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Results of a Plyometric Intervention Program and Relationship of Sport Commitment

by

Sonya L. Sanderson

A Dissertation Submitted to
the Faculty of The Graduate School at
Middle Tennessee State University
In Partial Fulfillment
of the Requirements for the Degree
Doctor of Arts

May
2002

UMI Number: 3042220

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ABSTRACT

This study describes the results of an eight week jump training intervention program on the vertical jump (VJ), block jump (BJ), and approach jump (AJ) performances of female high school volleyball players. A secondary purpose was to determine the association of the Sport Commitment Model constructs with increases in VJ, BJ, and AJ.

Eighteen high school female volleyball players were randomly assigned to participate in either Group 1, which received an eight week jump intervention program designed to improve VJ, BJ, and AJ or, Group 2, which received a control program of volleyball strategy training with no jumping.

Results demonstrated that Group 1 participants improved in VJ (1.06 in), BJ (.39 in), and AJ (.72 in). When compared with Group 2, control participant differences were significant at the $p < .05$ for the BJ, but not for the VJ or AJ. A significant relationship did not exist among mean gain scores of jump measurements with the constructs of the Sport Commitment Model.

APPROVAL PAGE

Results of a Plyometric Intervention Program and Relationship of Sport Commitment

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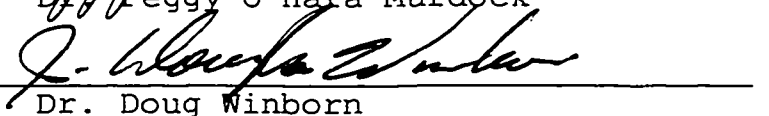
Committee Members 
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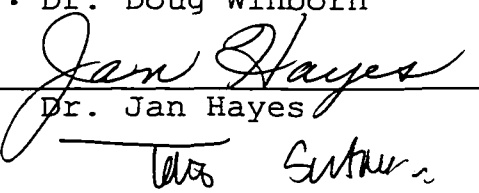
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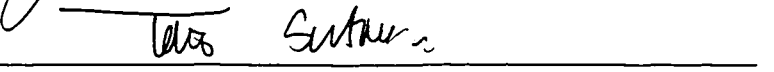
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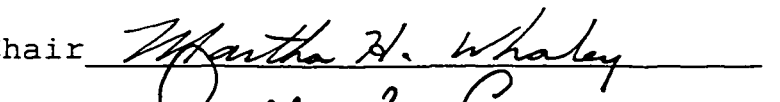
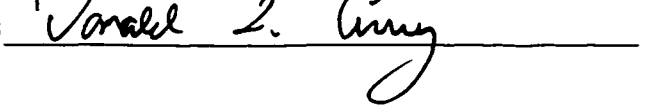
HPERS Department Chair 

Dean of Graduate Studies 

This dissertation is dedicated to my parents (James and Pat Sanderson) and to all of my friends who were there for me from the first day I entered Middle Tennessee State University to the day I earned my Doctor of Arts degree.

ACKNOWLEDGEMENTS

I wish to thank people who have helped me in the course of this work. I want to thank Dr. Peggy O'Hara-Murdock for her constant guidance, patience, and encouragement as my committee chair. I thank Dr. Jan Hayes for being such a positive and inspiring person, Dr. Doug Winborn for his comments and suggestions, and Dr. Toto Sutarso for his assistance with statistical information. A special thanks to Dr. Kent Wagoner for originally setting up SPSS programs for data collection.

Thanks to my friends to helped with data collection (Mom, Michelle Anderson, Melissa Bosi and Leigh Jackson). I thank all of the people who were there on a daily basis extending positive words of encouragement (Mom, Paula Stamps, Paula Pahmier, and many others).

I thank Lisa Kissee for giving me the opportunity to return to school and assist with the MTSU volleyball team while working towards my Doctor of Arts degree.

Thank you faculty of Riverdale High School (Tom Nolan, Ricky Field, Dr. Andrea Anthony, Barbara Wolff, and many others) and the 2000-2001 volleyball team.

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CHAPTER I

INTRODUCTION

During the past two decades, elite female collegiate athletes captured the attention of sports' enthusiasts as they displayed their skills and talents, but the increases in opportunities for female athletes drew little attention from researchers (Finkenberg, Mitchell & Weems, 1991). In sports that involve explosive power such as volleyball, players who possess the best jumping ability or quickness have an advantage over their opponents (Pestolesi, 1989). Pestolesi commented that the outcome of many contests is often determined by the ability of an individual to jump. As a result, coaches must design practice drills and individual activities that will lead toward optimum development of vertical jump performance (Pestolesi).

Women are becoming more aware of the importance of strength in the execution of various skills such as jumping (Ruley, 1979). Training programs used most commonly for improving vertical jumping performance have included different types of depth jumps, referred to as plyometric training, as well as more conventional training programs

(Helling, 1980). Beal (1994) wrote that the United States Men's National Volleyball coach believed that jumping was the purest form of a power movement. Plyometrics offer the athlete an intense method of improving his/her anaerobic capacity along with developing neuromuscular power (Roth, 1991).

Coaches as well as strength and conditioning professionals have long used performance tests such as the vertical jump to assess athletic ability (Klavora, 2000). These tests help coaches identify athletes' strengths and weaknesses, chart and document progress, or assign positions by ranking individuals (Klavora). Due to higher levels of competition and higher levels of physical conditioning, athletes and coaches strive to improve performance year after year (Klavora; Villarreal, 1992).

Vertical jump testing is used to measure the effectiveness of various training programs in the development of explosive power, including strength-training programs, plyometrics, and periodization training. The vertical jump is also used for talent identification and the prediction of future success in specific athletic disciplines (Klavora, 2000).

Plyometrics are commonly used to increase vertical jump height, agility, and power (Gambetta, 2000; Imisons, 2000). Plyometrics have been defined as: 1) powerful muscular contractions in response to rapid, dynamic loading or stretching of the involved muscles (Radcliffe & Farentinos, 1985), 2) a resistance-training activity that involves an interaction between muscles and the central nervous system (Von Duvillard, 1990), 3) linking speed with movement (Brittenham, 1996; Yessis, 1991), 4) a bridge between strength and speed (Gambetta, 1990; Othersen, 1992), 5) a natural part of most movements (Faigenbaum, 2000; Pate, 2000), 6) explosive responses in muscles that enhance performance (Beal, 1984; Seabourne, 2000; Waller & Piper, 1999), 7) being synonymous with power training (Brittenham, 1992), 8) activities that are experienced in short periods of time and include components of power, speed, and strength (Helling, 1980), and 9) an activity that allows the athlete's inborn reflexes to maximize muscle fiber recruitment (Skotidas, 1995).

Power is the relationship between strength and speed, and the ability to generate maximum force in the least amount of time (Brittenham, 1996; Gambetta, 2000). Brittenham (1996) stated that volleyball is a power sport,

combining strength and speed to enhance explosiveness, agility, coordination and reaction/response time. The stronger the athletes, the greater potential for increased power development (as the athletes' strength increases, they may progress to drills of higher intensity and greater volume)(Brittenham, 1996).

Motivation of athletes remains one of the most important challenges facing a team sport coach since it is difficult to prepare athletes individually for participation in team sports (Cox, 1986). Cox feels that the inverted "U" best describes the relationship between motivation and athletic performance (when motivation increases, performance normally will increase and when motivation decreases, performance normally decreases).

Rahshulte (1999) cited that increased motivation would facilitate athletic performances to higher levels. According to Huddleston and Garvin, many coaches spend time searching for the key to motivate athletes in an attempt to influence competitive behavior. The success for motivating athletes to be more competitive requires knowledge of certain individual variables such as whether an athlete is motivated to improve the quality of performance or to provide a winning performance (Huddleston & Garvin).

Significance of the Study

No research exists that evaluates the effectiveness of jump training interventions on female high school volleyball players for gains in vertical, block, or approach jumps. Research examining the association of motivational factors and sport commitment with jump performance has not been conducted at any level for female volleyball players. An investigation of a jump training intervention program as well as variables (such as sport commitment) dealing with successful volleyball programs is deemed necessary in determining what type of jump training intervention programs may be useful for volleyball programs. At the collegiate level, coaches are recruiting athletes who demonstrate that they are more advanced in jump training abilities than athletes who need training or have no knowledge of jump training (L. G. Kissee, personal communication, April 12, 2000). Summers (1999) reported that a Colorado high school trains athletes in strength and speed activities so that when the athletes go to college they will be ready to participate in collegiate strength and conditioning programs.

This study will provide results from a jump training intervention program that can be replicated for other high

school female volleyball programs. This study will also answer questions about the association of sport commitment to improvement from a jump training intervention program.

Purpose of the Study

The primary purpose of this study was to evaluate the effects of an eight week jump training intervention program for the vertical jump (VJ), block jump (BJ), and approach jump (AJ) performances of female high school volleyball players.

A second purpose of this study was to determine whether an association exists among players' sport commitment and gains in VJ, BJ, and AJ performance.

Research Questions

The following four questions were investigated during the course of this study:

1) Did the intervention group show more improvement than the control group with respect to their VJ, BJ, and AJ after eight weeks of training?
2) Did an association exist among the jump measurement scores for the VJ, BJ, and AJ?
3) Did an association exist among the five constructs of the Sport Commitment Model (SC, SE, PI, OI, and SOC)?

4) Did an association exist among the mean score differences of each jump and each construct of the Sport Commitment Model (SC, SE, PI, OI, and SOC)?

Hypotheses

1) Individuals who receive the intervention will show greater gains from pre-training to post-training in VJ, BJ, and AJ performance than non-intervention participants.
2) There will be an association among the jump measurement scores for the VJ, BJ, and AJ.
3) There will be an association among the five constructs of the Sport Commitment Model (SC, SE, PI, OI, and SOC).
4) There will be an association among the mean differences of each jump and each construct of the Sport Commitment Model.

Assumptions

1) The volunteers selected for this study were a representative population of competitive high school volleyball programs.
2) The athletes performed to the highest level of their ability during the jump training intervention program and testing.

2) The athletes performed to the highest level of their ability during the jump training intervention program and testing.

3) Intervention and control group contamination was controlled during the eight week intervention program.

4) Investigator bias was controlled through blinding of data collection on the Sport Commitment Model through coded answer sheets.

5) The items on the Sport Commitment Model were valid and reliable measures of sport commitment (motivation) under the areas of investigation.

Delimitations

1) This study is limited to a group of volleyball players who attended a high school in Middle Tennessee.

2) This study is limited to a sample of 18 high school volleyball players randomized into two groups of nine per group for intervention and control groups.

Definition of Terms

Ankle Bounces--An exercise performed with the knees slightly bent and arms raised overhead, bouncing up and down off the toes (Hewett et al., 1996).

Approach Jump--A two to five-step approach performed against a wall. Distance is measured from the highest reaching point with feet flat on the ground to the highest point touched during the jump (Radcliffe & Farentinos, 1985).

Basic Jump Training--An exercise that is performed without using apparatus (Gambetta, 1996).

Block Jump--A two-foot takeoff performed from a standing position facing a wall and extending both arms to the highest reach. The distance is measured from the highest reaching point with feet flat on the ground to the highest point touched during the jump (Radcliffe & Farentinos, 1985).

Bound--A plyometric exercise that requires the athlete to move horizontally and vertically, with an exchange from one foot to the other (Johnson-Armitage & Halling, 1990).

Broad Jump--A two-foot horizontal jump (jumping out as far as possible) (Hewett et al., 1996).

Depth Jumps--A person jumps off of an apparatus (12-42 inches) onto a resilient mat, then follows with an immediate jump upward (Radcliffe & Farentinos, 1985).

Hop--A plyometric exercise that requires the athlete to perform horizontal and/or vertical movement with one foot consecutively (Johnson-Armitage & Halling, 1990).

In-place jumps--An exercise that is performed in one place, such as a vertical jump and a tuck jump (Johnson-Armitage & Halling, 1990).

Involvement Opportunities--A construct of the Sport Commitment Model defined as "valued opportunities that are present only through continued involvement" (Scanlan, Carpenter, Schmidt, Simons, & Keeler, 1993).

Leaps--A large stepping movement performed low to the ground (low amplitude) and alternating legs (Johnson-Armitage & Halling, 1990).

Line Jumps--A double leg jump over a line from side to side with the feet together (Chu, 1998).

Personal Investments--A construct of the Sport Commitment Model defined as "a personal resource put into the activity which cannot be recovered if participation is discontinued" (Scanlan, Carpenter et al., 1993).

Plyometrics—An exercise characterized by powerful muscular contractions in response to rapid, dynamic loading or stretching of the involved muscles (Radcliffe & Farentinos, 1985).

Power--A relationship between strength and speed and the ability to generate maximum force in the least amount of time (Brittenham, 1996).

Repetition--The number of times an activity is performed (Johnson-Armitage & Halling, 1990), (i.e.; 10 reps X 2 sets).

Scissors Jump--Jumps begun in a stride position with one foot well in front of the other. Performed by jumping up and alternating foot position in midair (Hewett et al., 1996).

Sets--The units of repetitions (Johnson-Armitage & Halling, 1990).

Social Constraints--A construct of the Sport Commitment Model defined as "social expectations or norms that create feelings of obligation to remain in the activity" (Scanlan, Carpenter et al., 1993).

Specificity--Exercises that can be geared to any sport (Keenan, 1997).

Sport Commitment--A construct of the Sport Commitment Model defined as "a psychological construct representing the desire and resolve to continue sport participation" (Scanlan, Carpenter et al., 1993).

Sport Enjoyment--A construct of the Sport Commitment Model defined as "positive affective response to the sport experience that reflects generalized feelings such as pleasure, liking, and fun" (Scanlan, Carpenter et al., 1993).

Standing Reach--The distance that is measured to the highest reaching point with the dominant arm, with the feet flat on the ground, and standing sideways to a wall (Radcliffe & Farentinos, 1985).

Training Frequency--The number of training sessions per day or week (Johnson-Armitage & Halling, 1990).

Tuck Jump--A jump begun from a standing position jump with both knees brought up to the chest as high as possible (Hewett et al., 1996).

Vertical Jump--A two-foot takeoff that is performed from a standing position near a wall. The distance is then measured from the highest reaching point with feet flat on the ground to the highest point touched during the jump (Dintiman & Ward 1988).

CHAPTER II

REVIEW OF LITERATURE

The Review of Literature is divided into two areas of jump training/plyometrics and sport commitment/motivation. The two areas include a) a brief history of volleyball and plyometric training, b) descriptions of plyometrics/basic jump training, c) plyometric training programs, d) plyometric/jump training intervention studies, e) an overview of sport commitment/ motivation, and f) studies conducted on the Sport Commitment Model.

History of Volleyball

William C. Morgan originated the sport of volleyball in 1895 while he was a director at a YMCA in Holyoke, Massachusetts (Dinsmoor, 1993). After 100 years, volleyball is beginning to receive the attention it deserves. A game that began as a not-too-strenuous activity for middle-aged men is one of today's most popular sports for both men and women (Globus, 1997). William C. Morgan probably did not envision the way volleyball would grow and change from its less strenuous version to being

played by young athletes jumping high in the air spiking balls or blocking incoming balls (Dinsmoor).

During World War II, many Europeans had their first knowledge of volleyball when they saw American Servicemen playing the game. The International Volleyball Federation (IFV) was formed in Paris in 1947. Not long after the IFV was formed, the Japanese developed a new style of playing volleyball, which is referred to in today's game as "power volleyball". In 1964, volleyball became an Olympic event and is now more popular and demands more skill than ever before (Dinsmoor, 1993).

The United States Volleyball Association (USVBA) has grown into the largest membership group for competitive volleyball players of all ages since 1980. The sophistication of the Junior Olympic and youth volleyball clubs nationwide is largely responsible for the high quality of play found at higher levels (Neville, 1990). In club volleyball alone, it is estimated that hundreds of thousands of boys and girls aged 7-18, compete throughout the United States. As of 1996-97, volleyball was the 3rd most popular sport for girls in the U.S., consisting of 12,986 teams and 370,975 participants. As of 1996-97 in the state of Tennessee, 4,050 females were participating on

volleyball teams at the high school level. Currently 225 female teams participate in Tennessee's 8 regions consisting of 16 different districts sanctioned by the TSSAA (Tennessee State Secondary Athletic Association) organization. As of 2001, 963 female collegiate teams (Division I, 299; Division II, 272; Division III, 392) and 68 men's teams (Division I, 22; Division II, 14; Division III, 32) compete Nationally and are sanctioned by the NCAA (National Collegiate Athletic Association). National Association of Interscholastic Athletics (NAIA) included 273 female teams and 20 men's teams as of 2001. In 2001, the National Junior College Athletic Association (NJCAA) included 201 Division I and 68 Division II female teams.

The description by Dinsmoor (1993) that volleyball has a reputation of being a tame sport, no longer fits. Volleyball demands quick bursts of power, quick reflexes, coordination, balance, and provides a complete physical workout. According to Brant (1996), many fans prefer the women's game of volleyball to the men's since the women's game features longer rallies and involves more strategy than the men's game.

Plyometric Training

Training elite volleyball players involves weight lifting, jumping drills, and plyometric exercises to achieve maximal performance. Since jumping is fundamental to playing volleyball most players train intensively to develop higher VJs (Richards, Ajemian, Wiley, & Zernicke, 1996; Watson, 1983). Plyometric training is currently considered a credible approach as well as one of the most popular forms of training used to achieve jumping improvements (Gambetta, 2000).

Plyometrics came from Russian and Eastern European success in track and field beginning in the mid-1960s (Von Duvillard, Flynn, Jones, & Vetro, 1990). In Russia plyometrics was known as "jump training" or "shock training" until Fred Wilt (a former Olympic runner and a coach for the women's track team at Purdue University) introduced the term "plyometric training" in the 1960's to the United States (Imisons, 2000). The origin of plyometrics is thought to be derived from the Greek word "pleythyein," meaning to augment or to increase, or from the Greek root words "plio" and "metric," meaning more and measure (Radcliff & Farentinos, 1985). Yuri Verhoshansky, a leading Soviet coach has been referred to as the "Father

of Plyometrics" since he developed the methodologies most widely used by sport coaches and strength and conditioning coaches (Von Duvillard et al., 1990). Until recently acceptance in the United States has been slow due to coaches believing that plyometrics hindered (not helped) performance and not understanding how to use plyometrics in their training (Brooks, 1999; Ebben & Watts, 1998). According to Imisons, plyometrics became a training buzzword in the 1990's. Since the 1990's, plyometric training has gained worldwide acceptance and credibility through scientific research (Gambetta, 2000; Von Duvillard et al.).

Plyometric Definitions

Plyometrics have been defined in a number of ways, such as: 1) powerful muscular contractions in response to rapid, dynamic loading or stretching of the involved muscles (Radcliffe & Farentinos, 1985), 2) a resistance-training activity that involves an interaction between muscles and the central nervous system (Von Duvillard, 1990), 3) a link of speed with movement (Brittenham, 1996; Yessis, 1991), 4) a bridge between strength and speed (Gambetta, 1990; Othersen, 1992), 5) a natural part of most movements (Faigenbaum, 2000; Pate, 2000), 6) explosive

responses in muscles that enhance performance (Beal, 1984; Seabourne, 2000; Waller & Piper, 1999), 7) a synonym with power training (Brittenham, 1992), 8) activities that are experienced in short periods of time and include components of power, speed, and strength (Helling, 1980), and 9) an activity that allows the athlete's inborn reflexes to maximize muscle fiber recruitment (Skotidas, 1995).

Jump Training/Plyometrics

Physiology.

An important feature of plyometric training is the conditioning of the neuromuscular system to allow for fast and powerful changes of direction (Radcliff & Farentinos, 1985). That is, if the legs and fast-twitch muscle fibers are strengthened then VJ performance will increase (Asim, 1999). Great jumpers normally have higher percentages of fast-twitch muscle fibers than slow-twitch muscle fibers in the legs (Keenan, 1997). The differences between fast-twitch fibers and slow-twitch fibers are about 40% to 60% (Keenan). Fast-twitch fibers contract quickly and require anaerobic energy metabolism, whereas slow-twitch fibers contract more slowly and use aerobic energy metabolism (Imisons, 2000).

Initially athletes who have never performed plyometrics will see a negative effect due to the protective effect of the Golgi tendon. However, after a couple of weeks of plyometrics, jump performance will begin to improve (Kramer & Newton, 1994). A shortened (concentric) contraction that immediately follows a lengthening (eccentric) contraction utilizes the elastic energy that is stored in the muscles (Gambetta, 1996). Plyometrics decrease the time between the eccentric (lengthening) contraction and concentric (shortening) contraction of the muscles, providing improvements in forceful body movements (Von Duvillard et al., 1990). The increased rate of stretching during the eccentric phase allows for higher VJ (Potach & Chu, 2000). Contractions of muscles in most cases are between one and two tenths of a second according to Brooks (1999). Actual jumping achievement depends crucially on precise "timing" of muscles actions (Bobbert & Van Soest, 1994). The AJ uses quicker and more forceful eccentric phases than other jumps (Potach & Chu, 2000). Walking can even be characterized as a plyometric exercise since every time the foot hits the ground, the quadriceps goes through a stretching and shortening cycle (Faigenbaum, 2000).

Vertical Jump

The key to improving VJ is to address the individual player's strengths and weaknesses (Gambetta, 2000). Jumping is a constant interchange between force production and force reduction leading to a summation of forces that utilizes all three joints of the lower body: the hip, knee, and ankle (Cisar & Corbelli, 1989; Gambetta, 2000; Weaver, 1999). During the VJ, the muscles around the hips, knees, and ankles act rapidly and with great force in an attempt to produce the greatest possible speed of the body as it leaves the ground (which ultimately determines jump performance) (Weaver). L. G. Kissee (personal communication, April 12, 2000) stated her reason for incorporating plyometrics/jump training into her volleyball program is for quickness, hip and leg strength, and explosiveness. The legs and hips are main movers, but research suggests that the arm swing can involve as much as 5% of jumping velocity (Hatfield, 2000). Pestolesi (1989) commented that even a trained athlete could expect an increase in jumping ability from 10% to 25% with a good plyometric program.

Plyometric Training Programs

Training programs depend on the athlete's level of development, time of the training year, practicality, context of time, and proper facilities (Gambetta, 1996). When performing plyometrics, one should stretch (since a flexible muscle reacts and contracts faster), and warm-up (warm muscles have a higher temperature so more blood flows to the muscle tissues) (Keenan, 1997; Madden, 1998). The best results for increasing VJ performance when using plyometrics are achieved when athletes are "fresh" (Brittenham, 1996; Madden; Pate, 2000). Two to three days of plyometrics a week with at least 48 hours of rest between sessions provides optimal results when training (Gambetta, 1996; Chu, 1998; Othersen, 1992; Radcliffe & Farentinos, 1985). During in-season (competition phase), plyometric training should be removed or largely reduced to eight to ten repetitions with 6 to 10 sets depending on the plyometric exercises (Gambetta, 1996; Kraemer & Newton, 1994). Athletes should take a couple of seconds rest between repetitions and at least 30 seconds to two minutes of rest between sets (Radcliffe & Farentinos; Seabourne, 2000). A plyometric program should not exceed 20 to 30

minutes with an additional 10 to 15 minutes devoted to warm-up and cool-down activities (Chu, 1998).

Beginners should start a plyometric program with general to more advanced exercises such as, 60-100 foot contacts and increase to 150-250 foot contacts with low to moderate intensity exercises (hopping, and skipping to more advanced jumps) (Gambetta, 1996; L. G. Kissee, personal communication, April 12, 2000; Othersen, 1992; Von Duvillard et al., 1990; Waller & Piper, 1999; Yessis, 1991). For example, an activity like the standing triple jump, comprised of three parts, counts as three foot contacts (Chu, 1998). Athletes should wait until after the onset of puberty for significant responses from plyometrics (Brittenham, 1996; Chu, 1998; Gambetta, 1996; Radcliffe & Farentinos, 1985; Sinclair, 1981). An increased risk for joint injury (premature sealing of epiphysis/growth plate) occurs if athletes start too young (Brittenham, 1996).

Gambetta (1996) stated, "that athletes who have a history of injuries to the lower extremities or who are recovering from an injury of the lower extremities should not perform plyometrics. The athlete should resume plyometric training only with a doctor or trainer's approval" (p.11). However, when plyometric exercises are

done properly and under appropriate supervision they offer no greater risk than any other exercise program (Radcliffe & Farentinos, 1985). When plyometrics are done correctly and at the right time, they enable the athlete to gain more speed and explosiveness than can be gained by any other method presently known (Yessis, 1991). In most cases the athlete's own body weight provides the resistance that is necessary to create the explosiveness needed for plyometrics (Pate, 2000).

All lower body plyometrics should be performed on a semi-resilient surface, such as, well-groomed grass, a rubberized track, tumbling mats, or artificial turf. These resilient areas should also be dry, level and free of obstructions (Brittenham, 1996).

Plyometric/Jump Training Interventions

Several researchers in the field of plyometrics/jump training have evaluated the effectiveness of different types of jump training intervention programs on VJ performance of participants. Plyometrics are divided into three different groups of jumps: without apparatus, over apparatus, and on and off apparatus (Pauletto, 1994).

Bartholomew (1985) found that after an eight week jump training intervention program with three groups of

male collegiate students, each showed an increase in VJ performance. Each group trained two times a week for two four week periods separated by a one week break. Group 1 performed depth jumps from 80 cm in height and increased 13.1% or 3.3 inches; Group 2 performed depth jumps from 50 cm in height and increased 16.2% or 4.0 inches and Group 3 performed basic jump training on the floor and increased 19.0% or 4.6 inches in jump performance. Group 3, who performed basic jumping exercises (with no apparatus), had more of an increase in VJ performance than those who did the depth jumps. Bartholomew concluded there is no evidence that depth training using apparatus is better than basic on the floor jump training. Basic on the floor jump training is also cheaper, safer for participants and does not require any major equipment according to Bartholomew.

Newton, Kraemer, and Hakkinen (1999) conducted a study with 16 male volleyball players to determine the effects of VJ performance on an eight week ballistic resistance-training program incorporated into the preseason preparation of elite volleyball players. Participants had prior knowledge of resistance training (two years) and also had participated in volleyball for five years. The primary results of Newton's et al. (1999) study indicated that an

eight week program of ballistic resistance training is effective for increasing the VJ (5.9 cm or 2.3 in) and AJ (6.3 cm or 2.5 in) performance of elite volleyball players. Ballistic resistance training has also been effective for increasing explosive performance of non-elite participants. Newton et al. found that with the addition of ballistic training to preseason training there was an improvement of 5.9% and 6.3% in the VJ and AJ, respectively. Newton et al. wrote that VJ performance would be improved when plyometrics are combined with weight training.

Hewett, Stroupe, Nance, and Noyes (1996) conducted a study of 11 female high school players (mean age-15, weight-139, height-66.4 inches, and two years volleyball experience) for six weeks to determine if training in jumping and landing techniques could increase VJ performance and strength of participants. Participants performed a warm-up, jump training and then weight training for three days a week and for two hours a day. The results showed an increase in VJ performance by 9.2% or 1.5 inches after the six week training program. The range of increases for VJ was from 0 to 6 inches. Hewett et al. (1996) stated that 1.5 inch increase in jump performance over a six week training period is considerable. Hewett et

al. gave a few explanations for the importance of the 1.5 inch increase: 1) the 1984 U.S. Olympic Gold Medal Volleyball Team increased their vertical by 4 inches using a similar jump intervention over a two year period, and 2) female collegiate volleyball players increased their verticals with a similar intervention by 1.3 inches over an 11 month period (Dunnam et al., 1988). Hewett et al. believe that jump training programs that incorporate stretching, plyometric exercises, and weight lifting will increase performance and decrease injury risk in competitive athletes involved in jumping sports.

Fatouros, Jamurtas, Leontsini, Taxildaris, Aggelousis, Kostopoulos, and Buckenmeyer (2000) conducted a study with 41 males who were divided into four groups for plyometric training (N = 11), weight training (N = 10), a combination of plyometrics and weight training (N = 10) and a control group (N = 10). Intervention groups trained three days per week. The plyometric group improved 6 inches, the weight training group improved 5.4 inches, the combination group increased 8.6 inches on VJ performances, and the control group improved .4 cm (.1 in). Fatouros et al. (2000) stated that plyometric training resulted in a slightly better improvement than weight training in VJ performance,

Clutch, Wilton, McGown, and Bryce (1983) conducted two different experiments investigating the effectiveness of exercise programs. In experiment 1, 12 male participants (mean age = 20.9) were divided into four groups of 1) maximum vertical jumps, 2) .3 m depth jumps, 3) .75 m and 1.10 m depth jumps, and 4) a control group that performed no jumps. All groups participated in weight training. Group 1 increased, 2.1 cm (.8 in); Group 2, 3.4 cm (1.3 in), and Group 3, 3.0 cm (1.2 in) in VJ performance. The investigators gave no findings for Group 4. The results of this study indicated that depth jumps, when combined with weight training are no more effective than a program of maximum vertical jumps.

In experiment 2 by Clutch et al. (1983), 32 male participants (16 weight training individuals and 16 members of the men's volleyball team at Brigham Young University) (mean age 21.2) were selected. All were randomly assigned to either Group 1, who trained with weights and depth jumps or Group 2, who trained with weights but performed no depth jumps. Group 1 performed depth jumps from .75 m to 1.10 m for two times a week for 16 weeks (in addition, volleyball players practiced five days a week for 2.5 hours a day).

Group 1 increased jump performance by 3.7 cm (1.5 in), whereas Group 2 decreased in jump performance of -0.1 cm (0.0 in). The volleyball players who were participants in Group 1 increased VJ performance by 3.2 cm (1.3 in) and in Group 2 volleyball player's increased in VJ performance by 4.3 cm (1.7 in). Results from experiment 2 found depth jumps to be more useful for athletes who were not performing in other jumping activities, and depth jumps did not improve VJ over what is obtained from normal volleyball practices.

Pestolesi (1989) conducted his study with 33 high school athletes (ages 14-18) for six weeks to find if weight training would improve VJ performance over jump training. Participants were randomly placed into Group 1, which trained with weights, Group 2, which performed jump training, or Group 3, which continued participating in the regular physical education classes only. Pestolesi found that after six weeks of training three times a week there was a slight increase in AJ for Groups 1 (.2 in), Group 2 (.7 in), and Group 3 deceased in AJ (-.2 in). Pestolesi concluded that weight or jump training can increase VJ performance over a six week period.

Gehri, Ricard, Kleiner, and Kirkendall (1998) conducted a 12 week study with 28 college students (14 female and 14 male) to determine which plyometric training technique is best for improving VJ performance. Group 1 performed depth jumps (N = 11), Group 2 performed counter movements with jump training (N = 7), and Group 3 was a control group with no jumps (N = 10). Group 1 improved in squat jumps (SJ) 1.9 cm (.7 in), in depth jumps (DJ) 1.7 cm (.7 in), and 2.4 cm (1.0 in) in countermovement jumps (CMJ). Group 2 improved in SQ 3.3 cm (1.3 in), DJ 2.1 cm (.8 in), and CMJ 2.8 cm (1.1 in). Group 3 improved in SJ .2 cm (.1 in) and .6 cm (.2 in) in DJ and decreased in CMJ -.9 cm (-.3 in). The results of this study suggested that counter movements with jump training were equally effective in improving VJ performance.

Gemar (1986) tested 36 females and 36 males from a beginning weight training class twice a week for four weeks to determine if plyometric exercise programs were more effective in improving VJ and sprinting performance than a weight training exercise program. Gemar developed the following three groups: 1) weight training (12 female and 12 male), 2) plyometric (12 female and 12 male), and a 3) control group (12 female and 12 male). Gemar found gains

of 1.8 cm (.7 in) in Group 1 and gains of 2.3 cm (.9 in) for Group 2 in VJ performance. Gemar concluded that four weeks was not enough time to show a significant difference between the two intervention groups.

Cesarin, Mattacola, and Sitler (2001) studied 20 male participants (mean age 16.4) who were randomly assigned to either Group 1, who performed water plyometrics, or Group 2 who performed land plyometrics. Group 1 performed all jumps in waist deep water. The six week training protocol consisted of the participants performing three sets of twelve repetitions of stand and reach jumps at 80% of the participants individual maximal VJ height in weeks one and two. In week three, participants performed three sets of jumps at 85%, week four consisted of three sets of eight jumps at 90%, weeks five and six required the participants to jump three sets of five repetitions at 95%. The investigators found no difference between the two training programs, but they did find an increase in VJ from pretest to posttest for Group 1 of 2.5 cm (1.0 in) and 3.2 cm (1.24 in) for Group 2. The investigators concluded that using natural properties of water limited the impact on the lower extremities and also helped to decrease the chances of injury without compromising the training effect.

Sport Commitment (Motivation)

"It has only been during the last five years that there has been a systematic effort to investigate the impact of different psychological environments on participants motivation" (Ntoumanis & Biddle, 1998) (p. 3). Motivation for engaging in physical activity has been a central research topic in sport and exercise for years (Li & Harmer, 1996). Li and Harmer asserted that the primary interest of research should be on the development of conceptual models that delineate factors that facilitate and enhance motivation levels in physical activity involvement. While motivation in team sports is an important topic of discussion in the literature, little research has been conducted in this area (Li & Harmer).

George and Feltz (1995) conducted a study that examined elite athletes and the relation of goal orientations to perceived purposes of their involvement during training. Results suggest that the personal utility value of practicing in sport is perceived by elite athletes to some extent as different depending upon their motivational goal perspectives. The field of sport psychology has generally focused on investigating and enhancing individual motivation and performance in sport,

despite the fact that most sport activities occur in group settings (George & Feltz). Rahschulte (1999) cited that "dedicated athletes have a strong desire to improve, to compete, and to win" and that "many athletes know what method of motivation works best to enhance their level of performance" (p. 61). Higher amounts of motivation will facilitate athletic performances to higher levels of performance (Rahschulte). If the coaches' and athletes' motivational techniques are not compatible, athletes most likely will not excel in their performance (Rahschulte).

Ommundsen and Roberts (1996) found that achievement goals provide considerable insight into the kinds of reasons elite athletes participate in training. Specific sport training along with jump training must be motivating for athletes so they have something that they can relate to and be able to monitor their progress (Gambetta, 1996).

In 1993, Scanlan, Carpenter, Schmidt, Simons, and Keeler introduced a sport specific theoretical model of commitment. Sport commitment is defined as a psychological state representing the desire or resolve to continue sport participation. The basis of the Sport Commitment Model comes from theoretical concept of commitment in social and organizational psychology. The Sport Commitment Model

proposes that sport commitment is determined by the five constructs of 1) sport enjoyment, 2) involvement alternatives, 3) personal investments, 4) social constraints, and 5) involvement opportunities. The first study on the Sport Commitment Model was conducted on 95 females and 83 males who participated in a little league softball/baseball program. Correlational analyses demonstrated that several predictors were related to sport commitment. Stepwise regression findings revealed that sport enjoyment and personal investments were the dominant predictors of commitment for their sample and accounted for 58% of sport commitment variance.

Scanlan, Simons, Carpenter, Schmidt, and Keeler (1993) continued the model's progress by developing a set of survey measures to assess constructs of the Sport Commitment Model in the youth-sport domain. Question items were examined with three separate samples of 140, 178, and 1342 athletes (swimmers, badminton, baseball, softball, football, volleyball, and soccer). Overall, results of the three samples indicated reliable measures that can be used in tests of the Sport Commitment Model across samples of youth-sport athletes representing diversity in age, gender,

and ethnicity. The investigators found that sport enjoyment was the highest predictor of commitment.

Carpenter, Scanlan, Simons, and Lobel (1993) published their results of a structural equation modeling analysis of the Sport Commitment Model. Their research demonstrated that the Sport Commitment Model was applicable to both athletes younger than 12 years and those older than 12 years of age, to males and females, and to three different team sports. Structural equation modeling results demonstrated that the proposed model was a good fit of the data (CFI = .981), with the findings accounting for 68% of the commitment variance. Commitment was hypothesized to be a function of sport enjoyment, personal investments, and involvement opportunities. The investigators found that social constraints were negatively related to commitment. The investigators excluded involvement alternatives constraints due to measurement problems. Carpenter et al. stated with confidence that this Sport Commitment Model is the strongest predictor of sport commitment.

Weiss, Kimmel, and Smith (2001) researched youth tennis players (N = 198), 84 females, 114 males ranging in ages from 10 to 18 years, using the Sport Commitment Model. Weiss et al. (2001) found sport commitment, sport

enjoyment, personal investments, and social constraints as positive predictors for tennis commitment and attractiveness of alternative activities a negative predictor of tennis commitment. Results from this study provided additional support for the Sport Commitment Model. The Sport Commitment Model was viewed as an appealing conceptual framework because it was based on theory and research on commitment to social relationships yet customized for physical activity contexts.

Schmidt and Stein (1991) defined commitment to sports as a duration of participation in sports and commitment as simply membership stability. Carpenter et al. (1993) found a significant correlation among sport commitment, sport enjoyment, and involvement opportunities. These three variables were also found to be the strongest predictors of commitment. Enjoyment is a crucial element of understanding and explaining exercise participants' motivation and experiences, but it remains poorly defined (Kimiecik & Harris, 1996).

Helsen, Starkes, and Hodges (1998) suggested that the Sport Commitment Model provides an outline for motivational structures and precursors necessary for the development of expert performance. Skill improvement or increased

competence is a significant motivator in sports and is more obvious early in practice where the largest performance gains are noticed according to Helsen et al. (1998), who also felt that early gains help to justify the personal investments of time and effort and certainly increases in enjoyment.

The current study has investigated the association of the Sport Commitment Model with results of an eight week jump training intervention program for female high school volleyball players.

CHAPTER III

METHODS

The primary purpose of this study was to examine the effects of an eight week jump training intervention program on the performance of the vertical jump (VJ), block jump (BJ), and approach jump (AJ) of female high school volleyball players.

A second purpose was to determine whether an association exists among gains in VJ, BJ, and AJ performance and players sport commitment.

Study Design

The study examined 18 high school female volleyball players who were members of a Middle Tennessee high school competitive volleyball program. Pretest measures for reach, height, weight, VJ, BJ, AJ, and the Sport Commitment Model were collected during volleyball camp at a local college. The players were randomly assigned to participate in either Group 1, an eight week intervention program designed to improve vertical, block, and approach jumps or Group 2, a control program of volleyball strategy training

(with no jumps). The researcher hypothesized that participants in the jump training intervention program would demonstrate greater improvements in jump performance than participants in the control program.

Assignment to groups took place through random selection using the last digits of numbers selected from a directory. The nine participants in Group 1 received an eight week jump training intervention program and Group 2 participants received volleyball strategy training (with no jumping). Posttest measures were taken on standing reach, height, weight, VJ, BJ, AJ, and the Sport Commitment Model survey after eight weeks of participation (16-30 minutes for each day performed) in either the jump training intervention program or the control program.

Recruitment

Participants were recruited into the study by volunteer participation. A letter was sent to parents prior to attendance at a summer volleyball team camp at Middle Tennessee State University in Murfreesboro, Tennessee. During the second day of camp each participating athlete completed the Sport Commitment Model survey, a player profile sheet (with items including age, years of experience playing volleyball, number of years participants

played for their current school, position played, when participants began playing team sports, what motivates the player most to play volleyball), and a baseline assessment of height, weight, standing reach, VJ, BJ, and AJ.

Informed Consent

Prior to participation in this study each participant returned a written consent form with participant signature and participant parents' permission, which was written in accordance with the University IRB guidelines and approval (see Appendices A, B, C, D, & E). The principal of the school where the study was to be conducted was sent a letter requesting permission for the team to participate in the study while attending summer volleyball team camp and during the initial eight weeks of the regular volleyball season practice sessions (see Appendix F). Approval was received from the principal to conduct the jump intervention program on the volleyball team (see Appendix G). Next, the volleyball players received a letter that had to be signed by both the participant and the participant's parents and returned to the coach if they agreed to participate in the study (see Appendix H).

Jump Training Intervention Program

Participants were trained using nine different jumps: 1) 180 degree turns, 2) bounding in place, 3) bounding for distance, 4) broad jump-stick landing, 5) line jumps, 6) jump, jump, jump and vertical, 7) scissors jump, 8) tuck jumps, and 9) two-foot ankle bounces. The jump training was performed for two 16-30 minute sessions a week over eight weeks (Hewett et al., 1996). Each participant was asked to perform a normal practice warm-up before performing any jumps (a normal practice warm-up consists of a two-three minute jog and then a 10-minute stretch session). The jump program was developed into three phases of sets and repetitions due to length of high school seasons. Phase 1 (weeks 1 & 2, early pre-season) consisted of participants performing each jump in the intervention for two sets of 10 repetitions (200 foot contacts), phase 2 (weeks 3 & 4, preseason) consisted of three sets of 10 repetitions (300 foot contacts), phase 3 (weeks 5-8, in-season) consisted of one set of 10 repetitions (100 foot contacts) (see Appendix J). These phases represented other investigators' suggestions for preseason, competition (in-season), along with suggestions for beginners to advanced participants (Brittenham, 1996; Chu, 1998; Gambetta, 1996;

Waller & Piper, 1999). Each individual was asked to perform the intervention before practice so muscles were not fatigued. After each intervention session, a manager or assistant coach initialed a compliance sheet that was given back to the researcher at the end of the eight week jump training intervention program (see Appendix K). Any participant with a history of injuries to the lower body (knees, ankles, feet, etc) had to have a doctor's release before performing jumps. Any participant injured or quitting the team during the eight weeks of study was excluded from the study and data analysis.

Control Program

The control program was designed using strategies considered standard training for competitive volleyball teams (Volleyball Coaches Survival Guide, (Gozansky, 2001), Coaching Volleyball Successfully, (Neville, 1990), and Championship Volleyball Techniques and Drills, (Gozansky, 1983)). Two times per week, 16-30 minutes, for eight weeks participants performed offensive hitting (using the block, hitting line, cut shots, tips, and rolls), serving (zones, floaters and top spin serves), setting (zones on and off the net), passing (top spin serves, floater serves, line digs and tips, cross court digs, and passing hits off of a

block), and blocking (outside or middle hits). Participants performed blocks and hitting while stationary on a wooden box, to control for any jumping that normally occurs during these particular skills. Setting and serving were performed on the floor without jumping.

Measures

Body weight.

Using calibrated weight scales, weight measurements were taken at baseline assessment (pretest) with assistants, who were trained by the researcher in weighing procedures, during a summer volleyball team camp. Weight measures were repeated at posttest after eight weeks of jump training intervention or volleyball strategy training. Participants removed shoes and were dressed in practice uniforms during both the pretest and the posttest measurements.

Height.

Height measurements were taken at baseline assessment (pretest) with assistants, who were trained to read height charts. Height was calculated using feet and inches of the participant while standing flat-footed and the back placed against a height chart. Participants removed shoes before both the pretest and posttest measurements.

Player profile.

During the baseline assessment each participant received a profile sheet that included questions on age, years of experience playing volleyball, number of years participants played for their current school, position played, when participants began playing team sports, and factors that motivate participation in volleyball. The profile sheet also included a space for trained assistants to record participant's height, weight, standing reach, VJ, BJ, and AJ measurements (see Appendix H).

Standing reach.

The participant's reach was measured by the highest reaching point of the dominant arm fully extended vertically with the feet flat on the ground standing sideways to a wall by assistants (trained by the researcher) (Radcliffe & Farentinos, 1985).

Vertical jump.

Vertical jump was measured by a two-foot takeoff performed from a sideways standing position near a wall. Participants had a choice to stand with their right or left side to the wall depending on their dominant hand. Distance was then measured from the highest reaching point with feet flat on the ground to the highest point touched

during the jump (Bartholomew, 1985; Chu, 1998; Dintiman & Ward, 1988). A board marked by feet and inches was used to calculate VJ performance. Three trials were completed and the highest jump was recorded (Radcliffe & Farentinos, 1985).

Block jump.

Block jump was measured by a two-foot takeoff that was performed from a standing position facing a wall and extending both arms to the highest reach. Distance was measured from the highest reaching point with feet flat on the ground to the highest point touched during the jump. A board marked by feet and inches was used to calculate BJ performance. Three trials were completed and the highest jump was recorded (Radcliffe & Farentinos, 1985).

Approach jump.

Approach jump was measured by a two to five step approach that was performed against a wall (participants used their approach sideways to the wall as they would when transitioning to hit a ball during a game). Distance was measured from the highest reaching point with feet flat on the ground to the highest point touched during the jump. A board marked by feet and inches was used to calculate AJ

performance. Three trials were completed and the highest jump was recorded (Radcliffe & Farentinos, 1985).

Sport Commitment Model.

A validated survey with 19-questions that describe five constructs of sport commitment (sport commitment (SC), sport enjoyment (SE), involvement opportunities (IO), personal investments (PI), and social constraints (SOC)) was administered at baseline (pretest) and after eight weeks of jump training intervention or volleyball strategy training (see Appendix I). The Sport Commitment Model was validated in 1993 by Carpenter et al. and has been used by study investigators with tennis (Weiss et al., 2001). There were four questions that dealt with SC, SE, IO, and SOC. Three questions assessed PI. Each question was based on a five-point Likert scale. Higher mean scores on questions 1-15 were attributed to higher levels of sport commitment while lower mean scores on questions 16-19 were attributed to higher sport commitment.

Procedures

Pretest (baseline assessment).

Assistants were trained by the researcher to collect baseline assessment measures of the player profile sheet and the Sport Commitment Model prior to the beginning of

scheduled activities on the second day of camp. Instructions were given to each player before jumping measurements took place (see Appendix G). The assistant gave each participant a standard response when she performed jumping measurements. Pretest measures consisted of height, weight, standing reach, VJ, BJ, AJ, and the Sport Commitment Model.

Posttest.

Eight weeks after the pretest, research data were collected on the Sport Commitment Model and the participant's height, weight, standing reach, VJ, BJ, and AJ measures (see Appendix L). Procedures replicated those from the pretest.

Attrition and Compliance

Due to the player's commitment demonstrated by paying camp fees and attending pre-camp fitness training, the researcher anticipated that dropout from team participation would occur prior to baseline assessment and randomization. Attrition due to injury was not anticipated because volleyball is not a contact sport. Most of the injuries that occur are minor in nature and usually result in players returning to the team soon after occurrence. The team selected for this study has a history of high

stability so dropout was not anticipated as a problem during the eight week study.

Sample Size

The sample of 18 participants was based on a power calculation which projects a 0-4 cm (0-1.5 in) gain in VJ, BJ, and AJ occurring in those assigned to group 1. With power of .83 and a difference level at $p < .05$ nine participants per group were estimated to demonstrate a significant difference (Hewett et al., 1996). Hewett et al. (1996) conducted this same jump training intervention on 11 female high school volleyball players to determine if plyometric training would improve VJ performance while decreasing impact forces of jumping.

Analysis of Data

Descriptive statistics were employed to examine associations of factors such as age, height, weight, standing reach, years of experience, years of playing for current school, and the age when participants began playing sports.

Analyses were employed to examine the mean differences between the pretest and posttest for jump measurements and the Sport Commitment Model for all participants.

A MANOVA (multivariate analysis of variance) with repeated measures on the time factor was conducted to determine if the intervention group would show improvement over the control group with respect to VJ, BJ, and AJ. The independent variables (IV) were the jump program with two levels: 1) intervention, and 2) control. The dependent variables (DV) were VJ, BJ, and AJ.

Correlational analyses were employed to examine the association among jump measurements (VJ, BJ, and AJ).

Correlational analyses were employed to examine the association among the five constructs of the Sports Commitment Model (SC, SE, IO, PI, SOC).

Correlational analyses were employed to examine the association among the mean differences of each jump and each construct of the Sport Commitment Model.

CHAPTER IV

RESULTS

The primary purpose of this study was to evaluate the effects of an eight week jump training intervention on the vertical jump (VJ), block jump (BJ), and approach jump (AJ) performances of female high school volleyball players. A second purpose was to determine whether an association existed among the five constructs of the Sport Commitment Model and gains in VJ, BJ, and AJ performance.

This present chapter is divided into the following four sections: 1) Participant Characteristics, 2) Jump Measurement Scores, 3) Sport Commitment Model Scores, and 4) Jump Measurement Scores Associated with the Sport Commitment Model Scores.

Participant Characteristics

Data were collected for 18 members of a female high school volleyball team, aged 13-17 (mean age 14.8), in grades 9-12, who attended a high school in Middle Tennessee. All participants were members of the Tennessee State Secondary Athletic Association (TSSAA) and had successfully completed try-outs in demonstration that they

would be team members for the fall 2000 season. The total sample size for analysis purposes was 89%. Two participants (11%) were not present for the posttest. At pretest factors such as age, years of experience playing volleyball, number of years participants played for their current school, position played, and the age participants began playing team sports were examined for intervention and control group comparison (see Table 1).

There were differences in the years of experience in playing volleyball and in the age when the participants began playing sports between intervention and control groups, but not significant. The intervention group was younger by 2 years when they began participating in sports. The control group had nearly one more year of experience playing volleyball than did the intervention group (see Table 1).

The years experience in playing volleyball for both groups ranged from 1 year to 5 years. Years that the participants played for their current school ranged from 1 to 4 years. The age when participants began playing sports had a range from 4 to 14 years. The height range of participants was 61.5 in (156.3 cm) to 72.0 in (182.9 cm). The participants weight ranged from 110 lbs (50 kg) to 159

lbs (72 kg). The standing reach for participants on the pretest ranged from 81.5 in (207.1 cm) to 92.0 in (233.7 cm).

Table 1

Mean (SD) Intervention and Control Scores on Pretest Descriptive Variables

	Intervention		Control	
	M	SD	M	SD
Age (years)	14.8	(1.20)	14.9	(1.21)
Height (inches)	67.0	(1.83)	66.4	(3.66)
Weight (lbs)	135.0	(9.48)	132.7	(18.39)
Standing Reach (inches)	86.9	(2.74)	86.4	(3.88)
Years of Experience	1.9	(1.05)	2.7	(1.49)
Years Play	1.4	(.88)	1.9	(1.21)
Age Start	7.1	(3.05)	9.1	(3.07)

Note. Years Play = how many years participated in volleyball at current school; Age Start = age at which participant began playing sports

Jump Measurement Scores

Pretest and posttest measurements on the dependent variables among both intervention (N = 9) and control (N = 7) groups are listed in Table 2. The intervention group's pretest mean scores were lower than the control group. The posttest mean scores for the intervention group showed a tendency of change among the three dependent variables, while the control group showed lower mean scores on the VJ and the BJ, and a slight increase in AJ.

Table 2

Mean (SD) I and C Scores on Pretest and Posttest Jump Measures (VJ, BJ, and AJ)

		VJ	BJ	AJ
		M SD	M SD	M SD
Pretest	I	11.9(1.64)	10.4(1.68)	13.4(1.60)
	C	15.6(3.55)	14.1(3.52)	16.1(3.10)
Posttest	I	13.6(2.36)	11.4(1.94)	14.7(2.52)
	C	14.9(3.16)	11.7(1.82)	16.6(3.52)

Note. VJ = vertical jump; BJ = block jump; AJ = approach jump; I = Intervention group; C = Control group; Jumps are recorded as inches

Table 3 shows a tendency of change from pretest to posttest on all dependent variables. However, further analysis showed that some of the changes were not significant.

Table 3

Mean (SD) Scores on All Participants for Pretest and Posttest Jump Measurements

	Pretest	Posttest	Mean Difference
	M SD	M SD	
VJ	13.5(3.15)	13.8(2.65)	+.3
BJ	12.0(3.15)	11.2(1.80)	-1.0
AJ	14.6(2.65)	15.2(2.89)	+.6

Note. Jumps are recorded as inches

The mean differences from pretest to posttest for all participants are listed in Table 4. The intervention group improved in all jumps with the highest improvement in VJ performance followed by AJ, then the BJ. The control group differences from pretest to posttest for jumps measurements showed the largest decrease in BJ performance followed by VJ. The control group did show improvement in the AJ.

A MANOVA (multivariate analysis of variance) with repeated measures on the time factor was conducted to determine if the intervention group would show statistical significance over the control group over eight weeks with

respect to VJ, BJ, and AJ. The independent variable (IV) was the jump program with two levels: 1) intervention and 2) control. The dependent variables (DV) were VJ, BJ, and AJ. MANOVA revealed no significant differences on the multivariate effects of intervention to the three dependent variables (DVJ, DBJ, and DAJ) with Wilks Lambda = .650 on $F(3,12) = 2.15$ and $p = .15$.

Table 4 shows the results of univariate ANOVA. The ANOVA showed no significant differences between the intervention group and control groups on DVJ and DAJ $F(1, 14) = 3.73$; $p = .074$ and $F(1, 14) = .12$; $p = .73$ respectively. However, there was a significant difference between the intervention and control groups on DBJ with $F(1, 14) = 7.46$ with $p = .016$.

Table 4

Mean (SD) Differences from Pretest to Posttest for I and C on Jump Measurements

	Intervention		Control			
	M	SD	M	SD	F	P
DVJ	1.1	(1.86)	-0.8	(1.93)	3.73	.074
DBJ	0.4	(1.76)	-2.4	(2.26)	7.46	.016
DAJ	0.7	(1.30)	0.5	(1.22)	.12	.733

Note. D = differences between pretest and posttest; P = probability; F = Fisher statistics; jumps are recorded as inches

Correlational analyses for pretest and posttest for all participants on the VJ, BJ, and AJ showed significance at the $p < .01$ level, and the pretest BJ with posttest BJ a significance of $p < .05$. The highest correlation at the $p < .01$ level was found between pretest VJ and pretest BJ and the lowest was found between pretest BJ and posttest BJ (see Table 5).

Table 5

Correlational Analyses for Pretest and Posttest for All Participants on Jump Measurements

	PREVJ	POSTVJ	PREBJ	POSTBJ	PREAJ	POSTAJ
PREVJ	1	.8**	1.0**	.7**	.7**	.8**
POSTVJ		1	.7**	.9**	.8**	.9**
PREBJ			1	.6*	.7**	.7**
POSTBJ				1	.7**	.9**
PREAJ					1	.9**
POSTAJ						1

Note. **. p < .01, two-tailed; *. p < .05, two-tailed.

Sport Commitment Model Scores

Mean and standard deviation scores were calculated for the five constructs of the Sport Commitment Model for both the intervention and control groups' pretest and posttest measures (see Table 6). The intervention group scored higher than the control group on four of the constructs (SC, SE, IO, and PI) of the Sport Commitment Model except for SOC during pretest measures. The control group scored

commitment. The posttest for the Sport Commitment Model constructs revealed a decrease in the intervention group and control group mean scores on SE and IO. The intervention group showed gains in the SC, PI and SOC whereas the control group remained consistent in the SC construct and showed gains for the PI and SOC.

Table 6

Mean (SD) I and C Scores for Pretest and Posttest Sport Commitment Constructs

	Pre I		Pre C		Post I		Post C	
	M	SD	M	SD	M	SD	M	SD
SC	18.7	(1.32)	16.7	(3.63)	19.4	(0.73)	16.7	(3.25)
SE	19.4	(1.13)	17.9	(2.11)	18.7	(1.58)	17.0	(2.23)
IO	19.1	(1.61)	17.3	(3.49)	18.8	(1.20)	17.0	(2.16)
PI	12.1	(1.76)	11.4	(2.22)	12.4	(1.42)	12.1	(1.86)
SOC	5.3	(2.00)	5.3	(1.25)	4.7	(1.65)	4.4	(0.78)

Note. SC = sport commitment; SE = sport enjoyment; IO = involvement opportunities; PI = personal investments; SOC = social constraints (lower score on SOC shows more commitment)

The mean score differences between the pretest and posttest for both the intervention and control groups are listed in Table 7.

Table 7

Mean Differences between Pretest and Posttest for I and C on the Sport Commitment Model

	DSC	DSE	DIO	DPI	DSOC
Intervention	0.8	-.8	-.3	0.3	-.7*
Control	0.0	-.9	-.3	0.7	-.9*

Note. *lower score = more commitment

A positive mean effect was demonstrated from the pretest to posttest on SC, PI, and SOC constructs of the Sport Commitment Model for all participants. Participants decreased in mean score differences from pretest to posttest on SE and IO constructs of the Sport Commitment Model (see Table 8).

Table 8

Mean (SD) Scores on All Participants for Pretest and Posttest Sport Commitment Constructs

	Pretest		Posttest		Mean Differences
	M	SD	M	SD	
SC	17.8	(2.68)	18.3	(2.54)	+.4
SE	18.8	(1.77)	17.9	(2.01)	-.8
IO	18.9	(3.00)	18.0	(1.86)	-.9
PI	11.8	(1.94)	12.3	(1.57)	+.5
SOC	*5.3	(1.78)	*4.6	(1.31)	-.8*

Note. *This number indicates a lower score as showing more commitment

Correlational analyses showed significant relationships among the Sport Commitment Model constructs of SC with SE, IO and PI. The social constraints of the Sport Commitment Model showed no significant relationship with the other four constructs. Results showed that SC had a significant relationship at $p < .01$ with IO and PI constructs. SC also showed a significant relationship with SE construct at the $p < .05$ level (see Table 9).

Table 9

Correlational Analyses for I and C Groups on the Sport Commitment Constructs

	SC	SE	IO	PI	SOC
SC	1	0.4*	0.8**	0.6**	-.3
SE		1	0.2	0.3	-.3
IO			1	0.3	-.1
PI				1	-.3
SOC					1

Note. **. $p < .01$, two-tailed; *. $p < .05$, two-tailed.

Jump Measurement Scores with Sport Commitment Model Scores

Correlational analyses were conducted to determine if an association could be identified among mean score differences for the three jump measurements and the five constructs of the Sport Commitment Model. Table 10 showed that the only significant relationship was between the DVJ and DBJ (both of them were jump measurements) with $r = .79$ at the $p < .01$.

Table 10

Correlational Analyses for Differences among All Participants on Each Measure

	DVJ	DBJ	DAJ	DSC	DSE	DIO	DPI	DSOC
DVJ	1	0.8**	0.2	0.3	0.1	-.2	.0	0.3
DBJ		1	0.1	0.2	0.2	.0	.0	0.2
DAJ			1	0.3	0.0	0.4	0.1	0.2
DSC				1	0.4	0.3	-.5	0.3
DSE					1	0.3	-.3	-.4
DIO						1	.0	.0
DPI							1	0.1
DSOC								1

Note. **. $p < .01$, two-tailed.

CHAPTER V

DISCUSSION

The primary purpose of this study was to evaluate the effects of an eight week jump training intervention on the vertical jump (VJ), block jump (BJ), and approach jump (AJ) performances of female high school volleyball players. A second purpose was to determine whether an association existed among the five constructs of the Sport Commitment Model and gains in VJ, BJ, and AJ performance.

Chapter V has been divided into four sections: 1) Summary, 2) Design Issues, 3) Conclusions, and 4) Recommendations. The Summary section provides a summary on jump training intervention results and Sport Commitment Model results obtained during pretest and posttest. The Conclusions section provides discussion on both the jump training intervention and the Sport Commitment Model.

Summary

Jump training intervention program.

The present study results indicate that an eight week jump training intervention program is capable of improving

VJ, BJ, and AJ performances. The effectiveness of jump training interventions for improving VJ performance has been supported by several jump training studies in the field during the last two decades. Jump training intervention programs that have lasted for 4 to 12 weeks have been effective for increasing jump performances with depth jumps (Bartholomew, 1985; Clutch et al., 1983; Gehri et al., 1998), basic jumps on the floor (Bartholomew, 1985; Pestolesi, 1989), weight training (Clutch et al., 1983; Fatouros et al., 2000; Gemar, 1986; Pestolesi, 1989), stretching with plyometrics and weight training (Hewett et al., 1996), plyometric training (Fatouros et al., 2000; Gemar, 1986), maximum vertical jumps (Clutch et al., 1983), and a combination of both plyometric and weight training (Fatouros et al.).

Some previous investigations have failed to find that depth or weight training is significantly more effective than other jump training methods in improving VJ performance. Furthermore, previous research that used a combination of plyometric and weight training programs found that VJ performances did increase over time but still did not show a significant difference over basic jump training (Fatouros et al., 2000). Other investigators

(Clutch et al., 1983) found that the combination of plyometric and weight training programs were equally effective to plyometric or weight training programs when performed independent of one another.

The present study differed in its results of mean gain jump scores when compared to other research findings on the VJ, BJ, and AJ for intervention programs that lasted for eight weeks. Newton et al. (1999) found an increase of 2.32 inches for VJ performance and 2.48 inches for AJ performance for ballistic training with male collegiate volleyball players while Bartholomew (1985) found an increase of 4.57 inches in VJ performance after eight weeks of basic on the floor jump training with male collegiate students. The differences with the current study and Newton's et al. (1999) may be due to the two years of prior experience of participants with ballistic (resistance) training and using male collegiate volleyball players. Bartholomew's (1985) differences with current study may be due to the fact the present study was conducted on female participants during four weeks of preseason and four weeks of in-season, whereas Bartholomew's research was conducted on male collegiate students who did not participate in sports.

There were studies that showed similar results to the present study in regards to mean score gains on the VJ and AJ (Gemar, 1986; Hewett et al., 1996; Pestolesi, 1989). Pestolesi (1989) found increases in AJ ranging from .21 inches for groups trained with weights to .70 inches who performed basic jump training after six weeks of intervention. Hewett et al. (1996) found 1.5 inch increase in VJ performance after a combination of plyometrics, weight training, and stretching (which the authors refer to as ballistic or resistance training) during a six week intervention program. Gemar (1986) found that weight training alone increases VJ performance by 2.3 cm (.91 in), and plyometric training alone increases VJ by 1.78 cm (.70 in) over an eight week period.

Hewett et al. (1996) stated that a 1.5 inch jump increase (approximately 10% jump increase) over a six week training period is considerable. Hewett et al. gave an example of the 1984 male U.S. Olympic Gold Medal Volleyball Team who increased their VJ by 4 inches using a similar jump intervention program (to Hewett et al.) over a two year period. Dunnam et al. (1988) also used a similar intervention to Hewett et al. and found a 1.25 inch

increase with female collegiate volleyball players in VJ over an 11 month period.

The jump training intervention program used in this study was similar to the methods of Hewett et al. (1996) (who used 15 different jumps) with the exclusions of cone jumps, jump into bounding, mattress jumps, squat jumps, step up and jump up and down into a vertical, hop and hop and stick, and single leg jumps. The cone jumps, mattress jumps, and step up and jump up and down into a vertical jump were excluded as this study did not use any apparatus (only basic floor jumps with body weight acting as the resistance). The hop and hop and stick, and single leg jumps were excluded due to the inexperience level of participants. Young athletes should begin with lower progression exercises and should not perform single legged exercises until they are strong enough to squat 1.5 times their body weight (Brittenham, 1992; Gambetta, 1996; L. G. Kissee, personal communication, April 12, 2000; Radcliffe & Farentinos, 1999). Squat jumps were also excluded due to participants being in the competitive season; more than nine jumps would take away from season practice time and increase risk for injuries.

Some participants in the present study may not have improved as much as they could have during the jump training intervention program due to coaches' and athletes' motivational techniques not being compatible. Rahschulte (1999) wrote that coaches' and athletes' motivational techniques need to be compatible or athletes will not be motivated and most likely will not excel in their performance. Participants may not have felt driven to perform their best during the eight week jump training intervention program since the team was split into two different groups and did not work out together for the first 16 to 30 minutes of practice. The team under study had a new coach who began coaching the season of this study. Due to the unfamiliarity among players and the new coach, coaching expectations were not established before this study began, possibly resulting in lower mean gain jump scores.

The control program was designed using strategies that were a part of training for competitive volleyball teams. Participants performed blocks and hitting while stationary on a wooden box, to control for any jumping that normally occurs during these particular skills. The control group had negative mean gain scores for the VJ and BJ, but showed

mean gain scores in the AJ after the eight week intervention. Improvement in the AJ for the control group from pretest to posttest may have been due to learning and practicing the correct footwork for the AJ during practices and games. The control group showed a significant decrease in BJ performance that might have been due to the fact that four out of the seven participants were non-starters. Normally players who start have more foot contacts for jumps than nonstarters do during practices. Also starters have more foot contacts during competition than non-starters. The remaining four participants in the control group were freshman and first year volleyball players who did not receive large amounts of jumps during practice and never received any jumps during competition due to not being able to perform at the high standards set by starters.

The pretest variables in the present study for the control group showed participants as slightly older in age, shorter in height, weighed less, had a shorter standing reach, and started playing sports at an older age. The intervention group had more years of experience playing volleyball and had played volleyball longer for their current school. One additional difference between the two

groups was the control group had no players who were listed as setters for their position whereas the intervention group contained four out of the nine participant positions as setters. Overall, group differences showed 53% hitters and 47% setters in the intervention group and 100% hitters in the control group. The following are pretest variables that showed a major difference between the setter's (s) and hitters (h) for the intervention group: years playing volleyball for current school (s= 1.5, h = 2.2), age started in sports (s = 5.3, h = 7.0), height (s = 65.6, h = 68.1), standing reach (s = 85.5, h = 88.1), VJ (s = 11.8, h = 12.1), BJ (s = 10.3, h = 10.6), and AJ (s = 13.1, h = 13.7). Differences found between setters and hitters for the intervention group on the posttest VJ were (s = 13.5, h = 13.6), BJ (s = 10.6, h = 12.0), and AJ (s = 13.9, h = 15.4).

Sport Commitment Model.

Prior to this investigation there were no published findings that compared differences of jump gain scores with Sport Commitment Model constructs. Other investigators (Carpenter et al., 1993; Scanlan, Carpenter et al., 1993; Scanlan, Simons et al., 1993; Weiss et al., 2001) have conducted research using the Sport Commitment Model to

determine levels of sport commitment among sport participants. Carpenter et al. (1993) found that SE, PI, and IO showed high levels of sport commitment. Scanlan, Carpenter et al. (1993) found that SE and PI showed high levels of sport commitment. Scanlan, Simons et al. (1993) found that SE and IO showed higher levels of sport commitment than the other three constructs. Weiss et al. (2001) found SC, SE, PI, and SOC as positive predictors for sport commitment.

In the present study SC showed significance at the $p < .01$ level with IO and PI and at the $p < .05$ level with SE. SC, PI, and SOC showed mean gain scores between pretest and posttest for the Sport Commitment Model constructs. In previous studies conducted by other investigators, the SE construct was listed as showing the highest level of sport commitment, contrary to the present study. One reason why SE and IO may not have been as high in the present study was that 10 out of the 16 participants were freshmen (seven of which had not previously played volleyball competitively). The freshmen and especially the seven who had never played volleyball before may have felt overwhelmed by team rules, rules and regulations of the game of volleyball, or the style of coaching. The small

sample size of this study may have influenced mean score differences for the Sport Commitment Model constructs from the pretest to posttest.

Design Issues

Two factors not controlled in randomization may have influenced the outcomes of the intervention group mean gain scores of the VJ, BJ, and AJ. One, the control group all had higher pretest mean scores on all three jump measurements, which was probably due to containing all hitters. The control group also lost two participants (one setter and one hitter) midway through the study leaving the control group with seven participants (all hitters). Pretest scores on the Sport Commitment Model constructs proved to be lower for both participants who dropped out than those who remained in the study. Also both dropouts had higher scores in the SOC for the Sport Commitment Model (which is a lower score for sport commitment).

Two, the intervention group had four out of the nine participant positions listed as setters. Setters are not known for their jumping abilities. Setters tend to be shorter in height and normally do not play front row positions decreasing their foot contact for jumps. The intervention group mean gain scores may have been higher if

the setter and hitter positions were equally distributed between the two groups. Also significance may have been shown among the VJ and AJ between the control and intervention groups as the BJ.

Conclusions

The study's results demonstrated that Group 1 participants improved in VJ (1.06 in), BJ (.39 in), and AJ (.72 in). When compared with Group 2, control participant differences were significant at the $p < .05$ level for the BJ, but not for VJ or AJ (answering hypothesis #1).

When Groups 1 and 2 were combined, highly significant relationships were shown among all of the pretest and posttest jump variables at the $p. < .01$ level, except between the pretest BJ with posttest BJ which is significant at $p. < .05$ (See Table 5) (answering hypothesis #2).

There was a significant relationship among the Sport Commitment Model constructs of SC with IO and PI at the $p < .01$ and SC with SE at $p < .05$ (See Table 9) (answering hypothesis #3).

However, when groups were combined, no significant relationship existed among mean gain scores of jump

measurements with the constructs of the Sport Commitment Model (See Table 10) (answering hypothesis #4).

Recommendations

Additional research needs to be carried out with high school female volleyball players on performance variables of the VJ, BJ, and AJ. This study was performed during four weeks of preseason and four weeks of in-season competition. It is recommended that additional research be conducted to:

1) Replicate this study during one phase of the season (either preseason, in-season or off-season preseason) among female high school volleyball players,
2) Replicate this study to determine if differences exist among varsity, junior varsity and freshman programs when jump training programs are implemented,
3) Replicate this study with larger sample sizes to investigate additional demographic characteristics, such as ethnicity, grade level, height, weight, and years of experience, etc.,

4) Replicate this study using the head coach as the administrator for the jump intervention program instead of an assistant coach or manager,

5) Replicate this study with stratifying groups by the positions: such as setters (S), right outside hitters (OH), left OH, middle hitters (MH), and defensive specialists (DS), and

6) Replicate the use of the Sport Commitment Model every two weeks during intervention programs and record win and loss ratio and record individual play status along with practice performance to view if commitment level increases/decreases due to wins/loses, playing time, and performances in practice.

Jump training intervention studies may have benefits for coaches of female high school volleyball teams not only for training but in choosing their teams during tryouts. If some type of standard was found for height, weight, and jump performances for certain positions or even for certain shapes and sizes of females volleyball players, coaches might be able to help determine future success for their players. Coaches may also be able to give volleyball

players a standard (goal) to try to reach during practices and off-season that would improve playing performances.

APPENDIX A

Original Memo to IRB

To: MTSU
IRB, Chairperson

From: Sonya Sanderson, Graduate Student

Date: April 20, 2000

RE: Proposal, "The effects of motivation on training among high school volleyball players."

The attached proposal, "The effects of motivation on training among high school volleyball players" is being submitted to the Institutional Review Board for an expedited review and approval.

As requested, one copy is included, along with attachments in Appendices A, B, C, D, & E.

The proposed data collection will take place among participants of MTSU volleyball team camp July 26 to July 30, 2000. An expedited review is requested due to the fact that the information being gathered is considered standard for this type of training and setting.

No physiological, psychological or deception practices are employed.

Thank you for your consideration of this proposal. Your time and advisement on this research is appreciated.

APPENDIX B

Original IRB Forms

MIDDLE TENNESSEE STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
HUMAN SUBJECTS RESEARCH REVIEW FORM

Expedited Review ☒ Full Review☐

Investigator(s) name(s) Sonya Sanderson SS# 260290576

Project Title The effects of motivation on training among high school volleyball players.

Campus telephone 615-904-8346

Campus address P. O. Box 77

Department or University Unit Volleyball

Investigator Status (For each investigator)

☐ Faculty/Staff
☒ Graduate Student
☐ Undergraduate Student
☐ Other

If the principal investigator is a student, list name department and local telephone of faculty supervisor. Please note that THE FACULTY SUPERVISOR MUST INDICATE KNOWLEDGE AND APPROVAL OF THIS PROPOSAL BY SIGNING THIS FORM.

Faculty Supervisor Name Dr. Peggy O'Hara Murdock

Address & Telephone HPERS, P. O. Box 96, 615-904-8358

Social Security # 291-38-9713

Source of funding for project

Expected starting date for project July 26, 2000

Is this project expected to continue for more than one year?

☐ Yes ☒No Anticipated Completion Date

Approval for projects is valid for one year only. Investigators must request a continuation of the approval yearly if the activity lasts more than one year. Only two continuations will be granted for a given project. After three years, the project must be resubmitted.

APPENDIX B-2

PROJECT DESCRIPTION

- The following information is required for all projects.
- Limit your answers to the space provided. (Further information may be attached to supplement this description, but not to replace it)
- Attach copies of all questionnaires, testing instruments or interview protocols; include any cover letters or instructions to subject.

DESCRIPTION
Provide a **BRIEF** description, in **LAYMAN'S TERMS**, of the proposed research:

I propose as part of data collection for dissertation , on two occasions, to test height, weight, body fat, standing vertical reach, vertical jump, block jump, approach jump, and motivation levels of high school (9-12) volleyball players attending a Middle Tennessee State University volleyball team camp (appendix A). Permission will be asked of the coaches (appendix B), players, and parents. A signed assent/consent form (appendix C) will be returned before any measurements are taken.

Using a low intensity six-week jump training program, I can determine the effectiveness of jump trianing and how beneficial it is at the high school level. Using a predetermined questionnaire on sport commitment , I can coorelate the data to determine if positive or negative results of the training are due to motivational factors.

A certified athletic trainer will collect the height, weight, and body fat measures. A strength and conditioning coach and staff from Middle Tennessee State University will administer the standing reach, vertical jump, block jump and approach jump.

The questionnaire (appendix E) will be administered by other team camp staff members during testing procedures of the other measures.

Once data is analyzed, a report will be sent to the coaches on overall team performance levels.

METHOD (check all that apply)
☒ QUESTIONNAIRE ☐
OBSERVATION ☒ TEST
☐ INTERVIEW ☐
FILES ☐TASK
☐ TREATMENT
☐ OTHER

NUMBER OF SUBJECTS:

100+
PRISONER ☐MENTALLY RETARDED

SUBJECT POPULATION (check all that apply)
☐ ADULT ☒MINOR ☐
☐ MENTALLY ILL ☐ PHYSICALLY ILL
☐DISABLED ☐ OTHER
Specify:

APPENDIX B-3

SUBJECT SELECTION
Are subjects to be drawn from the Psychology subject pool? ☐ Yes ☒ No

- If yes, a completed sample sign-up sheet must be submitted.
- If no, describe how subjects will be selected for participation in this project and any payment to be received by the subject:

Subjects will be selected through permission of coaches, players and players parents during a volleyball team camp at MTSU.

NOTE: If the subjects are to be drawn from an institution or organization (e.g., hospital, social service agency, prison, school, etc.) which has the responsibility for the subjects, then documentation of permission from that institution must be submitted to the Board before final approval can be given.

CONFIDENTIALITY
Specify steps to be taken to guard the anonymity of subjects and/or the confidentiality of their responses. Indicate what personal identifying indicators will be kept on subjects. Specify procedures for storage and ultimate disposal of personal information.

While the participant is filling out her profile sheet, she will be assigned a letter and a number. Each school will have a letter assigned to them. (for example: Riverdale=A1 for the 1st participant, A2 for the second and so on). No names or school names will be reported.

APPENDIX B-4

CONSENT

Specify how subjects will be informed of the following: a) the nature of their participation in the project, b) that their participation is voluntary and that they may withdraw at any time without repercussions, and c) that their responses are confidential. (If a consent form is being used, attach a copy. If presented orally, a copy of presentation must be submitted.)

The player and the players parent(s) will sign an assent/consent form that describes what type of testing and how testing will be performed during camp. A script will be read prior to questionnaire administration describing that names will be removed and data collected by graduate students will be maintained in a locked files at MTSU. While at camp the player will have the option of stopping the testing at any time (appendix D).

ADDITIONAL PROCEDURAL INFORMATION

INDICATE BELOW WHETHER YOUR PROJECT INVOLVES ANY OF THE FOLLOWING. FOR EACH ITEM CHECKED, PROVIDE THE REQUESTED INFORMATION IN THE ADDITIONAL PROCEDURAL INFORMATION SECTION BEGINNING ON PAGE 5

- ☐ A) Risk (p. 5)
- ☒ B) Minors as subjects (p. 5)
- ☐ C) Psychological intervention (p. 6)
- ☐ D) Deception (p. 6)
- ☐ E) Physiological intervention (p. 7)
- ☐ F) Biomedical procedures (p. 7)

SEE THE PAGE INDICATED FOR A MORE DETAILED DESCRIPTION OF THESE CATEGORIES

APPENDIX B-5

SIGNATURES

The **Principal Investigator** must sign this form.

I certify that 1) the information provided for this project is accurate, b) no other procedures will be used in this project, and c) any modifications in this project will be submitted for approval prior to use.

Sonya Sanderson _____

Signature of Investigator **Date**

If the P.I. is a student, his/her **Faculty Supervisor** must also sign this form.

I certify that this project is under my direct supervision and that I am responsible for insuring that all provisions of approval are complied with by the investigator.

Regan O'Shea Murdock _____

Signature of Faculty Supervisor **Date**

Committee Use Only

NOTE: APPROVAL OF THIS PROJECT BY THE IRB ONLY SIGNIFIES THAT THE PROCEDURES ADEQUATELY PROTECT THE RIGHTS AND WELFARE OF THE SUBJECTS AND SHOULD NOT BE TAKEN TO INDICATE UNIVERSITY APPROVAL TO CONDUCT THE RESEARCH.

Expedited Review

Approved:_____ _____

College Representative Date

Committee Review

Approved:_____ _____

Committee Chair Date

APPENDIX C

Human Sciences Department

P.O. Box 86
Middle Tennessee State University
Murfreesboro, Tennessee 37132
(615) 898-2884
FAX: (615) 898-5130

MTSU IRB Approval

TO: Sonya Sanderson
Dr. Peggy O'Hara Murdock

FROM: Dr. Dellmar Walker Dellmar Walker
IRB Representative

SUBJECT: "The Effects of Motivation on Training Among High School Volleyball Players" Protocol no. 00-0252

DATE: April 27, 2000

The project has been reviewed and approved. This approval is granted for one year only and must be reviewed by the committee on an annual basis if the project continues beyond the next twelve months. Any changes in the protocol (materials, design, etc.) require resubmission of your project for committee approval.

Good luck on the successful completion of your project.

APPENDIX D

Revised Memo to IRB

To: MTSU
IRB, Chairperson

From: Sonya Sanderson, Graduate Student

Date: July 17, 2000

RE: Changes to proposal 00-0252, "The effects of motivation on training among high school volleyball players"

On April 27, 2000, I received permission from MTSU's Institutional Review Board to proceed with the study protocol number 00-0252.

I have since made revisions to the protocol and am resubmitting to the IRB with the request for an expedited review. A list of changes to the original protocol are described below:

1. 20 High School Volleyball Players will be asked to continue either jump reach training or strategy training once camp ends for their regular season practice over an eight-week period.
2. A revised parent letter is attached which informs parents of the changes described in #1 and requests their active consent.
3. A letter from the principal of Riverdale High School is attached which grants permission for conducting the training program.

APPENDIX E

Original IRB Forms

MIDDLE TENNESSEE STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
HUMAN SUBJECTS RESEARCH REVIEW FORM

Expedited Review ☒ Full Review☐

Investigator(s) name(s) Sonya Sanderson SS# 260290576

Project Title The effects of an eight week jump training program and testing of sport commitment among high school volleyball players.

Campus telephone 615-904-8346

Campus address P. O. Box 77

Department or University Unit Volleyball

Investigator Status (For each investigator)

☐ Faculty/Staff
☒ Graduate Student
☐ Undergraduate Student
☐ Other

If the principal investigator is a student, list name department and local telephone of faculty supervisor. Please note that THE FACULTY SUPERVISOR MUST INDICATE KNOWLEDGE AND APPROVAL OF THIS PROPOSAL BY SIGNING THIS FORM.

Faculty Supervisor Name Dr. Peggy O'Hara Murdock

Address & Telephone HPERS, P. O. Box 96, 615-904-8358

Social Security # 291-38-9713

Source of funding for project

Expected starting date for project July 26, 2000

Is this project expected to continue for more than one year?

☐ Yes ☒No Anticipated Completion Date

Approval for projects is valid for one year only. Investigators must request a continuation of the approval yearly if the activity lasts more than one year. Only two continuations will be granted for a given project. After three years, the project must be resubmitted.

APPENDIX E-2

PROJECT DESCRIPTION

- The following information is required for all projects.
- Limit your answers to the space provided. (Further information may be attached to supplement this description, but not to replace it)
- Attach copies of all questionnaires, testing instruments or interview protocols; include any cover letters or instructions to subject.

DESCRIPTION
Provide a **BRIEF** description, in **LAYMAN'S TERMS**, of the proposed research:

I propose as part of data collection for dissertation , on two occasions, to test height, weight, standing vertical reach, vertical jump, block jump, approach jump (appendix A), and sport commitment levels (appendix B) of high school (9-12) volleyball players attending Riverdale High School in Murfreesboro, Tennessee. Permission was requested from the Principal (appendix C), players, and parents. A signed assent/consent form by the players and players parents (appendix D) will be returned before any measurements are taken. A signed letter of consent was received from the principal of Riverdale High School on July 20, 2000(appendix E).

Using a low intensity eight-week jump training program, I can determine the effectiveness of jump training and how beneficial it is at the high school level. Using a predetermined questionnaire on sport commitment , I can correlate the data to determine if positive or negative results of the training are due to motivational factors.

A certified athletic trainer will collect the height and weight of each individual. The researcher and other trained staff will administer the standing reach, vertical jump, block jump and approach jump during the Middle Tennessee State University volleyball team camp.

The sport commitment questionnaire will be administered by the researcher and other staff members during the Middle Tennessee State University volleyball team camp.

Post data will be collected by a trained assistant for Riverdale High School Volleyball after the eight week jump training intervention program on weight, height, standing reach, vertical jump, block jump, approach jump, and sport commitment questionnaire.

APPENDIX E-3

METHOD (check all that apply)

☒ QUESTIONNAIRE ☐ OBSERVATION ☒ TEST
☐ INTERVIEW ☐ FILES ☐ TASK
☒ TREATMENT
☐ OTHER

NUMBER OF SUBJECTS:

20
RETARDED

SUBJECT POPULATION (check all that apply)

☐ ADULT ☒ MINOR
☐ PRISONER ☐ MENTALLY
☐ MENTALLY ILL ☐ PHYSICALLY ILL
☐ DISABLED ☐ OTHER
Specify:

SUBJECT SELECTION

Are subjects to be drawn from the Psychology subject pool? ☐ Yes ☒ No

- If yes, a completed sample sign-up sheet must be submitted.
- If no, describe how subjects will be selected for participation in this project and any payment to be received by the subject:

Subjects will be selected through permission of the principal of Riverdale High School, players and players parents during a volleyball team camp at MTSU.

APPENDIX E-4

NOTE: If the subjects are to be drawn from an institution or organization (e.g., hospital, social service agency, prison, school, etc.) which has the responsibility for the subjects, then documentation of permission from that institution must be submitted to the Board before final approval can be given.

CONFIDENTIALITY
Specify steps to be taken to guard the anonymity of subjects and/or the confidentiality of their responses. Indicate what personal identifying indicators will be kept on subjects. Specify procedures for storage and ultimate disposal of personal information.

A number will be placed in the upper right hand corner of the player profile sheet and questionnaire to keep confidentiality from the coach and other players

CONSENT
Specify how subjects will be informed of the following: a) the nature of their participation in the project, b) that their participation is voluntary and that they may withdraw at any time without repercussions, and c) that their responses are confidential. (If a consent form is being used, attach a copy. If presented orally, a copy of presentation must be submitted.)

The player and the players parent(s) will sign an assent/consent form that describes what type of testing and how testing will be performed during camp and at the end of the eight week intervention program (appendix D). A script will be read prior to questionnaire administration describing that names will be removed and data collected by assistants will be maintained in a locked files at MTSU (appendix F). While at camp and during the eight week intervention program the player will have the option to stop the testing at any time.

APPENDIX E-5

ADDITIONAL PROCEDURAL INFORMATION

INDICATE BELOW WHETHER YOUR PROJECT INVOLVES ANY OF THE FOLLOWING. FOR EACH ITEM CHECKED, PROVIDE THE REQUESTED INFORMATION IN THE ADDITIONAL PROCEDURAL INFORMATION SECTION BEGINNING ON PAGE 5

- ☐ A) Risk (p. 5)
- ☒ B) Minors as subjects (p. 5)
- ☐ C) Psychological intervention (p. 6)
- ☐ D) Deception (p. 6)
- ☐ E) Physiological intervention (p. 7)
- ☐ F) Biomedical procedures (p. 7)

SEE THE PAGE INDICATED FOR A MORE DETAILED DESCRIPTION OF THESE CATEGORIES

SIGNATURES

The **Principal Investigator** must sign this form.

I certify that 1) the information provided for this project is accurate, b) no other procedures will be used in this project, and c) any modifications in this project will be submitted for approval prior to use.

Sonya Sanderson — **Signature of Investigator**

July 19, 2000 — **Date**

If the P.I. is a student, his/her **Faculty Supervisor** must also sign this form.

I certify that this project is under my direct supervision and that I am responsible for insuring that all provisions of approval are complied with by the investigator.

Peggy O'Lan Murdock — **Signature of Faculty Supervisor**

July 19, 2000 — **Date**

Committee Use Only

NOTE: APPROVAL OF THIS PROJECT BY THE IRB ONLY SIGNIFIES THAT THE PROCEDURES ADEQUATELY PROTECT THE RIGHTS AND WELFARE OF THE SUBJECTS AND SHOULD NOT BE TAKEN TO INDICATE UNIVERSITY APPROVAL TO CONDUCT THE RESEARCH.

Expedited Review

Approved:_____ _____
College Representative Date

Committee Review

Approved:_____ _____
Committee Chair Date

APPENDIX F

Consent Letter to High School Principal

July 21, 2000

Mr. Tom Nolan
Riverdale High School
802 Warrior Drive
Murfreesboro, TN 37128

Dear Mr. Nolan,

As you know, I (Sonya Sanderson) am currently working on my postmaster's work at Middle Tennessee State University. I am writing this letter to ask permission to test the Riverdale High School volleyball players on their height, weight, standing reach, vertical jump (VJ), block jump (BJ) and approach jump (AJ). After testing each of the above variables, I will randomly select 10 to an intervention group and 10 to a control group. The intervention group would go through an eight week jump training program that would start on July 26th and run through mid October. Each volleyball player will be given a pretest and a posttest on their height, weight, standing reach, VJ, BJ, and AJ to see if there is a difference in the ones who receive the intervention and those who receive no intervention. While the intervention group is performing jump training, the control group will work on skills, techniques and overall strategies of volleyball. I also would like to give the volleyball players a 19-question survey dealing with sport commitment to see if there is a positive correlation with VJ, BJ, and AJ gains. All scores on the Sport Commitment Model will be kept confidential from other players. Thank you for your time and consideration in allowing me to measure the Riverdale High School Volleyball team. If you have any questions, you may reach me at 615-973-0454 or by email at Craz4u24@aol.com.

Sincerely,

Sonya Sanderson

Sonya Sanderson

APPENDIX G

Approval Letter from Principal

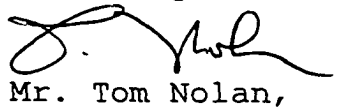
July 21, 2000

Sonya Sanderson
1005 Delray Ct.
Nashville, TN 37209

Dear Ms. Sanderson,

I am writing this letter in response to your request for permission to test the Riverdale High School volleyball players on their height, weight, standing reach, vertical jump (VJ), block jump (BJ) and approach jump (AJ). I understand that you will randomly select 10 to an intervention group and 10 to a control group that will practice 30 minutes prior to their regular practice. The intervention group would go through an eight week jump training program that would start on July 26th and run through mid October. While the intervention group is performing jump training, the control group will work on their skills, techniques and overall strategies of volleyball. I also understand that you intend to give the volleyball players a 19-question survey dealing with sport commitment. You have assured players and their parents that all scores on the Sport Commitment Model will be kept confidential from other players and will only be used to see if there is a positive correlation between sport commitment and gain scores of the VJ, BJ, and AJ.
I understand that participation by team members is strictly voluntary and will not affect any decisions regarding their participation in the season's competitive program.
I wish you well on your study and look forward to receiving information about the outcome.

Sincerely,



Mr. Tom Nolan,
Principal
Riverdale High School

APPENDIX H

Consent Letter to Parents

July 21, 2000

Dear Parents,

My name is Sonya Sanderson and I am currently the volleyball coach at Riverdale High School. I am working on my postmaster work at Middle Tennessee State University. I am asking for your permission to test your daughter on her weight, height, standing reach, vertical jump (VJ), block jump (BJ), and approach jump (AJ). I am also asking permission to administer a 19-question survey to test her sport commitment to volleyball. All information received will be kept confidential from other players. If you give your permission, I will randomly assign the team to two groups of one who receive volleyball techniques and one who will receive volleyball strategies. This will take place two times a week and will last for approximately 16-30 minutes each session at the beginning of practice. At the end of eight weeks your daughter will receive a posttest on her weight, height, VJ, BJ, AJ, and Sport Commitment Questionnaire to see if there are changes from pretest measures. This is voluntary participation and your daughter will not be punished for not participating in this study. This study may improve your daughter's success in volleyball.

Please read the section below.

If you **do** give your daughter permission to complete the questionnaire and be tested please sign, date and return this sheet with your daughter to Coach Sanderson. If you have any questions, please contact me at 615-973-0454 or Craz4u24@aol.com

Thank you for your cooperation.

I have read and understand this form concerning the questionnaire and measurements.

Parent's Signature_____Date: _____

Athletes Signature_____

APPENDIX I

Oral Script for Participants

Volleyball Testing and Measurement, Oral Script

"Good (morning/afternoon). A few assistants (athletic trainers and, graduate assistants) and I of Middle Tennessee State University are conducting some tests and measurements that may be important to your volleyball performance. The measurements will take about 20-30 minutes and the questionnaire about 10 minutes. Before you begin filling out the questionnaire there are a few things we would like to tell you.

First, your participation is voluntary. This means if you feel that you do not wish to participate, you are not required to do so. If you feel you need anymore stretching or warm up time please do so before attempting any jumps.

Second, there will be no penalty if you decide to quit testing at any time.

Third, instructions are given for each set of questions on the questionnaire, but if you do not understand the question you may ask one of the assistants.

Fourth, in order to keep track of information, we ask that you do **print** your name and school on your student profile legibly. Do not put your name on the questionnaire, there will be a number code in the right hand corner that will keep your answers confidential.

Finally, if there are any questions, please get the attention of one of the assistants and they will be happy to answer your question.

We appreciate your participation.

APPENDIX J

Pretest Profile Sheet

Volleyball Player Profile Sheet

Name:_____
First Last

School:_____

Please circle your answers

- Age: 11 12 13 14 15 16 17 18
- Years of Experience: 1 2 3 4 5 6 7 8 9 10
- Years Played at Present School: 1 2 3 4
- Position Played: setter hitter
- At what age did you begin playing team sports?
  4 5 6 7 8 9 10 11 12 13 14 15 16 17
- What sports have you competed in and how many years? (put the year beside the sport if you played)

_____soccer _____basketball _____softball _____cheerleading
_____track _____swimming _____gymnastics _____tennis
_____other

- What motivates you most? _____coach _____friends/peers
_____participating in a game _____yourself _____teammates
_____winning _____parents _____starting a game

Please do not write below this line

Height: _____ Weight: _____

Standing Reach:_____

VJ:	1_____	BJ:	1_____	AJ:	1_____
	2_____		2_____		2_____
	3_____		3_____		3_____
	Highest_____		Highest_____		Highest_____

APPENDIX K

Pre/Posttest Sport Commitment Model Questionnaire

Circle the number that best indicates your feelings

Answer questions (1-3) using the following scales: **1** = not at all; **2** = a little; **3** = sort of; **4** = dedicated/hard/determined; **5** = very

1. How *dedicated* are you to playing volleyball? 1 2 3 4 5
2. How *hard* would it be for you to quit volleyball? 1 2 3 4 5
3. How *determined* are you to keep playing volleyball? 1 2 3 4 5

Answer #4 using the following scale: **1** = nothing at all; **2** = a few things; **3** = some things; **4** = many things; **5** = a lot of things.

4. What would you be willing to do to keep playing volleyball? 1 2 3 4 5

Answer questions (5-12) using the following scale: **1** = not at all; **2** = a little; **3** = sort of; **4** = pretty much; **5** very much

5. Do you *enjoy* playing volleyball this season? 1 2 3 4 5
6. Are you *happy* playing volleyball this season? 1 2 3 4 5
7. Do you have *fun* playing volleyball this season? 1 2 3 4 5
8. Do you like playing volleyball this season? 1 2 3 4 5
9. Would you miss being a volleyball player if you left the program? 1 2 3 4 5
10. Would you miss your head coach if you left? 1 2 3 4 5
11. Would you miss the good times you have had playing volleyball this season if you left the program? 1 2 3 4 5
12. Would you miss your friends in volleyball if you left the program: 1 2 3 4 5

Answer questions (13-15) using the following scale: **1** = none; **2** = a little; **3** = some; **4** = pretty much; **5** very much

13. How much of your *time* have you put into playing volleyball this season? 1 2 3 4 5
14. How much *effort* have you put into playing volleyball this season? 1 2 3 4 5
15. How much of your own *money* have you put into playing volleyball this season for things like entrance fees or equipment? 1 2 3 4 5

Answer questions (16-19) using the following scale: **1** = not at all how I feel; **2** = a little how I feel; **3** = sort of how I feel; **4** = pretty much how I feel; **5** = very much how I feel

16. I feel I have to play volleyball so that I can be with my friends. 1 2 3 4 5
17. I feel I have to play volleyball to please my mom. 1 2 3 4 5
18. I feel I have to play volleyball to please my dad 1 2 3 4 5
19. I feel I have to stay in this program so that people won't think I am a quitter. 1 2 3 4 5

APPENDIX L

Jump Training Program

8-Week Jump Training Program

APPENDIX L-2

The following exercises need to be performed after you have **warmed up** and have **stretched** out. To get the highest outcome for your vertical jump you need to perform each exercise with **maximum effort**. This program has been designed to help your personal volleyball game. When college coaches sends out player profile sheets they will ask for your weight, height, vertical jump reach, block jump reach, and approach reach among other information that is vital to successful volleyball programs. If you begin to feel fatigued during the workout take another minute to catch your breath, and then complete the workout. If you have an injury to your lower body (ankle, knee, foot, etc.), please do not perform the workout until your doctor allows you to return to the program.

I want to personally thank you for helping me in my research and taking the time to perform these exercises. I hope you will find this program beneficial for increasing your vertical jumps this season. This program has been proven to increase vertical jumps up to 6" if performed with maximal effort during each exercise.

Thank you,

Sonya Sanderson

Sonya Sanderson

APPENDIX L-3

Phase 1
Week one and two

Total of 4 days

Perform each exercise 10 times by 2 sets with 20 seconds between each set

Except for:
6 Jump, Jump, Jump, and vertical will be performed 5 times by 2 sets with 30 seconds between each set

Phase 2
Week 3 and 4

(Total of 4 days)

All exercises and repetitions will remain the same
Except 3 sets will be performed i.e.: (10 X 3) (5 X 3)

Phase 3
Week 5-8

(Total of 8 days)

All exercises and repetitions will remain the same
Except 1 set will be performed i.e.: (10 X 1) (5 X 1)

APPENDIX L-4

Jump Training Exercises

Remember to warm up and stretch before performing these activities.

1. 180(degrees) Jumps: Two-foot jump. Rotate 180 (degrees) in midair. Hold landing for 2 seconds, then repeat in reverse direction.

2. Bounding in place: Jump from one leg to the other straight up and down, progressively increasing rhythm and height.

3. Bounding for distance: Start bounding in place and slowly increase distance with each step, keeping knees high.

4. Broad jumps-stick (hold) landing: Two-footed jump as far as possible. Hold landing for 5 seconds.

5. Line jumps: Double leg jump with feet together. Jump side-to-side over cones quickly. Repeat forward and backward.

6. Jump, jump, jump, and vertical: Three broad jumps with vertical jump immediately after landing the third broad jump.

7. Scissors jump-start in stride position with one foot well in front of other. Jump up, alternating foot position in midair.

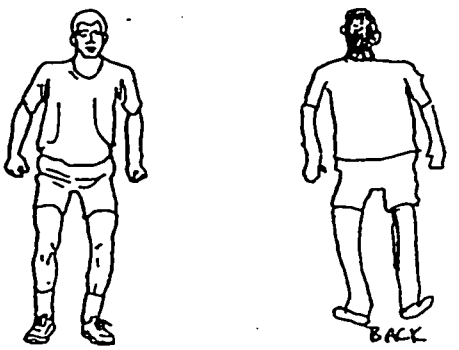
8. Tuck jumps: From standing position jump and bring both knees up to chest as high as possible. Repeat quickly.

9. Two-foot (ankle bounces): With knees slightly bent and arms raised overhead, bounce up and down off toes.

APPENDIX L-5

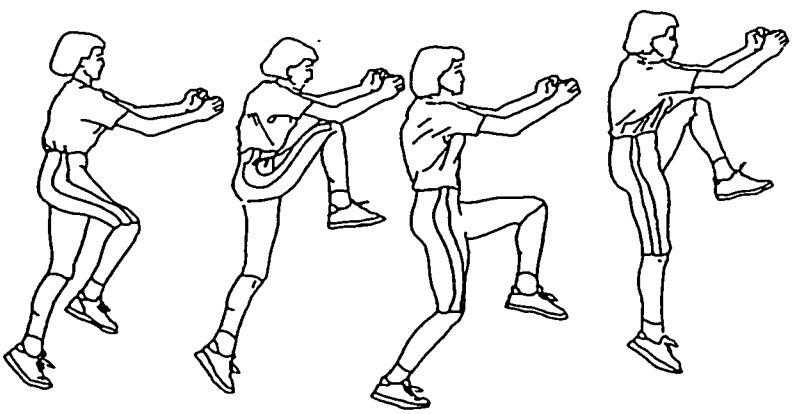
#1 180 Degree Turns

A two-foot jump. Rotate 180 (degrees) in midair. Hold landing for 2 seconds, then **repeat in reverse** direction.



#2 Bounding in Place

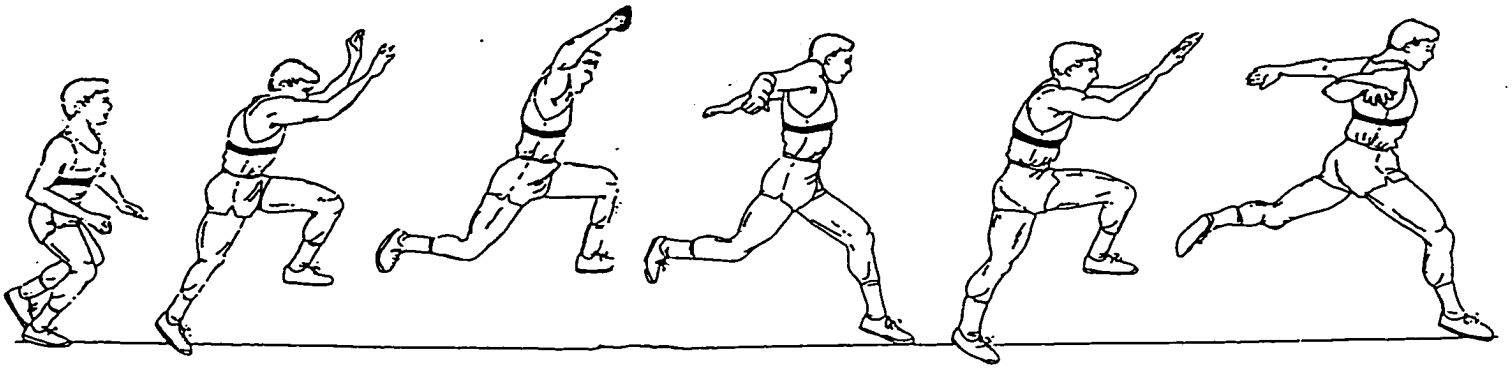
Jump from one leg to the other straight up and down, progressively increasing rhythm and height.



APPENDIX L-6

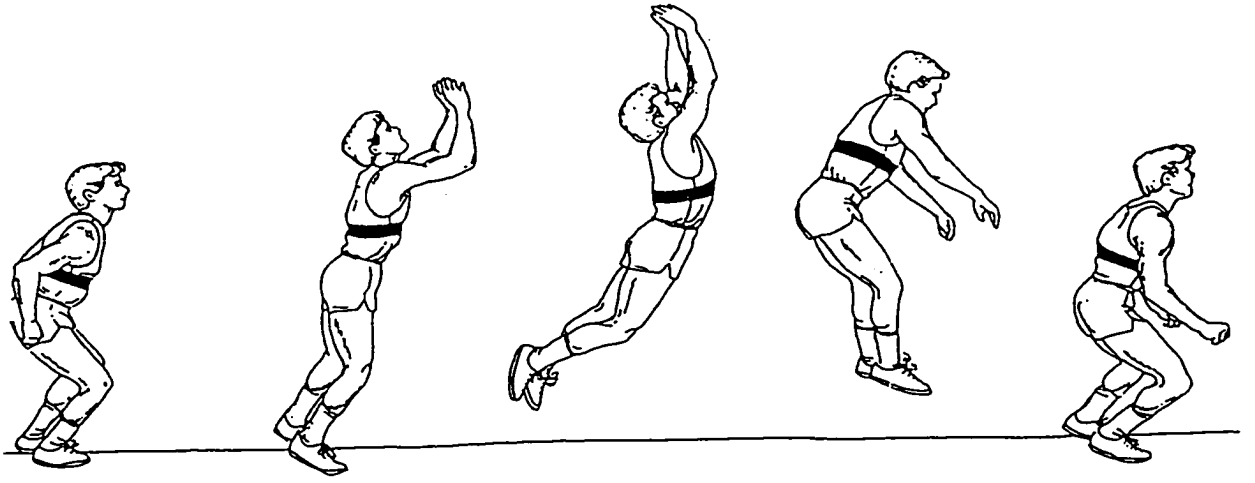
#3 Bounding for Distance

Start bounding in place and slowly increase distance with each step, keeping knees high.



#4 Broad Jumps-Stick Landing

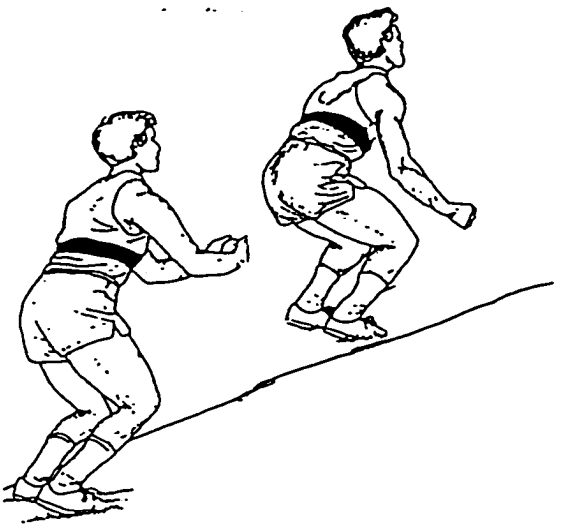
Two-foot jump as far as possible. Hold landing for 5 seconds.



APPENDIX L-7

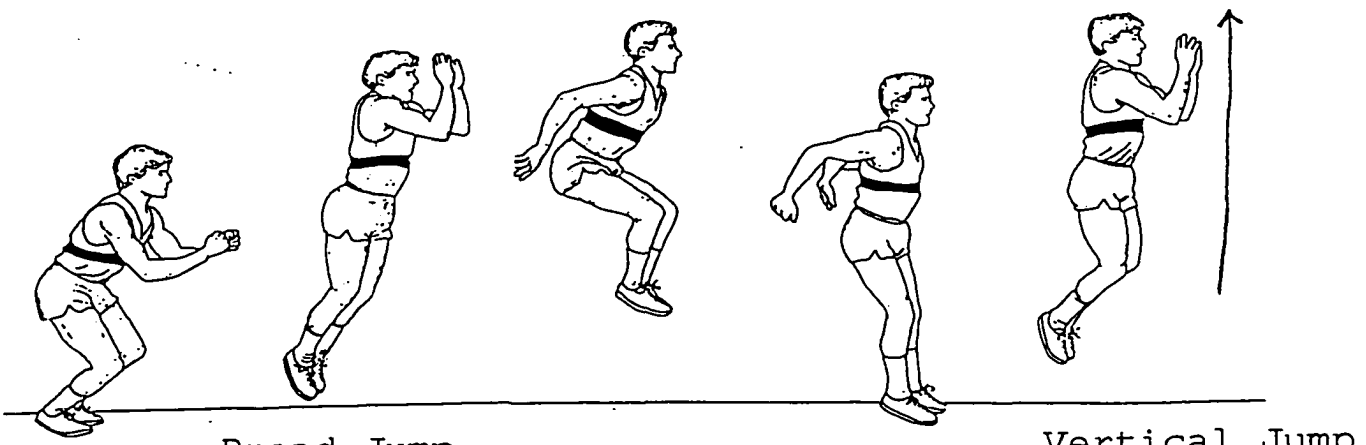
#5 Line Jumps

Double leg jump with feet together. Jump **side-to-side** over a line quickly. Repeat **forward and backward.**



#6 Jump, Jump, Jump and Vertical

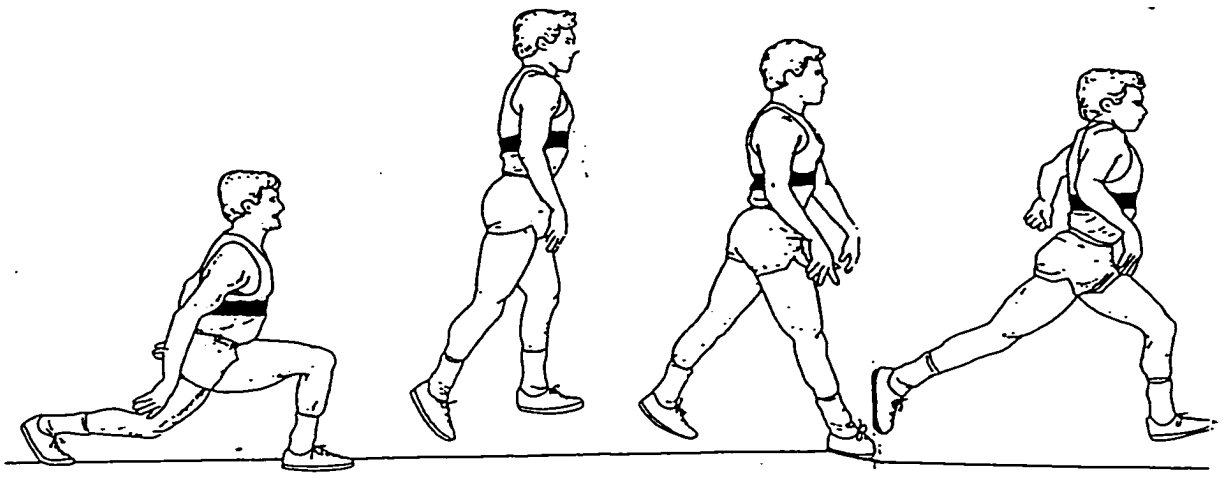
Three broad jumps with vertical jump immediately after landing the third broad jump.



APPENDIX L-8

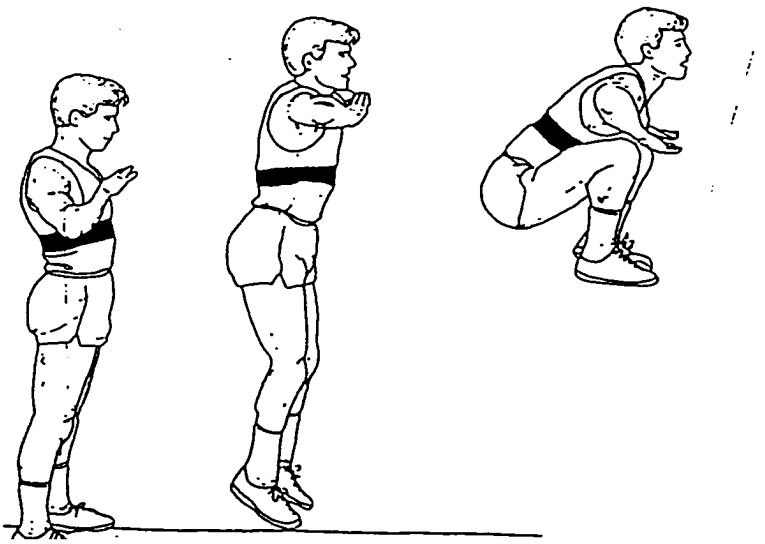
#7 Scissors Jump

Start in stride position with one foot well in front of other. Jump up, alternating foot position in midair.



8 Tuck Jumps

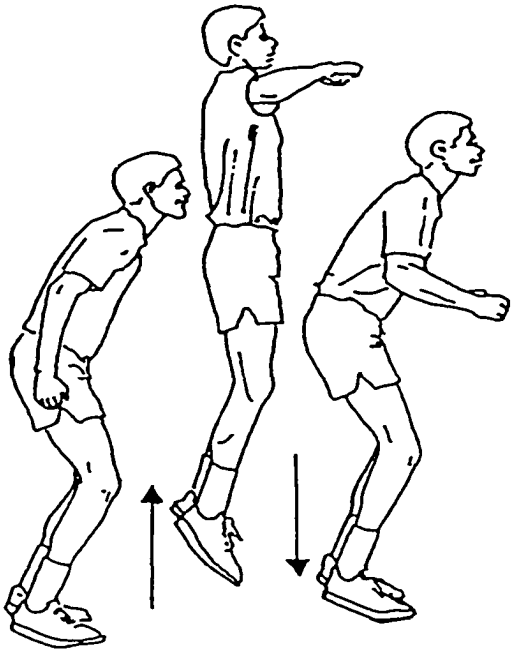
From standing position jump and bring both knees up to chest as high as possible. Repeat quickly.



APPENDIX L-9

#9 Two-foot Ankle Bounces

With knees slightly bent and arms raised overhead, bounce up and down off toes.



Compliance Sheet

Participant	8/22	8/24	8/30	9/1	9/5	9/8	9/11	9/13	9/18	9/20	9/25	9/27	10/3	10/9
C-1	x	x	x	x	x	x	x	x	Q					
I-2	x	x	x	x	x	x	x	x	x	x	x	x	x	x
C-3	x	x	x	x	x	x	x	x	x	x	x	x	x	x
I-4	x	x	x	x	x	x	x	x	x	x	x	x	x	x
I-5	x	x	x	x	x	x	x	x	x	x	x	x	x	x
C-6	x	x	x	x	Q									
I-7	x	x	x	x	x	x	x	x	x	x	x	x	x	x
C-8	x	x	x	x	x	x	x	x	x	x	x	x	x	x
C-9	x	x	x	x	x	x	x	x	A	x	x	x	x	x
I-10	x	x	x	x	x	x	x	x	x	x	x	x	x	x
I-11	x	x	x	x	x	x	x	x	x	x	x	x	x	x
I-12	x	x	x	x	x	x	x	x	x	x	x	x	x	x
I-13	x	x	x	x	x	x	x	x	x	x	x	x	x	x
I-14	x	x	x	x	x	x	x	x	x	x	x	x	x	x
C-15	x	x	x	x	x	x	x	x	x	x	x	x	x	x
C-16	x	x	x	x	x	x	x	x	x	x	x	x	x	x
C-17	x	x	x	x	x	x	x	x	x	x	x	x	x	x
C-18	x	x	x	x	x	x	x	x	x	A	A	A	A	A

Note.
C=Control
I=Intervention
A=Absent
Q=Quit

APPENDIX N

Posttest Measurement Sheet

Player Profile Sheet (Posttest)

Name:

_____
First Last

School:

_____

Please do not write below this line

Height: _____ Weight: _____

Standing Reach:_____

VJ:	1_____	BJ:	1_____	AJ:	1_____
	2_____		2_____		2_____
	3_____		3_____		3_____
Highest_____		Highest_____		Highest_____	

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