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Effect of Flat Feet on Foot Health and Quality of life on school going children

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Abstract: *The foot has 3 arches- medial and lateral longitudinal arches and transverse arch.For functions of foot like shock absorption, weight transmission and to act as a lever for propelling the body forward during locomotion, the structure and dynamicity of foot arches area unit are essential. Flat foot is often a composite disorder, with numerous symptoms and ranging degrees of deformity and incapacity. Flexible flatfoot is one of the most common forms of flatfoot. If left untreated, foot deformities can lead to abnormal spinal curvature, postural problems like tibial medial rotation, pelvis shifts anteriorly with increase in lordosis as COG shifts anteriorly, slower walking speed, uneven plantar region pressure distribution, problem in winding up daily activities, associate augmented risk of falling. Our study aims to search out the result of flat feet on foot health using Foot Health Status Questionnaire and quality of life using Rand SF-36 Questionnaire. This observational cross-sectional study was conducted on two groups of children- low arch foot and normal arch foot. The children were divided into groups on basis of Navicular Drop test value. A total of 86 students of age group between 14 and 15 years were included in the study. The results concluded that 50% foot health is affected in flat feet children and 75% quality of life is affected in flat feet children.*

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I. Introduction

Footproblems appear in approximately 70% to 80% of adults and 30% of children. The foremost ordinarily occurring issues concern deformities of the medial longitudinal arch, either because it is excessively high (a condition referred as *pes cavus*or cavus foot) or excessively low (*pes planus* or flat foot). [1]Studies have revealed that 60% of school age population have normal arches, 20% have a high arched foot and the remaining 20% have a low arch.[1] Medial longitudinal arch develops by 7-9 years of age.[2]Flexible flatfoot is one of the most common forms of flatfoot.[3]A flexible flatfoot has an arch that is present in open kinetic chain and lost in closed kinetic chain. It usually begins in childhood and adolescence and continues into adulthood.[4]

Flat foot deformity was classified into three subtypes by Harris RT and Beath T, viz. rigid flat foot, Flexible Flat Foot (FFF) and Flexible Flat Foot with Short Tendo-Achilles (FFF-STA). FFF is generally symptomless whereas FFF-STA gives rise to pain and functional disability.[5] Flat foot has been associated to case history, the usage of footwear, obesity.[6] In India, not much is known about the result of flat feet on health-related quality of life. The present study aims to form awareness concerning result of flat feet on quality of life in school children and to implement further additional programs for the betterment of foot health and improvement in quality of life.

II. Material and Methods

This observational cross-sectional study was carried out on students of Erin N. Nagarvala Day School, Kalyani Nagar, Pune, Maharashtra in January 2019. A total of 86 children (both male and female) of age 14-15 years were included in the study.

Study Design: Observational Cross-sectional study.

Study Location: This was a secondary school-based study done in Erin N. Nagarvala Day School, Kalyani Nagar, Pune, Maharashtra.

Study Duration: 6 months

Sample size: 86 school students

Subjects and selection method: In the secondary school, subjects were purposively selected of the desired age group (14-15 years) and were included in the study according to inclusion criteria and were screened to assess for the height of medial longitudinal arch using navicular drop test.The results of the test were used to classify children into two groups- normal arch children and low arch children. 43 were selected in flat feet group according to the ND test value- more than 10mm.Remaining 43 subjects were selected in normal arch group where ND test value was below 10mm.

Inclusion criteria:
1. Both male and female
2. Age group: 14-15 years[7,8, 9, 10, 11]
3. Bilateral flexible flat feet with navicular drop test value>10mm[12]

Exclusion criteria:
1. Rigid flat foot
2. Ankle sprain
3. Any previous foot surgery
4. BMI>23
5. Any lower limb fracture[13]
6. Any prior trauma to feet modifying foot morphology[13]

Procedure methodology:

The selected students were informed about the study to be conducted. An informed consent form was explained to the participants and was taken from all the guardians of the subjects at the beginning of the study. An assessment form was used to collect data of the selected students. The form included sections of name, age, gender, navicular drop test value of both legs- first in sitting position and then in standing. In this way, subjects were divided in two groups- normal arch and low arch group.

The participants were explained about the study to be conducted, they were informed about the details of FHSQ and Rand SF-36 questionnaires. The participants were then given Foot Health Status and Rand SF-36Questionnaire.The foot health status questionnaire was divided into two sections for the convenience. Section 1 contains four domains- questions related to foot pain, foot function, footwear and general foot health.Section 2 contains four domains- questions related to overall health, physical function, vigour and social capacity. The Rand SF-36 questionnaire comprises of 36 items that assesses 8 health concepts: physical functioning, role limitations caused by physical health problems, role limitations caused by emotional problems, social functioning, emotional well-being, energy/fatigue, pain and general health perceptions.

Navicular Drop test:

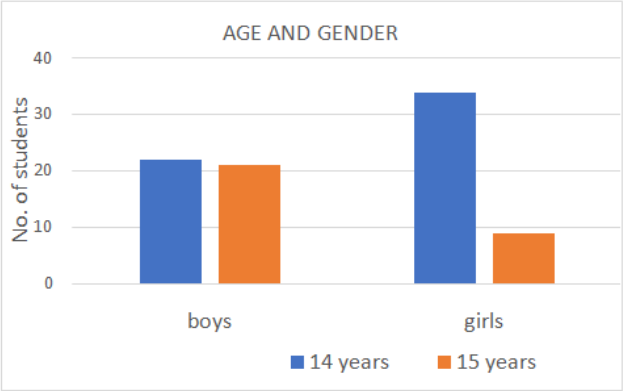
The subject will be placed in a sitting position with their feet flat on a firm surface and with the knees flexed to 90 degrees and ankle joint in neutral position.The most prominent part of the navicular tubercle while maintaining subtalar neutral position will be identified and marked with a pen.Subtalar neutral position would be establishedonce talar depressions area unit are equal on medial and lateral side of the ankle joint.The assessor places index card on the inner side of the hindfoot, with the card placed from the floor in a vertical position passing the navicular bone.The level of the most projectingpart of the navicular tubercle will be marked on the index card.The individual will then be asked to stand without changing the position of the feet and to distribute equal weight on both feet. In the standing position, the most protruding part of the navicular tubercle relative to the ground can then be identified and marked on the index card.Finally, the difference between the original height of the navicular tubercle in sitting and weight bearing positions will be assessed with a ruler providing ND in millimeters.Thus, value of ND below 10mm will be considered as normal and more than 10mm will be considered as abnormal.

Statistical analysis

Data was analyzed using GraphpadInStat Version 3.10. Unpaired t-test was used to ascertain the significance of differences between mean values of components of both the questionnaires between two groups. The value of $p< 0.0005$ was considered as cutoff value or significance.

III. Result

Graph 1: Demographic data
Showing participants of different age group and gender**.**



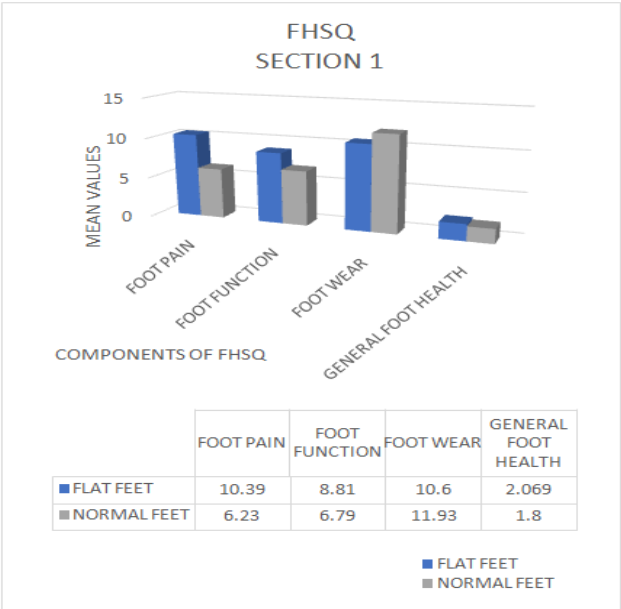
By comparing the mean scores of Foot Health Status Questionnaire, the two groups revealed similar results.

Table no 1 Shows mean scores with standard deviation of foot health status questionnaire components of two groups- normal arch feet and low arch feet. The difference in mean values of all domains was not statistically significant (p> 0.0005).

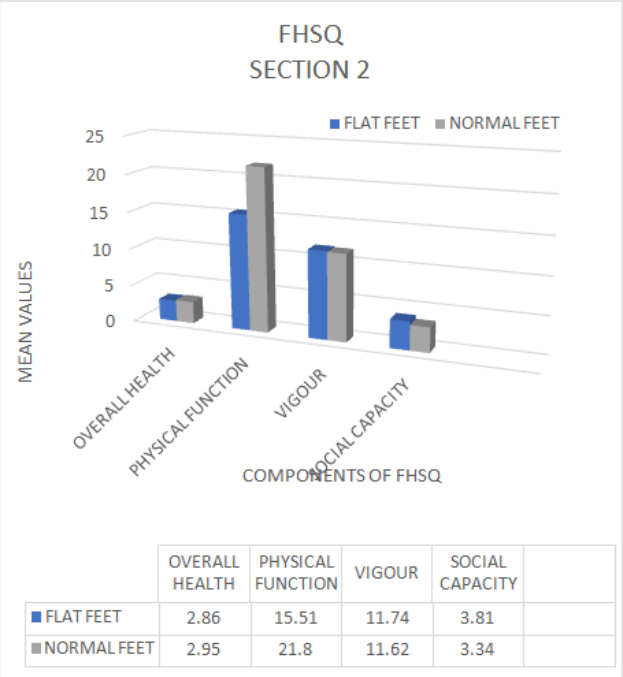
Table no 1 Mean scores of all 8 domains of foot health status questionnaire of two groups- normal and low arch feet children.

Section 1	Mean ± SD	Mean ± SD			
	Normal feet	Flat feet	P value	Test used	Level of significance
Foot Pain	6.23 ± 2.38	10.39 ± 2.33	P<0.0001	Unpaired t- test	Significant
Foot Function	6.79± 2.92	8.81 ± 2.63	p=0.0011	Unpaired t- test	Significant
Foot wear	11.93 ± 2.54	10.60 ± 2.77	p= 0.023	Unpaired t- test	Significant
General foot health	1.88 ± 0.90	2.07 ± 0.85	p=0.33	Unpaired t-test	Not Significant
Section 2					
Overall health	2.95 ± 1.02	2.86 ± 0.99	p= 0.66	Unpaired t-test	Not Significant
Physical function	21.83 ± 3.73	15.51 ± 2.76	p< 0.0001	Unpaired t-test	Significant
Vigour	11.62 ± 1.95	11.74 ± 2.67	p= 0.81	Unpaired t-test	Not Significant
Social Capacity	3.35 ± 1.32	3.81 ± 1.55	p= 0.14	Unpaired t-test	Not Significant

Graph 2: Foot Health Status Questionnaire Section 1
Showing mean values of four components of Section 1



Graph 3: Foot Health Status Questionnaire Section 2
Showing mean values of four components of Section 2



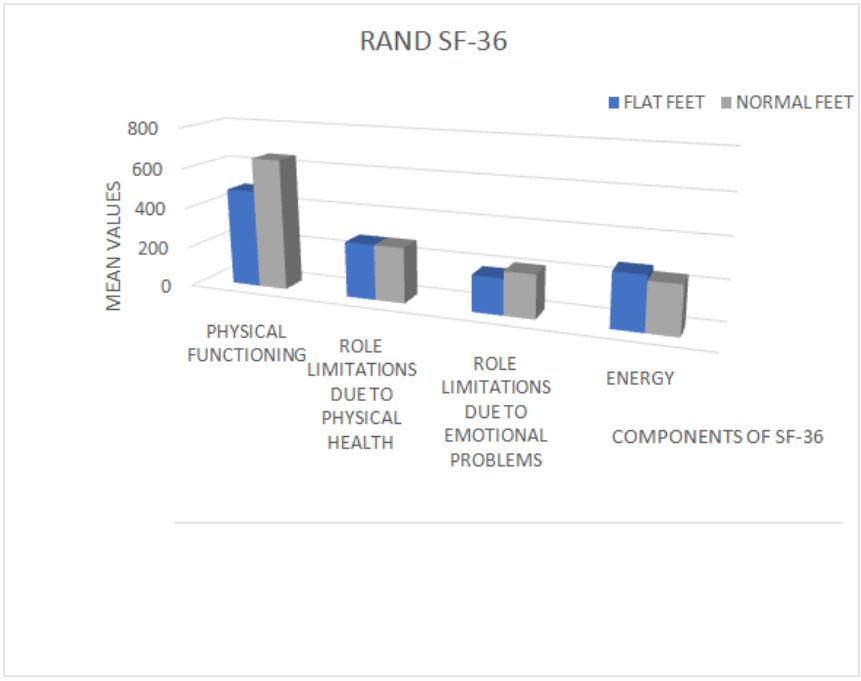
	OVERALL HEALTH	PHYSICAL FUNCTION	VIGOUR	SOCIAL CAPACITY
FLAT FEET	2.86	15.51	11.74	3.81
NORMAL FEET	2.95	21.8	11.62	3.34

Table no 2 Shows mean scores with standard deviation of Rand SF-36 questionnaire components of two groups- normal arch feet and low arch feet. The difference in mean values of all domains was not statistically significant (p> 0.0005).

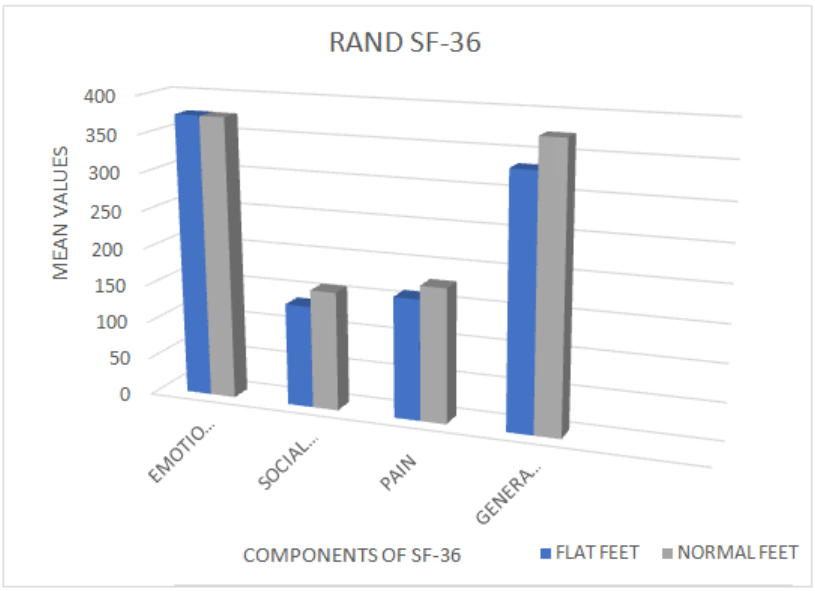
Table no 2 Mean scores of all 8 domains of Rand SF-36 questionnaire of two groups- normal and low arch feet children.

Components	Mean ± SD	Mean ± SD			
	Normal feet	Flat feet	P value	Test used	Level of significance
Physical Functioning	651.16 ± 299.1	486.05 ± 302.04	p= 0.012	Unpaired t-test	Significant
Role limitations due to physical health	274.41 ± 100.22	274.41 ± 119.7	P> 0.99	Unpaired t-test	Not significant
Role limitations due to emotional problems	213.95 ± 88.86	179.07 ± 94.01	p= 0.08	Unpaired t-test	Significant
Energy	240 ± 51.82	266.51 ± 64.10	p= 0.04	Unpaired t-test	Significant
Emotional well-being	374.41 ± 99.45	374.88 ± 88.7	p= 0.98	Unpaired t-test	Not significant
Social function	158.14 ± 44.23	136.02 ± 41.9	p=0.012	Unpaired t-test	Significant
Pain	178.25 ± 30.8	160.46 ± 37.22	p= 0.017	Unpaired t-test	Significant
General health	374.41 ± 73.29	333.72 ± 88.62	p= 0.0227	Unpaired t-test	Significant

Graph 4-A: Rand SF-36 Questionnaire
Showing mean values of four components of questionnaire



Graph 4-B: Rand SF-36 Questionnaire
Showing mean values of four components of questionnaire



IV. Discussion

The main aim of this study was to determine the effect of low foot arch on foot health and quality of life in a sample population of school children by comparing the scores of self- reported questionnaires- FHSQ and Rand SF-36. In this study, 86 students of secondary school of age group 14-15 years were included.

The participants with low arch were categorized according to the measurements obtained in the Navicular Drop Test. The sample population includes a specific age group of 14-15 years of age. [1]

From graph 1, it can be concluded that the number of boys participating in the study were approximately equal from both age groups-14 and 15 years. But the number of girls were more from the age group of 14 years as compared to those from 15 years age group.

From graph 2, it is seen that three domains-foot pain, foot function and foot wear are significant and general foot health domain is not significant. Thus, it can be concluded that foot health is more affected in flat feet children as they experience more pain, more interference of arch in activities, more restrictions in terms of footwear. This is supported by a study done by V Sachithanandam et al. who concluded that students who wore footwear(shoes) for over eight hours a day had more prevalence of flat foot.[18] Thus, this affection may be related to a higher number of foot injuries amongst schoolchildren who engage in sports activities and register hypermobility, highlighting the need for regular foot care and monitoring. [14,15,16]

From graph 3, it is seen that physical function domain is significant and other three domains- overall health, vigor and social capacity are not significant. Thus, it can be concluded that low arch children have more limitations in physical function. [19] The mean scores for social capacity are little higher in flat feet children indicating barrier faced by the students to indulge in social activities.[15]

Quality of life as seen from SF-36 questionnaire, is affected in flatfeet students as scores show significant difference in mean values. As of graph 4-A, physical functioning and role limitations due to emotional problems are affected in flatfeet children as they face difficulty in carrying out activities.[6] As for role limitations due to physical health, there is no change seen in mean scores irrespective of the foot arch type. It is seen that low arch students need more energy to perform activities.[6]

As for graph 4-B, social function, pain and general health scores are reduced in flat feet children indicating difficulty faced by students to interact socially, having more pain than others and affection of general health respectively indicating a negative impact of low arch on quality of life. [15]

The findings of the study coincide with the similar study done by Daniel Lopez Lopez et al. to determine the effect of arch height on quality of life in children of age 6-12 years. They concluded that quality of life is affected in flat feet children.[1]

Also, the study is supported with the similar study done by Alpesh Kothari et al. where health related quality of life was assessed in school children of age 8-15 years and results conclude that quality of life is affected in flat feet children.[7]

V. V.Conclusion

Comparison of the scores obtained reveal that low arch has a negative impact on foot heath and quality of life. It is seen that 50% of foot health is affected in low arch children. As for quality of life, 75% affection in quality of life is seen in low arch children.

Since there is a lack of evidence regarding the etiology and treatment of foot diseases and deformities, these results highlight the need to implement programs to promote foot health and to continue research into this commonly occurring disabling condition. [1]

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