Original Research

Anthropometric profile of elite women's volleyball players in the Philippines

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Abstract. The purpose of this study is to determine the anthropometric profile of elite women's volleyball players in the Philippines. Thirty-six (n=36) subjects with a mean age of 23.9 + 3 years participated in this study and were measured by ISAK-certified anthropometrics. Results showed that elite Filipino women's volleyball players are relatively taller and heavier than average Filipino females but smaller and lighter than most internationally-successful women's volleyball teams. They are in the athletic body fat percentage range with a somatotype of endomorph-mesomorph on average. Middle blockers are tall, thin and lean with a mean central somatotype with lengthy extremities. Outside hitters and opposite spikers are relatively tall, lengthy, and muscular with a mean endomorph-mesomorph somatotype. Liberos are shorter and lighter overall with low body fat and a generally endomorphic mesomorph somatotype. Setters are relatively shorter, heavier and larger with higher body fat and an endomorph-mesomorph somatotype on average. Various similarities and differences with related studies are also discussed.

 Keywords. Anthropometry, body composition, somatotype, volleyball.

Introduction

With its requirement for fast-paced and powerful movements in a variety of simple skills in complex settings, volleyball has gained its status as one of the most popular sports in the world. In the Philippines, women's volleyball is arguably the second most popular organized sport event, next to men's basketball (Ochosa, 2015). Two televised semi-professional leagues have been launched in the last decade, a boom in popularity for the collegiate ranks, and a return to the international scene after ten years is further indication of its rising popularity in the country (Henson, 2015; Ochosa, 2015). However, the history and competitiveness of women's volleyball in the country is still in its infancy with no formal, standardized recruitment system yet.

Women's volleyball overall has been continuously evolving to a point wherein some skills that were previously only seen in men's teams such as higher and faster attacks, sharp and powerful back row attacks and jump-serves and aggressive blocking are now seen in women's teams (Zhang, 2010). Each position has been specialized, requiring certain anthropometric characteristics and increased physical demands (Sheppard et al., 2009; Palao et al., 2014). The trend of change in anthropometry and height indices of the top six women's volleyball teams from the past four Olympic games showed that mass increased from 71.4 kg to 73.4 kg (+2 kg) and stature slightly increased from 1.81 m to 1.84 m (+.03 m). Furthermore, blocking height has increased from 290.4 cm to 297.2 cm (+6.8 cm) (Zhang, 2010).

Success in modern athletic competition has been associated with certain anthropometric characteristics, body composition, somatotype, science-based recruitment and early training (Gaurav et al., 2010; Koley et al., 2010; Zhang, 2010; Aouadi et al., 2012; Carvajal et al., 2012; Fattahi et al., 2012; Kim et al., 2013; Kim et al., 2014; Mielgo-Ayuso et al., 2015). Technical and tactical skills, anthropometric measurements and individual physical performance capacities highly contribute to success in volleyball. Faber et al. (2011) stated that

talent identification programs should be based on the sport-specific determinants for success under several areas such as anthropometry, physical qualities, motor skills, mental skills and contextual factors. Although the ideal physique is not the sole contributor to sport success, a lack of optimal anthropometric characteristics may hinder athletes from reaching higher performance levels. Quantifying the physical characteristics of athletes and analyzing these with regard to the demands of the sport and its different positions offers an insightful basis when it comes to choosing players, assigning roles and designing training programs. Anthropometric measurements would showcase the physical foundation and potential of a person for a certain sport and playing position (Papadopoulou, 2003; Duncan et al., 2006; Palao et al., 2014; Singh, 2016).

Anthropometric profiling and physical performance testing, including different approaches to body composition comparisons and somatotyping, have been widely used as talent identification and recruitment tools and training program bases for varying competitive levels in many countries which has led to more internationally-competitive volleyball teams (Duncan et al., 2006; Koley et al., 2010; Malá et al., 2010; Zhang, 2010; Carvajal et al., 2012; Mielgo-Ayuso et al., 2015). Top Olympic level women's volleyball teams such as China, Cuba and Brazil lean into established scientific approaches to talent identification in order to constantly enhance their level of performance (Zhang, 2010; Carvajal et al., 2012; Milistetd et al., 2013).

Over the years, volleyball has developed in terms of rules, gameplay, playing positions and roles and even equipment (Merrett, 2004). These have led to new trends in international gameplay such as the reiteration of the importance of height for middles (Sheppard et al., 2009) wherein these taller athletes are needed because they can move laterally at the net faster for blocking thanks to their lengthy extremities. The morphological profiles of elite players have also experienced changes and new trends. Carvajal et al. (2012) observed the variations in body composition factors of the Cuban Olympic team from 1976 to 2008. Fat mass percentage decreased from 25% to 22%, somatotype became more mesomorph-ectomorph from mesomorph-endomorph and stature increased from 175.1 cm to 182.2 cm (+7.1 cm).

Reaching a maximum height over the volleyball net is a discriminant for dominating volleyball teams (Aouadi et al., 2012). The height over the net is determined by stature and jumping ability which is observed in jumping height and spiking height. Spiking and jumping height also reflect offensive and defensive capabilities of the athlete. The positive trend in stature can be seen in the 26th Olympic Games which showed that the average stature of the top performing teams were also some of the highest average statures in the whole competition.

Methods

This study is a descriptive research design to identify the anthropometric measurements and indices of elite women's volleyball players in the Philippines.

Subjects

Thirty-six (*n* = 36) elite Filipino women's volleyball players were purposively-selected to take part in this study and be measured. The players invited were either part of the national team which represented the country in an international league in the last three years, part of the current national team training pool, members of a champion team or an individual awardee from the two semi-professional leagues in the last three years, or a top performer (top three statistically) in their respective positions from the top collegiate league in addition to the two semi-professional leagues.

Procedure

Letters of permission were sent to their coaches regarding the data gathering for this research. When the coach has approved, informed consent forms in accordance with the Declaration of Helsinki were handed out to the subjects. Participation was voluntary, none of the subjects were below 18 years old, and confidentiality was assured. ISAK-recommended equipment were used for the anthropometric measurements. Tape measures fixed to a wall and a stadiometer were used to measure stature, standing reach height, sitting height and arm span. A calibrated weighing scale was used to take each participant's body mass. The Cescorf anthropometric tape was used to measure girths and circumferences. The Cescorf Innovare 3 skinfold caliper was used to measure skinfolds. A

segmometer and an anthropometric box were used to measure segmental lengths. A bone caliper was used to measure bone breadths. Anthropometric measurements were taken by ISAK certified anthropometrists. Somatotypes were calculated using the Heath-Carter method.

Results

Stature, Body Mass and BMI

The average height of the 36 high level women's volleyball players is 168 ± 9 cm. The height of the participants are quite dispersed with some being short and some being tall. A difference is observed in the height and weight of the players in different playing positions. The tallest players are in the middle blocker position and the shortest are the liberos. The middle blockers are taller than the liberos and the setters while the opposite spikers are taller than the liberos. Their average weight is 64 ± 7 kg wherein middle blockers and setters are both heavier than liberos. The heaviest players are setters (66 ± 7 kg) and the lightest are the liberos (56 ± 6 kg). The mean BMI of the subjects is 22.5 ± 2.4 which is classified under the *normal* range.

Standing Reach Height, Sitting Height, and Arm Span

The mean standing reach height of the Filipino players is 218 ±13 cm, the mean sitting height is 88 ± 4 cm, and average arm span is 173 ± 11 cm. The standing reach height and arm span of the participants differ but their trunk lengths are more similar which suggests that the lower extremities are the biggest contributor to height differences.

Skinfolds and Body Fat Percentage

Skinfolds were utilized as the sum of 4 skinfolds (triceps, subscapular, supraspinale, medial calf) and body fat percentage estimation through 6 skinfolds (subscapular, triceps, abdominal, supraspinale, mid-thigh, medial calf). The mean sum of 4 skinfolds is 47 ± 18 mm while mean body fat percentage is 16 ± 5 percent.

Somatotypes

Among the 36 subjects, there are four (11.1%) balanced mesomorphs, two (5.6%) balanced ectomorphs, four (11.1%) mesomorphic

endomorphs, two (5.6%) ectomorphic endomorphs, five (13.9%) endomorphic mesomorphs, two (5.6%) ectomorphic mesomorphs, seven (19.4%) endomorph-mesomorphs, one (2.8%) endomorph-ectomorph, and nine (25%) centrals. The most common somatotype is central.

Per playing position, three outside hitters are central, one mesomorphic endomorph, two endomorph-mesomorphs and one balanced mesomorph. For middle blockers, there are two endomorph-mesomorphs, two balanced ectomorphs, two ectomorphic mesomorphs, two centrals, one ectomorphic endomorph, one endomorph-ectomorph and one mesomorphic endomorph. For opposite spikers, there are four centrals, one balanced mesomorph and one endomorphic mesomorph. For liberos, there are two balanced mesomorphs, one mesomorphic endomorph, one endomorphic mesomorph and two endomorph-mesomorphs. For setters, there are three centrals, one ectomorphic endomorph, one endomorph-mesomorph and one mesomorphhic endomorph.

Discussion

The mean height of the subjects is taller than the average Filipino female whose height is at 150 cm (Lozada, 2014) and the average female Filipino collegiate athlete at 1.6 ± 0.1 m (Kim et al., 2014), reiterating the value of height as a desired characteristic for the sport. Furthermore, they are heavier than the average female Filipino collegiate athlete at 55 ± 9 kg (Kim et al., 2014). The differences in height between playing positions are are similar to the findings of Zhang (2010) and Fernández et al. (2017) on elite Chinese and Cuban players and Mielgo-Ayuso et al. (2015) on Spanish Super-league players which supports the variation in height for different positions due to varying physical demands. The height of the middle blockers will be helpful due to the high blocking and jumping demand they have and the height of the net that they have to overcome multiple times (Sheppard et al., 2009). Their taller height would entail a higher reach and a wider coverage despite the lessened effort in jumping due to fatigue and frequency of jumps, especially in long rallies.

Compared to international teams, especially those competing in the Olympic level, the stature of the average Filipino player is shorter. In the 2016 Olympics, the shortest team was Japan at 176 ± 8 cm

while the tallest team, China, which won gold, is 11% taller than the sample at 189 ± 8 cm. Even with their top Southeast Asian neighbor, Thailand (175 ± 5 cm), a 4.2% difference exists (FIVB, 2016). The same goes for the profiles of other countries in the related literature wherein the participants have a smaller mean height even when compared to the junior Australian national team (179 ± 1 cm) (Gabbett & Georgieff, 2007) and all the studies on varying teams that Lidor & Ziv (2010) observed.

The heaviest players are the setters (66 ± 7 kg), which is contrary to that found in elite Spanish, Chinese and Cuban players with their setters being one of the lightest (Zhang, 2010; Trajković et al., 2011; Carvajal et al., 2012; Fernández et al., 2017; Mielgo-Ayuso et al., 2015) and the lightest are the liberos (56 ± 6 kg) which is similar to the findings of Mielgo-Ayuso et al. (2015) and Trajković et al. (2011). The middle blockers are heavier than the liberos and the setters are heavier than the liberos. The weight of the setters may be problematic due to the demand for speed and agility in that position and the amount of jumping they do per game (Sheppard et al., 2009). The low weight of the liberos may be advantageous for them due to the need for speed, agility and reaction time.

Comparing with elite Chinese, Russian (Zhang, 2010; Fernández et al., 2017) and Greek (Papadopoulou, 2003) players, the Filipinos have a practically shorter average standing reach height. The Chinese have a mean standing reach height of 237 ± 8 cm (a 7.9% difference), the Russians have a mean standing reach height of 231 ± 11 cm (a 5.6% difference) (Zhang, 2010; Fernández et al., 2017), while the Greeks have it at 234 ± 8 cm (a 6.6% difference). They also have shorter sitting heights compared to Chinese (96 ± 4 cm at an 8% difference) and Greek (94 ± 4 cm at a 6.1% difference) teams and a slightly shorter sitting height compared to Cuban players (90 ± 2 cm at a 3% difference) (Papadopoulou, 2003; Zhang, 2010; Carvajal et al., 2012; Fernández et al., 2017). They also have a shorter average arm span compared to elite Greek players (182 ± 7 cm at a 5.1% difference). This may be a disadvantage for the participants when up against the taller and longer teams due to the decrease in difficulty and exertion of effort to perform the necessary skills that taller players experience.

The average sum of 4 skinfolds of Filipino elite women's volleyball players is similar to that of elite Chinese who have an average of 47 ± 13 mm. Mean body fat percentages are different for the Filipinos when compared to elite Russians (15 ± 3 %), elite Serbians (14 ± 3%), elite Cubans (22 ± 3%), and elite Greeks (22 ± 5), while it is similar to elite European Champions League teams (16 ± 2%) (Malá et al., 2010; Malý et al., 2011; Carvajal et al., 2012). These are positive results, with the samples generally being in the athletic range of body composition.

The somtatotype results are different from elite Chinese players where chief spikers and liberos had the highest endomorphy and mesomorphy, while second spikers had the highest ectomorphy (Zhang, 2010). They are quite similar to elite Cubans, except that middle blockers had the highest endomorphy (Carvajal et al., 2012). For elite Greek players, however, setters had the highest mean endomorphy, liberos had the highest mean mesomorphy and opposites had the highest ectomorphy (Malousaris et al., 2008). The Filipino setters have the highest average endomorphy and mesomorphy and the lowest ectomorphy while the middle blockers have the lowest endomorphy and mesomorphy and the highest ectomorphy. This may mean that the setters tend to have larger mass and higher body fat while the middle blockers are thin and tall. This may be a disadvantage for the same reason that the setters need to be faster and more agile and that the middle blockers need to be bigger and stronger.

In general, elite Filipino women's volleyball players are relatively taller and heavier than the average Filipino athletes but smaller and lighter than most internationally-successful teams. They are in the athletic body fat percentage range and are endomorph-mesomorphs on average. Middle blockers are tall, thin and lean with a mean central somatotype. They have lengthy extremities and low body fat. Outside hitters and opposite spikers are relatively tall, lengthy and muscular with a mean endomorph-mesomorph somatotype. Liberos are shorter and lighter overall with low body fat and a generally endomorphic mesomorph somatotype. Setters are relatively shorter, heavier, and larger with a high body fat and an endomorph-mesomorph somatotype.

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