International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

Original Research Article

Relationship between Core Stability and Physical Activity in Young Adults

Dr Prachi Kapdule[1], Dr Titiksha Pol[2]

[1]B.P.Th, D.Y Patil University, School of Physiotherapy, Nerul, Navi-Mumbai, Maharashtra
[2]M.P.Th, Cardio-pulmonary, Department of Cardio-pulmonary,
Assistant Professor, D.Y Patil deemed to be University, School of Physiotherapy, Nerul, Navi-Mumbai, Maharashtra

Corresponding Author: Dr Titiksha Pol

ABSTRACT

The word 'core-stability' refers to a person's ability to stabilize their core. It is an ability to control position and movement of core, while Physical activity refers to any movement produced by skeletal muscles that increases energy expenditure above basal level. The ability of core to maintain control of body and movements can be contributing to the ability to have greater physical activity and vice versa thus aim of this study was to find out Association between Core-stability and Physical activity in Young Adults.

Methodology: A cross-sectional study was conducted on 110 Young Individuals by distributing an International Physical Activity Questionnaire (IPAQ) to determine the level of physical activity. Stabiliser's Pressure biofeedback Unit was used to assess the core stability of transverse abdominis muscle. Core stability was graded using the Sahrmann Core-stability test.

Result: Among the 110 individuals who participated in the study, 67 were females and 43 were males. Using the Chi-square test we observed significant association between physical activity level and core-stability level with 'p' value of 0.025. Significant association between physical activity level and core-stability in males was seen with 'p' value of 0.009 whereas insignificant association between physical activity level and core-stability was observed in females with p value of 0.466.

Conclusion: This study concluded that there was significant association between core stability and physical activity in young adults. Males had good association of core-stability with physical activity as compared to females.

Keywords: Core-stability, Physical activity, International physical activity questionnaire (IPAQ), Pressure bio-feedback unit.

INTRODUCTION

The anatomical core is defined as, "the axial skeleton (which includes the pelvic girdle and shoulder girdles) and all soft tissues (i.e., articular and fibro-cartilage, ligaments, tendons, muscle, and fascia).[1] The word 'core-stability' refers to a person's ability to stabilize their core. It is an ability to control the position and movement of the core. Thus, if a person has greater core stability, they tend to have a greater level of control over the position and movement of this area of the body. The major muscles involved in core stability include the pelvic floor muscles, transversus abdominis, multifidus, internal and external obliques, rectus abdominis, erector spinae especially the longissimus thoracis, and the diaphragm. Core stability plays a crucial part in proper load balance within the spine, pelvis, and kinetic chain, it has become a fitness trend.[2]

Core- Stability plays an important role in the elderly and individuals with disabilities, not only in maintaining an upright body posture, but even to help change positions when sitting, standing, and walking. In sports performances, core strength plays a crucial role to improve body balance and postural control in movements such as landing and contact.[3] As stated by Shih-Lin Hsu, 'Core training excluding the diaphragm for elderly individuals might help them to improve their balance ability'.[3] The importance and contributions of core stability in human movement in producing efficient trunk and limb actions for the generation, transfer, and control of forces or energy during integrated kinetic chain activities have recently been shown.[4] Considerable amount of attention is now been given to improve core strength and stability for improving fitness performance and prevent injury in various activities.[5,6] McGill stated that, 'Several contributions of each muscle continually changes throughout a task, such that discussion of the most important stabilizing muscle is restricted to a transient instant in time'. Core stability is a vigorous concept that keeps changing to meet postural changes or external loads accepted by the body. This suggests that to improve core stability, exercises must be done that simulate the movement patterns of a given sport.[7]

Physical activity refers to any movement produced by skeletal muscles that increases energy expenditure above a basal level. It can be divided into two main categories. One is exercise that involves structured and repetitive bodily movements and the other is non-exercise physical activity such as standing, occupational work. Both exercise and non-exercise physical activity is further classified by the level of intensity: light, moderate and vigorous. Different types of physical activity confer different health benefits.[8] Becoming more active is considered beneficial for most people.[9] Sedentary lifestyle and diseases associated with it are increasing in our communities.[10] Higher levels of physical activity and exercise are associated with lower risk of non-communicable diseases (NCDs), such as cardiovascular diseases and cancer.[11] An understanding of correlates and determinants of physical activity, especially in countries of low and middle income, can help reduce the effect of future epidemics of inactivity and contribute to global prevention of non-communicable diseases.[12] As stated by James F. Sallis, there are less documented articles about benefits of physical activity in youth. In recent times Reviewers have identified acceptable positive effects in the young population for health outcomes such as aerobic fitness, blood lipids, blood pressure, body composition, glucose metabolism, skeletal health, and psychological health.[13]

A systematic review is required for strength and conditioning specialists to help plan the types of physical fitness exercises that will be most effective for improving core strength and stability.[14] During the last decade, the roles of a physical therapist, personal trainer, and strength and conditioning coach have tremendously increased.[7] Thus, the purpose of this study was to find an association between core stability of transverse abdominis and physical activity levels in young individuals.

Aims and Objectives

Aims: To find out Association between Core-stability and Physical activity in Young Adults.

Objectives:

1. Relationship between core-stability with physical activity level
2. a) Relationship of core stability with physical activity levels in males
   b) Relationship of core stability with physical activity in females
3. Relationship between ability to hold core contractions (plank in seconds) with Physical activity

METHODOLOGY

1. Research approach: Prospective study

2. Study design: cross-sectional study design
3. Duration of study: 6 months
4. Sample size: 110 young individuals
5. Materials used: a) International Physical Activity Questionnaire
b) Stabilizer's Pressure Biofeedback unit
6. Inclusion criteria: a) Young adults from 18-28 years of age
b) Males and females
7. Exclusion criteria: a) Young adults with any pre-existing or chronic musculoskeletal, neurological or cardiopulmonary conditions
b) Acute low-back pain, strain, pelvic fractures, lower limb fractures, any lower-limb deformity

METHOD

Subjects were selected according to the inclusion criteria.

A study was conducted by distributing an International physical activity questionnaire (Criterion validity median rho of 0.30) among 110 individuals according to the inclusion criteria aimed to get information regarding the physical activity of the young individuals and were assessed by categorizing participants into insufficiently active(low), sufficiently active(moderate), and highly active based on their IPAQ score.[15] A verbal consent was taken from the individuals participating in the study prior assessing them.

Stabiliser's Pressure biofeedback Unit ($r=0.2$, $p<0.20$)[16] was used in order to assess the core stability of transverse abdominis (able or unable to maintain pressure of 40 ± 5 mmHg) and was graded using the Sahrmann Core-stability test[17]

Level 1: Begin in supine, crook-lying position while abdominal hallowing. Slowly raise 1 leg to 100° hip flexion with comfortable knee flexion. Opposite leg brought up to same position

Level 2: From hip-flexed position, slowly lower 1 leg until heel contacts ground. Slide out leg to fully extend the knee. Return to starting flexed position

Level 3: From hip-flexed position, slowly lower 1 leg until heel is 12cm above ground. Slide out leg to fully extend the knee. Return to starting flexed position

Level 4: From hip-flexed position, slowly lower both legs until heel contacts ground. Slide out legs to fully extend the knees. Return to starting flexed position

Level 5: From hip-flexed position, slowly lower both legs until heels 12cm above ground. Slide out legs to fully extend the knees. Return to starting flexed position.

The data obtained was analyzed according to statistical tests to obtain results

Statistical Analysis and Results

The Data collected from the study was analysed using appropriate statistical test using SPSS version 23 software.

Core-stability was measured using the Sahrmann classification. For statistical purposes the levels were categorized as:

Poor:
Absent
Able to maintain crook lying position while maintaining Transverse abdominis contraction slowly raise 1 leg to 100 of hip flexion with comfortable knee flexion

Moderate:
Able to maintain crook lying position while maintaining Transverse abdominis contraction slowly raise 1 leg to 100 of hip flexion with comfortable knee flexion
Able to slowly lower 1 leg from hip-flexed position until heel contacts ground, slide out leg to fully extend the knee
Able to slowly lower 1 leg from hip-flexed position until heel is 12cm above the ground, slide out leg to fully extend knees

Good and above:
Able to maintain crook lying position while maintaining Transverse abdominis contraction slowly raise 1 leg to 100 of hip flexion with comfortable knee flexion

Able to slowly lower 1 leg from hip-flexed position until heel contacts ground, slide out leg to fully extend the knee

3-Able to slowly lower 1 leg from hip-flexed position until heel is 12cm above the ground, slide out leg to fully extend knees
4-Able to slowly lower both legs from hip-flexed position until heel contacts ground, slide out both the legs
5-Able to slowly lower both legs from hip flexed position until heels are 12cm above the ground, slide out legs to fully extend the knees as 'Good and above'

Table no.1: Association between Physical Activity and Core Stability Cross tabulation

Physical Activity		Core Stability cat				
		Absent (0)	Poor	Moderate	Good & Above	Total
Low	Count	3	19	11	6	39
	% within Physical act	7.7%	48.7%	28.2%	15.4%	100.0%
	% within CoreStability cat	25.0%	46.3%	42.3%	19.4%	35.5%
Moderate	Count	6	15	7	8	36
	% within Physical act	16.7%	41.7%	19.4%	22.2%	100.0%
	% within CoreStability cat	50.0%	36.6%	26.9%	25.8%	32.7%
High	Count	3	7	8	17	35
	% within Physical act	8.6%	20.0%	22.9%	48.6%	100.0%
	% within CoreStability cat	25.0%	17.1%	30.8%	54.8%	31.8%
Total	Count	12	41	26	31	110
	% within PhysicalActivity	10.9%	37.3%	23.6%	28.2%	100.0%
	% within CoreStabilitycat	100.0%	100.0%	100.0%	100.0%	100.0%

Table no. 2: Chi-Square Tests

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	14.502[a]	6	.025

Inference: In table no.1 we observed 6(15.4%) cases of low physical activity with good and above core-stability level, In moderate physical activity we observed 8 cases (22.2%) and in high physical activity 17cases (48.6%) having good and above core-stability level. On the contrary the proportionality of poor or below is higher in low physical activity group compared to moderate and high physical activity.
In table 2 using the Chi-square test we observed significant association between physical activity level and core-stability level with a 'p' value of 0.025

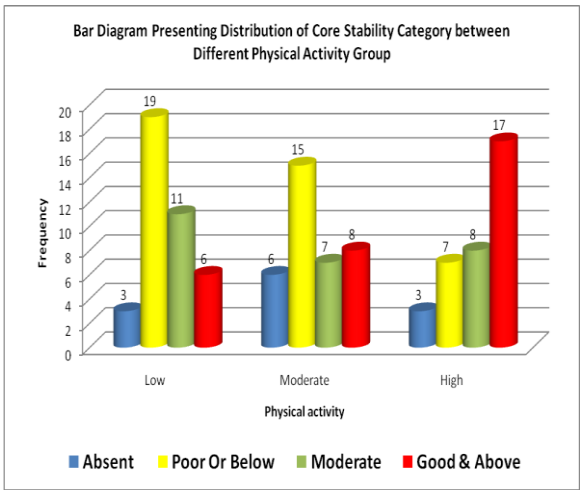

Fig 1: Distribution of core-stability between different physical activity group

Inference: Maximum no. of people from low(19) and moderate(15) physical activity group had poor core-stability whereas maximum no. of people from high(17) physical activity group had good core-stability

Table no. 3. Association between Core-stability and Physical activity in Male group

Physical Activity		Core Stability cat				
		Absent (0)	Poor Or Below	Moderate	Good & Above	Total
Low	Count	1	8	2	2	13
	% within Physical act	7.7%	61.5%	15.4%	15.4%	100.0%
	% within CoreStability cat	16.7%	53.3%	40.0%	11.8%	30.2%
Moderate	Count	2	4	1	0	7
	% within Physical act	28.6%	57.1%	14.3%	.0%	100.0%
	% within CoreStability cat	33.3%	26.7%	20.0%	.0%	16.3%
High	Count	3	3	2	15	23
	% within Physical act	13.0%	13.0%	8.7%	65.2%	100.0%
	% within CoreStability cat	50.0%	20.0%	40.0%	88.2%	53.5%
Total	Count	6	15	5	17	43

	% within PhysicalActivity	14.0%	34.9%	11.6%	39.5%	100.0%
	% within CoreStabilitycat	100.0%	100.0%	100.0%	100.0%	100.0%

Table no. 4: Chi-Square Tests[b]

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	17.131[a]	6	.009

Inference:

In Table 3 we observed 2 cases (15.4%) of low physical activity with good and above core-stability level, in moderate physical activity we observed no cases, in high physical activity we observed 15 cases (65.2%) with good and above core-stability.

In table no. 4 Using Chi-square test we observed there was a significant association between physical activity level and core-stability in males with a 'p' value of 0.009

Table no. 5: Association between Core-stability and Physical activity in Female group

Physical Activity		Core Stability cat				
		Absent (0)	Poor Or Below	Moderate	Good & Above	Total
Low	Count	2	11	9	4	26
	% within Physical act	7.7%	42.3%	34.6%	15.4%	100.0%
	% within CoreStability cat	33.3%	42.3%	42.9%	28.6%	38.8%
Moderate	Count	4	11	6	8	29
	% within Physical act	13.8%	37.9%	20.7%	27.6%	100.0%
	% within CoreStability cat	66.7%	42.3%	28.6%	57.1%	43.3%
High	Count	0	4	6	2	12
	% within Physical act	.0%	33.3%	50.0%	16.7%	100.0%
	% within CoreStability cat	.0%	15.4%	28.6%	14.3%	17.9%
Total	Count	6	26	21	14	67
	% within PhysicalActivity	9.0%	38.8%	31.3%	20.9%	100.0%
	% within CoreStabilitycat	100.0%	100.0%	100.0%	100.0%	100.0%

Table 6: Chi-Square Tests[b]

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.633[a]	6	.466

Inference:

In table 5 we observed 4 cases (15.4%) of low physical activity with good and above core-stability level, in moderate physical activity we observed 8 cases (27.6%) with good and above core-stability level and in high physical activity we observed 2 cases (16.7%) with good and above core-stability level.

In Table 6 Using Chi-square test we observed there was an insignificant association between physical activity level and core-stability with p value of 0.466

Table 7: Association between ability to hold Plank (core contraction) and Physical Activity

	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Low	39	42.3846	24.94374	3.99420	8.00	116.00
Moderate	36	56.1667	36.51262	6.08544	9.00	180.00
High	35	73.7714	27.78498	4.69652	25.00	124.00
Total	110	56.8818	32.44635	3.09364	8.00	180.00

Table 8

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	18,199.061	2	9,099.531	10.084	.000

Inference:

To compare the ability to hold plank and physical activity 'One way Anova' test was used.

In Table 7 we observed that the plank varies between 8.00 to 116.00 for Low Physical Activity, the mean plank time was 42.38 with standard deviation 24.94 secs and for moderate category the plank varies from 9.00 to 180.00 with mean of 56.16 and standard deviation 36.51 secs and for high physical activity group the mean was 73.77 with standard deviation of 27.78 secs using 95% confidence index.

The table 8 indicated there was a significant difference existing in mean planks and physical activity levels with a 'p' value of 0.000

Multiple Comparisons showing differences existing in various physical activity groups and the ability to hold plank

Table no. 9: Post Hoc Test was used

(I) PhysicalActivity PhysicalActivity	(J) PhysicalActivity PhysicalActivity	Mean Difference (I-J)	Std. Error	Sig.
Low	Moderate	-13.78205	6.94283	.149
	High	-31.38681*	6.99422	.000
Moderate	Low	13.78205	6.94283	.149
	High	-17.60476*	7.13072	.045
High	Low	31.38681*	6.99422	.000
	Moderate	17.60476*	7.13072	.045

Table 9 provides multiple comparison and shows in which group difference exists in the ability to hold plank

Comparing plank time between low and moderate group of physical activity, difference of 13.78secs was observed indicates that in between low and moderate physical activity difference in plank was 13.78 secs which was statistically insignificant with a 'p' value of 0.149

In between low and high physical activity, difference in plank time was 31.38secs which was statistically significant with a 'p' value of 0.000

In between moderate and high physical activity, difference in plank time was 17.604secs which was statistically significant with a 'p' value of 0.045

The high group differed significantly from low and moderate groups of physical activity.

DISCUSSION

The purpose of this study was to find an Association between core-stability and physical activity in young adults. This study was done on a sample collection of 110 young adults both, male and female who fulfilled the inclusion and exclusion criteria. Among the 110 individuals who participated in the study, 67 were females and 43 were males. We assessed core stability through Sahrmann core-stability test which elicited isometric muscle contractions of the Transverse Abdominis and Pressure Biofeedback was used to measure the core-stability. Physical activity was assessed with IPAQ. The performance tests were selected on the basis of their required movements and muscle involvement. Several significant and insignificant association were identified between core-stability and physical activity variables.

Association of Core-stability with Physical activity:

The primary objective of the study was to find the Association of Core-stability with Physical activity level in young adults. According to the study, we observed 6 (15.4%) cases of low physical activity with good and above core-stability level, in moderate physical activity we observed 8 cases (22.2%) and in high physical activity 17cases (48.6%) having good and above core-stability level. Thus, it was found that individuals with high physical activity had a good core-stability as compared to individuals with poor physical activity level. In theory, it is accepted that core stability and athletic performance are interrelated, the current study supports this relationship. Core stability is a vast topic that includes prospective control, strength, power, and endurance.[18] However, core strength training affects core stability [3]. Core stability exercises have strong theoretical root for inhibition of different musculoskeletal conditions and the treatment of spinal ailments.[19] The first stage of core stability training begins with learning to activate the abdominal wall musculature. Showing individuals abdominal hollowing, which may activate the transversus abdominis, as well as abdominal bracing, which activates many muscles including the transversus abdominis, external obliques, and internal

obliques, is an important foundation step.[19] Study conducted by Barnet showed that performing abdominal hollowing and bracing prior to performing abdominal curls facilitated activation of the transversus abdominis and internal obliques throughout the abdominal curling movement.[20] In a study conducted by Barnekow-Bergkvist M,[21] he stated that individuals who were physically active had higher estimated VO2 max.

Gender wise association of core stability and physical activity:

In males, we observed 9 cases of low physical activity with below poor core stability level, 6 cases with moderate physical activity in below poor core stability levels and 6 cases with high physical activity level in below poor physical activity. 2 cases were seen in moderate core-stability group with low physical activity, 1 case with moderate physical activity and 2 cases with high physical activity were seen to have moderate core-stability level. We observed 2 cases (15.4%) of low physical activity with good and above core-stability level, in moderate physical activity we observed no cases, in high physical activity we observed 15 cases (65.2%) with good and above core-stability. We observed there is significant association between physical activity level and core-stability in males. Thus, it can be said that males with high physical activity had a good core-stability as compared to males with low physical activity

In females, we observed 13 cases of low physical activity with below poor core-stability, 15 cases of moderate physical activity with below poor core-stability and 4 cases of high physical activity from below poor core-stability group. 9 cases were seen in low physical activity group having moderate core-stability, 6 cases in moderate physical activity group and no cases were seen in high physical activity group having moderate core-stability. We observed 4 cases (15.4%) of low physical activity with good and above core-stability level, in moderate physical activity we observed 8 cases (27.6%) with good and above core-stability level and in high physical activity we observed 2 cases (16.7%) with good and above core-stability level. Hence from the current study it can be said that females with high physical activity did not have a good core-stability or females with good core-stability were not highly physically active.

According to a study conducted by Barnekow-Bergkvist M[21] that there was not much difference in overall physical activity between men and women, but the men exercised more dynamically as compared to women. Also Early experience of physical activity at the age of 16 reduced the risk of becoming inactive during adulthood.[21] Exercise and participation in sports, even if only of moderate intensity are associated with reduced levels of ovarian oestrogen.[22] A study conducted by Oguma Y showed that moderate levels of leisure-time physical activity helps to enhance oestrogen metabolism, especially among women with higher body weight.[10] Also, the findings of epidemiological studies have showed that women with higher levels of recreational activity have a lesser risk of breast cancer.[21]

Association of ability to hold plank with Physical activity:

The last objective of the study was to find association between ability to hold contractions (plank secs) with Physical activity. We observed that the plank varies between 8.00 to 116.00 for Low Physical Activity, the mean plank time was 42.38 with standard deviation 24.94 secs and for moderate category the plank varies from 9.00 to 180.00 with mean of 56.16 and standard deviation 36.51 secs and for high physical activity group the mean was 73.77 with standard deviation of 27.78 secs using 95% confidence index. There is a significant difference existing in mean planks and physical activity levels with a ‘p’ value of 0.000. Thus, higher the physical activity more chances of the individuals to hold plank for maximum mins. Plank is one of

those exercises which are low-impact and require minimum hard work but provides a plethora of health profits. The exercise requires minimal movement but contracts all layers of the abdominal fascia to strengthen the core, which in return also helps to reduce low-back pain. Increased flexibility is another great benefit of planking. The exercise affects the body as a whole. Along with posture, planking also works on overall body balance as it makes us balance our body weight perfectly.[23]

CONCLUSION

This study concludes that there is a significant association between core-stability and physical activity in young adults

Males have a good core-stability as compared to females

A significant association is seen in core-stability and physical activity in males while not significant in females.

Significant Association is seen in between ability to hold contractions (plank secs) with the level of Physical activity

Acknowledgement:

The authors would like to thank all staff members of the Physiotherapy department of D.Y. Patil Hospital, Nerul for their assistance in the conduction of this study. We are grateful to all our study subjects for co-operating with us in carrying out this study, as without them it would have been impossible to complete the study.

REFERENCES

1. Behm DG et al, 'The use of instability to train the core musculature. Appl Physiol Nutr Metab, 2010; 35: 91–108
2. Akuthota et al, 'Core Stability Exercise Principles'. Curr Sports Med Rep. 2008 Feb;7(1):39-44
3. Shih-Lin Hsu et al, 'Effects of core strength training on core stability. J Phys Ther Sci. 2018 Aug; 30(8): 1014–1018'
4. Jyoti Kataria et al,'Relationship between core stability and performance in recreational cricket, International Journal of Yoga, Physiotherapy and Physical Education. November 2018; 3(6): 01-05.
5. Farries M et al, 'Core training: Stabilizing the confusion. Strength and Conditioning, April 2007; 29(2):10–25
6. Gamble P et al 'An integrated approach to training core stability. Strength and Conditioning J, February 2007; 29:1: 58–68'
7. Jeffrey M. Willardson, 'Core Stability Training: Applications To Sports Conditioning Programs, Journal of Strength and Conditioning Research, 2007, 21(3), 979–985'
8. Classification of Physical Activity and Level of Intensity, Tokyo: Ministry of Health, Labour and Welfare of Japan; 13 December 2013
9. Exercise and physical activity guide for health promotion 2006. Tokyo: Ministry of health, labour and welfare of Japan, Exercise Guide 2006.
10. Oguma Yet al, 'Physical activity decreases cardiovascular disease risk in women: review and meta-analysis, Yuko Oguma-Tomoko Shinoda-Tagawa - American Journal of Preventive Medicine, June 2004; 26(5):407-18'
11. Motohiko Miyach et al, 'Measures of physical activity and exercise for health promotion by the Ministry of Health, Labour and Welfare, the journal of physical fitness; 2012: 1(3)
12. ProfAdrian EBauman PhD et al, 'Correlates of physical activiy: why are some people physically active and others not?, The lancet, 21–27 July 2012; 380 (9838): 258-271
13. James F. Sallis, Prochaska JJ, Taylor WC., 'A review of correlates of physical activity of children and adolescents', Med and science in sports and exercise, 2000 May ;32(5):963-75
14. Martuscello et al, 'Systematic Review of Core Muscle Activity During Physical Fitness Exercises, Journal of strength and conditioning research; 2013 Jun;27(6):1684-98
15. Exercise Prescription for the Prevention and treatment of a disease MOOC, 'Trinity College Dublin'
16. Lima Po et al, 'Concurrent validity of the pressure biofeedback unit and surface electromyography in measuring transversus abdominis muscle activity in patients with

chronic nonspecific low back pain, Rev Bras Fisioter, 2012 Sep-Oct;16(5):389-95
17. Sudip K Sarker, 'Training & Assessing Advanced Core Stability & Strength for the Triathlete'; April 2016. https://www.researchgate.net/publication/309399149_Training_Assessing_Advanced_Core_Stability_Strength_for_the_Triathlete
18. Dr. / Marwan Ali Abd Allah et al, " Core Stability Relation To Physical Performance In Some Collectivity Games, December 2013"
19. Akuthota et al, 'Core Stability Exercise Principles, Current sports medicine report; 2008 Feb;7(1):39-44"
20. Barnet et al, 'The use of lumbar spinal stabilization techniques during the performance of abdominal strengthening exercise variations, *J. Sports Med. Phys. Fitness*, 2005; 45:38-43'
21. Barnekow-Bergkvist M , Hedberg G, Janlert U, Jansson E, 'Prediction of physical fitness and physical activity level in adulthood by physical performance and physical activity in adolescence--an 18-year follow-up study', Scandinavian Journal of Medicine Science and Sports. 1998 Oct;8(5 Pt 1):299-308
22. Chidiadi M. Atuegbu et al, 'Effect of moderate - vigorous intensity physical exercise on female sex hormones in premenopausal university students in Nnewi, Nigeria, International journal of research in medical science, 2014; 2(4)"
23. Himanshu sharma et al, '7 benefits of doing planks everyday, Onlymyhealth editorial team; March 9 2018

How to cite this article: Kapdule P, Pol T. Relationship between core-stability and physical activity in young adults. Int J Health Sci Res. 2019; 9(7):126-134.

******