlen and Bennett (1980) suggested that "Although personality traits 'may' be helpful in selecting elite athletes, such information has little utility for training these athletes to maximize their performance. Therefore, research identifying situational rather than trait differences between successful and unsuccessful elite athletes seems more promising."

Singer et al. (1977) have agreed that trait psychology should be abandoned. They stated:

In recommending that researchers discontinue the search for common traits among specific athlete groups, we do not mean that researchers should abandon the study of behavior unique to specific athlete groups. Instead we mean that the behavior of athletes can be understood better by investigating individual differences in specified environments.... It appears that sport psychology research has reached the limits of what can be achieved through assessment techniques derived from trait theories or from generalized global approaches to evaluating behavior. For better understanding, multivariate relationships, the interaction of behaviors both within the individual and among teammates, manipulative interventions, as well as precursors to involvement in the sport situation need to be evaluated.

Related Studies of Gymnastic Success

There are several studies pertaining to the psychological and social predictors of gymnastic success, and a few studies pertaining to the physiological predictors of gymnastic success. Only two studies have attempted to look at both factors simultaneously.
Maul and Thomas (1975) found that third grade children in a Tumbling Tots gymnastic program were not significantly different from a control group in either academic self concept or gymnastic movement self concept. The researchers admitted limitations regarding their research instruments, which included the Self Concept and Motivation Inventory and the Movement Satisfaction Scale.

Klint and Weiss (1987) investigated 106 males and females who were recreational gymnasts, competitive gymnasts, and former elite gymnasts. Elite and recreational gymnasts scored significantly higher on perceived social competence compared to competitive gymnasts. The most frequent and important motives cited for gymnastic participation were intrinsic reasons, followed by social reasons (excitement, team atmosphere, and affiliation), then extrinsic reasons (energy release, popularity, and status). Researchers Klint and Weiss summarized Harter's Theory of Perceived Competence Motivation: "Individuals who perceive themselves as competent in sports are more likely to continue their participation, while those low in perceived physical competence will likely discontinue participation in the particular sport."

Brooks (1973) investigated the relationship between self concept and gymnastic performance of 38 female gymnasts from high school teams. Gymnasts who considered themselves 'valuable' rather than 'worthless' on the concept called myself scored significantly higher in competition on the different gymnastic events. With a sample of 48 female collegiate gymnasts, Breedlove (1977) found a significant difference between gymnastic scores in vault, bars, beam, and floor exercise and self concept scores as measured by the Tennessee Self Concept Scale.
Simpson (1974) utilized the Cattell 16 Personality Factor Questionnaire to study the relationship between personality traits of 150 female gymnasts and their gymnastic performances. There were no significant differences between the lower-skilled and higher-skilled gymnasts on any of the personality traits. However, gymnasts were more reserved, dominant, apprehensive, controlled, and tense than a control group.

In an *ex post facto* study, Balazs (1975) gathered social and psychological information from female athletes (*N* = 24), representing the 1972 United States Olympic skiing, gymnastics, track and field, and swimming teams. More than one-half of the athletes were first-born children with a majority of them having four siblings or more. The Edwards Personal Preference Schedule and a Data Questionnaire characterized the athletes as early goal setters with strong self concepts, deep desires to excel, and innate abilities to follow through on goals. Although the athletes were self confident, they "needed" encouragement from their parents and coaches who gave them their main motivation.

Darden (1972) compared body image, body cathexis, and self cathexis variables between male team sports and male individual sports at Florida State University. Team sports included football (*N* = 65), basketball (*N* = 12), and baseball (*N* = 26). Individual sports included weightlifting (*N* = 15), swimming (*N* = 18), and gymnastics (*N* = 9). Using multiple discriminant analysis, significant differences were noted for body cathexis and self cathexis among the two groups, but not for body image. Data were subjected to Duncan's Multiple Range test to locate
significant differences between specific pairings. Twelve of the fifteen possible pairings were significantly different from each other, but no differences were found between football and swimming, football and baseball, and swimming and baseball. Basketball players and gymnasts were found to be the most different from each other.

In 1977, Mahoney and Avener made one of the first psychological investigations of competitive gymnasts. Although exploratory in nature with small sample sizes, the study isolated several psychological skills which elite male gymnasts (N = 12) used within 48 hours of the 1976 Olympic Trials. Significant correlations were found between gymnastic success and several variables: self-confidence (r = +.57), performance success in dreams (r = +.55), self-talk (r = +.62), the use of internal imagery (r = -.51), frequency of gymnastic dreams (r = +.45), and frequency of gymnastic thoughts (r = +.78). Self confidence was the most important factor differentiating the Olympic qualifiers and non-qualifiers. The second most important personality trait was the belief that qualifiers were close to reaching their maximum potential. Successful gymnasts were more frequently prepared for competition. By focusing on meet-related thoughts only, the qualifiers experienced greater anxiety prior to competition, but during the competition the non-qualifiers experienced greater anxiety.

Fodero (1980) found that male and female gymnasts from highly skilled teams were more alike than different regarding their motivation to achieve in gymnastic competition. Ravizza and Rotella (1982) suggested that optimal gymnastic performances were driven by an "inner athlete". Gymnasts who learned to control negative doubts, fears, or
anxieties by anticipating a stress response could then practice stress management techniques to maximize their "inner athlete".

Henschen and Gordin (1983) advocated that psychological profiles of female gymnasts were needed at the University of Utah to maximize gymnastic performance. The Tennessee Self Concept Scale was one of several tests described, but no official data were presented. Agreeing that psychological readiness of gymnasts should be developed by design and not chance, Marsden (1983) suggested that "Psychological training should be applied just like physiological training, regular and systematical [sic]."

Wilson and Minden (1980) described the sport psychology program of the Canadian Gymnastic Federation, which included a list of recommendations to aid both gymnasts and coaches. The six psychological programs aimed to develop: (1) stress management skills, (2) a battery of psychological tests for mental assessment, (3) self confidence, (4) parental support, (5) interpersonal contacts, and (6) an exit program for gymnasts who quit the sport. The Federation used psychology consultants to develop the psychological programs and physical education consultants to identify gymnastic talent from skill tests and fitness tests.

Szot and Jurkiewicz (1979) studied 106 male gymnasts from Poland to isolate factors which influenced their gymnastic success. The study examined the relationships between gymnastic success and five selected variables: social class, marital status, total years of gymnastic practice, present age, and age when they began gymnastic training. Multiple regression revealed that social class, marital status, and total
years of gymnastic practice influenced gymnastic success. Since national champion gymnasts from families of Polish intellectuals were not compelled to earn a living like gymnasts from working class families, the former group had more time to train. Consequently, they scored an average of 4.734 points higher in national competitions. However, in international competition, the opposite occurred; gymnasts from the working class were more successful than gymnasts from families of intellectuals. Results showed that working class gymnasts began gymnastic training between ages ten and twelve, practicing an average of 10.39 years. In contrast, gymnasts from the intellectual class trained an average of 8.73 years. An additional 1.5 years of gymnastic training improved competitive scores by 1.102 points. Thus, there was an interaction between age of starting gymnastics and total number of training years.

Several researchers have emphasized the physiological predictors of gymnastic success: Tomberg (1966), Cammon (1968), Boyd (1971), Read (1967), Landa (1974), DiGiovanni (1943), and Williams (1963). To investigate both the physiological and psychological factors of gymnastics ability, Wettstone (1938) sought three objectives: "(1) to compile a complete list of the innate and the acquired qualities that a good all-around gymnast should possess; (2) to devise tests that will measure the degree and amount of such qualities in any individual; and (3) to set up a working formula that can be used as a measuring rod." From a list of 25 qualities thought to be requisites for good gymnasts, a poll of experts ranked the top 15 qualities to be correlated with gymnastics ability. Three tests were significantly correlated with
gymnastics ability: thigh circumference to height ratio; combined strength score on pull-ups, dips, and leg lifts; and the speed of squat thrusts (Burpee Test). Wettstone also determined psychological factors for gymnastics ability, but his predictive tests were not described. Wettstone concluded:

When a gymnastics coach assembles his [her] prospective candidates at the beginning of a season, the first question confronting him [her] is: which of these men [women] possesses the qualities, both innate and acquired, that go to make a good gymnast? Coaches often spend too much time on individuals that do not possess the essential innate capacities and miss finding many students who do have the prerequisites. Reliable prognostic tests would help the coach in advising students who are interested in some phase of athletics and would assist in locating men [women] who are potentially good but who have never been motivated to take part in gymnastics and tumbling."

In another state-of-the-art study, Giese (1980) investigated both psychological and physiological characteristics of male intercollegiate gymnasts in the Big Eight Conference. He found:

The prediction of success was much harder to define. Success itself is achieved by many complex variables, some physiological and others psychological. The results of this study indicate that gymnasts at an intercollegiate all-around level look very similar, on the outside, as well as the inside, when compared with each other."

Using Lakie's Test of Competitive Attitudes and the State-Trait Anxiety Inventory, Giese investigated the psychological differences of 19 all-around gymnasts from Big Eight Conference teams and a control group of 21 Kansas University students enrolled in a gymnastics course. Neither psychological test separated the advanced gymnasts from the good gymnasts. Giese recommended that more tests be used to identify psychological factors important to gymnastic success.
Birth Order

Research is divided in its assessment of the importance of birth order. Adler (1931) suggested that birth order, family size, and sex of siblings played an important part in personality development. He noted that "It is not an easy task to understand a human being. Individual Psychology is perhaps the most difficult of all psychologies to learn and to practice. We must listen always for the whole." With regard to birth order, Adler emphasized that "The situation counts, not the mere order of birth." Starr (1973) stated:

Each child differs from the other because of the birth order. Each is in a different relationship to the parents and to each other, and so interprets the experiences of the group situation in light of this position and his [her] physical endowment... Every child must find his [her] place within the family.

Sears (1970) contended that family size and birth order affected the self concept of individuals. He found that first borns and only children had significantly higher self concepts than later borns. This study was rejected by Nystul (1976) who found no significant differences between family size and birth order when he gave a demographical inventory and the Tennessee Self Concept Scale (TSCS) to 180 college students. Results showed that family size and birth order did not effect the self concept of college students. Specifically, (1) there were no differences between first borns and later borns for any of the 29 TSCS mean scores, (2) there were no differences between persons from two, three, or more than four sibling families on any of the 29 TSCS mean scores, and (3) there were no interaction effects between birth order and family size as measured by any of the 29 TSCS mean scores.
Referring to the Tennessee Self Concept Scale, Thompson (1972) advocated

...that other variables such as sex, years of formal education, birth order and scores on achievement tests have little systematic relationship to self concept scores...no consistent trends are demonstrated across studies and population samples. The significance of these findings lies in the fact that many of the usual cues which people use in classifying each other are essentially irrelevant to their self concepts.

Eating Behavior

Only a few research instruments have been designed to study interdependent forces that affect food consumption of individuals and groups. The School Health Education Study (1972) conceptualized that "food selection and eating patterns are determined by physical, social, mental, economic, and cultural factors." Cunningham et al. (1981) designed an instrument called the Comprehensive Assessment of Nutrition Knowledge, Attitudes, and Practices to study the cognitive, affective, and practice domains of nutrition. The instrument was designed for students in grades K to 12, elementary teachers, secondary teachers, food service personnel, administrators, and parents. It was not intended for use with college students.

Richards (1982) believed that "sociocultural and psychological factors affect decisions concerning not only what people eat, but when, where, with whom, how, and why they eat." Richards developed an Eating Awareness Inventory to support her claim that there was "a need for some systematic means for gathering information concerning the interplay of social and psychological factors influencing food related practices." The Eating Awareness Inventory was designed to investigate the eating
behaviors of university faculty members and administrators who resided in southern Illinois. Five categories were used to systematize eating behavior: (1) conditions which dictated WHEN people ate; (2) sources WHERE people obtained their food; (3) interpersonal relationships and environments which influenced WITH WHOM people ate; (4) repetitive acts describing HOW people ate; and (5) WHY people ate for reasons other than to satisfy biological and survival needs. Part I asked respondents how often they ate meals and snacks, if they tended to eat more than three meals per day, if there were differences in their weekend and weekday eating, and under what conditions they tended to eat. Part II asked respondents where they obtained their food and how often they obtained it from that particular source, as well as how frequently they ate at social gatherings or in motor vehicles as drivers or as passengers. Part III asked respondents with whom they typically ate their meals, and their differences in food consumption when they ate alone as compared to when they ate with others. Part IV asked respondents how they ate and whether any repetitive acts could describe their eating habits. Part V asked respondents how often they ate under the influence of twenty-two different conditions.

In the same year that Richards was successful in isolating variables specific to eating behavior, Hochbaum (1982) challenged health educators to develop new eating theories from nutrition research. He stated that "More research is needed in the context of people's daily lives in all the complexity and seeming irregularity and unpredictability of their food related practices to discover common and recurrent elements which may generate new theories."
Hochbaum (1982) claimed that

Nutrition education research has generally relied on three approaches: (1) surveys of people's knowledge and practices; (2) research on physiological factors; and (3) research on psychological factors carried out, by and large, under controlled experimental conditions. Although much has been learned and our understanding of people's nutrition-related practices has been greatly increased by such research, it seems to have had relatively little effect on nutrition education and on the pursuit of its avowed goal of changing the public's eating practices.... Research has not yet provided any guidelines to help nutrition educators match an optimally effective type and quantity of factual information with a specific target population.... The social, psychological, and cultural dynamics which determine what, when, and how people eat are as complex and varied as those that determine all of human behavior. No single theory can encompass what we call nutrition behavior.

Ahmann and Glock (1975) suggested that nutrition education programs might consistently change people's knowledge and often their attitudes about eating, but not change their eating behaviors. They believed that nutrition education programs have focused on cognitive changes at the expense of affective and behavioral changes, because the former can be measured with greater validity and reliability than the latter two dimensions.

Eating Behavior and Self Concept

People are compelled to eat by psychological and physiological factors. In many cases, physiological hunger is easier to understand than the psychological-emotional meanings and uses of food. For example, some people use food to boost their self concept or as a substitute for love and affection. Others use eating as a way of handling their boredom, loneliness, anxieties, or frustrations.
Giff, Washbon, and Harrison (1972) defined eating behavior as ...characteristic and repetitive acts he [she] performs under the impetus of the need to provide himself [herself] with nourishment and simultaneously to meet an assortment of social and emotional goals.... For some people, having what they most want to eat is a major gratification and if denied they feel great distress. Others put more emphasis on when they eat. Food must be immediately available at the first sign of hunger, or meals must be served on time. If thwarted, they indicate their distress by becoming irritable. To others the surroundings or the service or the accouterments of the meal loom largest in importance; to some, the people with whom one shares a meal are vital; and to some, the thing that matters most is quantity.

Eating behaviors are shaped by family attitudes and practices throughout childhood. Hamburger (1958) explained:

It is around the family dining table in childhood that the different emotional meanings of eating and the different symbols of specific foods become established. Food as symbols of parental affection, reward, and [sic] punishment, conformity or defiance, competition with siblings, and many other emotional motifs have become invested in specific food and eating patterns.

According to Hochbaum (1982), "What foods we select, how we prepare them, when we eat, and even when we feel hunger, are mostly learned behaviors." He noted that

...the great majority of people are guided in their food selections by considerations totally unrelated to health, such as by their own and by their family's taste preferences, by costs, by convenience, and by the lures of advertising and store displays. They may be influenced to a moderate degree by some broad and vague notion about what is supposed to be healthful, such as consuming fresh vegetables or using polyunsaturated fats, but even these notions are not the primary factor determining what they buy.

To examine the relationship between self concept and eating behavior, Schafer (1979) studied how self concept was a factor in diet selection and food quality for 116 married women residing in two metropolitan midwestern cities. In the study, subjects were asked to
rate how nine different factors influenced the food they ate. The factors were family members; advertisements; newspapers; magazines; radio; television; classes in food purchasing and preparation; information gathered from newspapers, magazines, radio and television; and government information and regulations. Results indicated that women with positive self concepts sought out food information from the media and from food education classes, whereas women with low self concepts sought food information from people and from food advertisements.

**Eating Behavior and Gymnastic Success**

Peer groups are known to exert a profound effect on the eating habits and practices of individuals. Lewin (1943) observed:

> The psychological meaning of eating is closely related to group situations. Eating with fellow workers in a factory is something different from eating at the family table or eating in a restaurant. The "eating group" influences greatly the eating conduct and eating ideology of the individual. One can say that every eating group has a specific eating culture.

Female gymnasts are known to have a specific eating culture. In general, research on the eating behaviors of athletes, particularly gymnasts, has focused on eating disorders (Boskind-White & White, 1983; Cauwels, 1983; Garfinkel & Garner, 1982; Garner, Olmsted, Polivy, & Garfinkel, 1984; Wooley, 1980).

In addition, Costar (1983) surveyed female collegiate gymnasts (N = 41) about their eating-disorder behaviors at six Division I, II, and III New England schools. Results of the survey found that 24% of the gymnasts induced vomiting and/or used laxatives or diuretics to control their weight. Binge eating was practiced by 61% of the
gymnasts; 21% of these binge eaters used purging as a form of weight control. Costar suggested that "Certainly meaningful education regarding health practices should be an important part of the gymnast's training."

With exceptional accuracy, Guthrie (1985) discussed the need for preventive measures when dealing with eating behaviors of athletes. She claimed that "In terms of prevention strategies, little has been written. As has been often the case, something remains invisible to society until becoming viewed as a problem; hence, the primary focus has been on treatment rather than on creating a preventive environment in which health may flourish."

In her dissertation, Guthrie (1985) investigated the prevalence and development of eating disorders (anorexia nervosa, bulimia, and binge eating) within collegiate sports of cross country, diving, gymnastics, swimming, synchronized swimming, tennis, track and field, and wrestling. To achieve her research objectives, Guthrie gave four psychological tests to 226 male and 157 female athletes at Ohio colleges and universities. The tests were the Eating Disorder Inventory, the Binge Eating Questionnaire, the Purging Mechanism Inventory, and the Survey of Eating Disorders Among Athletes. Guthrie found that 71% of the respondents identified themselves as having some form of eating disorder. The percentage of female gymnasts who practiced binge eating was 63.7%, and the percentage of female gymnasts who practiced purging was 54.6%. Overall, Guthrie found "at least 80 percent of all athlete respondents believed that a list of ten preventive measures might be helpful in reducing the incidence of eating disorders in their particular
sport." According to data derived from the Eating Disorder Inventory, athletes did not exhibit anorexic symptoms or appear to be at risk for developing anorexia nervosa. Nevertheless, Guthrie suggested that

...nutritional education should be provided to all athletes by a nutritional expert... The educational process might be most appropriate in a group setting during the pre-season. However, nutritional counseling also should be made available (on an individual basis) both before and during the athletic season as part of a prevention program. This program should include strategies for healthful eating, as well as for weight maintenance and change.

She concluded that "This study is believed to be one of the first, if not the first, to document the existence of eating disorders among an athlete population on a large scale. Until now, the problem of eating pathology among athletes has been, for the most part, overlooked or ignored."

Calabrese (1985) stated: "It is hard to believe that in growing disciplines such as gymnastics and dance, in which great pressures for leanness exist, so little published data or active research exists."

He advocated:

Success in gymnastics is not only a function of technical expertise but also of appearance.... The young, prepubescent East European gymnasts who captured our hearts in the 1972 and 1976 Olympic games were also instrumental in establishing new standards of desired body image. The desirability of prepubescent figures as well as the extreme youth of the competitors has produced what some observers call the "Nadia" syndrome.

Baum (1987) stated:

There has been the overemphasis on leanness in recent years (from coaches and the media) which has subjected athletes to serious health problems which make it appear as though too much training can be bad. This is an oversimplification. The culprit is not exercise but relative energy drain -- an imbalance between physical demands on the body, caloric intake, and rest. Balance is the key. Professionals need to be on the lookout for problems so that "train, don't strain" becomes the
rule rather than the exception. With that, perhaps even more women athletes will fully reach their potential.

Calabrese (1985) reported:

The problem of maintaining a low percentage of body fat while training in a predominantly nonendurance fashion is indeed difficult, but the solution is clear: either add an endurance component to the training program or restrict calories. Since the aspiring gymnast or dancer trains as long and as hard as any serious athlete, it is not reasonable to assume that an additional training activity such as running, cycling, or swimming is a practical solution. Instead, calorie restriction is practiced.

Moffat (1984) wrote one of four descriptive papers on the dietary status of gymnasts. He examined the dietary practices of 13 female high school gymnasts ($\bar{X} = 15.2$ years; $\pm 4.1$), who were members of the 1982 Washington State High School Gymnastics Championship team. Weight, height, and body fat were evaluated with these respective results: 50.4 kg. ($\pm 6.5$ kg.); 161.1 cm. ($\pm 3.8$ cm.); and 13.1% fat ($\pm 5.1$%). Subjects consumed the Recommended Daily Allowances of Vitamins A, E, C, and riboflavin, but "Diets were judged to be inadequate for Vitamins $B_6$, folic acid, calcium, iron, zinc, and magnesium in 30% to 60% of the gymnasts studied." In addition, the gymnasts consumed 850 calories of cakes, candies, soda pop, butter, jellies, and jams. Moffat suggested that gymnasts would benefit from nutrition counseling since gymnastic success can be hampered by poor nutrition.

In their study of 97 female gymnasts (aged 11 to 17), Loosli, Benson, Gillien, and Bourdet (1986) directed subjects to complete a three-day dietary recall in order to evaluate their nutrition habits. Healthaide, a software package with a database of 700 foods and 34 nutrient values, was used to analyze the dietary histories. Subsequently, gymnasts were given a questionnaire to determine their
nutrition knowledge. Results showed that 77% of the gymnasts rated protein as their favorite source of food energy with 55% of the gymnasts not knowing what complex carbohydrates were. Dietary histories revealed that gymnasts averaged 49% carbohydrates, 36% fats, and 15% proteins during the three days. Most gymnasts listed spaghetti, potatoes, and bread as their favorite carbohydrate foods, but 36% of them chose low nutrient foods such as doughnuts, cakes, and soft drinks as their favorites. With regards to energy requirements needed by gymnasts, the researchers stated:

Most gymnastic training and performance involves spurts of nonaerobic exercise and relatively little continuous aerobic energy expenditure. Thus, the only way for gymnasts to maintain the low body weight (in proportion to height) required by their sport is to restrict calorie intake.... Restricting food intake also depletes glycogen stores, which in turn impairs work capacity, especially in non-aerobic sports for which carbohydrates or glycogen are the most efficient fuel. Repeated bouts of the high intensity, spurt-type exercise characteristic of gymnastic activity can further deplete glycogen stores. An individual's ability to sustain prolonged work of this nature is directly related to initial glycogen stores. Finally, fatigue resulting from glycogen depletion may place the gymnast at risk for injury.

The researchers concluded that nutrition education programs for gymnasts were a major responsibility of coaches.

Hickson, Schrader, and Cunningham-Trischler (1986) reported age, height, and weight measures of nine female collegiate gymnasts and 13 collegiate basketball players. A twenty-four hour dietary recall determined if the two groups were receiving adequate intakes of energy, vitamins, and minerals as compared to Recommended Daily Allowances. Results showed that mean energy intakes of both groups were 1,932 calories per day, approximately 325 calories higher than the Recommended Daily Allowances for college students. However, their mean intakes of
vitamin B₆, iron, magnesium, and zinc were less than 70% of the Recommended Daily Allowances.

Ledoux, Brisson, and Peronnet (1982) assessed the nutritional status of young elite female gymnasts (N = 14) from three age groups: nine to 11 years, 12 to 14 years, and greater than 15 years. The nine to 11 year olds ate an average of 1,972 calories with 192 grams of carbohydrates, 58 grams of protein, and 40 grams of fat. The 12 to 14 year olds ate a daily average of 2,138 calories with 250 grams of carbohydrates, 84 grams of protein, and 39 grams of fat. The 15 year and older gymnasts ate a daily average of 1,251 calories with 178 grams of carbohydrates, 45 grams of protein, and 30 grams of fat. Gymnasts compiled a seven-day diary and food frequency questionnaire, plus gave blood and urine samples to a Canadian laboratory. Although blood and urine samples showed no clear deficiencies, low values of proteins, iron, and calcium were found. In the 15 year and older group, Vitamins A, B₁, and B₂ were low. Thus, the gymnasts adhered to diets which could eventually lead to nutritional deficiencies.

Summary

This chapter presented a review of the literature relative to self concept, eating behavior, and gymnastic success. Three major sections divided and organized the review. First, literature from 1941 to 1987 reported that individuals with lower self concepts had more personal health problems than individuals with higher self concepts. Four studies showed that individuals with higher self concepts practiced more positive health behaviors than individuals with lower self concepts. Research
pertinent to self concepts of athletes highlighted the interrelationship of the mental and physical aspects of sport. These populations were investigated: athletes and nonathletes from high schools and colleges, athletes from team sports and individual sports, and female and male athletes and nonathletes. Only two studies investigated both the psychological and the physiological factors of gymnastic success simultaneously. Second, literature on birth order was limited to two theories and to two studies on self concept and birth order. Third, literature from 1958 to 1981 focused on the psychological and physiological factors of eating behavior. Eating behavior studies with gymnasts were reviewed from two perspectives: (1) eating disorders, which included two major studies and five supportive studies, and (2) dietary status, which included four major studies and two position papers.
CHAPTER III

METHODOLOGY

There is a wealth of literature examining the self concept of athletes and nonathletes. Similarly, there are some studies which have surveyed the eating practices and behaviors of athletes and nonathletes. Few studies, if any, have explored how self concept and eating behaviors are related in the sport of gymnastics. No studies have investigated the relationship of these variables to predict gymnastic success.

Background

This study investigates the self concept and eating behaviors of female collegiate gymnasts. Gymnastic success is measured by Seasonal Average Scores on five different gymnastic events (vault, uneven bars, balance beam, floor exercise, and all around). Gymnasts must compete on each event at least four times during the season to establish a Seasonal Average Score. Then, an average of four scores (two highest scores from "home" competitions and two highest scores from "away" competitions) becomes the Seasonal Average Score for each gymnast. Seasonal Average Scores are also tallied for teams. Big Ten coaches compute Seasonal Average Scores for their individual gymnasts and teams to determine conference, regional, and national rankings. The researcher sought
verbal permission from Big Ten coaches to obtain 1987-88 meet results in the mail each week for compilation of Seasonal Average Scores.

Research Design

Since in this study subjects self-select the levels of the independent variables, or in some cases the levels are naturally occurring, the independent variables cannot be manipulated. Since independent variables cannot be manipulated, an ex post facto research design is required. Thus, this survey "attempt[s] to explain attitudes and behavior on the basis of data gathered at a point in time" (Ary, Jacobs & Razavieh, 1985). This research design observes the dependent variable "first", then seeks ways to explain how the independent variables affect the dependent variable. In addition, the researcher looks for rival variables which might explain the dependent variable (Ary et al., 1985). This is a major concern because neither random selection nor random assignment of treatments can be used.

The researcher will study six independent variables: self concept, eating behavior, school rank, scholarship status, birth order, and school status, plus one dependent variable, gymnastic success. This study will investigate the predictive characteristics of each of the independent variables on the dependent variable, gymnastic success.

Mail Surveys

Several factors must be considered when organizing surveys for mail distribution. Miller and Smith (1983) suggested that investigators should: (1) make a complete list (frame) of all participants (the
population); (2) send postcards to announce the questionnaire and any follow up questionnaires; (3) send up to six complete mailings of the questionnaire to non-respondents; (4) use envelopes with several stamps to highlight mailing costs; (5) write correspondence on official letterhead with co-signatures; (6) sign all letters personally; (7) include rewards or incentives like gum, mints, pens, stickers; and (8) consider the differences between late respondents and non-respondents.

Ary et al. (1985) highlighted a number of factors that influence return rates of mailed questionnaires: (1) the length of the questionnaire, (2) the cover letter, (3) the sponsorship of the questionnaire, (4) the attractiveness of the questionnaire, (5) the ease of completing it and mailing it back, (6) the interest aroused by the content, and (7) the follow-up procedures used. They indicated that "Response rate is often higher among the more intelligent, better educated, more conscientious, and more interested...".

Human Subjects Review Committee

The Behavioral and Social Science Human Subjects Review Committee was contacted at The Ohio State University in Summer, 1987 (Appendix N) for approval to conduct the study. The application process required a summary of research protocol with emphasis on how this study would involve human subjects. Typically, a written consent form is used in research studies to inform subjects about "both the nature of the information collected and the purposes for which the information will be used." (Walsh & Betz, 1985). However, subjects in the present study do
not have to sign statements of informed consent to indicate their voluntary participation, because their responses to the questionnaires constitute their consent.

Field Tests

In Fall, 1987, the battery of four questionnaires comprising the Research Testing Packet was field tested with female collegiate gymnasts (N = 11) from Northern Illinois University, where the researcher was employed. The researcher served as the proctor, who encouraged subjects to ask unlimited questions about confusing or ambiguous directions. No questions were raised concerning the administration of the four questionnaires which made up the Research Testing Packet. However, after the survey session, three gymnasts incorrectly placed their names on the large manila envelopes which contained the four questionnaires. Thus, a few changes were made to include a return address label, mailing address labels, and proper postage on the envelopes so gymnasts understood where to write their names upon completion of the questionnaires.

Instrumentation

The data for this study are collected by the administration of four paper and pencil questionnaires. The four questionnaires are arranged into a "Research Testing Packet" in the following order:

1. **Collegiate Gymnastics Profile (CGP)** -- developed by the researcher.
2. **Tennessee Self Concept Scale (TSCS)** -- developed by Fitts (1964).
3. **Food Choice Inventory (FCI)** -- developed by the National Dairy Council (1985).
4. **Eating Awareness Inventory (EAI)** — developed by Richards (1982).

   Cronbach (1984) listed the following criteria for research involving psychological tests: (1) the administrator is qualified to administer and score the test; (2) directions are clear; (3) the test is free from coachability; (4) the test is convenient to score; (5) the test is objective; (6) the test has adequate norms; (7) the test is valid; and (8) the test is reliable.

**Collegiate Gymnastics Profile**

The researcher developed the Collegiate Gymnastics Profile following the guidelines of Babbie (1979), Berdie and Anderson (1974), and Dillman (1978). The Collegiate Gymnastics Profile was designed to obtain information on gymnastic training practices, eating behaviors, health status, and family demographics of female collegiate gymnasts (Appendix A).

The instrument was field tested with the gymnastic team at Northern Illinois University in mid-November, 1987. Most subjects in the study completed the profile in five to seven minutes.

**Tennessee Self Concept Scale**

Fitts (1964) developed the Tennessee Self Concept Scale as a standardized, multidimensional scale to assess self concept. The TSCS has high internal consistency, test-retest reliability, and construct validity. The test-retest reliability on the Total Score was 0.90 when used with sixty college students over a two week period. The Eighth
Mental Measurement Yearbook (Buros, 1978) listed 582 research studies which had used the TSCS.

When taking the TSCS, subjects rate themselves from one (completely false) to five (completely true) on 100 descriptive items related to low and high self concept. Scores from the 100 items are summed to make the Total Positive Score.

For purposes of this study, only the Total Positive Score rather than any subscores are used in data analysis, because it measures a general level of self concept, taking into account all aspects of self concept. Fitts (1964) described the Total Positive Score as:

...the most important single score on the Counseling Form. It reflects the overall level of self-esteem. Persons with high scores tend to like themselves, feel that they are persons of value and worth, have confidence in themselves and act accordingly. People with low scores are doubtful about their own worth; see themselves as undesirable; often feel anxious, depressed and unhappy; and have little faith or confidence in themselves.

The TSCS contains 90 self concept items and ten self-criticism items. These items are tallied into a Total Positive Score and several subscale scores. The subscores that form the external frame of reference are: physical self, moral-ethical self, personal self, family self, and social self. Each of these areas, in turn, is divided into subscales which form the internal frame of reference. The subscores that form the internal frame of reference are: self-identity, self-acceptance, and behavior. Thus, the internal and external frames of reference form a 3 x 5 grid containing 15 cells; six scores are found in each of 15 cells.
The Tennessee Self Concept Scale was field tested with the gymnastic team at Northern Illinois University in mid-November, 1987. Most subjects completed the instrument in ten to twenty minutes.

Due to stringent copyright laws and the commercial nature of the TSCS, only original materials could be used in the present study. In order to obtain permission to purchase and to use the TSCS, the researcher completed an application form which listed her educational and professional background. In accordance with the "Ethical Principles of Psychologists", the researcher's advisor had to sign the application. This was necessary because the TSCS is a Level B test in accordance with the American Psychological Association (1974). According to Walsh and Betz (1985), "Graduate students may be qualified to purchase and use Level B or Level C tests if they are being supervised in that work by someone who does possess the appropriate user qualifications."

Furthermore, use of Level B tests required that the researcher had technical knowledge of test construction and completed university coursework in psychology, counseling, test and measurements, and statistics.

The TSCS was obtained from Western Psychological Services, 12031 Wilshire Boulevard, West Los Angeles, CA 90025. Once Western Psychological Services granted consent to the researcher, the following materials were ordered: The TSCS Test Manual, the TSCS Counseling Form Test Booklet (100 copies), and the TSCS Answer Sheet (100 copies) (Appendix J).
Food Choice Inventory

The Food Choice Inventory was developed by the National Dairy Council (1985) for use with adults, junior high school students, and senior high school students. Subjects are instructed to identify foods from the Food Choice Inventory that they "Will Eat". The Food Choice Inventory contains 25 High Food choices, 15 Low Food choices, and 40 Total Food choices (Appendix C). The instrument also contains two columns entitled "Like but Try Not to Eat" and "Will Not Eat", which are not used in the present data analysis.

The National Dairy Council found that Cronbach alpha reliability coefficients for the "Will Eat" option were 0.81 for Total Foods, 0.77 for High Nutrient Foods, and 0.83 for Low Nutrient Foods. In validation studies, the mean proportion of agreement was 85.1% out of a possible 100% between the inventory and actual food consumption.

The Food Choice Inventory was field tested with the gymnastic team at Northern Illinois University in mid-November, 1987. Most subjects completed the inventory in two to three minutes.

Permission to utilize the FCI, courtesy of National Dairy Council, was granted after writing to: National Dairy Council, 6300 North River Road, Rosemont, IL 60018-4233 (Appendix K). One copy of the FCI was purchased at a cost of $4.50. The National Dairy Council encouraged duplication of the test for distribution in this study.
Eating Awareness Inventory

For her doctoral dissertation, Richards (1982) developed and used the Eating Awareness Inventory (EAI) with 400 randomly selected university faculty members and administrators. The EAI was designed to describe five selected eating practices—when, where, with whom, how, and why (exclusive of physiological need) people eat. In her study, content validity was established by a panel of experts.

The Eating Awareness Inventory was field tested with the gymnastic team at Northern Illinois University in mid-November, 1987. Most subjects completed the inventory in five to ten minutes. Only the "when" section of the EAI was used for data analysis.

The EAI was obtained without cost from Dr. Jane Richards at Northern Iowa University, School of Health, Physical Education and Recreation, Cedar Falls, IA 50614. After written correspondence and telephone conversations, Dr. Richards granted the researcher permission to use her revised EAI for college students (Appendix L).

Subject Selection

Fifty-six female gymnasts from six Big Ten Conference teams volunteered to participate in the study. Eight to twelve gymnasts comprise each university team, representing: Michigan State University (East Lansing, Michigan); The Ohio State University (Columbus, Ohio); University of Illinois (Urbana, Illinois); University of Iowa, (Iowa City, Iowa); The University of Michigan (Ann Arbor, Michigan); and University of Minnesota (Minneapolis, Minnesota). The University of Wisconsin declined to participate in the study. Purdue University,
Northwestern University, and University of Indiana do not have women's gymnastic teams.

In September 1987, the Big Ten Assistant Commissioner, Mrs. Phyllis Howlett, was contacted by telephone concerning the methodology and objectives of the present study (Appendix E). Since there is no formal protocol for obtaining permission to research Big Ten athletes, Mrs. Howlett suggested that a letter be drafted to the six Big Ten athletic directors to invite their approval and support of the study. The athletic directors could, in turn, make recommendations to their respective gymnastic coaches and teams to participate in the study. The fact that this researcher coached gymnastics at The Ohio State University from 1983 to 1986 in the Big Ten conference could have increased the likelihood of team participation.

Once approval to conduct the study was granted by the Human Subjects Review Committee at The Ohio State University, the researcher telephoned the Big Ten gymnastic coaches to determine their interest in the research project. The coaches were contacted by telephone and letter prior to any communication with the gymnasts. Sample questions during the telephone interviews included: Would the coach like to serve as the research proctor or should that task be assigned to their athletic trainer? Would the coach be willing to schedule a thirty-five minute session before practice so gymnasts could answer the research questionnaires? Could the coach arrange for a quiet environment in a classroom setting for use during the research session? (Appendix F). In most cases, the dialogue between the researcher and each of the six coaches lasted approximately ten minutes. Six of the seven coaches
responded favorably to the request. The coach at the University of
Wisconsin chose not to participate in the telephone interview, thus
declining her team's involvement in the study.

Data Collection

Between Thanksgiving and Christmas, 1987, coaches were sent a large
box called, for the purposes of this study, the Research Testing Package.
The Research Testing Package contained a cover letter to the coach
(Appendix G), an oral script for the research proctor (Appendix H), and a
Research Testing Packet for each gymnast. The Research Testing Packet
for each gymnast consisted of a large manila envelope with the following
contents: a pencil, a cover letter encouraging gymnast participation in
the study (Appendix I), and four research questionnaires. The
questionnaires were organized in the following order: Collegiate
Gymnastics Profile (Appendix A), Tennessee Self Concept Scale (Appendix
B), Food Choice Inventory (Appendix C), and Eating Awareness Inventory
(Appendix D). An incentive of chewing gum was taped to the cover letter
of each Research Testing Packet (Miller & Smith, 1983). In addition,
gymnasts were encouraged to keep the pencil after completing their
questionnaires.

As suggested in the cover letter to coaches (Appendix G), gymnastic
teams were taken to a classroom sometime before gymnastic practice to
participate in the study. The testing began when the proctor read the
oral script (Appendix H) to the gymnastic team. The proctor then
distributed one Research Testing Packet to each gymnast in the room.
Gymnasts were instructed first to read the cover letter attached to the
large manila envelope (Appendix I), which contained the four questionnaires. The cover letter contained explicit directions to the gymnasts about volunteering to participate in the study. The decision of each gymnast to open the envelope to remove the four research questionnaires did not constitute her consent to participate in the study. At any time during the survey session, gymnasts were allowed to choose whether they wished to complete the questionnaires. However, the cover letter suggested that once they agreed to participate in the study, they were to answer each and every item on the questionnaires. They were instructed to answer the questionnaires without talking to the proctor, teammates, or coaches.

The four questionnaires together took a minimum of thirty-five minutes and a maximum of fifty minutes to complete. When finished, gymnasts were instructed by the cover letter to: (1) return their completed (or uncompleted) instruments to the original manila envelope, (2) place their first and last names in the upper left hand corner of the mailing envelope (return address position), (3) remove the cover letter from the back of the envelope, (4) secure the clasp and hand the sealed envelope to the proctor. All manila envelopes had 90 cents (third class postage) affixed to them, so the proctor could mail them separately to the researcher without any effort or additional expense.

Data Treatment

Once data were collected from 56 Big Ten gymnasts in mid-December, 1987 and early January, 1988, the researcher hand-scored the four
instruments from the Research Testing Packets. Statistical analyses were completed by computer using the SPSS statistical software (Nie et al., 1975; Norusis, 1986). Descriptive statistics included measures of central tendency, whereas correlational and inferential statistics included correlational analysis, regressional analysis, and multiple discriminant analysis. In this study the Collegiate Gymnastics Profile, the Tennessee Self Concept Scale, the Eating Awareness Inventory, and the Food Choice Inventory generated frequency and percentage data, Pearson product moment correlation coefficients, analysis of variance statistics, multiple regression statistics, and discriminant analysis statistics. The 0.05 alpha level was established for this study.

Correlational analysis determined if a change in one variable was accompanied by a change in another variable. Regressional analysis determined if each of the independent variables was predictive of the dependent variable (Ary et al., 1985). Both Pearson product moment correlation and multiple regression techniques measured linear relationships only. In other words, they reflected the degree to which two variables were related in a "straight line" so that as one increased the other increased (direct relationship) or decreased (inverse relationship). Thompson (1972) advocated that if a population sample was highly selective, a general relationship between any two variables may be observed. In other words, if all gymnasts had high self concept scores, the correlation would be much lower than if their self concept scores were spread throughout the full range of scores.
Summary

This chapter described the methodology used in the study. The research design was ex post facto, which observed the dependent variable "first", then sought ways to explain how the independent variables affected the dependent variable. The dependent variable was gymnastic success. The independent variables were self concept, eating behavior, school rank, scholarship status, birth order, and school status. Preliminary survey methods were described, along with the four questionnaires which comprised the Research Testing Packet. The questionnaires which were used included the Collegiate Gymnastics Profile, the Tennessee Self Concept Scale, the Food Choice Inventory, and the Eating Awareness Inventory. Information about subject selection, data collection, and data treatment was detailed, also.
CHAPTER IV
ANALYSIS OF DATA

This chapter describes information on subject selection and data collection for this study. The majority of the chapter contains an analysis of data for three research questions and six research hypotheses. Data analysis is presented according to the purposes of the study.

The first purpose of this study was to describe and explain the relationship between self concept, eating behavior, and gymnastic success of female collegiate gymnasts from Big Ten Conference teams. A second purpose of this study was to isolate selected rival variables which might contaminate the explanation of the dependent variable, gymnastic success. The final purpose of this study was to predict how the two main independent variables, self concept and eating behavior, along with other independent variables, would help to explain and predict gymnastic success of Big Ten Conference gymnasts and teams.

This study utilized a questionnaire package consisting of four parts: (1) Collegiate Gymnastics Profile, (2) Tennessee Self Concept Scale, (3) Food Choice Inventory, and (4) Eating Awareness Inventory. The data were collected from mail surveys which were sent to female collegiate gymnasts at Big Ten Conference schools in the Fall of 1987. A total of 56 gymnasts, ranging in age from 17 to 23 years, participated in
the study (Table 1). A minimum of eight and a maximum of eleven gymnasts comprised each of six Big Ten Conference teams: Michigan State University, The Ohio State University, University of Illinois, University of Iowa, The University of Michigan, and University of Minnesota (Table 2). Each gymnast took 30 to 60 minutes in one session to complete the entire research package containing 236 items. Descriptive and inferential statistics were employed to analyze the data. These included measures of central tendency, Pearson product moment correlation, analysis of variance, multiple regression, and discriminant analysis. The 0.05 alpha level was established for this study.

Therefore, in keeping with these three purposes, this chapter is organized into three parts: Part I, which describes and explains the relationship between the independent variables and the dependent variable; Part II, which describes the independent variables in order to explain gymnastic success, and isolates rival variables which might contaminate the explanation of gymnastic success; and Part III, which explains and predicts gymnastic success. Part I utilizes correlation coefficients, Part II utilizes analysis of variance, and Part III utilizes multiple regression and discriminant analysis.

Part I: Explanation of Relationships Between Independent and Dependent Variables

In order to accomplish the first purpose of this study, Part I describes and explains the relationship between the independent variables and the dependent variable. Data from three research questions are
### TABLE 1
**SCHOOL RANK AND AGE VARIABLES**

<table>
<thead>
<tr>
<th>SCHOOL RANK</th>
<th>N</th>
<th>%</th>
<th>AGE</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
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<td>30.4</td>
<td>17</td>
<td>1</td>
<td>1.8</td>
</tr>
<tr>
<td>SOPHOMORE</td>
<td>17</td>
<td>30.4</td>
<td>18</td>
<td>15</td>
<td>26.8</td>
</tr>
<tr>
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<td>19.6</td>
<td>19</td>
<td>16</td>
<td>28.6</td>
</tr>
<tr>
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<td>19.6</td>
<td>20</td>
<td>11</td>
<td>19.6</td>
</tr>
<tr>
<td></td>
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<td>1.8</td>
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<td>56</td>
<td>100</td>
<td>17-23</td>
<td>56</td>
<td>100</td>
</tr>
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</table>

### TABLE 2
**FREQUENCIES AND PERCENTAGES OF SCHOOL STATUS VARIABLES**

<table>
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<tr>
<th>SCHOOL</th>
<th>N</th>
<th>%</th>
<th>SAS*</th>
<th>RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>MICHIGAN STATE UNIV</td>
<td>8</td>
<td>14.3</td>
<td>185.51</td>
<td>1</td>
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</tr>
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<td>17.9</td>
<td>184.40</td>
<td>3</td>
</tr>
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<td>11</td>
<td>19.6</td>
<td>183.95</td>
<td>4</td>
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<tr>
<td>THE UNIV OF MICHIGAN</td>
<td>9</td>
<td>16.1</td>
<td>181.19</td>
<td>5</td>
</tr>
<tr>
<td>UNIV OF IOWA</td>
<td>10</td>
<td>17.9</td>
<td>178.69</td>
<td>6</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td>56</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*SAS = SEASONAL AVERAGE SCORE*
discussed. Since Part I utilizes correlation coefficients, the magnitude of relationship between variables is defined according to Davis (1971). His scale consists of the following standards:

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Description of Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.70 or greater</td>
<td>very strong association</td>
</tr>
<tr>
<td>0.50 to .69</td>
<td>substantial association</td>
</tr>
<tr>
<td>0.30 to .49</td>
<td>moderate association</td>
</tr>
<tr>
<td>0.10 to .29</td>
<td>low association</td>
</tr>
<tr>
<td>0.01 to .09</td>
<td>negligible association</td>
</tr>
</tbody>
</table>

Three research questions were tested with the following results:

Research Question #1: Were there relationships between gymnastic scores and Total Positive Scores on the Tennessee Self Concept Scale among Big Ten gymnasts who competed on the vault, uneven bars, balance beam, floor exercise, or all-around?

Table 3 shows the relationship between gymnastic event scores and the Total Positive Score of the Tennessee Self Concept Scale as measured by Pearson product moment correlations. Of the five gymnastic events, only vault scores were correlated with self concept scores; there was a
TABLE 3
PEARSON PRODUCT MOMENT CORRELATIONS FOR TOTAL POSITIVE SCORE X EVENT SCORES

<table>
<thead>
<tr>
<th>Event</th>
<th>N</th>
<th>R</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAULT</td>
<td>34</td>
<td>.30</td>
<td>.04*</td>
</tr>
<tr>
<td>BARS</td>
<td>34</td>
<td>.21</td>
<td>.12</td>
</tr>
<tr>
<td>BEAM</td>
<td>33</td>
<td>.02</td>
<td>.46</td>
</tr>
<tr>
<td>FLOOR EX</td>
<td>31</td>
<td>.13</td>
<td>.24</td>
</tr>
<tr>
<td>ALL AROUND</td>
<td>21</td>
<td>.32</td>
<td>.08</td>
</tr>
</tbody>
</table>

*P < .05
N = NUMBER OF GYMNASTS
R = CORRELATION COEFFICIENT
positive moderate association (r = +.30) between vault scores and self concept scores. Thus, high vault scores were associated with high self concept scores, and low vault scores were associated with low self concept scores.

Table 4 shows the range of Seasonal Average Scores for the present study. Seasonal Average Scores for vault, bars, beam, and floor exercise were based on a perfect score of 10.0 points whereas Seasonal Average Scores for all around were based on a perfect score of 40.0 points. The narrow range of scores between the lowest and highest scoring gymnasts suggests that Big Ten competitors were more alike than different in their gymnastic talent. Hopkins and Glass (1978) suggested that "...the more homogeneous the group, the lower the correlation." In other words, a lower correlation between vault scores and self concept scores (r = +.30) may be expected when comparing members of gymnastic teams than when comparing a less homogeneous group. Cronbach (1951) urged that "A high alpha is to be desired, but a test need not approach a perfect scale to be interpretable. Items with quite low intercorrelations can yield an interpretable scale."

**Research Question #2:** Were there relationships between gymnastic scores and Food Choice Inventory scores among Big Ten gymnasts who competed on the vault, uneven bars, balance beam, floor exercise, or all-around?
<table>
<thead>
<tr>
<th>EVENT</th>
<th>N</th>
<th>MEAN</th>
<th>S.D.</th>
<th>RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAULT</td>
<td>34</td>
<td>9.129</td>
<td>.283</td>
<td>8.50-9.65</td>
</tr>
<tr>
<td>BARS</td>
<td>34</td>
<td>9.112</td>
<td>.370</td>
<td>8.00-9.80</td>
</tr>
<tr>
<td>BEAM</td>
<td>33</td>
<td>9.090</td>
<td>.340</td>
<td>8.30-9.60</td>
</tr>
<tr>
<td>FLOOR EX</td>
<td>31</td>
<td>9.215</td>
<td>.229</td>
<td>8.60-9.60</td>
</tr>
<tr>
<td>ALL AROUND</td>
<td>21</td>
<td>36.672</td>
<td>.843</td>
<td>34.75-38.00</td>
</tr>
</tbody>
</table>
Table 5 shows the means and standard deviations for the three categories of the Food Choice Inventory. Table 6 shows the relationship between gymnastic event scores and Food Choice Inventory scores as measured by Pearson product moment correlations. There were no relationships between any of the five gymnastic event scores and the number of Low Nutrient Foods from the "Will Eat" category of the Food Choice Inventory.

When Spearman Rank correlations were done, only one significant relationship resulted. There was a negative low association ($r = -.37$) between beam scores (N = 33) and the number of Low Nutrient Foods from the "Will Eat" category of the Food Choice Inventory. Therefore, as beam scores increased, the number of Low Nutrient Foods from the "Will Eat" category decreased. Conversely, as beam scores decreased, the number of Low Nutrient Foods from the "Will Eat" category increased. Simply, the higher scorers on balance beam indicated less interest in Low Nutrient Foods, whereas the lower scorers on balance beam indicated more interest in Low Nutrient Foods.

**Research Question #3:** Was there a relationship between scores on the Tennessee Self Concept Scale and scores on the Food Choice Inventory among Big Ten gymnasts?

Table 7 shows the relationship between scores on the Tennessee Self Concept Scale and scores on the Food Choice Inventory as measured by Pearson product moment correlations. This correlation considered the relationship between self concept scores and "Will Eat" food scores from
### TABLE 5
MEANS AND STANDARD DEVIATIONS FOR FOOD CHOICE INVENTORY

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL FOOD (40)</td>
<td>56</td>
<td>19.54</td>
<td>6.20</td>
</tr>
<tr>
<td>HIGH FOOD (25)</td>
<td>56</td>
<td>13.48</td>
<td>3.43</td>
</tr>
<tr>
<td>LOW FOOD (15)</td>
<td>56</td>
<td>6.05</td>
<td>4.11</td>
</tr>
</tbody>
</table>

### TABLE 6
RELATIONSHIP BETWEEN GYMNASTIC EVENT SCORES AND FOOD CHOICE INVENTORY SCORES

<table>
<thead>
<tr>
<th>Event</th>
<th>N</th>
<th>R</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAULT</td>
<td>34</td>
<td>.06</td>
<td>.38</td>
</tr>
<tr>
<td>BARS</td>
<td>34</td>
<td>.17</td>
<td>.18</td>
</tr>
<tr>
<td>BEAM</td>
<td>33</td>
<td>-.28</td>
<td>.06</td>
</tr>
<tr>
<td>FLOOR EX</td>
<td>31</td>
<td>-.12</td>
<td>.27</td>
</tr>
<tr>
<td>ALL AROUND</td>
<td>21</td>
<td>-.17</td>
<td>.22</td>
</tr>
</tbody>
</table>

N=NUMBER OF GYMNASTS  
R=CORRELATION COEFFICIENT
<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>R</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL FOOD</td>
<td>56</td>
<td>.14</td>
<td>.16</td>
</tr>
<tr>
<td>HIGH FOOD</td>
<td>56</td>
<td>.25</td>
<td>.03*</td>
</tr>
<tr>
<td>LOW FOOD</td>
<td>56</td>
<td>-.003</td>
<td>.49</td>
</tr>
</tbody>
</table>

*P<.05
N=NUMBER OF GYMNASTS
R=CORRELATION COEFFICIENT
all gymnasts (N = 56) regardless of their gymnastic event. Only one score, the Total Positive Score, was utilized from the Tennessee Self Concept Scale, whereas the "Will Eat" scores were utilized from the Food Choice Inventory: Total Foods, High Nutrient Foods, and Low Nutrient Foods. Of the three Food Choice Inventory scores, only High Nutrient Foods correlated with self concept; there was a positive low association (r = +.25) between High Nutrient Foods and self concept. Thus, high self concept scores were associated with many High Nutrient Foods from the "Will Eat" category of the Food Choice Inventory, whereas low self concept scores were associated with some High Nutrient Foods from the "Will Eat" category of the Food Choice Inventory. Simply, gymnasts with higher self concept scores indicated an increased interest in High Nutrient Foods, whereas gymnasts with lower self concept scores indicated a decreased interest in High Nutrient Foods.

Part IIA: Description of Independent Variables
to Explain Gymnastic Success

In order to accomplish the second purpose of this study, Part IIA describes the independent variables in order to explain gymnastic success. Data from five research hypotheses are discussed in null form. The statistics applied to these data are analysis of variance.

In order to compile a Seasonal Average Score for a gymnastic event, a gymnast must have competed in that event in at least two home and two away competitions during the season. Table 8 shows the number of gymnasts who met the Seasonal Average Score criterion for vault, uneven
TABLE 8
NUMBER OF GYMNASTS WHO MET SEASONAL AVERAGE SCORE (SAS) CRITERION FOR EVENTS

<table>
<thead>
<tr>
<th>EVENT</th>
<th>N</th>
<th>MEAN SAS</th>
<th>S.D.</th>
<th>RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAULT</td>
<td>34</td>
<td>9.129</td>
<td>.283</td>
<td>8.50-9.65</td>
</tr>
<tr>
<td>BARS</td>
<td>34</td>
<td>9.112</td>
<td>.370</td>
<td>8.00-9.80</td>
</tr>
<tr>
<td>BEAM</td>
<td>33</td>
<td>9.090</td>
<td>.340</td>
<td>8.30-9.60</td>
</tr>
<tr>
<td>FLOOR EX</td>
<td>31</td>
<td>9.215</td>
<td>.229</td>
<td>8.60-9.60</td>
</tr>
<tr>
<td>ALL AROUND</td>
<td>21</td>
<td>36.672</td>
<td>.843</td>
<td>34.75-38.00</td>
</tr>
</tbody>
</table>
bars, balance beam, floor exercise, and all around. There were 34 gymnasts who met the criterion in vault; gymnasts had a combined Seasonal Average Score of 9.129. In uneven bars, there were 34 gymnasts with a combined Seasonal Average Score of 9.112. In balance beam, there were 33 gymnasts with a combined Seasonal Average Score of 9.090. In floor exercise, there were 31 gymnasts with a combined Seasonal Average Score of 9.215. Finally, in all around, there were 21 gymnasts with a combined Seasonal Average Score of 36.672.

For statistical purposes, Seasonal Average Scores (SAS) were ranked and divided by thirds into a high, middle, and low group for each event. Table 9 shows the number of gymnasts assigned to each group, plus the cut-off scores for the lower one-third group and the upper one-third group for vault, bars, beam, floor exercise, and all around. Only the lower one-third and upper one-third groups were considered for Part II of the statistical analysis. In the vault event, 12 gymnasts from the lower one-third group scored less than 8.975 SAS, and 11 gymnasts from the upper one-third group scored greater than 9.275 SAS. In the bar event, 13 gymnasts from the lower one-third group scored less than 9.000 SAS, and 13 gymnasts from the upper one-third group scored greater than 9.300. In the beam event, 11 gymnasts from the upper one-third group scored less than 8.950 SAS, and 11 gymnasts from the upper one-third group scored greater than 9.325. In the floor exercise event, 11 gymnasts from the lower one-third group scored less than 9.050, and ten gymnasts from the upper one-third group scored greater than 9.400. In the all around event, eight gymnasts from the lower one-third group scored less than
<table>
<thead>
<tr>
<th>Event</th>
<th>LOW 1/3</th>
<th>N</th>
<th>HIGH 1/3</th>
<th>N</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vault</td>
<td>&lt; 8.975</td>
<td>12</td>
<td>&gt; 9.275</td>
<td>11</td>
<td>23</td>
</tr>
<tr>
<td>Bars</td>
<td>&lt; 9.000</td>
<td>13</td>
<td>&gt; 9.300</td>
<td>13</td>
<td>26</td>
</tr>
<tr>
<td>Beam</td>
<td>&lt; 8.950</td>
<td>11</td>
<td>&gt; 9.325</td>
<td>11</td>
<td>22</td>
</tr>
<tr>
<td>Floor</td>
<td>&lt; 9.050</td>
<td>10</td>
<td>&gt; 9.400</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>All Around</td>
<td>&lt;36.400</td>
<td>8</td>
<td>&gt;37.200</td>
<td>8</td>
<td>16</td>
</tr>
</tbody>
</table>
36.400, and eight gymnasts from the upper one-third group scored greater than 37.200.

The fact that gymnasts are an intact, homogeneous sample whose Seasonal Average Scores are narrow in range makes statistical tests of significance quite challenging. In addition to these two factors, the sample size was decreased by one-third when the middle group was dropped from Part II statistics. Although a large number of subjects is desired for statistics, the researcher divided the sample into a lower one-third group and an upper one-third group in order to increase heterogeneity of the sample.

Five hypotheses (in null form) as described in Chapter I were tested with the following results:

**Research Hypothesis #1:** There will be no significant differences between gymnasts in the top 33% and bottom 33% of Seasonal Average Scores on VAULT and the following variables:

A. School Rank: freshman, sophomore, junior, or senior
B. Scholarship Status: in-state athletic scholarship, out-of-state athletic scholarship, or non-scholarship
C. Birth Order: first born, middle born, last born, or only child
D. School Status: affiliation to one of the six Big Ten gymnastic teams
E. Self Concept: Total Positive Score of the Tennessee Self Concept Scale
F. Eating Behavior: "Will Eat" Scale of the Food Choice Inventory

Table 10 shows that there was a significant difference in self concept between the lower one-third and the upper one-third of vaulters as measured by an analysis of variance. Self concept, measured by the
### TABLE 10
**ANALYSIS OF VARIANCE FOR TOTAL POSITIVE SCORE (SELF-CONCEPT) X VAULT GROUPS**

<table>
<thead>
<tr>
<th>SOURCE OF VARIATION</th>
<th>SUM OF SQUARES</th>
<th>DF</th>
<th>MEAN SQUARE</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAULT GROUP</td>
<td>4069.57</td>
<td>1</td>
<td>4069.57</td>
<td>4.12</td>
<td>0.055</td>
</tr>
<tr>
<td>ERROR</td>
<td>20737.64</td>
<td>21</td>
<td>987.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>24807.22</td>
<td>22</td>
<td>1127.60</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GROUP MEANS</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LOWER ONE-THIRD</td>
<td>334.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UPPER ONE-THIRD</td>
<td>361.55</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Total Positive Score of the Tennessee Self Concept Scale, was the only one of six independent variables which was significant. The lower one-third of vaulters (N = 12) averaged a Total Positive Score of 334.92, whereas the upper one-third of vaulters (N = 11) averaged a Total Positive Score of 361.55. In short, the lower one-third scorers on vault had lower self concept scores, and the upper one-third of scorers on vault had higher self concepts. Therefore, the null hypothesis was rejected for self concept, because there was a significant difference between the vault groups.

Research Hypothesis #2: There will be no significant differences between gymnasts in the top 33% and bottom 33% of Seasonal Average Scores on UNEVEN BARS and the following variables:
A. School Rank: freshman, sophomore, junior, or senior
B. Scholarship Status: in-state athletic scholarship, out-of-state athletic scholarship, or non-scholarship
C. Birth Order: first born, middle born, last born, or only child
D. School Status: affiliation to one of the six Big Ten gymnastic teams
E. Self Concept: Total Positive Score of the Tennessee Self Concept Scale
F. Eating Behavior: "Will Eat" Scale of the Food Choice Inventory

Tables 11 and 12 show that only two of six independent variables were significant: scholarship status and school status. Table 11 shows that there was a significant difference in scholarship status between the lower one-third and the upper one-third of scorers on bars as determined by an analysis of variance. Scholarship status was defined
**TABLE 11**

ANALYSIS OF VARIANCE FOR SCHOLARSHIP STATUS X BAR GROUPS

<table>
<thead>
<tr>
<th>SOURCE OF VARIATION</th>
<th>SUM OF SQUARES</th>
<th>DF</th>
<th>MEAN SQUARE</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAR GROUP</td>
<td>2.46</td>
<td>1</td>
<td>2.46</td>
<td>6.62</td>
<td>0.017</td>
</tr>
<tr>
<td>ERROR</td>
<td>8.92</td>
<td>24</td>
<td>0.37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>11.385</td>
<td>25</td>
<td>0.455</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**GROUP MEANS**

<table>
<thead>
<tr>
<th>LOWER ONE-THIRD</th>
<th>UPPER ONE-THIRD</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.15</td>
<td>1.54</td>
</tr>
</tbody>
</table>

**KEY**

1=IN-STATE SCHOLARSHIP
2=OUT-OF-STATE SCHOLARSHIP
3=NO SCHOLARSHIP
as the type of scholarship that gymnasts received: in-state scholarship, out-of-state scholarship, or no athletic scholarship. Results showed that the lower one-third of scorers on bars (N = 13) received out-of-state scholarships, whereas the upper one-third of scorers on bars (N = 13) received in-state scholarships. Thus, the null hypothesis was rejected for scholarship status, because there was a significant difference between the bar groups.

Table 12 shows that there was a significant difference in school status between the lower one-third (N = 13) and the upper one-third (N = 13) of scorers on the bars as determined by an analysis of variance. The lower one-third of scorers tended to come from the three schools with the lowest team Seasonal Average Scores, whereas the upper one-third of scorers tended to come from the three schools with the highest team Seasonal Average Scores. Thus, the null hypothesis was rejected for school status, because there was a significant difference between the bar groups.

Research Hypothesis #3: There will be no significant differences between gymnasts in the top 33% and bottom 33% of Seasonal Average Scores on BALANCE BEAM and the following variables:
A. School Rank: freshman, sophomore, junior, or senior
B. Scholarship Status: in-state athletic scholarship, out-of-state athletic scholarship, or non-scholarship
C. Birth Order: first born, middle born, last born, or only child
D. School Status: affiliation to one of the six Big Ten gymnastic teams
E. Self Concept: Total Positive Score of the Tennessee Self Concept Scale
<table>
<thead>
<tr>
<th>SOURCE OF VARIATION</th>
<th>SUM OF SQUARES</th>
<th>DF</th>
<th>MEAN SQUARE</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAR GROUP</td>
<td>18.62</td>
<td>1</td>
<td>18.62</td>
<td>7.85</td>
<td>0.010</td>
</tr>
<tr>
<td>ERROR</td>
<td>56.923</td>
<td>24</td>
<td>2.372</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>75.538</td>
<td>25</td>
<td>3.022</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GROUP MEANS

<table>
<thead>
<tr>
<th>LOWER ONE-THIRD</th>
<th>UPPER ONE-THIRD</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.15</td>
<td>2.46</td>
</tr>
</tbody>
</table>

KEY
1 = MICHIGAN STATE UNIV
2 = THE OHIO STATE UNIV
3 = UNIV OF ILLINOIS
4 = UNIV OF MINNESOTA
5 = THE UNIV OF MICHIGAN
6 = UNIV OF IOWA
F. Eating Behavior: "Will Eat" Scale of the Food Choice Inventory

Tables 13 and 14 show that only two of six independent variables were significant: eating behavior and school status. Table 13 shows that there was a significant difference in eating behavior between the lower one-third and the upper one-third of scorers on the beam as determined by an analysis of variance. The lower one-third of scorers on the beam (N = 11) indicated an average of 11 Low Nutrient Foods on the "Will Eat" category of the Food Choice Inventory, whereas the upper one-third of scorers on the beam (N = 11) indicated an average of 3.82 Low Nutrient Foods on the "Will Eat" category of the Food Choice Inventory. In short, low scorers on beam indicated an increased interest in Low Nutrient Foods; conversely, high scorers on beam indicated a decreased interest in Low Nutrient Foods. Thus, the null hypothesis was rejected for eating behavior, because there was a significant difference between the beam groups.

Table 14 shows that there was a significant difference in school status between lower one-third and upper one-third of scorers on the beam as determined by an analysis of variance. The lower one-third of scorers (N = 11) tended to come from the three schools with the lowest team Seasonal Average Scores, whereas the upper one-third of scorers (N = 11) tended to come from the three schools with the highest team Seasonal Average Scores. Thus, the null hypothesis was rejected for school status, because there was a significant difference between the beam groups.
### TABLE 13

**ANALYSIS OF VARIANCE FOR LOW FOODS SCORE**  
*FOOD CHOICE INVENTORY* X BEAM GROUPS

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>DF</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beam Group</td>
<td>58.91</td>
<td>1</td>
<td>58.91</td>
<td>4.00</td>
<td>0.059</td>
</tr>
<tr>
<td>Error</td>
<td>294.545</td>
<td>20</td>
<td>14.73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>353.455</td>
<td>21</td>
<td>16.83</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Group Means**  

<table>
<thead>
<tr>
<th>GROUP</th>
<th>LOWER ONE-THIRD</th>
<th>UPPER ONE-THIRD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7.09</td>
<td>3.82</td>
</tr>
</tbody>
</table>

**Key**:  
1 = MICHIGAN STATE UNIV  
2 = THE OHIO STATE UNIV  
3 = UNIV OF ILLINOIS  
4 = UNIV OF MINNESOTA  
5 = THE UNIV OF MICHIGAN  
6 = UNIV OF IOWA

### TABLE 14

**ANALYSIS OF VARIANCE FOR SCHOOL STATUS X BEAM GROUPS**

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>DF</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beam Group</td>
<td>13.14</td>
<td>1</td>
<td>13.14</td>
<td>5.52</td>
<td>0.029</td>
</tr>
<tr>
<td>Error</td>
<td>47.63</td>
<td>20</td>
<td>2.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>60.77</td>
<td>21</td>
<td>2.89</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Group Means**  

<table>
<thead>
<tr>
<th>GROUP</th>
<th>LOWER ONE-THIRD</th>
<th>UPPER ONE-THIRD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4.09</td>
<td>2.55</td>
</tr>
</tbody>
</table>

**Key**:  
1 = MICHIGAN STATE UNIV  
2 = THE OHIO STATE UNIV  
3 = UNIV OF ILLINOIS  
4 = UNIV OF MINNESOTA  
5 = THE UNIV OF MICHIGAN  
6 = UNIV OF IOWA
Research Hypothesis #4: There will be no significant differences between gymnasts in the top 33% and bottom 33% of Seasonal Average Scores on FLOOR EXERCISE and the following variables:
A. School Rank: freshman, sophomore, junior, or senior
B. Scholarship Status: in-state athletic scholarship, out-of-state athletic scholarship, or non-scholarship
C. Birth Order: first born, middle born, last born, or only child
D. School Status: affiliation to one of the six Big Ten gymnastic teams
E. Self Concept: Total Positive Score of the Tennessee Self Concept Scale
F. Eating Behavior: "Will Eat" Scale of the Food Choice Inventory

Table 15 shows that only one of six independent variables was significant: school status. There was a significant difference in school status between the lower one-third and the upper one-third of scorers on the floor exercise as determined by an analysis of variance. The lower one-third of scorers (N = 11) tended to come from the three schools with the lowest Seasonal Average Scores, whereas the upper one-third of scorers (N = 10) tended to come from the three schools with the highest Seasonal Average Scores. Thus, the null hypothesis was rejected for school status, because there was a significant difference between the floor exercise groups.

Research Hypothesis #5: There will be no significant differences between gymnasts in the top 33% and bottom 33% of Seasonal Average Scores in ALL AROUND and the following variables:
TABLE 15
ANALYSIS OF VARIANCE FOR SCHOOL STATUS X FLOOR EXERCISE GROUPS

<table>
<thead>
<tr>
<th>SOURCE OF VARIATION</th>
<th>SUM OF SQUARES</th>
<th>DF</th>
<th>MEAN SQUARE</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLOOR EX GROUP</td>
<td>12.66</td>
<td>1</td>
<td>12.66</td>
<td>6.39</td>
<td>0.020</td>
</tr>
<tr>
<td>ERROR</td>
<td>37.63</td>
<td>19</td>
<td>1.98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>50.29</td>
<td>20</td>
<td>2.51</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GROUP MEANS
LOWER ONE-THIRD 4.45
UPPER ONE-THIRD 2.90

KEY: 1=Michigan State Univ
2=The Ohio State Univ
3=University of Illinois
4=University of Minnesota
5=The University of Michigan
6=University of Iowa
A. School Rank: freshman, sophomore, junior, or senior
B. Scholarship Status: in-state athletic scholarship, out-of-state athletic scholarship, or non-scholarship
C. Birth Order: first born, middle born, last born, or only child
D. School Status: affiliation to one of the six Big Ten gymnastic teams
E. Self Concept: Total Positive Score of the Tennessee Self Concept Scale
F. Eating Behavior: "Will Eat" Scale of the Food Choice Inventory

Tables 16, 17, and 18 show that three of six independent variables were significant: scholarship status, birth order, and school status. Table 16 shows that there was a significant difference in scholarship status between the lower one-third and the upper one-third of scorers in the all around event as determined by an analysis of variance. The lower one-third of scorers in the all around (N = 8) received out-of-state scholarships, whereas the upper one-third of scorers in the all around (N = 8) received either in-state or out-of-state scholarships. Thus, the null hypothesis was rejected for school status, because there was a significant difference between the all around groups.

Table 17 shows that there was a significant difference in birth order between the lower one-third and the upper one-third of scorers in the all around event as determined by an analysis of variance. The lower one-third of scorers in the all around (N = 8) were middle born, whereas the upper one-third of scorers in the all around (N = 8) were
### TABLE 16
ANALYSIS OF VARIANCE FOR SCHOLARSHIP STATUS X ALL AROUND GROUPS

<table>
<thead>
<tr>
<th>SOURCE OF VARIATION</th>
<th>SUM OF SQUARES</th>
<th>DF</th>
<th>MEAN SQUARE</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Around Group</td>
<td>1.00</td>
<td>1</td>
<td>1.00</td>
<td>7.00</td>
<td>0.019</td>
</tr>
<tr>
<td>Error</td>
<td>2.00</td>
<td>14</td>
<td>0.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3.00</td>
<td>15</td>
<td>0.200</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Group Means**

- **Lower One-Third**: 2.00
- **Upper One-Third**: 1.50

**Key**
1 = In-State Scholarship
2 = Out-of-State Scholarship
3 = No Scholarship

### TABLE 17
ANALYSIS OF VARIANCE FOR BIRTH ORDER X ALL AROUND GROUPS

<table>
<thead>
<tr>
<th>SOURCE OF VARIATION</th>
<th>SUM OF SQUARES</th>
<th>DF</th>
<th>MEAN SQUARE</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Around Group</td>
<td>3.06</td>
<td>1</td>
<td>3.06</td>
<td>4.57</td>
<td>0.051</td>
</tr>
<tr>
<td>Error</td>
<td>9.38</td>
<td>14</td>
<td>0.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>12.44</td>
<td>15</td>
<td>0.83</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Group Means**

- **Lower One-Third**: 2.25
- **Upper One-Third**: 1.38

**Key**
1 = First Born
2 = Middle Born
3 = Last Born
4 = Only Child
first born. Thus, the null hypothesis was rejected for birth order, because there was a significant difference between the all around groups.

Table 18 shows that there was a significant difference in school status between the lower one-third and the upper one-third of scorers in the all around event as determined by an analysis of variance. The lower one-third of scorers in the all around (N = 8) tended to come from the three schools with the lowest Seasonal Average Scores, whereas the upper one-third of scorers (N = 8) tended to come from the three schools with the highest Seasonal Average Scores. Thus, the null hypothesis was rejected for school status, because there was a significant difference between all around groups.

Part IIB. Isolation of Selected Rival Variables to Explain Gymnastic Success

In order to accomplish the second purpose of this study, Part IIB isolates selected rival variables which might contaminate the explanation of the dependent variable, gymnastic success. Data from one research hypothesis are discussed in null form. Analysis of variance statistics are applied to these data.

Research Hypothesis #6: Between gymnasts who ranked in the top 33% of Seasonal Average Scores and those who ranked in the bottom 33% of Seasonal Average Scores on vault, uneven bars, balance beam, floor
<table>
<thead>
<tr>
<th>SOURCE OF VARIATION</th>
<th>SUM OF SQUARES</th>
<th>DF</th>
<th>MEAN SQUARE</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL AROUND GROUP</td>
<td>16.00</td>
<td>1</td>
<td>16.00</td>
<td>9.43</td>
<td>0.008</td>
</tr>
<tr>
<td>ERROR</td>
<td>23.75</td>
<td>14</td>
<td>1.70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>39.75</td>
<td>15</td>
<td>2.65</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GROUP MEANS

<table>
<thead>
<tr>
<th>LOWER ONE-THIRD</th>
<th>UPPER ONE-THIRD</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.63</td>
<td>2.63</td>
</tr>
</tbody>
</table>
exercise, or all around, there will be no significant differences in these descriptive characteristics:

A. Training

The Collegiate Gymnastics Profile sought information on training variables. These rival variables were:

1. number of training months per year in gymnastics
2. years of competitive experience in gymnastics
3. total years of gymnastic participation, including competitive experience
4. number of competitions per season attended by one or both parents
5. number of competitions per season attended by a close friend of either sex

B. Eating Behavior

The Collegiate Gymnastics Profile sought information on eating behavior. These rival variables were:

1. number of gymnasts who sought professional help for symptoms of anorexia nervosa
2. number of gymnasts who sought professional help for symptoms of bulimia
3. number of gymnasts who sought professional help for symptoms of overweight
4. number of gymnasts who were satisfied with their eating habits
5. number of gymnasts who were satisfied with their body weight
6. number of gymnasts who were satisfied with their body fat

The Eating Awareness Inventory sought information on eating behavior. These rival variables were:
1. number of morning meals eaten in a typical week
2. number of midday meals eaten in a typical week
3. number of evening meals eaten in a typical week
4. typical habits concerning the largest meal of the day

To determine whether significant differences in training variables occurred between the lower one-third and the upper one-third of gymnasts, an analysis of variance was computed for the five gymnastic events on each the following rival variables: (1) number of training months per year in gymnastics, (2) years of competitive experience in gymnastics, (3) total years of gymnastic participation, including competitive experience, (4) number of competitions per season attended by one or both parents, and (5) number of competitions per season attended by a close friend of either sex. Thus, 25 analyses of variance were performed.

Tables 19, 20, and 21 show the three training variables that were statistically significant: number of training months per year, years of competitive experience, and number of competitions attended by one or both parents during the season. There was a significant difference in the number of training months per year between the lower one-third and upper one-third of scores on the floor exercise (Table 19). The lower one-third of gymnasts on floor exercise averaged 11.82 months of training per year, whereas the upper one-third of gymnasts on floor exercise averaged 10.70 months of training per year. Thus, the null hypothesis was rejected for the number of training months per year, because there was a significant difference between the floor exercise groups.
<table>
<thead>
<tr>
<th>SOURCE OF VARIATION</th>
<th>SUM OF SQUARES</th>
<th>DF</th>
<th>MEAN SQUARE</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor Ex Group</td>
<td>6.55</td>
<td>1</td>
<td>6.55</td>
<td>4.18</td>
<td>0.055</td>
</tr>
<tr>
<td>Error</td>
<td>29.74</td>
<td>19</td>
<td>1.57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>36.29</td>
<td>20</td>
<td>1.81</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GROUP MEANS

<table>
<thead>
<tr>
<th>LOWER ONE-THIRD</th>
<th>UPPER ONE-THIRD</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.82</td>
<td>10.70</td>
</tr>
</tbody>
</table>
There was a significant difference in years of experience in gymnastic competition between the lower one-third and the upper one-third of gymnasts on the vault (Table 20). The lower one-third of vaulters averaged 9.08 years of experience in gymnastic competition, whereas the upper one-third averaged 10.36 years of experience in gymnastic competition. Thus, the null hypothesis was rejected for years of competitive experience, because there was a significant difference between the vaulting groups.

There was a significant difference in the number of competitions attended by one or both parents during the season between the lower one-third and the upper one-third of gymnasts on the vault (Table 21). The lower one-third of vaulters averaged 2.70 visits by parents during competitions, whereas the upper one-third of vaulters averaged 6.73 visits by parents during competitions. Thus, the null hypothesis was rejected for the number of competitions attended by one or both parents during the season, because there was a significant difference between the vaulting groups.

To determine whether significant differences in eating behaviors occurred between the lower one-third and the upper one-third of gymnasts in vault, bars, beam, floor exercise, and all around, five analysis of variances were computed for each of the following ten variables: (1) number of gymnasts who sought professional help for symptoms of anorexia nervosa, (2) number of gymnasts who sought professional help for symptoms of bulimia, (3) number of gymnasts who sought professional help for symptoms of overweight, (4) number of gymnasts who were satisfied with their eating habits, (5) number of gymnasts who were satisfied with
TABLE 20
ANALYSIS OF VARIANCE FOR YEARS OF COMPETITIVE EXPERIENCE X VAULT GROUPS

<table>
<thead>
<tr>
<th>SOURCE OF VARIATION</th>
<th>SUM OF SQUARES</th>
<th>DF</th>
<th>MEAN SQUARE</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAULT GROUP</td>
<td>9.41</td>
<td>1</td>
<td>9.41</td>
<td>3.99</td>
<td>0.059</td>
</tr>
<tr>
<td>ERROR</td>
<td>49.46</td>
<td>21</td>
<td>2.36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>58.87</td>
<td>22</td>
<td>2.68</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GROUP MEANS
LOWER ONE-THIRD    9.08
UPPER ONE-THIRD    10.36

TABLE 21
ANALYSIS OF VARIANCE FOR NUMBER OF COMPETITIONS ATTENDED BY ONE OR BOTH PARENTS X VAULT GROUPS

<table>
<thead>
<tr>
<th>SOURCE OF VARIATION</th>
<th>SUM OF SQUARES</th>
<th>DF</th>
<th>MEAN SQUARE</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAULT GROUP</td>
<td>84.96</td>
<td>1</td>
<td>84.96</td>
<td>6.11</td>
<td>0.023</td>
</tr>
<tr>
<td>ERROR</td>
<td>264.28</td>
<td>19</td>
<td>13.91</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>349.24</td>
<td>20</td>
<td>17.46</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GROUP MEAN VISITS
LOWER ONE-THIRD    2.70
UPPER ONE-THIRD    6.73
their body weight, (6) number of gymnasts who were satisfied with their body fat, (7) number of morning meals eaten in a typical week, (8) number of midday meals eaten in a typical week, (9) number of evening meals eaten in a typical week, and (10) typical habits concerning the largest meal of the day.

Tables 22, 23, and 24 show the three eating behaviors that were statistically significant: body weight satisfaction for floor exercise, body weight satisfaction for all around, and body fat satisfaction for balance beam. There was a significant difference between the lower one-third and the upper one-third of gymnasts on the floor exercise who were satisfied with their body weight (Table 22). The lower one-third of scorers on floor exercise were not satisfied with their body weight ($N = 11$), whereas the upper one-third of scorers were satisfied with their body weight ($N = 10$). Thus, the null hypothesis was rejected, because there was a significant difference between floor exercise groups in body weight satisfaction.

There was a significant difference between the lower one-third and the upper one-third of all around gymnasts who were satisfied with their body weight (Table 23). The lower one-third of all around gymnasts were not satisfied with their body weight ($N = 8$), whereas the upper one third of all around gymnasts were satisfied with their body weight ($N = 8$). Thus, the null hypothesis was rejected, because there was a significant difference between all around groups in body weight satisfaction.

There was a significant difference between the lower one-third and upper one-third of gymnasts on the balance beam who were satisfied with
### TABLE 22
**ANALYSIS OF VARIANCE FOR NUMBER OF GYMNASTS WHO WERE SATISFIED WITH THEIR BODY WEIGHT X FLOOR EXERCISE GROUPS**

<table>
<thead>
<tr>
<th>SOURCE OF VARIATION</th>
<th>SUM OF SQUARES</th>
<th>DF</th>
<th>MEAN SQUARE</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLOOR EX GROUP</td>
<td>1.41</td>
<td>1</td>
<td>1.41</td>
<td>7.15</td>
<td>0.015</td>
</tr>
<tr>
<td>ERROR</td>
<td>3.74</td>
<td>19</td>
<td>0.20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>5.14</td>
<td>20</td>
<td>0.26</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**GROUP MEANS**

| LOWER ONE-THIRD | 1.82 |
| UPPER ONE-THIRD | 1.30 |

**KEY**

1 = YES, SATISFIED  
2 = NO, NOT SATISFIED  
3 = WOULD NOT LIKE TO ADMIT

### TABLE 23
**ANALYSIS OF VARIANCE FOR NUMBER OF GYMNASTS WHO WERE SATISFIED WITH THEIR BODY WEIGHT X ALL AROUND GROUPS**

<table>
<thead>
<tr>
<th>SOURCE OF VARIATION</th>
<th>SUM OF SQUARES</th>
<th>DF</th>
<th>MEAN SQUARE</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL AROUND GROUP</td>
<td>1.56</td>
<td>1</td>
<td>1.56</td>
<td>9.21</td>
<td>0.009</td>
</tr>
<tr>
<td>ERROR</td>
<td>2.38</td>
<td>14</td>
<td>0.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>3.94</td>
<td>15</td>
<td>0.26</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**GROUP MEANS**

| LOWER ONE-THIRD | 1.88 |
| UPPER ONE-THIRD | 1.25 |

**KEY**

1 = YES, SATISFIED  
2 = NO, NOT SATISFIED  
3 = WOULD NOT LIKE TO ADMIT
their body fat (Table 24). The lower one-third of scorers on balance beam were not satisfied with their percentage of body fat ($N = 10$), whereas the upper one-third of scorers on balance beam were satisfied with their percentage of body fat ($N = 11$). Thus, the null hypothesis was rejected, because there was a significant difference between beam groups in body fat satisfaction.

A total summary of significant group differences for the lower one-third and the upper one-third of gymnasts on the vault, bars, beam, floor exercise, and all around is shown in Table 25. This table highlights the primary and secondary independent variables by gymnastic event, whereas Table 26 highlights the rival independent variables by gymnastic event. Ary et al. (1985) suggested: "When the null hypothesis is rejected as a result of this analysis-of-variance procedure, we cannot say more than that the measures obtained from the groups involved differ and the differences are greater than one would expect to exist by chance alone."

PART III: Explanation and Prediction of Gymnastic Success

In order to accomplish the third purpose of this study, Part III explains and predicts gymnastic success. Two types of analyses are utilized in an attempt to predict the success of Big Ten gymnasts: multiple regression analysis and discriminant analysis. The discussion on multiple regression analysis is organized by gymnastic event. The discussion on discriminant analysis is organized into four topics: variables which failed the tolerance test, Wilks' lambda and chi-square
TABLE 24
ANALYSIS OF VARIANCE FOR NUMBER OF GYMNASTS WHO WERE SATISFIED WITH THEIR BODY FAT X BEAM

<table>
<thead>
<tr>
<th>SOURCE OF VARIATION</th>
<th>SUM OF SQUARES</th>
<th>DF</th>
<th>MEAN SQUARE</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEAM GROUP</td>
<td>1.04</td>
<td>1</td>
<td>1.04</td>
<td>5.44</td>
<td>0.031</td>
</tr>
<tr>
<td>ERROR</td>
<td>3.63</td>
<td>19</td>
<td>0.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>4.67</td>
<td>20</td>
<td>0.23</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GROUP MEANS
- LOWER ONE-THIRD: 1.90
- UPPER ONE-THIRD: 1.45

KEY
- 1=YES, SATISFIED
- 2=NO, NOT SATISFIED
- 3=WOULD NOT LIKE TO ADMIT
<table>
<thead>
<tr>
<th>EVENT</th>
<th>GROUP</th>
<th>SCHOOL RANK</th>
<th>SCHOLARSHIP</th>
<th>BIRTH ORDER</th>
<th>SCHOOL STATUS</th>
<th>SELF CONCEPT</th>
<th>EATING BEHAVIOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAULT</td>
<td>LOWER 1/3 (12)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>334.92</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UPPER 1/3 (11)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>361.55</td>
<td></td>
</tr>
<tr>
<td>BARS</td>
<td>LOWER 1/3 (13)</td>
<td>2.15</td>
<td></td>
<td>4.15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>UPPER 1/3 (13)</td>
<td>1.54</td>
<td></td>
<td>2.46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BEAM</td>
<td>LOWER 1/3 (11)</td>
<td></td>
<td></td>
<td>4.09</td>
<td></td>
<td>7.09</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UPPER 1/3 (11)</td>
<td></td>
<td></td>
<td>2.55</td>
<td></td>
<td>3.82</td>
<td></td>
</tr>
<tr>
<td>FLOOR</td>
<td>LOWER 1/3 (11)</td>
<td></td>
<td></td>
<td>4.45</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>UPPER 1/3 (10)</td>
<td></td>
<td></td>
<td>2.90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.A.</td>
<td>LOWER 1/3 (8)</td>
<td>2.00</td>
<td>2.25</td>
<td>4.63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>UPPER 1/3 (8)</td>
<td>1.15</td>
<td>1.38</td>
<td>2.63</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TABLE 26: SUMMARY OF SIGNIFICANT GROUP DIFFERENCES (P = 0.05)
BETWEEN RIVAL VARIABLES X EVENT

<table>
<thead>
<tr>
<th>EVENT</th>
<th>GROUP</th>
<th>COMPYRS</th>
<th>COMPPAR</th>
<th>TRAINMO</th>
<th>WTSATIS</th>
<th>FATSATIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAULT</td>
<td>LOWER 1/3 (12)</td>
<td>9.08 YRS</td>
<td>2.70 VISITS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>UPPER 1/3 (11)</td>
<td>10.36 YRS</td>
<td>6.73 VISITS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BARS</td>
<td>LOWER 1/3 (13)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>UPPER 1/3 (13)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BEAM</td>
<td>LOWER 1/3 (11)</td>
<td></td>
<td></td>
<td></td>
<td>10 NO</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UPPER 1/3 (11)</td>
<td></td>
<td></td>
<td></td>
<td>11 YES</td>
<td></td>
</tr>
<tr>
<td>FLOOR</td>
<td>LOWER 1/3 (11)</td>
<td></td>
<td></td>
<td>11.82 MO</td>
<td>11 NO</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UPPER 1/3 (10)</td>
<td></td>
<td></td>
<td>10.70 MO</td>
<td>10 YES</td>
<td></td>
</tr>
<tr>
<td>A.A.</td>
<td>LOWER 1/3 (8)</td>
<td></td>
<td></td>
<td></td>
<td>8 NO</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UPPER 1/3 (8)</td>
<td></td>
<td></td>
<td></td>
<td>8 YES</td>
<td></td>
</tr>
</tbody>
</table>
results, classification of group membership, and standardized discriminant coefficients.

**Multiple Regression Analysis**

Multiple regression analysis was conducted to determine the influence of several independent variables on gymnastic success. The independent variables were also called predictor variables; they were located on the horizontal axis and were denoted by the variable X. The dependent variable was also called the criterion variable; it was located on the vertical axis and was denoted by the variable Y.

According to Norusis (1986), there are two concerns when selecting the independent variables for multiple regression analysis. First, since large intercorrelations between the independent variables can substantially affect the results of the multiple regression analysis, the researcher attempted to choose predictor variables that were not highly correlated with each other. For example, instead of including all three scores from the Food Choice Inventory, only the Low Food category was used since it was combined with High Foods to form a linear combination of Total Foods. Secondly, it may be necessary to omit independent variables from the regression model. Norusis (1986) stated:

> Including a large number of independent variables in a regression model is never a good strategy, unless there are strong, previous reasons to suggest that they all should be included. The observed increase in $R^2$ does not necessarily reflect a better fit of the model in the population. Including irrelevant variables increases the standard errors of all estimates without improving prediction. A model with many variables is often difficult to interpret...On the other hand, it is important not to exclude potentially relevant independent variables.
Consequently, in the present study, school status was not a necessary predictor variable in the multiple regression analysis since better teams will tend to have better gymnasts. Hence, school status would obviously be predictive of gymnastic success.

Two methods of multiple regression were employed in this study: stepwise and hierarchical. Hierarchical regression (backward elimination) started with all variables in the equation and sequentially removed them according to the computing criterion. Stepwise multiple regression (forward selection) started with no independent variables in the equation and sequentially entered them. If an independent variable failed to meet entry requirements, the procedure terminated with no independent variables in the equation. If it passed the criterion, the second independent variable was selected based on the next highest partial correlation.

Data from all 56 gymnasts were included in the multiple regression analysis. Five different regressions were run, because the dependent variable was defined from vault scores, bar scores, beam scores, floor exercise scores, or all around scores.

**Multiple Regression Analysis for Vault**

The stepwise multiple regression for the total group on vault (N = 34) revealed that scholarship status accounted for 13% of the variance in vault scores. This was significant at the 0.05 alpha level. Table 27 shows scholarship status was the only independent variable that was significant in the multiple regression analysis for vault. In addition, coefficient of determination (R²), standard error of estimate
TABLE 27
REGRESSION OF GYMNASTIC SUCCESS (VAULT) ON
SCHOLARSHIP STATUS (N=34)

<table>
<thead>
<tr>
<th>INDEPENDENT VARIABLE</th>
<th>R</th>
<th>SE</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCHOLARSHIP STATUS</td>
<td>.12936</td>
<td>.26824</td>
<td>.037*</td>
</tr>
</tbody>
</table>

* P < .05
SE = STD ERROR
(SE), and the test of significance (p = 0.05) are shown. The standard error of estimate was dependent upon the extent of variability in vault scores and provided an estimate of the average amount of error in prediction. Walsh and Betz (1985) claimed that the stronger the correlation between the two variables, the less the extent of error in prediction.

When hierarchical regression (backward elimination) was employed for vault, four independent variables were forced into the equation: Total Positive Score (self concept), Low Nutrient Foods, school rank, and birth order. R squared revealed that 25% of the variance in vault scores was accounted for by the linear combination of all the independent variables acting on the dependent variable. However, this statistic was not significant.

Beta coefficients are the coefficients of each independent variable expressed in standardized Z form; they indicated which independent variable had the most influence on the dependent variable. Scholarship status had the most influence on vault scores; it had a negative influence (B = -.361305). The next independent variable with the most influence on vault scores was self concept as measured by the Total Positive Score of the Tennessee Self Concept Scale. There was a positive influence (B = .335348). Only scholarship status was significant.

**Multiple Regression Analysis for Bars**

The stepwise multiple regression for the total group on uneven bars (N = 34) revealed that scholarship status accounted for 31% of the
variance in bar scores. Table 28 shows scholarship status was the only independent variable that was significant in the multiple regression analysis for bars. In addition, coefficient of determination (R²), standard error of estimate (SE), and the test of significance (p = 0.05) are shown.

When hierarchical regression (backward elimination) was employed for bars, four independent variables were forced into the equation: Total Positive Score (self concept), Low Foods, school rank, and birth order. R squared revealed that 37.5% of the variance in bar scores was accounted for by the linear combination of all the independent variables acting on the dependent variable. This statistic was significant at the 0.05 alpha level.

Beta coefficients indicated that two independent variables had the most influence on the dependent variable: scholarship status (B = -.592494) and self concept (B = .266938). Only scholarship status was significant.

Multiple Regression Analysis for Balance Beam

The stepwise multiple regression for the total group on balance beam (N = 33) revealed that birth order accounted for 12% of the variance in beam scores. Table 29 shows birth order was the only independent variable that was significant in the multiple regression analysis for beam. In addition, coefficient of determination (R²), standard error of estimate (SE), and the test of significance (p = 0.05) are shown.
### TABLE 28
REGRESSION OF GYMNASTIC SUCCESS (BARS) ON SCHOLARSHIP STATUS (N=34)

<table>
<thead>
<tr>
<th>INDEPENDENT VARIABLE</th>
<th>R</th>
<th>SE</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCHOLARSHIP STATUS</td>
<td>0.31406</td>
<td>0.31145</td>
<td>0.006*</td>
</tr>
</tbody>
</table>

* P<.05
SE= STD ERROR

### TABLE 29
REGRESSION OF GYMNASTIC SUCCESS (BEAM) ON BIRTH ORDER (N=33)

<table>
<thead>
<tr>
<th>INDEPENDENT VARIABLE</th>
<th>R</th>
<th>SE</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIRTH ORDER</td>
<td>0.12288</td>
<td>0.32379</td>
<td>0.0455*</td>
</tr>
</tbody>
</table>

* P<.05
SE= STD ERROR
When hierarchical regression (backward elimination) was employed for beam, four independent variables were forced into the equation: Total Positive Score (self concept), Low Foods, school rank, and birth order. $R^2$ squared revealed that 28.5% of the variance in beam scores was accounted for by the linear combination of all the independent variables acting on the dependent variable. This statistic was not significant. Since it was not significant, there was no reason to look at the beta coefficients for beam.

**Multiple Regression Analysis for Floor Exercise and All Around**

The stepwise multiple regression for the total groups on floor exercise ($N = 31$) and all around ($N = 21$) revealed no significant statistics. Norusis (1986) suggested that if no linear relationship existed between independent and dependent variables, then the $R^2$ was zero. She urged: [an] "$R^2$ of 0 does not necessarily mean that there is no association between the variables. Instead, it indicates that there is no linear relationship."

**Summary of Multiple Regression Statistics**

Table 30 shows a summary of multiple regression statistics for vault, bars, and beam. The best predictor for vault scores was scholarship status ($R^2 = 13\%$), which was significant at the 0.05 alpha level. The best predictor for bar scores was scholarship status ($R^2 = 31\%$), which was significant at the 0.05 alpha level. Lastly, the best predictor for beam scores was birth order ($R^2 = 12\%$), which was significant at the 0.05 alpha level. In all three cases, the stepwise multiple regression was a
<table>
<thead>
<tr>
<th>DEPENDENT VARIABLE</th>
<th>INDEPENDENT VARIABLE</th>
<th>VARIANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAULT SCORES</td>
<td>SCHOLARSHIP STATUS</td>
<td>13%</td>
</tr>
<tr>
<td>BAR SCORES</td>
<td>SCHOLARSHIP STATUS</td>
<td>31%</td>
</tr>
<tr>
<td>BEAM SCORES</td>
<td>BIRTH ORDER</td>
<td>12%</td>
</tr>
</tbody>
</table>
test of whether there was a linear relationship between the dependent variable and the entire set of independent variables. In each case, only one variable was predictive of gymnastic success. Even when other independent variables and rival variables were forced into a hierarchical multiple regression, no other significant variables resulted. Hopkins and Glass (1978) suggested: "Any number of independent variables can be employed for predicting a dependent variable. To be accurate, however, multiple correlations need to be based on large sample sizes (200 or more), especially if three or more independent variables are involved."

**Discriminant Analysis**

Klecka (1981) defined discriminant analysis as

"...a statistical technique which allows the researcher to study the differences between two or more groups of objects with respect to several variables simultaneously.... The basic prerequisites are that two or more groups exist which we presume [to] differ on several variables and that those variables can be measured at the interval or ratio level. Discriminant analysis will then help us analyze the differences between the groups and/or provide us with a means to assign [classify] any case into the group which it most closely resembles.

Thus, researchers use discriminant analysis in order to interpret and classify group membership.

In this study, a linear discriminant analysis was done in order to classify future gymnasts into either low- or high-scoring groups on the basis of several independent variables. Tiedeman (1951) wrote that discriminant analysis answered the question, "What group am I most like?" He stated that discriminant analysis examined the relationship between a set of variables and a particular group of people as long as each subject belonged to that group of people."
According to Klecka (1981), "there is no limit on the number of discriminating variables as long as the total number of cases exceeds the number of variables by more than two." Hence, since there were 56 subjects in the present study, there could be no more than 54 discriminating variables. Consequently, only 24 discriminating variables were employed in the analysis. These variables were: Total Positive Score (TPS); High Foods (prifood); Low Foods (prlowfood); birth order (birth); school rank (year); scholarship status (athstat); school status (rank); age train (agetrain); number of training months per year in gymnastics (gymmo); years of competitive experience in gymnastics (compyrs); total years of gymnastic participation and competition (totyrs); number of competitions per season attended by one or both parents (compar); number of competitions per season attended by a close friend of either sex (comfri); number of gymnasts who sought professional help for symptoms of anorexia nervosa (anorex); number of gymnasts who sought professional help for symptoms of bulimia (bulmic); number of gymnasts who were medically diagnosed with an eating disorder (eatdis); number of gymnasts who sought professional help for symptoms of overweight (overhelp); number of gymnasts who were satisfied with their eating habits (eatsatis); number of gymnasts who were satisfied with their body weight (wtsatis); number of gymnasts who were satisfied with their body fat (fatsatis); number of morning meals eaten in a typical week (break); number of midday meals eaten in a typical week (lunch); number of evening meals eaten in a typical week (supper); typical habits concerning the largest meal of the day (largest).
Klecka (1981) highlighted six other assumptions concerning discriminant analysis. The discriminant analysis must: (1) contain two or more groups, (2) contain at least two cases per group, (3) measure the discriminating variables at the interval level, (4) not have a discriminating variable which is a linear combination of other discriminating variables, (5) have approximately equal covariance matrices for each group, and (6) have each group drawn from a population with a normal distribution. In this study, numbers one, two, four, and five were accommodated.

In the discriminant analysis for vault groups, seven of the 24 variables failed the minimum tolerance test of 0.001, so only 16 variables formed the discriminant function. Since there was a lower one-third and an upper one-third group of gymnasts, only one function was formed. The variables excluded from the discriminant function were: anorex, eatdis, wtsatis, fatsatis, lunch, supper, and largest. To determine if vault groups were different on the other 16 discriminating variables, Wilks' lambda was observed. The Wilks' lambda for vault was 0.3115426. A large lambda indicated that the vault groups would be separated on that function; there would be discrimination between the two groups. A value of zero indicated that the independent variables were not able to predict the dependent variable. Norusis (1986) claimed that even when lambda is zero, there may be other measures of association between the variables. Lambda was converted to chi-square in order to test for statistical significance. Chi-square for vault was 9.91, which was not significant at the 0.05 alpha level.
Discriminant analysis for the other gymnastic events, excluding vault, were organized into the following topics: (1) a list of the independent variables which failed the tolerance test for bars, beam, floor, and all around, and (2) a list of Wilks' lambdas and chi-squares for bars, beam, floor, and all around. Classification of group membership for the lower one-third and upper one-third groups on vault, bars, beam, floor exercise, and all around will be presented. Lastly, standardized discriminant coefficients for all dependent variables will be discussed.

Variables which Failed the Tolerance Test

Gilbert (1968) suggested that "In situations where the independent variables are all binary (yes-no, male-female) or a mixture of continuous and discrete variables, the linear discriminant function is not optimal.... In the case of dichotomous variables, most evidence suggests that the linear discriminant function often performs reasonably well." Several discrete variables and some continuous variables made up the 24 variables used in the discriminant analyses for vault, bars, beam, floor exercise, and all around. As some of these 24 variables failed the tolerance test for vault, bars, beam, floor exercise, or all around, they were eliminated from the analyses. For each function, only rival variables were eliminated; all independent variables passed the tolerance tests.

Table 31 highlights the rival variables which failed the tolerance test for each discriminant function. Vault was described above. For bars, five of the 24 independent variables failed the tolerance test.
TABLE 31

RIVAL VARIABLES FAILING THE TOLERANCE TEST FOR VAULT, BARS, BEAM, FLOOR, AND ALL AROUND

<table>
<thead>
<tr>
<th>Variable</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPFRI</td>
<td>5</td>
</tr>
<tr>
<td>ANOREX</td>
<td>5</td>
</tr>
<tr>
<td>BULMIC</td>
<td>125</td>
</tr>
<tr>
<td>EATDIS</td>
<td>5</td>
</tr>
<tr>
<td>OVERHELP</td>
<td>35</td>
</tr>
<tr>
<td>EATSATIS</td>
<td>1345</td>
</tr>
<tr>
<td>WTSATIS</td>
<td>1345</td>
</tr>
<tr>
<td>FATSATIS</td>
<td>345</td>
</tr>
<tr>
<td>BREAK</td>
<td>12345</td>
</tr>
<tr>
<td>LUNCH</td>
<td>12345</td>
</tr>
<tr>
<td>SUPPER</td>
<td>12345</td>
</tr>
<tr>
<td>LARGEST</td>
<td>12345</td>
</tr>
</tbody>
</table>

KEY: 1=VAULT

2=BARS

3=BEAM

4=FLOOR EX

5=ALL AROUND

NOTE: RIVAL VARIABLES NOT FAILING THE TOLERANCE TEST: AGETRAIN, TRAINMO, COMPYRS, TOTYRS, COMPAR.
These rival variables were not included in the bar function: anorex, eatdis, lunch, supper, and largest. Eight of the 24 independent variables failed the tolerance test for beam. These rival variables were not included in the beam function: anorex, eatsatis, wtsatis, fatsatis, lunch, supper, and largest. Seven of the 24 independent variables failed the tolerance test for floor exercise. These rival variables were not included in the floor exercise function: anorex, wtsatis, fatsatis, break, lunch, supper, and largest. Twelve of the 24 independent variables failed the tolerance test for all around. These rival variables were not included in the all around function: compfri, overhelp, anorex, bulmic, eatdis, eatsatis, wtsatis, fatsatis, break, lunch, supper, and largest.

**Wilks' Lambda and Chi-Square Results**

Norusis (1986) stated: "It is important to remember that even though Wilks' lambda may be statistically significant, it provides little information about the effectiveness of the discriminant function in classification. It only provides a test of the null hypothesis that the population means are equal." Table 32 shows Wilks' lambda and chi-square for the five dependant variables. Three of the five dependent variables had Wilks' lambdas which were statistically significant as measured by chi-square. The Wilks' lambda for bars was 0.050177; chi-square was 28.43, but it was not significant at the 0.05 alpha level. The Wilks' lambda for beam was 0.0041972; chi-square was 43.80, which was significant at the 0.05 alpha level. The Wilks' lambda for floor exercise was 0.0219794; chi-square was 32.45, which was significant at
### TABLE 32

**WILKS' LAMBDA AND CHI-SQUARE RESULTS FROM DISCRIMINANT FUNCTIONAL ANALYSES**

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>WILKS' LAMBDA</th>
<th>CHI-SQUARE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. VAULT</td>
<td>0.3115426</td>
<td>9.91</td>
</tr>
<tr>
<td>2. BARS</td>
<td>0.0501770</td>
<td>28.43</td>
</tr>
<tr>
<td>3. BEAM</td>
<td>0.0041972</td>
<td>43.80*</td>
</tr>
<tr>
<td>4. FLOOR EX</td>
<td>0.0219794</td>
<td>32.45*</td>
</tr>
<tr>
<td>5. ALL AROUND</td>
<td>0.0220555</td>
<td>22.89*</td>
</tr>
</tbody>
</table>

*P<.05
the 0.05 alpha level. The Wilks' lambda for all around was 0.0220555; chi-square was 22.89, which was significant at the 0.05 alpha level.

Classification of Group Membership

Tables 33 to 37 show the classification rates for group membership in vault, bars, beam, floor, and all around, respectively. Group membership in the lower one-third and upper one-third groups was highly predictive; classification rates were remarkably high at 95% to 100%. Norusis (1986) suggested that "a discriminant function with an observed misclassification rate of 50% is performing no better than chance." The present study excels in classifying gymnasts into the lower one-third and upper one-third groups.

Table 33 shows that 95% of the grouped cases for vault were classified correctly. Specifically, nine gymnasts (100%) were classified correctly as members of the lower one-third vault group. Nine gymnasts (90%) were classified correctly into the upper one-third vault group, and one gymnast (10%) was misclassified into the lower one-third vault group. Twenty-eight gymnasts formed an ungrouped classification with 21 gymnasts (75%) classified into the lower one-third group, and seven gymnasts (25%) classified into the upper one-third group.

Table 34 shows that 100% of the grouped cases for uneven bars were classified correctly; ten gymnasts were classified correctly into the lower one-third bar group, and 11 gymnasts were classified correctly into the upper one-third bar group. Twenty-five gymnasts formed an ungrouped classification with 13 gymnasts (52%) classified into the lower one-third bar group, and 12 gymnasts (48%) classified into the upper one-third bar
### TABLE 33
CLASSIFICATION RESULTS OF DISCRIMINANT ANALYSIS FOR VAULT

<table>
<thead>
<tr>
<th>ACTUAL GROUP</th>
<th>NO. OF CASES</th>
<th>PREDICTED GROUP MEMBERSHIP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>GROUP 1</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>GROUP 2</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10.0%</td>
</tr>
<tr>
<td>UNGROUPED CASES</td>
<td>28</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>75.0%</td>
</tr>
</tbody>
</table>

PERCENT OF "GROUPED" CASES CORRECTLY CLASSIFIED: 94.7%

### TABLE 34
CLASSIFICATION RESULTS OF DISCRIMINANT ANALYSIS FOR BARS

<table>
<thead>
<tr>
<th>ACTUAL GROUP</th>
<th>NO. OF CASES</th>
<th>PREDICTED GROUP MEMBERSHIP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>GROUP 1</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>GROUP 2</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0%</td>
</tr>
<tr>
<td>UNGROUPED CASES</td>
<td>25</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>52.0%</td>
</tr>
</tbody>
</table>

PERCENT OF "GROUPED" CASES CORRECTLY CLASSIFIED: 100%
Table 35 shows that 95% of the grouped cases for balance beam were classified correctly. Specifically, eight gymnasts (88.9%) were classified correctly into the lower one-third beam group, and one gymnast (11.1%) was misclassified into the upper one-third beam group. Ten gymnasts (100%) were classified correctly as members of the upper one-third group. Thirty gymnasts formed an ungrouped classification with ten gymnasts (33.3%) classified into the lower one-third group, and 20 gymnasts (66.7%) classified into the upper one-third group.

Table 36 shows that 100% of the grouped cases for floor exercise were classified correctly; 11 gymnasts were classified correctly into the lower one-third floor exercise group, and nine gymnasts were classified correctly into the upper one-third floor exercise group. Twenty-nine gymnasts formed an ungrouped classification with 22 gymnasts (75.9%) classified into the lower one-third group, and seven gymnasts (24.1%) classified into the upper one-third group.

Table 37 shows that 100% of the grouped cases for all around were classified correctly; eight gymnasts were classified correctly into the lower one-third all around group, and eight gymnasts were classified correctly into the upper one-third all around group. Thirty-five gymnasts formed an ungrouped classification with 14 gymnasts (40%) classified into the lower one-third group, and 21 gymnasts (60%) classified into the upper one-third group.
**TABLE 35**

CLASSIFICATION RESULTS OF DISCRIMINANT ANALYSIS FOR BEAM

<table>
<thead>
<tr>
<th>ACTUAL GROUP</th>
<th>NO. OF CASES</th>
<th>PREDICTED GROUP MEMBERSHIP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>GROUP 1</td>
<td>9</td>
<td>8 88.9%</td>
</tr>
<tr>
<td>GROUP 2</td>
<td>10</td>
<td>0 0.0%</td>
</tr>
<tr>
<td>UNGROUPED</td>
<td>30</td>
<td>10 100%</td>
</tr>
</tbody>
</table>

PERCENT OF "GROUPED" CASES CORRECTLY CLASSIFIED: 94.7%

**TABLE 36**

CLASSIFICATION RESULTS OF DISCRIMINANT ANALYSIS FOR FLOOR EX

<table>
<thead>
<tr>
<th>ACTUAL GROUP</th>
<th>NO. OF CASES</th>
<th>PREDICTED GROUP MEMBERSHIP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>GROUP 1</td>
<td>11</td>
<td>11 100%</td>
</tr>
<tr>
<td>GROUP 2</td>
<td>9</td>
<td>0 0.0%</td>
</tr>
<tr>
<td>UNGROUPED</td>
<td>29</td>
<td>22 75.9%</td>
</tr>
</tbody>
</table>

PERCENT OF "GROUPED" CASES CORRECTLY CLASSIFIED: 100%
<table>
<thead>
<tr>
<th>ACTUAL GROUP</th>
<th>NO. OF CASES</th>
<th>PREDICTED GROUP MEMBERSHIP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>GROUP 1</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>0.0%</td>
</tr>
<tr>
<td>GROUP 2</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0.0%</td>
<td>100%</td>
</tr>
<tr>
<td>UNGROUPED</td>
<td>35</td>
<td>14</td>
</tr>
<tr>
<td>CASES</td>
<td></td>
<td>40.0%</td>
</tr>
</tbody>
</table>

PERCENT OF "GROUPED" CASES CORRECTLY CLASSIFIED: 100%
Standardized Discriminant Coefficients

Standardized discriminant coefficients which comprised the discriminant functions for vault, bars, beam, floor, and all around were observed for their magnitude without regard to positive or negative values. The larger the magnitude of each standardized discriminant coefficient, the greater the contribution of that variable in discriminating group membership in vault, bars, beam, floor exercise, and all around. Tables 38 to 42 show the trends of the standardized discriminant coefficients for vault, bars, beam, floor exercise, and all around, respectively. Their functions are described in the following tables:

Table 38. For the vault function, totyrs \((y_1 = -2.48994)\) was about 50% more important than self concept \((y_1 = 1.67351)\) and agetrain \((y_1 = -1.53024)\) in discriminating between the lower one-third vault group and the upper one-third vault group. Also, totyrs \((y_1 = -2.48994)\) was 25% more important than gymyrs \((y_1 = 2.06522)\) in discriminating between the lower one-third vault group and the upper one-third vault group.

Table 39. For the bar function, eatsatis \((y_1 = 6.03528)\) was 50% more important than self concept \((y_1 = 3.95766)\) and bulmic \((y_1 = -4.15863)\) in discriminating between the lower one-third bar group and the upper one-third bar group. Eatsatis \((y_1 = 6.03528)\) was approximately 70% more important than agetrain \((y_1 = 3.39204)\), totyrs \((y_1 = 3.56239)\), comppar \((y_1 = -3.63607)\), and wtsatis \((y_1 = -3.60063)\) in discriminating between the lower one-third bar group and the upper one-third bar group.
### TABLE 38

**CONTRIBUTION OF VARIABLES IN DISCRIMINATING GROUP MEMBERSHIP OF VAULT**

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>STANDARD DISCRIMINANT COEFFICIENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTYRS $^2$</td>
<td>$Y' = -2.48994$</td>
</tr>
<tr>
<td>GYMYRS $^2$</td>
<td>$Y' = 2.06522$</td>
</tr>
<tr>
<td>TPS $^1$</td>
<td>$Y' = 1.67351$</td>
</tr>
<tr>
<td>AGETRAIN $^2$</td>
<td>$Y' = -1.53024$</td>
</tr>
</tbody>
</table>

**KEY:**

1 = INDEPENDENT VARIABLE  
2 = RIVAL VARIABLE

### TABLE 39

**CONTRIBUTION OF VARIABLES IN DISCRIMINATING GROUP MEMBERSHIP OF BARS**

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>STANDARD DISCRIMINANT COEFFICIENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>EATSATIS $^2$</td>
<td>$Y' = 6.03528$</td>
</tr>
<tr>
<td>BULMIC $^1$</td>
<td>$Y' = -4.15863$</td>
</tr>
<tr>
<td>TPS $^2$</td>
<td>$Y' = 3.95766$</td>
</tr>
<tr>
<td>COMPPAR $^2$</td>
<td>$Y' = -3.63607$</td>
</tr>
<tr>
<td>WTSATIS $^2$</td>
<td>$Y' = -3.60063$</td>
</tr>
<tr>
<td>TOTYRS $^2$</td>
<td>$Y' = 3.56239$</td>
</tr>
<tr>
<td>AGETRAIN</td>
<td>$Y' = 3.39204$</td>
</tr>
</tbody>
</table>

**KEY:**

1 = INDEPENDENT VARIABLE  
2 = RIVAL VARIABLE
Table 40. For the beam function, there was little discrimination between four variables: eatdis ($y^1 = 25.19056$), trainmo ($y^1 = 24.91188$), agetrain ($y^1 = 23.16678$), and athstat ($y^1 = -22.02465$). These four variables were about 49% more important than gymyrs ($y^1 = 16.57666$), overhelp ($y^1 = 16.28843$), bulmic ($y^1 = -15.70035$), and compfri ($y^1 = 15.08918$) in discriminating between the lower one-third beam group and the upper one-third beam group.

Table 41. For the floor exercise function, totyrs ($y^1 = 19.94473$) was nearly twice as important (100%) as gymyrs ($y^1 = -10.40304$) in discriminating between the lower one-third floor group and the upper one-third floor group. Also, totyrs ($y^1 = 19.94473$) was nearly 50% greater than agetrain ($y^1 = 14.70921$), compfri ($y^1 = -13.48657$), and complpar ($y^1 = -12.22528$) in discriminating between the lower one-third floor group and the upper one-third floor group.

Table 42. For the all around function, birth ($y^1 = 11.43571$) was nearly twice as important (100%) as year ($y^1 = 5.78404$) in discriminating between the lower one-third all around group and the upper one-third all around group. Also, birth ($y^1 = 11.43571$) was 20% more important than rank ($y^1 = 10.24428$) and 50% more important than athstat ($y^1 = -8.88342$) and prlofood ($y^1 = 7.28921$) in discriminating between the lower one-third all around group and the upper one-third all around group.
### Table 40

**Contribution of Variables in Discriminating Group Membership of Beam**

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>Standard Discriminant Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>EATDIS</td>
<td>$Y' = 25.19056$</td>
</tr>
<tr>
<td>TRAINMO</td>
<td>$Y' = 24.91188$</td>
</tr>
<tr>
<td>AGETRAIN</td>
<td>$Y' = 23.16678$</td>
</tr>
<tr>
<td>ATHSTAT</td>
<td>$Y' = -22.02465$</td>
</tr>
<tr>
<td>GYMYRS</td>
<td>$Y' = 16.57666$</td>
</tr>
<tr>
<td>OVERHELP</td>
<td>$Y' = 16.28843$</td>
</tr>
<tr>
<td>BULMIC</td>
<td>$Y' = -15.70035$</td>
</tr>
<tr>
<td>COMPFRI</td>
<td>$Y' = 15.08918$</td>
</tr>
</tbody>
</table>

**Key:**

1 = Independent Variable  
2 = Rival Variable

---

### Table 41

**Contribution of Variables in Discriminating Group Membership of Floor**

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>Standard Discriminant Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTYRS</td>
<td>$Y' = 19.94473$</td>
</tr>
<tr>
<td>AGETRAIN</td>
<td>$Y' = 14.70921$</td>
</tr>
<tr>
<td>COMPFRI</td>
<td>$Y' = -13.48657$</td>
</tr>
<tr>
<td>COMPPAR</td>
<td>$Y' = -12.22528$</td>
</tr>
</tbody>
</table>

**Key:**

1 = Independent Variable  
2 = Rival Variable
<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>STANDARD DISCRIMINANT COEFFICIENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIRTH</td>
<td>$Y' = 11.43571$</td>
</tr>
<tr>
<td>RANK</td>
<td>$Y' = 10.24428$</td>
</tr>
<tr>
<td>ATHSTAT</td>
<td>$Y' = -8.88342$</td>
</tr>
<tr>
<td>PRLOFOOD</td>
<td>$Y' = 7.28921$</td>
</tr>
</tbody>
</table>

**KEY:**
1 = INDEPENDENT VARIABLE
2 = RIVAL VARIABLE
Summary

This chapter revealed data from Pearson product moment correlation, analysis of variance, regression statistics, and discriminant functional analysis. Three relationships resulted from Pearson product moment correlations. Fifteen analyses of variance were significant at the 0.05 alpha level which was established a priori. Six of the 15 analyses of variance resulted in significant variances between rival variables. An analysis of variance was used to test for significant differences among means of the lower one-third vault, bars, beam, floor, and all around groups and the upper one-third vault, bars, beam, floor, and all around groups. Consequently, 15 null hypotheses were rejected. When a null hypothesis was rejected at the 0.05 alpha level of significance, significantly different means were observed between the two groups on various independent variables and rival variables.

Both stepwise and hierarchical methods were employed for the multiple regression analyses. Scholarship status explained 13% and 31% of the variance for vault scores and bar scores, respectively. Birth order explained 12% of the variance for beam scores. A discriminant analysis was employed for two reasons: (1) interpretation of the independent variables, and (2) classification of vault, bars, beam, floor, and all around membership into the lower one-third scoring group and the upper one-third scoring group. Three of the five dependent variables were significant as measured by Wilks' lambda and chi-square. A 95 to 100% classification of group membership into the lower one-third
scoring group and upper one-third scoring group resulted for each gymnastic event.
CHAPTER V
SUMMARY, DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

This chapter highlights the statement of the problem, the purposes of the study, research methodology, data collection, and data analysis. Specific conclusions will be formulated from those research questions and hypotheses which were statistically significant. A general conclusion will be made of the overall study, and recommendations for future research will be addressed.

Statement of the Problem
There is little information available on the positive eating behavior of athletes, and in particular, gymnasts. No studies have examined the relationship of self concept and eating behavior as predictors of gymnastic success. The problem to be explored by this study is the relationship between self concept, eating behavior, and gymnastic success of female collegiate gymnasts from Big Ten Conference teams.

Purposes of the Study
The first purpose of this study was to describe and explain the relationship between self concept, eating behavior, and gymnastic success of female collegiate gymnasts from Big Ten Conference teams. A second purpose of this study was to isolate selected rival variables which might contaminate the explanation of the dependent variable, gymnastic success.
The final purpose of this study was to predict how the two main independent variables, self concept and eating behavior, along with other independent variables, would help to explain and predict gymnastic success of Big Ten Conference gymnasts and teams.

Research Questions and Hypotheses

This study investigated three major research questions and six major research hypotheses. The major research questions were:

1. Are there relationships between gymnastic scores and Total Positive Scores on the Tennessee Self Concept Scale among Big Ten gymnasts who competed on the vault, uneven bars, balance beam, floor exercise, or all around?

2. Are there relationships between gymnastic scores and Food Choice Inventory scores among Big Ten gymnasts who competed on the vault, uneven bars, balance beam, floor exercise, or all around?

3. Is there a relationship between scores on the Tennessee Self Concept Scale and scores on the Food Choice Inventory among Big Ten Gymnasts?

The major research hypotheses (in null form) were:

1. There will be no significant differences between gymnasts in the top 33% and bottom 33% of Seasonal Average Scores from VAULT and the following variables:
   A. School Rank: freshman, sophomore, junior, or senior
   B. Scholarship Status: in-state athletic scholarship, out-of-state athletic scholarship, or non-scholarship
   C. Birth Order: first born, middle born, last born, or only child
D. School Status: affiliation to one of the six Big Ten gymnastic teams
E. Self Concept: Total Positive Score of the Tennessee Self Concept Scale
F. Eating Behavior: "Will Eat" Scale of the Food Choice Inventory

2. There will be no significant differences between gymnasts in the top 33% and bottom 33% of Seasonal Average Scores from UNEVEN BARS and the following variables:
   A. School Rank: freshman, sophomore, junior, or senior
   B. Scholarship Status: in-state athletic scholarship, out-of-state athletic scholarship, or non-scholarship
   C. Birth Order: first born, middle born, last born, or only child
   D. School Status: affiliation to one of the six Big Ten gymnastic teams
   E. Self Concept: Total Positive Score of the Tennessee Self Concept Scale
   F. Eating Behavior: "Will Eat" Scale of the Food Choice Inventory

3. There will be no significant differences between gymnasts in the top 33% and bottom 33% of Seasonal Average Scores from BALANCE BEAM and the following variables:
   A. School Rank: freshman, sophomore, junior, or senior
   B. Scholarship Status: in-state athletic scholarship, out-of-state athletic scholarship, or non-scholarship
   C. Birth Order: first born, middle born, last born, or only child
   D. School Status: affiliation to one of the six Big Ten gymnastic teams
   E. Self Concept: Total Positive Score of the Tennessee Self Concept Scale
   F. Eating Behavior: "Will Eat" Scale of the Food Choice Inventory
4. There will be no significant differences between gymnasts in the top 33% and bottom 33% of Seasonal Average Scores from FLOOR EXERCISE and the following variables:
   A. School Rank: freshman, sophomore, junior, or senior
   B. Scholarship Status: in-state athletic scholarship, out-of-state athletic scholarship, or non-scholarship
   C. Birth Order: first born, middle born, last born, or only child
   D. School Status: affiliation to one of the six Big Ten gymnastic teams
   E. Self Concept: Total Positive Score of the Tennessee Self Concept Scale
   F. Eating Behavior: "Will Eat" Scale of the Food Choice Inventory

5. There will be no significant differences between gymnasts in the top 33% and bottom 33% of Seasonal Average Scores from ALL AROUND and the following variables:
   A. School Rank: freshman, sophomore, junior, or senior
   B. Scholarship Status: in-state athletic scholarship, out-of-state athletic scholarship, or non-scholarship
   C. Birth Order: first born, middle born, last born, or only child
   D. School Status: affiliation to one of the six Big Ten gymnastic teams
   E. Self Concept: Total Positive Score of the Tennessee Self Concept Scale
   F. Eating Behavior: "Will Eat" Scale of the Food Choice Inventory

6. Between gymnasts who ranked in the top 33% of Seasonal Average Scores and those who ranked in the bottom 33% of Seasonal Average Scores on vault, uneven bars, balance beam, floor exercise, or all around, there
will be no significant differences in these descriptive characteristics:

A. **Training**

The Collegiate Gymnastics Profile sought information on training variables. These rival variables were:

1. number of training months per year in gymnastics
2. years of competitive experience in gymnastics
3. total years of gymnastic participation, including competitive experience
4. number of competitions per season attended by one or both parents
5. number of competitions per season attended by a close friend of either sex

B. **Eating Behavior**

The Collegiate Gymnastics Profile sought information on eating behavior. These rival variables were:

1. number of gymnasts who sought professional help for symptoms of anorexia nervosa
2. number of gymnasts who sought professional help for symptoms of bulimia
3. number of gymnasts who sought professional help for symptoms of overweight
4. number of gymnasts who were satisfied with their eating habits
5. number of gymnasts who were satisfied with their body weight
6. number of gymnasts who were satisfied with their body fat

The Eating Awareness Inventory sought information on eating behavior. These rival variables were:
(1) number of morning meals eaten in a typical week
(2) number of midday meals eaten in a typical week
(3) number of evening meals eaten in a typical week
(4) typical habits concerning the largest meal of the day

Research Methodology

Since subjects self-selected the levels of the independent variables, or in some cases the levels were naturally occurring, the independent variables could not be manipulated. Since independent variables could not be manipulated, the researcher was required to use an *ex post facto* research design. Kerlinger (1966) defined *ex post facto* as "that research in which the researcher starts with the observation of a dependent variable or variables. He/she then studies the independent variables in retrospect for their possible relation to, and effect on, the dependent variable or variables." Thus, this survey did two things: (1) observed the dependent variable "first", then sought ways to explain how the independent variables were affecting the dependent variable, and (2) investigated rival variables which might explain the dependent variable. These were major concerns because neither random selection nor random assignment of treatments could be used.

The researcher studied six independent variables: self concept, eating behavior, school rank, scholarship status, birth order, and school status, plus one dependent variable, gymnastic success. The predictive capabilities of each of the independent variables on the dependent variable, gymnastic success, were investigated.
There were two concerns for this *ex post facto* research. One, the researcher attempted to control or account for extraneous variables which might contaminate the explanation of the dependent variable. Van Dalen (1979) explained that a single critical factor is rarely found when working with complex social phenomena, because events usually have multiple rather than single "causes". He advocated that researchers need to have considerable knowledge of the phenomena under investigation if they are going to recognize significant trends and associations in their research. In fact, a phenomenon may result not only from multiple causes but also from one "cause" in one instance and from another "cause" in another instance.

The second concern for this *ex post facto* research was the interpretation of results. Correlations between the independent variables could not be interpreted as causation. Instead, correlations were interpreted as measures of relationships between the dependent variable and the independent variables, expressed as correlation coefficients. Wambrod and Miller (1974) stated: "Since in conducting ex post facto research, the investigation does not have the power to manipulate variables, internally valid explanations of outcomes -- that is, cause-effect explanations -- are for all practical purposes impossible."

In this study, since rival variables were accounted for and measured by the sixth research hypothesis, internal validity was not threatened. Wambrod (1981) claimed:

If the analysis indicates that the rival (extraneous) variables are not related to the dependent variable, findings concerning the relationship between the major independent variable or variables and the dependent variable are strengthened in terms
of internal validity. On the other hand -- which is more frequently the case -- if the analysis indicates that some or all of the extraneous variables are related to the dependent variable, interpretation of the findings pertaining to the major hypotheses must be qualified by the findings concerning the variables specified in the alternative hypotheses.

Data Collection

Once approval to conduct the study was granted by the Human Subjects Review Committee at The Ohio State University, the researcher wrote the Big Ten athletic directors for their support, then telephoned the Big Ten gymnastic coaches to determine their interest in the research project. Between Thanksgiving and Christmas, 1987, each of the six Big Ten gymnastic coaches was sent a Research Testing Package. The package contained a cover letter to the coach, an oral script for the research proctor, and a Research Testing Packet for each gymnast. Each team consisted of eight to twelve gymnasts.

Fifty-six gymnasts volunteered to participate in the study. They represented: Michigan State University (East Lansing, Michigan); The Ohio State University (Columbus, Ohio); University of Illinois (Urbana, Illinois); University of Iowa, (Iowa City, Iowa); The University of Michigan (Ann Arbor, Michigan); and University of Minnesota (Minneapolis, Minnesota). The University of Wisconsin declined to participate in the study. Purdue University, Northwestern University, and University of Indiana do not have women's gymnastic teams.

The study was conducted in December, 1987. Prior to gymnastic practice, the gymnastic teams were taken to a classroom by their coaches to participate in the research session. The testing began when the proctor read the oral script to the gymnastic team, then distributed one
Research Testing Packet to each gymnast in the room. Gymnasts first were instructed to read their cover letters attached to their Research Testing Packets before volunteering to participate in the study.

Gymnasts were asked to complete four research questionnaires from their Research Testing Packet. They were: (1) Collegiate Gymnastics Profile, (2) Tennessee Self Concept Scale, (3) Food Choice Inventory, and (4) Eating Awareness Inventory. The four questionnaires together took a minimum of 35 and a maximum of 50 minutes to complete. When finished, gymnasts were instructed by the cover letter to: (1) return their completed (or uncompleted) instruments to their original manila envelope, (2) place their first and last names in the upper left hand corner of their mailing envelope (return address position), (3) remove the cover letter from the back of their envelope, and (4) secure the clasp and hand their sealed envelope to the proctor. All manila envelopes had 90 cents (third class postage) affixed to them, so the proctor could mail them separately back to the researcher without any effort or expense.

Data Analysis

Statistical analyses were completed by computer using the SPSS statistical software (Nie et al., 1975; Norusis, 1986). Descriptive statistics included measures of central tendency. Inferential and correlational statistics included correlational analysis, analysis of variance, multiple regression analysis, and discriminant analysis. The 0.05 alpha level was established a priori for this study.
Discussion and Implications of Significant Results:

Dependent Variables

Ary et al. (1985) emphasized the importance of distinguishing between results and conclusions. Results are direct observations summarized and integrated by statistical analysis, whereas conclusions are an inference based on the results, expressed in terms of the objectives or hypotheses of the study.

Data from three research questions and six research hypotheses revealed that there were three relationships between variables and fifteen statistically significant differences between groups. Taken collectively, the results were neither conclusive nor definitive, but they were consistent and compelling. For example, the vault event was correlated with self concept, and there were three statistically significant differences between vault groups. The uneven bar event had two statistically significant differences between groups. The balance beam event was correlated with Low Nutrient Foods, and there were three statistically significant differences between beam groups. The floor exercise event had three statistically significant differences between groups. The all around event had four statistically significant differences between groups. Finally, two independent variables were correlated without regard to the dependent variable; Total Positive Score (self concept) and High Nutrient Foods had a low, positive association of +0.25.

In order to accomplish the research purposes which were established at the onset of this project, the researcher conceptually observed the dependent variable first, then looked back at the independent variables
to see how the latter contributed separately and collectively to explain and predict the former. In order to observe the dependent variable, this discussion is divided into five parts: vault, uneven bars, balance beam, floor exercise, and all around. Within each section, the primary, secondary, and rival variables are explained whenever statistically significant differences existed between the lower one-third and upper one-third groups on a gymnastic event. By collapsing all the statistically significant independent variables onto a dependent variable, trends and conclusions are better visualized.

Vault

In the vault event, a positive, moderate association ($r = +0.30$) was found between vault scores and the Total Positive Score of the Tennessee Self Concept Scale. Further statistical analysis revealed that there was a significant difference in self concept between the lower one-third and upper one-third vault groups. The low-scoring vault group averaged 334.92 on the Total Positive Score of the Tennessee Self Concept Scale, whereas the top-scoring vault group averaged 361.55 on the Total Positive Score of the Tennessee Self Concept Scale. Consequently, the lower scorers had lower self concept scores, and the top scorers had higher self concept scores. Even though both groups scored above and below the averages set by Fitts (1964), each group had good self concept scores. The fact that there was a significant difference between the lower one-third and upper one-third groups was remarkable in light of this homogeneous, intact sample of collegiate gymnasts.
The fact that self concept played a role in explaining vault scores, and not the other gymnastic events, was at first confusing. However, two rival independent variables helped to interpret vault success: years of experience in gymnastic competition and number of competitions attended by one or both parents during the season. In the first rival independent variable, there was a significant difference of 1.28 years in competitive experience between the lower one-third and upper one-third vault groups. The lower one-third vault group had 9.08 years of competitive experience, whereas the upper one-third vault group had 10.36 years of competitive experience. One more year of vaulting experience helped gymnasts in the upper one-third group to score better. Since vaulting has become increasingly more difficult over the years, gymnasts with an additional year of vault training may have had an opportunity to develop physical skills such as sprint speed, explosive leg power, and vaulting technique more fully than gymnasts with less experience.

To add a psychological component of self concept to vault success, one wonders if a strong self concept precedes a gymnast's ability to vault or if increased vaulting experience generates an increased self concept. Both situations may have occurred with gymnasts in the present study.

Another rival variable which was statistically significant for vault was the number of competitions attended by one or both parents during the competitive season. Parental support at competitions may play a significant role in the self concepts of gymnasts, and ultimately, vaulting success. Lower-scoring vaulters had only 2.7 visits by one or both parents at competitions, whereas the higher-scoring vaulters had
6.73 visits by one or both parents at competitions. Brookover et al. (1967) claimed that "It is the individual's interpretation of the expectations and acts of others which most influence his/her behavior." Fitts (1971) emphasized that "the more optimal the self concept the more effectively the individual will function...improvement in the self concept will result in improved behavioral performance."

When several independent variables were entered into a stepwise multiple regression for vault, the best predictor for vault scores was scholarship status. Scholarship status accounted for 13% of the variance in vault scores. There was a significant negative influence on vault scores \( B = -0.361305 \), which indicated that lower-scoring vaulters received in-state scholarships and higher-scoring vaulters received out-of-state scholarships. Self concept was the next independent variable with the most influence on vault scores. There was a positive influence \( B = 0.335348 \), but it was not significant. Thus, the latter variable could not be used as a predictor of vault success.

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**Uneven Bars**

In the bar event, two independent variables were significant: scholarship status and school status. In the lower one-third bar group, 13 gymnasts received out-of-state scholarships, and some of them received no scholarships. In contrast, 13 gymnasts in the upper one-third bar group received in-state scholarships, and in some cases, out-of-state scholarships. When several independent variables were entered into a stepwise multiple regression for bars, the best predictor for bar scores was scholarship status. Scholarship status accounted for 31% of the
variance in bar scores. There was a significant negative influence on bar scores ($B = -0.592494$), which indicated that low-scoring bar performers received in-state scholarships and top-scoring bar performers received out-of-state scholarships.

The fact that there was a significant difference in scholarship status between the lower one-third and upper one-third bar groups was not surprising. Coaches may need to seek more extensively for potentially successful recruits on the uneven bars. Although coaches need to recruit gymnasts for each gymnastic event, successful bar performers are in the most demand due to major changes in the bar event. Over the years, uneven bar routines have changed to a distinctly different style of swinging movements, release movements, and handstand movements. With these changes, gymnasts have had to respond with greater strength and endurance, comparable to no other gymnastic event. Consequently, that explains why the best predictor for bar scores was scholarship status.

According to the stepwise multiple regressions, self concept was the next independent variable with the most influence on bar scores. There was a positive influence ($B = 0.266938$), but it was not significant. Thus, self concept could not be used as a predictor of bar success.

Another independent variable, school status, needs little explanation with regard to success on the bars. Simply, the lower one-third of bar scorers were more likely to be members of Big Ten schools with lower Seasonal Average Scores, whereas the upper one-third of bar scorers were more likely to be members of Big Ten schools with higher Seasonal Average Scores.
Balance Beam

In the beam event, a negative moderate association (r = -0.37) was found between beam scores and the number of Low Nutrient Foods from the "Will Eat" category of the Food Choice Inventory. Gymnasts who scored higher on balance beam preferred more High Nutrient Foods, whereas gymnasts who scored lower on balance beam preferred more Low Nutrient Foods. Further statistics revealed that there was a significant difference in Low Nutrient Foods between the lower one-third and upper one-third beam groups. The low-scoring beam group averaged 11 out of 15 possible Low Nutrient Foods, whereas the top-scoring beam group averaged 3.8 out of 15 possible Low Nutrient Foods. Consequently, the lower scorers on beam preferred to eat more junk foods compared to higher scorers on beam.

One rival independent variable added clarity to these findings. Results showed that there was a significant difference in body fat satisfaction between the lower one-third group and upper one-third group on beam. Generally on the Collegiate Gymnastics Profile, the lower one-third group (N = 10) indicated that they were not satisfied with their body fat, whereas the upper one-third beam group (N = 11) indicated that they were satisfied with their body fat. Since dietary fat provides nine kilocalories of energy for every gram of fat consumed, gymnasts who consume primarily high fat diets will tend to have more body fat. Carbohydrates and proteins each provide approximately four kilocalories of energy for every gram consumed. The Senate Select Committee on Nutrition and Human Needs (1977) has advocated that American diets consist of 60% carbohydrates, 10% proteins, and 30% fats. Since
gymnastics is an anaerobic sport, gymnasts utilize carbohydrates as a primary source of fuel. In order to utilize fats as a predominant source of fuel, gymnasts would need to participate in aerobic activities beyond gymnastic workouts. For example, those gymnasts desiring both fat and weight reduction could engage in low-intensity aerobic activity for a minimum of twenty minutes, three times per week. Aerobic workouts in excess of 30 minutes, five times per week, would result in greater losses of body fat as long as dietary calories were decreased simultaneously.

Another independent variable, school status, needs little explanation with regard to success on the beam. Simply, the lower one-third of beam scorers were more likely to be members of Big Ten schools with lower Seasonal Average Scores, whereas the upper one-third of beam scorers were more likely to be members of Big Ten schools with higher Seasonal Average Scores.

In a stepwise multiple regression, birth order accounted for 12% of the variance in beam scores. However, beta weights for beam (B = -.398185) revealed no significant influence for birth order. Thus, birth order could not be used as a predictor of beam success. In fact, birth order results remain inconclusive.

Floor Exercise

In the floor exercise event, one secondary independent variable (school status) and two rival variables (number of training months and body weight satisfaction) were statistically significant. School status needs little explanation with regard to success on floor exercise. Simply, the lower one-third of scorers on floor exercise were more likely
to be members of Big Ten schools with lower Seasonal Average Scores, whereas the upper one-third of scorers on floor exercise were more likely to be members of Big Ten schools with higher Seasonal Average Scores.

A significant difference existed in number of training months between the lower one-third and upper one-third of scorers on floor exercise. The lower one-third group trained an average of 11.82 months per year, whereas the upper one-third group trained an average of 10.70 months per year. The fact that the top-scoring gymnasts trained one month less per year than the lower-scoring gymnasts was surprising. Perhaps higher-scoring gymnasts, who generally performed multiple somersaults in their floor exercise routines, had more chronic injuries to rehabilitate during the non-competitive season. Additionally, the lower one-third group may have needed the extra month to learn more difficult skills and to choreograph new floor exercise routines for the next season. It is also possible that mental burnout played a role in the fewer training months of the top-scoring gymnasts.

A significant difference existed in body weight satisfaction between the lower one-third group and upper one-third group in floor exercise. The lower one-third group (N = 11) was not satisfied with their body weight, whereas the upper one-third group (N = 10) was satisfied with their body weight. Since gymnastics is an aesthetic sport, one would expect all gymnasts to be concerned about their physical appearance. Fortunately in this study, there were several Big Ten gymnasts who found their body weight acceptable. The top-scoring gymnasts on floor exercise perceived themselves to have acceptable body weights, whereas the lower-
scoring gymnasts on floor exercise perceived themselves to be overweight.

All Around

In the all around event, three independent variables and one rival variable were statistically significant between the lower one-third group and upper one-third group. School status needs little explanation with regard to success in the all around event. Simply, the lower one-third of all around scorers were more likely to be members of Big Ten schools with lower Seasonal Average Scores, whereas the upper one-third of all around scorers were more likely to be members of Big Ten schools with higher Seasonal Average Scores.

A significant difference existed in scholarship status between the lower one-third and upper one-third scorers in the all around event. All around gymnasts in the lower one-third group received out-of-state scholarships, whereas all around gymnasts in the upper one-third group received both in-state and out-of-state scholarships. Since most coaches try to recruit all around gymnasts instead of one-event specialists to add depth of talent to their teams, the better all around gymnasts received both in-state and out-of-state scholarships.

A significant difference existed in birth order between the lower one-third and upper one-third groups in the all around event. All around gymnasts in the lower one-third group tended to be middle-born children, whereas all around gymnasts in the upper one-third group tended to be first-born children. Although research is divided on the assessment of birth order, first borns tend to be more achievement oriented (Forer, 1976; Clark, 1982). Hence, the top scorers in the all around event were
first-born children. The fact that birth order did not play a significant role in the other gymnastic events was puzzling.

A significant difference in body weight satisfaction existed between the lower one-third and upper one-third all around groups. Eight gymnasts from the lower one-third all around group were not satisfied with their body weight, but eight gymnasts from the upper one-third all around group were satisfied with their body weight. The extent to which body weight satisfaction played a role in all around success was difficult to assess, because it was not a predictor variable in the stepwise regression analysis. However, the following ideas are possible: (1) gymnasts who like their physical appearance may carry themselves more confidently during their gymnastic performances, thus affecting their mental concentration, and ultimately their scores; (2) gymnasts with lower body weights would have a higher muscular strength to body weight ratio, thus having the fitness to perform more difficult skills (Giese, 1980); and, (3) gymnastic judges might unconsciously award the higher scores to gymnasts with more aesthetic-looking body shapes and sizes.

Discussion and Implications of Significant Results:

Independent Variables

In the previous section, entitled Discussion and Implications of Significant Results: Dependent Variables, gymnastic success was explained in five sections: vault, uneven bars, balance beam, floor exercise, and all around. The following discussion is organized by the independent variables as a final way to discuss trends and conclusions.
In this study, primary independent variables were: (1) Self Concept, and (2) Eating Behavior. The secondary independent variables were: (1) School Rank, with four levels: freshman, sophomore, junior, and senior; (2) Scholarship Status, with three levels: in-state athletic scholarship, out-of-state athletic scholarship, and non-scholarship; (3) Birth Order, with four levels: first born, middle born, last born, and only child; and (4) Big Ten School Status with six levels: Michigan State University, The Ohio State University, University of Illinois, University of Iowa, The University of Michigan, and University of Minnesota. In addition, fifteen rival independent variables were investigated.

Six of the 15 rival variables were statistically significant in explaining differences between the lower one-third scoring groups and the upper one-third scoring groups. There were no consistent trends in these rival variables. However, there were consistent trends in some of the independent variables.

**Self Concept**

Self concept, a primary independent variable, was a significant factor only in determining the difference between low-scoring and top-scoring vaulters. Self concept was not a significant variable on any other gymnastic event. Also, there was a significant difference between two rival variables, compyrs and comppar, when comparing vault groups. Hence, gymnasts who had higher self concept scores had more years of competitive gymnastic experience (compyrs) and more competitions attended by one or both parents during the season (comppar). A discriminant
analysis showed that total combined years of gymnastic participation and competition (totyrs) was 25% more important than years of gymnastic participation (gymyrs) and 50% more important than self concept in discriminating between the lower one-third vault groups and the upper one-third vault groups. Thus, self concept was descriptive of vault success.

Eating Behavior

Eating behavior, a primary independent variable, was determined from three categories of the Food Choice Inventory (Total Foods, Low Nutrient Foods, and High Nutrient Foods), as well as several rival variables from the Collegiate Gymnastics Profile. There was a significant difference in the number of Low Nutrient Foods consumed by the lower one-third and upper one-third groups on the balance beam, only. Eating behavior was not a significant variable on any other gymnastic event. In addition, there was a significant difference in one rival variable, the number of gymnasts who were satisfied with their bodyfat (fatsatis). Thus, gymnasts in the lower one-third group who ate a majority of Low Nutrient Foods were not satisfied with their body fat. A discriminant analysis showed that medical diagnosis of an eating disorder (eatdis) was 49% more important than seeking professional help for problems of overweight (overhelp) and 49% more important than seeking professional help for problems of bulimia (bulmic) in discriminating between the lower one-third and upper one-third beam groups. Thus, eating behavior was descriptive of beam success.
Even though one-half of the gymnasts did not like their body weight when surveyed by the Collegiate Gymnastics Profile, an eating disorder problem was not determined in this population. According to data from the Collegiate Gymnastics Profile, when all 56 gymnasts were asked the question: "Have you ever sought professional help for overweight problems?", eight gymnasts (14.3%) responded "yes" and 48 gymnasts (85.7%) responded "no". When all 56 gymnasts were asked the question: "Have you ever sought professional help for symptoms of anorexia nervosa?", one gymnast (1.8%) responded "yes" and 55 gymnasts (98.2%) responded "no". When all 56 gymnasts were asked the question: "Have you ever sought professional help for symptoms of bulimia?", seven gymnasts (12.5%) responded "yes" and 49 gymnasts (87.5%) responded "no". In all three survey questions, gymnasts were given the option to respond to a third answer, "would not like to admit". However, no gymnasts selected that response.

In this study, gymnasts were urged to complete two questionnaires which emphasized their eating awareness and eating practices. Specifically, the Food Choice Inventory emphasized the characteristic, repetitive patterns of food consumption (eating practices). Gymnasts were asked whether they would eat certain foods from a list containing 25 High Nutrient Foods and 15 Low Nutrient Foods. The Eating Awareness Inventory asked gymnasts about their eating awareness, which emphasized with whom, why, how, when, and where they ate. Richards (1982) suggested that "The Eating Awareness Inventory should be administered to sample groups which reflect varying demographic.... characteristics to determine similarities and differences in patterns of eating practices."
Glaringly absent in gymnastics research has been a positive approach to characterizing healthy, successful gymnasts. Instead, interventions have had a "problem" theme. The rationale for choosing this approach has been if some gymnasts have eating disorders, then most gymnasts must have eating disorders. Fortunately, a majority of Big Ten gymnasts was not troubled by eating disorders. However, many gymnasts were troubled by their self perception of acceptable eating habits, body weight, and body fat. In the present study, 25 gymnasts (44.6%) reported satisfaction with their eating habits, and 31 gymnasts (55.4%) reported dissatisfaction with their eating habits. Similarly, 26 gymnasts (46.4%) reported a satisfaction with their body weight, and 30 gymnasts (53.6%) reported a dissatisfaction with their body weight. When asked about their body fat, 21 gymnasts (38.9%) reported satisfaction, 31 gymnasts (57.4%) reported dissatisfaction, two gymnasts (3.7%) responded "Would not like to admit", and two gymnasts (3.7%) chose not to respond at all. Since "satisfaction" and "dissatisfaction" responses are related to body perception and possibly self concept, further research is needed on the psychological aspects of eating behaviors.

Whereas many researchers would choose to highlight the negative responses of gymnasts in order to highlight a problem or weakness, this researcher preferred to emphasize the fact that many gymnasts have good psychological health (self concept) and physiological health (eating behaviors). In this study, there was a positive low association (r = +.25) between self concept and eating behaviors. Thus, gymnasts with higher self concepts tended to have better eating behaviors, whereas gymnasts with lower self concepts tended to have poorer eating behaviors.
Gymnasts who have positive self concepts and practice good eating behaviors are important role models to other gymnasts.

In the present study when all 56 gymnasts were asked about their health status from a mental and physical perspective (excluding any injuries), 12 gymnasts (21.4%) reported "excellent", 33 gymnasts (58.9%) reported "good", nine gymnasts (16.1%) reported "average", two gymnasts (3.6%) reported "fair", and no gymnasts reported "poor". Thus, 80% of the gymnasts reported excellent or good health status. When asked about their injury status, 18 gymnasts (32.1%) reported that they had an injury limiting their participation in the first competition of the season, whereas 38 gymnasts (67.9%) reported that they had no injuries limiting their participation in the first competition of the season. Obviously, not every gymnast can report excellent or good health status on a daily basis, but it should be the priority of coaches to maximize both physical and mental preparation of gymnasts during gymnastic practice. Marsden (1983) suggested that "psychological training should be applied just like physiological training, regular and systematical [sic]."

When gymnasts in the present study were asked whether their teams participated in group nutrition education programs, 29 gymnasts (51.8%) reported "no", but a remarkable 48.2% (N = 27) reported "yes". Upon careful analysis, the researcher found that only one Big Ten gymnastic team had a unanimous "yes" response to that question. Unfortunately, gymnasts from other schools did not consistently perceive what constituted "team participation" in nutrition education programs. Furthermore, all Big Ten gymnasts reported a wide range of people from
whom they obtained the most current nutrition information. Responses included: self (N = 17); gymnastic coach (N = 9); nutritionist (N = 7); gymnastic teammate (N = 5); parent (N = 5); college professor/instructor (N = 4); friend (N = 4); roommate (N = 3); registered dietician (N = 1); and other family members besides parents (N = 1). While gymnasts should learn as much as they can about nutrition, one questions the authenticity of information that was learned from gymnast to gymnast in the Big Ten Conference. Ideally, gymnasts should receive individual and group instruction in sport nutrition to ensure common eating practices and behaviors from gymnast to gymnast and from team to team.

Support to this suggestion was found when Big Ten gymnasts were asked from what one source they obtained the most current nutrition information. Responses included: personal reading of magazines and journals (N = 20); gymnastic team meetings (N = 10); home (N = 8); food labels (N = 6); weight control programs (N = 5); formal college courses (N = 4); personal reading of newspapers (N = 1); and television (N = 1). One gymnast reported no interest in nutrition.

School Rank

School rank, a secondary independent variable, was not significant in determining differences between any low-scoring or top-scoring group on any gymnastic event. Simply, whether gymnasts were freshmen, sophomores, juniors, or seniors did not matter with regard to vault success, bar success, beam success, floor exercise success, or all around success.
Scholarship Status

Scholarship status, a secondary independent variable, was a significant factor in determining differences between low-scoring and top-scoring gymnasts on two events only: uneven bars and all around. Generally speaking, the better scorers tended to receive in-state scholarships. In fact, in the bars event, scholarship status accounted for a significant 31% of the variance in scores. In the all around event, a discriminant analysis showed that scholarship status (athstat) was one of several variables discriminating between the lower one-third and upper one-third all around groups, but birth order was the top discriminator. Thus, scholarship status helped to explain both bar success and all around success.

Birth Order

Birth order, a secondary independent variable, was a significant factor in determining the differences between low-scoring and top-scoring gymnasts in the all around event, only. Top-scoring all around gymnasts tended to be first-born children, whereas the low-scoring all around gymnasts tended to be middle-born children. A discriminant analysis showed that birth order was 20% more important than school status and 50% more important than scholarship status in discriminating between the lower one-third all around group and the upper one-third all around group. Birth order was not a significant variable in any other gymnastic event. Birth order accounted for 12% of the variance in beam
scores when a multiple regression analysis was computed. It was significant at the 0.05 alpha level.

School Status

School status, a secondary independent variable, was a significant factor in determining the differences between low-scoring and top-scoring gymnasts in four of the five gymnastic events: uneven bars, balance beam, floor exercise, and all around. School status was not a significant variable for vault. Low-scoring gymnasts tended to come from schools with lower Seasonal Average Scores, whereas the top-scoring gymnasts tended to come from schools with higher Seasonal Average Scores.

Conclusions

The importance of this study derives from the fact that the major variables under investigation, self concept and eating behavior, have been proposed as vital components of gymnastic success, yet the actual relationships between them have been generally neglected in the gymnastic literature.

In view of the research that has been completed to date, this study makes a strong contribution to the current body of knowledge in gymnastics. This investigation may be one of the first (if not the first) studies to examine eating behaviors among collegiate gymnasts. Van Dalen (1979) described descriptive research "as a tool that is used to locate significant variables in the field.... After the variables are identified, experiments may study them under more rigorous conditions."
This study went beyond descriptive survey research, which simply measures factors and variables without questioning why they exist, into ex post facto research.

Moreover, this investigation may be the first to explore and describe the relationship between self concept and eating behavior within an athletic environment. Sanborn and Hartman (1964) contented that the mental and physical components of health cannot be isolated or separated, because they are interdependent. To date, no studies on gymnastics have shown conclusively that the synergism between "a sound mind in a sound body" (Locke, 1965) is thoroughly substantiated. This study focused on the fact that the two main independent variables under investigation, eating behavior and self concept, have been proposed as components of a sound mind in a sound body, yet the actual relationship between them generally have been neglected in the sport of gymnastics. The present study revealed a low, positive association ($r = +.25$) between self concept and eating behavior.

Lastly, this investigation may be the first to identify statistically significant independent and rival variables from both a psychological and physiological perspective in order to predict gymnastic success. There has been a continual debate concerning the extent to which gymnasts of various talents possess similar or dissimilar personalities. This study lent understanding to similarities and differences of female collegiate gymnasts in the Big Ten Conference.

As a result of this study, five conclusions can be drawn: (1) self concept helped to explain vault success, (2) eating behavior helped to explain balance beam success, (3) scholarship status helped to explain
uneven bar success and all around success, (4) birth order helped to explain all around success, and (5) school status helped to explain uneven bar success, balance beam success, floor exercise success, and all around success.

Since many different independent variables helped to describe the dependent variable, gymnastic success, a multidimensional model was necessary. Such a model included independent variables with psychological and physiological characteristics in order to explain and predict gymnastic success. Regression statistics found only three significant predictors for gymnastic success. These predictors were scholarship status for vault, scholarship status for uneven bars, and birth order for balance beam. Morgan (1979) claimed:

Any dependent variable that accounts for 20-45% of the variance should theoretically be useful in predicting behavior if utilized in concert with other dependent measures.... It is also clear that a multidimensional model consisting of psychological states and physiological variables will consistently account for more of the unexplained variance.

Since gymnastic success was measured throughout the season by Seasonal Average Scores, the researcher was confident that the data were reliable for characterizing each gymnast. This built-in reliability factor gave the statistical results more credence than other studies which have defined success from one competition or contest only. Equally impressive was the narrow range of Seasonal Average Scores on each event that were used to divide gymnasts into the lower one-third and upper one-third groups. Given that this intact population of Big Ten gymnasts could not be manipulated for the levels of the independent and rival variables, and given the narrow range of Seasonal Average Scores, one might initially hypothesize that few significant differences would result
between similar scoring groups. However, this was not the case. Significant differences between low-scoring gymnasts and top-scoring gymnasts occurred in 15 cases. In short, the null hypothesis was rejected at the 0.05 alpha level for nine independent variables and six rival variables.

Discriminant analysis provided a promising model for the identification and classification of female collegiate gymnasts into a good calibre and elite calibre group. A 95% to 100% correct classification of group membership into the lower one-third scoring group and upper one-third scoring group was remarkable for this homogeneous group of athletes. Future research should investigate the efficacy of utilizing this multivariate model for characterization of gymnasts from different college conferences, different gymnastic programs, different age groups, different ability levels, and different gymnastic events.

Recommendations

As a result of this study, the following recommendations are offered:

1. Since the lower one-third and upper one-third vault groups were significantly different on the variable, self concept, more studies with vaulters should be done to determine why vault success occurs more often to gymnasts with higher self concepts. Gymnasts from other collegiate conferences and younger gymnasts from private gymnastic clubs should be surveyed to determine their self concepts as related to vault success.
2. A serious limitation of this study was that it utilized self report measures rather than actual behavioral assessments from subjects, particularly in eating behaviors. Future research should investigate the relationship between all scores on the Food Choice Inventory and the actual food consumption of gymnasts for five to seven days. This might help to explain why eating behavior was only related to balance beam success in the present study, and whether food consumption patterns are similar or different between gymnasts who compete on other gymnastic events.

3. Future studies should correlate all aspects of the Food Choice Inventory with all subscales of the Tennessee Self Concept Scale to determine if additional significant relationships occur between eating behavior and self concept. In the present study, a low positive correlation ($r = +.25$) was found between the Low Nutrient Foods of the Food Choice Inventory and the Total Positive Score of the Tennessee Self Concept Scale. Research needs to further define this relationship for gymnasts in different gymnastic populations across the country.

4. Both female and male gymnasts should be evaluated to determine if any pre-test to post-test changes occur in their eating behaviors as a result of nutrition education sessions. The Eating Awareness Inventory would generate good data on where, when, why, how, and with whom gymnasts eat. The Food Choice Inventory and dietary recalls would generate good data on what foods gymnasts eat. In short, use of these instruments and
other available resources could provide valuable information on the knowledge, attitudes, and behaviors of collegiate gymnasts.

5. Team sessions which emphasize common knowledge, attitudes, and behaviors on nutrition should be an integral part of the gymnastic training program. Gymnasts who have healthful eating behaviors could serve as positive role models to other gymnasts who receive inaccurate nutrition information and/or practice poor eating behaviors. Coaches who encourage these healthy gymnasts about their positive eating behaviors might influence other gymnasts to practice better eating behaviors. Too often, these healthy gymnasts are obstructed from serving as exemplary role models to other gymnasts because of individual jealousies, team competitiveness, peer pressure, and even poor restaurant choices by their coaches on roadtrips, to name a few.

6. In addition to nutrition education, health education classes in self concept, time management, stress management, and injury prevention should be offered to collegiate gymnasts on a weekly basis to encourage them to practice positive psychological and physiological behaviors. By incorporating educational sessions during gymnastic practices, coaches would remind their gymnasts that good health behaviors are an important foundation to their training.

7. Gymnasts who report a lack of satisfaction with their body weight and/or body fat should be further tested for potential eating disorders, and specifically, low self concepts. Both psychological
counseling and nutrition counseling should be provided for these gymnasts on an individual basis and on a group basis with their teammates.

8. Since coaches serve as ultimate role models to their gymnasts, coaches need to be evaluated with regard to their own self concepts and eating behaviors. Studies should be designed to determine any significant differences between male and female gymnastic coaches, and between college and private club coaches. Ultimately, the knowledge, attitudes, and behaviors of gymnastic coaches could have a profound influence on the success of their individual gymnasts and teams.
BIBLIOGRAPHY


Zilboorg, G. (1941). Psychosomatic medicine: A historical perspective. Psychosomatic Medicine, 6, 1-16.
APPENDIX A:

COLLEGIATE GYMNASTICS PROFILE
COLLEGIATE GYMNASTICS PROFILE

DIRECTIONS: Please answer each item as honestly as possible by circling the letter of the best response or by filling in the blank. If unsure about a question, make an educated guess. Do not leave any items blank.

1. Name of your school:
   1. UNIVERSITY OF ILLINOIS
   2. UNIVERSITY OF IOWA
   3. UNIVERSITY OF MICHIGAN
   4. MICHIGAN STATE UNIVERSITY
   5. UNIVERSITY OF MINNESOTA
   6. OHIO STATE UNIVERSITY
   7. UNIVERSITY OF WISCONSIN

2. Current year in school:
   1. FRESHMAN
   2. SOPHOMORE
   3. JUNIOR
   4. SENIOR

3. Your age: ___YEARS

3. Number of brothers and sisters in your family (not including yourself): ___SIBLINGS

4. Your birth order:
   1. FIRST BORN
   2. MIDDLE BORN, NOT FIRST BORN OR LAST BORN
   3. LAST BORN
   4. ONLY CHILD

5. Your family status:
   1. PARENTS MARRIED; TOGETHER
   2. PARENTS APART; LIVING WITH MOTHER
   3. PARENTS APART; LIVING WITH FATHER
   4. FATHER DECEASED; LIVING WITH MOTHER
   5. MOTHER DECEASED; LIVING WITH FATHER
   6. OTHER
6. Your parents' combined estimated yearly earnings:
   1. LESS THAN $10,000
   2. $10,000 TO 19,999
   3. $20,000 TO 29,999
   4. $30,000 TO 39,999
   5. $40,000 TO 49,999
   6. $50,000 TO 59,999
   7. $60,000 TO 69,999
   8. MORE THAN $69,999
   9. WOULD NOT LIKE TO ADMIT
   10. HAVE NO IDEA

7. How is your education being financed? (Circle as many as apply)
   1. PAYING FOR SCHOOL YOURSELF
   2. PARENT(S) PAYING FOR SCHOOL
   3. LOAN
   4. GRANT
   5. ACADEMIC SCHOLARSHIP
   6. GIFT FROM FAMILY OR FRIEND
   7. FOUR YEAR ATHLETIC SCHOLARSHIP

8. Your athletic status:
   1. IN-STATE SCHOLARSHIP ATHLETE
   2. OUT-OF-STATE SCHOLARSHIP ATHLETE
   3. NON-SCHOLARSHIP ATHLETE

9. At the present time, do you have an injury that would limit your ability to compete:
   1. YES
   2. NO

10. Other than any injuries, how would you rate your current health status from a mental and physical perspective:
    1. EXCELLENT HEALTH STATUS
    2. GOOD HEALTH STATUS
    3. AVERAGE HEALTH STATUS
    4. FAIR HEALTH STATUS
    5. POOR HEALTH STATUS
11. Age when you took your first gymnastics lessons or training: 

   __YEARS

12. Number of training months per year in gymnastics: 

   __MONTHS

13. Years of participation in competitive gymnastics: 

   __YEARS

14. Total years of participation in gymnastics, including competitive gymnastics: 

   __YEARS

15. Number of competitions per season attended by one or both parents: 

   __MEETS

16. Number of competitions per season attended by close friend (either sex): 

   __MEETS

17. From what one source do you obtain the most current information about nutrition:

   1. PERSONAL READING OF MAGAZINES/JOURNALS
   2. PERSONAL READING OF NEWSPAPERS
   3. GYMNASTICS TEAM MEETINGS
   4. RADIO
   5. TELEVISION
   6. WEIGHT CONTROL PROGRAMS
   7. HEALTH FOOD STORES
   8. FOOD LABELS
   9. FORMAL COLLEGE COURSES
  10. HOME
  11. NOT INTERESTED IN NUTRITION
18. From whom do you obtain the most current information about nutrition:
   1. YOURSELF
   2. GYMNASTICS COACH
   3. GYMNASTICS TEAMMATE
   4. ROOMMATE
   5. FRIEND
   6. PARENT
   7. COLLEGE INSTRUCTOR/PROFESSOR
   8. NUTRITIONIST
   9. REGISTERED DIETICIAN
  10. OTHER FAMILY MEMBERS BESIDES PARENTS

19. How would you rate your interest in nutrition and food awareness?
   1. VERY INTERESTED
   2. MILDLY INTERESTED
   3. NO INTEREST

20. Has your gymnastics team participated in nutrition education sessions as a collective group:
   1. YES
   2. NO
   3. WOULD NOT LIKE TO ADMIT

21. Have you ever sought professional help for symptoms of overweight:
   1. YES
   2. NO
   3. WOULD NOT LIKE TO ADMIT

22. Have you ever sought professional help for symptoms of anorexia nervosa:
   1. YES
   2. NO
   3. WOULD NOT LIKE TO ADMIT

23. Have you ever sought professional help for symptoms of bulimia:
   1. YES
   2. NO
   3. WOULD NOT LIKE TO ADMIT
24. Have you ever been medically diagnosed and treated for any eating disorder or problem:
   1. YES
   2. NO
   3. WOULD NOT LIKE TO ADMIT

25. Are you satisfied with your eating habits:
   1. YES
   2. NO
   3. WOULD NOT LIKE TO ADMIT

26. Are you satisfied with your body weight:
   1. YES
   2. NO
   3. WOULD NOT LIKE TO ADMIT

27. Are you satisfied with your percent body fat:
   1. YES
   2. NO
   3. WOULD NOT LIKE TO ADMIT
APPENDIX B:
TENNESSEE SELF CONCEPT SCALE
PLEASE NOTE:

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These consist of pages:

173, Appendix B
175-179, Appendix C
181-191, Appendix D
APPENDIX C:

FOOD CHOICE INVENTORY
APPENDIX D:

EATING AWARENESS INVENTORY
APPENDIX E:

SUPPORT LETTERS TO BIG TEN ATHLETIC DIRECTORS
September 17, 1987

Phyllis Howlett  
Assistant Commissioner  
Big Ten Conference  
111 Plaza Drive, Suite 600  
Schaumburg, IL 60173-4990

Dear Phyllis Howlett:

I enjoyed our conversation on September 11th regarding my dissertation research at Ohio State University, and particularly, our association with colleagues and experiences in the Big Ten Conference. At that time, you advised me that a letter could be drafted by me concerning my research intent with female gymnasts at Big Ten Conference institutions. Such a letter would inform the respective athletic directors in the Big Ten about my research goals and methodology. You indicated that you would be willing to distribute such letters with the understanding that you would not be endorsing my research by distributing them. You mentioned that you could circulate my letters at the Big Ten Conference Meeting in Minneapolis on Tuesday, September 22nd, or in Chicago on Monday, October 19th.

I really appreciate your willingness to help me. I was pleased to have an opportunity to speak with you. Thank you for your time.

Sincerely,

Valerie A. Ubbes
I am ready to begin my study entitled the "Relationship Between Self Concept, Eating Behavior, and Gymnastics Success of Female Collegiate Gymnasts from NCAA Big Ten Conference Teams." In mid-September, you received a copy of my letter written to the athletic directors of the Big Ten Conference. That letter described my research purposes and methodology and asked that you would encourage your gymnastics coaches to become involved in my study. Since I cannot assume that I have your support, I am writing you once again. Attached is the letter that you may have read in September. Should you have any questions concerning my research with Big Ten female gymnasts, please contact me by writing on or before November 16th. If I do not hear from you, it will specify your approval of my research plan.

Thank you for your support.
November 3, 1987

Valerie A. Ubbes
Department of Physical Education
Northern Illinois University
DeKalb, IL 60115

Directors of Women's Athletics
University of Illinois
University of Iowa
University of Michigan
Michigan State University
University of Minnesota
The Ohio State University
c/o Ms. Phyllis Howlett
Assistant Commissioner
Big Ten Conference
1111 Plaza Dr. Suite 600
Schaumburg, IL 60173-4990

Greetings:

I am a doctoral candidate in Health Education at The Ohio State University. My dissertation will study the relationship between self concept, eating behavior, and gymnastics success of female gymnasts from Big Ten Conference teams. In order to perform this study, I must obtain the approval of The Ohio State University Human Subjects Review Committee. My advisor, Dr. Mary K. Beyrer, has suggested that I solicit your support as well.

The purposes of this study are as follow:

- To describe and explain the relationship between self concept, eating behaviors, and athletic success of female gymnasts from Big Ten Conference teams,
- To isolate selected rival variables which might contaminate the explanation of the dependent variable, gymnastics success, and
- To predict how the two main independent variables (self concept and eating behavior) will help to explain and predict gymnastics success of Big Ten gymnasts and teams.

All previous studies of this nature have examined only eating disorders. This study will be the first to focus on positive eating behaviors and their relationship to self concept and gymnastics success. Eating behaviors will be evaluated by the Food Choice Inventory and the Eating Awareness Inventory. Self concept will be evaluated by the Tennessee Self Concept Scale. Gymnastics success will be measured by the Seasonal Average Score (SAS) of each gymnast on the different gymnastics events (vault, or uneven bars, or balance beam, or floor exercise).
I will not contact any of the coaches until my study is approved by the Human Subjects Review Committee in late November. After that time, I will telephone the coaches to inform them of my specific research methodology and to seek their verbal commitment for their teams' participation in my study. I will then forward them a written confirmation with a sample Research Testing Packet to be previewed. By early December, 1987, the official mailing of all Research Testing Rackets (one per gymnast) will be forwarded to the coaches. The coach (or athletic trainer) will distribute the Research Testing Packets to the athletes, who will fill them out during one session of thirty-five minutes. The gymnasts will return their completed questionnaires (or uncompleted questionnaires if they choose not to participate) to the original envelope. The envelopes must be sealed by the gymnasts before they are returned to me in the mail.

I would appreciate your support for this study by encouraging your coaches and athletes to participate. Each of the Big Ten coaches is known to me personally, as I served as Assistant Coach of Women's Gymnastics at Ohio State from 1983 to 1986. If you have any questions or wish any further information, please contact me at (815/753-1424) or at the above address.

Sincerely,

Valerie A. Ubbes

VAU/ac

cc: Dr. M. K. Bayrer, OSU
    Dr. L. Miller
    Dr. B. Nelson
APPENDIX F:

TELEPHONE QUESTIONNAIRE TO BIG TEN GYMNASTIC COACHES
Hi Coach!

My name is Valerie Ubbes. You may remember me as the assistant coach of women's gymnastics at Ohio State University from 1983-86. I'm writing my dissertation this year and hope to graduate with my Ph.D. in Health Education and Physiology next year from OSU. I'm calling you, today, to ask about involving your team in my research. I have a script that I will follow, which tells you about my dissertation and asks you some questions about your team.

1. Do you have about five minutes to respond to my oral questionnaire or is there a time tomorrow when I might call you back?

2. Has your team participated in any research projects this year? If yes, would you mind participating in another study that would involve your gymnasts for only one session of thirty-five minutes?

My dissertation is entitled "The Relationship between Self Concept, Eating Behavior, and Gymnastics Success of Female Collegiate Gymnasts from NCAA Big Ten Conference Teams". From my title, you can assume that I am interested in how gymnasts feel about themselves and whether their self concept has any relationship to eating behaviors. All previous studies of this nature have examined only eating disorders. This study will be the first to focus on positive eating behaviors and their relationship to self concept and gymnastics success. This research may help coaches describe a successful gymnast. In other words, if we know something about a gymnast's self concept and eating behaviors, we may be able to predict gymnastics success.

3. Would you be willing to devote about 35 minutes before one of your practice sessions so your athletes can fill out questionnaires related to their self concept and eating behavior?

4. The research session would take place sometime between Thanksgiving "break" and your school's final exam week. Would you happen to know the dates of your final exam week?
5. I need your gymnasts to be in a somewhat relaxed state before they fill out the questionnaire. They should not be stressed by final exams and/or by any gymnastics intrasquads and competitions. Knowing this, would you be able to select a day within this time frame when all your athletes are in practice? Simply respond: yes or no.

6. Would you be able to secure a classroom situation where your gymnasts can sit in desks or at a table with chairs?

In early December, I will ship a box to you containing one Research Testing Package for each of your gymnasts. One Research Testing Package per gymnast will be distributed to your team by a proctor.

7. Would you like to serve as the research proctor or would you prefer to designate that responsibility to your athletic trainer?

8. How many team members do you have on your team?

9. Would you tell me your official mailing address, so that I can send you a written letter to explain the purposes and procedures of my research?

And, lastly, I want to investigate whether self concept and eating behavior can predict success. In my study, team Seasonal Average Scores and individual Seasonal Average Scores on vault, bars, beam, and floor will be indicative of gymnastics success. I will need to compile your team's Seasonal Average Score and your gymnasts' Seasonal Average Scores during the season for my statistics.

10. Would you object to me obtaining your team's meet results from the Big Ten Conference office each month?

I thank you for your time today. I hope your team will have a very successful season. Do you have any questions?

Valerie A. Ubbes
APPENDIX G

COVER LETTER TO COACHES ENCLOSED IN RESEARCH TESTING PACKAGE
Dear Coach,

Thank you for agreeing to participate in my study entitled: "The Relationship between Self Concept, Eating Behavior, and Gymnastics Success of Female Collegiate Gymnasts from NCAA Big Ten Conference Teams."

This box contains the following: an oral script for the research proctor and a Research Testing Package for each gymnast. Please determine a convenient time and day for your gymnasts to participate in this study. As we discussed over the telephone, please be sure you choose a day when all your athletes are present at the beginning of practice and not stressed by Final Exams and/or gymnastics intrasquad competitions. Any gymnasts, who are not present on the day that the surveys are administered, should fill them out at your next practice or as soon as possible.

Your team's participation in the actual study will involve one session of approximately thirty-five minutes. Including organizational time, your total team involvement could be one hour at the most. A classroom setting is highly recommended.

When gymnasts have completed the questionnaires, they will return their sealed envelope to you. Each Research Testing Package will already have my return address and the correct return postage affixed to it. All you need to do is ensure that each envelope is sealed, then drop them into the mail.

As we discussed over the telephone, please try to complete the study sometime between Thanksgiving and your school's Final Exam week. At the very latest, these surveys must be completed before your team's first official competition. Please return the envelopes to me no later than January 6, 1988.

Thank you in advance for your interest and participation. I intend to share the results of my study with you upon its completion. Best wishes for a successful gymnastics season!

Sincerely,

Valerie A. Ubbes

P.S. Please enclose a copy of your team's roster in the attached, self-addressed stamped envelope. I would also appreciate a copy of your competitive schedule.

ENCLOSURES: Oral Script for Research Proctor
Research Testing Packets
APPENDIX H:

ORAL SCRIPT FOR RESEARCH PROCTOR
PROCTOR'S ORAL SCRIPT

(Please read this script to the gymnasts at the beginning of the testing session.)

Valerie Striggow-Ubbes, a Ph.D. candidate at Ohio State, has asked you to participate in her study entitled "The Relationship between Self Concept, Eating Behavior, and Gymnastics Success of Female Collegiate Gymnasts from NCAA Big Ten Conference Teams". All female gymnasts in the Big Ten have been asked to participate in this study. You will be asked to answer questions ranging from your gymnastics training to your eating habits.

Your participation in this study is strictly on a volunteer basis. You may decline to participate at any time during the survey session. All information on these questionnaires will be completely confidential. You will be asked to place your name on the sealed envelope AFTER you complete the questionnaires. Your name is needed so that your Seasonal Average Scores on the vault, uneven bars, balance beam, and floor exercise can be matched to your questionnaires at the end of the season. Once matching occurs, your name will be anonymous again. All participants will be analyzed as a group. No individual results will be determined.

As soon as I finish reading this, you will be given a manila envelope containing the survey questionnaires. A cover letter will be attached to the envelope. The letter will have a piece of chewing gum taped to it. You may keep the chewing gum even if you choose not to participate. After reading the cover letter, open your envelope, and remove the four questionnaires. There is a pencil in the envelope for filling out the questionnaires. You may keep the pencil, too. Read the directions for each of the questionnaires before you answer any of the questions for that questionnaire. Please answer all of the questions without leaving any answers blank. Do not talk to anyone during the survey session. If you do not understand an item on a questionnaire, reread the directions for that questionnaire. If you are are still not sure about your answer to a question, make the best guess you can. Even though one of the questionnaires has a space for your name, do not put your name on any of the questionnaires.
The surveys should take about thirty-five minutes to complete. After you have finished, put the completed questionnaires into the original envelope. Even if you have decided not to participate, place the uncompleted questionnaires into the original envelope. Seal the envelope. Print your first and last name in the return address portion of the envelope where indicated. Return the sealed envelope to the person who gave it to you. These instructions are repeated for you in the cover letter.

(Distribute the envelopes)

Please take a moment to read the cover letter attached to your manila envelope.
APPENDIX I:

COVER LETTER TO GYMNASTS IN RESEARCH TESTING PACKET
Dear Big Ten Gymnast:

I am a Ph.D. candidate in Health Education at The Ohio State University. From 1983 to 1986, I served as the Assistant Coach of Women's Gymnastics at OSU. I am currently writing my dissertation on the topic of self concept, eating behaviors, and gymnastics success. My research is under the jurisdiction of my advisor, Dr. Mary K. Beyrer. The purpose of this letter is to request your involvement in my study.

Your participation in this study is strictly on a volunteer basis. Should you agree to participate, you will spend the next thirty-five minutes answering four questionnaires. Your responses will be completely confidential. Your name is needed on the outside of the original envelope so that your Seasonal Average Scores can be matched to your responses at the end of your gymnastics season. Once matching occurs, your name will be anonymous again. No individual results will be reported in my final dissertation.

Attached to this letter is a manila envelope containing the questionnaires which will ask you various questions about your gymnastics training, your family, and your eating practices. Please read the directions for each questionnaire before you answer any of the questions on that questionnaire. Once you begin the questionnaire(s), it is imperative that you answer every question. Please do not leave any answers blank. However if you feel uncomfortable with any question, you do not have to answer it. Should you be unsure about your response, make an "educated guess". Work through the questions quickly without talking to your teammates or coaches.

PLEASE FOLLOW THESE STEPS WHETHER OR NOT YOU CHOOSE TO PARTICIPATE:

1. Put your completed (or uncompleted) questionnaires back into the original envelope and seal it.

2. Place your full name in the upper left hand corner of the same side of the envelope that has the postage. Your name should not appear on any of the questionnaires.

3. Remove this letter from the outside of the envelope and discard it.

4. Return the sealed envelope to the same person who gave it to you.
I thank you in advance for your participation in my study. I hope you will find the experience worthwhile, knowing that you have contributed to research in our great sport of gymnastics.

Sincerely,

Valerie Striggow-Ubbes

P.S. Enjoy this chewing gum while you complete the questionnaires. You make also keep the pencil when you are finished.
APPENDIX J:
CONSENT MATERIALS FOR USING THE TENNESSEE SELF CONCEPT SCALE
Dear Susan Weinburg:

I am a doctoral candidate in Health Education at The Ohio State University. I am writing you to seek your permission to use the Tennessee Self Concept Scale (Fitts, 1964) as one of my research instruments in my dissertation. In this letter, I will describe the purposes of my study, outline my research methodology, and seek your permission to obtain a research discount of 20% for my enclosed order of the Tennessee Self Concept Scale. I would also like to know if the Tennessee Self Concept Scale can appear in the appendices of my final dissertation?

My dissertation is entitled "The Relationship between Self Concept, Eating Behavior, and Gymnastics Success of Female Collegiate Gymnasts from Big Ten Conference Teams." The purposes of this study are:

1) To describe and explain the relationship between self concept, eating behaviors, and athletic success of female gymnasts from Big Ten Conference teams,

2) To isolate selected rival variables which might contaminate the explanation of the dependent variable, gymnastics success, and

3) To predict how the two main independent variables (self concept and eating behavior) will help to explain and predict gymnastics success of Big Ten gymnasts and teams.

All previous studies of this nature have examined only eating disorders. This study will be the first to focus on positive eating behaviors and their relationship to self concept and gymnastics success. The Tennessee Self Concept Scale will be administered to all subjects, along with three other instruments, in order to answer the research questions and hypotheses. Scores from three of the four instruments, of which one is the Tennessee Self Concept Scale, will be correlated with the levels of the independent variables: rank in school, birth order, scholarship status, and team affiliation. Specific methodology follows on the enclosed outline.
There will be approximately eighty female gymnasts involved in my study. This will necessitate the ordering of the following materials from Western Psychological Services:

W-182A Tenn Self Concept Scale Test Bklt (pkg/10)......9 pkgs @ 11.30
W-182B Tenn Self Concept Answr-Profile--C (pkg/25)......4 pkgs @ 7.90

Please find an order form enclosed with a check for $117.30 to cover the costs of the materials, plus shipping and handling. As directed by a phone receptionist from your company, I have deducted the permissible 20% from my total bill. Should you be unable to grant me the student discount, I will gladly pay the balance of the bill. As required, I have submitted the application to purchase and use assessment materials. It has been signed by my academic advisor, Dr. Mary K. Beyrer.

Thank you in advance for your support.

Sincerely,

Valerie A. Ubbes
Application to Purchase and Use Assessment Materials

To be completed by all individuals desiring to purchase psychological or educational tests and related materials. This form must be signed by the person who will assume overall professional responsibility for the interpretation and use of such tests. Please type or print clearly.

A. General Background

Name: VALERIE A. UBBES

Organizations (if applicable):

Address: 1601 KANEVILLE ROAD (WORK: UNIVERSITY OF NORTHERN ILLINOIS; Dekalb, IL 60115)

City: GENEVA State: IL Zip: 60134 Telephone: (312) 206-1579

Type of organization employed by:

☐ Clinics or Counseling Centers  ☐ Medical Facilities  ☐ Private Practice
☐ College or University  ☐ Public or Private School  ☐ Social Agency
☐ Business  ☐ Government Agency  ☐ Other (specify)

B. Educational Background

<table>
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<tr>
<th>Degree</th>
<th>Major Field</th>
<th>College/University</th>
<th>Year Received</th>
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<tbody>
<tr>
<td>R.S.</td>
<td>PHYSICAL EDUCATION (K-12)</td>
<td>APPALACHIAN STATE UNIVERSITY</td>
<td>1970</td>
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<tr>
<td>M.Ed.</td>
<td>PHYSICAL EDUCATION</td>
<td>UNIVERSITY OF TOLEDO</td>
<td>1990</td>
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<tr>
<td>PH.D.</td>
<td>HEALTH EDUCATION</td>
<td>OHIO STATE UNIVERSITY</td>
<td>CANDIDATE</td>
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Indicate any graduate courses you have completed in each of the following areas.

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<tr>
<th>Content Area</th>
<th>Number of Semester Units</th>
<th>College, University, or Sponsoring Organization</th>
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<tbody>
<tr>
<td>Tests &amp; Measurement</td>
<td></td>
<td>UNIVERSITY OF TOLEDO; OHIO STATE UNIVERSITY</td>
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<tr>
<td>Statistics</td>
<td>6</td>
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<tr>
<td>Intelligence Assessment</td>
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<tr>
<td>Clinical Assessment (Adult)</td>
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<td>Clinical Assessment (Child)</td>
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<td>Psychodynamic Assessment</td>
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<td>Neuropsychological Evaluation</td>
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<tr>
<td>Speech, Language, Hearing Assessment</td>
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<tr>
<td>Marriage &amp; Family Counseling</td>
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<tr>
<td>Learning Disability Assessment</td>
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<tr>
<td>Sensory Integration Assessment</td>
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In addition, please indicate any additional coursework, supervised training, or experience you have with testing in other specific content areas. Include any relevant continuing education experiences.

C. Professional Background

Indicate any clinical internship or employment experiences that include administering and interpreting tests.

<table>
<thead>
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<th>Organization</th>
<th>Position</th>
<th>Tests Used</th>
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</table>
List all professional associations in which you are a member.

AMERICAN ALLIANCE FOR HEALTH, PHYSICAL EDUCATION, RECREATION AND DANCE
ETA SIGMA GAMMA
AMERICAN TURNERS
AMERICAN SCHOOL HEALTH ASSOCIATION

List all licenses, credentials, or certifications you now hold that are relevant to the materials you wish to purchase.

<table>
<thead>
<tr>
<th>Certificate or License</th>
<th>Certifying or Licensing Agency</th>
<th>Number</th>
<th>Expiration Date</th>
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</table>

D. Type of Materials to be Purchased

What type of materials do you plan to purchase?

TENNESSEE SELF CONCEPT SCALE: TEST BOOKLET, ANSWER-PROFILE SHEET, & MANUAL/BIBLIOGRAPHY

What supervised training or experience do you have with these materials?

NONE

What is their intended use?

SURVEY RESEARCH: GATHERING OF DESCRIPTIVE DATA FROM THE TENNESSEE SELF CONCEPT SCALE (FORM C), WHICH WILL BE MAILED TO WOMEN GYMNASTICS TEAMS IN THE BIG TEN CONFERENCE.

I certify that the above information is complete and accurate to the best of my knowledge.

I agree to supervise the use of all psychological tests purchased from Western Psychological Services and to adhere to the professional and ethical standards of the American Psychological Association. I also agree to recognize all copyrights and will not reproduce, nor cause to be reproduced in any form whatsoever, including but not limited to electronic and/or computer applications, for any purpose any materials protected by copyright. I have read and agree to the above statement.

SIGNATURE: [Signature] Date: October 26, 1987

E. Following to be Completed Only if the Applicant is a Graduate Student

I certify that I will supervise this student's use of any test materials purchased from Western Psychological Services in accordance with APA's "Ethical Principles of Psychologists."

SUPERVISOR'S SIGNATURE: [Signature] Date: October 26, 1987

Position: [Position]
License and Certifications: [License]
Membership in Professional Organizations: [Membership]

Have you filed a WPS Qualification Questionnaire? ☐ Yes ☐ No
**WPS ORDER FORM**

**WHERE TO ORDER:** Purchases may be made at the WPS offices or by mail. Please address all mail orders to:

Western Psychological Services  
Order Department  
12031 Wadsworth Blvd.  
Los Angeles, California 90025

1. **PHONE ORDERS:** Orders may be placed by telephone only if they are to be charged to a Visa or MasterCard account. No other orders can be accepted by telephone. Telephone orders may be placed 24 hours a day, 7 days a week, 365 days a year. All phone orders are subject to a 3% convenience fee. We cannot accept orders from a payphone.

2. **HOW TO ORDER:** Each purchase order should contain the following information for every item ordered:
   1. **CATALOG NUMBER**
   2. **FULL TITLE**
   3. **EXACT QUANTITY**
   4. **TEST FORM**
   5. **QUOTATION:** We will gladly provide written price quotations upon written request. These written quotations guarantee that we will honor the prices quoted for 30 days. All price quotations must be in writing. We will not give any binding price quotations by telephone.

3. **BILLING:** WPS maintains no "Open Accounts." All individuals and private organizations must include payment with their order or charge their order to their MasterCard account. By providing us with the correct credit card account number in full and expiration date, and by signing the authorization for Western Psychological Services to bill the mastercard ordered to the credit card indicated, recognized public agency, government, and institutional orders will be billed, but they must be processed through normal purchasing procedures. At the request of many school districts, public agencies, and large organizations of clients, we will honor orders requesting billing unless they are submitted on formal purchase orders from the authorized purchasing authority. Terms are net.

4. **PRICES:** Prices are subject to change without notice. Orders with terms or statements to the effect that prices charged are not to be higher than those indicated on the purchase order will not be honored and will be returned for price increases. Authorization should have any changes in the prices of the mastercard ordered. All shipments to California will be charged the appropriate sales tax.

5. **SHIPPING AND HANDLING CHARGES:** There is a $5.00 handling charge for each shipment, regardless of order amounts. Please note that all charges are based on average costs and do not directly reflect actual cost. If you have a specific order, please consult our shipping and handling chart as discussed 7 above. All foreign orders must be in U.S. Dollars drawn upon a U.S. Bank or by International Money Order (NOTE: Payments in U.S. Dollars drawn upon foreign banks are NOT acceptable). The foreign order must be in U.S. Dollars and the order must be shipped at our discretion. All foreign orders will be charged an extra 20% due to the excessive shipping charges to these countries. Orders for special shipping will be charged accordingly.

6. **FOREIGN ORDERS:** All foreign orders, except Canada, must be prepaid in U.S. dollars. Where checks will be accepted upon request indicating the source are shipping and handling charges as discussed in 7 above. All foreign payments must be in U.S. Dollars drawn upon a U.S. Bank or by International Money Order (NOTE: Payments in U.S. Dollars drawn upon foreign banks are NOT acceptable). The foreign order must be in U.S. Dollars and the order must be shipped at our discretion. All foreign orders will be charged an extra 20% due to the excessive shipping charges to these countries. Orders for special shipping will be charged accordingly.

7. **DELIVERY TIME:** Virtually all orders are shipped promptly. This means that delivery, depending on distance from Los Angeles, normally will take from a few days to a few weeks. It is suggested that you allow 2-4 weeks for shipping of large quantities. Substantial price savings are usually available on purchases of large quantities.

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**Send this order form to Western Psychological Services, Order Department, 12031 Wadsworth Blvd., Los Angeles, California 90025**

Payment or authorization to charge the order to your Visa or MasterCard must accompany the order. Orders are billed only to recognized public or governmental agencies and institutions and they must be placed on an official purchase order by the authorized purchasing department.

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<th>Quantity</th>
<th>Catalog No.</th>
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<th>Unit Price (USD)</th>
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<tr>
<td>9 pkgs</td>
<td>W-182A</td>
<td>TENNESSEE SELF CONCEPT SCALE TEST BOOKLET</td>
<td>11.30</td>
<td>101.70</td>
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<td>4 pkgs</td>
<td>W-182B</td>
<td>TENNESSEE SELF CONCEPT SCALE ANSWER-PROFILE C</td>
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**Materials Total:**

133.30

**Shipping & Handling:** (12% of the Materials Total for domestic orders in the United States, 5% for Canada and 10% for other foreign orders)

13.33

**Subtotals:**

146.63

**Sales Tax:** (Calculated on Subtotal and subject to shipping and handling)

-20%

**Total Due:**

$117.30

I hereby authorize Western Psychological Services to charge my Visa or MasterCard account the amount as indicated above.

*Please send me a copy of the current WPS catalog.*

**Signature:**

**Expiration Date:**

**Year:**

---

**Or, complete Card No.**

**Order Number:**

**Signature:**

**Date:**

m-998
November 6, 1987

Valerie A. Ubbes
1601 Kaneville Road
Geneva, Illinois 60134

Dear Ms. Ubbes:

Thank you for your letter of November 2 in which you place an order for Tennessee Self-Concept Materials (TSCS) and apply for a WPS Research Discount for use in your dissertation research on "The Relationship between Self Concept, Eating Behavior, and Gymnastics Success of Female Collegiate Gymnasts from Big Ten Conference Teams." You also request authorization to include the TSCS in the appendices of your final dissertation.

With regard to your order, it has been referred to our Order Department, and the materials will be sent to you under separate cover via U.P.S.

As to the discount request, Western Psychological Services hereby authorizes you for its 20% Research Discount, to be applied against the cost of TSCS materials to be used in the above-referenced research. This discount is not retroactive, but has been applied against your current order and may be used again effective immediately until the discount authorization expires on November 15, 1988.

When ordering by mail, please enclose a copy of this letter of authorization to ensure that your orders are processed correctly and without delay.

The permission of WPS is not required for you to include the TSCS in the appendices of your dissertation, as long as you bind into your appendices original materials purchased from WPS. Should the inclusion of an original be impossible, please write again and specify the compelling reason(s) for reproduction. Please remember that unauthorized reproduction of copyrighted materials is not only illegal, but also unethical.

Your interest in the TSCS is appreciated, and we wish you success with your research. Should you have additional inquiries, please feel free to contact me.

Sincerely,

Susan Dunn Weinberg
Assistant to the President

Enclosures
APPENDIX K:
CONSENT LETTERS FOR USING THE FOOD CHOICE INVENTORY
September 28, 1987

Gloria Kristopek
Permission Editor
National Dairy Council
6300 North River Road
Rosemont, IL 60018
(312) 696-1020

Dear Gloria Kristopek:

On September 25th, I telephoned you to discuss my dissertation research which will include the use of the Food Choice Inventory by the National Dairy Council. I am writing you to seek your permission to use the Food Choice Inventory as one of my research instruments. In addition, I hope to get your permission to reprint the Food Choice Inventory in the Appendix of my dissertation. I understand that the test may be duplicated for educational purposes. As such, I plan to xerox the instrument for distribution to my subjects.

My dissertation is entitled "The Relationship between Self Concept, Eating Behavior, and Gymnastics Success of Female Collegiate Gymnasts from Big Ten Conference Teams". The purposes of this study are as follow:

1) To describe and explain the relationship between self concept, eating behaviors, and athletic success of female gymnasts from Big Ten Conference teams,
2) To isolate selected intervening and extraneous variables which might contaminate the explanation of the dependent variable, gymnastics success, and
3) To predict how the two main independent variables (self concept and eating behavior) will help to explain and predict gymnastics success of Big Ten gymnasts and teams.

All previous studies of this nature have examined only eating disorders. This study will be the first to focus on positive eating behaviors and their relationship to self concept and gymnastics success. The Food Choice Inventory will be administered to all subjects, along with three other instruments, in order to answer the research questions and hypotheses. In short, the Food Choice Inventory will measure the various foods that female gymnasts will or will not eat. Scores from the Food Choice Inventory will be correlated with the various levels of the independent variables: rank in school, birth order, scholarship status, and team affiliation.
I have enclosed a copy of my unofficial prospectus for your files. Should you have any further questions concerning my research plan or methodology, please call me at home: (312) 208-1579 or at my office: (815) 753-1424.

Thank you in advance for your support.

Sincerely,

Valerie A. Ubbes
Department of Physical Education
Northern Illinois University
Dekalb, IL   60115
Valerie A. Ubbes  
Department of Physical Education  
Northern Illinois University  
DeKalb, IL 60115  

Dear Valerie,

Thank you for your interest in National Dairy Council materials. Permission is granted to reprint Food Choice Inventory in the Appendix of your dissertation and use Food Choice Inventory as one of your research instruments. Please use the credit line, "Food Choice Inventory, courtesy of NATIONAL DAIRY COUNCIL."

When published, please send a copy of the Appendix for our files.

Very cordially yours,

Gloria A. Kristopec  
Permissions Editor  
Nutrition Education  

cc: Records Center
APPENDIX L:

CONSENT LETTERS FOR USING THE EATING AWARENESS INVENTORY
Northern Illinois University
Department of Physical Education
DeKalb, IL  60115

September 21, 1987

Dr. Jane Richards
University of Northern Iowa
Department of Health Education
West Gymnasium
Cedar Falls, IA  50614-0161
Telephone (319) 273-3265

Dear Dr. Richards:

I thoroughly enjoyed our telephone conversation concerning your dissertation research, particularly your Eating Awareness Inventory. As we discussed today, I am very interested in using your instrument to answer one of the research questions in my dissertation, entitled "The Relationship between Self Concept, Eating Behavior, and Gymnastics Success of Female Collegiate Gymnasts from NCAA Big Ten Conference Teams". You indicated that your instrument would be extremely helpful in generating descriptive data about the eating practices of certain populations. In fact, you said that you had recently adapted your Eating Awareness Inventory to college students, but that no formal research had been published as of yet. Since I have been able to read your entire dissertation from Southern Illinois University, I would really appreciate the opportunity to see your updated and adapted instrument for a college population. Additionally, I would like your written approval of my intent to cite your research and to use your Eating Awareness Inventory in my research.

As I told you today, I appreciate your excellent contribution to the field of health education and nutrition education. Your instrument is comprehensive and thorough. I thank you in advance for allowing me to use your copyrighted material. I am enclosing a copy of my research prospectus for you to view in case you have any questions about my intentions to use your Eating Awareness Inventory.

Sincerely,

Valerie A. Ubbes
Ph.D. Candidate in Health Education
Ohio State University
October 7, 1987

Ms. Valerie A. Ubbes  
Northern Illinois University  
Department of Physical Education  
DeKalb, IL 60015

Dear Ms. Ubbes:

I appreciate your interest in the Eating Awareness Inventory (EAI) and am pleased to learn of its suitability for your study of the relationship between self-concept, eating behavior and gymnastics success. Please feel free to use the instrument in your research and make any adaptations which may be necessary to enhance its applicability to your study sample. I am assuming you will follow proper citation procedures and request that your data may be referenced as further validation of the instrument.

Please feel free to call or correspond if you have questions regarding the EAI. I would appreciate receiving a copy of your results upon completion of the project and wish you the best in your continued efforts.

Sincerely,

Jane E. Richards, Ph.D.
Assistant Professor  
Health Education
Valerie A. Ubbes  
Northern Illinois University  
Department of Physical Education  
DeKalb, IL 60015  

October 7, 1987  

Dear Valerie:  

Thank you for following up on our recent phone conversation with your letter and a copy of your research proposal. I shall enjoy reading it and am pleased that the Eating Awareness Inventory is suitable for your study.  

I am enclosing a copy of the EAI which was revised for use with university students. As you will note, only minor changes were made from the original instrument. Specifically, response options for item one (1) in EAI Parts II and III were changed to enhance their applicability to student populations. Also, enclosed is a formal statement of permission to use the EAI in your study.  

Please feel free to call or correspond if I can be of further assistance. I well remember the dissertation "process" and wish you the best in your endeavor.  

Sincerely,  

Jane E. Richards, Ph.D.  
Assistant Professor  
Health Education  

nj
APPENDIX M:
CONSENT PROCESS WITH HUMAN SUBJECTS REVIEW COMMITTEE
Dear Human Subjects Committee:

Please find enclosed the necessary forms and materials for your review involving human subjects in the behavioral and social sciences. Due to the nature of my expense in providing several copies of my survey instruments, I would like to request that four of the five "Research Testing Packages" be returned to me, if at all possible. You will find these instruments in Appendices A-D.

This prospectus was written in the past tense as was advised by my dissertation committee member, Dr. Larry Miller. This should not be interpreted as meaning that the research has already been performed. No subjects have been contacted.

I appreciate your support of my prospectus.

Sincerely,

Valerie A. Ubbes

ENCLOSURES: 5 complete copies of the proposal
5 copies of the four instruments (Appendices A-D)
5 copies of the oral script for proctor (Appendix J)
and cover letter for subjects (Appendix K)
5 copies of the summary sheets
5 copies of waiver of written consent
Research Center
Room 205
1314 Kinnear Road
Columbus, OH 43210

Dear Human Subjects Review Committee:

My dissertation, entitled the "Relationship between Self Concept, Eating Behavior, and Gymnastics Success of Female Collegiate Gymnasts from Big Ten Conference Teams", will utilize survey research with an ex post facto research design. All subjects will be ushered to a classroom and asked to listen to the proctor's oral script, which will describe the research methodology. Subjects will be told that they have an option to participate or not to participate in the research project. These directions will be repeated in the cover letter that the gymnasts will read before opening the Research Testing Packets. Subjects, who do not consent to participate, will not complete the research questionnaires. Since the subjects' response to the questionnaires will constitute their consent to participate in the study, I will not be using consent forms.

I request your committee to issue me a waiver of written consent. Thank you for your consideration.

Sincerely,

Valerie A. Ubbes
The following summary must accompany your proposal. Be specific about exactly what subjects will experience when they participate in your research, and about the protections that have been included to safeguard them. Careful attention to the following may help facilitate the review process.

1. In a sentence or two, describe the background and purpose of the research.
   The threefold purpose of this study will be:
   1) to describe and explain the relationship between self concept, eating behavior, and athletic success of female collegiate gymnasts from NCAA Big Ten Conference teams,
   2) to isolate selected intervening and extraneous variables which might contaminate the explanation of the dependent variable, gymnastics success, and
   3) to predict how the two main independent variables, self concept and eating behaviors, will help to explain and predict gymnastics success.

2. Briefly describe each condition or manipulation to be included within the study.
   No manipulation occurs. Data will be gathered from mail questionnaires, which will be completed by subjects who elect to participate in the study. The study will involve survey research.

3. What measures or observations will be taken in the study? If any questionnaires, tests, or other instruments are used, provide a brief description and either include a copy or indicate when a copy will be submitted for review.
   COLLEGIATE GYMNASICS PROFILE (Valerie A. Ubbes, 1987). Investigates descriptive information from collegiate gymnasts regarding their training practices, eating practices, and family demographics.
   TENNESSEE SELF CONCEPT SCALE (William H. Pitts, 1964). Consists of 100 self-descriptive statements which subjects use to rate themselves on a scale of 1 to 5.
   FOOD CHOICE INVENTORY (National Dairy Council, 1985). Assesses the current food choice patterns of individuals and groups.
   EATING AWARENESS INVENTORY (Jane Richards, 1982). Surveys the eating practices of subjects from the perspectives of when, where, with whom, how, and why people eat.
   COPIES OF ALL 4 INSTRUMENTS ARE ATTACHED.
4. Will the subjects encounter the possibility of psychological, social, physical or legal risk? Yes ____ No X If so, please describe.

5. Will any stress to subjects be involved? Yes X No ____ If so, describe.

Some stress to the subjects may occur if the test facilitators, i.e. athletic trainers or gymnastics coaches at each institution, fail to follow the recommended testing conditions. If suggested testing conditions are not followed, some athletes may have to compete with noisy and active gymnasiums while filling out the inventories as opposed to a classroom which could offer subjects chairs, tables, and an uninterrupted environment.

6. Will the subjects be deceived or misled in any way? Yes ____ No X If so, please describe and include an outline or script of the debriefing.

7. Will there be a request for information which subjects might consider to be personal or sensitive? Yes X No ____ If so, please describe.

The Tennessee Self Concept Scale will query subjects with 100 questions that reflect "What I Am", "How I Feel", and "What I Do". These questions will encompass the following categories: Identity, Self Satisfaction, Behavior, Physical Self, Moral-Ethical Self, Personal Self, Family Self, and Social Self.
The Collegiate Gymnastics Profile requests information on the subjects' family status.

8. Will the subjects be presented with materials which might consider to be offensive, threatening or degrading? Yes ____ No X If so, please describe.

9. Approximately how much time will be demanded of each subject?

<table>
<thead>
<tr>
<th>Inventory</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collegiate Gymnastics Profile</td>
<td>10 minutes</td>
</tr>
<tr>
<td>Tennessee Self Concept Scale</td>
<td>15 minutes</td>
</tr>
<tr>
<td>Food Choice Inventory</td>
<td>2 minutes</td>
</tr>
<tr>
<td>Eating Awareness Inventory</td>
<td>10 minutes</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>37 minutes</strong></td>
</tr>
</tbody>
</table>

NS-008C (Rev. 3/87)
10. Who will be the subjects in this study? How will they be solicited or contacted?
Subjects must be informed about the nature of what is involved as a participant,
including particularly a description of anything they might consider to be
unpleasant or a risk. Please provide an outline or script of the information which
will be provided to subjects prior to their volunteering to participate. Include a
copy of the written solicitation and an outline of the oral solicitation.

Female collegiate gymnasts from seven of the Big Ten Institutions will be subjects in this study.
The seven institutions are: Michigan State University, The Ohio State University, University of Illinois,
University of Iowa, University of Michigan, University of Minnesota, and University of Wisconsin.
Each team will be contacted by mail. The mailing to each team will contain a cover letter to the coach, an
oral script for the research proctor, and a Research Testing Package for each gymnast. The Research Testing
Package will have a cover letter (written solicitation) taped to it and the four research instruments inside it.
The written solicitation letter(s) can be found in Appendix J and K.

11. What steps will be taken to insure that each subject’s participation is voluntary?
What, if any, inducements will be offered to the subjects for their participation?
The solicitation letter(s), found in Appendix J and K, emphasizes that the subjects’ participation is
voluntary.

An incentive of chewing gum will be taped to the cover letter on the outside of each Research Testing Package.

12. How will you insure that the subjects give their consent prior to participating?
Will a written consent form be used? Yes No
If so, please include the form, and if not, please indicate why not.

Subjects’ response to the questionnaires will constitute their consent.

13. Will any aspect of the data be made a part of any permanent record that can be
identified with the subject? Yes No

14. Will the fact that a subject did or did not participate in a specific experiment or
study be made a part of any permanent record available to a supervisor, teacher or
employer? Yes No

15. What steps will be taken to insure the confidentiality of the data?
Subjects will not place their names on the individual research questionnaires. However, their names will
appear on the envelope containing the research questionnaires after they have participated (or not participated)
in the study. Names will be needed to match the subjects’ Seasonal Average Score in the different gymnastics
events with the scores from the four research questionnaires. Once matched, subjects will again be
anonymous. Results will be reported by group, not by individual scores.

Subjects will place completed or uncompleted questionnaires into their original manila envelopes. Then
they will seal their envelopes and hand them to the research proctor. The envelopes will be “mail-ready”, needing
no further manipulation by the test proctor, except to be placed in the U.S. Postal system.

HS-008D (Rev. 3/87)
16. If there are any risks involved in the study, are there any offsetting benefits that might accrue to either the subject or society?

17. Will any data from files or archival data be used? Yes ___ No X ___
Research Involving Human Subjects

ACTION OF THE REVIEW COMMITTEE

With regard to the employment of human subjects in the proposed research protocol:

87B0175 RELATIONSHIP BETWEEN SELF CONCEPT, EATING BEHAVIOR, AND GYMNASTICS SUCCESS OF FEMALE COLLEGIATE GYMNASTS FROM NCAA BIG TEN CONFERENCE TEAMS, Mary K. Beyrer, Valerie A. Ubbes, Health, Physical Education and Recreation

THE BEHAVIORAL AND SOCIAL SCIENCES REVIEW COMMITTEE HAS TAKEN THE FOLLOWING ACTION:

<table>
<thead>
<tr>
<th>APPROVED</th>
<th>DISAPPROVED</th>
</tr>
</thead>
<tbody>
<tr>
<td>X APPROVED WITH CONDITIONS*</td>
<td>X WAIVER OF WRITTEN CONSENT GRANTED</td>
</tr>
</tbody>
</table>

* Conditions stated by the Committee have been met by the Investigator and, therefore, the protocol is APPROVED.

It is the responsibility of the principal investigator to retain a copy of each signed consent form for at least four (4) years beyond the termination of the subject's participation in the proposed activity. Should the principal investigator leave the University, signed consent forms are to be transferred to the Human Subjects Review Committee for the required retention period. This application has been approved for the period of one year. You are reminded that you must promptly report any problems to the Review Committee, and that no procedural changes may be made without prior review and approval. You are also reminded that the identity of the research participants must be kept confidential.

Date: November 20, 1987  Signed: [Signature]

(Chairperson)

HS-025B (Rev. 3/85)
APPENDIX N:

CONSENT LETTERS FROM BIG TEN CONFERENCE
October 22, 1987

Valerie A. Ubbes
Department of Physical Education
Northern Illinois University
DeKalb, IL 60115

Dear Valerie,

In response to your request of September 17, 1987 relevant to your doctoral dissertation advised by Dr. Mary K. Beyrer, I am happy to report that I have visited with Bev Mackes concerning your request and she is willing to be of assistance. Therefore, as you get your study approved by the Ohio State University Human Subjects Committee, you may feel free to proceed with the collection of your data from the University of Illinois through direct contact and coordination with Dr. Beverly Mackes, our head gymnastics coach.

It is hoped that you will receive support from the other Big Ten Conference schools and are able to complete your research in a timely and affective manner. We will look forward to receiving a copy of your results and conclusions and any specific information related to Illinois's team that would be helpful to the coaching staff. Thank you for your interest in our program and that of the Big Ten women's gymnastics programs. Best of luck to you.

Sincerely yours,

Karol A. Kahrs
Associate Director of Athletics

KAK/j
087-10-2203
cc: Bev Mackes
October 29, 1987

Valerie A. Ubbes
Department of Physical Education
Northern Illinois University
DeKalb, IL 60115

Dear Ms. Ubbes:

Women's Athletic Director, Christine Grant, has requested advice from the Sports Medicine Research Review Committee in regards to your study. However, before I forward your request to the Chairman of that committee, I would suggest that the details of the protocol along with goals, objectives, materials and methods be provided for a more thorough evaluation. Rest assured that both the members of our Department of Women's Intercollegiate Athletics and the Sports Medicine Services share an interest in this problem to the point that we are presently working with experts in nutrient and eating disorders.

I whole heartedly support the idea of pooling this type of information you are seeking among multiple institutions. However, I am sure you can appreciate the concern for avoiding conflicts with our consulting staff. Furthermore, it has been our experience that such protocols must avoid the coercion of the results from any direct involvement of our coaching staff with this study. We look forward to reviewing your proposal. Please address it to Joseph A. Buckwalter, M.D., Chairman, Sports Medicine Research Review Committee, Department of Orthopaedic Surgery, University of Iowa Hospitals and Clinics, Iowa City, Iowa, 52242.

Sincerely,

John P. Albright, M.D.
Director, Sports Medicine Services
Department of Orthopaedic Surgery
Joseph A. Buckwalter, M.D.
Chairman, Sports Medicine Review Committee
Department of Orthopaedic Surgery
University of Iowa Hospitals and Clinics
Iowa City, Iowa 52242

Dear Dr. Buckwalter:

In September, I contacted the Big Ten Womens' Athletic Directors regarding my dissertation regarding the relationship between self concept, eating behavior, and gymnastics success in Big Ten Conference teams. My request was forwarded by Christine Grant to Dr. John Albright, who requested that I send you further information including my protocol, goals, objectives, materials and methods so that you may give it a more thorough evaluation. A copy of Dr. Albright's letter is enclosed.

I am pleased by the attention that the University of Iowa is giving to my study. A copy of my dissertation prospectus, which contains the requested information, is enclosed. Specifically, you will find that my testing protocol preserves the confidentiality of the subjects. The survey consists of four paper-and-pencil questionnaires: the Collegiate Gymnastics Profile (Ubbes, 1987), the Tennessee Self Concept Scale (Fitts, 1964), the Food Choice Inventory (National Dairy Council, 1982), and the Eating Awareness Inventory (Richards, 1982). The subjects will seal their completed questionnaires into stamped envelopes to be mailed to me. Their coaches will not be aware of their answers. Subjects who elect not to answer the questionnaires will follow the same protocol, so their coach will not know whether or not they have elected to participate.

I hope that this information will satisfy any concerns you may have. If you have any further questions, please contact me at (815) 753-1424. I look forward to receiving your response.

Sincerely,

Valerie A. Ubbes

Enclosures: Letter of 10/29/87 from Dr. John Albright
Athletic Directors' Approval Letter
Dissertation Prospectus
February 26, 1988

John P. Albright, M.D., Director
University of Iowa Sports Medicine Services
Department of Orthopaedics
Carver Pavilion

Re: Proposal: "Relationship Between Self Concept, Eating Behavior and Gymnastic Success of Female Collegiate Gymnasts from NCAA Big Ten Conference Teams" By Valerie A. Ubbes

Dear Dr. Albright:

The Sports Medicine Research Committee has reviewed the above proposal. The comments of the reviewers were favorable. One reviewer indicated that it was a well designed study. Others emphasized that they felt it would be likely to provide helpful information. The committee did not find any significant risks to the proposed participants and felt that the 35 minute testing period was not excessive.

Sincerely,

Joseph A. Buckwalter, M.D.

JAB/jam

CG: Christine Grant, Assoc. Professor
Women Athletics
340G CHA

Diane DeMarco
Women Gymnastics Coach
CHA