Journal Homepage: -www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/14299
DOI URL: http://dx.doi.org/10.21474/IJAR01/14299

RESEARCH ARTICLE

EFFECT OF BALANCE TRAINING ON ATHLETES WITH FUNCTIONAL ANKLE INSTABILITY OF ANKLE JOINT

Dr. G.K. Scindia[1] and Dr. S. Suganthi[2]

1. Assistant Professor, Department of Physical Medicine and Rehabilitation, Madurai Medical College & Government Rajaji Hospital, Madurai, Tamilnadu, India.
2. Assistant Professor, Department of Physical Medicine and Rehabilitation, Government Thanjavur Medical College & Hospital, Thanjavur, Tamilnadu, India.

Manuscript Info

Manuscript History
Received: 18 December 2021
Final Accepted: 20 January 2022
Published: February 2022

Key words:-
Athlete, Functional Ankle Instability, Sports Injury, Balance training.

Abstract

Introduction: The ankle is an amazing structure because it helps transfer vertical to horizontal weight bearing and rarely deteriorates over the course of a life time.This study aims to find out the prevalence of functional ankle instability in athletes and to determine the effect of posturography training on balance in athletes with functional ankle joint instability.

Material and Methods: This study was conducted in two phases. In the first phase after obtaining the informed consent, a descriptive study was conducted among 453 students from the Department of Physical Education and were included in the study to determine the prevalence of functional ankle instability (FAI). The study participants were distributed with Modified Ankle Instability Instrument questionnaire with brief explanation about the questionnaire and the prevalence of FAI was studied. Modified ankle instability instrument has high reliability,feasible and has appropriate way to obtain information on the presence of instability symptoms.[21]It contains 11 yes/no type questions.9 questions focus on ankle injury,last 2 questions focus on knee for exclusion purpose.12 questionnaires were found to be incomplete and the remaining 441 completed questionnaires were taken for data analysis.Among the 441 questionnaires,207 was excluded as they have knee and leg injuries.With the remaining 234, 43 athletes have FAI with the prevalence of 18.4%.From them, 39 athletes entered phase II and were given balance training using a commercially available device, Posturograph-the Biodex Balance Stability System (BSS) (Biodex, Inc., Shirley, New York).

Results: The prevalence of FAI was 18.4% in the present study.The most common age group of the present study was 21-25 years(52.2%). Male participants (58.5%) were outnumbered female participants(41.5%). Most of the athletes had normal BMI.Underweight population was 20.4% and overweight was 5.9%. The common events participated by the athletes of the present study were football (25.85%),basketball (14.51%) and volley ball (12.24%).Of the total 441 participants ,207 (46.9%) had associated knee and leg injuries and

Corresponding Author:- Dr.G.K. Scindia
Address:- Department of Physical Medicine and Rehabilitation, Madurai Medical College and Government Rajaji Hospital, Madurai, Tamilnadu, India.

hence was not taken for analysis.There is no association found between FAI in relation to gender game - wise as demonstrated in the above table.There was significant association observed between FAI and BMI for football and hockey players (x^2 = 6.195, p =0.045).There is significant difference in anterior reach distance,posteromedial and posterolateral reach distance between affected and normal ankle at baseline (p <0.05)

Conclusion: The present study results showed that balance training with posturograph effectively improved the functional ankle instability in athletes and also enhances the stability of the normal ankle. In addition, the balance training may increase patients' interest and participation rate in treatment more than existing therapy methods.

……

Introduction:-

The ankle is an amazing structure because it helps transfer vertical to horizontal weight bearing and rarely deteriorates over the course of a life time.In recent years, participation in sports has increased, resulting in an increase in sports-related injuries. These injuries frequently involve the lower extremities especially the ankle joint.[1]Ankle injuries are the common cause of morbidity in the general and athletic population with considerable socio economic impact.Overall,ankle sprains are slightly more likely to occur in males (50.3%) than in females (49.7%) and nine times more likely to occur in younger than in older individuals.Eighty five percent of all ankle sprains occur on the lateral aspect of the ankle result from inversion injury, involving the anterior talofibular ligament and calcanaeofibular ligament.Another 5% to 10% are syndesmotic injuries or high ankle sprains which involves a partial tear of the distal anterior tibiofibular ligament.Only 5% of all ankle sprains involve the medial aspect of the ankle result from eversion injury as the strong medial deltoid ligament is resistant to tearing.[2]A grade I ankle sprain involves a mild sprain of the anterior talofibular with a negative ankle drawer and talar tilt test.A grade II sprain involves disruption of the anterior talofibular with sprain of the calcaneofibular, with a positive ankle drawer and a negative talar tilt test, whereas a grade III ankle sprain involves disruption of the lateral ligament complex with both positive ankle drawer and talartilt tests. It is estimated that 20% to 40% of ankle sprains result in chronic sequelae.[3]

The development of repetitive ankle sprains and persistent residual symptoms such as repeated episodes of ankle giving way, pain, weakness, loss of function, and feeling of ankle instability after injury has been termed chronic ankle instability (CAI) . CAI can be caused by either mechanical ankle instability (MAI), functional ankle instability (FAI), or both. Mechanical instability has been defined as ankle movement beyond the physiologic limit of the ankle range of motion and is frequently quantified through the measurement of joint flexibility.[4] The term functional ankle instability (FAI) describes the subjective feeling of the ankle "giving way", and was first conceptualised by Freeman (1965).The relationship between ankle injury, proprioceptive, and balance deficits was also proposed by Freeman.[5] Since this time altered proprioception has been proposed as a predisposing factor to ankle injury when deficits exist. The deterioration of proprioceptive sensibility causes difficulties in postural control and induces instability in the ankle joints. Balance refers to the ability to maintain one's center of gravity over the base of support during static and dynamic movements, and deterioration in balance ability increases ankle instability as well as lateral movements in ankle joints.Somatosensory system which plays important role in maintaining the body in a particular position, whether in a static or in a dynamic in response to external stimulus. Somatosensory system works with the integration of subsystems namely visual system and vestibular system. Reported sensory information obtained from somatosensory, vestibular & visual systems and motor responses that affect joint, range of motion (ROM), coordination & strength are the factors influencing balance.

For individuals with ankle instability, compromised muscle strength and proprioception around the ankle joint may hamper balance control.[6,7] A variety of laboratory equipment (e.g., force plates) and clinical tests (e.g., Y Balance Test, Star Excursion Balance Test, Foot Lift Test) have been developed to examine balance control. One of the commonly used devices to examine both static and dynamic balance control is the Posturograph - Biodex Balance System (BBS; Biodex, Inc, Shirley, NY).[8] This apparatus has a good test-retest reliability and provides quantitative measures of balance control.[9,10] In addition, the BBS uses a multi-axial testing platform which can be set at various degrees of instability/difficulty (from the static protocol of 0° surface tilt to a dynamic protocol of 20° surface tilt) to

challenge the subjects with various fitness levels and injury severities.[10] Compared to other balance testing equipment, the unstable platform of the BBS can simulate unexpected external perturbations (such as landing on an uneven surface) in various activities.

Modified Star Excursion Balance Test(SEBT) is used as a pre and post test assessment after the balance training using Biodex balance system.Researchers[11] have shown redundancy in the 8 directions originally described in the SEBT. To avoid this redundancy,we used a modified version of the SEBT with only 3 directions (anterior, posterolateral [PL], and posteromedial[PM]).Modified Star Excursion Balance Test is a valid and reliable outcome measure of dynamic balance. A range of indications for the clinical use of the test in athletic and pathologic populations including screening,[12,13] injury identification,[14,15] training[16,17,18] and rehabilitation.[19] It is a series of single limb excursion in three directions intersecting at the centre grid.[20] The goal of the task is to maintain a stable base of support on the stance limb & to reach maximum excursion while maintaining stable position. The advantage to assess dynamic postural control is that additional demand of proprioception, range of motion & strength are required while remaining in steady & upright positions which is achieved by these reaching tasks.

Phases of rehabilitation of ankle injuries include resolving pain and inflammation, restoring range of motion, strengthening, proprioceptive training, sports/task specific activities.[21]Return to sport may depend on satisfactory completion of a rehabilitation program. For a sports physician every athlete is unique with special needs.Incomplete recovery or inadequate rehabilitation may predispose the patient to reinjury. This leads to functional ankle instability in athletes and it decreasing their performance in sports.

In athletes with ankle injury ,the importance is given only for treating pain,swelling,ligament injuries and fractures.Many times correction of functional ankle instability is ignored.As balance forms the basis of motor skills from simple to more challenging in sports,giving balance training in athletes with functional ankle instability will improve their performance in sports. Better balance is strongly positively associated with enhanced athletic performance and negatively associated with lower limb sports injuries.This study aims to find out the prevalence of functional ankle instability in athletes and to determine the effect of posturography training on balance in athletes with functional ankle joint instability.

Methodology:-

This study was conducted in two phases. In the first phase after obtaining the informed consent, a descriptive study was conducted among 453 students from the Department of Physical Education and were included in the study to determine the prevalence of functional ankle instability (FAI). The study participants were distributed with Modified Ankle Instability Instrument questionnaire with brief explanation about the questionnaire and the prevalence of FAI was studied. Modified ankle instability instrument has high reliability,feasible and has appropriate way to obtain information on the presence of instability symptoms.[21]It contains 11 yes/no type questions.9 questions focus on ankle injury,last 2 questions focus on knee for exclusion purpose.12 questionnaires were found to be incomplete and the remaining 441 completed questionnaires were taken for data analysis.Among the 441 questionnaires,207 was excluded as they have knee and leg injuries.With the remaining 234, 43 athletes have FAI with the prevalence of 18.4%.

From them, 39 athletes entered phase II and were given balance training using a commercially available device, Posturograph-the Biodex Balance Stability System (BSS) (Biodex, Inc., Shirley, New York). The BSS consists of a circular balance platform that provides up to 20° of surface tilt in a 360° range of motion and can move in the anterior–posterior and medial - lateral axes simultaneously . The BSS also has built in software that allows control of the platform's stability level based on the amount of tilt allowed. The platform stability ranges from level 2 to 8, with level 2 representing the least stable setting and level 8 as the most stable setting. The amount of tilt allowed by the balance platform is determined by the level setting. Visual feedback of the subject's sway is provided via a monitor mounted on the BSS.Before giving balance training the athletes were tested on a Biodex platform for 20 seconds to find out the pre interventional balance status of athletes in the Department of Physical Medicine and Rehabilitation,Rajah Muthiah Medical College Hospital,Annamalai University. The athlete's unstable and the stable ankle was examined using the Athletic Single Leg Stability Test of the BBS. The single-leg test was chosen because all subjects were athletes and other protocols of the BBS lack functional significance.[22]They were then given with balance training using posturograph for 3 alternate days in a week for 4 weeks each session lasting approximately 20 minutes.During the balance training with different levels of stability,athletes were instructed to focus on the visual feedback screen in front of them and to maintain the cursor at the center of the screen by adjusting their balance as

needed.During the whole training ,they were also instructed to maintain the same body position at all stability levels. At the end of the training athletes were again assessed for their overall stability index,anteroposterior and mediolateral stability.

Improvement in balance training were compared with pre and post testing using Modified Star Excursion Balance Test (SEBT).It is a valid and reliable tool which was used to assess the dynamic postural control deficit.It has 3 directions (anterior,posterolateral and posteromedial).The directions are made by using straps.The posterior straps are positioned 135 degrees from the anterior straps with 45 degrees between the posterior straps.Each strap is marked in 5 millimetre increments for measurement.

The athletes are allowed to do 3 trials in each of the 3 directions prior to formal testing after giving balance training using posturograph.The subject stood on 1 leg in the centre of a grid, with toes behind the line.While maintaining single leg stance, the subject was asked to reach with the free limb in the anterior, posteromedial and posterolateral directions in relation to stance foot. The reach distance was measured by marking the tape measurement at the edge of the reach indicator, the point where the most distal part of the foot reached.

The greatest of 3 trials for each reach direction was used for analysis of the reach distance in each direction.The trial was discarded and repeated if the subjects failed to maintain unilateral stance, lifted or moved the stance foot from the grid, touched down with the reach foot, failed to return the reach foot to the starting position and to reach distance for all three directions were compared with pre and post training.

Results:-

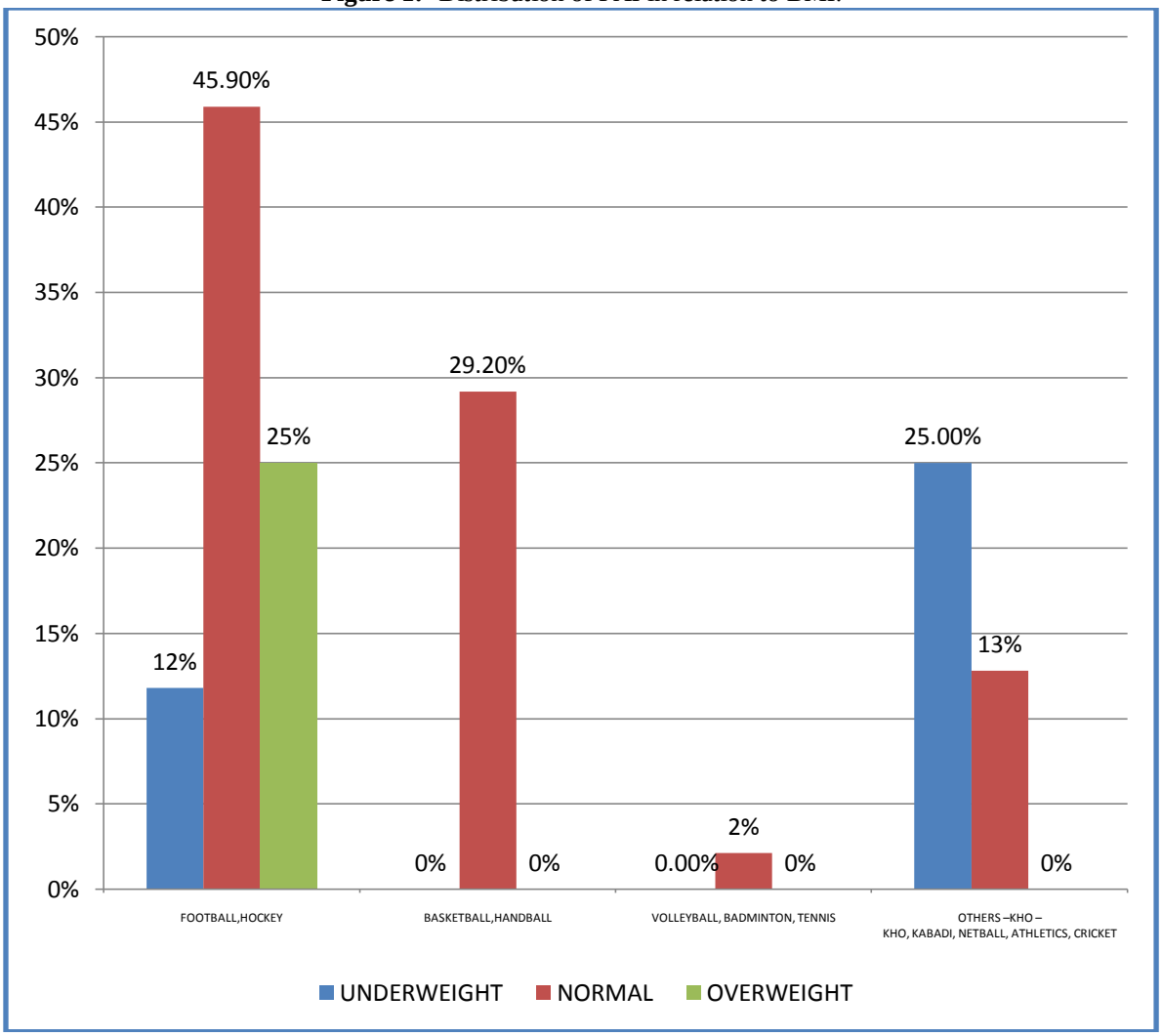
The most common age group of the present study was 21-25 years(52.2%). Male participants (58.5%) were outnumbered female participants(41.5%) (Table 1). Most of the athletes had normal BMI.Underweight population was 20.4% and overweight was 5.9%. The common events participated by the athletes of the present study were football (25.85%),basketball (14.51%) and volley ball (12.24%).Of the total 441 participants ,207 (46.9%) had associated knee and leg injuries and hence was not taken for analysis.The prevalence of FAI was 18.4% in the present study.There is no association found between FAI in relation to gender game - wise as demonstrated in the above table.

Table 1:- Distribution of background variables.

SLNo	VARIABLE	NUMBER	PERCENT
1	AGE :		
	<20	140	31.7
	21-25	230	52.2
	>25	71	16.1
2	SEX		
	MALE	258	58.5
	FEMALE	183	41.5
3	BMI :		
	UNDERWEIGHT <18.5	90	20.4
	NORMAL 18.5 – 24.9	325	73.7
	OVERWEIGHT 25 -29.9	26	5.9
	OBESE >30	-	-
4	EVENT PARTICIPATING :		
	I - FOOTBALL	114	25.85
	HOCKEY	22	4.98
	II - BASKETBALL,	64	14.51
	HANDBALL	34	7.70
	III - VOLLEYBALL,	54	12.24
	TENNIS,	28	6.34
	BADMINTON.	25	5.66

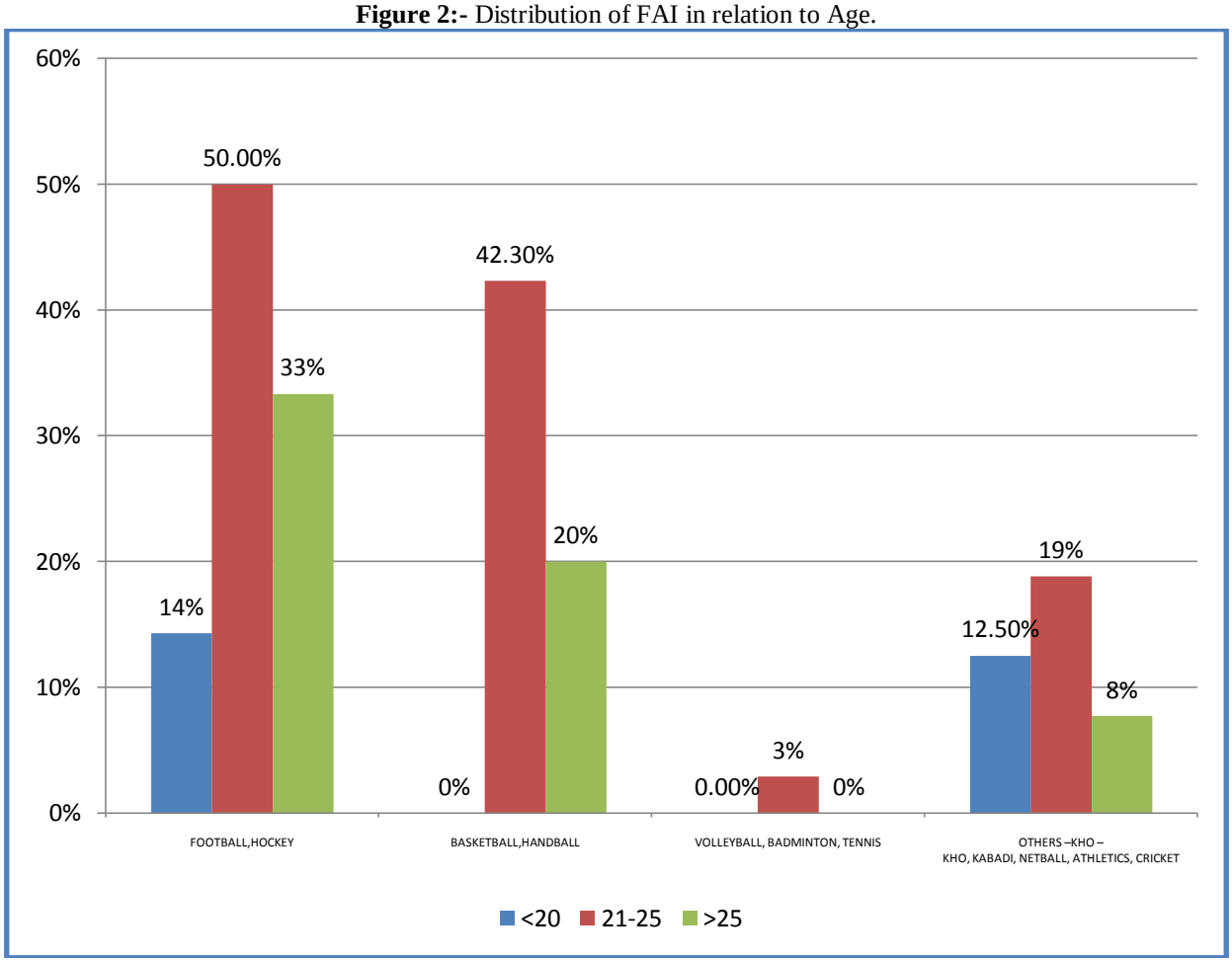
	IV -OTHERS – ATHLETICS, KABADI, KHO-KHO, CRICKET, NETBALL	23 23 5 13 35	5.21 5.21 1.13 2.94 7.93
5	KNEE AND LEG INJURIES YES NO	 207 234	 46.9 53.1
6	FUNCTIONAL ANKLE INSTABILITY YES NO	 43 191	 18.4 81.6

Figure 1:- Distribution of FAI in relation to BMI.



There was significant association observed between FAI and BMI for football and hockey players (x^2 = 6.195, p =0.045).It is inferred that 25% of overweight had FAI and 45.9% of normal had FAI.FAI was observed in 11.8% of underweight athletes. There is no significant association between FAI and BMI for other sports events (p > 0.05) (Figure 1).

Figure 2:- Distribution of FAI in relation to Age.



There is significant association between FAI and age for football and hockey players. Chi square test of association is x^2 = 6.781,p = 0.034. It is evident from cross tabulation that FAI was higher for the age group 21-25 (50%) and >25(33.3%). With respect to basketball and handball players, the association is again statistically significant (x^2 = 11.108, p = 0.004).FAI percentage was 42.3% in the age group of 21-25 years and it is 20% for the age group >25 years. There is no association between FAI and age for other sport events (Figure 2).

At the baseline there is statistically significant difference in the overall stability index between affected (M = 3.563 ± 0.40) and the normal ankle (M = 1.711 ± 0.33).Likewise there is significant difference in A/P and M/L stability between affected and normal ankle (p <0.05).

There is significant difference in anterior reach distance,posteromedial and posterolateral reach distance between affected and normal ankle at baseline (p <0.05)

Table 2:- Comparison of athletic single leg stability and modified star excursion balance test.

Variable	Before training	After training	t, p
	MEAN± SD	MEAN± SD	
OVERALL STABILITY			
AFFECTED	3.56±0.40	1.36±0.23	33.68, <0.001
NORMAL	1.71±0.33	0.38±0.31	27.26, <0.001
A/P			
AFFECTED	3.00±0.47	1.04±0.27	23.06, <0.001
NORMAL	1.41±0.29	0.17±0.08	27.18, <0.001

M/L			
AFFECTED	2.65±0.54	0.43±0.46	19.53, <0.001
NORMAL	1.19±0.25	0.03±0.06	27.49, <0.001
ANTERIOR REACH DISTANCE AFFECTED			
NORMAL	62.34±4.54	67.97±4.35	21.68, <0.001
	68.34±4.58	69.40±4.57	6.67, <0.001
PM REACH DISTANCE AFFECTED			
NORMAL	75.43±8.71	82.34±9.67	16.69, <0.001
	83.14±10.16	84.11±9.64	3.77, <0.001
PL REACH DISTANCE AFFECTED			
NORMAL	73.26±7.50	77.49±8.05	8.10, <0.001
	83.14±8.49	78.77±8.03	1.99, 0.05

In affected ankle, the overall stability is significantly improved after balance training (t = 33.683; p = 0.001).Likewise A/P stability and M/L stability was also significantly improved following balance training (p < 0.05).There is significant improvement in anterior reach distance (t = 21.685,p = 0.001),posteromedial (t = 16.669,p = 0.001)and posterolateral reach distances (t = 8.102,p = 0.001) of the affected ankle after balance training.There is significant improvement in normal ankle stability also following balance training in all three parameters viz. overall stability index,A/P and M/L stability (Table 2).

Table 3:- Comparison of athletic single leg stability test after training.

STABILITY INDEX	**MEAN**	**SD**	**t VALUE**	**P VALUE**
OVERALL STABILITY				
AFFECTED	1.360	0.2379	14.957	0.001*
NORMAL	0.389	0.3017		
A/P				
AFFECTED	1.043	0.2736	19.032	0.001*
NORMAL	0.117	0.0891		
M/L				
AFFECTED	0.437	0.4659	5.156	0.001*
NORMAL	0.029	0.0519		

The difference in all the parameters of athletic single leg stability following balance training between normal and affected ankle was statistically significant (p <0.001).Both the affected and the normal ankle showed improvement in the overall,anteroposterior and posterolateral stability.Hence as the post mean of normal ankle stability is higher than the affected ankle,the post balance training outcome was significantly higher for normal ankle (Table 3).

Table 4:- Comparison of modified star excursion balance test after balance training.

VARIABLE	**MEAN**	**SD**	**t VALUE**	**p VALUE**
ANTERIOR REACH DISTANCE				
AFFECTED	67.97	4.355		
NORMAL	69.40	4.577	1.338	0.185
PM REACH DISTANCE				
AFFECTED	82.34	9.674	0.767	

NORMAL	84.11	9.643		0.446
PL REACH DISTANCE				
AFFECTED	77.49	8.053		
NORMAL	78.77	8.026	0.669	0.506

After the training, the mean stability of the anterior reach distance,posteromedial and posterolateral reach distance in modified star excursion balance test between affected and normal shows no significant difference which means the stability of the affected ankle is improved to that of the normal ankle (Table 4).

Discussion:-

This study was conducted among the athletes from the Department of Physical Education,Annamalai University to find out the prevalence of functional ankle instability and to determine the effect of Posturography training on balance in athletes with functional ankle joint instability.

This study comprises of two phases.First phase is the descriptive study to find out the prevalence of functional ankle instability in athletes of Department of Physical Education,Annamalai University.Second phase is the experimental study to determine the effect of Posturograph training on balance in athletes with functional ankle instability.

PHASE -I:

In the first phase of the study, a total of 453 athletes from the Department of Physical Education from different disciplines of games who were willing to participate were selected.Modified Ankle Instability Questionnaire was used to find out the prevalence of FAI. All 453 athletes were distributed with Modified Ankle Instability Instrument questionnaires with brief explanation.Incomplete questionnaires were 12 and were excluded.Remaining 441 completed questionnaires were included for data analysis.

The questionnaires were analysed mainly on age,sex,body mass index,event participation,associated injuries other than ankle and the association of FAI in relation to age,sex,BMI and the game played by the athletes.The most common age group of the present study was 21-25 years(52.2%).31.7% of the athletes were in the age group <20 and 16.1% were in the age group > 25.Male participants (58.5%) were outnumbered female participants(41.5%).Most of the athletes were in normal BMI range(73.7%).Underweight population was 20.4% and overweight was 5.9%.The common event participated by the athletes of the present study were football (25.85%),basketball (14.51%) and volley ball (12.24%).Netball players were 7.93%, Handball 7.70 % , Tennis 6.34% ,Badminton 5.66%, Athletics and Kabadi 5.21%, Hockey 4.98 %, Cricket 2.94%, and Kho -Kho 1.13%.Out of 441 participants, 207 (46.9%) had associated knee and leg injuries and hence was excluded from the prevalence study.

The remaining 234 were included for the data analysis.From them the prevalence of FAI was 18.4%(43 athletes). Previous study by Arnold,reported 20-40% prevalence of ankle instability in collegiate sports.[23]Jyotsana Mehta and AGK Sinha found a higher prevalence of FAI (57.74%) among the Punjab basketball players.[24]This may probably due to inadequate rehabilitation,badtechnique,overtraining and competitive temperament by the athletes. In this present study,the prevalence of FAI was low compared to the previous studies which may probably due to obtaining early medical help and effective rehabilitation of ankle sprains.

Males (23%)are more affected than females (14%) with FAI with a significant p value 0.048.Similar results were observed by Jyotsana Mehta and AGK Sinha with higher prevalence of FAI among males compared to females.[24]

The prevalence of FAI was seen most commonly in the age group 21-25 (26.4%). There is significant association between FAI and age for football and hockey players (Chi square test of association is x^2= 6.781,p = 0.034) and the FAI prevalence was higher for the age group 21-25 (50%) and >25(33.3%).With respect to basketball and handball players, the association is again statistically significant (x^2= 11.108, p = 0.004) and the FAI prevalence was 42.3% in the age group of 21-25 years and it is 20% for the age group >25 years.There is no association between FAI and age for other sport events. There was no association found between FAI in relation to gender game.There was no significant association found in relation to FAI and BMI except in football and hockey players were there is significant association with p value 0.045. The sport event participated by the athletes has a significant

role in causing ankle sprains which further predisposes to FAI.The most common sports associated with FAI was football and hockey (34.5%) ,followed by basketball,handball (23.3%) ,volleyball,tennis,badminton (1.6%) and others including athletics,netball,kho-kho,kabadi,cricket(15.1%). Similar study by Hansen et al[25] reported that 67.3% of their football players had sprained their ankles during sports.Smith and Reischl[26],reported that 70% of their basketball players had a history of ankle sprain and 80% of them had multiple sprains.Both the studies showed football and basketball players are more prone to have recurrent ankle sprains which makes them susceptible to FAI.

PHASE -II :

In the second phase of the study, all 39 athletes were given balance training using a commercially available device,Posturograph - Biodex Balance Stability System in the Department of Physical Medicine and Rehabilitation,Rajah Muthiah Medical College Hospital,Annamalai University. Before giving balance training the athletes were tested on a Biodex platform for 20 seconds to find out the pre interventional balance status of athletes.All were assessed in athletic single leg test for their initial overall stability,A/P stability and M/L stability and Modified Star Excursion Balance Test for their anterior reach distance,posteromedial and posterolateral reach distance.After the pre assessment in both Athletic single leg balance test and Modified Star Excursion Balance Test,they were given balance training in Posturograph at different stability levels.Posturograph balance training was given for both affected and normal ankle for 3 alternate days in a week for 4 weeks with each session lasting for 20 mins.At the end of the training the athletes were again assessed for the overall stability index,A/P stability and M/L stability.Improvement in balance training were compared using Modified Star Excursion Balance Test (SEBT) and assessed their postural control in anterior,posterolateral and posteromedial reach distances.Drop out athletes were 4 and the remaining 35 athletes were chosen for data analysis.

Before giving balance training in Posturograph , significant difference was noted in the overall stability index,A/P and M/L stability of the affected and the normal ankle with the normal ankle had more stability than the affected ankle.

Pre assessment with Modified Star Excursion Balance Test also shows a significant difference ($p < 0.05$) between the affected and normal ankle with the increased anterior,posteromedial and posterolateral reach distance by the normal ankle compared to the affected one. Lawren C.Olmsted et al[27] in their study also showed that the group with chronic ankle instability demonstrated significantly decreased reach while standing on the injured limb compared with the matched limb of the uninjured group .Additionally, subjects with chronic ankle instability reached significantly less when standing on their injured limbs as compared with their uninjured limbs.

In the present study, after the completion of the balance training ,we noted significant improvement in all three parameters of the athletic single leg balance test in affected with p value <0.001. Similar results were observed in the study done by Asimenia G.[28]The normal ankle also showed significant improvement in overall stability,A/P stability and M/L stability of the athletic single leg balance test.Study by Sierra-Guzman R et al[29] also found significant improvement in normal ankle following balance training in all three parameters of athletic single leg stability system.Post assessment of the mean stability of the anterior reach distance,posteromedial and posterolateral reach distance in modified star excursion balance test between affected and normal shows no significant difference which shows the stability of the affected ankle is improved to that of the normal ankle.Post assessment with Modified Star Excursion Balance Test also shows a significant improvement in anterior,posteromedial and posterolateral reach distances in affected ankle ,similar finding were observed in the study done by Sheri A Hale[30].In the normal ankle, pre and post assessment of anterior,posteromedial reach distances were significantly improved and the statistical significance was not seen with posterolateral reach distance.The limitation of this present study is the follow-up observations were not conducted to identify changes in ankle stability over time. Functional ankle instability is one of the common cause of morbidity in the athletic population with considerable socio economic impact since it creates long term problems with high rates of recurrence.The evaluation of FAI is necessary in the athletes because many times correction of functional ankle instability is ignored.As balance forms the basis of motor skills from simple to more challenging in sports,correcting the FAI in athletes will improve their performance in sports.It is also important to educate athletes and the instructors regarding the need to identify FAI and to seek early medical care and rehabilitation for initial ankle injuries. These type of studies are needed to sensitize the community about the problem and to plan intervention.

Conclusion:-

The present study results showed that balance training with posturograph effectively improved the functional ankle instability in athletes and also enhances the stability of the normal ankle. In addition, the balance training may increase patients' interest and participation rate in treatment more than existing therapy methods. Therefore, balance training with posturograph can be recommended as an efficient training method for functional ankle instability and also for the normal population to improve their balance ability.

References:-

1. Frontera WR, Silver JK,RizzoJr.T.ESSENTIALS OF PMR (3rd Edition). PHILADELPHIA : ELSEVIER/SAUNDERS, 2015.
2. Gary S Firestein, Ralph C Budd,Sherine E Gabriel,Iain B Mcinnes,James R O'Dell.KELLEY'S TEXTBOOK OF RHEUMATOLOGY. s.l. : SAUNDERS, 2013.
3. Effects of ankle sprain in a general clinic population 6 to 18 months after medical evaluation. Braun BL Arch Farm Med,1999;8:143-148.
4. Functional Anatomy, Pathomechanics, and Pathophysiology of Lateral Ankle Instability. J, Hertel. 2002, Vol. 37.
5. .Freeman MA,DeanMR,HanhamIW.Theetiology and prevention of functional instability of the foot.The Journal of bone and joint surgery.British volume.1965 Nov;47(4):678-85.
6.Tropp H, Odenrick P. Postural control in single-limb stance. J Orthop Res 1988; 6: 833-839 [PMID: 3171763 DOI: 10.1002/jor.1100060607]
7.Riemann BL. Is There a Link Between Chronic Ankle Instability and Postural Instability? J Athl Train 2002; 37: 386-393 [PMID:12937560]
8.Cug M, Wikstrom EA. Learning effects associated with the least stable level of the biodex® stability system during dual and single limb stance. J Sports Sci Med 2014; 13: 387-392 [PMID: 24790494]
9.Arifin N, Abu Osman NA, Wan Abas WA. Intrarater test-retest reliability of static and dynamic stability indexes measurement using the Biodex Stability System during unilateral stance. J ApplBiomech 2014; 30: 300-304 [PMID: 23878204 DOI: 10.1123/jab.2013-0130]
10.Jose A Parraca, Pedro R Olivares, Ana Carbonell-Baeza, Virginia A Aparicio, Jose C Adsuar, NarcisGusi. Test-Retest reliability of Biodex Balance SD on physically active old people. J Human Sports Exercise 2011; 6: 444-450 [DOI: 10.4100/jhse.2011.62.25]
11.Hertel J, Braham RA, Hale SA, Olmsted-Kramer LC. Simplifying the Star Excursion Balance Test: analyses of subjects with and without chronic ankle instability.JOrthop Sports PhysTher. 2006;36(3):131–137.
12.Sato K, Mokha M. Does core strength training influence running kinetics, lower-extremity stability, and 5000-M performance in runners? J Strength Cond Res. 2009;23(1):133–140.
13.Batson G. Validating a dance-specific screening test for balance: preliminary results from multisite testing. Med Probl Perform Art.2010;25(3):110–115.
14.Sefton JM, Hicks-Little CA, Hubbard TJ, et al. Sensorimotor function as a predictor of chronic ankle instability. ClinBiomech (Bristol, Avon). 2009;24(5):451–458.
15.Herrington L, Hatcher J, Hatcher A, et al. A comparison of Star Excursion Balance Test reach distances between ACL deficient patients and asymptomatic controls. Knee. 2009;16(2):149–152.
16.McLeod TC, Armstrong T, Miller M, Sauers JL. Balance improvements in female high school basketball players after a 6-week neuromuscular-training program. J Sport Rehabil. 2009;18(4):465–481.
17.Eisen TC, Danoff JV, Leone JE, Miller TA. The effects of multiaxial and uniaxial unstable surface balance training in college athletes. J Strength Cond Res. 2010;24(7):1740–1745.
18.Filipa A, Byrnes R, Paterno MV, Myer GD, Hewett TE. Neuromuscular training improves performance on the Star Excursion Balance Test in young female athletes. J Orthop Sports Phys Ther.2010;40(9):551–558.
19.Hale SA, Hertel J, Olmsted-Kramer LC. The effect of a 4-week comprehensive rehabilitation program on postural control and lower extremity function in individuals with chronic ankle instability. J Orthop Sports PhysTher. 2007;37(6):303–311.
20.Gribble PA, Hertel J. Considerations for normalizing measures of the Star Excursion Balance Test. MeasPhysEducExerc Sci. 2003;7(2):89–100.
21. Docherty CL, Gansneder BM, Arnold BL, Hurwitz SR. Development and reliability of the Ankle Instability Instrument. J Athl Train. 2006;41(2):154–158.
22. Hung YJ, Miller J. Extrinsic visual feedback and additional cognitive/physical demands affect single-limb balance control in individuals with ankle instability.World J Orthop. 2016 Dec 18;7(12):801-807.

23.Arnold BL,LinensSW,de la MotteSJ,ScottE,RossSE.ConcentricEvertor Strength Differences and Functional Ankle Instability:A Meta-Analysis.Journal of Athletic Training 2009;44(6):653-662
24.Jyotsana Mehta,AGKSinha,Prevalence of functional ankle instability and its association with riskfactors in Basketball players of Punjab,International journal of Physical Education,Sports and health,2015;1(6):03-07
25.Hansen H,Damholt V,Termansen NB.Clinical and social status following injury to the lateral ligaments of the ankle.Acta Orthop Scand 1979; 50:699-704
26.Smith RW,Reischl SF.Treatment of ankle sprains in young athletes.Am J Sports Med 1986;14:465-71.
27. LawrenC.Olmsted et al. Efficacy of the Star Excursion Balance Tests in Detecting Reach Deficits in Subjects With Chronic Ankle Instability.Journal of athletic training 37(4):501-506.
28. Asimenia G, Paraskevi M, Polina S, Anastasia B, Kyriakos T, Georgios G. Aquatic training for ankle instability. Foot Ankle Spec. 2013 Oct;6(5):346-51.
29. Sierra-Guzmán R, Jiménez-Diaz F, Ramírez C, Esteban P, Abián-VicénJ. Whole-Body-Vibration Training and Balance in Recreational Athletes With Chronic Ankle Instability.JAthl Train. 2018 Apr;53(4):355-363. doi: 10.4085/1062-6050-547-16. Epub 2018 Mar 23.
30. Hale SA, Fergus A, Axmacher R, Kiser K. Bilateral improvements in lower extremity function after unilateral balance training in individuals with chronic ankle instability.JAthl Train. 2014 Mar-Apr;49(2):181-91.