



**EFFECT OF BAREFOOT WEIGHT BEARING EXERCISE COMBINED
WITH STRENGTH TRAINING FOR INTRINSIC FLEXOR MUSCLE
OF THE FOOT-ON-FOOT FUNCTION AMONG INDIVIDUALS WITH
FLAT FEET**

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ABSTRACT

Background – The purpose of the study is to apply the barefoot weight bearing exercise combined with strength training for intrinsic flexor muscle of the foot in order to improve medial longitudinal arch of the flatfoot and compare the result to identify the effect of the short foot exercises with barefoot weight training on flatfoot participants

Methodology – Study was undertaken on 9 subjects with age 18 – 25 and diagnosed with flatfoot. All the subjects received intervention for 4 weeks per 5 session/ week. The FADI score were used before and after the treatment.

Objective – The primary objective of this study was to determine the effectiveness of barefoot weight bearing exercise combined with strength training for intrinsic flexor muscle of the foot on foot function among individuals with flat feet.

Result – The p-value of 0.00 provides strong evidence to reject the null hypothesis, supporting the conclusion that there is a significant difference in the variable of interest between the pre and post values of FADI. These findings contribute valuable insights to the understanding of that barefoot weight bearing exercise combined with strength training for intrinsic flexor muscle is effective in improving foot on foot function.

Conclusion – Four Weeks barefoot weight bearing exercise combined with strength training for intrinsic flexor muscle of the foot is effective in improving foot function among individuals with flatfoot.

Keywords - Barefoot weight bearing exercise, Strength training for intrinsic flexor muscle of the foot, Flatfoot, Short foot exercise, Foot and ankle disability index

1. INTRODUCTION

There are of total 26 bones—7 tarsals (comprising the calcaneus; talus; navicular; cuboid; and medial, intermediate, and lateral cuneiforms), 5 metatarsals, and 14 phalanges—normally interlock to form medial and lateral longitudinal arches between the calcaneus and the metatarsal heads.

The normal medial longitudinal arch is 15 to 18 mm from the ground at the level of the navicular, which is the keystone of the arch, whereas the lower lateral longitudinal arch is normally 3 to 5 mm from the ground at the level of the cuboid.

The formation of these arches allows the support of the body weight with the least expenditure of anatomical material and provides protection for the nerves and vascular supply on the plantar aspect of the foot. An excessively high arch or low arch can result in a variety of dysfunctions in the foot and more distant segments as forces from the foot are transferred to more proximal joints. The bones that form these arches are passively interlocked by the action of the plantar aponeurosis (plantar fascia), long and short plantar ligaments, and

the plantar calcaneo-navicular (spring) ligament [1].

Flatfoot is a syndrome combining multiple static and dynamic deformities, with flattening of the medial arch. Flatfoot is a pathology of the weight-bearing foot, it involves different level

The talocalcaneonavicular joint - The mid-plantar tendon-ligament sling constituted by the calcaneonavicular or “spring” ligament and the posterior tibial tendon play an essential role in the elastic support of the joint complex.

The medial collateral ligament (MCL) of the tibiotarsal joint - it is subjected to stress when the heel strikes the ground, due to physiological non-alignment between the calcaneus and the tibia.

The midfoot - raising the heel automatically induces dorsiflexion of the phalanges, leading to tension in the plantar muscles and fascia, known as the “windlass mechanism”. This locks the midfoot joints; locking failure, encountered in case of first-ray hypermobility, leads to elevation of the first metatarsal during medial forefoot weight-acceptance, then to locking defect during

unipodal weight-bearing and hallux toe-off [2].

Foot and Ankle Disability Index

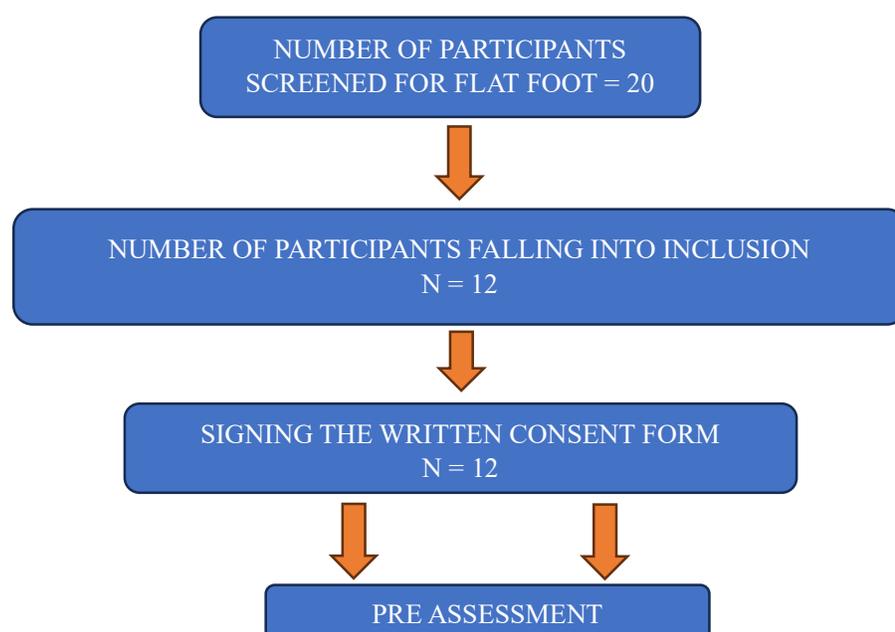
The FADI specific questionnaire for foot and ankle consists in a total of 26 items, grouped into three different categories of questions: 16 items (1-16) related to walking, 6 items (17-22) to daily activity and 4 (23-26) to pain. Each item can be scored on a 5-points Likert scale (from zero to four), with a maximum total score of 104 points; the score can be transformed into percentage if a comparison with other questionnaires is needed. The best possible score (104) corresponds to a complete absence of any difficulty in daily activities and no pain; the minimum score of zero (0) corresponds to the worst possible condition i.e. severe limitation in walking and daily activities as well as pain presence [3].

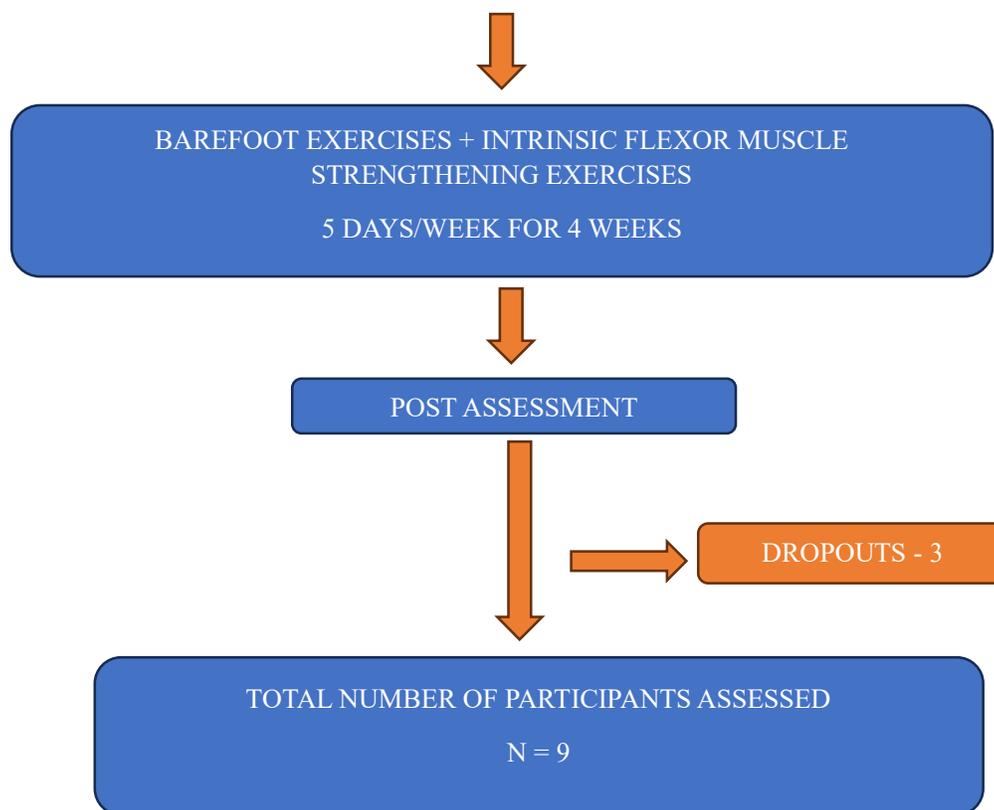
Short Foot Exercise and Barefoot Weight Bearing Exercise

Short foot exercises (SFE) are sensory-motor training that activates the intrinsic muscles of the foot and actively forms the longitudinal arch and the horizontal arch [4]. Short-foot exercise (SFE) is a widely used balance training intervention that has been developed recently to improve ankle proprioception and to strengthen the intrinsic foot muscles (IFM) so as to elevate and support the medial longitudinal arch (MLA) of the foot and improve dynamic standing balance [5].

Barefoot weight bearing activities were considered any activity that required them to be full weight bearing barefoot, wearing socks or light-weight, indoor slippers that provided no arch support [6].

2. METHODOLOGY





Flow chart – 2.1

2.1. Materials used:

1. Ink pad
2. Blank Paper
3. Plastic tray
4. Cotton
5. FADI scale
6. Pen

Procedure:

The study was conducted among college level individuals between 18 to 25 years of age to find the effect of barefoot weight bearing exercise combined with strength training for intrinsic flexor muscle of the foot.

20 participants with flat foot were screened for inclusion criteria out of which 12 individuals fulfilling the inclusion criteria

were recruited for the study. The inclusion criteria were: individuals between 18-25 years, individuals with non-structural flat foot, FADI Score ≥ 30 (Moderate), individuals who can understand Hindi, English and Gujarati, individuals who were willing to sign the consent form.

Each individual was then asked to sign the written consent form. Once the consent form was signed, each participants were made to perform barefoot weight bearing exercise and strength training for intrinsic flexor muscles of the foot under supervision and all the participants were assessed pre and post intervention for Foot and Ankle Disability Index. Total no. of dropouts was 3 (1 participant did not turn out for the post

intervention assessment and 2 participants did not complete the strength training program as per the protocol).

**The intervention is as mentioned below:
Strength Training for Intrinsic Flexor Muscles**

Level 1	Step 1 – Great toe extension and bring back to normal Step 2 – Extension of other toes bring back to normal
Level 2	Repeat to above steps and then do fanning of other toes
Level 3	Squeezing of toes

Short Foot Exercise (SFE): The SFE has to be held with 10 repetitions, 3 sets completed per training session, with a 2- min rest period. Once a day, 5 times a week for 4 weeks.

Barefoot weight bearing exercises:

EXERCISES	WEEK – I	WEEK - II	WEEK - III	WEEK - IV	SETS (1 min. rest between sets)
Squats	10 Reps.	20 Reps.	10 Reps. On bosu ball	20 Reps. On bosu ball	3
Forward lunges	10 Reps.	20 Reps.	10 Reps. On bosu ball	20 Reps. On bosu ball	3
Side lunges	10 Reps.	20 Reps.	10 Reps. On bosu ball	20 Reps. On bosu ball	3
Duck walks	20 Steps	30 Steps	40 Steps	50 teps	3

3. RESULT

The study included total 20 participants, out of which 12 were included in the study according to the criteria, and 3 dropped out, total 9 participants (3 Male and 6 Female) were there for the intervention. All participants provided informed consent. The descriptive statistics of our study group are presented in **Table 3.1**.

The above **Table 3.1** shows the descriptive statistics of the data in which mean age is 21.68, pre-FADI is 78.89 and mean post-FADI is 89.68 The data followed the

normality so between group analysis was done with paired sample t test.

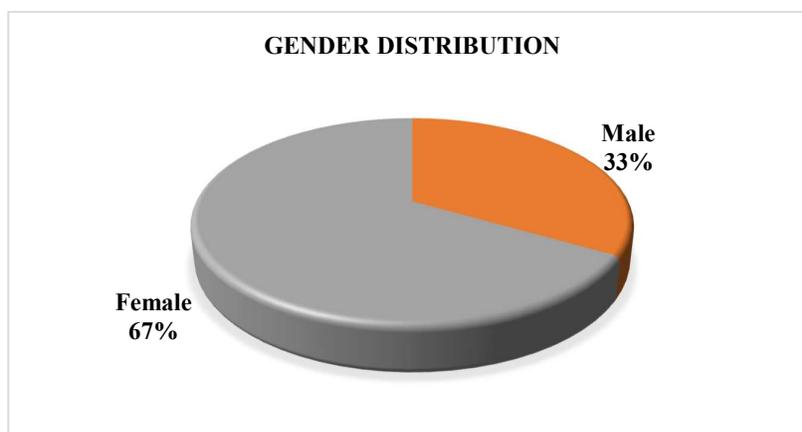
The above Pie chart shows the gender distribution of the data, in which 67% female and 33% male (**Graph 3.1**). There is unequal distribution of the data.

The mean age is 21.68, pre-FADI is 78.89 and mean post-FADI is 89.6 (**Graph 3.2**).

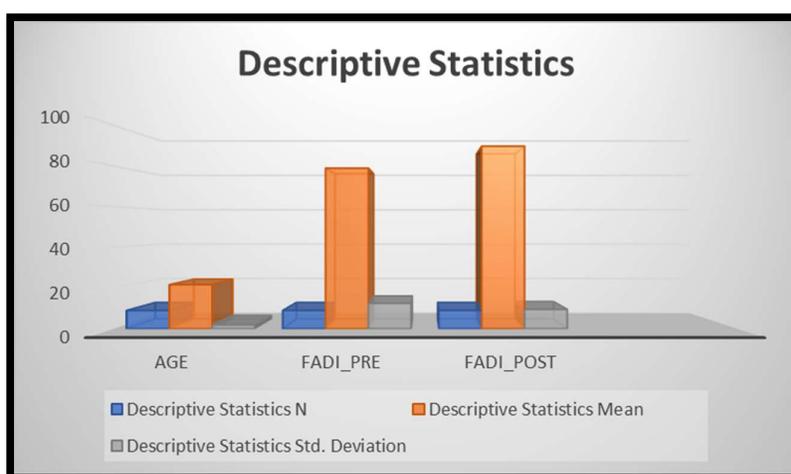
The data followed the normality so between group analysis was done with paired sample t test. The table shows the mean Pre and Post FADI and the test showed significant difference between the pre and post values.

Table 3.1

Descriptive Statistics			
	N	Mean	Std. Deviation
Age	9	21.67	1.94
FADI PRE	9	78.89	12.52
FADI POST	9	89.67	9.53



Graph 3.1



Graph 3.2

Table 3.2: Paired Samples Test

Paired Samples Test								
	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
FADI_POST - FADI_PRE	10.78	4.15	1.38	7.59	13.96	7.79	8	0.00

In the provided **Table 3.2**, a paired samples test has been conducted to assess the differences between two related sets of data of Pre and Post FADI.

The mean difference of 10.78, along with the 95% confidence interval (7.59 to 13.96), suggests that the variable under

consideration has undergone a substantial change from the pre-assessment to the post-assessment. The p-value of 0.00 provides strong evidence to reject the null hypothesis, supporting the conclusion that there is a significant difference in the variable of interest between the pre and post values of

FADI. These findings contribute valuable insights to the understanding of that barefoot weight bearing exercise combined with strength training for intrinsic flexor muscle is effective in improving foot on foot function.

4. DISCUSSION

The goal of the study was to establish the effect of barefoot weight bearing exercise combined with strength training for intrinsic flexor muscle of the foot-on-foot function among individuals with flat feet. Total number of subjects screened for the study was about 20. Based on inclusion and exclusion 12 subjects were selected. In which 12 were included in the study as they were willingly participating. Total number of subjects were made to perform barefoot weight bearing exercises and strength training for intrinsic flexor muscles of the foot under supervision. In that dropout was 3. At the end of 4 week of training program, post FADI was used measured the foot function.

In the previous study Takayuki Hashimoto, suggested that muscle strength training method significantly improved muscle strength scores, foot arch shape, and movement performance, also believe that intrinsic foot flexor strength training is useful for improving standing and walking performance, in addition to improving the performance of sports athletes engaged in

activities involving greater exercise loads [7].

Another study was done by Eun-Kyung Kim, “short foot exercises and arch support insoles improved flatfoot conditions and it could be seen that as the medial longitudinal arch was improved, dynamic balance ability was improved. In addition, it could be seen that sensory-motor training such as short foot exercises were more effective than conservative treatment methods such as arch support insoles” [8].

Previous Study was conducted by Marcey Keefer Hutchison, this study confirms that foot specific exercises achieve sufficient training intensity to strengthen foot muscles. The study also confirms that these training effects specific to the foot are achievable in participants with significant FF deformity. Qualitative data supports several possible benefits of the exercise program and noted high compliance over an 8-week period [6]. Present study shows significant improvement in foot function among individuals with flatfoot after the treatment with barefoot weight bearing exercise combined with strength training for intrinsic flexor muscle of the foot. The mean difference of 10.78, along with the 95% confidence interval (7.59 to 13.96), suggests that the variable under consideration has undergone a substantial change from the pre-assessment to the post-assessment. The p-value of 0.00 provides strong evidence to

reject the null hypothesis, supporting the conclusion that there is a significant difference in the variable of interest between the pre and post values of FADI. These findings contribute valuable insights to the understanding of that barefoot weight bearing exercise combined with strength training for intrinsic flexor muscle is effective in improving foot on foot function.

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6. CONCLUSION

Four Weeks barefoot weight bearing exercise combined with strength training for intrinsic flexor muscle of the foot is effective in improving foot function among individuals with flatfoot.

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