Strength Demands for Elite Basketball Shooting Performance

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Abstract

The purpose of this study was to identify the strength demands of the lay-up, free throw and jump shots. General strength has been established as significant to general fitness of the athletes in order to maintain stability, protect the body from injuries and delay the onset of fatigue especially in repeated movements as found in the game of basketball. The specific strength is paramount and is a strength type of training harmonized with specific skill for optimal performance. Correlation research design was used while purposive sampling technique was used to select the sample. The eighteen registered players of the Niger potters' team of Nigeria were used as the participants. Descriptive statistics of mean and standard deviation were used describe the data while Pearson Product Moment correlation Coefficient (r) was used to test significant relationship. The findings revealed that only the general leg explosive power training was needed for the three styles of shooting (r= 0.07,0.03 &,-0.06<.05) while general strength fitness of the abdominal muscles are required for the lay-up and jump shot (r= 0.33 &-0.23<.05). However, specific abdominal strength has significant relationship with the free throw shooting ability (r=0.517>0.05), while specific arm strength was significantly related with the jump shot ability ('r=-0.57>0.05). These results indicated that specific athletic strength harmonized with the technique demanded by the arms for jump shot, and the abdominal muscles for free throw shot is paramount to optimal performance in these shooting styles.

Keywords: *Strength demands, shooting ability, performance, specific athletic strength*

Introduction

Basketball is a modern game, a collective sport, a high intensity game, and dynamic (Marinkovic & Pavlovic, 2013) for optimal performance and success in it. Specific basketball skills which include passing, dribbling, and shooting show little variance among all elite players, yet something separates the great ones from the bench warmers. The level of athletic skill development directly influence the level at which a player performs a specific basketball skills (Brittenham, 2006). Athletic skills include physical traits such as strength, power, speed, quickness, coordination, agility, and endurance. It is in this area of athleticism that a select few perform those same skills at

a higher level and from those select few that legends are made. Simply scoring the highest on these athletic trait does not guarantee that the athletes will be a superior performer during actual competition but been able to harmonize the athletic skills to their sport skill performance to enhance ability. Therefore physical conditioning of athletes in relation to the sport skills is important for enhancing performance, reducing the potential of injury, thus extending the career of players at peak level (Stone & Steingard, 1993). Basketball is a game of continuously changing tempo requiring players to be able to sustain high levels of continuous effort especially in scoring points, which when not made leads to wasted efforts. Manilovic and Erculj (2013) explained that basketball is characterised by many explosive movement such as jumping, running, dunking and rebounding to mention few.

Strength has been defined from several angles. Strength has been viewed as the capacity of the individual to exert muscular force (Barrow & McGee, 1971) or the ability to make use of the needed number of muscle fibres to execute a given task (Uche, 1988). Strength is not only to apply force, but the ability to maximize that force for a well performed physical task like shooting the basketball. Greater strength often results in better performance (Nossek, 1982; Merle & Keteyian, 1998) and there is no physical performance without a factor of strength (Nossek, 1982).

Nossek (1982) recognized the development of general strength and specific strength. According to him, general strength implies versatile strengthening of all the body muscles independent of sports discipline. This enables the athlete to have the in-built long term strength to avoid accidents and also to increase joint stability. Many studies have shown that strength imbalance in muscle groups make athletes prone to injuries. Opatola (1992) explained that strength imbalance, inflexibility at the joints, poor neuromuscular coordination, insufficient muscular bulk and weak ligaments and tendons cause injury due to inadequate fitness; hence the essentiality for basketball players to develop general strength.

Muscular strength have been confirmed and established to be an important aspect of basketball, since the game involves skills that must be applied dynamically, explosively, and the power of legs and hips determine how explosive basketball skills are executed (Stone & Steingard, 1993). Both strength and power training has been consistently shown to improve speed, acceleration and jumping ability (Harris, 2011). However, its contribution to shooting ability has not been well defined.

Arm strength for passing and controlling rebounds and total body strength for maintaining position under the basket are also examples of the importance of strength. In addition, strength is a determinant of speed and agility of the basketball players. Though muscular power and endurance are also essential components of the game, from the practical point of view strength testing is used most commonly to assess muscular fitness of basketball players (Stapff, 2002) but not for shooting ability. Though muscular power and also assessed within and or as part of the physiological laboratory and field tests, but not as part of assessing shooting performance.

Shooting has been known to be the concluding part of the basketball game, therefore is a scoring team always a winning team (Tutmuss, 1989; Walters *et al.*, 1990). This makes this skill very significant and requires that the successful athlete, male or female, to be one who has been training based on scientifically based training management strategy tailored to fit his or her style of shooting for best performance. O.shea, (2000) referred to this type of training as Athletic- type Strength Training.

Athletic-type strength training is the ability to apply optimal muscular force through a full range of multiple joint movements with speed for a set distance or time as required to execute a

specific athletic movement. This is what Nossek (1982) referred to as Specific strength, and this is related to the appropriate sports discipline as required by the various sports movements. This is very essential for basketball shooting. It offers the greater training transfer value biomechanically, physiologically and psychologically to a sport, especially in explosive and dynamic sports like basketball (O.shea, 2000).

Specific strength training needs to be a priority training so as to produce peak performance required for success in basketball. The intrinsic value also is its capacity to duplicate the large muscular and explosive forces required when running, jumping, tackling, throwing or striking (Nossek, 1982; O.Shea, 2000) as found in basketball shooting like the lay-up shot, free throw and the jump shot.

The primary goal of athletic- type strength training is to maximize the development of true genetic potential for strength, speed and power (O.shea, 2000). "How hard your plan works today determines how well you perform tomorrow". Therefore, identifying the type of strength needs of the different basketball shots and with a well planned time schedule and practice will lead to perfecting of the shots for peak performance and delay of fatigue.

This study was carried out in order to identify the strength demand of the lay-up, free throw and the jump shots.

Methods

The participants were the eighteen registered players of the Niger Potters Club of Nigeria. Their age range was between 19 to 26 years, while the mean was 22 years. This was a consistent club both in professional, national and international championships since the 1970s. Bench press was used to test arm-strength, while leg explosive power was tested with the vertical jump. For the shooting ability test the jump shot and free throw shot were measured using one set of 10 shots each, while five shots from either side of the basket for lay-up shot. All measurements were taken at the Niger state gymnasium at Minna, Niger state.

The instruments were validated by the use of content validity. Subjective ratings by the coach were also used to validate the test scores. The strength instrument was also validated with previously validated criteria (Matthews, 1978; Wathen, 1994; Kraemer and Fry, 1995).

Results

Table 1: Mean, SD and r Correlation of Leg Strength Demands and Basketball Shooting

Variable	Mean	S.D	'r'
Leg strength (cm)	48.90	9.97	-
Lay up shot (No)	8.40	1.25	-0.07
Jump shot (No)	6.50	0.76	-0.06
Free throw shot (No)	6.44	1.12	0.03

*Sig.>0.456

The table 1 shows that no insignificant relationships exist between leg strength and lay-up shot (r=.05>-0.07), jump shot(r=.05>-0.06), and free throw shot (r=.05>.03) respectively.

Table 2: Mean, SD and r Correlation of Arm Strength Demands and Basketball Shooting

Variable	Mean	S.D	'r'
Arm strength (kg)	80.83	8.90	
Lay up shot (No)	8.40	1.25	0.18
Jump shot (No)	6.50	0.76	0.57*
Free throw shot (No)	6.44	1.12	0.19

*Sig.>0.456

The table 2 above indicated that only in jump shot was arm strength found to be modestly inversely significant (r =-0.456<0.57); revealing that there was no significant relationship between arm strength and both lay-up(r =.05>0.18) and free throw shots (r=0.05>-0.19) respectively. This established the fact that there is specific athletic strength training essential for optimal performance in jump shot.

Table 3: Mean, SD and r Correlation of Abdominal Strength Demands and Basketball Shooting

Variable	Mean	S.D	'r'
Abdominal strength (sec.s)	67.33	10.26	-
Lay up shot (No)	8.40	1.25	0.33
Jump shot (No)	6.50	0.76	-0.23
Free throw shot (No)	6.44	1.12	0.517*

*Sig.>0.456

The above table 3 revealed that there is no significant relationship between abdominal strength and lay-up (r=0.05>0.33) and jump shot (r=0.05>-0.23) except with the free throw shot (r=0.05<0.517).

Discussion

Table 1 revealed that though general strength fitness is needed in basketball playing ability but not significant in shooting ability of lay-up, jump shot and free throw shots. This indicates that specific training of the leg muscles strength is not demanded by these three types of shots for optimal performance. However, general strength fitness of the legs is essential for athletic fitness. Basketball has become a more physically demanding sport, with an emphasis being placed on movements being performed at high intensity (Bishop, 2007). The power of legs and hips determine how explosive basketball skills are executed (Stone & Steingard 1993). McClay *et al.* (1994) identified a typical list of basketball movements through notational analysis study to include running, cutting, turning, jump shot take-off and landing, lay-up take off and landing and

vertical jump take off and landing essentially used in rebounds and blocking of shots. However, it was not so for shooting ability.

Bishop (2007) concluded in his study that it is possible that the repeated nature of jumping movements and the loads that are being generated during normal play basketball are predisposing players to increased risk of overuse injuries such as patellar tendonitis and stress fractures. Therefore, to prevent overuse injuries, well planned programme for general strength athletic fitness should be included specifically for strengthening the lower limbs of the basketballers. Furthermore, ground reaction forces for jump shot are slightly lower than that of the vertical jump, although the movements are similar in nature (Bishop, 2007). The reason attributed to this, was that during jump shot, the emphasis is on good technique to achieve success and height and this is only important in limited situations. Unlike in rebounds, the players may likely be attempting to generate maximum height. Therefore, specific strength athletic development is not needed for the shots. Hoy & Carter (1988) explained that though the power for the jump shot is provided by the legs, the actions of the arms, wrist, hands and the fingers provides the height, accuracy and direction to the ball. Therefore, there is a particular level of strength training of the arm, harmonized with the skill practice that will ensure a high level of jump shot ability. Since in basketball shooting, the overall performance objective is maximum accuracy of projection (Kreighbaum &Barthels, 1996; Miller, 1998, Malone, 1999), therefore there is a threshold of force that will be needed for particular jump shot depending on the distance from the ring.

In the relationship of abdominal strength with shooting, it was only in free throw any significance was found ($r=0.057$; $p<0.05$), revealing the need for special abdominal strength training simulated after this shot for peak performance. The free throw shot is a closed skill, in which a natural action is established, as the ball is released into the ring, the knee is straightened up with mainly the abdominal muscles contributing significantly to the power for the shot (Titmuss, 1989). According to Alexander (2005), the force producing movements for the free throw shooting begins when the trunk reaches the vertical position and the ball is held just above shoulder level. Finally, to produce upward and forward force to project the ball to the basket, include leg and trunk extension as well as straightening of the shooting arm, thus emphasizing the needs for general and specific strength training for efficient free throw performance.

Injury can result from a single traumatic event when the tissues maximum tolerance is overloaded or through a repeated overload of the tissues fatigue limit leading to an overuse injury (Whiting and Zernicke, 1998). Therefore, general strength training programme should be an integral part of any basketball programme to prepare the muscles to withstand the stress and strain placed on the body. Apple (1988) as reported by Bishop (2007) suggested that strength training should be an integral part of the game of basketball since the players are becoming more taller and stronger, and so making the game more physically demanding. Amiridis *et al*. (1997) as reported by Maffiuletti, *et al.* (2000) also observed that regular basketball practice had no beneficial effect on strength performance, therefore specific athletic strength training programme needs to be planned to develop strength of the basketball players in relation to the demands of the body segments for optimal performance, especially in shooting.

Conclusion

The following conclusions were drawn from this study. The findings in this study suggests that

1. Specific strength of legs does not significantly correlate with lay-up, jump shot and free throw shooting accuracy.
2. Specific arm strength correlated significantly with jump shot only.
3. Abdominal strength significantly correlated with free-throw shot only.

Apart from general strength fitness programme, specific strength training programme should be synchronized with the arm skill practice for jump shot, as well as for the abdominal muscles for free throw shot along with the technical development programme. The core muscles specific strength fitness is essential for the free throw repetitive demands for optimal shooting performance. However, there is a need to undertake more researches to validate the findings of this study.

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