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To Study the Effectiveness of Corrective Exercises and Insole Placement on Flatfoot in Overweight Individuals

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Abstract
Background: The studies had been attempt to determine the effectiveness of corrective exercises and insole placement on flatfoot in overweight individuals but it appears that the results are varied. A study on the effectiveness of corrective exercises and insole placement on flatfoot in overweight individuals resulted that exercise alone provide less improvement on medial longitudinal arch. Another study on efficiency of corrective exercises and insole placements on flatfoot in overweight individuals provides greater improvement on medial longitudinal arch than the study on the effects of insole placement alone on flatfoot in overweight individuals.
Purpose: The main purpose of this studies is to determine the presence of flatfoot in overweight individuals and to determine the effect of insole placement and foot corrective exercises on flat foot in overweight individuals.
Subjects and Methods: The 30 overweight individuals with BMI of 25-29.9 between 20 to 30 years old with flatfoot was divided into 3 groups that receive insole only (n = 10), group that receive corrective exercise only (n = 10) and a group that receive insole and corrective exercises (n = 10). The outcome of footprint was measured based on The Foot Print Angle (FA) proposed by Forriol and Pascual. Measurement of the Body Mass Index (BMI) of the subject was measured based on Standard International (SI) Unit. Measurements of BMI and Footprints Angle was taken on pretest initially and then followed by 4^{th}, 8^{th} and 12^{th} week. Measurements of each individuals was recorded to evaluate the effectiveness of interventions.
Results: There was a significant different in Group A (Insole group) on left side at the level $p< 0.0001$ [R square=0.8124, mean=27.40], and on right side at the level $p<0.0001$ [R square=0.7664, mean=27.70], In Group B on left side, there was a significant different at the level $p=0.0269$ [R square =0.416, mean=5] and on right side at the level $p=0.0234$ [R square= 0.4169, mean=6.4]. In Group C on left side, there was a significant different at the level $p=<0.0001$ [R square=0.8994, mean=43.1] and on right side at the level of $p<0.0001$ [R square=0.7997, mean= 35.2].
Application of insoles shows a greater significant value than the exercise with the mean difference of (21.85). Corrective exercises alone shows less significant compared to Insole placement and corrective exercises with the mean differences of (33.45). Insole placement and corrective exercises shows greater significant compared to Insoleplacement alone with the mean differences of (11.6). This indicates the data from the table supported the alternate hypotheses of the study and rejected the null hypotheses.
Conclusion: This studies concluded that the combination of insole and corrective exercises has greater significant in improving medial longitudinal arch than exercise and insole alone.

Keywords: Over weight individuals, flat foot, body mass index, footangle, insole, corrective exercises.

1. Introduction
Hind foot, midcourt and forefoot are the major parts of the foot. The foot supports the body weight and provides the leverage for walking and running. Arch is a segmental elevation of the foot. Human foot consist of three arches, medial longitudinal arch, lateral longitudinal arch and transverse arch [1]. Medial longitudinal arch (MLA) height is one of the most important and variable structural properties of foot [2]. Reduction or loss of this arch height is called as flatfoot [3].
Flatfoot can be categorized into flexible which is mobile and rigid which is stiff. Flexible flatfoot is one of the most common types of flatfoot. It typically begins in childhood or adolescent and continues into adulthood. The term 'flexible' refers that while the foot is flat when standing and the arch returns when not in standing [4].

Those individuals with flexible flatfoot may experience pain in the heel, arch, ankle or along the outside of the foot, turned in ankle, general weakness or fatique in the foot or leg, bunion, hammer toe, shin splints, knee, hip, and low back pain [4].

Flatfoot can occur due to injury or illness, wear and tear, genetic factors, faulty biomechanics or prolong stress on foot caused by excessive body mass. A study conducted by the National Health Statistics of Malaysia indicated that Malaysia is southeast fattest country. According to the British medical journal. The Lancet (2014), showed that 49% of women and 44% of men in Malaysia found to be obese [5]. At least 48 percent of Malaysians of whom 15.2 percent are adults, are obese, based on a National Health and Morbidity Survey (NHMS) in 2011 [6].

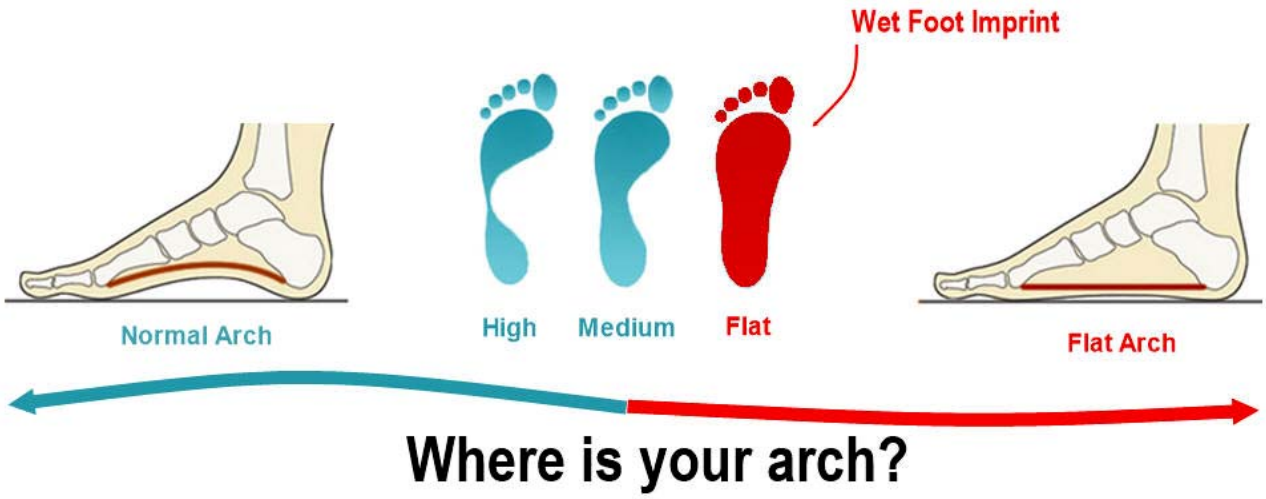
There are many long term debilitating effects of excessive body mass that may impair quality of life, including cardiovascular disease and various musculoskeletal disorder. Of these musculoskeletal disorders, foot problems in those with excessive body mass are salient. This is due to the increased stress placed on the feet by the need to bear excessive mass [7].

Excessive increase in weight bearing forces caused by excessive mass may negatively affect the lower limbs and feet [7]. Overweight and obesity are related to, certain disorder of the foot, in particular with flatfoot [8]. As weight is gained with age, there is a high chance of reduced tensile strength of ligamentous and muscular structures of the foot. However, if laxity continues with weight gain, a lowered longitudinal arch or flatfoot maybe maintained and lead to problematic adolescent or adult feet [7] Therefore, excessive body mass plays an important role in flatfoot.

Overtime, health problems such as rheumatoid arthritis or diabetes sometimes increase the risk of developing flatfoot. In addition, adults who are overweight frequently have flatfoot. If flatfoot diagnosed and given treatment on time, the side effect could be Prevented [9]. Corrective exercises at the same time with insole use improves the medial longitudinal arch [10]. Flexible flatfoot appear to have a corrective ability and respond positively in conservative management [11, 12] Therefore, management on flatfoot is essential to prevent future complications.

Materials and Method

This research was conducted as experimental study in 3 groups namely Group A: Insole, Group B: Corrective Exercises, Group C: Insole and Corrective Exercises. In which the pre and post data was measured by foot print angle (FA) proposed by Forriol and Pascual.



Inclusion Criteria

1. Overweight individuals with BMI of 25 to 29.9
2. Age from 20 to 30 years old of both sexes
3. General population
4. Flexible flatfoot
5. Physically active individuals

Exclusion Criteria

1. History of surgery, trauma, fracture at ankle and foot.
2. Congenital flat foot.
3. Congenital foot anomaly.
4. Rigid flatfoot.
5. Any neuro-muscular involvement.

Procedure

This study was conducted from 23th February 2015 to 7th July 2015. 30 overweight adult participants of both sexes who were recruited from general populations. The subjects are screened for inclusion and exclusion criteria. The subjects who fulfilled the inclusion criteria were included in the study and was explained about the procedure and a written informed concern letter has been taken. Subjects were followed up throughout the (12 Weeks) duration. The selected 30 participants was randomised into 3 groups. The three group are a insole group (IG) (GROUP A), an exercise therapy group (EG) (GROUP B) and a combined insole and exercise therapy group (IEG) (GROUP C).

Each participant in IG (GROUP A) and IEG group (GROUP C) was receive insole. The primary aim of insole is to improve the medial longitudinal arch. The intervention for EG (GROUP B) and the IEG (GROUPC) consisted of individual exercises based on exercise protocol proposed by (Mohammad Kolooli, 2014, the effects of 8 weeks corrective exercises program on the navicular height of teens with flatfeet).

Statistical Analysis

Repeated measures ANOVA

Group A

Left side

Group	Pretest (left)	Posttest (left)
Mean	9.90	37.30
SD	7.16	6.86
Significance	0.0099	

Right side

Group	pretest (right)	posttest (right)
Mean	13.00	40.70
SD	8.64	7.18
Significance	0.0350	

Table 1.0: The data collected from 10 subjects from Group A. The data is taken before (Pre-test) and after insole placement (Post-test). The data shows improvement in insole placement with the Mean difference of 27.40 on the left side and 27.70 on the right side.

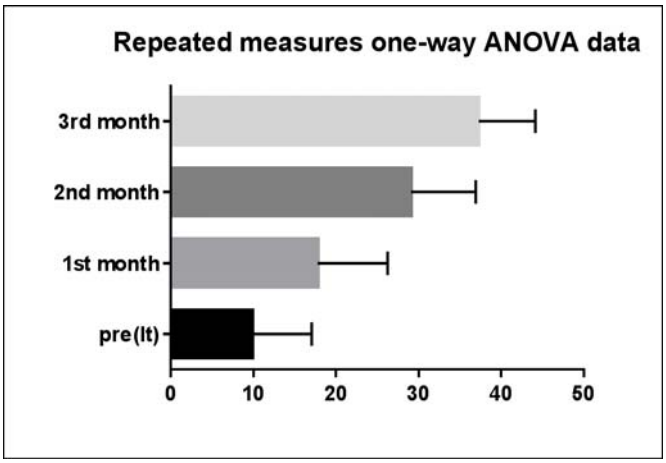


Fig 1.1: The bar chart shown significant on Insole placement on flatfoot in overweight individuals for Group A (Left side)

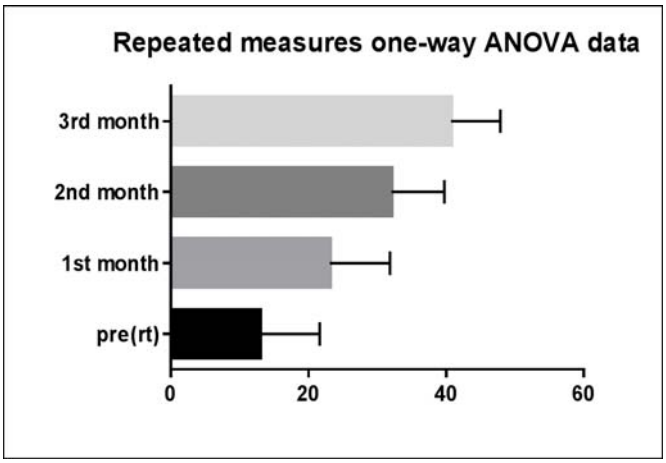


Fig 1.2: The bar chart shown significant on Insole placement on flatfoot in overweight individuals for Group A (Right side)

Group B

Left side

Group	pretest (left)	posttest (left)
Mean	9.90	14.90
SD	18.16	16.91
Significances	0.0269	

Right side

Group	pretest (right)	posttest (right)
Mean	13.30	19.70
SD	18.54	18.79
Significances	0.0234	

Table 2.0: The data collected from 10 subjects from Group B. The data is taken before (Pre-test) and after Corrective exercises (Post-test). The data shows significant in corrective exercises with the Mean difference of 5 in left side and 6.4 in right side.

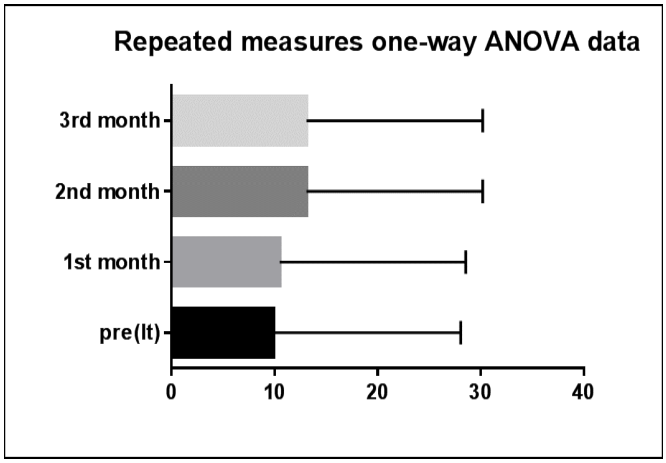


Fig 2.1: The bar chart shown significant on corrective exercises for Group B (Left side)

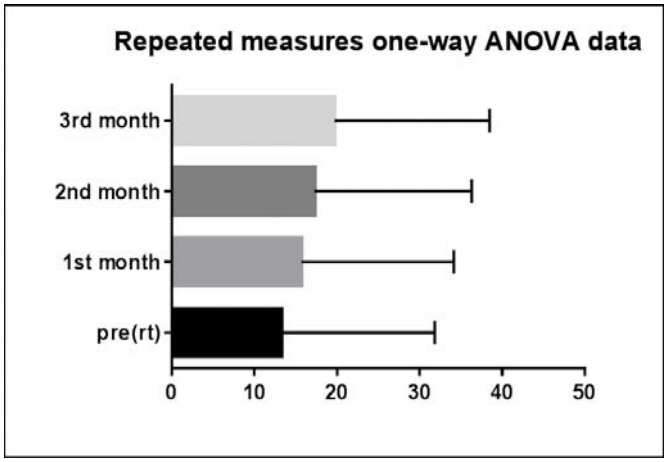


Fig 2.2: The bar chart shown significant on corrective exercises for Group B (Right side)

Group C

Left side

Group	pretest (left)	posttest (left)
Mean	4.70	47.80
SD	4.85	3.55
Significances	0.0025	

Right side

Group	pretest (right)	posttest (right)
Mean	14.20	49.40
SD	11.77	3.60
Significances	0.0002	

Table 3.0: The data collected from 10 subjects from Group C. The data is taken before (Pre-test) and after Insole placement and Corrective exercises (Post-test). The data shows greater significant in insole placement and corrective exercises with the Mean difference of 43.10 in left side and 35.20 in right side.

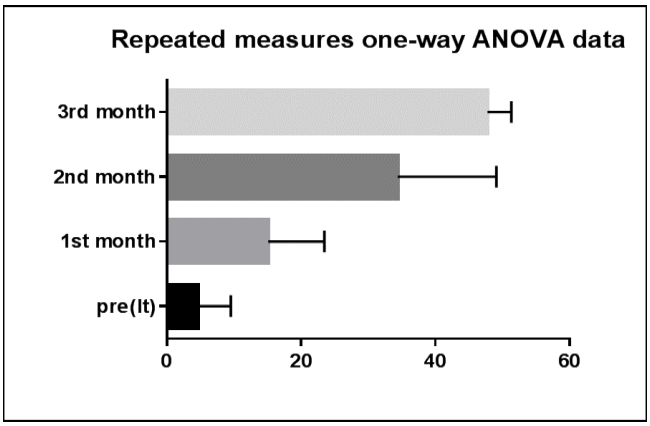


Fig 3.1: The bar chart shown significant on insole placement and corrective exercises for Group C (Left side).

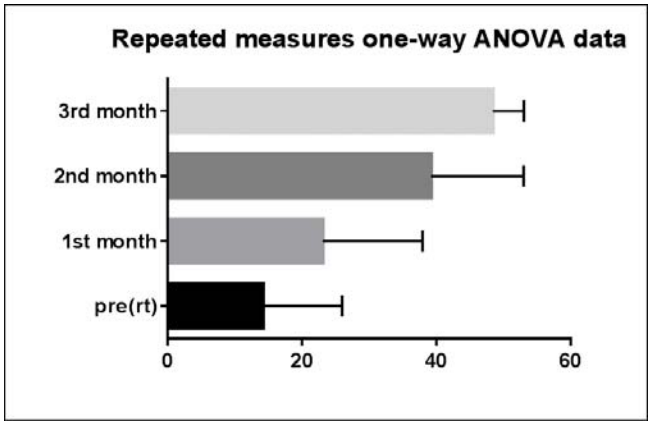


Fig 3.2: The bar chart shown significant on insole placement and corrective exercises for Group C (Right side).

Statistical result analysis

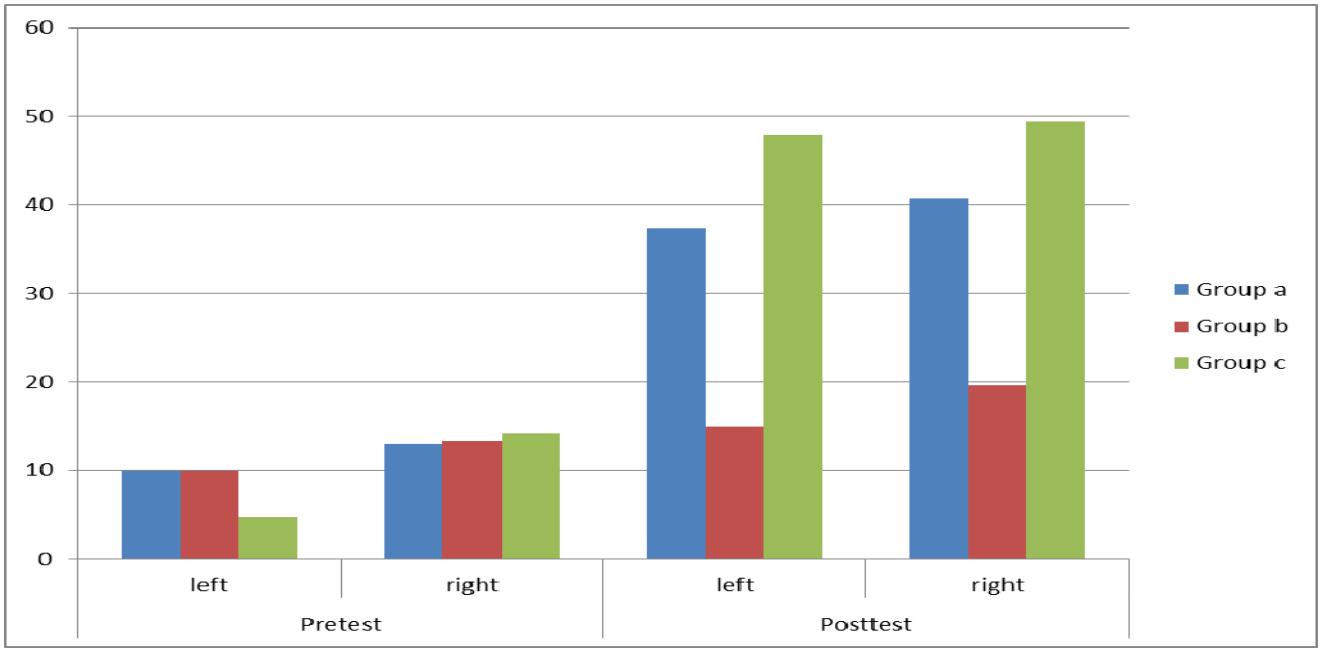


Fig 4.0: This bar chart has compared within the 3 groups. It is shown that placement of insoles and corrective exercises group and insole placement group shows a greater significant than the corrective exercises group.

Results

The pretest and post test results of each group were compared using repeated measures one-way ANOVA. There was a significant difference between the Insole group, Corrective exercises group and insoles and corrective exercises group. To find out the mean and standard deviation for each group, the data were analyzed using a Paired t test.

There was a significant different in Group A (Insole group) on left side at the level p< 0.0001 [R square=0.8124, mean=27.40], and on right side at the level p<0.0001 [R square=0.7664, mean=27.70], In Group B on left side, there was a significant different at the level p=0.0269 [R square =0.416, mean=5] and on right side at the level p=0.0234 [R square= 0.4169, mean=6.4]. In Group C on left side, there was a significant different at the level p=<0.0001 [R square=0.8994, mean=43.1] and on right side at the level of p<0.0001 [R square=0.7997, mean= 35.2].

Application of insoles shows a greater significant value than the exercise with the mean difference of (21.85). Corrective exercises alone shows less significant compared to Insole placement and corrective exercises with the mean differences of (33.45). Insole placement and corrective exercises shows greater significant compared to Insole placement alone with the mean differences of (11.6). This indicates the data from the table supported the alternate hypotheses of the study and rejected the null hypotheses.

Patient education in the form of pamphlet as a suggestion for weight management has been given to all the 30 subjects. However, there is no difference obtained from the BMI from 3 groups. This data has been attached at Appendix.

Discussion

There was a significant increase in the height of medial longitudinal arch within the 3 group especially insole group and insole and corrective exercise group compared to only corrective exercise group. However with the numbers of patient available in this study, no improvements on weight management could be detected between the 3 groups.

No other randomized controlled trials addressing overweight and flatfoot and treatment with insoles and /or exercises have been identified. Earlier studies on insoles with corrective exercises are done on some physical and motor fitness factors in girls with flatfoot. Mehrnaz Faraji *et al*. (2014) found that insole use method together with corrective exercises is effective for improvement on physical and motor fitness improvement of children.

The training program primiraly consisted of recommended and generally accepted corrective exercises addressing both the intrinsic and extrinsic foot muscles proposed by Mohammad Kolooli *et al*. (2014). In a research titled 'comparing the effect of a special corrective exercises program on improvement of flatfeet, Kuhi Achachluei *et al*. (2004) did not observe any significant correlation between an 18 session's corrective exercises program and recovering the disorder. Their result does not match with the results of present study. The reason is thought to be the fewer exercise sessions which is 18 sessions compared to present study consisted of 36 sessions.

Insoles and corrective exercises group shows significant and to explain this, we can refer to a complicated process called adaptation. Body preparedness and daily activities can be effective as well. Factors such as muscular strength and arch stabilizing contribute to the improvement. Wilmur *et al*. (2004) state that by short or long term physiologic responses, human body shows adaptation and tries to fight against pressures and recreate a suitable setting.

Conclusion

According to the hypothetical view, the third alternate hypothetical have high significant impact on increasing the arch of the foot in overweight individuals. Although the exercise and insole given separately in separate group, it is also having the significant but the Group C, which consisted of insole and corrective exercises having more significant than other groups.

It is concluded that excess body mass had a significant effect on flatfoot and that corrective exercises and insole can strengthen the intrinsic muscles and improve the medial longitudinal arch height on flatfoot in overweight individuals. Continuation of this exercises and insole placement probably reduces the severity of the effects and deformation of ankle and other abnormalities.

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