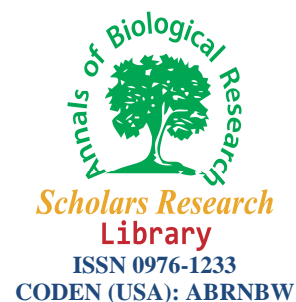




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# The Effects of Corrective Exercise Program on Flat Foot Deformity of Male and Female Students

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## ABSTRACT

*The present study, in addition to investigating the prevalence of flat-foot deformity among 12-15 year old male and female teenagers, studies the effect of a special exercise program on correcting this deformity. For this purpose, 351 male and 346 female students were evaluated randomly by using "foot-print" technique. Among them 83 male student and 47 female students were considered having flat-foot to some degree. Then out of the total number of the subjects, 30 subjects were selected randomly and divided into two experimental and control groups. These subjects participated in 6 weeks of corrective exercise program with 3 sessions per week. To ensure the validity of the method of evaluation by foot-print, 3 subjects were X-ray in pre and post tests tags. The information related to the subjects' health status and movement habits were also collected through questionnaires. The collected data were analyzed statistically by method of  $\chi^2$  ( $P \leq 0.05$ ) which led to the following results. The prevalence of flat-foot deformity in males is higher than females. There is a significant relationship between age and weight of the students and this deformity ( $P \leq 0.05$ ). It means that older, heavier and endomorphic subjects had more problems about flat-footedness. The results of the post-test also did not indicate a significant relationship between 18 sessions of exercise program and the correction of this deformity among subjects ( $P \leq 0.05$ ). Therefore considering the high prevalence of flat-foot deformity among teenagers, and its negative effects on their health, it is emphasized in this study that a more serious attention should be paid to recognition, prevention and correction of this deformity. according to the out comes of researches it also seems that using X-ray method has been useful in the sifting stage, and to be more effective, taking exercise, increasing intensives and time of exercise and using other complementary methods such as medical shoes during exercise and after that and using surgery in secretive cases can be effective in the cure near flat-footed people*

**Keywords:** Flat-Foot; Corrective Exercises; Flexible Flat-Foot; Rigid Flat Foot.

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## INTRODUCTION

Foot as the motion part and fulcrum, consist of some bones that have aligned beside each other and connected together by ligaments and muscles. Bone structure of metatarsal is dome – like and consists of three arcs; two internal and external longitude arcs and a latitude arc, kept by ligaments and muscles that serve as pressure distributor of other body organs. Any change in height decrease of these arcs is abnormal and called flat foot or pes/planus (4, 5, 15). This deformity will cause decreased body efficacy, premature fatigue sense, back pain and secondary deformity in individual (9, 5, 15). This can be acquisitive and hereditary in both gender in various ages (5, 1) and usually seen flexible and rigid flat foot and divided into low, middle and severe (5, 13, 1). It appears that first type have a corrective ability because of weakness of preservative soft tissues of arcs and respond positively in unsurgical and conservative method (14,16).

It appears that, for correction of this deformity, therapeutic training must perform for strengthening of articular-muscular structure in establishment of arces (14, 11) lack of correction of this deformity can result in creating and intensifying of compensational and secondary deformities in other organs. The most important deformity – related to flat foot are wide foot, hullux valgus , jenu valgus and lordosis(9,18,16).

Farzi and colleagues (1993) showed that breakout of flat foot in students was 36/6 percent. (19/4% in boy, 17/2 % in girls). They reported that maximum and minimum breakout of flat foot was in 8 years (%27/5) and 12 years (%41/2) respectively.

This study also showed that the breakout rate of one grade flat intensity decreased with increasing age and increased the breakout of rate of 2- grade flat intensity(18). In a study with purpose of flexible flat foot in children: an actual problem in range of 4-13 years (Antonio Garcia and teal, 1999) showed that breakout of flat foot in 1181 children was %2/7. They could cure some children by using devices such as boots and medicine crescent foot floor arcs (1).

In a study titled study of flat foot and it's relationship with overweight in Italy schools on 243 students with 8-10 years ( Bordin D and etal , 2001) , results showed that breakout rate of flat foot in studied students was %16/4 , %18 boy and %14/6 girl . Rate and overweight estimated %27/3 in same studied students. It also showed that obesity and overweight had significant relation with flat foot deformity in subjects (2). Most specialist suggest surgery for curing severe flat foot, but they believe that for curing low and middle flat foot , weak ligaments and muscles can strengthen by planning suitable corrective exercise(7). The aim of present study is description of studied students status regard to infection to flat foot deformity and then prescription and study effect of a corrective exercise period on subjects flat foot changes and comparison effect of training program on both gender with assumption there is no significant different in flat foot change after a period of research in determining of breakout rate of this deformity in society, but, little studies have done on effect of corrective exercise on curing flat foot deformity.

## MATERIALS AND METHODS

### Methodology

351 boys and 346 girls selected randomly, then using by foot print, a visual method, all subjects evaluated. Among 351 examined students, 83 students (%23/6) had a flat foot with different intensity , and among these students 13 ones (%3/6) had intense flat foot and 70 ones (%19/9)

had low flat foot with various intensity , and among 346 girl student, 47 students(%13/6) had flat foot with various intensity, and among them, 15 ones (%4/3) had intense flat foot and 32 ones (%9/2) had low flat foot.

Among subjects with flat foot, 30 students in each group (boy and girl) selected randomly. From 30 boy students, 15 students with average age  $13/3 \pm 1/29$  (experiment group) and 15 student with Average age  $13/71 \pm 1$ (control group) and in girl group, 15 students with average age  $13/60 \pm 1/44$  (experiment) and 15 students with average age  $13/58 \pm 1$  (control) divided into tow group of 15 students. Characteristic of boy and girl experiment and control group in pre-test phase seen in table 2. In girl experiment group , a corrective training consists of 6 week training with 10 stretch and strength exercises (4 , 6 , 10)performed regarding, to overload and overstretch principle and respect to factor like number , duration of exercise and test between exercise and training bouts. First week training program consisted of 3 sessions/ each session with 5 repetition, in first repetition of first session, subjects performed 10 exercises to 10 second with 5 second rest. In next repetition, exercise time was 35 minute. Second week: 3 session / 6 rep ,10 exercise : 10 sec exercise and 5 sec rest , next rep : 5 sec added ,whole training time : 44. Third week: 3 session / 7 rep , 10 exercise: 10 sec exercise and 5 sec rest , next rep : 5 sec added ,whole training time: 54 min. In next weeks, repetition and whole training time added, until in 18th session, training program was 10 repetitions with whole training time of 112 minute. A questionnaire consists of 14 question provided for gaining data about physical position and motor habits of subjects. X ray method only performed on little students for ethnical limits on children, unsatisfaction of parents and subjects and expensive costs. Subjects of two groups reevaluated after end of training of experiment group.  $X^2$  test used for analysis of data ( $p \leq .05$ ) (table 7).

## RESULTS AND DISCUSSION

1. Among 351 screened boy students with average age 13 / 01, 83 students (%23/6) infected to flat foot with various intensities, 25 students of 83 were 12 years (%7/1), 33 one's 13 years (9/4). 20 one's were 14 years (%5/7) and 5 ones 15 years (%1/4) (table 3).
2. Among 346 screened girl students with average age 13/13 , 47 students (%13/6) infected to flat foot with various intensities ,16 students of them (4/62) were 12 years , 14 ones (%4/04) 13 years, 8 ones (%2/31) 14 years and 9 ones (%2/6) 15 years. (Table 4).
3. Among 351 screened boy students externally status, 83 students ( %23/6) infected to flat foot with various intensities , 38 students (%10/8) were ectomorph , 33 ones (%9/6) mesomorph and 12 ones (%3/4) endomorph (table 5).
4. Among 346 screened girl students from externally status, 47 students (%13/6) infected to flat foot with various intensities , which 16 students (%4/7) were ectomorph , 20 ones (% 5/8) mesomorph and 11 ones (%3/2) endomorph ( table 6).
5. Frequency percentage and intensity of deformity using by foot print in boy groups were: 70 students (%19,9) of 83 ones (23/6) with flat foot had low flat foot and 13 ones (% 3/7) had intense flat foot ( diagram 2).
6. Frequency percentage and intensity of deformity using by foot print in girls were: 32 students (%9/2) of 42 ones (%13/6) had low flat foot and 15 ones (%4/3) had intense flat foot (diagram 2).
7. comparison of table 2 and diagram 1 and test of main study hypotheses ( hypotheses 1,2) showed that corrective exercise had no significant effect on changing flat foot deformity from intense to low or from low to natural , on the other hand, corrective training exercise didn't cause improvement in flat foot status of subjects in any groups(  $p \leq 5\%$ ).

- 8. There was significant relationship between flat foot and externally status of subject ( $p \leq 5\%$ ).
- 9. Rate of deformity breakout in boy group was greater (%23/6) than girls (%13/6)

**Table 1- Total distribution of boy subjects at age and outbreak rate of flat foot at various ages**

	Age 12	Age 13	Age 14	Age 15	Total
Subjects distribution	130	121	65	35	351
Percentile distribution	%37	%34.5	%18.5	%10	%100
Outbreak rate of deformity	25	33	20	5	83
Outbreak percentile	%7.1	%9.4	%5.7	%1.4	%23.6

**Table 2- Total distribution of girl subjects at age and outbreak rate of flat foot at various ages**

	Age 12	Age 13	Age 14	Age 15	Total
Subjects distribution	111	120	77	38	346
Percentile distribution	%32.1	%34.7	%22.2	%11	%100
Outbreak rate of deformity	16	14	8	9	47
Outbreak percentile	%4/62	%4.04	%2.31	%2.6	%13.6

**Table 3- Total distribution of boy subjects at physical status and outbreak rate of flat foot**

	Ectomorph	Mesomorph	Endomorph	Total
Subjects distribution	198	135	18	351
Percentile distribution	%56.4	%38.5	%5.1	%100
Outbreak rate of deformity	38	33	12	83
Outbreak percentile	%10.8	%9.4	%3.4	%23.6

**Table 4- Total distribution of girl subjects at physical status and outbreak rate of flat foot**

	Ectomorph	Mesomorph	Endomorph	Total
Subjects distribution	196	130	20	346
Percentile distribution	%56.6	%37.6	%5.8	%100
Outbreak rate of deformity	16	20	11	47
Outbreak percentile	%4.6	%5.8	%3.2	%13.6

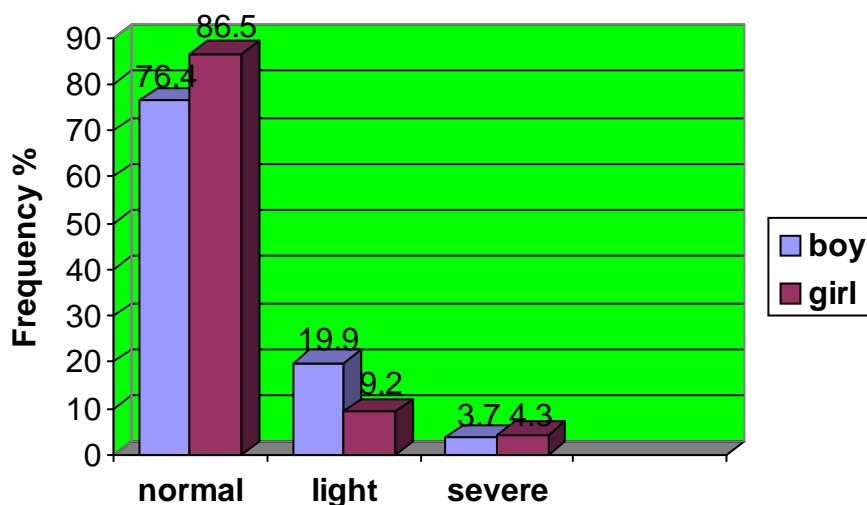
**Table 5- Results of hypothesis test in boy group**

	Alternate hypothesis $A$	$H_0$ hypothesis	$\chi^2$ Computed	$\chi^2$ Table	df	Result
1	There is relation between training program and deformity correction	There is no relation between training program and deformity correction	3.52	3.84	1	No relation
2	There is relation between flat foot and age	There is no relation between flat foot and age	13.20	12.59	6	relation
3	There is relation between flat foot and physical status	There is relation between flat foot and physical status	30.13	9.49	4	relation

**Table 6- Results of hypothesis test in girl group**

	Alternate hypothesis	$H_0$ hypothesis	$\chi^2$ Computed	$\chi^2$ Table	df	Result
1	There is relation between training program and deformity correction	There is no relation between training program and deformity correction	3.52	3.84	1	No relation
2	There is relation between flat foot and age	There is no relation between flat foot and age	13.80	12.59	6	relation
3	There is relation between flat foot and physical status	There is relation between flat foot and physical status	34.25	9.49	4	relation

Fig. 1



Frequency percentile and outbreak rate of deformity in boys and girls

### CONCLUSION

Because of being a series of differences in results of some studies, it is possible, this difference results from lack of measurement and estimate error, but it can be concluded that if examiner have enough experience, the used method in this study will have high and acceptable reliability and in most study before this study, researchers have used of this method for evaluating foot status. For ensure of reliability of foot print, 3 students selected randomly and had an x ray. 2 of them had intense flat foot and other had low flat foot in pre-test phase. After performing corrective exercise and end of training program, same 3 ones evaluated by x ray post-test, and no change in flat foot from severe to lower or from low to natural reported by orthopedic specialist. Borden D and college (2001) reported that in primary school with range of 8-10 years, rate of flat foot breakout in studies group estimated % 16/4, which % 18 of them was boy and % 14/6 girls (2) Totally, the cause of children pain from this deformity recognized obesity and over-weight, the results of this study agree with Borden.

In other study with closer range to present study, the results were same. Ghodami in study of deformity rate of lower body in 11-15 boy students and corrective exercise, he reported the rate of flat foot deformity is %26/85 (6) which from viewpoint of infection rate to this deformity agree with present study.

Farzi and colleagues (1993) using by foot print method for determining breakout rate of flatfoot in primary school students, they reported breakout rate of this deformity is %36/6 which %19/4 in boys and %17/2 in girls by gender separation. Also, breakout rate of first grade flat intensity decreased and breakout rate of second of grade flat intensity increased (18). The results of this study are not against with present study. Because of more action freedom of boys comparison with girls and unlimiting of their motor activities in places such as school, houses, street, which most of these activities is play and recreation, and beside these activities children confront to a series of pressure and hit, these pressures in joints and muscles of foot cause fall in this joints and also more stretch of muscles (12). On the other hand, unsuitable nutrition among children

and, lack of enough mobility of them make them obesity and by increasing weight pressure on foot joint and muscles increase and this agent intensify flat foot deformity (17).

Mark. N charrette(2003) , in study titled children flat foot and orthopic fulcrum , reported that one of causes to flat foot deformity is overweight(3). Lack of standards considerations in producing suitable shoes (13) and chronic use of people, especially people with flat foot in growing age, can intensify this deformity. Also , regarding to lack of effectiveness of 10 stretch and strength exercise for curing this deformity according to training table, it is possible that these exercise had no good quality for healing or training table had no suitable intensity and duration. So, for healing this deformity, combination of training program with therapeutic devices such as medicine foot floor and increase duration and intensity of training is necessary.

Antonio Garica and colleage (1999) could cure this deformity by using devices like boots and medicine crescent foot arcs (1).

Therefore, considering breakout rate of above deformity, problems and various consequences which can make for infected one, importance and necessity of prevention and curing flat foot, especially among students determined. Also, because in education environment, physical education teachers are ones who work with student's physical status, by coordination of parents and trainers, PE teachers can have the most roles in identifying and preventing of this deformity. It suggest that x ray method is used in screen phase , because in x ray method , existing angles between bones are clear , and for preventing of breakout of flat foot , factors like nutrition, decreased weight , use suitable shoes and correction of bad motor habits must be considered.

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