Available online at www.scholarsresearchlibrary.com

Scholars Research Library

Scholars Research Library

European Journal of Sports and Exercise Science, 2014, 3 (2):1-5
(http://scholarsresearchlibrary.com/archive.html)

Scholars Research Library
ISSN: 2278 – 005X

Study of back strength and its correlations among anthropometric variables and performance tests in Inter-university Basketball Players

Shyamal Koley and Ravneet Inder

Department of Sports Medicine and Physiotherapy, Guru Nanak Dev University, Amritsar, Punjab, India
E-mail drkoley@yahoo.co.uk; drskoley@gmail.com

ABSTRACT

3The purpose of this study was of two-fold: first, to estimate the back strength of inter-university basketball players and, second, to search the correlation of it with selected anthropometric variables and performance tests. To serve this purpose, a total of thirteen anthropometric variables, viz. height, weight, BMI, percent body fat, percent lean body mass, biceps and triceps skinfolds, humerus and femur biepicondylar diameters, knee height, femur length, hip circumference and total leg length, and back strength; and three performance tests, viz. vertical jump, sit and reach and standing broad jump were measured on purposely selected 85 inter-university hockey players (44 male and 41 female) aged 18–25 years collected from Inter-university Championship organized in Amritsar and Chandigarh, India. Results indicated significant sex differences in all the variables between them. In conclusion, it may be stated that back strength had some strong positive correlations (p< 0.01) with all the variables studied in elite Indian basketball players.

Keywords: Anthropometric variables. Back strength. Performance tests. Elite Indian basketball players.

INTRODUCTION

Basketball is an aerobic-based anaerobic sport [9,22,23] which requires high intensity activities such as jumping (for rebounds, blocks and shots), turns, dribbles, sprints, screens and low intensity activities such as walking, stopping and jogging. Frequent stoppages in games allow players to recover between bouts of activity, thus allowing repeated high-intensity spells of play [10]. Aerobic capacity is positively associated with recovery during repeated high-intensity bouts [8]. Moreover, the high intensity movements of basketball players are closely related to the development of strength, speed and agility [8,12,22]. During a basketball game, professional players cover about 3500- 5000m [13]. Each player performs about 1000, mainly short, activities lasting around 2 seconds; time motion analysis has shown that these short activities are performed with a different frequency according to the player's position [1]. Explosive strength, take-off power, speed, and agility are abilities that make an important contribution to efficient movement with and without the ball, thus play an important role in basketball technique and tactics [11]. Basketball involves motion in the sagittal, frontal and transverse planes. To be successful player, he/she must be both quick and strong in all three planes for which muscular strength is required. A lack of strength in the transverse and frontal planes may out the player at a higher risk of injury, and limit their capabilities when performing side to side and rotational movements on the court. Strength can be defined as the maximum force which can be exerted against an immovable object (static or isometric strength), the heaviest weight which can be lifted or lowered

(dynamic strength), or the maximal torque which can be developed against a pre-set rate-limiting device (isokinetic strength) [29,25]. Muscular strength, endurance and flexibility are important components of healthy back functions. A number of studies reveal that muscle strength is critical to health and well-being [21,3]. Several external factors, viz. altitude [26], position of exerting strength [28], diet [14] and internal factors, viz. age, sex [20], height, weight [27] etc. influence the maximum force that can be exerted by a muscle [6]. Though the importance of studying back strength is immense, literature related to back strength in basketball players is scanty, especially in Indian context. So the present study was planned. The objectives of the present study were to estimate the back strength of inter-university basketball players, to study the gender differences on the basis of their back strength and to search any association of back strength with selected anthropometric variables and performance tests among them.

MATERIALS AND METHODS

A total of 85 basketball players (44 male and 41 female) aged 18-25 years (mean age for boys was 21.46 ± 1.41 years and for girls was 20.47± 1.67) were considered as samples. These samples were taken purposively from inter-university level competitions organized in Amritsar and Chandigarh, India. The age of the subjects were recorded from the date of birth registered in their respective records submitted to the organizers. The subjects were divided in such a way that age 18 refers to the individuals aged 17 years and 6 months through 18 years and 5 months and 29 days. A written consent was obtained from the subjects. The data were collected under natural environmental conditions in morning (between 8 AM. to 12 noon). The study was approved by the institutional ethical committee.

Back Strength Measurement (BS)

The back strength was measured using back leg- chest dynamometer. The subject was positioned with body erect and knees bent so that grasped-hand rests at proper height. Then straightening the knees and lifting the chain of the dynamometer, pulling force was applied on the handle. The body was inclined forward at an angle of 60 degrees. The strength of the back muscles was recorded on the dial of the dynamometer as the best of three trials in kg. All subjects were tested after 3 minutes of independent warm-up. Thirty seconds time interval was maintained between each back strength testing.

Anthropometric Measurements

Thirteen anthropometric characteristics, viz. height (HT), weight (WT), BMI, hip circumference (HC), percent body fat (%BF), percent lean body mass (%LBM), biceps skinfold (BSK), triceps Skinfold (TSK), humerus biepicondylar diameter (HBED), femur biepicondylar diameter (FBED), knee height (KH), femur length (FL) and total leg length (TLL) were measured on each subject using standard techniques [19] and were measured in triplicate with the median value used as the criterion. The height was recorded during inspiration using a stadiometer (Holtain Ltd., Crymych, Dyfed, UK) to the nearest 0.1 cm. Weight was measured by digital standing scales (Model DS- 410, Seiko, Tokyo, Japan) to the nearest 0.1 kg. BMI was then calculated using the formula weight (kg)/height^2 (m)^2. Hip circumference was measured using a flexible metallic tape (Holtain Ltd). Percent body fat was assessed with standard formula [32]. Percent lean body mass was calculated subtracting percent body fat from 100. Humerus biepicondylar diameter and femur biepicondylar diameter were recorded using sliding caliper in subjects in sitting positions. Knee height, femur length and total leg length were recorded during inspiration using a anthropometer (Holtain Ltd., Crymych, Dyfed, UK) to the nearest 0.1 cm.

Performance Tests

Sit and reach test (S&RT)

The subject was asked to warm up properly and then made to sit on the floor with feet placed against the inner side of the box. With one hand over the other, the tips of the two middle fingers on top of one another, the subject was then asked to slowly stretch forward without bouncing or jerking and slide fingertips along the 20- inch scale as far as possible. The test was repeated thrice and best reading was recorded in inches.

Vertical jump test (VJT)

An adequate warm up with several easy jumps proceeded with a few minutes rest, which also served the purpose of reviewing the jumping technique of the subject. The subject was told to bend the knees immediately prior to the jump which activates the stretch-shortening cycle in the muscles, resulting in greater power production in the legs. The subject was asked to stand with side toward wall and reach up as high as possible keeping the feet flat on the ground to mark the standing reach height. As and when the subject was ready, with color on the distal part of his/her third finger (of right hand), he/she was asked to jump up as high as possible using both arms and legs to assist in

projecting the body upwards and touch the wall at the highest point of the jump. The subject performed multiple attempts with short rests until a plateau or decrease in performance was observed and the best score was recorded in cm. The "net height" was calculated by subtracting the standing reach height from the jump height in cm.

Standing broad jump test (SBJT)

Standing broad jump is a common and easy to administer test of explosive leg power. The subject stood behind a line marked on the ground with feet slightly apart. A two feet take-off and landing was used, with swinging of the arms and bending of the knees to provide forward drive. The subject attempted to jump as far as possible, landing on both feet without falling backwards. Best of longest straight distance score was measured by steel tape and was recorded in cm.

Statistical Analysis

Standard descriptive statistics (mean ± standard deviation) were determined for directly measured and derived variables. Pearson's correlation coefficients were applied to establish the relationships among the variables measured for male and female players. Data were analyzed using SPSS (Statistical Package for Social Science) version 17.0. A 5% level of probability was used to indicate statistical significance.

RESULTS

Descriptive statistics of back strength, selected anthropometric variables and physical performance tests in elite Indian basketball players were shown in Table 1. Male basketball players have higher mean values in all the variables studied, except %BF), BSK and TSKthan their female counterparts. However, statistically significant differences ($p < 0.006 - 0.001$) were found in all the variables, except S&RT. In the present study data from Indian players were not compared as it was done from the same laboratory (Koley and Singh 2010).

Table 2 showed the correlation coefficients of back strength with selected anthropometric variables and physical performance tests in Indian elite basketball players. In male players, back strength had significantly no correlations ($p>0.05$) in any case, whether in female players significantly positive correlations ($p\leq.01$) were found with BMI, %LBM and HC, and significantly negative correlation ($p\leq.01$) with %BF . However, when male and female data was pooled, significantly positive correlations ($p\leq.01$) were found with all the variables studied (except S&RT). Among the anthropometric variables, significantly positive correlations were noted in almost all the variables.

Table1. Descriptive statistics of back strength, selected anthropometric variables and performance tests in inter-university basketball players

Variables	Male basketball players (n=44)		Female basketball players (n=41)		t- value	p- value
	Mean	SD	Mean	SD		
Back strength (kg)	291.410	37.26	123.08	24.64	23.533	0.001
Height(cm)	186.7	1.59	160.9	0.07	17.683	0.001
Weight(kg)	88.44	4.23	54.97	4.53	33.708	0.006
Body mass index (kg/m^2)	25.39	1.26	21.27	1.65	12.399	0.001
% Body fat	21.56	1.69	25.67	2.26	-9.104	0.001
% Lean body mass	78.44	1.69	74.33	2.26	9.104	0.001
Biceps Skinfold (mm)	2. 90	0.09	5.33	2.61	-5.485	0.001
Triceps Skinfold (mm)	10.95	3.98	17.41	3.13	-7.965	0.001
Hum biepicon dia (cm)	7.44	0.52	6.53	0.57	7.113	0.001
Femur biepicon dia (cm)	10.11	1.06	8.91	1.12	4.857	0.001
Knee height (cm)	56.53	3.04	46.69	3.34	13.837	0.001
Femur length (cm)	53.07	1.26	44.34	3.74	13.814	0.001
Hip circumference(cm)	103.23	6.39	93.18	5.56	7.406	0.001
Total leg length (cm)	90.00	2.25	78.52	3.58	16.961	0.001
Sit and reach test (inches)	5.59	5.245	4.08	6.76	1.105	0.237
Vertical jump test (cm)	52.94	5.238	33.77	8.70	11.785	0.001
Standing broad jump test (cm)	198.79	20.485	128.92	14.91	17.223	0.001

Table 2 Correlation coefficient of back strength with selected anthropometric variables and physical performance tests in elite Indian basketball players

Variables	Male players		Female players		Pooled male and female players	
	r value	p value	r value	p value	r value	p value
HT(cm)	0.162	0.325	0.183	0.266	0.839	0.001
WT(kg)	-0.115	0.486	0.110	0.506	0.898	0.001
BMI (kg/m^2)	0.093	0.574	-0.309	0.055	0.749	0.001
% BF	-0.093	0.575	-0.308	0.055	-0.700	0.001
% LBM	0.095	0.572	0.310	0.054	0.699	0.001
BSK (mm)	-0.274	0.092	0.043	0.795	-0.516	0.001
TSK (mm)	0.126	0.446	-0.231	0.156	-0.632	0.001
HBRD (cm)	-0.062	0.707	0.051	0.756	0.589	0.001
FBED (cm)	-0.064	0.699	0.054	0.746	0.452	0.001
KH (cm)	0.248	0.128	0.270	0.096	0.840	0.001
FL (cm)	0.027	0.872	0.025	0.878	0.797	0.001
HC(cm)	0.049	0.765	0.342	0.033	0.648	0.001
TLL (cm)	0.191	0.244	0.201	0.219	0.862	0.001
S&RT (inches)	0.018	0.914	-0.156	0.342	0.098	0.396
VJT (cm)	-0.039	0.814	0.259	0.112	0.776	0.001
SBJT (cm)	-0.078	0.639	-0.058	0.724	0.825	0.001

DISCUSSION

Athletes with poor back muscle endurance are prone to injury [18]. It was also reported that reduced back extensor muscle endurance might be a major risk factor for non-specific low back pain [7,5]. Thus, assessment of back endurance is one of the important preventive measures for sports persons. In the present study, male basketball players have significantly higher mean values in all the variables studied, except percent body fat, biceps and triceps skinfold than their female counterparts. Significant sex differences were noted in the basketball players showing male players predominantly stronger for their back strength. Anatomical, physical and physiological factors might be the reasons for these differences, also more musculature in male cyclists due to presence of testosterone hormone in them. More musculature generates more force in their back region. Differences in mode of training programs in cyclists of these two sexes might be another reason. Due to sexual dimorphism, female basketball players were found to have significantly higher mean values in percent body fat, biceps and triceps skinfold as compared to male players.

In basketball, teams compete by manicures handling the ball above the head, height is considered to be the most important physical attribute. In the present study, the mean height and weight of the male basketball players (186.70 cm, ± 3.59 and 88.44 kg, ± 4.23 respectively) were lesser than the male basketball players of Greece (199.50 cm ± 6.2 and 95.5 kg, ± 8.8 respectively) [14], USA (192.40 cm ± 11.7, 91.9 kg, ± 17.5 respectively) [24], Italy (194.2 cm, ± 6.5 and 94.7 kg, ± 8.7 respectively) [30] and Australia (188.8 cm, ± 7.2 and 82.7 kg, ± 7.3 respectively) [31], while in female players, the mean height and weight (160.90 cm, ± 3.07 and 53.88 kg, ± 7.56 respectively) were lesser than the Greece (174.70 cm, ± 7.8 and 71.50 kg, ± 10.1 respectively) [18] and American (174.20 cm, ± 9.00 and 66.90 kg, ± 5.8 respectively) [24]. In the study, significantly lesser height among the Indian inter-university basketball players might be disadvantageous for them in attaining a good jumping height as their center of gravity would be comparatively lower.

It was also found that back strength had significantly positive correlations ($p \leq .01$) with all the variables studied (except S&RT). Statistically significant correlations were also found among the anthropometric variables themselves (which was obvious). It was reported earlier too, that several anthropometric variables were strongly correlated with back strength in different populations [25,16,17]. In the present study, strong correlations of back strength with all the anthropometric and physical fitness characteristics studied showed structural and physiological affinity towards the back strength. In the present study those anthropometric variables were considered which were not reported earlier for the study of correlations with back strength. The limitations of the study were the small sample size with only inter-university data. More anthropometric variables should be taken into consideration for this purpose in future studies.

CONCLUSION

It might be concluded from the present study that, significant between-group differences ($p \leq 0.001$) were found in all the variables studied between the two sexes of the basketball players. It was also observed that back strength had some strong positive correlations ($p< 0.01$) with all the variables studied (except sit and reach test. The data presented in the study carry immense practical applications and should be useful in future investigation on player selection, talent identification in basketball game and training program development.

REFRENCES

[1] Abdelkrim, N. Fazaa, S. and Ati, J. *British Journal of Sports Medicine,* **2007**, 41:69–75.
[2] Apostolidis, N., Nassis, GP., Bolatoglou, et al. Physiological and technical characteristics of elite young basketball players. *J Sports Med Phys Fitness,* 2004; 44(2): 157- 163.
[3] Astrand, PO. and Rodahl, K. *Textbook of Work Physiology*: *Physiological Cases of Exercise*. 2nd Ed. McGraw-Hill Inc. New York, **1986**.
[4] Bayios, IA., Bergeles, NK. and Apostolidis, NG. *Journal of Sports Medicine and Physical Fitness*, **2006**, 46(2): 271- 280.
[5] Beckman, SM. and Buchanan, TS. *Archives of Physical Medicine and Rehabilitation,* **1995**, 76(12): 1138–1143.
[6] Berne, RM. and Levy, MN. *Physiology* St. Louis, Mo: CV Mosby Co. **1983**.
[7] Biering-Sorensen, FA. *Spine*, 1984, 9: 106-119.
[8] Castagna, C. Abt, G. Manzi, V. Annino, G. Padua, E. and D'ottavio S. *Journal of Strength and Conditioning Research*, **2008**, 22(3):923–929.
[9] Delextrat, A. and Cohen, D. *Journal of Strength and Conditioning Research*, **2009**, 23(7):1974–1981.
[10] Drinkwater, E. Pyne, D. and McKenna, M. *Sports Medicine,* **2008**, 38(7):565–578.
[11] Erculj, F. Blas, M. and Bracic, M. *Journal of Strength and Conditioning Research*, **2010**, 24(11):2970–2978.
[12] Hedrick, A. *National Strength & Conditioning Association Journal*, **1993**, 15:31–35.
[13] Janeira, MA. and Maia, J. *Coaching and Sport Science Journal*, **1998**, 3:26–30.
[14] Keys, A. Brozek, J. Henschel, A. Mickelsen, O. and Tylor, HN. *Biology of Human Starvation*. University of Minnesota Press. Minneapolis, **1950**.
[15] Koley, S. and Singh, J. *Journal of Physical Education and Sport*, **2010**, 28(3): 70-76.
[16] Koley, S., Jha, S. and Sandhu, JS. *The Anthropologist*, **2012b**, 14(4): 359-363.
[17] Koley, S., Kalsi, R and Sandhu, JS. *The Anthropologist*, **2012a**, 14(4): 339-346.
[18] Latiner, J., Maher, CG., Refshauge, K. and Colaco, I. *Spine,* **1999**, 24: 2085-2090.
[19] Lohmann, TG., Roche, AF. and Martorell, R. *Anthropometric Standardization Reference Manual*. Champaign, IL: Human Kinetics Books. **1988**.
[20] Mathiowetz, V., Rennells, C. and Donahoe, L. *Archives for Physical Medicine and Rehabilitation*, **1985**. 66: 69-74.
[21] McDonangh, MJN. and Davies, CTM. *European Journal of Applied Physiology*, **1984**, 5(2): 139-55.
[22] Meckell, Y., Casorla, T. and Eliakim, A. *International Journal of Coaching Science*, **2009**, 3(2):43–56.
[23] Metaxas, T., Koutlianos, N., Sendelides, T. and Mandroukas, A. *Journal of Strength and Conditioning Research*, **2009**, 23(6):1704–1713.
[24] Narazaki, K., Berg, K. and Stergiou, N. *Scandanevian Journal of Medical Science and Sports*, **2008**.
[25] Roy, SK. and Pal, B. *International Journal of Anthropology*, **2001**, 16: 263-73.
[26] Ruff, S. and Strughhold, H. *Compendium of Aviation Medicine*. WADA Technical Report 14. OH. Wright Air Development Centre, Air Research and Development Command. United States Air Force, **1942**, pp.32-34.
[27] Schmidt, RT. and Toews, J.. *Archives of Physical Medicine and Rehabilitation,* **1970**. 51:321-327.
[28] Teraoka T. *Kobe Journal of Medical Scienc,* **1979**, 25:1-17.
[29] Thompson, LV. *Physical Thermodynamics*, **1994**, 94: 71
[30] Viviani F. *Journal of Sports Medicine and Physical Fitness,* **1994**; 34(1): 70- 75.
[31] Withers, RT., Roberts, GD. and Davies, GJ. *Journal of Sports Medicine and Physical Fitness*, **1977,** 17(4): 391-400.
[32] Womersely, J. and Durnin, JUGA. *British Journal of Nutrition*, **1977**, 38:271-284.