International Journal of Physical Education and Sports Sciences

Vol. 10, Issue No. 17, July-2016, ISSN 2231-3745

A STUDY OF PHYSICAL PERFORMANCE AND CHARACTERISTICS OF ADOLESCENT ATHLETES AT DISTINCTIVE ACHIEVEMENT LEVELS

AN INTERNATIONALLY INDEXED PEER REVIEWED & REFEREED JOURNAL

www.ignited.in

International Journal of Physical Education and Sports Sciences
Vol. 10, Issue No. 17, July-2016, ISSN 2231-3745

A Study of Physical Performance and Characteristics of Adolescent Athletes at Distinctive Achievement Levels

Dr. Raj Kumar

rajdps05@gmail.com

Abstract – There are very few studies concerning anthropometric characteristics and body composition of female athletes, especially the ones related to volleyball athletes. The purpose of this study is to compare anthropometric characteristics and physical performance of girl volleyball players who are adolescent girls aged around 14 years old, and participated in national championships with different success levels. The subjects of the study consisted of 60 volunteering girl volleyball players.

Anthropometric measures were used for anthropometric and somatotype characteristics. Hand strength test, leg and back strength test, flexibility, knee-bend sit-up, vertical jump test, 20,-meter sprint test and bruce test for maximal oxygen consumption were used for measuring physical performance. As a result, the endomorphy values of the 2nd group's players were significantly higher ($p<0.05$) than those of the 1st group's volleyball players. The new regression formula developed from this study is as follows: % fat=0.126(thight skf.) + 0.626(triceps skf.) – 0.637(biceps skf.) + 0.955(BMI) – 13.144 ($R=0.836$ and $SEE=1.33\%$). Successful girl volleyball players had a dominant somatotype profile, ectomorph structure, and lower ratio of body fat.

----------♦----------

INTRODUCTION:-

The morphological features of a female athlete play a highly decisive role in achieving a successful athletic career of high level performance and, thus, constitute a basic criterion for selecting female volleyball athletes.

Distinction in volleyball comes as a result of specific physiological, kinesiological, psychological, as well as environmental influences of both natural and social surroundings. Yet, it is a basic precondition that female athletes have the appropriate anthropometric characteristics. These characteristics are basically inherited.

Furthermore, Olympic level athletes are characterised by certain body features which are specialised based upon the sport they are involved.

According to Carter (1981) young girl athletes who distinguish in performance have similar somatometry to the one, that successful women athletes of the same sport have.

Research dealing with female volleyball athletes has shown that high performance demands certain features, which are improved by training, provided, however, that athletes bear the appropriate morphological features. The anthropometry of a volleyball athlete combined with their natural mechanical abilities, are the most important factors, which can limit the technical and tactical level of an opponent during a game.

There is a great number of research studies related to the morphological features and body composition of female volleyball athletes from different countries around the world. However the number of similar studies of female volleyball athletes is very limited, especially studies regarding high level performance.

The purpose of the present study was to record the anthropometric characteristics and body composition of top female volleyball athletes, and compare the athletes of the National Team (NT) to those of the A1 National Division (AD), defining any special features of NT athletes, which could be possibly used as criteria for the initial selection of young athletes.

Physique can be characterized by the interactive sum of its parts, body structure, body size and body composition. Body composition, anthropometric dimensions, and morphological characteristics play a vital role in determining the success of a sportsperson. Proper evaluation of these parameters reflects the quantification of the body"s major structural components, which are required in different

proportions for various games to achieve excellence (Amit Bandyopadhyay, 2007).

Somatotyping deals with the body type or physical classification of human body in which the terms endomorphy, mesomorphy and ectomorphy are used to describe a person in terms of his or her somatotype. The first component endomorphy is charectarised by roundness and softness of the body. It denotes fatness of the body. The second component mesomorphy is characterised by square body with hard rugged and prominent musculation. The bones are large and covered with thick muscles. The third component ectomorphy represents the leanness of the body. The limbs are relatively long and trunk short, the bones are small and the muscles thin.. Percent body fat (% fat) has been defined as the percentage of total weight that composed of fat. Lean Body Mass (LBM) refers to all the body tissues like muscles, bones etc. excluding the stored deposit fat. That means LBM is the total body weight minus the weight of the stored fat.

Studies on somatotype of athletes, elite athletes and Olympic athletes have generally shown that strength dependent athletes tended to be basically mesomorphic while distance dependant athletes were found to be more ectomorphic with limited amount of mesomorphic muscularity. In reference to the male athletes wrestlers were more mesomorphic and endomorphic but less ectomorphic than were boxers and runners (Battinelli, 2000).

Today, sporting events have reached high levels. Whilst the social phenomenon of sport societies has become a part of human life as sports promote prestige, scientific developments have brought a new dimension to sports. Sports scientists, who first examined the effects of sports on human health (Gutin et al. 2001), now research on how to help increase the athletes' performance (Hassapidou and Manstrantoni 2011; McArdle et al. 2009). The human body, in terms of structure and function, bares features that can adapt to sports with training sessions. With regular training sessions, the athletes' lean body mass (FFM) increases, resulting in a reduction in percentage of body fat (%BF). Body fat percentage values change according to both, the athlete's gender as well as the type of sport played. In addition, the athlete's somatotype structure is very important in deciding which branch of sport is most appropriate. This assessment can be done by comparing the athlete's anthropometric measurements to the physical measurements. Physical structure and performance-related studies are outdated. For many years it was thought that the appropriate body type played an important role in sports performance (Adriaanse and Crosswhite 2008; Perroni et al. 2015). The first studies being performed today for anthropometric measurements and somatotype are essential in determining ability. Different body types require special athletic skills for maximum performance.

In many sports, usually the sports industry determines whether or not the athlete's body type is appropriate. Somatotype profile is very important for determining the suitability of an athlete in a specific branch of sports. Throughout the world, anthropometric characteristic studies have investigated which body types are most appropriate in which sports, and to what extent it plays a role in the selection of talent within the infrastructure. In order to increase performance levels, the overall results of the research applied show that people must first have certain characteristic features. These characteristics also change from sport to sport (Gaurav et al. 2010).

In order to research future potential talent, this study examined female volleyball players' physical and anthropometric characteristics and their effect on this specific area of sports. Current literature lacks information on this exact topic.

Volleyball sports have been subject to these researches, however, the existing literature is restricted to the individual performance and anthropometric characteristics. In order to more accurately define the talent criteria, further research on the volleyball players' full anthropometric profiles is needed. In recent years, researchers have shown more interest in studying the relationship between physical performance and anthropometric characteristics, and its influence on performance of players. If one wants a more accurate assessment of physical performance and anthropometric characteristic effects on performance, further research is needed. In the literature, there have been many researches on the importance of physical performance, the selection of physical performance tests, the correlation between different physical performance tests, and the relationship between performance of players and physical performance. So far there is no data in an age group that indicate whether physical performance of players is under the influence of their anthropometric characteristics, or whether some specific physical performance may impact anthropometric characteristics of players. Moreover, there have rarely been any studies that compared physical performance of the volleyball players. Due to the lack of research on the girl volleyball players of this age group, this research may constitute as a resource for sports scientists and trainers. Considering somatotype measures alone cannot provide enough evidence, and hence volleyball-specific physical fitness tests were used.

Anthropometric characteristics and morphological parameters, in combination with the physiological and biochemical tests are becoming more and more subject of diverse studies in the field of sports especially in the last two decades (G. Cometti, D. Cometti, 2009). They can be used on one side, to assess the physical growth and nutritional status of sport exercisers and on the other hand as a reliable individual specific profile for the prediction and

improvement of the physical performance. An appropriate and wise approach and use of these indicators and tests both in quantitavive and qualitative terms, a reliable interpretation and integration of the relative values alone or in combination, can be utilized to project the performance level of the elite sportpersons. The ongoing monitoring of such parameters, the identification of eventual health and/or perfomative problems, can help not only for the healthy maintainance of the sportpersons, but at the same time for planning and undertaking of the proper measures for the continuos improvement of the physical fitness, performance and physiological profile both at individual and group/team level.

While individuals in general respond and adapt to different exercise levels and types in different and through various biological, biochemical and physiological mechanisms, exercise and sport training and level seem to be among the most important factors that influence such responses. Physical acitivity and sport induces stress on the body and influences not only modifications in physical and physiological parameters, but brings about a number of blood cells alterations and related blood parameters as well. From their side, alterations of haematological parameters can influence differently the physical and sport performance in different types of sport (F.D. Descorges, M. Testa, C. Petibois, 2008). The type and dynamics of the response patterns indicates the appropriateness of the exercising and training to different individuals,

SPORT PARTICIPATION AND PHYSICAL MATURITY

The body structure and a variety of basic functions that relate to athletic performance undergo striking change during the early years of adolescence. The age at which children are physically ready for many types of sports also vary greatly. It is important to identify early-maturing and late-maturing individuals if they are to be directed into appropriate sport experiences. Early maturation in boys is an advantage in some sports, but the opposite applies in girls. There is an apparent delay in maturity in sports where females who maintain preadolescent physique seem to have an advantage. Successful female athletes display physical characteristics that favor good performances successful young female athletes have similar somatotypes to older successful athletes. There is a trend towards increase linearity in these athletes and this linear physique characterizes the physical attributes of late maturing girls. Early maturing girls undergo a socialization process which does not motivate them any more to excel in physical exercise. On the other hand, late-maturing girls tend to be socialized into sports participation. Late-maturing girls are older chronologically when they attain menarche and have not yet experienced the social pressures regarding competitive athletics for girls and/or are more able to cope with the social pressures. The late mature athletes have less strength, endurance, and skeletal maturity and lower motor skills than their average peers. The late mature athletes have increased risk of injury, with his/her undeveloped muscles and immature skeleton. More importantly, playing with and competing against larger, stronger, and more mature athletes, the late maturer have been a less skilled athlete, and is a prime candidate to drop out at the earliest opportunity. Parents and coaches should know the implications of delayed adolescent development, and they should develop their expectations accordingly.

ADOLESCENT PHYSICAL ACTIVITY

Regular participation in physical activity (PA) has health, fitness and behavioral benefits for children and adolescents. Patterns of PA established in childhood and adolescence may track into the adult years, though relationships tend to be moderate. On the other hand, PA tends to decline, on average, over adolescence. The majority of studies are crosssectional and the adolescent-associated decline approaches 50% in some studies.

Adolescent-related changes in specific contexts of PA are less studied. Participation in organized sport does not decline during adolescence in the Amsterdam Longitudinal Growth and Health Study, while a sport score increases across adolescence in a cross-sectional sample of Portuguese youth. Correlates of the adolescent decline in PA are complex, but most discussions do not include biological variables except for the body mass index (BMI). Better understanding these factors and their interactions would help inform interventions and strategies aimed at increasing adolescent PA.

Physiological, psychological, social and behavioral changes characterize adolescence. The growth spurt in height, changes in body shape, proportions and composition, and sexual maturation (puberty) and attainment of reproductive capacity are most prominent. Sexual maturation also has important societal or cultural dimensions. Puberty usually starts with the breast development in girls and genital enlargement in boys, though there are considerable interindividual differences in the timing of these events. Earlier or later development of secondary sexual characteristics relative to age and sex peers may influence self-perceptions and intragroup dynamics. Earlier and later maturing youth are not in biological synchrony (off time compared with on time or average maturers) with peers. Differential timing of sexual maturation and the growth spurt relative to age and sex peers may be relevant to the decline in PA. Indeed, preliminary research suggests that the adolescent decline in PA may be more closely

associated with biological age than chronological age.

Habitual PA is a complex behavioral phenotype determined by the interaction of biological and psychosocial factors and the physical environment. Puberty and the growth spurt are dynamic biological processes that interact with each other and also with adolescent behavioral development. Physical activity is a behavior and as such is involved in the dynamic interactions. The biological basis of PA and potential biological correlates of PA associated with sexual maturation and the growth spurt require more attention.

Rationale for careful study of maturity-associated variation in PA either crosssectionally or longitudinally is implicit in the underlying neuroendocrine processes that trigger and modulate adolescent growth and sexual maturation. Maturation of the hypothalamic-pituitary-gonadal axis mediates the release of gonadotropins.

Subsequent neural reorganization and rapid changes in maturity status and in body size and composition may directly or indirectly influence PA. As noted among early adolescent girls, early maturing girls show lower PA than average (on time) or late maturing peers. The results were significant when variation in leg length was statistically controlled. This is relevant because the growth spurt in leg length precedes that in height. However, when BMI was controlled, PA differences by maturity group were no longer significant suggesting that body mass per se and/or fatness influences PA in early maturing girls. Although a potential role for psychosocial influences cannot be dismissed, it is important to consider the possible role of biological factors. Many biomarkers that may influence energy expenditure have been identified. Some of the biomarkers may be a product of adipose tissue metabolism (leptin) or may be indirectly involved in the accumulation of adiposity and energy regulation including PA. Longitudinal research is needed to gain insights into the role of neuroendocrine maturation and associated changes in biomarkers during puberty and their potential influence on the hypothesized 'activity-stat'.

METHODOLOGY

Subjects -

The subjects of the study consisted of 60 girl volleyball players as volunteers. Each team consisted of 10 volleyball players. The volleyball teams were devided into two groups by their ranking. There were 28 teams in the competition. The 1st, 2nd and 3th ranking teams formed the 1st group (age mean: 13.62±00.76 years, height mean: 165.84±04.38cm, weight mean: 52.71±05.26kg) and the 26th, 27th and 28th teams formed the 2nd group (age mean: 13.08±00.49 years, height mean: 164.37±04.76cm, weight mean: 52.96±06.32kg). All players participated in the league matches according to their age groups and performed three training sessions per week. All players and their parents were informed about the procedures of the measurements and gave written consents for participation.

Experimental Design-

All participants made two visits to the laboratory on separate days. On the first visit, anthropometric measurements and underwater weighing measurements were collected. During the second visit, residual volume and bruce test for maximal oxygen consumption measurements were collected. Each participant was given a set of written guidelines to adhere to before their designated testing date. The guidelines included the following:

No large meals for four hours before the test

No vigorous exercise for 12 hours before the test

Empty bladder 30 minutes before the test

Consumption of liquids limited to one percent of body weight 2 hours before the test.

Subjects participated in the measurements after staying hungry for a period of one night. The following tests for physical performances were used. Hand strength test, leg and back strength test, flexibility, knee-bend sit-up, vertical jump test, 20-meter sprint test and Bruce test to determine maximal oxygen consumption. Hand strength was tested using the hand dynamometer, leg and back strength were tested using the leg and back dynamometer, flexibility was tested with the sit and reach test, vertical jump was tested using a jumpmeter, the 20 meter sprint test was tested using a photocell, and the Bruce test was tested with a SensorMedics Spectra 229LV analysis system. The laboratory temperature was maintained at a constant temperature for all tests. Testing was administered at the same time of the day for all subjects.

Statistical Analyses -

Statistical analyses were performed using SPSS 11.0 for Windows (SPSS Inc, Chicago, IL). All values are expressed as mean ± standard deviation (SD). In order to detect differences between groups, an independent sample t-test was used. Statistical significance was established at $p<0.05$. In order to obtain the test retest reliability of anthropometric measurement and HW, the intra-class correlation coefficients (ICC's) were calculated. Pearson correlation coefficients were used to determine relationships between variables. Also, stepwise regression was performed in order to develop new regression formula for estimation of HW.

CONCLUSION

Physical activity, whether through informal or organized sports, is important for optimal health, growth and development of children. Physical and physiological process influences on sports participation and performance in sports. The aspects of development influencing sport participation among children and adolescents. Understanding athlete development and outcome of sport participation is a key to effective coaching and teaching of young athletes, and helps coaches work more effectively with the young athletes.

In the research applied, the researchers aimed to examine the anthropometric characteristics and physical performances of girl volleyball players with different degrees of success, and detected that from the two groups, they constituted as successful and unsuccessful after an official match applied, the factors related to age, height and weight had no significant difference. When such observation was examined in accordance to the results of the anthropometric results the researchers found that the successful group players had lower values of skinfold structures and thus lower values of body fat percentages. Furthermore, they had larger shoulders and thus a wider length of their fathom, and a wider mass of muscle in their biceps, calf and abdominal areas.

It was also detected that players with success in their somatotype structures also had a considerable ectomorphy structure. All these parameters are significantly effective on the physical performance characteristics of successful volleyball players.

REFERENCES

Adriaanse JA (2008). Crosswhite JJ. David or Mia: The influence of gender on adolescent girls' choice of sport role models. *Women's Stud Int Forum,* 31: pp. 383- 389.

Allison, K.R., E.M. Adlaf, J.J. Dwyer, D.C. Lysy, and H.M. Irving (2007). The decline in physical activity among adolescent students: a cross national comparison. *Can. J. Public Health.* 98: pp. 97–100.

Amit Bandyopadhyay (2007). Anthropometry and Body Composition in Soccer and Volleyball Players in West Bengal, India, *Journal of Physiological Anthropology*, 26: pp. 501–505.

Baker, B.L., L.L. Birch, S.G. Trost, and K.K. (2007). Davison. Advanced pubertal status at age 11 and lower physical activity in adolescent girls. *J. Pediatr.* 151: pp. 488–493.

Byrne NM, and Hills AP. (2007). The importance of physical activity in the growth and development of children. In Hills AP, King NA, and Byrne NM (Ed.) Children, obesity and exercise: prevention, treatment and management of childhood and adolescent obesity. Routledge, London, pp. 50-60.

CARTER, J.E.L. (1981). Somatotypes of female athletes. In E. Jokl (Ed.). The female athletes, medicine and sport (pp. 85-116). Basel: Karger.

Caspersen, C.J., M.A. Pereira, and K.M. Curran (2000). Changes in physical activity patterns in the United States, by sex and cross-sectional age. *Med. Sci. Sports Exerc.* 32: pp. 1601–1609.

COMETTI, G., COMETTI, D., (2009). *"La Pliometria: Origini, teorie e allenamento".* Calzetti Mariucci Editori. pp. 57-65.

DErcole AA, D Ercole C, Gobbi M, Gobbi F. (2013). Technical, perceptual and motor skills in novice-expert water polo players: an individual discriminant analysis for talent development. *J Strength Cond Res.*; 27(12): pp. 3436-3444.

DESGORCES, F.D., TESTA, M., PETIBOIS, C., (2008). *Training level induced changes in blood parameters to on-water rowing races.* Journal of Sport Science and Medicine. 7: pp. 425-430.

Gaurav V, Singh M, Singh S (2010). Anthropometric characteristics, somatotyping and body composition of volleyball and basketball players. *J Phys Educ Sport Manag, pp.* 28-32.

Gutin B, Barbeau P, Owens S, Lemmon CR, Bauman M, Allison J, Kang HS, Litaker MS (2001). Effects of exercise intensity on cardiovascular fitness, total body composition and visceral adiposity of obese adolescents. *Am J Clin Nutr,* 75: pp. 818-826.

Hassapidou MN, Manstrantoni A (2011). Dietary intakes of elite female athletes in Greece-The British Dietetic Association. *J Hum Nutr Diet,* 14: pp. 391-396.

Malina, R.M. (2001). Tracking of physical activity across the lifespan. *President's Council on Physical Fitness and Sports Research Council.* 3: pp. 1–8.

McArdle WD, Katch FL, Katch VL (2009). *Exercise Physiology: Nutrition, Energy, and Human Performance.* Philadelphia: Lippincott Williams and Wilkins.

Neoklis A, Georgopoulos, Kostas B. et al. (2004). Growth, pubertal development, skeletal maturation and bone mass acquisition in athletes. *Hormones*. 3(4): pp. 233-243.

Norton K, Marfell-Jones M, Whittingham N, Carter L, Kerr D (2000). *Anthopometric assessment protocols*. In: Gore CJ. Physiological tests for elite athletes. Champaign: Human Kinetics; pp. 66-85.

PAPADOPOULOU, S.D. (2001). Anthropometric characteristics of Greek top volleyball players. The effect of demographic and socioeconomic factors on the differentiation between competition levels. PhD Dissertation, Department of Sport Medicine, Faculty of Physical Education and Sports Science, Aristotle University of Thessaloniki, Greece.

Perroni F, Vetrano M, Camolese G, Guidetti L, Baldari C (2015). Anthropometric and somatotype characteristics of young soccer players: Differences among categories, subcategories, and playing position. *J Strength Cond Res,* 29(8): pp. 2097-2104.

Thomas Battinelli (2000). *Physique, fitness, and performance*, CRC Press.