# EFFECTS OF PLYOMETRICS TRAINING WITH ANKLE WEIGHTS ON SKILL-RELATED PHYSICAL FITNESS COMPONENTS

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**In Partial Fulfilment of the Requirements for the Degree**

**Master of Arts in Education**

**With Specialization in Physical Education**

**EARONE MHICO S. SIGUA**

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# APPROVAL SHEET

This thesis entitled "**EFFECTS OF PLYOMETRICS TRAINING WITH ANKLE WEIGHTS ON SKILL-RELATED PHYSICAL FITNESS COMPONENTS"** prepared and submitted by **EARONE MHICO S. SIGUA** in partial fulfillment of the requirements for the degree of **Master of Arts in Education with Specialization in Physical Education**, is hereby recommended for approval and acceptance.

**BRANDO C. PALOMAR, MST**
Adviser

Approved in partial fulfillment of the requirements for the degree **Master of Arts in Education with Specialization in Physical Education** by the Oral Examination Committee.

**ADONIS P. DAVID, Ph.D.**
Chairperson

**LORDINIO A. VERGARA, D.Pd**
Member

**SALVE A. FAVILA, D.E.M., D.Pd**
Member

**JULIO VICTOR B. SANTARIN, D.Pd**
Member

**ROSALINA ELIZABETH N. EDRALIN, Ed.D**
Member

Accepted in partial fulfillment of the requirements for the degree **Master of Arts in Education with Specialization in Physical Education**.

________________________
Date

**RONALD ALLAN S. MABUNGA, Ph.D.**
Dean
College of Graduate Studies and Teacher Education Research

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# DEDICATION

Almighty God,

Daddy Emilio Sigua and Mommy Mila Sunga

Carlyn, Eimanuel Carlyle, and Elijah Calyx

Kuya Mark, Ate Dholo, Eirish, Dreiven, Ellan, and Ian

LolaVines, Lolo Adong, Lolo Igi, and Lola Inda

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This study explores the significant effect of plyometrics training with ankle weights on volleyball and basketball athletes' skill-related physical fitness components. More specifically, the athletes' skill-related physical fitness components such as agility, leg power, and speed were considered in this study since these are essential attributes in playing both basketball and volleyball. The researcher developed a six-week plyometrics training program with ankle weights that was evaluated by three content experts. Using a quasi-experimental with pretest-posttest design. The control and experimental groups were composed of forty-eight members of combined male and female basketball and volleyball athletes in one public school. The Illinois agility run test, 20-meter dash, and Vertec jump height test were used in the pretest and posttest in assessing athletes' agility, speed and leg power, respectively. Results of the study revealed that the athletes in both groups had significant improvement on their agility, leg power and speed as implied on the findings of the paired *t*-test between the pre-test and post-test in all skill-related physical fitness components. However, results of the independent *t*-test comparing the two groups' posttests in all skill-related physical fitness components showed significant difference leaning towards the experimental group. The findings provided evidence on the significant

influence of plyometrics training with ankle weights in enhancing agility, leg power and speed among basketball and volleyball athletes. Further, this study promotes the significance of designing, developing and validating training programs for the improvement of desired athletes' skills and sports performance.

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# CHAPTER I

# THE PROBLEM AND LITERATURE REVIEW

## Background of the Study

Everyone is encouraged to achieve the attributes of physical fitness. Moreover, physical fitness is the ability of an individual to perform daily tasks with high level of vigor and alertness, with ample amount of energy to meet cases of emergencies or to observe leisure time activities (Farlex, 2012). There are numerous benefits of physical fitness such as improved health condition, more flexibility, greater strength, enhanced appearance, higher level of energy, and more positive mood and attitude. Specifically, having a regular exercise provides immediate and long-term benefits, whereas, observing regular physical activity shows decrease of mortality and morbidity from any forms of chronic diseases. This concern is part of the main goal of the K-to-12 Physical Education Curriculum that promotes life-long fitness and wellness for all Filipino. Physical fitness is generally achieved through physical activity and exercise, stress management and relaxation, proper diet and nutrition, and enough rest for physical recovery.

There are varied measurable components that influence individual's physical activity and can be categorized into two groups: (a) health-related, and (b) skill-related. The first group pertains more to the efficiency of the body to carry out day to day activities. All of these fitness components have specific purpose and parts in describing someone as physically fit and healthy. More specifically, activities that promote improvement of the overall health and well being are described under health-related physical fitness. The main purpose of this form of fitness is to prevent the occurrence or rehabilitation of diseases, as well as, the enhancement of optimum level of functional capacity in performing daily life activities. This component focused on cardiovascular or cardiorespiratory strength, muscular stamina, body composition and flexibility. On the other hand, the components of fitness that are related to the enhancement of performance for athletic activities are described as skill-related physical fitness. These are abilities that influence the increase of individual's capacity to perform various tasks and have indirect link with health. Components of this physical fitness involves balance, coordination, agility, reaction time, speed and power which are considered for evaluating an athlete's physical fitness. These components are significant for any sports-related performance and actual game execution. Moreover, the components such as agility, leg power and speed are considered essential attributes for athletes who are playing in the two most popular sports in the local setting – basketball and volleyball. These three skill-related physical fitness components are pre-selected as measurable variables considered in this study.

More specifically, agility is described as an individual's capacity to move the body easily and quickly which also includes the ability to change direction quickly while observing balance. In the case of playing volleyball, agility is demonstrated as the player's ability to change direction in a split of second relative to the direction of the ball as for the player to make sound decision in performing duck, dive or dodge movements. Likewise, agility is essential in playing basketball which requires constant changes in direction, where a basketball athlete requires agility in moving and penetrating towards the basket, in getting a position to take charge, or in catching up the opponent in performing a turnover during a fast break. In most cases, a team or an individual who is described to be extremely agile will have the momentum and perform better on fast breaks, pressing and defense. The difference between an uncontested lay-up and turnover in basketball game is attributed to the fractions of a second gained from proper agility training.

On the other hand, power refers to a person's ability to transfer energy into force at a rapid pace also known as explosive body movement. It is considered to be the synergy of speed and strength which is further defined as the capacity of exerting muscular force quickly. In most cases, it is considered both skill- and health-related physical fitness components. Vertical jump height test is one assessment used to test power for both volleyball and basketball athletes. Excessive jump height is a requirement in playing front row in volleyball. Performing the movements such as blocking, hitting and jump serving in volleyball depend on the height of the jump related to explosiveness and power. It is also an advantage to jump high for effective execution of dunks, blocks and jump shots in playing basketball.

Conversely, the person's ability to move at faster rate is associated with speed and will yield to physical power and force when combined with strength. It is the component that is related to the capacity in performing a movement over a short duration of time. It is essential in playing volleyball as players are needed to move in several directions quickly for the entire game period. Volleyball athletes are required to move faster on certain directions as to perform quick forward, lateral, vertical and backward movements. More specifically, it is demonstrated as the immediate response to the direction of the ball in order to prevent it touching the ground. Skills like setting, blocking, hitting, and digging will be enhanced when a volleyball athlete is able to move quickly around the court area. Likewise, a constant change in direction and stop-and-go movements are often observed in playing basketball, where athletes are required to start, halt and quickly restart effectively. All the stop-and-go movements not only require athletes to be quick off from the start but also to be able to accelerate quickly into a full sprint. Hence, athletes will be able to elude their opponents during offense and fast breaks.

With the aforementioned significance of those skill-related physical fitness components, it is essential to design and develop a good fitness program in promoting, as well as in maintaining good health and better performance. These fitness programs are vital in assuring individuals, especially athletes, in yielding workouts with specific muscle groups. Most individuals do exercise but not maximizing the utmost potential their exercise may provide that is why it is necessary to plan out these fitness programs as not to waste time without significant improvement.

In order to achieve physical fitness and perform better in sports, it is important to observe specific means of improving all abilities (Balciunas, Stonkus, Abrantes, & Sampaio, 2006). One of the promising training programs is the plyometrics. It is a method utilized by athletes in almost all types of sports. Bal, Kaur and Singh (2011) described it as an “explosive-reactive” power training since it involves repeated swift contracting and stretching of muscles in order to enhance power. It is achieved by optimizing the stretch-shortening cycle. This cycle occurs when an active muscle quickly switches from eccentric to concentric actions of the muscles which produce a stretch reflex and gains more muscle power. Rahim and Behpur (2005) further explained that greater amount of force is produced and powerful muscle movement when muscles are stretched faster. These studies provided significant basis for this study in utilizing plyometrics training with the hope of contributing for the improvements of agility, leg muscle power, and speed performance among volleyball and basketball athletes.

On the other hand, one of the latest innovations in strength and conditioning training is the use of ankle weights. Dr Anthony Luke as interviewed by De Luca (2007) explained that muscles like hamstrings, quadriceps and glutes, work harder to do the same motion when subjected with ankle weights. He further discussed that ankle weights give better workout for big muscles since there is also a greater cardiovascular gain as exertion is utilized. It is a weight placed above the ankle around the Achilles' tendon and the lower shin. Greater leverage requires less weight in order to increase the forces on the body. These weights are often positioned to smaller diameter regions than the thigh and being attached above the ankle provides benefits for movements including calf muscles. Jothi, Vinu, and Eleckuvan (2010) examined the effects of resistance and plyometrics programs in enhancing selected bio-motor abilities. Results revealed improvement on resistance power by 11.81%, anaerobic strength by 7.53%, feet's strength by 4.13%, and speed by 4.00% after the implementation of the training program. It suggested that the combination of the said training programs yielded significant effects in improving the said variables.

It is necessary to design training programs for athletes that focused on physiological abilities using appropriate sets of equipment and strategies as suggested and evaluated by sports trainers and experts that will provide desirable repercussions. These programs may also consider the decrease on wasting time and the cost effectiveness in developing the skills for each athlete. However, there is a dearth of research studies in the local context which is focused on the use of ankle weights particularly in minimally trained populations as combined with plyometrics training program. More studies need to be done to examine if the ankle-weights paired with plyometrics training would be beneficial in improving the components of skill-related physical fitness as compared with traditional methods for athletes without any specialized training history. Therefore, the purpose of this study was to determine the effects of plyometrics training with ankle weights on skill-related physical fitness components such as agility, leg power, and speed, of male and female secondary basketball and volleyball athletes.

## Literature Review

This section provides basis for the conduct of this study. The first part focused on studies related on the significance of physical fitness and exercise then followed by studies on plyometrics and use of ankle weights. The last part of this section highlights the synthesis of this literature review which served as discussion for the conceptual framework of this study.

## Physical Fitness

Nugent (2008) explained that chronic diseases are considered as the foremost health-related problem and threat to the general population. It includes cancer, diabetes and cardiovascular disease. Lim et al. (2010) cited the report of the World Health Organization (WHO) showing that approximately fifty nine percent of the fifty-seven million records of deaths annually that may reach forty six percent of the world disease problems are attributed to these chronic deceases. In the Philippines, chronic diseases accounted for fifty seven percent of all deaths as reported by the WHO and this may increase to twenty one percent more for the next ten years (The Partnership to Fight Chronic Disease, 2011). Unhealthy lifestyle behaviors are strongly associated with the occurrence and rapid increase of chronic disease cases, which is why everyone is highly encouraged to be physically fit.

Physical fitness is described as the measure of a person's ability to perform effectively and efficiently work-related and leisure activities, to prevent occurrence of diseases, to maintain healthy body and to address emergency cases. It is achieved through physical activity and exercise. Delisle, Werch, Wong, Bian and Weiler (2008) proposed physical activity as one of the indicators of healthy lifestyles as demonstrated in current years and as an important means of responding with wide range of health-related problems due to poor sedentary routines. It can also avoid and control varied chronic illness like hypertension, diabetes, coronary heart disease, osteoporosis, and colon cancer. However, increasing the participation to physical activity is not just considered as an individual problem but as a societal concern. Thus, it requires the use of a multi-cultural, disciplinary and sectored population-based approach (WHO, 2008).

Additionally, Kruk (2007) provided an analysis on how physical activity prevents occurrence of most frequent chronic disease using recent evidences. Results revealed that reduction on the incidence of major chronic diseases and rehabilitation of patients related to physical activity and exercises echoed the findings of previous studies. Maximum risk reduction percentages were reported for breast cancer (75%), heart diseases (49%), diabetes (35%) and colon cancer (22%). Results also suggested that increasing physical activity prevents gain of weight that are related with aging when compared to active and inactive adults. Further, Durstine, Gordon, Wang and Luo (2012) explored the link between physical activity and chronic disease. They found that the leading cause of death, globally, are chronic diseases and continues increase of its incident rates is related with increase cases of physical inactivity. Both primary prevention in reducing diseases and secondary disease treatment of chronic diseases among young and adults emphasized on the participation to physical activity and exercise. Many countries developed physical activity guidelines and programs that provide information on the significance of exercise in managing diseases. It is hoped that there will be a decrease of chronic disease cases and improvement on the quality of life as physical activity and exercises are incorporated as essential part for both primary and secondary prevention approaches.

Moreover, engagement of children in sports competition contributed to the attainment of healthy lifestyle as children understand and enhance their social, physical and cognitive skills

(Choi, et. al., 2014). In addition, Bailey (2012) explained that participation and engagement in physical activity contributed to the development of positive outcomes such as social well being; academic and cognitive performance; and physical and mental health conditions.

Reports from the U.S Department of Health and Human Services (2008) and WHO (2010) explained that youth who engaged in organized school-based and community-based sports are less likely to experience health and behavior risk than those who have no sports participation. Moreover, young male and female athletes are less likely to use drugs and alcohol. The report also revealed that both genders who are having irregular breakfast, practicing smoking and observing poor self-perceived health was highly related with determined physical inactivity. It suggested that persistent physical inactivity among adolescents had association with less healthy lifestyle and that youth who participate in physical activities like team sports are less likely to engage in unhealthy activities and behaviors. A study also showing the relationship between the preference of physical activity sedentary behavior and dietary habits among adolescents (Al-hazza, et.al., 2011) revealed high percentage for both male (84%) and female (94%) students spent more time in watching television daily and were described as not physically active. Most of the participants are not taking daily breakfast, eating fruits and vegetables and drinking milk. It is widely accepted that physical activity participation was significantly correlated positively with intakes of vegetables and fruits but not related with sedentary lifestyle. On contrary, the study explained the prevalence of sedentary behavior, physical inactivity and poor dietary habits among adolescents.

Conversely, physical fitness can be categorized as health- and skill-related attributes of an individual in relation to his or her ability to perform physical activity. Health-related physical fitness is focused on the individual's health status that includes cardiorespiratory fitness, muscular strength, muscular endurance, flexibility, and body composition (Ortega, Ruiz, Castillo, & Sjostrom, 2008). On the other hand, skill-related fitness covers movement-related components that enable a person to perform a wide range of physical activities such as balance, coordination, power, strength, muscular endurance, agility and speed (Monyeki & Kemper, 2007).

More specifically, Sheppard, & Young (2006) defined agility as a quick response to a stimulus in a form of the whole-body change of movement or direction. Furthermore, they mentioned that it has association with trainable physical attributes like power, strength and technique, along with other cognitive-related components like anticipation, visual-scanning speed and techniques. Testing someone's agility is generally confined in assessing individuals' manner of changing direction and speed, or of cognitive components in the form of patter recognition and anticipation. In addition, Negra et al. (2016) reiterated that agility is an important physical attribute for successful participation in team sports events. They investigated the extent of agility as an independent physical ability as compared to speed time and jumping ability among soccer and handball players. Results revealed that jumping ability, speed time and agility assessed the same physical attribute among young players of a competitive-level of team sports.

Conversely, power is often described as the maximum muscular force exerted at maximum speed of the synergy of strength and speed (explosiveness). It is an essential factor in performing jumping, kicking, striking and throwing. Santos and Janiera (2008) explained that in developing muscular power among basketball players, resistance-plyometrics and/or the combination training approaches are often described as the most effective methods. Furthermore, developing explosive leg power is significant for better performance of athletic movements like the attacking and the rebounding actions for volleyball and basketball, respectively. Klavora

(2000) described that the effective measure of leg power as an indirect assessment of performance is the vertical jump test. This test is used among athletes in the field of football, volleyball, swimming, weightlifting and power lifting. In addition, this test is used by most strength trainers and coaches. In this test, the starting jumping position is a crouch where knees are bent or in a standing position then followed by a fast knee-bending movement. There are protocols allowing the swinging movement of the arm before jumping. On the other hand, Vertec is a variation of the jump-reach protocol in measuring vertical jump execution. This device includes colored swivel vanes attached to an adjustable pole relative to the player's standing reach. The maximum vertical jump can be measured by performing a two-footed no-step jump approach when the player can no longer displace the same swivel wave on two consecutive jumps (Klavora, 2000).

Lastly, speed is described as the capacity of an individual to move quickly across the ground or to rapidly move limbs grabbing or throwing. It is not just identified by how fast someone can run, but is more dependent on the person's acceleration, maximum speed movement and speed maintenance. Pandey and Sadar (2015) explained that movement speed entails good strength and power as well as how much the weight and air resistance act to impede the motion of a person. Sprint or speed test is utilized to measure individual's acceleration, speed endurance and maximum running speed which are dependent to the distance-run. This test is performed over varied distances as determined by the variables to be assessed and by the type of sports event. Part or the Speed-Power-Agility-Reaction-Quickness rating system for basketball and other sports is the 20-m dash in which speed is measure over similar distance. Moreover, the average sprint distance among athletes of a team sport is within the range of 15- to 20-m over more than 3-seconds (Andrzejewski, et al, 2015; Gabbet, 2012). This result implied that athletes in the said sport perform sprint in shorter distance as compared with track-and-field athletes and may suggested that they may gain a maximum speed within far shorter distances as short as ≤ 21-m. Moreover, Hopker, Coleman, Wiles, and Galbraith (2009) assessed the reliability of sprint performance in laboratory and field conditions among male and female players of a team sport. Results revealed that data were reliable as culled from a single maximal measure of sprint using protocols of fixed distance.

**Exercise**

It should not be mistaken to interchange the word "physical activity" with "exercise." Exercise is included as a form of physical activity together with other types of activities that involve movements of the body which are necessary for individuals in performing work, household chores, recreational programs and transportation (Wakefield, 2015). Moreover, exercise is considered as a sub-domain of physical activity which is described as planned, structured and repetitive for the purpose of improving and maintaining the different physical fitness components.

A study from the University of Georgia found evidence on the significant role of regular exercise in improving energy levels and decreasing fatigue. More specifically, the magnitude effect of exercise is stronger as compared to the effect of drugs, like narcolepsy drug modafinil, as treatment for individuals who experienced severe level of fatigue with 0.37 standard deviation, as compared to the other group with 0.23 standard deviation, of improvement. In addition, Puetz (2006) emphasized that across groups, healthy adults and individuals with cancer and chronic conditions, benefited from performing regular exercise by increasing the feeling of energy and reducing fatigue. This finding echoed the results of previous studies showing the increase on the levels neurotransmitters, like norepinephrine, dopamine and serotonin, for mood-enhancing and energy-promoting on the brain of animals subjected to regular exercise situations.

Thompson, et al. (2010) and the report from Department of Health and Human Services (2008) identified warm-up, conditioning, cool-down and stretching as phases of exercise. Each phase of the exercise has significant role in reaching fitness goals while maintaining health and safety. The warm-up phase, which is usually observed for at least five to ten minutes, prepares the body for the conditioning phase of the workout. It gradually allows the muscles, breathing, hearth and circulation to adjust from low to moderate level of intensity of aerobic exercise. It also causes slow increase of the body temperature, enhances flexibility and keeps the body from muscle soreness and injury. The second phase is the conditioning, more often observed for sixty minutes, is described as the main training or the sport activity. The exercise activities performed in the conditioning phase yield benefits like calorie burning and muscle or endurance strengthening. Conversely, the cool-down phase, good for five to ten minutes with low to moderate intensity level of aerobic exercise, allow the body temperature, blood pressure and heart rate to slowly return to its normal condition. The last phase is the stretching, activities performed after the cool-down or warm up phase for at least ten minutes, permits greater range of movement and provides ease from stress on the tendons and joints which prevents any form of injury.

Haff (2007) alluded that there have been studies explaining the benefit of static stretching to vertical jump performance. Moreover, Frantz and Ruiz (2011) found the significant effect of dynamic warm-ups to the athletes' vertical jump scores as compared to those in a static form of warm-up. For this reason, dynamic warm-up activities were observed in this study.

There are three basic underpinnings of exercise that must be observed in order to attain the desired outcome. According to Cissik (2013), these principles are overload, progression and specificity. The overload is described as the mechanism of improving fitness by "increase over time." This suggests the increase of resistance, speed and time. Novice in exercise may find difficulty the concept of overload, but as time progresses it will be easier to practice the increase of time, resistance and speed. Conversely, progression is described as the rate of increasing exercise activities steadily. Lastly, specificity is described as to the specific types of activities to be observed in developing specific aspect of fitness and dimension of the body. All forms of exercise help in conditioning the body but different exercises develop muscles in varied means.

**Plyometrics**

Plyometrics is derived from the Greek words "*plythein" or "plyo,"* that means "to increase" and "metric" that means "measure." Therefore, the main goal of plyometrics is to increase the measurement of sports performance for competition or testing outcomes like serving velocity, sprint speed, throwing and jump height.

Concepts of plyometrics are usually used on lower and upper extremities sports for utmost efficient patterns of movement and skills in executing sports. Plyometrics training employs stretch-shortening cycle for eccentric or lengthening movements that are rapidly followed by concentric or shortening movement. It also assists in enhancing power which is the foundation for athletes in refining their skills of their specific sports. Both theoretical and potential training benefits of implementing plyometrics exercises for developing upper and lower extremities involve: (1) capacity to enhance the average velocity and power; (2) increased velocity of acceleration and peak force; (3) heighted levels of muscle activation; (4) increased time for force development; and (5) capacity to induced stretch reflexes (Davies, et al., 2015).

Davies, Riemann and Manske (2015) also identified periodization and training components of plyometrics training. Periodized training is a program in which alteration of workouts over a regular interval of time. Plyometrics program utilized progression and overload principles of exercise and may be achieved by working the volume dosage, in terms of repetitions, sets or weights, of the different identified variables. The quality of work is considered more important than the quantity of work for plyometrics training. Work intensity should be performed within the range of 80-100% for maximum contraction, where the rate of muscle stretch is more significant than the length of stretch. During training session, athletes may be experiencing fatigue as evident based on the poor quality of movement performance and suggested the termination on the plyometrics exercise session. Based on the “rest, recovery and reparative” phase, following high intensity resistive plyometrics exercises, there should be increased recovery time when compared to other types of exercise. Although no evidence exists regarding the optimum rest period between high intensity plyometrics workouts, it is recommended 48-72 hours between sessions.

In designing a plyometrics program, the following training variables are to be considered based on the study by Davies, et al. (2015) on current concepts of plyometrics exercise:

*Neuromuscular Overload: Applied Loads and Distances*

It is often observed in the form of a quick change of direction of a limb or the entire body without external loads. The amount of total work, described in terms of repetitions, set and range of the athlete’s motion, contributes to the amount of total overload.

*Spatial Overload: Range of Motion*

Movements also influence overload from standpoint of the motion's range. This range of motion is performed through a wider range by exaggerated pattern of movements. This concept is employed for activation of muscles and for stretch reflex of specific range of motion. As formerly described, reflex mechanisms facilitate the motion pattern that enhances the production of force.

*Temporal Overload: Timing*

This concept can be achieved by focusing on the execution of movements rapidly and intensely. It is often associated with keeping the time to rebound or the amortization phase in a short duration that is considered vital in performing plyometrics activities to enhance the production of power. The shorter time to perform rebound and electro-mechanical delay permits the operative transmission of force from the pre-stretch eccentric to concentric power performance of the plyometrics exercises.

*Intensity*

It is the actual proportion of required effort by the athlete in executing certain activity. The types or forms of exercise performed in plyometrics define intensity to be observed. For example, bilateral jumping to a box has lower plyometrics intensity level as compared to single leg jumping from a box which has intense plyometrics intensity level. Intensity is highly considered in designing conditioning and rehabilitation programs.

*Volume*

It is described as the total performance in doing work over a single periodization or cycle. It is often measured by computing the load, determining the number of repetitions and sets of specific physical activity in a plyometrics training program. A fifty-foot contact in a training cycle is considered low volume, while two-hundred plus of foot contact is described as high volume. The volume may be altered in a developmental mechanism to reduce the risk of injury as well as over-training.

*Frequency*

It is defined as the number of exercise or activities per session that is considered during a training schedule. After plyometrics training is executed, the body completes a process of rebuilding and recovering. Thus, identifying the frequency of the training program is significant in order to obtain adequate stress for the body to adapt and also allows sufficient rest time for healing. The recommended frequency per week in a plyometrics training program is two to three times with a rest each session.

*Recovery*

It is identified as an essential concept to prevent over-training and injuries, as well as to determine the primary significance of plyometrics program. During the intense performance of the body in plyometrics training, it is appropriate to observe longer recovery periods between sets. Usually, the recovery between training sessions is within the range of forty-eight to seventy-two hours between exercises bouts as recommended in plyometrics training even there is limited studies describing the optimum recovery times.

*Specificity*

It is designed based on the nature of the sports and position of the athletes as to enhance specific goals of the programs and to duplicate in a given sports-specific activities. In plyometrics training, specificity may include types of motions, angular velocities, loading cases and metabolic-demand tasks.

There are several studies that discussed the effect of plyometrics training in enhancing maximal vertical jump height (Davies, et al., 2015) which included varied jump training programs with a range of duration from six to twenty-four weeks among athletes categorized as pre-pubertal, pubertal and adult. There are also varied forms of jump training tests utilized to measure the improved vertical jump height including simple squat jumps, split squat jumps, counter-movement jumps with and without arm swings, bounding and drop jumps. Some included advanced techniques like depth jumps, tuck jumps and single leg hops. A total training session of six to more than twenty sessions were observed as to achieve the improved jump heights training with a volume of jump training that ranged from 400 to 1700 jumps. With all forms of variation of factors and components that have been controlled and manipulated with all these studies, yielded a consistent outcome of an improved vertical jump performance.

In addition, there is an increase on the sprinting speed or velocity as influenced by plyometrics training for the lower extremities. Sprinting velocity is essential for team sports such as basketball, soccer, volleyball, handball and tennis since these sports require rapid change of speed or repetitive alteration of direction. There are studies presenting various forms of plyometrics training with range of duration from three to twelve weeks with weekly dosage range of once per week to utmost of four times per week. The volume is of more than eighty jumps per sessions in order to gain maximum benefit. However, the improvement of sprint performance was not found to be significantly greater if activities of plyometrics are executed with other types of exercises like combining with weight training as compared when it is executed alone. Moreover, the sprint-specific programs under plyometrics training revealed to be greatest over initial sprint's portion (10- to 40-m) as compared to longer distances (>40-m). These results implied that athletes who are familiar to sprint over distances of 40-m could further improve by enhancing the initial acceleration of sprinting via inclusion of plyometrics exercises in their training programs (Davies, et al., 2015).

Thomas, French and Hayes (2009) determined and compared the effect of two plyometrics training techniques on young soccer players' agility, muscular power and speed for six-week duration. The first group utilized Depth Jump (DJ) while the Counter-Movement Jump (CMJ) was given to the other group. Participants of the DJ group were instructed to perform drop jump with minimal ground-contact time and increasing the elevation, while the members from the CMJ group were instructed to execute jumping from a standing start position as to gain higher jump height. Results revealed that both groups had improvements in their vertical jump height and agility with $p<0.05$ for both components and no change in their sprint performance with $p>0.05$. The study concluded that the two plyometrics training techniques provided significant improvement on young soccer players' agility and power but no significant difference between the two treatment groups ($p>0.05$).

In a similar study, Ziv and Lidor (2010) compared the vertical jump (VJ) performance of volleyball players who have undergone plyometrics training focused on strength and conditioning program. Results showed that higher values of VJ were related to players from better performing teams and that better VJ performance is attributed to the conditioning and strength programs implemented and suggested to continue the conditioning program throughout the season. On the other hand, the study also identified the limitations related to the testing protocols and implementation of the programs and recommended the inclusion of plyometrics training in the annual training program, testing the players' VJ performance on the entire season, avoidance of disruptions during the conditioning phase and of over-training during the pre-season.

Conversely, Santos and Janeira (2010) studied the effects of plyometrics training with reduced and detraining program periods on adolescent male basketball players' explosive strength. The experimental group was subjected to a twice a week plyometrics training for 10 weeks with a regular basketball practice while the control group was subjected to a regular basketball practice only. After the training period, the experimental group was subdivided into two: (1) detraining group and (b) reduced training group. All participants were subjected to counter-movement jump, squat jump, depth jump, Abalakov test, medicine ball throw and mechanical power as pretest and posttest of the plyometrics training. The detraining and reduced training periods were observed during the 4$^{th}$, 8$^{th}$, 12$^{th}$ and 16$^{th}$ week of the in-season training. Results showed that the experimental group increased in all indicators significantly ($p$<0.05) and the study concluded that the plyometrics training provided positive effects on both upper- and lower-body explosive strength of the participants. In addition, both detraining and reduced training program had no significant influence in maintaining the participants' strength levels which may imply that basketball-specific training on power is more related on maintenance and sustainability of sports performance.

Similarly, Sáez-Sáez de Villarreal, Requena and Newton (2009) conducted a meta-analysis on fifteen studies with thirty-one effect sizes related to the improvement of strength performance as influenced by plyometrics training. They used the following criteria in undertaking the meta-analysis: (a) studies with sufficient information in order to compute the effect size; (b) studies employing experimental design with valid and reliable measurements; and (c) studies utilizing plyometrics training for muscles in the lower limb. Most of the studies suggested that plyometrics training enhances the maximal strength performance. More specifically, all participants gained equally in improving strength via plyometrics training. The variables of the training program are the volume of the training of less than ten weeks with more than fifteen sessions and the implementation of high-intensity activities that maximize the possibility to have better improvements in performance. On the other hand, in order to attain utmost strength enhancement, the study recommended the combination of varied forms of plyometrics with weight-training. In addition, this study emphasized the use of appropriate dose-response trends on plyometrics training in optimizing the strength gains by conditioning and strength professionals.

Moreover, De Villarreal et al., (2009) made a meta-analysis on the different variables of plyometrics training that enhances vertical jump height (VJH) performance. They used fifty-six studies with 225 effect sizes in analyzing the effect of different factors on VJH of plyometrics training. They used the following criteria in analyzing the different studies: a) employment of true experimental designs with valid and reliable measurements; b) papers focused on plyometrics programs for the improvement of the muscles in the lower-limb; and c) studies with information about the effect size. Results of the analysis showed that participants with more experience in doing sports had greater improvement in VJH performance and that all participants, with good or bad condition of the physical body, gained equally from the plyometrics program. In addition, men had better results on power as compared to women after the implementation of the plyometrics training. More specifically, training volumes of more than 10 weeks with high-intensity programs (like having more than fifty jumps per session) and of more than twenty sessions, provided maximum possibility of having significant improvement in VJH performance. It is recommended to use combination of different forms of plyometrics like squat jump with drop-jump and with counter-movement jump in order to attain optimum jumping improvement.

On the other hand, Marques, et al. (2008) conducted a case study exploring the changes in the power and strength performance during in-season training of elite female senior professional volleyball players. Literature suggested that the aim of in-season training programs is to develop and maintain power and muscular strength, but it can be attained only with a well-crafted training design regimen. In the study, ten female elite volleyball players underwent two training sessions per week that include plyometrics and resistance trainings, apart from their normal practice sessions. The participants performed three to four sets of three to eight repetitions of plyometrics and resistance exercises for each training session. The participants' power and muscular strength were assessed before and after the twelve-week training program using the following tests: a) four repetition maximum bench press and parallel squats; b) overhead medicine ball throw; and c) unloaded and loaded countermovement jumps. Results revealed that the participants' strength improved by 15% in the bench press and 11.5% in the parallel squat. In addition, their distance in the ball throw improved by 11.8% and their performance in the unloaded and loaded counter-movement jump increased within the range of 3.8% and 11.2%. These findings suggested that the implementation of the training program with plyometrics and resistance exercises may improve the power and strength of female elite volleyball players during the competition season.

Moreover, de Villarreal, González-Badillo, and Izquierdo (2008) compared the effect of low (one day per week), moderate (two days per week) and high (four days per week) plyometrics training frequencies on students' jumping and sprinting performances. The three different plyometrics training frequencies were related with three different plyometrics training volume in attaining maximum strength, sprinting ability and vertical jump performance. Forty-two students participated in the study and were randomly assigned to one of the four groups: ten in the control (with seven sessions of drop-jump training, one day per week with 420 drop-jumps), twelve in the group with fourteen sessions of drop-jump training (two days per week with 840 drop-jumps) and nine in the group with twenty-eight session of drop-jump training (four days per week with 1680 drop-jumps). The drop-jump protocols include three varied heights (20-, 40- and 60-cm). The following tests were done before and after the seven weeks plyometrics training: a) maximal strength with one-repetition maximum and maximal isometric strength; b) 20-m sprint time test; and vertical height in counter-movement jumps and drop-jumps. Results revealed that there is no difference observed in any of the variables among the groups during the pre-training, and that there are no significant changes observed in any of the variables in the control group at any point of the training. The implementation of short-term plyometrics training with moderate training frequency (two days per week) and volume of jumps (840 jumps) provided the same improvement in the jumping performance but had greater training efficiency with 12% value (0.014% per jump) as compared with high frequency training (four days per week) and volume of jumps (1680 jumps) with training efficiency of 18% (0.0011% per jump). In addition, the same improvement was recorded in the jumping contact times, 20-m sprint time and maximal strength for both love and moderate frequency of training sessions per week when compared with high frequency training. These findings had practical value in designing plyometrics training programs for athletes where moderate volume plyometrics training is more efficient as compared with the higher one.

Similarly, Ronnestad, et al. (2008) explored the effect of short-term effects strength and plyometrics training on professional soccer players' sprint and jump performances. Six soccer players were grouped for the strength training (ST) for seven weeks with twice a week session in addition to their six to eight soccer sessions for a week. On the other hand, eight players were grouped for the strength training with plyometrics (STP) in addition to the same training as of the first group, while seven players performed six to eight soccer sessions in a week (control group). The following were observed for the pretest and posttest: a) one-repetition maximum half squat; b) squat jump; c) counter-movement jump; d) 4-bounce test; e) sprint acceleration; f) total time on 40-m sprint; g) peak sprint velocity; and h) peak power in half squat with 20-, 35- and 50-kg. Results revealed that there is no significant difference between the performance of the ST and STP groups. Both groups were combined and considered as the intervention group. There were significant improvements in all measurements for the intervention group except for the counter-movement jump, while the control group only had significant improvement in the peak power with 20-kg test. More specifically, there was a significant difference in the improvement of the one-repetition half squat, squat jump and 4-bounce test between the intervention and control groups, but no difference in the measurement of the sprint acceleration, total time on 40-m sprint, peak sprint velocity, peak power in half squat with 20- and 35-kg. Findings suggested that the combined strength and plyometrics training have no significant effects on the performance of soccer players. Although, implementing heavy strength training may lead to significant improvement in power and strength related measures for professional soccer players.

Conversely, Meylan and Malatesta (2009) conducted a study investigating the effect of short-term plyometrics training on early pubertal soccer players' explosive actions. The said training was implemented during the regular soccer practice in eight weeks and explosive actions considered in this study were jumping, sprinting and changes of direction. Plyometrics activities like hurdling, jumping, skipping, bouncing, and footwork were used as substitute for some soccer drills of twenty-five children. Fourteen of these children were classified as part of the training group (TG) and eleven as part of the control group (CG). Results revealed that there were no significant changes in the CG and that plyometrics training experienced by the TG provided significant decreases in the 10-m sprint time and agility time with values of -2.1% and -9.6%, respectively. In addition, there are significant increases in the TG's counter-movement jumps and contact test with values of +7.9% and +10.9%, respectively. Findings explained that plyometrics training during regular practice season helps in improving the explosive actions among young soccer players.

Lastly, Vissing, et al. (2008) made a study comparing the muscle adaptations in terms of muscle strength, morphology and power among untrained young men exposed to Plyometrics Training (PT) and Conventional Resistance Training (CRT). Eight participants have undergone twelve weeks of progressions conventional resistance training, while seven participants have undergone same number of weeks of plyometrics training. Results revealed that the muscle strength of both groups increased by 20-30%. In addition, members of the CRT group showed 50% improvement in hamstring strength as compared with the members of the PT group but they showed increased performance in the counter-movement jump height and maximal power with

10% and 9% increase, respectively. Moreover, the PT's maximal power in ballistic leg press improved greater as compared with the CRT with values of 17% and 4%, respectively. There is also an equal increase of seven to ten percentage of both groups' hamstring, quadriceps and adductor whole-muscle cross-sectional area and no significant changes happened for the fiber analysis. In addition, the study also found that there is no significant difference on the content decrease of myosin heavy-chain IIX (11 to 6%) between the two groups. These findings concluded that both groups, PT and CRT, provided a gross muscle size increase but only CRT had an increase in muscle fiber. It was also revealed that both groups had an increase in the maximal muscle strength but PT increased the muscle power.

**Ankle Weights**

Ankle weights are loads placed to the area just above the ankle joint to offer additional loads for leg movement. The added weight helps to enhance the strength of calve, quadriceps and gluteus muscles due to the added resistance and will result to an enhanced muscle mass over time. In addition, these are designed to fit around the ankle with varied sizes ranging from 0.50 to 10 kilogram and had various modes of attachment, like belts and Velcro straps (De Luca, 2007).

They have various modes of attachment, including belts and Velcro straps. They are adjustable to a persons' frame size, and some ankle weights have the ability to add or remove weight increments. According to Galt Tech, a properly fitting ankle weight fits snugly but not too tight. The proper ankle weight to use with core muscles varies. If a person is just starting to work out with ankle weights, he should use the smaller 0.50kg to 1kg versions first and build up (Hatcher, 2014).

Kim et al. (2016) studied the effects of wearing ankle weight on knee joint repositioning sense in the elderly and found out that knee joint repositioning error was generally lower than without ankle weights in both groups. It is interesting that the error value was lowest with the 1.0% ankle weight among the other conditions. However, the difference was not significant. Knee joint reposition error was significantly higher in the elderly group than in the young group under all the ankle weight conditions ($p<0.05$). No interaction was observed between ankle weight and age group ($p=0.84$).

**Synthesis**

There is an undeniable proof that doing a regular physical activity like an exercise contributes to the prevention, on primary and secondary levels, of chronic illnesses. It is also associated to the decrease of risk on premature death. In addition, there is a direct relation between health status and volume of performing physical activities, where most individuals who are physically active have low health risk. Though, the utmost improvements in health condition are often associated with individuals who are least fit at first then become more physically active. Risk of chronic illnesses begins from childhood and increases with age, thus health promotion programs must encourage individuals of all groups of ages (Delisle et al., 2010; Kruk, J., 2007; and Durstine et al., 2012).

The researcher, in this chapter, reviewed related literature on skill-related fitness which includes components of skilled movements, like agility, leg power, and speed that enable the individual perform a great variety of physical activities which have a great effect and contribute to physical fitness (Monyeki et al., 2007; Sheppard et al., 2006; Pandey et al., 2015; and Santos et al., 2008).

The effects of plyometrics training on certain athletes' physiological, physical and skill performance variables especially to basketball and volleyball athletes were also reviewed. The literature identified significant benefits for an individual's upper and lower extremities (Davies et al., 2015; Ziv et al., 2010; Santos et al., 2010; Meylan et al., 2009; and De Villarreal et al., 2009). Further, the researcher reviewed on comparative studies between plyometrics training and other resistance training (Vissing et al., 2008; Marques et al., 2008).

Ankle weights were identified to be beneficial in strengthening lower extremities and repositioning knee joint errors (De Luca, 2007; Hatcher, 2014; and Kim et al., 2016).

From these reviews, the researcher found that there was scope to further investigate the influence of plyometrics training with ankle weights on secondary school level of basketball and volleyball athletes' speed, leg power, and agility.

**Conceptual Framework**

This present study is anchored on the underpinnings of studies suggesting the significant influence of the implementation of plyometrics training and utilization of ankle weights in improving physical fitness components among athletes. More specifically, plyometrics training is described as an innovation in the field of sports training which is done by eccentric and concentric movement of the muscle with force and speed. Studies revealed that almost all athletes trained using plyometrics developed their upper and lower extremities. In the study conducted by Thomas, French, and Hayes (2009) on the effects of plyometrics training among young soccer players, results revealed that plyometrics training provided significant improvement on agility and leg power. In addition, there are recent studies suggesting the significant influence of plyometrics exercises, with a range duration of six to twenty-four weeks, to leg power in terms of vertical jump height by improving consistently among basketball, volleyball, soccer, handball, and tennis male and female athletes (Davies et al., 2015; Marques et al., 2008; Santos & Janeira, 2010; and Ziv & Lidor, 2010). In addition, there are studies also revealing the significant effects of plyometrics on decreasing sprint time among athletes (Davies et al., 2015; and Meylan et al., 2009).

Conversely, ankle weights are additional loads attached on each ankle to improve the strength of the calve, quadriceps, and gluteus muscles by increasing resistance which results to an enhanced muscle mass over time (De Luca, 2007). Kim et al. (2016) described the beneficial effects on wearing ankle weights on knee joint repositioning sense among elderly. For this study, the use of 0.50 kilogram ankle weights for beginners in working out was based on the suggestion of Hatcher (2014).

There have been studies showing the positive influence of integrating plyometrics on the training design of athletes and of utilizing ankle weights. More particularly, both variables had significant effects on athletes' skill-related physical fitness components. However, there is a dearth of studies focusing on the synergistic effect of implementing plyometrics training and using ankle weights on improving student-athletes' agility, leg power, and speed. More particularly, there are limited studies exploring the effect of the two combined variables on physical fitness components among secondary student-athletes. Thus, this research undertaking is proposed to determine if there are significant changes on secondary student-athletes' agility, leg power and speed as attributed to the implementation of plyometrics training together with the use of ankle weights. This study also observed the development of a six-week plyometrics training matrix guide observing the exercise principles – frequency, intensity, time and type, which include the following drills: 1) hurdle jump; 2) drop jump; 3) lateral hurdle hop; and 4) lunge jump. The developed training matrix was face and content validated by three experts thru criterion-based validation procedure prior to the implementation of the intervention to basketball and volleyball athletes in a public secondary school where the researcher is teaching.

Figure 1 shows the conceptual framework of the study which assumed that plyometrics training with ankle weights has a significant effect on skill-related fitness components.

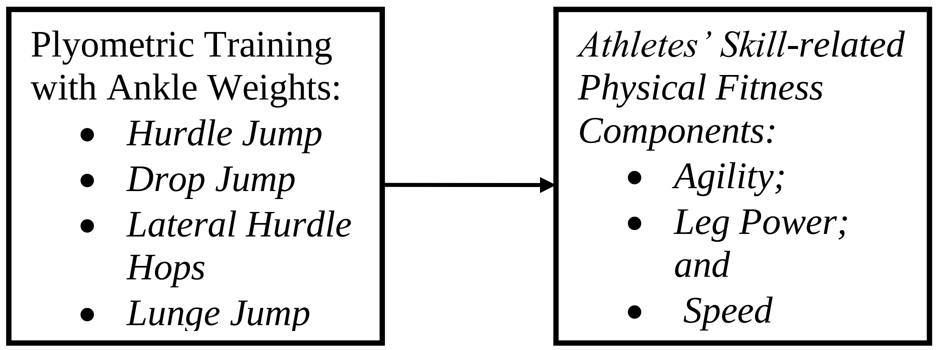


**Figure 1.** *Conceptual Framework of the Study*

**Research Problems**

The main objective of this study was to determine if the implementation of plyometrics training program with ankle weights improved the basketball and volleyball athletes' agility, leg power, and speed. Moreover, this study answered the following specific questions:

1. What are the profiles in terms of agility, leg power and speed of the athletes in the control and experimental groups before and after the implementation of the plyometrics training with ankle weights?
2. Is there a significant difference on the agility, leg power, and speed of athletes between the experimental and control groups before and after the implementation of the plyometrics training with ankle weights?

3. Is there a significant difference on the posttest scores in terms of agility, leg power, and speed between the athletes in the control and experimental group?

**Research Hypotheses**

This present study had tested the hereunder hypotheses addressing specific research problems 2 and 3, respectively:

$H_{o1}$: There is no significant difference on the agility, leg power, and speed of athletes in the experimental and control groups before and after the implementation of the plyometrics training with ankle weights.

$H_{o2}$: There is no significant difference on the post-test scores in terms of agility, leg power, and speed between the athletes in the control and experimental group.

**Significance of the Study**

The main goal of this study was to develop a good sports training program which will enhance the capabilities of the athletes to perform the skills most necessary to basketball and volleyball. It will benefit the athletes in terms of: injury prevention; decrease wasted effort due to training activity; increase in agility, leg power and speed; increase in total strenght; and elevate maximun power output.

This study is also important because it can help coaches in planning and implementing a training program. The most essential resource a trainer or a coach at his or her disposal is planning. The coach may be able to design a training program and activities with appropriate time by utilizing a well-organized, proven and research-based training design. These training designs allow athletes to fully enhance their performance at the optimum times. Output of this study will serve as a guide for trainers or coaches in designing and implementing training that will improve athletes' game performance.

Furthermore, research has not yet been able to clearly identify the benefits of ankle weights especially among female athletes. Results of this study may assist on future research undertakings as it may be considered as a reference and baseline study dealing with the same variables. Further, it will add to the few literatures writen which are related to ankle weights.

**Definition of Terms**

For the purpose of this study, the following terms are conceptually and operationally defined:

*Ankle Weights:* These are devices for exercise made from cloth and sand which are worn on each ankle to increase the weight of an individual (De Luca, 2007).

*Agility:* A component of physical fitness that is described as the ability to alter direction swiftly while maintaining balance (Sheppard & Young, 2006).

*Physical Fitness:* Capacity to perform daily tasks with vigor and alertness without the feeling of fatigue and with enough energy intended to address emergencies or to enjoy leisure activities (Farlex, 2012).

*Plyometrics*: A type of training for power development using the muscles and tendons' natural elasticity after a primary counter movement (Baechle & Earle, 2008).

*Speed:* It is a physical fitness component that is described as the ability of an individual to perform movement over a short duration of time (Pandey & Sadar, 2015).

*Vertical Jump:* It is a measure of how high an individual or athlete can elevate off the ground (jump) from a standstill. (McClenton, Brown, Coburn, & Kersey, 2008)

# CHAPTER II

# METHODS

This chapter presents and discusses the method and techniques that are utilized in providing significant findings relevant in examining which method of agility, leg power, and speed training is the most efficient in producing a changed and increased agility, leg power, and speed performance.

## Research Design

A quasi-experimental pretest-posttest design was employed in this study, consisting of two groups with 24 members of combined male and female basketball and volleyball athletes. Each group had undergone pre-test in determining their agility, leg power and speed for matching purposes. Illinois Agility Run Test was the tool for gathering data in agility, 20 Meter Dash for gathering data in speed, and the Vertec device was used for leg power. After the pretest, a plyometrics training program with ankle weights was administered to the participants of experimental group for six (6) weeks as an intervention. Finally, a posttest was conducted for all the groups using the same procedure and instruments in gathering data applied in the pretest.

## Sampling and Participants

The participants of the study were the 48 male and female basketball and volleyball athletes of Pampanga High School in the S.Y. 2017-2018, with almost the same age, height and weight. Universal sampling technique was employed in this study. All of these athletes have experienced playing in the regional competition, specifically in Central Luzon Athletic Association Meet, and participated in regular trainings. Matching was also used to aid for balance in terms of participants' profile during the pretest phase. The control group did not wear ankle weights and continued their regular training. The experimental group wore 0.50 kg ankle weights on each foot and participated in the plyometrics training program. Ankle weights had only been worn during the plyometrics training program, and was removed after training time under the supervision of the researcher. Participants were not subjected to observe any type of specialized jump program. Aerobic conditioning was not taken into consideration because of its minimal effects on agility, speed, and leg power. Participants were encouraged however to keep up their normal aerobic activities. Sleeping patterns, cardiovascular exercise, and nutrition were not controlled as part of the research study; all participants were advised to continue their normal habits.

Table 1 shows the profile of the participants in terms of gender. As shown in the table, there is an equal number of male (*N*=12) and female (*N*=12) athletes distributed from basketball and volleyball events for the experimental and control group.

**Table 1.**

*Frequency and percentage distribution of student-athlete participants for both control and experimental groups by gender and by sports*

| Group | Sport | Male *N* (%) | Female *N* (%) |
|---|---|---|---|
| **Control** | Basketball | 6 (25%) | 6 (25%) |
| | Volleyball | 6 (25%) | 6 (25%) |
| Sub-total | | **12 (50%)** | **12 (50%)** |
| **Experimental** | Basketball | 6 (25%) | 6 (25%) |
| | Volleyball | 6 (25%) | 6 (25%) |
| Sub-total | | **12 (50%)** | **12 (50%)** |
| **Total** | | **24 (100%)** | **24 (100%)** |

Results of independent *t*-test between the experimental and control groups in terms of age, height, weight, academic year level, and number of playing years at 0.05 level of significance were presented in Table 2.

**Table 2.**

*Results of Independent t-test between the experimental and control groups in terms of age, height, weight, academic year level and number of playing years.*

| Criteria | Group | *M* | $M_G$ | *SD* | *t* | Confidence Interval | | *Df* | *p-value* | Interpretation |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Lower | Upper | | | |
| Age | Control | 14.21 | .000 | 1.22 | .000 | -.706 | .706 | 46.00 | 1.00 | No Significant Difference |
| | Experimental | 14.21 | | 1.22 | | | | | | |
| Height (m) | Control | 1.658 | .000 | .057 | .000 | -.036 | .036 | 44.91 | 1.00 | No Significant Difference |
| | Experimental | 1.658 | | .066 | | | | | | |
| Weight (kg) | Control | 60.29 | .625 | 6.97 | .276 | -3.94 | 5.19 | 44.07 | .784 | No Significant Difference |
| | Experimental | 60.92 | | 8.62 | | | | | | |
| Academic Year Level | Control | 9.17 | .000 | 1.17 | .000 | -.678 | .678 | 46.00 | 1.00 | No Significant Difference |
| | Experimental | 9.17 | | 1.17 | | | | | | |
| No. of Playing Years | Control | 3.25 | .042 | .847 | .164 | -.469 | .552 | 45.78 | .870 | No Significant Difference |
| | Experimental | 3.29 | | .908 | | | | | | |

The average age for both control and experimental groups is the same with the value of 14.21 (*SD*=1.22). In addition, the average height for control group was 1.658 meters (*SD*=0.057) which was the same for experimental group but with slightly different standard deviation (*SD*=0.066). Moreover, the average weight for control group was 60.29 kilograms (*SD*=6.97) while the mean score for experimental group was 60.92 kilograms (*SD*=8.62). Furthermore, both control and experimental groups had an average academic year of 9.17 (*SD*=1.17). Lastly, the average number of playing years for control group was 3.25 (*SD*=0.847) and for experimental group was 3.29 (*SD*=0.980).

Results of the independent *t*-test revealed that all criteria (age, height, weight, academic year level, and number of playing years) used in the matching process had *p*-value>0.05 and interpretation of "no significant difference." Also, all *t*-values were within the range of the lower and upper values of the confidence intervals which validated the prior results. Therefore, results on Table 2 showed that the participants of both groups were matched and there is no level of bias which can interfere with the later results.

## Research Equipment

Ankle Weights are devices for exercise made from cloth, nylon, and sand which are worn on each ankle to increase the weight of an individual, usually as part of resistance training (De Luca, 2007). Control group will not wear any weights and the experimental group will wear 0.50kg of ankle weights on each foot.

**Figure 2.** *Ankle Weights*

Vertec device was used to measure the participants' leg power through vertical jump. It has a series of multi-coloured veins with 0.02127 meters spacing which hinge on an adjustable telescoping pole that fit subjects to reach different heights. This device is widely used due to its accuracy and reliability in measuring vertical jump (Hutchison & Stone, 2009).

**Figure 3.** *Vertec Device*

**Plyometrics Training Device/Materials**

Plyometrics hurdles are obstacle made from metal, plastic or wood with different sizes which are used for plyometrics training and rehabilitation exercises. In the study, the participants utilized six hurdles, with varied height based on exercise loading or progression, in the hurdle jump and lateral hurdle hops.

**Figure 4.** *Plyometrics Hurdles*

Plyometrics box is a tool that adds another element of challenge or modification to a workout routine. It is made from wood or metal with different heights which is used for utilizing body weight. Drop jump in plyometrics training of this study used plyometrics box.

**Figure 5.** *Plyometrics Box*

**Research Instruments**

**Plyometrics Training Program**

It is an effective power training program that provides significant enhancement on sports performance. Most athletes underwent this form of training to the maximum peak of physical condition. An exercise under this training program enhances the elasticity and strength of muscles by improving the force and speed of the muscles' contraction. Plyometrics workouts generate powerful and fast movements that provide high endurance and power for a variety of sports activities.

Four plyometrics drills were included in the design of this study namely: hurdle jump; drop jump; lateral hurdle hops; and lunge jump. The drills were selected for the improvement of agility, speed and vertical jump.

**Evaluation Tool for the Validation of the Plyometrics Training Program**

The researcher created an evaluation tool for the validation of the plyometrics training program. It consisted of four to seven statements for each of the six major criteria assessing the designed plyometrics training program with ankle weights matrix guide (PTAWMG) using a 5-point scale level of acceptability. The PTAWMG's training design, training drills/activities, language, figures, layout, and overall presentation were the major criteria included in this tool. This was adapted and modified from papers of Pantig (2013) and Riofloridо (2018). Experts in the field of sports training and exercise evaluated the training program. This further checked if the plyometrics training program is fair, logical or reasonable.

**Interview Protocol**

Selected participants were interviewed about their experiences regarding the plyometrics training and wearing of ankle weights. This further probed the effectiveness of the plyometrics training program. The questions below were developed by the researcher and were evaluated and approved by the research adviser:

Question 1: *How do you describe your experience in the implementation of the plyometrics training program with ankle weights?*

Question 2: *Is there any effects of the training on your performance as an athlete?*

Question 3: *Will you recommend what you have experienced for your future training programs?*

**Research Procedure**

This present study observed three phases for its data preparation, gathering and analysis. The first phase focused on the development and evaluation of the plyometrics training program, while the second phase is the actual implementation of the plyometrics and traditional training program for experimental and control groups, respectively. It also includes conduct of the pretest and posttest of the skill-related physical fitness components and interview with selected participants. The final phase is the analysis of the numerical data and interview responses culled from the study.

**Phase 1 – Development and Evaluation of the Plyometrics Training Program:**

The researcher had designed and developed the plyometrics training program with ankle weights for male and female basketball and volleyball athletes. The plyometrics training program was evaluated and approved by the experts in the areas of sports, physical fitness and exercise using an evaluation tool adopted and modified by the researcher and approved for utilization by the research adviser. Basis for the experts' level of acceptability of the PTAWMG was presented on Table 3 (Pantig, 2013; and Riofloridо, 2018).

**Table 3.**

*Range and Interpretation of Level of Acceptability for PTAWMG's Validation*

| Range | Interpretation |
|---|---|
| 1.00 – 1.50 | Not Acceptable |
| 1.51 – 2.50 | Least Acceptable |
| 2.51 – 3.50 | Moderately Acceptable |
| 3.51 – 4.50 | Acceptable |
| 4.51 – 5.00 | Very Acceptable |

Results of the evaluation of the three expert evaluators' acceptability of the PTAWMG in terms of mean and standard deviation with their corresponding interpretation are presented in Table 4. The overall mean ratings of the three expert evaluators on PTAWMG is 3.344 (*SD*=0.656) with an interpretation of "moderately acceptable." This value suggested that the developed instrument is acceptable for the expert evaluators as an instrument to increase the agility, leg power, and speed of athletes. Moreover, the language and layout of the PTAWMG had "acceptable" ratings from the expert evaluators with mean ratings of 3.80 (*SD*=0.68) and 3.58 (*SD*=.67), respectively. On the other hand, the training design of the instrument had the least mean rating of 3.00 (*SD*=0.55), but it remains interpreted as "moderately acceptable."

**Table 4.**

*Summary of the Expert Evaluators' Level of Acceptability on PTAWMG*

| Criteria | *M* | *SD* | Interpretation |
|---|---|---|---|
| Training Design | 3.00 | 0.55 | Moderately Acceptable |
| Training Drills | 3.22 | 0.44 | Moderately Acceptable |
| Language | 3.80 | 0.68 | Acceptable |
| Figures | 3.47 | 0.74 | Moderately Acceptable |
| Layout | 3.58 | 0.67 | Acceptable |
| Overall Presentation | 3.27 | 0.70 | Moderately Acceptable |
| **Overall** | **3.34** | **0.66** | **Moderately Acceptable** |

Table 5 presented the range and interpretation for Fleiss Kappa values (FKV). The study used the Fleiss Kappa to determine the inter-rater agreements on the PTAWMG's evaluation done by the three expert evaluators (Rioflorido, 2018).

**Table 5.**

*Range and Interpretation of FKV for Inter-rater Agreement*

| Range | Interpretation |
|---|---|
| 0.81 – 1.00 | Almost Perfect Agreement |
| 0.61 – 0.80 | Substantial Agreement |
| 0.41 – 0.60 | Moderate Agreement |
| 0.21 – 0.40 | Fair Agreement |
| 0.01 – 0.20 | Slight Agreement |
| < 0 | Poor Agreement |

Table 6 shows the results of the inter-rater agreements on the overall and on the different criteria of the evaluation tool. The overall FKV on the PTAWMG's evaluation of the expert evaluators pertains to .421 with an interpretation of "moderate agreement." This value implied that the evaluations of the experts for the validation of the PTAWMG remain consistent with another. It verified the results on the instrument's level of acceptability.

**Table 6.**

*Expert Evaluators' Inter-rater Agreements on PTAWMG*

| Criteria | FKV | Interpretation |
|---|---|---|
| Training Design | .524 | Moderate Agreement |
| Training Drills | .667 | Substantial Agreement |
| Language | .333 | Fair Agreement |
| Figures | .333 | Fair Agreement |
| Layout | .333 | Fair Agreement |
| Overall Presentation | .333 | Fair Agreement |
| **Overall** | **.421** | **Moderate Agreement** |

**Phase 2: Implementation of the Evaluated and Approved Plyometrics Training Program:**

**a. Pretest**

The participants were asked to meet with the researcher for two hours to conduct the individual pretesting. It was done a week before the orientation and initiation of training protocol. All participants were given instruction of refraining from any form of physical activities or exercise 48 hours prior to testing. Testing was conducted as follows:

**Agility: Illinois Agility Run Test**

The participant started by lying face down or prone with head beside the starting point. At the signal, the participant got up as quickly as possible and ran around the Illinois agility course without bumping into the cones. The timer will stop when the participant reaches the finish line and time to complete the course will be recorded and be considered as the participant's score.

**Speed: 20 Meter Dash**

The main goal of this test is to run in a single maximum sprint covering a total distance of 20 meters. The participants started on a stationary position where one foot was in front of the other and that front foot was on or behind the starting line. The participants were not allowed to do any rocking movements and that the starting position was held for two seconds before starting the test. In addition, the participants were given instructions on how to maximize speed, by keeping the body low and driving hard both arms and legs, and encouragement to continue running after passing the finish line. Recording the time started from the first movement of the participants from the starting line until the chest of the participant passes the finish line. Each participant was given two trials and the best time was recorded until the hundredth's decimal values.

**Leg Power (Vertical Jump): Vertec**

The participants were requested to perform the standing reach height test using the vertec device. After performing the initial standing reach height test, they were instructed to begin with a hip-width posture then execute the vertical jump with maximal counter-movement arm swing and strike the vertec's horizontal veins using their dominant hand. They were also instructed to execute two practice jumps for them to perform the technique properly. After the practice jumps, three attempts were given to each participant to reach the maximal vertical jump height with a minimum of two minutes interval for proper recovery. The highest vertical jump will be the score to be used for the data analysis.

Results of the independent t-test, comparing the pretest on the athletes' agility, leg power and speed of the experimental and control groups revealed p-values greater than .05 as presented in Table 7. The p-value for agility is 0.757, for leg powers is 0.611 and for speed is 0.587, which suggested that there are no significant differences between the two group's agility, leg power and speed prior to the implementation of plyometrics training with ankle weights to the experimental group. This information provided explanation that the two groups have equal level of physical fitness components before the implementation of the intervention and that the possible significant changes during the posttest may be attributed to the kind of training experienced by the athletes from the two groups involved in this study.

**Table 7.**

*Summary Result of Athletes' Pretest on Agility, Leg Power, and Speed*

| | | | | 95% Confidence Interval of the Difference | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Group** | **Skill** | ***M*** | ***SD*** | **Lower** | **Upper** | ***t*** | ***df*** | ***p-value*** | **Interpretation** |
| **Control** | Agility | 18.045 | 0.945 | -0.738 | 0.540 | -0.312 | 43.102 | 0.757 | No Significant Difference |
| **Experimental** | | 17.947 | 1.232 | | | | | | |
| **Control** | Leg Power | 56.583 | 4.432 | -2.239 | 3.912 | 0.512 | 41.845 | 0.611 | No Significant Difference |
| **Experimental** | | 57.375 | 6.142 | | | | | | |
| **Control** | Speed | 3.788 | 0.216 | -0.119 | 0.207 | 0.547 | 39.580 | 0.587 | No Significant Difference |
| **Experimental** | | 3.833 | 0.331 | | | | | | |

**b. Training Program**

After the pretest week, the experimental group performed the plyometrics training program and comparable group performed their regular court training exercises on a covered court twice a week (Monday and Thursday) for six weeks with two and three days or 48 and 72 hours recovery between training sessions. The plyometrics training program also included a 10-minute warm-up (jogging) and 10-minute cool-down (jogging) (Poomsalood, 2015). Control group did not wear ankle weights, while the experimental group wore ankle weights with 0.50 kg on each foot during the plyometrics training program, and it was removed after the training program.

**Plyometrics Drill 1: Hurdle Jump**

**Materials:** six hurdles.

**Starting position:** The participant stands in a mid-high squat position in front of the row of hurdles.

**Action:** The jump is with both feet, and over the first hurdle. During the landing, the participant takes off again quickly and jumps over the second hurdle, repeating the sequence for all the remaining hurdles.

**Figure 6.** *Hurdle Jump*

**Plyometrics Drill 2: Drop Jump**

**Materials:** a box

**Starting position:** The participant stands upright on the box, closer to its front edge.

**Action:** The participant dismounts from the box, moving forward, and using both feet at the same time. While landing, he uses both feet to take off moving upwards, as fast as possible, and jump at maximum reach.

**Figure 7.** *Drop Jump*

**Plyometrics Drill 3: Lateral Hurdle Hops**

**Materials:** hurdle 30 cm high.

**Starting position:** The participant stands sideways next to the hurdle with his feet shoulder-width apart.

**Action:** The participant hops sideways over the hurdle with both feet and during the landing quickly takes off again and hops to the opposite side of the hurdle, continuing to do so in an alternating fashion until the end of the exercise. Touching the floor surface on one side of the hurdle counts as one touch. The following instructions were given: 30 touches over a period of 30 seconds at the beginning of the training session, 60 touches over a period of 60 seconds during the middle of the training session and 90 touches over 90 seconds at the end of the training session.

**Figure 8.** *Lateral Hurdle Hops*

**Plyometrics Drill 4: Lunge Jump**

**Materials:** no materials are required

**Starting position:** The participant lunges forward, forming a 90-degree angle between the hip joint and the knee of the forward leg.

**Action:** Swinging the arms forward, the participant jumps off the ground high as possible, lands in the starting position, and immediately repeats the jump.

**Figure 9.** *Lunge Jump*

Table 8 shows the 6-week plyometrics training program with corresponding plyometrics drill components and number of sets and/or repetitions for each drill. The training was designed in increasing number of sets and/or repetitions to provide simple to rigorous training familiarity for the participants of this study.

The set of the specialized model for explosive leg strength in this study consisted of four plyometrics exercises, which were adapted and modified based on the training model of Stojanović, N. et al. (2012) in developing explosive leg strength of volleyball players through plyometrics training. Furthermore, the study of Davies et al. (2015) emphasized the use of the principles of progression and overload in conducting plyometrics training program. This can be achieved by setting and controlling the volume dosage of the included variables in terms of repetitions, sets, weights and the likes.

Volume is usually assessed by computing and/or counting the number of repetitions, sets, and loads for specific activity like the number of jumps, where a fifty to sixty-foot contacts (fc)/jumps is considered as low volume and a 200+ foot contacts/jumps is high volume during a training session. A volume of 80 jumps/fc or more gives a result of significant gain. There are studies also that discussed the duration of implementing plyometrics training program ranging from three to twelve weeks with weekly dosage of once a week and of four times a week at most.

The values of the maximum repetitions of all forms of exercises included in this study for explosive leg-strength training program served as basis for dosing of load in the whole duration of the proposed training. The principle of 70% loading for the first week, 80% for the second and the sixth week, 90% for the third and fifth week, and 100% for the fourth week was utilized in designing and implementing the plyometrics training program of this study.

On the first week of the plyometrics training program, athletes performed the following: 2-sets of hurdle-jump with 6 hurdles at 50 cm height; 2 sets of drop-jump with 10 repetitions per set at 60 cm height of plyometrics box; 2 sets of lateral hurdle hops for 30 seconds at 30 cm hurdle height; and 2 sets lunge jump with 9 repetitions per set. This training week has 110-foot contacts per session (fc/s).

On the second week of the plyometrics training program, athletes performed 3 sets of hurdle-jump with 6 hurdles at 50 cm height; 3 sets of drop-jump with 10 repetitions per set at 70 cm height of plyometrics box; 3 sets of lateral hurdle hops for 60 seconds at 30 cm hurdle height; and 3 sets lunge jump with 10 repetitions per set. This training week has 258-fc/s.

On the third week of the plyometrics training program, athletes performed 3 sets of hurdle-jump with 6 hurdles at 60 cm height; 3 sets of drop-jump with 10 repetitions per set at 80 cm height of plyometrics box; 3 sets of lateral hurdle hops for 90 seconds at 30 cm hurdle height; and 3 sets lunge jump with 11 repetitions per set. This training week has 351-fc/s.

On the fourth week of the plyometrics training program, athletes performed the following: 4 sets of hurdle-jump with 6 hurdles at 60 cm height; 3 sets of drop-jump with 10 repetitions per set at 90 cm height of plyometrics box; 3 sets of lateral hurdle hops for 90 seconds at 30 cm hurdle height; and 3 sets lunge jump with 13 repetitions per set. This training week has 363-fc/s.

On the fifth week of the plyometrics training program, athletes performed 4 sets of hurdle-jump with 6 hurdles at 60 cm height; 3 sets of drop-jump with 10 repetitions per set at 80 cm height of plyometrics box; 3 sets of lateral hurdle hops for 60 seconds at 30 cm hurdle height; and 3 sets lunge jump with 12 repetitions per set. This training week has 270-fc/s.

On the sixth week of the plyometrics training program, athletes performed the following: 3 sets of hurdle-jump with 6 hurdles at 50 cm height; 3 sets of drop-jump with 10 repetitions per set at 70 cm height of plyometrics box; 3 sets of lateral hurdle hops for 30 seconds at 30 cm hurdle height; and 3 sets lunge jump with 10 repetitions per set. This training week has 168-fc/s.

**Table 8.**

*Plyometrics Training Program for Experimental Group*

| ***Training Week*** | ***No. of Sessions Per Week*** | ***Training Volume (Foot Contacts)*** | ***Plyometrics Drill with Ankle Weights*** | ***Sets/Repetitions*** |
|---|---|---|---|---|
| 1 | 2 | 110 | Hurdle Jump | 2 sets, 6 hurdles, hurdle height 50 cm |
| | | | Drop Jump | 2 sets, 10 repetitions; box height 60 cm |
| | | | Lateral Hurdle Hops | 2 sets, 30 sec; hurdle height 30cm |
| | | | Lunge Jump | 2 sets, 9 repetitions |
| 2 | 2 | 258 | Hurdle Jump | 3 sets, 6 hurdles, hurdle height 50 cm |
| | | | Drop Jump | 3 sets, 10 repetitions; box height 70 cm |
| | | | Lateral Hurdle Hops | 3 sets, 60 sec; hurdle height 30cm |
| | | | Lunge Jump | 3 sets, 10 repetitions |
| 3 | 2 | 351 | Hurdle Jump | 3 sets, 6 hurdles, hurdle heights 60 cm |
| | | | Drop Jump | 3 sets, 10 repetitions; box height 80 cm |
| | | | Lateral Hurdle Hops | 3 sets, 90 sec; hurdle height 30cm |
| | | | Lunge Jump | 3 sets, 11 repetitions |
| 4 | 2 | 363 | Hurdle Jump | 4 sets, 6 hurdles, hurdle height 60 cm |
| | | | Drop Jump | 3 sets, 10 repetitions; box height 90 cm |
| | | | Lateral Hurdle Hops | 3 sets, 90 sec; hurdle height 30cm |
| | | | Lunge Jump | 3 sets, 13 repetitions |
| 5 | 2 | 270 | Hurdle Jump | 4 sets, 6 hurdles, hurdle heights 60 cm |
| | | | Drop Jump | 3 sets, 10 repetitions; box height 80 cm |
| | | | Lateral Hurdle Hops | 3 sets, 60 sec; hurdle height 30cm |
| | | | Lunge Jump | 3 sets, 12 repetitions |
| 6 | 2 | 168 | Hurdle Jump | 3 sets, 6 hurdles, hurdle height 50 cm |
| | | | Drop Jump | 3 sets, 10 repetitions; box height 70 cm |
| | | | Lateral Hurdle Hops | 3 sets, 30 sec; hurdle height 30cm |
| | | | Lunge Jump | 3 sets, 10 repetitions |

Table 9 presents the regular training program executed by control group without ankle weights. It is a six-week training program with two sessions per week, Monday and Thursday, with a resting period of 48 and 78 hours or two and three days between sessions. Specificity, progression, and overload principles in exercise were also considered in this training program. Squats, calf raises, side leg raises, and side to side lunges are the drills that were included in this training program for the enhancement of the skill-related physical fitness components; agility, speed, and leg power.

**Table 9.**

*Regular Training Program for Control Group*

| ***Training Week*** | ***No. of Sessions Per Week*** | ***Training Drills without Ankle Weights*** | ***Sets/Repetitions*** |
|---|---|---|---|
| 1 | 2 | Squats | 3 sets, 40 repetitions |
| | | Calf Raises | 3 sets, 20 repetitions |
| | | Side Leg Raises | 3 sets, 20 repetitions |
| | | Side to Side Lunges | 3 sets, 20 repetitions |
| 2 | 2 | Squats | 4 sets, 40 repetitions |
| | | Calf Raises | 4 sets, 20 repetitions |
| | | Side Leg Raises | 4 sets, 20 repetitions |
| | | Side to Side Lunges | 4 sets, 20 repetitions |
| 3 | 2 | Squats | 5 sets, 40 repetitions |
| | | Calf Raises | 5 sets, 20 repetitions |
| | | Side Leg Raises | 5 sets, 20 repetitions |
| | | Side to Side Lunges | 5 sets, 20 repetitions |
| 4 | 2 | Squats | 5 sets, 40 repetitions |
| | | Calf Raises | 5 sets, 20 repetitions |
| | | Side Leg Raises | 5 sets, 20 repetitions |
| | | Side to Side Lunges | 5 sets, 20 repetitions |
| 5 | 2 | Squats | 4 sets, 40 repetitions |
| | | Calf Raises | 4 sets, 20 repetitions |
| | | Side Leg Raises | 4 sets, 20 repetitions |
| | | Side to Side Lunges | 4 sets, 20 repetitions |
| 6 | 2 | Squats | 3 sets, 40 repetitions |
| | | Calf Raises | 3 sets, 20 repetitions |
| | | Side Leg Raises | 3 sets, 20 repetitions |
| | | Side to Side Lunges | 3 sets, 20 repetitions |

More specifically, on the first and sixth week of training, 80% of loading was used. Furthermore, 90% of loading was utilized on the second and fifth week, and 100% for the third and fourth week as reflected on the number of sets and repetitions. These sets of training drills were the conventional activities observed by the researcher in training both groups of athletes on previous school year. (See drill illustrations on Appendix G)

**c. Posttest**

Posttesting procedure and instrument is similar to pre-test, wherein Illinois agility run test was also used to measure participants' agility, 20-meter sprint measured speed, and vertec measured leg power. It was administered 48 hours after the six weeks of plyometrics training program.

An informal random interview was also conducted after the administration of the post-test to further investigate the participants' significant experiences in the conduct of this study as to further substantiate the results of the pretest and posttest.

**Phase 3 – Data Analysis:**

The researcher used mean and standard deviation to represent the profile of participants from the two groups in terms of agility, leg power and speed during the pretest and posttest. In addition, paired t-test was utilized to determine significant differences on the pre-test and post-test of the skill-related fitness components of the two groups, while the independent t-test was employed to identify significant differences between the two groups' posttests of the skill-related components included in this study. On the other hand, responses of the participants in the interview were analysed to probe thematic items that will reveal the significance effect of the use of ankle weights and the implementation of the developed plyometrics training program to the participants' experiences and physical fitness components – agility, speed and leg power. Figure 10 shows the summary of the research procedure observed in this study.

**Phase 1:**

- *Development and Evaluation of Plyometrics Training Program with Ankle Weights*
- *Communication with the school principal, parents of the participants and the participant-athletes*
- *Analysis of the athletes' matching profile*

↓

**Phase 2:**

- *Conduct of pretest on agility, leg power, and speed*
- *Implementation of the Plyometrics Training Program with Ankle Weights*
- *Conduct of posttest on agility, leg power, and speed*
- *Informal interview with selected participant-athletes*

↓

**Phase 3:**

- *Data analysis on the participant-athletes' pretest and posttest results*

**Figure 10.** *Research Procedure*

### Statistical Tools

The following statistical tools were utilized to properly represent and interpret the pertinent data and to answer the research questions of this study:

**Mean.** It was utilized in this study to represent the average agility, speed, and leg power of the participants during the pretest and posttest segment of the implementation of the training program. It also represented the average ratings of the experts in the evaluation of the developed plyometrics training program.

**Standard Deviation.** It was used to determine and describe if participants are homogeneous or heterogeneous in terms of their skills as a group. Likewise, it also represented the variation of the ratings of the experts in the evaluation of the developed plyometrics training design and activities.

**Paired *t*-test.** It was utilized to determine if there are significant differences in terms of agility, speed and leg power between the pretest and posttest of both control and experimental groups.

**Independent *t*-test.** It was employed to identify if there are significant differences between control and experimental groups post-tests' agility, leg power, and speed.

**Fleiss Kappa.** It was used to figure out the consistency of the expert evaluators' ratings in the validation of the plyometrics training program.

**Cohen's *d*.** It was utilized to determine the effect size of the difference between control and experimental groups' post-test on agility, leg power, and speed.

## Ethical Considerations and Limitations

The participants of this study were minor students who are considered vulnerable subjects which means they should be protected from the risks of research. The researcher monitored the wearing and removing of ankle weights of each participant for their safety, since he was the coach of the participant athletes.

The researcher informed the participants together with their parents during the orientation program about the nature, purpose, gains and potential risks of this study. Assent and consent forms were also distributed by the researcher to the participants and parents prior to the implementation of the study. Likewise, the study was non-graded, which means it did not in any way affect the computation of performance and academic grades of participants.

In addition, the information and results of the study were treated only for sole purpose of this research undertaking, but will be shared with the participants and coaches to provide feedback about their skill-related fitness components and other related concerns. The plyometrics training program of this study were evaluated and approved by experts in the areas of sports, exercise and physical fitness.

# CHAPTER III

## Results and Discussions

This chapter presents, analyzes, and interprets the data gathered to answer the specific research problems of the study. More particularly, this section shows the results and discussions of the following: the profile of the basketball and volleyball athletes during pretest and posttest in terms of agility, speed, and leg power; the significant difference on the agility, speed, and leg power of basketball and volleyball athletes before and after the implementation of the plyometrics training with ankle weights; and the significant difference on the agility, speed, and leg power among basketball and volleyball athletes after the implementation of the regular routinary training program.

### Athletes' Pretest and Posttest Mean Scores

Displayed in Table 10 were the pretest and posttest mean scores and standard deviation that served as profile of the basketball and volleyball athletes in terms of agility, leg power and speed. Participants in the control group had mean scores on pretest for agility, leg power and speed with values of 18.045 seconds (*SD*=0.945), 56.583 centimeters (*SD*=4.432), and 3.788 seconds (*SD*=0.216), respectively. In addition, participants in the experimental group had the mean scores of 17.947 seconds (*SD*=1.232), 57.375 centimeters (*SD*=6.142) and 3.833 seconds (*SD*=0.331) for agility, leg power and speed, respectively. Conversely, the posttest mean scores of the participants in the control group were 17.122 seconds (*SD*=1.067) for agility, 59.708 centimeters (*SD*=4.477) for leg power, and 3.466 seconds (*SD*=0.245) for speed. Moreover, in the experimental group, the participants' posttest mean scores for agility was 16.090 seconds

(*SD*=1.332), for leg power was 66.125 centimeters (*SD*=7.213), and for speed was 3.208 seconds (*SD*=0.352).

**Table 10.**

*Pretest and Posttest Mean Scores of Athletes' Agility, Leg Power and Speed*

| Groups | Agility | | | Leg Power (Vertical Jump) | | | Speed | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Pretest** | **Posttest** | | **Pretest** | **Posttest** | | **Pretest** | **Posttest** | |
| | ***M (SD)*** | ***M (SD)*** | $M_G$ | ***M (SD)*** | ***M (SD)*** | $M_G$ | ***M (SD)*** | ***M (SD)*** | $M_G$ |
| **Control Group** | 18.045* (0.945) | 17.122* (1.067) | -0.923* 5.11% | 56.583** (4.432) | 59.708** (4.477) | 3.125** 5.52% | 3.788* (0.216) | 3.466* (0.245) | -0.322* 8.50% |
| **Experimental Group** | 17.947* (1.232) | 16.090* (1.332) | -1.857* 10.35% | 57.375** (6.142) | 66.125** (7.213) | 8.750** 15.25% | 3.833* (0.331) | 3.208* (0.352) | -0.624* 16.28% |

Legend: * - seconds
** - centimeters

After the training program was implemented, gain scores were achieved. The researcher found out that the control group had a mean gain score of -0.923 seconds and the experimental group had -1.857 seconds mean gain for agility which is 5.11% and 10.35% increase, respectively. The negative gain scores conveyed that both groups finished the agility test on the posttest faster than the pre-test. This suggested that both groups enhanced their agility during the training program. The mean gain scores of 3.125 centimeters of the control group and 8.750 centimeters of the experimental group for leg power during the vertical jump test, through a vertec device, implied that both groups increased their leg power and had a percentage gain of 5.52% and 15.25%, respectively. Lastly, both control and experimental groups had boosted speed during the posttest in comparison with their pretest scores during the 20-meter dash as shown on the mean gain of -0.332 seconds and -0.624 seconds for control and experimental group, respectively. The speed of control group increased by 8.50% while the experimental group's speed increased by 16.28%.

### Significant Difference between Athletes' Pretest and Posttest Mean Scores

Table 11 presents the summary results of the paired sample test between the pretest and posttest mean scores of each group in terms of agility, leg power, and speed at 0.05 level of significance.

**Table 11.**

*Summary Result of Paired Sample Test for Agility, Leg Power, and Speed*

| | | | | | 95% Confidence Interval of the Difference | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Group** | **Skill** | **Test** | ***M*** | ***SD*** | **Lower** | **Upper** | ***T*** | ***df*** | ***p*-value** | **Interpretation** |
| **Control** | **Agility** | Pretest<br>Posttest | -0.923 | 0.405 | 0.752 | 1.094 | 11.170 | 23 | 0.000 | Significant Difference |
| **Control** | **Leg Power** | Pretest<br>Posttest | 3.125 | 1.035 | -3.562 | -2.688 | -14.796 | 23 | 0.000 | Significant Difference |
| **Control** | **Speed** | Pretest<br>Posttest | -0.322 | 0.128 | 0.268 | 0.376 | 12.321 | 23 | 0.000 | Significant Difference |
| **Experimental** | **Agility** | Pretest<br>Posttest | -1.857 | 0.505 | 1.643 | 2.070 | 18.004 | 23 | 0.000 | Significant Difference |
| **Experimental** | **Leg Power** | Pretest<br>Posttest | 8.750 | 2.454 | -9.786 | -7.714 | -17.468 | 23 | 0.000 | Significant Difference |
| **Experimental** | **Speed** | Pretest<br>Posttest | -0.624 | 0.127 | 0.571 | 0.678 | 24.142 | 23 | 0.000 | Significant Difference |

Results of the paired sample test on agility of athletes in the control group revealed a *p*-value<0.000 which suggested significant difference in terms of agility between the posttest and pretest mean scores after observing the regular routinary training. This result was further verified by the *t*-value compared with the lower and upper values of the confidence interval. The values of the lower and upper confidence interval were 0.752 and 1.094 while the *t*-value was 11.170. Moreover, the athletes' paired sample test on leg power shows a *p*-value<0.000 which indicated the significant difference in terms of leg power between their pretest and posttest mean scores. The *t*-value was -14.796 and was not included in the range of the confidence interval with upper and lower values of 2.688 and 3.562, respectively, that confirmed the said result and interpretation on leg power. Furthermore, Table 11 also exhibited the significant difference between the pretest and posttest mean scores on speed of athletes in the control group because the computed *p*–value is < 0.000 and the *t*-value of -12.321 is beyond the lower value -0.268 and upper value -0.376.

Additionally, athletes' from the experimental group got 0.000 *p*-value on paired sample test for agility which was interpreted as a substantial difference between the pretest and posttest mean scores. Moreover, this difference was counter-validated by the *t*-value of -18.004 which is out of range from the lower value of -1.643 and upper value of -2.070 of the confidence intervals. Further, the result of the paired sample test for leg power in the experimental group showed a *p*-value of 0.000 which signified difference between their pretest and posttest mean scores on leg power after the plyometrics with ankle weights training. This result was further substantiated by the *t*-value compared with the lower and upper values of the confidence interval. The values of the lower and upper confidence interval were 7.714 and 9.786 while the *t*-value is 17.468. Lastly, the experimental group's result of paired sample test for speed presented a *p*-

value<0.000 which indicated that the mean score difference on speed between the pretest and posttest was significant. This result was further justified by the *t*-value -12.321 which was outside the lower value -0.571 and upper value -0.678 of confidence intervals.

The results of the paired sample test suggested that both training programs used for the control and experimental groups provided substantial difference on the mean scores in terms of the athletes' agility, leg power and speed between the pretest and posttest as revealed by the *p*-values which are all less than 0.05. Furthermore, this explained that both training programs given to the two groups of athletes provided significant enhancement on their agility as measured by the Illinois agility test, leg power as measured by the vertec device for vertical jump, and speed as measured by the 20-meter dash. In addition, the findings of this study were found similar with the studies conducted on the effect of different strength training programs on young athletes' sprint performance by Dasteridis et al. (2011). Moreover, Slimani, M. et al. (2016) also discussed that the 4 to 16 weeks with 2 to 3 sessions per week helped in improving the jump height, agility and sprint performances among children and young adults engaged in team sports.

The following are excerpts from the interview conducted by the researcher with selected athletes in experimental group sharing their experiences that substantiated the results presented:

Athlete 1: *"The training program is difficult and tiring at first, but I eventually enjoyed it because I feel that my speed and jump is improving when I play volleyball."*

Athlete 2: *"As the weeks pass by, the training becomes harder and harder and I think I become better and better as an athlete. It is easier for me to move and play specially after removing the ankle weights."*

Athlete 5: *"I became happy when coach told us to do plyometrics training because it is a new experience for us. We want to win the city meet so I will do whatever I* *need to do to improve. And the training program is worth it, my agility, speed, and vertical jump increased during the last testing (Posttest)."*

### Significant Difference between the Two Groups' Posttest Mean Scores

Table 12 revealed the summary results of the two groups of athletes' posttest on agility, leg power, and speed. Independent *t*-test with 0.05 level of significance was used to determine if difference on the posttest scores between the athletes in the control and experimental groups in terms of agility, leg power and speed were statistically significant.

**Table 12.**

*Summary Result of the Two Groups of Athletes' Posttest on Agility, Leg Power, and Speed*

| | | | | 95% Confidence Interval of the Difference | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Group** | **Skill** | ***M*** | ***SD*** | **Lower** | **Upper** | ***T*** | ***df*** | ***p-value*** | **Interpretation** |
| **Control** | Agility | 17.122 | 1.067 | -1.734 | -0.330 | -2.963 | 43.898 | 0.005 | Significant Difference |
| **Experimental** | | 16.090 | 1.332 | | | | | | |
| **Control** | Leg Power | 59.708 | 4.477 | 2.910 | 9.923 | 3.703 | 38.430 | 0.001 | Significant Difference |
| **Experimental** | | 66.125 | 7.213 | | | | | | |
| **Control** | Speed | 3.466 | 0.245 | -0.435 | -0.081 | -2.949 | 41.019 | 0.005 | Significant Difference |
| **Experimental** | | 3.208 | 0.352 | | | | | | |

Athletes' posttest results on agility from both control and experimental groups had a *p*-value of 0.005 which suggested that the difference in the posttest mean scores in terms of agility between the control and experimental groups were significant. This result was further verified by the *t*-value -2.963 compared with the lower value -1.734 and upper value -0.330 of the confidence intervals.

The *t*-value 3.703 between the control and experimental groups' posttest mean scores on leg power was within the range of the lower value 2.910 and upper value 9.923 of the confidence interval. However, the *p*-value is 0.001 which was still under the 0.05 level of significance. Therefore, there was a significant difference between the posttest mean scores of control and experimental groups on leg power.

Furthermore, control and experimental groups' independent *t*-test result on speed between the posttest mean scores of the two groups showed a *p*-value of 0.005, which indicated that there was a substantial difference on speed between their posttest scores. The *t*-value of -2.949 is not within the range of the confidence interval of -0.435 and -0.081, lower and upper values respectively, which confirmed the result and interpretation on speed.

Lastly, the result on Table 12 shows leg muscles work harder when subjected with ankle weights therefore causing much more muscle development which results to greater enhancement in agility, leg power, and speed as explained by Dr. Anthony Luke in the article of De Luca (2007). The combination of resistance and plyometrics training programs yielded significant effects in the improvement on skill-related physical fitness components. Similar findings were also revealed in the study of Jothi, Vinu, and Eleckuvan (2010) about the effects of resistance and plyometrics programs in enhancing selected bio-motor abilities.

Table 13 presented the range and effect size interpretation for Cohen's *d* and power (*P*) while Table 14 showed the results of effect size and power of the significant difference between the two groups of athletes' posttest on agility, leg power, and speed.

**Table 13.**

*Cohen's d Rule of Thumb Interpretation*

| Effect size | *d* | References |
|---|---|---|
| Small | 0.20 – 0.49 | Cohen, 1988 |
| Medium | 0.50 – 0.79 | Cohen, 1988 |
| Large | 0.80 > | Cohen, 1988 |

The value of *d* for the effect size of athletes' posttest on agility is 0.855 and for the power (*P*) was 0.827 with an interpretation of "large effect size." Moreover, the *d*-value of athletes' posttest on leg power was 1.069 with 0.952 value for *P* which was also interpreted as "large effect size." In addition, the *d*-value and *P*-value of athletes' posttest on speed was 0.851 and 0.823, respectively.

**Table 14.**

*Effect Size and Power of the Significant Difference between the Two Groups of Athletes' Posttest on Agility, Leg Power, and Speed*

| Group | Skill | *M* | $M_D$ | *SD* | $SD_{Pooled}$ | *d* | *P* | Interpretation |
|---|---|---|---|---|---|---|---|---|
| **Control** | Agility | 17.122 | 1.032 | 1.067 | 1.206 | 0.855 | 0.827 | Large Effect Size |
| **Experimental** | | 16.090 | | 1.332 | | | | |
| **Control** | Leg Power | 59.708 | 6.417 | 4.477 | 6.003 | 1.069 | 0.952 | Large Effect Size |
| **Experimental** | | 66.125 | | 7.213 | | | | |
| **Control** | Speed | 3.466 | 0.258 | 0.245 | 0.303 | 0.851 | 0.823 | Large Effect Size |
| **Experimental** | | 3.208 | | 0.352 | | | | |

In addition, all the *d* values were greater than 0.8 which suggested that the effect size is large. Hence, plyometrics training with ankle weights had a greater effect in terms of enhancing the agility, leg power, and speed of athletes rather than regular routinary training. All *P* values were all greater than 0.8 which suggested that the difference between the posttest scores of the two groups in terms of agility, leg power, and speed were not only statistically different but also practically different.

Listed below were some of the responses of the selected participants describing their experiences under the plyometrics training with ankle weights and how it differs from their previous regular routinary training:

Athlete 1: *"Based on the experiences I had on my previous regular training compared with this training (plyometrics training with ankle weights) my muscles became bigger/more developed. I like the plyometrics training more than our usual training."*

Athlete 3: *"The plyometrics training is good unlike our old training, because I feel that I can move better when playing basketball. I feel that I became more faster in defending my opponents. If possible, I will continue the plyometrics training with much heavier ankle weights because it feels good."*

Athlete 4: *"Yes! I will continue and recommend this plyometrics training with ankle weights to my friends and teammates because I enjoyed it, even if it is difficult to do at first but eventually you will become used to it, and the results on improving my skills because of this program is very evident."*

**Implications of the Study**

Results of this study revealed that plyometrics training with ankle weights provided significant gains for the athletes' skills-related physical fitness components such as agility, leg power and speed. It provided significant empirical data that may serve as baseline for future research endeavours related to this form of study. Furthermore, this study contributed significantly on the need of developing research-based training programs to enhance skills-related physical fitness components for athletes covering pre- to post-competition seasons. Sports coaches and trainers may anchor their future training programs on the procedure presented in this study as to provide evidences on the significant gains of using plyometrics training in enhancing lower extremities of volleyball and basketball players. As a consequence, it is necessary to adopt and implement this proposed training program using plyometrics and ankle weights in the annual periodization plan for athletes. More particularly, this training has to be incorporated in the pre-competition period as to provide positive enhancement of physical fitness components needed by athletes in preparation for the actual competition. In addition, the implementation of this training also entails budgetary concern to be considered by the school management in relation to the sets of equipment and materials needed under the athletic development program. Lastly, future undertakings may be ventured as to verify the veracity of these results in improving the upper extremities of the said group of athletes and other skills and health-related concerns.

Results of this study also implied some concerns in relation to the attainment of the learning competencies set in the K-12 Physical Education Curriculum. Specifically, this study anchors on the physical fitness and sports strands of the curriculum. Results may serve as basis on how to improve empirically the physical fitness components using validated training programs of learners from Grades 7 to 10. This may also provide enhancement of awareness and actual experiences on the utilization of these kinds of training programs and sets of equipment both for student-athletes and regular students depending on their level of physical fitness. In addition, this study may serve as an example in developing athletic training program as an output requirement for pre-service Physical Education teachers in the sports science and coaching, and in the administration and management of physical education program courses.

Moreover, this study suggests evidence on the beneficial use of ankle weights in improving athletes' skills and performance. This study was driven by the dearth of local literature on the significant effect of ankle weights on athletes' skills and performance. Thus, the results serve as a proof on its influence and may serve as baseline for future research undertakings related on its use. Conversely, this study implies the need of holistic training program, utilizing available materials and equipment that are anchored on previous research studies, with the hope of improving the athletes' performance both in the training season and actual competition. The lens provided by the experts in the validation process of the training matrix gave substantial inputs for its improvement and proper observation during the actual implementation. These inputs as incorporated in the implementation provided proper guidance and clear directions both for the researcher, who served as conditioning coach, and for the student-athletes. Lastly, the study may be utilized by education specialists and sports coordinators as basis in converging and implementing other related training models or programs that are contextualized on the nature of their sports-event and locality, which may further contribute to the growing recognition of contextualization and evidence-based programs in the field of sports training and education.

## CHAPTER IV

## Summary, Conclusions and Recommendations

### Summary of the Study

This study primarily aimed to determine the effects of plyometrics training with ankle weights on agility, leg power, and speed of basketball and volleyball athletes. This study used a quasi-experimental pre-test and post-test design to determine the effectiveness of the plyometrics training program with ankle weights in enhancing the said skill-related physical fitness components.

The plyometrics training program was designed by the researcher and validated by three expert evaluators in the field of physical fitness. The training program was administered for six weeks together with ankle weights which were only worn during the training program. Furthermore, the researcher conducted an informal interview with selected participants using a set of guide questions as to probe information that would support the result of the training program regarding its effectiveness.

Forty-eight junior high school basketball and volleyball athletes were the participants of the study. The participants of the study were divided into two matched groups and categorized as experimental group and control group. Matching with participants' age, height, weight, academic year level, and number of playing years was used in choosing the members of each group to prevent bias which can affect the result of the study.

Mean was used to present the profile of the athletes of both groups in terms of agility, leg power and speed before and after the implementation of the plyometrics training with ankle weights. Moreover, paired t-test was utilized to determine if there are differences significantly on the agility, leg power, and speed of athletes in both groups before and after the implementation of the plyometrics training program with ankle weights. Lastly, independent t-test was employed to determine if post-test mean scores in terms of agility, leg power, and speed between the two groups are significantly different.

## Summary of Findings

A quasi-experimental pretest-posttest design was used to examine the effects of the plyometrics training program with ankle weights on athletes' agility, leg power (vertical jump), and speed**.** Illinois agility test was used during pretest and posttest to measure athlete's agility while a vertec device was used to measure leg power through performing vertical jump, and 20-meter dash was used for measuring speed.

After thorough analysis and interpretation of the data gathered, the researcher found out that the designed and evaluated Plyometrics Training with Ankle Weights Matrix Guide (PTAWMG) was "moderately acceptable" and the inter-rater agreements by the expert validators showed using Fleiss Kappa with an interpretation of "moderate agreement."

Both the regular routinary and plyometrics training programs provided significant enhancements on athletes' agility, leg power, and speed as revealed by the significant results of the paired t test between the pretest and posttest mean scores of the control and experimental groups. Moreover, the six-week training programs significantly increased athlete's skill-related physical fitness components as presented on the profile of the athletes during the pretest and posttest.

Between the regular routinary training and the plyometrics training with ankle weights, the plyometrics training program with ankle weights yielded the most significant enhancement on athletes' agility, leg power, and speed as shown on the significant findings of the independent t-test revealing difference of the posttest mean scores between the two groups. Lastly, the result of the Cohen's *d* suggests a large effect size on the significant difference on the posttest mean scores between the two groups in terms of agility, leg power, and speed.

**Limitations of the Study**

Plyometrics training with ankle weights was included as an intervention to determine if it would significantly increase the agility, leg power and speed of male and female basketball and volleyball athletes compared with regular routinary training alone. The first group of participants did not wear ankle weights while the second group wore 0.50 kg ankle weights on each foot. The participants only wore ankle weights during the training program. These ankle weight were removed before and after the training time.

The study involved male and female high school basketball and volleyball athletes with 13 to 16 years old age range because there is little to no research which suggests the use of ankle weights among teenage athletes.

Plyometrics training was utilized as a training program for the participants of the study for six (6) weeks with 48 hours recovery between training sessions. Drills included in the plyometrics training design catered specificity, loading, and progression, from low to moderate and to high intensity training.

**Conclusions**

The result of this study revealed the significant importance of plyometrics with ankle weights in enhancing agility, leg power and speed. A six-week training program can increase skill-related physical fitness components as long as frequency, intensity, type, and time (FITT) principle is applied on designing a training program. Recovery time after a training session is also very important in the development of the body, specifically the muscles, and prevention of fatigue or injury. Plyometrics training with ankle weights can increase physical fitness and can be beneficial on any sport. Hurdle jump, drop jump, lateral hurdle hops, and lunge jump are effective to increase agility, leg power and speed of both basketball and volleyball athletes.

## Recommendations

From the findings and conclusions culled from this study, the following items serve as recommendations for its improvement and are hereby forwarded. P.E teachers, coaches, and fitness instructors should design, develop, and validate more training programs for the improvement of athletes' skills. The plyometrics training program with ankle weights should be taken into consideration when designing an annual periodized training plan for athletes because of its effectiveness in enhancing skill-related physical fitness components. Information on the proper use of ankle weights should be disseminated to coaches, athletes and other students to maximize its effectiveness and reduce injuries. This study can be used as baseline information for further research undertakings of similar focus or related concerns. The instrument was validated only in terms of content and face validity through criteria-based validation procedure, where comments and suggestions of the experts were incorporated. However, this may also suggest that the instrument may be further improved for the next form of study and be subjected to other means of validity. It is recommended that a larger group of participants may be selected to further validate and generalize the results of this study. A weekly journal log for participants is also recommended to further substantiate the effects of the implemented training program.

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APPENDIX A
REQUEST LETTER TO THE PRINCIPAL

October 13, 2017

**FE ROSALINDA R. CAYLAO**
Principal IV, Pampanga High School
City of San Fernando, Pampanga

Dear Ma'am,

In partial fulfilment of the requirements for the Degree of Masters of Arts in Education with Specialization in Physical Education, I am presently undertaking a research study entitled "Effects Of Plyometric Training With Varied Ankle Weights On Skill-Related Physical Fitness". It aims to develop a good sports training program which will enhance the capabilities of the athletes to perform the skills most necessary to basketball and volleyball.

In connection with this, may I request through your good office to allow me to conduct a training program for six weeks with the school's basketball and volleyball athletes. Rest assured that safety of the athletes will be prioritized and that data will be used solely for the purpose of this study.

I am anticipating for your kind consideration and approval upon this request.

Thank you very much and God bless.

Respectfully yours,

**Earone Mhico S. Sigua**
Researcher

Noted:

**Brando C. Palomar**
Thesis Adviser

APPENDIX B

CONSENT LETTER TO PARENTS

October 13, 2017

Dear Parents,

Your child has been invited to join a research study to test his/her agility, speed, and leg power. Please take whatever time you need to discuss the study with your family and friends, or anyone else you wish to. The decision to let you child join, or not to join, is up to you. In this research study, I am investigating the effects of plyometrics training with varied ankle weights on agility, speed, and leg power. Your child will be asked to participate in a plyometrics training program with varied ankle weights. This will take him/her 90 minutes, twice a week for six weeks, after class hours.

It is reasonable to expect the following benefits from this research: injury prevention; decrease wasted effort due to training activity; increase in agility, speed and leg power; increase in total strenght; and elevate maximun power output. However, we can’t guarantee that your child will personally experience benefits from participating in this study. Others may benefit in the future from the information we find in this study.

This study may involve the risks of injuries to knee and ankle. And there may also be other risks that we cannot predict. But the training program is usually safe and effective if proper procedures are followed. The investigator may stop the study or take your child out of the study at any time he judge it is in your child’s best interest. He may also remove your child from the study for various other reasons. He can do this without your consent.
Your child’s name will not be used when data from this study are published. Every effort will be made to keep research records, and other personal information confidential.

Participation in this study is voluntary. Your child has the right not to participate at all or to leave the study at any time. Deciding not to participate or choosing to leave the study will not result in any penalty or loss of benefits to which your child is entitled, and it will not harm his/her relationship with the school.

Call the researcher at 09356077571 if you have questions about the study, any problems, if your child experiences any unexpected physical or psychological discomforts, any injuries, or think that something unusual or unexpected is happening.

Respectfully yours,

**Earone Mhico S. Sigua**
Researcher

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**Permission for a Child to Participate in Research**

As parent or legal guardian, I authorize ________________________________ (child's name) to become a participant in the research study described in this form.

_____________________________________________ __________________

Parent or Legal Guardian's Signature over printed name Date

APPENDIX C
ASSENT FORM TO PARTICIPANTS

October 13, 2017

Dear Participant,

I am doing a research study about the effects of plyometric training with varied ankle weights on agility, speed, and leg power of basketball and volleyball athletes. A research study is a way to learn more about people. If you decide that you want to be part of this study, you will be asked to participate in a plyometric training program with varied ankle weights. This will take you 90 minutes, twice a week for six weeks, after class hours.

This study may involve the risks of injuries to knee and ankle. And there may also be other risks that we cannot predict. But the training program is usually safe and effective if proper procedures are followed.

Not everyone who takes part in this study will benefit. A benefit means that something good happens to you. We think these benefits might be increase in agility, speed and leg power, increase in total strenght, and elevate maximun power output.

When I am finished with this study, I will write a report about what was learned. This report will not include your name or that you were in the study.

You do not have to be in this study if you do not want to be. If you decide to stop after I begin, that's okay too. Your parents know about the study too.

If you decide you want to be in this study, please sign your name.

Sincerely yours,

**Earone Mhico S. Sigua**
Researcher

-------------------------------------------------------------------------------------------------------------

I, ___________________________________ (Participant's Name), want to be involved in the conduct of this research study.

_________________________________ ___________
(Signature of Participant) (Date)

APPENDIX D
LETTER TO THE EXPERT EVALUATORS

February 24, 2018

**Prof. Jerome Porto**
Program Director, Institute of Physical Education and Athletics
University of Sto. Thomas

Dear Prof. Porto,

Greetings in the Name of the Lord!

The undersigned is currently conducting a thesis focusing on the effects of plyometric training with varied ankle weights on agility, speed, and leg power of basketball and volleyball athletes. The Principal of Pampanga High School has approved the implementation of this study among the junior high school basketball and volleyball athletes S.Y. 2017-2018 in a span of six weeks.

In view of this, the undersigned seeks for your assistance in validating the training matrix guide to be used in the study. Your expertise in examining and evaluating the validity of the content of the said training material will greatly contribute in realizing the objectives of the study. Attached with this communication is the plyometric training with varied ankle weights matrix guide and the evaluation tool for the validation process.

Your positive response on this research undertaking is highly appreciated, thank you very much and God bless.

Respectfully yours,

**Mr. EARONE MHICO S. SIGUA**
*Researcher*

ASSOC. PROF. JEROME A. PORTO
CHAIRPERSON, IPE PROGRAM
UST-IPEA 2/26/18

Noted:

**Prof. BRANDO C. PALOMAR**
*Thesis Adviser*

UNIVERSITY OF STO. TOMAS
RECEIVED
FEB 26 2018
Institute of Physical Education and Athletics
By: REIN Time: 9:24 am

APPENDIX E

EVALUATION TOOL FOR THE VALIDATION OF THE PTAWMG

**Evaluation Tool for the Validation of the Plyometric Training with Varied Ankle Weights Matrix Guide**

**Part I. Personal Data**

**Direction:** *Please fill in the necessary information asked in the questionnaire by supplying the data or by checking (✓) the item in the space provided in each item.*

Name: JEROME A. PORTO Gender: M

Present Position/ Rank: ASSOCIATE PROFESSOR Years of Teaching Experience: 20

School/ Affiliation: UST

Subjects Taught: FITNESS; SPORTS COACHING; SPORTS MANAGEMENT COURSES

Highest Educational Attainment

_____Doctorate Degree
__✓__Master's Degree with PhD units
_____Master's Degree
_____Bachelor's Degree with MA Units
_____Bachelor's Degree

Area of Specialization FITNESS and SPORTS COACHING

---

**Part II. Evaluation Tool for the Validation of the Plyometric Training with Varied Ankle Weights Matrix Guide (PTVAWMG)**

***Direction:*** *Please put a check mark (✓) on your assessment on the level of acceptability of the plyometric training with varied ankle weights matrix guide in terms of its design, drills/activities, language, figures, layout, and overall presentation. This training program will be administered to junior high school basketball and volleyball athletes.*

***Please assess the Plyometric Training with Varied Ankle Weights Matrix Guide (PTVAWMG) using the following scales and descriptions:***

| Scale | Interpretation | Description |
|---|---|---|
| 5 | Very Acceptable | The statement is highly evident in the PTVAWMG |
| 4 | Acceptable | The statement is evident in the PTVAWMG |
| 3 | Moderately Acceptable | The statement is somehow evident in the PTVAWMG |
| 2 | Least Acceptable | The statement is not that evident in the PTVAWMG |
| 1 | Not Acceptable | The statement is really not evident in the PTVAWMG |

1

| The **Training Design** featured in the PTYAWMG… | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|
| *1. is aligned to the objectives of the study* | | | ✓ | | |
| *2. is appropriate to the features and mechanism of plyometric* | | | | ✓ | |
| *3. is suitable for the target participants* | | | ✓ | | |
| *4. is presented in an organize and functional manner* | | | | ✓ | |
| *5. presents increasing training complexity and progression* | | | | ✓ | |
| *6. identifies the need sets of equipment, training materials and time allotment* | | | ✓ | | |
| *7. explains the different training procedures and safety measures* | | ✓ | | | |

| The **Training Drills/ Activities** included in the PTYAWMG… | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|
| *1. are properly discussed* | | | ✓ | | |
| *2. are appropriated illustrated* | | | ✓ | | |
| *3. are aligned to the objectives of the study* | | | ✓ | | |
| *4. are aligned to the design of the study* | | | ✓ | | |
| *5. measure the expected outcomes of the study* | | | ✓ | | |
| *6. provided incremental enhancement of the physical fitness component included in the study* | | | ✓ | | |

| The **Language** used in the PTYAWMG… | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|
| *1. is easy to understand/ comprehend* | | | ✓ | | |
| *2. is free of misspelled words* | | | ✓ | | |
| *3. avoids too much technical terms* | | | ✓ | | |
| *4. is free from grammatical/ structural errors* | | | ✓ | | |
| *5. provides easy to follow discussion and instructions* | | | ✓ | | |

| The **Figures** included in the PTYAWMG… | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|
| *1. are visually appealing* | | | ✓ | | |
| *2. are appropriate to the discussion* | | | | ✓ | |
| *3. are aligned to the design and objectives of the study* | | | ✓ | | |
| *4. provide better understanding on the context of the study* | | | ✓ | | |
| *5. are free from conceptual and procedural errors* | | | | ✓ | |

| The **Layout** used in the PTYAWMG… | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|
| *1. provide clear and visually appealing layout design* | | | ✓ | | |
| *2. shows readability of the text* | | | ✓ | | |
| *3. uses appropriate and clear illustrations and figures* | | | | ✓ | |
| *4. presents the contents and parts in an organized mater and proper sequence* | | | ✓ | | |

2

| The **Overall Presentation** of the PTVAWMG… | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|
| *1. is written in a clear and understandable manner* | | | ✓ | | |
| *2. is presented in a visual appealing and enticing manner* | | | ✓ | | |
| *3. contains the significant content and parts for a training program* | | | | ✓ | |
| *4. can be carried out in an actual school-based training program* | | | ✓ | | |
| *5. is developed in comprehensive and substantial manner* | | | | ✓ | |

***Comments / Suggestions for the improvement of the PTVAWMG:***

Please see the manual.

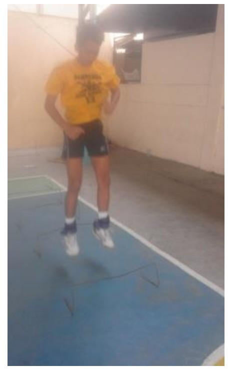
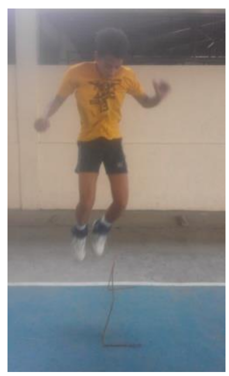
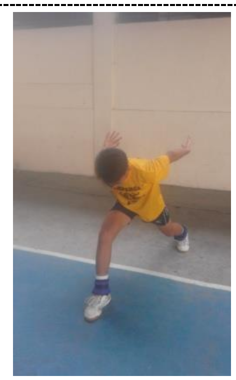
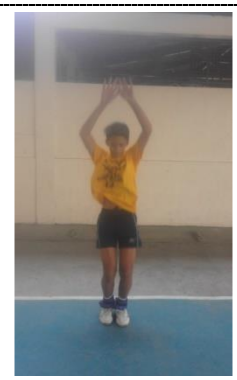
God bless. Thanks

JEROME A. PORTO, LPT
ASSOCIATE PROFESSOR, UST
7/26/18

***Rater's Signature over Printed Name***

APPENDIX F

PLYOMETRICS DRILLS WITH ANKLE WEIGHTS

| | | | |
|---|---|---|---|
| HURDLE JUMP |  |  |  |
| DROP JUMP |  |  |  |
| LATERAL HURDLE HOPS |  |  |  |
| LUNGE JUMP |  |  |  |

APPENDIX G

REGULAR TRAINING DRILLS WITHOUT ANKLE WEIGHTS

| | | | |
|---|---|---|---|
| SQUATS |  |  |  |
| CALF RAISES |  |  |  |
| SIDE LEG RAISES |  |  |  |
| SIDE TO SIDE LUNGES |  |  |  |

APPENDIX H

INDIVIDUAL PRETEST AND POSTTEST SCORES OF CONTROL GROUP

| SPORT | GENDER | | AGILITY | | | | LEG POWER | | | | SPEED | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Pretest** | **Posttest** | **$M_G$** | **%** | **Pretest** | **Posttest** | **$M_G$** | **%** | **Pretest** | **Posttest** | **$M_G$** | **%** |
| **Basketball** | **Male** | 1 | 19.07 | 18.12 | -0.95 | 4.98 | 53 | 56 | 3 | 5.66 | 3.88 | 3.62 | -0.26 | 6.70 |
| | | 2 | 18.96 | 18.20 | -0.76 | 4.01 | 62 | 66 | 4 | 6.45 | 4.04 | 3.84 | -0.2 | 4.95 |
| | | 3 | 18.54 | 17.67 | -0.87 | 4.69 | 61 | 64 | 3 | 4.92 | 3.59 | 3.19 | -0.4 | 11.14 |
| | | 4 | 16.62 | 15.35 | -1.27 | 7.64 | 62 | 67 | 5 | 8.06 | 3.67 | 3.07 | -0.6 | 16.35 |
| | | 5 | 17.96 | 16.33 | -1.63 | 9.08 | 58 | 60 | 2 | 3.45 | 3.66 | 3.34 | -0.32 | 8.74 |
| | | 6 | 17.63 | 17.25 | -0.38 | 2.16 | 52 | 55 | 3 | 5.77 | 4.04 | 3.46 | -0.58 | 14.36 |
| | **Female** | 1 | 20.30 | 19.38 | -0.92 | 4.53 | 48 | 51 | 3 | 6.25 | 4.20 | 3.88 | -0.32 | 7.62 |
| | | 2 | 17.89 | 16.36 | -1.53 | 8.55 | 56 | 58 | 2 | 3.57 | 3.80 | 3.44 | -0.36 | 9.47 |
| | | 3 | 19.27 | 18.77 | -0.5 | 2.59 | 51 | 53 | 2 | 3.92 | 4.16 | 3.87 | -0.29 | 6.97 |
| | | 4 | 17.95 | 17.22 | -0.73 | 4.07 | 57 | 61 | 4 | 7.02 | 3.75 | 3.54 | -0.21 | 5.60 |
| | | 5 | 17.54 | 17.12 | -0.42 | 2.39 | 59 | 62 | 3 | 5.08 | 3.68 | 3.32 | -0.36 | 9.78 |
| | | 6 | 18.43 | 17.38 | -1.05 | 5.70 | 53 | 58 | 5 | 9.43 | 4.04 | 3.65 | -0.39 | 9.65 |
| **Volleyball** | **Male** | 1 | 17.57 | 16.95 | -0.62 | 3.53 | 55 | 57 | 2 | 3.64 | 3.95 | 3.55 | -0.4 | 10.13 |
| | | 2 | 17.23 | 16.63 | -0.6 | 3.48 | 59 | 61 | 2 | 3.39 | 3.73 | 3.52 | -0.21 | 5.63 |
| | | 3 | 17.01 | 16.39 | -0.62 | 3.64 | 59 | 63 | 4 | 6.78 | 3.48 | 3.26 | -0.22 | 6.32 |
| | | 4 | 17.32 | 17.19 | -0.13 | 0.75 | 60 | 63 | 3 | 5.00 | 3.52 | 3.17 | -0.35 | 9.94 |
| | | 5 | 16.85 | 15.46 | -1.39 | 8.25 | 60 | 64 | 4 | 6.67 | 3.60 | 3.25 | -0.35 | 9.72 |
| | | 6 | 16.92 | 15.79 | -1.13 | 6.68 | 67 | 69 | 2 | 2.99 | 3.45 | 3.17 | -0.28 | 8.12 |
| | **Female** | 1 | 19.56 | 18.72 | -0.84 | 4.29 | 53 | 56 | 3 | 5.66 | 3.92 | 3.93 | 0.01 | 0.26 |
| | | 2 | 17.76 | 16.39 | -1.37 | 7.71 | 56 | 58 | 2 | 3.57 | 3.97 | 3.46 | -0.51 | 12.85 |
| | | 3 | 17.67 | 16.50 | -1.17 | 6.62 | 51 | 56 | 5 | 9.80 | 3.75 | 3.43 | -0.32 | 8.53 |
| | | 4 | 18.24 | 17.52 | -0.72 | 3.95 | 52 | 56 | 4 | 7.69 | 3.63 | 3.37 | -0.26 | 7.16 |
| | | 5 | 17.63 | 16.01 | -1.62 | 9.19 | 56 | 59 | 3 | 5.36 | 3.55 | 3.25 | -0.3 | 8.45 |
| | | 6 | 19.17 | 18.23 | -0.94 | 4.90 | 58 | 60 | 2 | 3.45 | 3.86 | 3.61 | -0.25 | 6.48 |

APPENDIX I

INDIVIDUAL PRETEST AND POSTTEST SCORES OF EXPERIMENTAL GROUP

| SPORT | GENDER | | AGILITY | | | | LEG POWER | | | | SPEED | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Pretest** | **Posttest** | **$M_G$** | **%** | **Pretest** | **Posttest** | **$M_G$** | **%** | **Pretest** | **Posttest** | **$M_G$** | **%** |
| **Basketball** | **Male** | 1 | 18.74 | 16.81 | -1.93 | 10.30 | 57 | 62 | 5 | 8.77 | 4.05 | 3.22 | -0.83 | 20.49 |
| | | 2 | 19.52 | 17.38 | -2.14 | 10.96 | 68 | 77 | 9 | 13.24 | 4.12 | 3.66 | -0.46 | 11.17 |
| | | 3 | 18.03 | 15.85 | -2.18 | 12.09 | 72 | 84 | 12 | 16.67 | 3.38 | 2.90 | -0.48 | 14.20 |
| | | 4 | 16.97 | 14.51 | -2.46 | 14.50 | 68 | 79 | 11 | 16.18 | 3.32 | 2.52 | -0.8 | 24.10 |
| | | 5 | 18.15 | 16.01 | -2.14 | 11.79 | 57 | 65 | 8 | 14.04 | 3.63 | 3.04 | -0.59 | 16.25 |
| | | 6 | 17.38 | 15.42 | -1.96 | 11.28 | 53 | 61 | 8 | 15.09 | 3.61 | 3.02 | -0.59 | 16.34 |
| | **Female** | 1 | 20.44 | 19.15 | -1.29 | 6.31 | 49 | 57 | 8 | 16.33 | 4.14 | 3.61 | -0.53 | 12.80 |
| | | 2 | 16.77 | 15.45 | -1.32 | 7.87 | 53 | 60 | 7 | 13.21 | 3.66 | 3.15 | -0.51 | 13.93 |
| | | 3 | 19.92 | 17.82 | -2.1 | 10.54 | 48 | 55 | 7 | 14.58 | 4.42 | 3.73 | -0.69 | 15.61 |
| | | 4 | 18.56 | 17.38 | -1.18 | 6.36 | 56 | 68 | 12 | 21.43 | 3.98 | 3.18 | -0.8 | 20.10 |
| | | 5 | 16.20 | 15.13 | -1.07 | 6.60 | 61 | 67 | 6 | 9.84 | 3.71 | 2.86 | -0.85 | 22.91 |
| | | 6 | 18.68 | 17.27 | -1.41 | 7.55 | 58 | 69 | 11 | 18.97 | 3.82 | 3.39 | -0.43 | 11.26 |
| **Volleyball** | **Male** | 1 | 17.96 | 15.73 | -2.23 | 12.42 | 52 | 59 | 7 | 13.46 | 3.82 | 3.18 | -0.64 | 16.75 |
| | | 2 | 17.87 | 15.79 | -2.08 | 11.64 | 58 | 64 | 6 | 10.34 | 3.91 | 3.23 | -0.68 | 17.39 |
| | | 3 | 17.55 | 14.72 | -2.83 | 16.13 | 60 | 73 | 13 | 21.67 | 3.54 | 3.07 | -0.47 | 13.28 |
| | | 4 | 17.62 | 16.06 | -1.56 | 8.85 | 59 | 71 | 12 | 20.34 | 3.48 | 2.81 | -0.67 | 19.25 |
| | | 5 | 16.34 | 14.08 | -2.26 | 13.83 | 62 | 70 | 8 | 12.90 | 3.58 | 2.88 | -0.7 | 19.55 |
| | | 6 | 16.79 | 14.24 | -2.55 | 15.19 | 64 | 72 | 8 | 12.50 | 3.47 | 2.89 | -0.58 | 16.71 |
| | **Female** | 1 | 19.97 | 17.85 | -2.12 | 10.62 | 50 | 59 | 9 | 18.00 | 4.33 | 3.84 | -0.49 | 11.32 |
| | | 2 | 16.86 | 14.72 | -2.14 | 12.69 | 55 | 62 | 7 | 12.73 | 3.63 | 3.08 | -0.55 | 15.15 |
| | | 3 | 17.18 | 15.51 | -1.67 | 9.72 | 52 | 66 | 14 | 26.92 | 4.28 | 3.76 | -0.52 | 12.15 |
| | | 4 | 17.30 | 16.43 | -0.87 | 5.03 | 54 | 62 | 8 | 14.81 | 4.25 | 3.47 | -0.78 | 18.35 |
| | | 5 | 16.45 | 15.07 | -1.38 | 8.39 | 57 | 64 | 7 | 12.28 | 3.58 | 2.91 | -0.67 | 18.72 |
| | | 6 | 19.47 | 17.78 | -1.69 | 8.68 | 54 | 61 | 7 | 12.96 | 4.27 | 3.60 | -0.67 | 15.69 |

APPENDIX J
PLYOMETRICS TRAINING WITH ANKLE WEIGHTS MATRIX GUIDE

# PLYOMETRIC TRAINING WITH ANKLE WEIGHTS MATRIX GUIDE (PTAWMG)

Developed by:

EARONE MHICO S. SIGUA

## Table of Contents

# INTRODUCTION

The main goal of K-to-12 Physical Education Curriculum is to achieve life-long fitness and wellness for all (May, 2016). The curriculum's conceptual framework shows that with the support of society, community, family and school, and self-motivation in regularly practicing rhythms and dances, games and sports, and body management, we can produce an individual who lives an active life for fitness and lifelong health. Physical fitness is generally achieved through physical activity and exercise, stress management and relaxation, proper diet and nutrition, and enough rest for physical recovery. There is incontrovertible evidence that regular physical activity contributes to the prevention of several chronic diseases and is associated with a reduced risk of premature death.

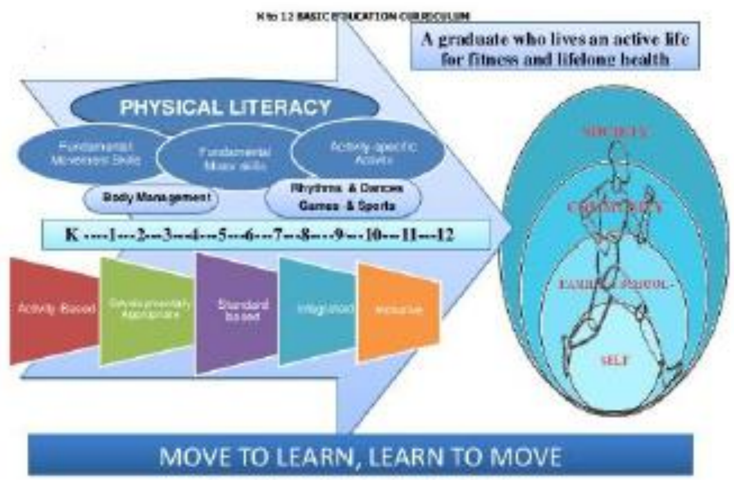



Figure 1. The Conceptual Framework of Physical Education

Planning-out good fitness programs is a key in promoting and maintaining good health. Fitness programs are a great way to make sure that individuals, specially athletes, are getting the most out of their workouts and that they are targeting specific muscle groups they want to develop as well as getting a good cardio workout. Many people exercise but are not getting the full benefits that exercise can provide. By planning-out some fitness programs, people can make sure that they are not wasting their time.

Education and training programs have been created, over the past 30 years, in an effort to assist coaches and athletes with the development of methods and strategies for achieving peak performance (Johnson, S., et. al., 2011). In the Philippines, the Department of Education (DepEd) selects capable schools in implementing a special program for sports. DepEd Order No. 25, s. 2015, "*Implementing Guidelines on the Special Program in Sports (SPS)*", item no.1 explains that the department shall implement the SPS in regular high schools, which have the capacity to implement and sustain the program in terms of trained teachers, facilities and equipment as to address the needs of talented students in the different sports disciplines. Curriculum in the said program is different from regular class in the sense that subjects are sports-related and students are given time daily to train with their specific sport. This help students improve and master their skills in playing a specific sport at the same time valuing education, which makes them develop holistically.

In order to achieve success in sport and achieve physical fitness, all abilities should be subjected to training in specific ways (Balciunas, Stonkus, Abrantes, & Sampaio, 2006). Plyometrics is a training method used by athletes in many types of sports. This type of training, which involves repeated rapid stretching and contracting of muscles to increase power is referred to as "explosive-reactive" power training (Bal, et al., 2011). This is accomplished by optimizing the stretch-shortening cycle, which occurs when the active muscle switches from rapid eccentric muscle action to rapid concentric muscle action. The rapid eccentric movement creates a stretch reflex that produces a more forceful concentric muscle action than could otherwise be generated from a resting position. The faster the muscle is stretched, the greater the force produced and the more powerful the muscle movement (Rahimi & Behpur, 2005). Plyometric training can contribute to improvements in speed, agility, and leg muscle power (vertical jump) performance, which are important skills especially in volleyball and basketball.

One of the latest innovations in strength and conditioning training is called ankle weights. These are a commonly found weight used in many activities. Located further from the core, fixated above the ankle around the lower shin and achilles tendon, due to leverage much less weight is needed to increase the forces on the body. It makes muscles, such as hamstrings, quadriceps and glutes, work harder to do the same motion which leads to a more efficient and effective training.

One of the localize initiatives developed by local school sports coaches to adhere the goals of education in terms of physical education is to prepare and implement training programs for future athletes. A systematic way of ensuring that everything is well addressed or covered fully in a fitness program is with the use of a training matrix. Providing a well-designed training matrix will help coaches and implementers to see the progress of the different components of fitness an athlete must have. More specifically, a training matrix can help in the proper implementation of the varied training guidelines like with the plyometric training guidelines. The matrix will help not only adhere to the guidelines, but assess where we are in the process and work towards improving our skills. It is a valuable guide in helping others to have better understanding about the training program, its goals, and served as a motivator to achieve higher quality physical activity.

In consequence of the above-mentioned ideas, this plyometric training with varied ankle weights matrix guide is a part of the researchers' paper that probes on the effects of plyometric training with varied ankle weights on agility, speed, and leg power among high school basketball and volleyball athletes. This training matrix will be employed as basis of the high school basketball and volleyball athletes' six-week training program with the hope of enhancing the athletes' agility, speed and leg power, which are the essential fitness components needed in the said sports program. In addition, if proven effective, results of this paper may serve as reference in developing and formulating better training programs for the improvement of athletes' skills and game performance in different kinds of sports.

Specifically, this present study will be participated by male and female basketball and volleyball athletes in a secondary school in Pampanga. The participants will be grouped into two (2) and matching process will be observed in order to realize the objectives of the study. One group will be the control group and the other will be the experimental group. The control group will use court exercises and not plyometric training with ankle weights. On the other hand, the experimental group will utilize the training matrix presented in this paper. Pretest and posttest will be observed through 20 m dash, illinois agility test, and vertec device to determine speed, agility, and leg power (vertical jump) respectively.

| *Annual Periodized Training Plan for Athletes* | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | March | April | May | June | July | August | September | October | November | December | January | February |
| Periods | Preparatory | | | | | | | Competition | | | | |
| Phases of Training | General Preparation | | | | Specific Preparation | | | Pre-Competitive | | Competitive | | Transition |
| Physical | Aerobic Endurance & Strength | | Strength/Power (Plyometric Training with Ankle Weights) | | Maintain Strength/Power Aerobic Interval | | | Maintain Strength and Speed | | Maintain | | |
| Technical-Tactical | Refine Basic Skills of the Game | | | | Develop Tactics | | | Refine Techniques-Tactics | | Maintain and Specialized Tactics | | |

## MATERIALS AND SETS OF EQUIPMENT

| *Materials and Equipment* | *No. of Pieces/ Dimensions* | *Pictures* |
|---|---|---|
| **Ankle Weights** | **24 Pairs – ½ Kg** |   |
| **Plyometric Hurdles** | **6 Pieces** |   |
| **Plyometric Box** | **3 Pieces** |   |

## PLYOMETRIC DRILLS

| *Drills* | *Materials* | *Starting Position* | *Action* | *Landing Position* |
|---|---|---|---|---|
| **Hurdle Jump** | **Plyometric Hurdles** | The participant stands in a mid-high squat position in front of the row of hurdles.<br> | The jump is with both feet, and over the first hurdle. During the landing, the participant takes off again quickly and jumps over the second hurdle, repeating the sequence for all the remaining hurdles.<br> | The participant lands with both feet in a mid-high squat position in front of the row of hurdles.<br> |

| *Drills* | *Materials* | *Starting Position* | *Action* | *Landing Position* |
|---|---|---|---|---|
| **Drop Jump** | **Plyometric Box** | The participant stands upright on the box, closer to its front edge.  | The participant dismounts from the box, moving forward, and using both feet at the same time. While landing, he uses both feet to take off moving upwards, as fast as possible, and jump at maximum reach.   | The participant lands with both feet in a mid-high squat position.  |

| ***Drills*** | ***Materials*** | ***Starting Position*** | ***Action*** | ***Landing Position*** |
|---|---|---|---|---|
| **Lateral Hurdle Hops** | **Plyometric Hurdles** | The participant stands sideways next to the hurdle with his feet shoulder-width apart. Then the participant hops sideways with both feet from a mid-high squat position. | The participant hops sideways over the hurdle with both feet and during the landing quickly takes off again and hops to the opposite side of the hurdle, continuing to do so in an alternating fashion until the end of the exercise. Touching the floor surface on one side of the bench counts as one touch. | The participant lands with both feet shoulder-width apart and in a mid-high squat position. |
| | |  |  |  |

| *Drills* | *Materials* | *Starting Position* | *Action* | *Landing Position* |
|---|---|---|---|---|
| **Lunge Jump** | **None** | The participant lunges forward, forming a 90 degree angle between the hip joint and the knee of the forward leg. | Swinging the arms forward, the participant jumps off the ground high as possible, lands in the starting position, and immediately repeats the jump. The participant switches forward foot after every set. | The participant lands in a forward lunge position, forming a 90 degree angle between the hip joint and the knee of the forward leg. |
| | |  |  |  |

## SAFETY MEASURES

Sport participation and demanding athletic training regimens can produce significant sport injuries for athletes. Experiencing a sport injury may affect an athlete physically and psychologically once the individual returns to athletic competition (Podlog & Eklund, 2006).

Plyometric is not a dangerous form of exercise, but there is a risk for stress on joints and muscles if the exercise is not done properly. Low-intensity plyometric exercises have been used in injury rehabilitation, therefore making them safe to practice. To avoid injuries during performing certain training, general safety measures are to be taken into accounts which are as under.

- *Participants should undergo medical check-up and be free from any medical conditions that can affect their health during the training.*
- *A proper and thorough total body warm-up is essential before plyometric training, and a warm up should be general to specific in a nature.*
- *To perform plyometric exercises a firm flat surface like grass, turf, and wood is required and helpful.*
- *Equipment like boxes, hurdles, etc. are to be used for plyometric training and the equipment should be in better condition.*
- *Proper execution of the drills must be taught and observed by the training supervisor or coach.*
- *In case of emergencies, health personnel and first aid kits must be available.*

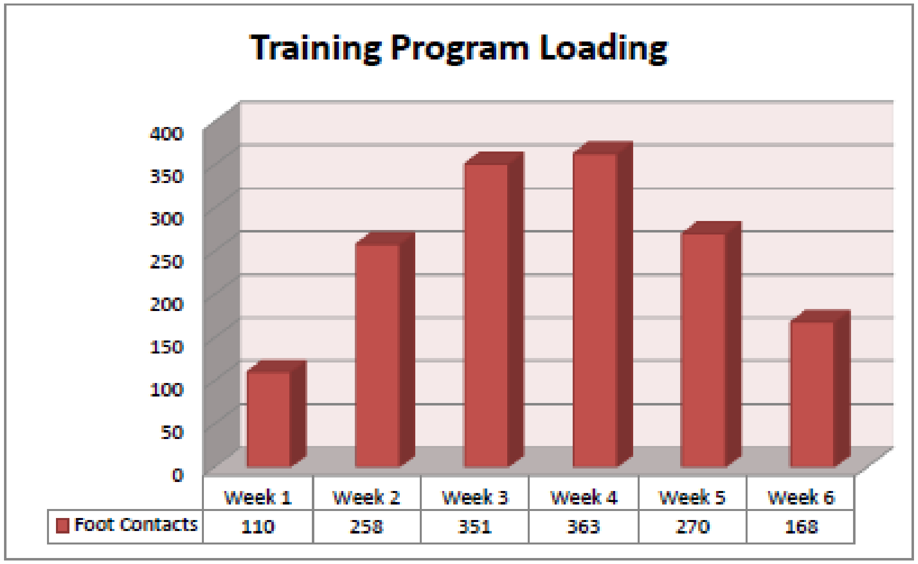
## TRAINING MATRIX

| Training Week | No. of Sessions Per Week | Training Volume (Foot Contacts) | Plyometric Drill With Ankle Weights | Sets/Repetitions |
|---|---|---|---|---|
| 1 | 2 | 110 | Hurdle Jump<br>Drop Jump<br>Lateral Hurdle Hops<br>Lunge Jump | 2 sets, 6 hurdles, hurdle height 50 cm<br>2 sets, 10 repetitions; box height 60 cm<br>2 sets, 30 sec; hurdle height 30cm<br>2 sets, 9 repetitions |
| 2 | 2 | 258 | Hurdle Jump<br>Drop Jump<br>Lateral Hurdle Hops<br>Lunge Jump | 3 sets, 6 hurdles, hurdle height 50 cm<br>3 sets, 10 repetitions; box height 70 cm<br>3 sets, 60 sec; hurdle height 30cm<br>3 sets, 10 repetitions |
| 3 | 2 | 351 | Hurdle Jump<br>Drop Jump<br>Lateral Hurdle Hops<br>Lunge Jump | 3 sets, 6 hurdles, hurdle heights 60 cm<br>3 sets, 10 repetitions; box height 80 cm<br>3 sets, 90 sec; hurdle height 30cm<br>3 sets, 11 repetitions |
| 4 | 2 | 363 | Hurdle Jump<br>Drop Jump<br>Lateral Hurdle Hops<br>Lunge Jump | 4 sets, 6 hurdles, hurdle height 60 cm<br>3 sets, 10 repetitions; box height 90 cm<br>3 sets, 90 sec; hurdle height 30cm<br>3 sets, 13 repetitions |
| 5 | 2 | 270 | Hurdle Jump<br>Drop Jump<br>Lateral Hurdle Hops<br>Lunge Jump | 4 sets, 6 hurdles, hurdle heights 60 cm<br>3 sets, 10 repetitions; box height 80 cm<br>3 sets, 60 sec; hurdle height 30cm<br>3 sets, 12 repetitions |
| 6 | 2 | 168 | Hurdle Jump<br>Drop Jump<br>Lateral Hurdle Hops<br>Lunge Jump | 3 sets, 6 hurdles, hurdle height 50 cm<br>3 sets, 10 repetitions; box height 70 cm<br>3 sets, 30 sec; hurdle height 30cm<br>3 sets, 10 repetitions |

The set of the specialized model for explosive leg strength in this study consisted of four plyometric exercises, which was adapted and modified based on the training model for the development of explosive leg strength in the study conducted by Stojanović, N., et. al. (2012) "The effects of plyometric training on the development of the jumping agility in volleyball players". Furthermore, the study of Davies, et. al. (2015), "Current concepts of plyometric exercise", identified that plyometric program should use the principles of progression and overload. This can be accomplished by manipulating the volume dosage (reps, sets, weight, etc.) of many different variables.

Volume is often measured by calculating the load, counting the number of repetitions, sets, etc. of the specific activity (number of jumps, etc.) Fifty-foot contacts/jumps during a training session would be considered low volume, while 200 + would be considered high volume. Volume of greater than 80 jumps/foot contacts per session seems to result in the greatest benefit. Also, reviewed studies included various forms of plyometric training ranging from three to 12 weeks in duration. Weekly dosage ranged from once per week to four times per week at most.

The values of the maximum repetitions of all the exercises in the explosive leg-strength training program were used as the basis for dosing the load during training. The principle that load during the first week was 70% of the maximum, 80% during the second, 90% during the third, 100% during the fourth, 90% during the fifth, and 80% during the sixth week was used in the creation of the training program as shown on the following chart:




Two groups of high school athletes will perform a training program on a covered court twice a week (Monday and Thursday) for six weeks with two to three days or 48-72 hours recovery between training sessions. The plyometric training program will also include a 10-minute warm-up (jogging) and 10 minute cool-down (jogging) (Poomsalood, 2015). One group which is the control group will not wear ankle weights and continue their usual training (court exercises, etc.), the second group will wear ankle weights with ½ kg during plyometric training, and will be removed after the training program.

On the first week of the plyometric training program, athletes will perform the following: 2-sets of hurdle jump with 6 hurdles at 50 cm height; 2 sets of drop jump with 10 repetitions per set at 60 cm height of plyometric box; 2 sets of lateral hurdle hops for 30 seconds at 30 cm hurdle height; and 2 sets lunge jump with 9 repetitions per set. This training week has 110-foot contacts per session.

On the second week of the plyometric training program, athletes will perform 3 sets of hurdle jump with 6 hurdles at 50 cm height; 3 sets of drop jump with 10 repetitions per set at 70 cm height of plyometric box; 3 sets of lateral hurdle hops for 60 seconds at 30 cm hurdle height; and 3 sets lunge jump with 10 repetitions per set. This training week has 258-foot contacts per session.

On the third week of the plyometric training program, athletes will perform 3 sets of hurdle jump with 6 hurdles at 60 cm height; 3 sets of drop jump with 10 repetitions per set at 80 cm height of plyometric box; 3 sets of lateral hurdle hops for 90 seconds at 30 cm hurdle height; and 3 sets lunge jump with 11 repetitions per set. This training week has 351-foot contacts per session.

On the fourth week of the plyometric training program, athletes will perform the following: 4 sets of hurdle jump with 6 hurdles at 60 cm height; 3 sets of drop jump with 10 repetitions per set at 90 cm height of plyometric box; 3 sets of lateral hurdle hops for 90 seconds at 30 cm hurdle height; and 3 sets lunge jump with 13 repetitions per set. This training week has 363-foot contacts per session.

On the fifth week of the plyometric training program, athletes will perform 4 sets of hurdle jump with 6 hurdles at 60 cm height; 3 sets of drop jump with 10 repetitions per set at 80 cm height of plyometric box; 3 sets of lateral hurdle hops for 60 seconds at 30 cm hurdle height; and 3 sets lunge jump with 12 repetitions per set. This training week has 270-foot contacts per session.

On the sixth week of the plyometric training program, athletes will perform the following: 3 sets of hurdle jump with 6 hurdles at 50 cm height; 3 sets of drop jump with 10 repetitions per set at 70 cm height of plyometric box; 3 sets of lateral hurdle hops for 30 seconds at 30 cm hurdle height; and 3 sets lunge jump with 10 repetitions per set. This training week has 168-foot contacts per session.

*"Physical fitness is not only one of the most important keys to a healthy body, it is the basis of dynamic and creative intellectual activity".* – John F. Kennedy

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APPENDIX K
CURRICULUM VITAE


**EARONE MHICO SUNGA SIGUA**
BLK13 LOT 3 SACOP HOMES, MAGALANG, PAMPANGA
CELL NO. 09356077571
E-mail: mhico_ocihm@yahoo.com


## PERSONAL INFORMATION

| | | |
|---|---|---|
| Date of Birth | : | November 4, 1987 |
| Place of Birth | : | Magalang, Pampanga |
| Age | : | 31 |
| Height | : | 5'6" |
| Weight | : | 75kg |
| Civil Status | : | Married |
| Religion | : | Roman Catholic |
| Citizenship | : | Filipino |
| Language Spoken | : | English, Tagalog, Pampango |
| Name of Father | : | Emilio D. Sigua |
| Name of Mother | : | Mila S. Sigua |

## EDUCATIONAL ATTAINMENT

| | | |
|---|---|---|
| Graduate Studies | : | Philippine Normal University<br>Manila, Philippines |
| Degree | : | Master of Arts in Education |
| Specialization | : | Physical Education |
| Tertiary | : | Pampanga Agricultural College<br>Magalang, Pampanga<br>2004-2008 |
| Degree | : | Bachelor of Secondary Education |
| Major | : | Physical Education, Health, and Music |
| Secondary | : | Pampanga Agricultural College<br>Magalang, Pampanga<br>2000-2004 |
| Primary | : | Magalang Central Elementary School<br>Magalang, Pampanga<br>1994-2000 |

## TRAININGS/SHORT COURSES

| | | |
|---|---|---|
| Training Body | : | Department of Education |
| Course | : | National Training in Sports Coaching<br>(Level II National Coach in Volleyball)<br>October 15-19, 2018 |
| Training Body | : | Department of Education |
| Course | : | National Training in Sports Coaching |

(Level I National Coach in Volleyball)
November 6-10, 2017

| | | |
|---|---|---|
| Training Body | : | Boy Scouts of the Philippines |
| Course | : | Basic Training Course for Troop Leaders<br>(Permanent Senior Patrol Leader)<br>August 25-27, 2017 |
| Training Body | : | Private Schools Athletic Association |
| Course | : | Technical Officiating in Athletics<br>(Class A - National Technical Official)<br>April 23-28, 2017 |
| Training Body | : | DepEd Division of City of San Fernando (P) |
| Course | : | 2015 Arnis Fundamental Course for Teachers<br>April 20-22, 2015 |
| Training Body | : | Department of Education |
| Course | : | Training on Second-Level Coaching for the Special Program in Sports (SPS) Implementers<br>March 31 - April 4, 2014 |
| Training Body | : | Philippine Society for Music Education<br>National Commission for Culture and the Arts<br>Department of Education Region III |
| Course | : | PSME-NDCEP Training for Trainers of Grade 2 & 8 Music Teachers and Supervisors<br>January 27-31, 2014 |

## ELIGIBILITY

Licensure Examination for Teachers, PRC – September 2008

## WORK EXPERIENCE

**PAMPANGA STATE AGRICULTURAL UNIVERSITY**
City of San Fernando, Pampanga
Instructor I (S.Y. 2019 – present)

**PAMPANGA HIGH SCHOOL**
City of San Fernando, Pampanga
Teacher III (S.Y. 2015 – 2019)
Teacher I (S.Y. 2010 – 2015)

**CENTRAL LUZON REGIONAL ATHLETIC ASSOCIATION (CLRAA) MEET**
Officiating Official in Athletics (February 3-8, 2019)
Officiating Official in Athletics (February 7-12, 2016)
Officiating Official in Athletics (December 7-12, 2014)

**CITY SCHOOLS DIVISION ATHLETIC ASSOCIATION MEET (CSDAAM)**

Officiating Official in Athletics (September 28, 29 and October 6, 2018)
Officiating Official in Athletics (November 19, 26 and December 3, 2016)

**PRIVATE SCHOOLS ATHLETIC ASSOCIATION (PRISAA) NATIONAL GAMES**
Iba, Zambales
Officiating Official in Athletics (April 23-28, 2017)

**EAST CENTRAL COLLEGES**
City of San Fernando, Pampanga
Instructor I (S.Y. 2010 – 2012)

**SCHOOL OF ST. BROTHER BENILDE**
Mexico, Pampanga
Sports Coordinator (S.Y. 2009 – 2010)
Primary and Secondary Teacher (S.Y. 2008 – 2010)

## AFFILIATION

Member
National Organization of Professional Teachers
(2008-Present)

December 2019

# Effects of Plyometrics Training with Ankle Weights on Skill-Related Physical Fitness Components

Earone Mhico S. Sigua
*Philippine Normal University*