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Determinants of Flat Foot Incidence on Early Childhood Posture

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ABSTRACT

Introduction: Scoliosis is a structural deformity of the spine in the lateral direction with a curvature of ≥10° in the coronal plane. The occurrence of posture disorders towards scoliosis is often only realised in adolescence, namely with an age range of 10-16 years. If you only realise it at this age, then it is too late, because other health problems can arise that affect your future life. **Methods:** Therefore, the existence of this study is expected to be able to make an instrument for the early detection of postural developmental disorders in preschool children against the incidence of scoliosis. **Results:** From the examination that has been carried out on 94 students, it has been found that 74% of children have normal posture with a degree range of 1^0 to 4^0, and 25% of children have been detected with intermediate scoliosis (5^0 to 7^0). The next measurement that the researcher made was to measure the degree of arch of the child's foot. Measurements of normal categories of foot, flat foot and cavus foot use Clarke's angle. **Conclusion:** Clarke's angle is obtained from the meshing angle of the tangent formed by the first line connecting the medial edge of the first metatarsal caput and the heel and the second line connecting the first metatarsal caput with the crest of the medial longitudinal arch. Data was obtained that most children experience flat feet as much as 77%, which is dominated by male children.

***Keywords**: Scoliosis, Flat Foot, Preschool*

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INTRODUCTION

A child's growth and development can be determined by innate (genetic) factors and the surrounding environment in which they live, and can even be due to a combination of the two. This affects the physical condition of the child in the future during the golden age period or from the first 5 years of life. All of their abilities develop very quickly, these abilities will be related to physical fitness. (Awanis et al., 2022).

One of the things that can affect a child's fitness is the appearance of orthopaedic abnormalities that can be detected in early childhood. The case that can be detected is Flat Foot. If this abnormality appears, it can adversely affect the overall function of the musculoskeletal system, as well as interfere with the child's posture, thereby worsening well-being, and reducing the child's resistance to physical activity. (Romanova et al., 2022).

A flat foot is one of the growth disorders of the arch shape of the foot (arcus). The normal arch of the foot (arcus) is formed between the ages of 2-6 years, with age 6 years being a critical time for the formation of the arch of the foot and deformity in the foot and can affect its balance (Nisa et al., 2020). The incidence of flat foot occurs as much as 52% in boys and 36% in girls with additional factors being the condition of the child's weight and the presence of ligament weakness. The number of musculoskeletal system disorders in childhood is increasing during the time of active growth, as well as during puberty (Maharani et al., 2020; Pfeiffer et al., 2006; Romanova et al., 2022).

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How important it is to detect the condition of the arch of the foot in children from the beginning so that in the future it does not affect their posture. Because if the flat foot is not detected from the beginning, it will have an impact on the body structure which results in over-pronation of the ankle and causes internal rotation of the arrival and femur, subsequently inducing a shift in the alignment of the pelvis towards the anterior direction and when the body structure changes, the centre of gravity (COG) will also change (Ripdianawati & Ramadhani, 2024). So, this study is to determine the determinants of flat feet to changes in posture in pre-school children.

METHODS

This study is a descriptive-correlation research. The participants were 60 preschool-age children (aged 4-6 years) from ABA Imam Syuhodo Kindergarten (TK) located on Jl. Sendang Jengglong, Jenggong, Jatisobo, Polokarto District, Sukoharjo Regency, Central Java. The health research ethics commission from Aisyiyah University of Surakarta has issued an ethical clearance agreement with number 271/XI/AUEC/2024 and then distributed informed consent sheets to agree to be subjects in this research.

Samples were selected using the convenience sampling method. To evaluate whether or not there is a flat foot condition, the researcher uses a "wet footprint" measuring tool with the following procedure. (Ripdianawati & Ramadhani, 2024): 1. Fill a flat container using watercolour. 2.Put the feet in a container filled with watercolours. 3. Put the feet into the container that has been filled with watercolours, then stick the feet on a piece of paper. 4. Lift your legs so that they stick to the mould on the paper.

Figure 1. Wet Footprint

If the resulting footprint is not obvious due to an inadequate amount of ink, then the footprint is discarded and the procedure is repeated to obtain a better or clearer footprint. To assess the results of the footprints, the researcher applied the Clarke's Angle (CA) method. CA is calculated using markers, rulers, and protractors marked at one-degree intervals.

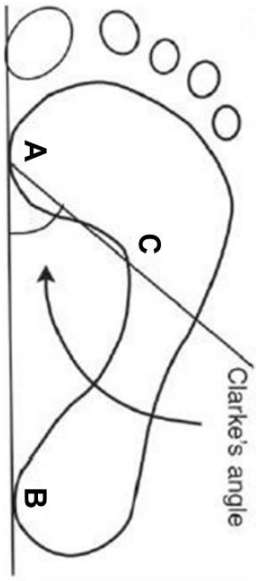

Figure 2. Clark's Angle (CA)

FISIO MU: Physiotherapy Evidences

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CA is obtained by calculating the angle between the medial tangential line (A.B. line in Figure 2) connecting the medial edge of the first metatarsal head and the heel, and the second line (AC line in Figure 2) connecting the first metatarsal head and the crest of the basin. Clarke's angle is considered "normal" if it is in degrees (CA 42°–54°), categorized as "mild flat foot" (CA 35°–41°), categorized as "moderately flat foot" (CA 30°–34.9°), categorized as "severe flat foot" (CA <30°), and categorized as "high curved foot" (CA > 54°) (Hegazy et al., 2021).

Posture evaluation in children is carried out by measuring using a scoliometer. This scoliometer shows a good correlation with the Cobb angle. The scoliometer measures the Angle of Trunk Rotation (ATR). Bunnel defines the screening criteria as follows:

Table 1. Interpretation of ATR

Scoliometer Measurement Results	Interpretation
ATR 00 - 30	Normal
ATR 40 - 60	Scoliosis Intermediate
ATR ≥70	High probability of scoliosis

* This method has a sensitivity of 83.3% and a specificity of 86.8% (Parera et al., 2016).

The results of the data obtained will later be used in descriptive statistics and test the relationship with the chi-square formula to test the hypothesis on the SPSS software. The significance value used is p≤ 0.05 which is considered statistically significant.

RESULTS

The location of this research was carried out at Aisyiyah Bustanul Atfal Imam Syuhodo Kindergarten which is located at Jl. Sendang Jengglong, Jenggong, Jatisobo, Polokarto District, Sukoharjo Regency, Central Java. The total number of students who were measured by early detection instruments for early detection of postural developmental disorders in preschool children against the incidence of scoliosis was 94 students, spread from 49 months to 81 months of age. The following is the distribution of data seen with a figure 3.

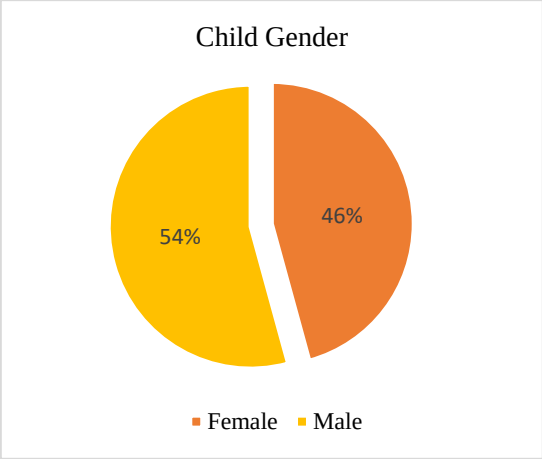

Figure 3. Distribution of Child Sex

Broadly speaking, the respondents in this study were dominated by male students with the oldest age being 5-6 years old, 50 students (Figure 4).

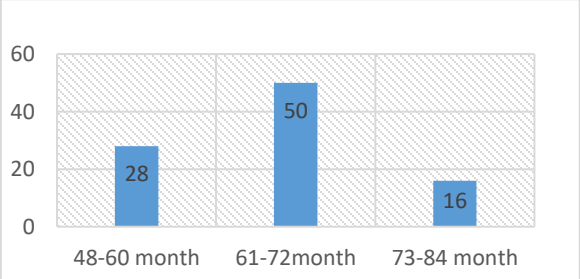

Figure 4. Distribution of Age

This study focuses on testing the validity of the instruments that have been made related to the development of children's posture at an early age. So the researcher measured the degree of change in the curvature of the spine. Physical observation is carried out by the examiner by paying attention to the height level of the left and right sides of the shoulders and waist in an upright standing position. If there is one side of the shoulder or shoulder higher accompanied by a waist/hip on one side is also higher, then it is most likely scoliosis.

The Adam Test examines the examined person by standing upright with his legs open at

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waist-width apart, then bending forward, and his hands are released freely downwards. With this position, the examiner can observe the spine. The examiner can see if there is one side that is higher/shorter than the other. If the answer is yes, then the one tested positive for scoliosis. Check with the scoliometer in a bent state, place the scoliometer on the apex of the curve, do not press it, then read the number that the degree of the curve shown on the scoliometer. Most students have normal degrees, which are in the range of 10 to 40.

The distribution of data can be seen in the following figure 5.

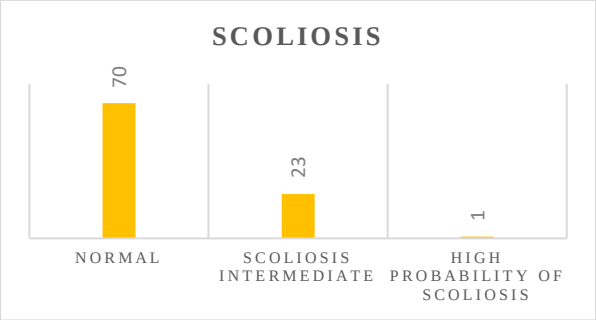

Figure 5. Distribution of Spinal Degree

The next measurement was researcher made was to measure the degree of arch of the child's foot. Measurements of normal categories of foot, flat foot and cavus foot use Clarke's angle. Clarke's angle is obtained from the meshing angle of the tangent formed by the first line connecting the medial edge of the first metatarsal caput and the heel and the second line connecting the first metatarsal caput with the crest of the medial longitudinal arch. The results of the data obtained by the researcher are seen in the following figure 6.

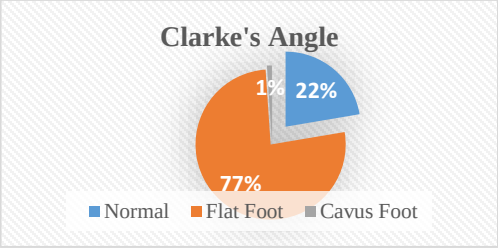

Figure 6. Distribution of Flat Foot

DISCUSSION

Researchers conducted a relationship test to find out whether changes in the degree of the spine have a relationship with flat foot conditions in children. Data analysis using the SPSS application with a significance value of 0.886, it was found that the p-value > 0.05 so it can be concluded that there is no relationship between the change in the trunk rotation angle and the occurrence of flat foot. However, on the other hand, the researcher also found some other information that could add to the data, namely in the results of children with intermediate scoliosis as many as 20 children had changes in trunk rotation in their posture examination. The most important aspect of the occurrence of deformity in scoliosis is the progression of bone growth. With the occurrence of lateral bending of the vertebrae accompanied by spinal rotation, will be followed by a change in secondary development in the vertebral bones and ribs by the Karen there is a progressive growth disorder. Changes in the vertebrae will also be followed by changes in the ribs where the increasing curve (arch) causes the deformity of the rib bones to become more obvious. The ribs also rotate and cause deformity in the form of rib humps (rip hump). Examining the posture or looking at the child's spine from the posterior aspect of the body is also something done by the researcher because the bending of the spine in the lateral direction will be visible. The rotation of the spine is also visible, especially when the child is asked to bend forward, and the rib hump is also visible (Seki et al., 2019; Syabariyah et al., 2022).

The legs play a big role in supporting the body weight and maintaining dynamic balance when performing functional walking movements. The existence of foot problems will cause postural instability and disturbances in mobility so it has an impact on the quality of life. Flat feet are associated with abnormalities in walking and adapting to the environment. Although it usually does not show symptoms at first, it can cause a change in the degree rotation of the trunk. Changes in postural reactions result in a compensatory pattern between the spine and lower extremities. (Chou et al., 2021).

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Other literature mentions that in the first 10 years of age, the pedis arcus in children begins to form and becomes stable. However, it does take a long time to make the arcus perfectly formed, because it is also influenced by the child's motor ability throughout the growth and development cycle. (Dewi et al., 2020).

If you look at gender differences, it also affects the condition of flat feet. The results of the study obtained data that of 72 children with flat feet, 63 children were male and 9 children were female. This is supported by a study by Fadhillah (2017) which states that the legs of the male sex have thicker fat pads compared to women. This is what affects the development and growth of the medial longitudinal arch in men more slowly compared to women. Because of this, the male population is more at risk of flat feet than women. Abnormal musculoskeletal system conditions if screening has been carried out early need for follow-up improvement (Fadillah et al., 2017; Pristianto et al., 2022).

CONCLUSION

Screening for scoliosis and arch of the legs is one of the initial strategies for early detection of early signs of scoliosis. This is part of health promotion related to body alignment and improving ergonomic position. The earlier a change in trunk degree is detected, the earlier prevention can also be done so that more severe complications do not appear. Thus, through scoliosis screening in kindergarten from an early age, appropriate treatment can be provided and complications can be anticipated.

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