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EFFECTS OF KETTLEBELL SWING AND HIP THRUST TRAINING ON STRENGTH AND POWER IN RECREATIONAL ATHLETES

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Abstract

Background: Lumbo-pelvic control and flexibility of body parts enhances peak performance and prevents musculoskeletal injury.Kettlebell training and Hip thrustexercise are emerging strength training methodsforimprovingcore and hip strengthtoincreasevertical jump and standing long jump capacity in athletes. The study aims to compare the effects of kettlebell swing and hip thrust exercise on strength and power performance in recreational athletes. **Method:**Thirty recreational athletes were randomly allocated to kettlebell swing (group A) and hip thrust group (group B).Strength and power performance were assessed before and aftersix weeks of training using vertical jump height (VJH) and standing long jump test(SLJ), respectively. **Results:**'t' is significant in both groups. The mean percentage increase in the vertical jump is more significant in group B,and the percentage increase inthe Standing long jump is similar in both groups. **Conclusion:**Both kettlebell swing and hip thrust training are effective in increasing strength and power performance. The hip thrust is more effective than the kettlebell swing in improving strength in recreational athletes.

Keywords:Kettlebell swing, hip thrust, vertical jump height, standing long jump test.

Introduction

The hip joint is the strongest joint in the human body. The hip joint canstabilise forces through its full range of motion. This plays a significant role in executing everyday activities such as standing upright, maintaining a proper gait pattern, rising from a chair, and lifting weight from a squatting position.[1]

The stability of the joint is provided by joint capsules, muscles, and ligaments around the joint. HipMuscle strength, especially gluteus maximus, knee muscles strength,and a strong core areessentialfor sports performance and injury prevention in athletes.[2]

Sport and recreational activity have been essentialin recent years,and participation in recreational physical activity is extensivelyhyped as part of a healthy lifestyle.[3]

In general, the athletes need to bring on high power outputs in a sport, making them successful in competition. Thishigh-speed movement is called explosive movement. Explosive movements involve sprinting, quick changes of direction, jumping, kicking, throwing, squatting, etc. Those are common in sports such as basketball, football, hockey, tennis, boxing, wrestling, golf, track & field, and weightlifting. These sports require explosive power and strength.[4]

Sports medicine and rehabilitation emphasise that physical fitness in injury prevention is more important.Muscle strength plays a vital role in lower limb biomechanics especiallyanterior cruciate ligament injury.[5]Therefore, Preseason conditioning ought to be organised astutely to enhance performance, and targeted conditioning may help to prevent knee damage [6]

Hip hinge exercises are one of the exercises whichimprove lower body quick force production.Several training for enhancing the rate of force production within the hip hinge pattern exists, but kettlebell training has received popularity in recent years. It was found that Kettlebell training improves squat strength and explosive performance. It is hip extension exercise[7] and reduces musculoskeletal pain symptoms and also stated that "kettlebell swing activated the hamstrings muscles at high degrees of hip flexion".[8] Hip thrust (HT) exercise, a type of hip hinge exercise, is becoming an extensively knownstrength training method to enhance hip extension strength.[9]The barbell hip thrustis a loaded bridging exercise. It may efficiently enhance horizontal force production. It was stated that "HT exercises activated the gluteus maximus and biceps femoris than back squat exercise".[10]

None of the studies compared kettlebell training with hip thrust exercise to the best of our knowledge. Hence this study aimed to compare those two training methods on lower extremities strength and power performance in recreational athletes.

Methods

The study design was an experimental study.A total of30 Recreationally resistant trained male athletesaged 18 to 25 were selected using a convenient sampling method. Written informed

consent was obtained from all the participants. They were randomly assigned into two training groups(1:1) through the drawing lots method. The athletes included were moderately trained with at least two years of experience in any sports, those who passed the physical activity readiness questionnaire, those who had at least one year experience of performing squat movement, those who had 3 Repetition Maximum Hip strength testing, those who had normal ECG report, were included in this study. The exclusion criteria were Musculoskeletal injuries in the past year, Cardiorespiratory conditions, Bodybuilders, and Systemic illness.

Procedure

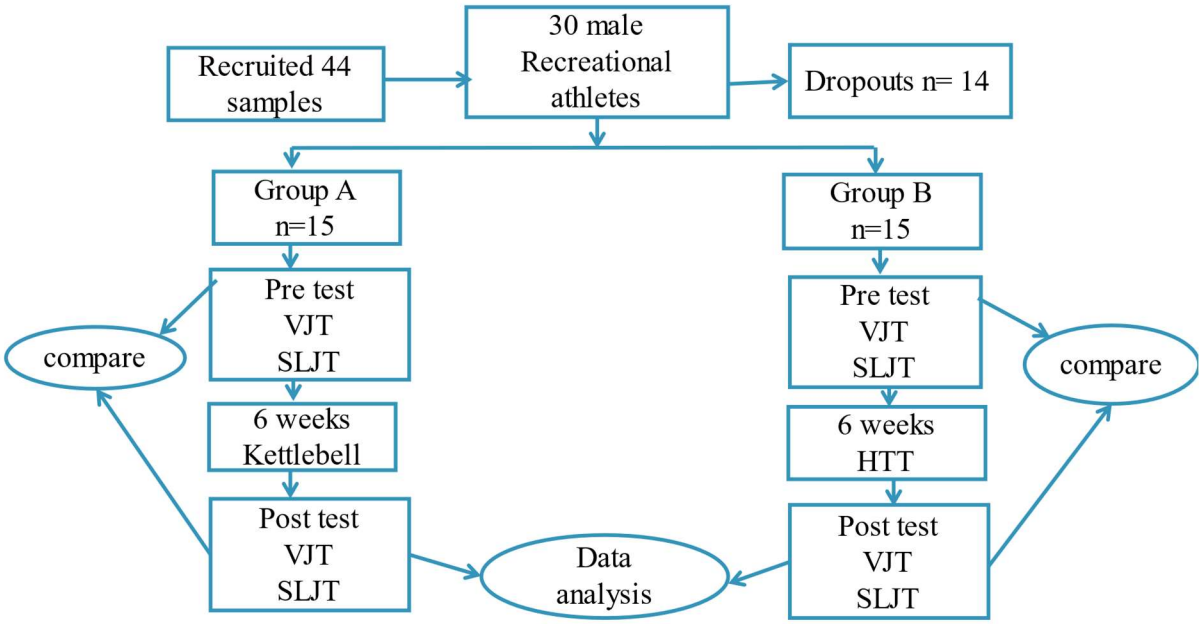
The exercises were demonstrated by a certified strength training coach,starting with how to hinge and swing the kettlebell properly and how to do Hip Thrust movements accurately. Once they were well acquainted with the training methods, they were instructed to do 5 minutes of warm-up stretching exercises before the testing procedure.The vertical jump test and standing long jump test were used to measure strength and power, respectively. They were instructed to do the training for six weeks. Again, the testing procedure was repeated after the 6-week training program.

Vertical jump test(VJT)[18]

To test the vertical jump height, participants dipped their right middle finger into the blue chalk powder and stood next to the wall with theirfeet flat on the ground. With the arm fully abducted, they marked over the wall at the highest reachable point. Then they were instructed to flex the lower limbs freely and jump as high as possible to mark the maximum reachable point. The distance between the two marking points was recorded.

Standing long jump(SLJ)[22]

To start the test, subjects were asked to stand on the starting line with their legs parallel and feet shoulder-width apart. Participants were instructed to bend their knees (the depth of the flexion was self-selected) and bring their arms behind the body. Then, with a powerful drive, they should extend their legs, move their arms forward and jump as far as possible.The distance jumped was measured in centimetres.



Kettlebell swing protocol[11]

Before the training session, the participants were instructed to do warm-up stretching exercises. Initially, training started with an unweighted swing, then progressed to a two-handed 4 kg kettlebell swing, then to one-handed 4 kg, then weights were increased to8kg, and so on. Repetitions were done for ten sets of 60 seconds work with a rest period of 60 seconds(1:1). The duration of the workout was 20 minutes, followed bythree days per week.

Hip thrust training protocol

This protocol was framed according to the guidelines given by the American College of Sports Medicine and based on Kun-Han Lin's 2017[16] protocol. After performing 5 minutes warm-up session, the participants were asked to do pelvic bridging exercises before starting the training. They were taught to maintain good control of hip-dominated movements. Their 3RM was tested, and then six weeks of hip thrust protocol were followed.

Week	1	2	3	4	5	6
Load (3RM)	50%	55%	60%	65%	70%	75%
Repetitions	15	12	12	10	10	8
Sets	4	4	4	4	4	4
Rest (min)	1	1	1.5	1.5	2	2

Data analysis

The data were analyzedby using descriptive and inferential statistics. Pre and post-values were compared within the group, and percentage increases were compared between groups.

1.Vertical jump(VJ)pre-testand post-testcomparison in group A

Descriptive Statistics

Variable	Mean	Std Dev.	Std Err	Lower 95% CL	Upper 95% CL	N
post test VJ (cm)gp A	**52.267**	**3.081**	**0.796**	50.560	53.973	15
pre test VJ (cm)gp A	**51.267**	**3.240**	**0.836**	49.473	53.061	15

1-tailed t-Test (post test VJ gp A > pre test VJ gp A)

Ho. Diff	Mean Diff.	SE Diff.	't' value	DF	'p' value
0.000	1.000	0.138	**7.246**	**14**	**'p' < 0.01**

2. Vertical jump(VJ)pre-test and post-testcomparison in group B

Descriptive Statistics

Variable	Mean	Std Dev.	Std Err	Lower 95% CL	Upper 95% CL	N
post test VJ (cm)gp B	**54.267**	**3.411**	**0.881**	52.377	56.156	15
pre test VJ (cm)gp B	**52.467**	**3.482**	**0.899**	50.538	54.395	15

1-tailed t-Test (post test VJ gp B > pre test VJ gp B)

Ho. Diff	Mean Diff.	SE Diff.	't' value	DF	'p' value
0.000	1.800	0.200	9.000	14	**'p' < 0.01**

3.Percentage increase Vertical jump(VJ) in group A and Group B comparison

Descriptive Statistics

Variable	Mean	Std Dev.	Std Err	Lower 95% CL	Upper 95% CL	N
% increase VJ gp B	3.463	1.563	0.403	2.598	4.328	15
% increase VJ gp A	1.982	1.124	0.290	1.359	2.605	15

1-tailed t-Test (% increase VJ gp B > % increase VJ gp A)

Ho. Diff	Mean Diff.	SE Diff.	't' value	DF	'p' value
0.000	1.481	0.497	2.979	28	**'p' < 0.01**

4.Standing long jump(SLJ) pre-test and post-test comparison in group A

Descriptive Statistics

Variable	Mean	Std Dev.	Std Err	Lower 95% CL	Upper 95% CL	N
post test SLJ (cm) gp A	**224.200**	**10.199**	**2.633**	218.552	229.848	15
pre test SLJ (cm)gp A	**218.800**	**9.697**	**2.504**	213.430	224.170	15

1-tailed t-Test (post test SLJ gp A > pre test SLJ gp A)

Ho. Diff	Mean Diff.	SE Diff.	't' value	DF	'p' value
0.000	5.400	0.363	14.895	14	**'p' < 0.01**

5.Standing long jump(SLJ) pre-test and post-test comparison in group B

Descriptive Statistics

Variable	Mean	Std Dev.	Std Err	Lower 95% CL	Upper 95% CL	N
post test SLJ (cm)gp B	**223.667**	**11.776**	**3.040**	217.146	230.188	15
pre test SLJ (cm)gp B	**219.067**	**11.973**	**3.091**	212.436	225.697	15

1-tailed t-Test (post test SLJ gp B > pre test SLJ gp B)

Ho. Diff	Mean Diff.	SE Diff.	't' value	DF	'p' value
0.000	4.600	0.289	15.890	14	**'p' < 0.01**

6.Percentage increase in Standing long jump(SLJ) in group A and Group B comparison

Descriptive Statistics

Variable	Mean	Std Dev.	Std Err	Lower 95% CL	Upper 95% CL	N
% increase SLJ gp B	**2.111**	**0.549**	**0.142**	1.807	2.415	15
% increase SLJ gp A	**2.464**	**0.625**	**0.161**	2.118	2.810	15

1-tailed t-Test (% increase SLJ gp B > % increase SLJ gp A)

Ho. Diff	Mean Diff.	SE Diff.	T	DF	P
0.000	-0.353	0.215	-1.645	28.000	0.944

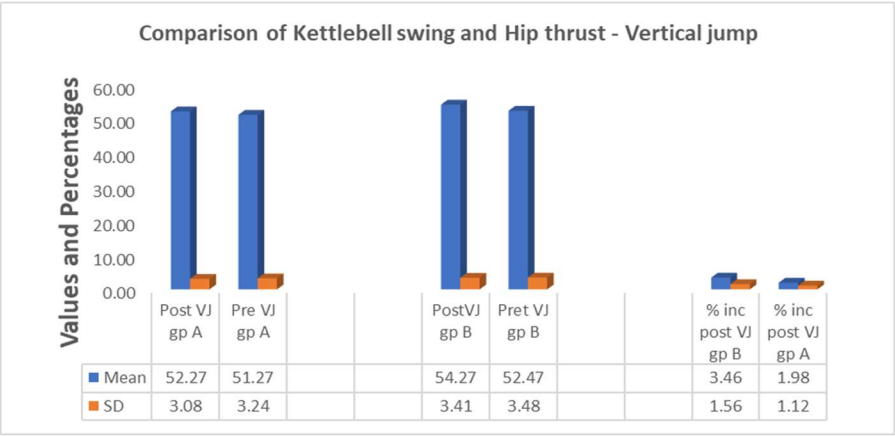


Figure-1comparison of group A and group B vertical jump test values

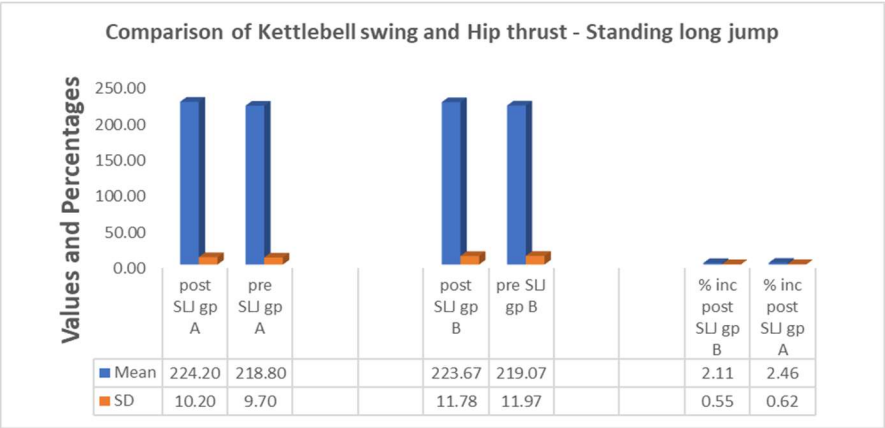


Figure-2 comparison of group A and group B Standing long jump test values

Results

In figure 1, it was shown that the meanpre-value of the vertical jump test in group A was 51.27(3.24) cm,and the mean post-test value of the vertical jump test in group A was 52.27(3.08) cm. Group B'spre-value mean was 52.47(3.48) cm,and group B'spost-test value mean was 54.27(3.41) cm.

Both were statistically significant, with the p-value< 0.01. when comparing the percentage increase of the vertical jump test between group A and group B, the mean values were more significant in group B than in group A.

In figure 2, it was shown that the mean pre-value of the standing long jump test in group A was 218.80(9.70) cm, and the mean post-test value of the vertical jump test in group A was 224.20(10.20) cm. Group B'spre-value mean was 219.07(11.97) cm, and group B'spost-test value mean was 223.67(11.78) cm. 't' values were significant in both the groups with the p-value< 0.01. The mean percentage increase in group B post values was greater than in group A. It was not statistically significant. Both groups had similar effects.

Discussion

After six weeks of training, the vertical jump test and standing long jump test values were increased in both the kettlebell and hip thrust training groups.This study agrees with the study done by Hill, 1938; Kaneko et al., 1983[12,13]mentioned that the speed of movement during the kettlebell swing might be more specific to athletic movements,which makes it an ideal exercise for explosive strength development.[24,25]Velocity-specific resistance training of the hip hinge movement can lead to increases in performance, such as the vertical jump[14]. The velocity of training and load lifted is highly correlated with the development of strength and power[15]. This study's results showthat significant changes in strength and power depend on the velocity of training. The mean percentage

increase in the vertical jump test was 1.98(1.12) %in group A and 3.46(1.56) % in group B. Hence, lower body strength is increased in the Hip thrust training group than kettlebell swing group.According to Kun-Han Lin 2017,"performing hip extension exercises regularly facilitates squat strength and explosive performance. Explosive exercises tend to enhance an athlete's ability to generate high rates of force development"[16].Hip thrust exercise activates hip extensors majorly[9]. This study correlates well with the present study—moreover, the standing long jump test increases in groups A and B. The mean percentage increase in SLJ was 2.46(0.62) %in group A and 2.11(0.55) % in group B. It was not statistically significant. It shows that both groups had a similar effect in increasing lower body power.G. Gregory Haff 2001 stated, "training at high force level results stiffer response of the muscle-tendon unit. So, its contribution to the increased explosive force is questionable but may have important implications for injury prevention"[23].Explosive exercises appear to be a safe means of increasing sports performance. These lifts stimulate neuromuscular adaptations, which may result in improved sports performance[4]

Conclusion

Bothkettlebell swing and hip thrust are effective in increasing lower body strength and power performance, whereas Hip thrust training is more effective in increasing explosive strength in recreational athletes. Hence, Strength training professionals can utilize both the kettlebell swing and hip thrust training to improvethe lower extremities' power and strength.

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References

1. Glenister R, Sharma S. Anatomy, bony pelvis and lower limb, hip. InStatPearls [Internet] 2021 Jul 26. StatPearls Publishing.
2. Contreras B, Vigotsky AD, Schoenfeld BJ, Beardsley C, Cronin J. A Comparison of Gluteus Maximus, Biceps Femoris, and Vastus Lateralis Electromyographic Activity in the Back Squat and Barbell Hip Thrust Exercises. J ApplBiomech. 2015 Dec;31(6):452-8. doi: 10.1123/jab.2014-0301. Epub 2015 Jul 24. PMID: 26214739.
3. Marshall SW, GuskiewiczKMSports and recreational injury: the hidden cost of a healthy lifestyleInjury Prevention 2003;9:100-102.
4. Haff, Guy Gregory, Adrian L. Whitley and Jeffery A. Potteiger. "A Brief Review: Explosive Exercises and Sports Performance." Strength and Conditioning Journal 23 (2001): 13.
5. Herman, Daniel &Weinhold, Paul &Guskiewicz, Kevin & Garrett, William & Yu, Bing & Padua, Darin. (2008). The Effects of Strength Training on the Lower Extremity

Biomechanics of Female Recreational Athletes During a Stop-Jump Task. The American journal of sports medicine. 36. 733-40. 10.1177/0363546507311602.

6. Thacker SB, Stroup DF, Branche CM, Gilchrist J, Goodman RA, Porter Kelling E. Prevention of knee injuries in sports. A systematic review of the literature. J Sports Med Phys Fitness. 2003 Jun;43(2):165-79. PMID: 12853898.
7. Lake, Jason & Lauder, Mike. (2012). Kettlebell Swing Training Improves Maximal and Explosive Strength. Journal of strength and conditioning research / National Strength & Conditioning Association. 26. 2228-33. 10.1519/JSC.0b013e31825c2c9b.
8. Zebis MK, Skotte J, Andersen CH, Mortensen P, Petersen HH, Viskaer TC, Jensen TL, Bencke J, Andersen LL. Kettlebell swing targets semitendinosus and supine leg curl targets biceps femoris: an EMG study with rehabilitation implications. Br J Sports Med. 2013 Dec;47(18):1192-8. doi: 10.1136/bjsports-2011-090281. Epub 2012 Jun 26. PMID: 22736206.
9. Neto WK, Vieira TL, Gama EF. Barbell Hip Thrust, Muscular Activation and Performance: A Systematic Review. J Sports Sci Med. 2019 Jun 1;18(2):198-206. PMID: 31191088; PMCID: PMC6544005.
10. Contreras, Bret & Cronin, John & Schoenfeld, Brad. (2011). Barbell Hip Thrust. Strength & Conditioning Journal. 33. 58-61. 10.1519/SSC.0b013e31822fa09d.
11. Jay K, Frisch D, Hansen K, Zebis MK, Andersen CH, Mortensen OS, Andersen LL. Kettlebell training for musculoskeletal and cardiovascular health: a randomized controlled trial. Scand J Work Environ Health. 2011 May;37(3):196-203. doi: 10.5271/sjweh.3136. Epub 2010 Nov 25. PMID: 21107513.
12. Kaneko M, Fuchimoto T, Toji H, Suei K (1983) Training effect of different loads on the force-velocity relationship and mechanical power output in human muscle. Scand J Sports Sci 5:50–55
13. Hill AV (1938) The heat of shortening and the dynamic constants of muscle. Proc R Soc Lond [Biol] 126:136–195
14. Adams, O'Shea, O'Shea, &Climstein, 1992, the effect of six weeks of squat,plyometric, squat- plyometric training on power production, journal of applied sports science research, vol 6, no.1, pp-36-41
15. McBride JM, Triplett-McBride T, Davie A, Newton RU. The effect of heavy- vs. light-load jump squats on the development of strength, power, and speed. J Strength Cond Res. 2002 Feb;16(1):75-82. PMID: 11834109.
16. Lin, Kun-Han, Chih-Min Wu, Yi-Ming Huang and Zong Yan Cai. “Effects of Hip Thrust Training on the Strength and Power Performance in Collegiate Baseball Players.” Journal of Sports Sciences 5 (2017): n. pag.
17. De Salles, P. G., Vasconcellos, F. V., de Salles, G. F., Fonseca, R. T., & Dantas, E. H. (2012). Validity and reproducibility of the sargent jump test in the assessment of explosive

strength in soccer players. Journal of human kinetics, 33, 115–121. https://doi.org/10.2478/v10078-012-0050-4

18. Carlson K, Magnusen M, Walters P. Effect of various training modalities on vertical jump. Res Sports Med. 2009;17(2):84-94. doi: 10.1080/15438620902900351. PMID: 19479627.
19. Eckert, Ryan &Snarr, Ronald. (2016). Kettlebell Training: A Brief Review. Journal of Sport and Human Performance. 4. 1-10.
20. Elbadry N, Alin L, Cristian P. Effect of kettlebells training on certain physical variables and performance level of hammer throw for female college students. Ovidius University Annals, Series Physical Education & Sport/Science, Movement & Health. 2018 Jun 1;18(2):172-8.
21. Aragón-Vargas, Luis. (2000). Evaluation of Four Vertical Jump Tests: Methodology, Reliability, Validity, and Accuracy. Measurement in Physical Education and Exercise Science. 4. 215-228. 10.1207/S15327841MPEE0404_2.
22. Krishnan, Anup et al. "Comparison between Standing Broad Jump test and Wingate test for assessing lower limb anaerobic power in elite sportsmen." Medical journal, Armed Forces India vol. 73,2 (2017): 140-145. doi:10.1016/j.mjafi.2016.11.003
23. Michaud, Florian, Manuel Pérez Soto, Urbano Lugrís, and Javier Cuadrado. 2021. "Lower Back Injury Prevention and Sensitization of Hip Hinge with Neutral Spine Using Wearable Sensors during Lifting Exercises" Sensors 21, no. 16: 5487. https://doi.org/10.3390/s21165487
24. Maulit, Matthew R., David C. Archer, Whitney D. Leyva, Cameron N. Munger, Megan A. Wong, Lee E. Brown, Jared W. Coburn, & Andrew J. Galpin. "Effects of Kettlebell Swing vs. Explosive Deadlift Training on Strength and Power." International Journal of Kinesiology and Sports Science [Online], 5.1 (2017): 1-7. Web. 2 May. 2022
25. Manocchia, Pasquale & Spierer, David & Lufkin, Adrienne &Minichiello, Jacqueline & Castro, Jessica. (2012). Transference of Kettlebell Training to Strength, Power, and Endurance. Journal of strength and conditioning research / National Strength & Conditioning Association. 27. 10.1519/JSC.0b013e31825770fe.
26. Indahwati, Nanik, and Kolektus Ristanto. "The application of pettlep imagery exercise to competitive anxiety and concentration in Surabaya archery athletes." *International Journal of Educational Science and Research (IJESR)* 6.3 (2016). The Application of PETTLEP Imagery Exercise to Competitive Anxiety and Concentration in Surabaya Archery Athletes International Journal of Educational Science and Research
27. Ozturk, Mehmet, and Ehsan Rahimi Alishah. "Examination of Knee Osteoarthritis in Retired Professional Athletes and Nonathletic Individuals." *International Journal of General Medicine and Pharmacy (IJGMP)* 7 (2018): 1-10. International Journal of General Medicine and Pharmacy(IJGMP) https://www.iaset.us/search?sname=athletes&stype=2&jtype=2&submit=Search