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Design of an Optical Foot printer Device According to Mechanical Principles for Diagnosing Flatfoot and Standardizing It for Female player in Gymnastic

Bashaer Hashem Abdel Wahed[1]*, Ali Hasan Neamah[2]

1,2 University of Kerbala

*Correspondence: Bashaer Hashem Abdel Wahed
Email: bashaer.hashem@uokerbala.edu.iq

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Abstract: *The sciences related to sports help improve athletic performance, with proper posture being essential for achieving balance and movement capability. The foot pressure measurement device is a vital tool for selecting gymnasts, as it measures the force exerted on the ground. There is a need for research on postural deformities and their impact on athletic performance, highlighting the importance of sports selection and choosing the right athletes to achieve desired results in various sports activities. The sciences related to sports help improve athletic performance, with proper posture being essential for achieving balance and movement capability. The foot pressure measurement device is a vital tool for selecting gymnasts, as it measures the force exerted on the ground. There is a need for research on postural deformities and their impact on athletic performance, highlighting the importance of sports selection and choosing the right athletes to achieve desired results in various sports activities. Materials and Methods the researcher used the experimental method with a one-group design, which aligns with the research problem and helps achieve the study's objectives. The researcher defined the research population as gymnasts aged 5 to 8, consisting of 5 athletes, and the sample represented the population using a comprehensive sampling approach. Results: The use of the electronic foot scanner has saved time and effort for both the teacher and the student in measuring the foot arch, and it had a positive effect on student engagement with the proposed device. It also clarified that the foot arch positively impacts the performance level of the athletes, as evidenced by the statistics utilized by the researcher in their work Conclusion1. The arch of the foot can be an indicator of overall body balance issues. 2. The device is easy to use and can measure arch height within a standard time frame*

Keywords: *Gymnastic; Performance; Foot Printer; Device; Flatfoot; Mechanical.*

Introduction

Sport approaches achieving its general and specific goals by benefiting from the sciences associated with it, and measurements and tests of the body are one of the areas that specialists in the field of physical education have researched because of their importance in skill performance and level of achievement, and that a healthy body depends on the strength of the muscles that work to make the body mechanically balanced in the face of the force of gravity and other forces. The muscles work continuously, and this work requires a sufficient amount of strength and energy to maintain the natural position of the body. The tension that occurs in the working and opposing muscles is one of the things that maintain balance.

The weakness, lethargy or sagging of these muscles leads to curvatures and deviations from the normal physiological range, causing deformity of the body.

The main criterion for assessing posture is the feet, as the correct position of the feet is the basis for the overall posture of the body.

Any incorrect distribution of the body's weight on the feet will lead to a reaction from one of the body parts to address that, and thus lead to deformity in that place.

The foot is the vital part on which all team and individual sports depend, as it is responsible for the direction of force.

(Its line of work) and the path of movement and the weight of the athlete, as it has to distribute that on the ground, and the end of the twentieth century and the beginning of this century witnessed scientific progress in all different areas of life. Among these areas that have a share in scientific development is the sports field. The level of sports performance has generally increased in all sports activities, in accordance with the principle of acquaintance, integration, information and scientific principles derived from many sciences (physiology, psychology, biomechanics And other sciences)

Sports selection is of great importance in choosing gymnasts. The need for selection arose as a result of the differences in the characteristics of individuals in terms of physical, mental and psychological abilities. We can summarize all of this by saying that selection is one of the basic pillars through which advanced levels are reached in certain sports and sports competitions.

Each game or sport has special requirements and specifications that must be met by the athlete in order to achieve the desired goal.

Here the importance of research appears in studying some postural deformities in sports performance.

It is readyFoot print is one of the important devices for selecting gymnastics players. It is characterised by the wide range of innovation in the skills used and the nature of performance on the (foot print) device. It is represented in measuring the flatness of the feet and their relationship to selecting gymnasts. The foot scanner is an electronic board in measuring the dynamics of the force exerted by the foot on the ground and contains high-frequency digital sensors.

Here lies the importance of research in manufacturing a mechanical device to measure the degree of flatness of the feet, which is an essential part of the formation of the lower extremities, as they are the basic pillar of the human body, as they are characterized by characteristics that qualify them to carry the weight of the body and are almost the parts most affected by effort and work to balance and stabilize the body and have a role in performance.

Motor activity as well as being the part on which the weight of the body falls The skeleton and its importance in selecting gymnasts

Methodology

Study Design: The researcher used the experimental group design to suit the nature of his research.

Study Location: Spatial Field: Specialized Center for Gymnastics- Baghdad

Study Duration: 1-11-2023 AD | 2-28-2024 AD.

Sample size: 5 patients.

Sample size calculation: The researcher identified the research community consisting of female gymnasts aged (5-8) and over. Their number is 5 players The sample represented the community using the comprehensive enumeration method.

Homogeneity of the research sample

Before starting the implementation, the researcher resorted to verifying the homogeneity of the research sample in the variables related to anthropometric measurements, which are (weight and age). As in Table (1).

coefficient of variation	Standard deviation	Arithmetic mean	Unit of measure	Statistical features Variables
4.125	7.106	33,044	Kg	**Mass**
3.662	0.604	9.014	Year	**the age**

The table shows(1). The values of the coefficient of variation are less than (10), which indicates the homogeneity of the research sample individuals in these variables, i.e. the normality of their distribution.

Methods, devices and tools used in the research

1. Observation and experimentation.
2. Personal interview. Appendix (1)
3. Foot arch test on the device (foot print).

Devices and tools used in the research:

1. The proposed device (foot print).
2. Computer type (Asus) Number (1).
3. papera4
4. Pens
5. Leather measuring tape (meter and its parts).
6. (5) Laser discs.

Run and Field research:

Device foot print (idea design device components)

Proposed device design

After the idea became clear to the researcher and the supervisor, the proposed device was designed in a three-dimensional form, the correct measurements were taken, and the realistic design of the device was chosen using a program. (4d program) and the device was designed as in Shape (1).

Figure (1). The shape of the device is shown.

Result and Discussion

Device components foot print

The printer is designed to suit the type and accuracy of printing and to show the foot clearly by isolating the light.

1. Printer brother) dcp t 520w

   The refill case features a clear cover that provides easy front access to the included ink cartridge. This easy-to-use design is designed to reduce the risk of leakage and spillage and the ultra-high-yield ink bottles can help you: Brother in reducing printing costs. Print 5,000 color pages And up to 7500 pages of black text. Our printer is designed with flexible connectivity options to suit all business environments. Built-in wireless connectivity allows your entire workgroup to share a single device. Our printer is designed to fit every work environment with adaptable connectivity options. Your entire workforce can seamlessly share one device thanks toBuilt-in Wi-Fi Includes printers Brother also offers direct mobile printing, making it easy to print wirelessly from your mobile devices. Brother printers speed up your processes so you can get more done in less time. With document print speeds of up to 17|16.5ipm, you can confidently develop effective business materials that make the best impression, from stunning reports to professional brochures.

2. Unbreakable plastic glass

   Inspired by the extreme durability of seashells, according to the newspaper. British Daily Mail It is highly durable and unbreakable, perfectly designed from durable and lightweight materials. And it is suitable for all needs. Its properties include good light transmittance (60-90)% and resistance. For weather and UV protection and a wide temperature range (7) degrees Celsius to (120) degrees Celsius...

How to perform on devicefoot print

The first step to perform on the proposed device is to install the gas and operate it and make sure it works. After that, we photograph the foot by ascending the sample onto the device and making sure that the sample is stable and standing on it in the correct way and the place designated for it in order to take the picture in the correct way. After that, we give the device the command to photograph and take a snapshot of the sample. When the image comes out of the device, we take measurements of the foot and extract the results and know the type of foot.

Selection and measurement of the arch variable

To measure normal, flat and concave feet, there are certain proportions to reach. We define 4 Main points and then the sub-points. The location of these points is partly in the front of the foot and partly in the heel. There are also main points such as the front of the toe above the big toe (1). The second point is at the farthest point on the medial side of the foot, point number (3). The farthest point on the heel Point number (4) is on the lateral side in the farthest area on the lateral side, and then we draw a straight line using a ruler between two points (2-3), and then we cut the vertical line through the end of the finger, while keeping the ruler straight. We draw the third line with the straightness of point No. 2, and it will be as follows, while maintaining the straightness of the ruler: We take a measurement of part of the front of the foot and let us assume that it is (5) cm. Then we take (5) cm and pull the third horizontal line and try to keep the ruler straight. Here we finish the first stage. Then we startAThe second stage is measuring the furthest area (4) from the vertical line. The most important note here is to maintain the straightness of the ruler. Then we draw another line from point number (4) across and measure the width of the front of the foot (3,6). After we have determined the four points mentioned previously, we determine point number (5). Midfoot width (1.5) With the last point of intersection on this line and the last area from the inside, we measure the distance between them (1.5), and it is called the width of the middle of the foot.As in Figure (2)Then the equation (percentages) is applied, which is:

Foot shape ratio = width of the forefoot - width of the midfoot ÷ width of the forefoot * 100

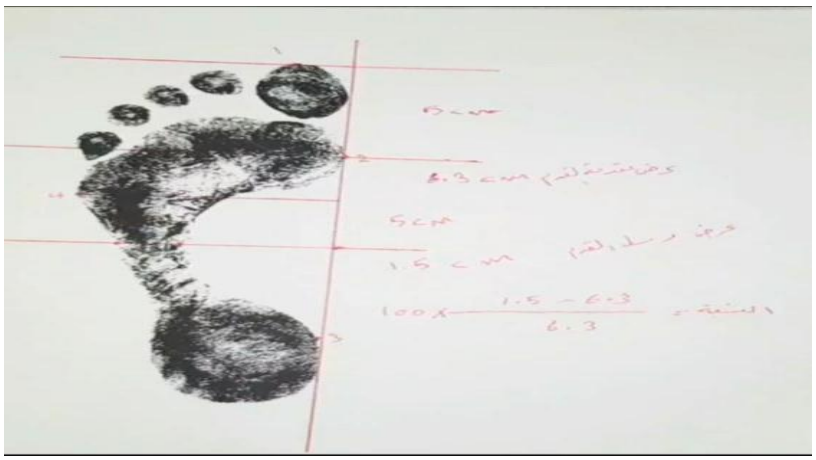

Figure (2). Explains how to measure the arch of the foot

Determine the measurements

In order to achieve accuracy and objectivity in the results of the measurements that help us solve the research problem and obtain accurate data, the researcher conducted personal interviews with experts and specialists in the field of biomechanics, physiology and training. The arch of the foot was identified as a variable affecting the skill performance of the gymnast.

Features of the designed device:

1. It can be moved from one place to another.
2. It can be made from simple and available materials.
3. The principle of safety and security is taken into account when performing for the learner.
4. Saves effort and time

Exploratory Experiment:

"The pilot experiment is one of the most important procedures that the researcher performs before conducting the main experiment. Therefore, it is considered a practical training for the researcher to stand on the negatives and positives that he encounters while conducting the tests to avoid them in the future" (Al-Mandlawi et al., 1989, 107). The researcher conducted the pilot experiment on Sunday, November 5, 2023, at 10:30 am, on a sample from outside the research sample. It is "a mini-experiment similar to the main (basic) experiment." (Mahjoub, 2002, p. 42). Several objectives were confirmed, namely:

1. Identifying the extent to which the proposed device's measurements are compatible with the students' body measurements.
2. Ensure that the tools are complete and that the proposed device is valid.
3. Knowing the time taken for each test as well as the total test time.
4. Knowing the validity of the proposed device.
5. Ensure the safety and security procedures for the device.
6. Identify errors that may arise from using the proposed device.
7. Identify the time required to install the proposed device.

Pilot results

1. The device and tools used have been verified.
2. The time taken has been determined To performEvery student.
3. Introducing the support team to the duties assigned to them.
4. Overall situation with surrounding conditions, nature of the ground and lighting.

Main experience

After completing the procedures that qualify the researcher to conduct the main experiment, the researcher applied the proposed device to the experimental group. andIt took (5) hours to apply and operate the device.

And the data related to the arch of the foot will be processed according to the law of the arch of the foot and a table of fixed values will be considered that was set to represent the levels of the arches of the foot as shown in the table (2)

Table (2). Shows the values of the arch of the foot.

حساب القدم الطبيعية والمسطحة والمقعرة

الجدول يوضح تصنيف شكل القدم بناءً على نسبة قوس القدم.

النسبة	التصنيف
0-34%	قدم مسطحة
35-39%	قدم مسطحة/طبيعية
40-54%	قدم طبيعية
55-59%	قدم طبيعية/مقعرة
60-74%	قدم مقعرة
75-84%	قدم مقعرة قوية
85-100%	قدم مقعرة شديدة

معادلة حساب نسبة التقوس

$$\text{نسبة التقوس} = \frac{\text{عرض مقدمة القدم} - \text{عرض وسط القدم}}{\text{عرض مقدمة القدم}} \times 100$$

Statistical means

The researcher resorted to choosing statistical methods, and used the statistical processing program (spss), and as follows:

a. Coefficient of variation.
b. Arch measurement law
c. 3-Presentation, analysis and discussion of results

Display and analyze results

After obtaining the research results related to the levels of the foot arch, which were obtained from the research sample when measuring the foot arch, the data was processed statistically using the special foot arch law and referring to the fixed values. The following results showed us: As shown in the table (3)

Table (3). shows the values of the results of measuring the arch of the foot and comparing them to the criterion for female gymnasts.

Arc type	ratio/criterion	The player's arch degree	The player
normal foot	54 – 40	51.38	**the first**
concave foot	60 – 74	64.28	**the second**
Natural concave foot	55 – 59	57.14	**the third**
normal foot	54 – 40	44.44	**Fourth**

flat feet	0 – 34	23.07	**Fifth**

Where After wiping the 5-year-old player's foot, the player The first In the table(3)It turned out that the device had given a paper image through which we were able to conduct statistics according to the law of the ratio of the arch of the foot, and it turned out that the height of the arch compared to the criterion in the table above was (51-38) Upon referring to the table, it became clear that bracket foot The first player is within the natural foot. Also After wiping the 7-year-old player's foot, the playerSecondIn the table(3)It turned out that the device had given a paper image through which we were able to conduct statistics using the law of proportions for the arch of the foot, and it turned out that the height of the arch compared to the criterion in the table above was (64%).-28) When referring to the table, it becomes clear that the second player's arch is within the concave foot.After wiping the 6-year-old's foot ThirdIn the table(3)It turned out that the device had given a paper image through which we were able to conduct statistics according to the law of the ratio of the arch of the foot, and it turned out that the height of the arch compared to the criterion in the table above was (57-14) Upon referring to the table, it was found that the arch of the third player is within a concave nature. After scanning the foot of the 8-year-old player,Fourth In the table(3)It turns out that The device gave a paper image that enabled us to conduct statistics using the law of the ratio of the arch of the foot, and it was shown that the height of the arch compared to the touchstone As shown in the table above, the percentage is (44 - 44) When referring to the table, it was found that the arch of the fourth player is within a normal foot. After wiping the 5-year-old's foot Fifth In the table (3) It turned out that the device had given a paper image through which we were able to conduct statistics according to the law of the ratio of the arch of the foot, and it turned out that the height of the arch compared to the criterion in the table above was (23%).-07) When referring to the table, you will see that the fifth player's arch is within a flat foot.

Discussion

By analyzing the table (3) we note, in general, that the value of weight and distance was not significant, i.e. the more the student's weight increased, the more she was exposed to foot curvature.

Then there is an effect on the skill performance, and thus the correlation between weight and skill performance is not significant. The higher the weight, the lower the skill performance of the students.

There is a link between bowed feet and being overweight. Excess weight can put extra stress on the feet, which can lead to structural changes and deformities such as bowed feet. Carrying excess weight can also affect the spine and joints, making bowed feet more likely to occur.

Body length has a clear effect on skill performance and hence the expectation of better performance in gymnastics. This is supported by what one source indicated: "The total body length that an individual reaches is a matter that deserves attention and is a decisive factor in selection. The results of scientific research in the field of biomechanics are clear evidence

of this, as they indicate the existence of high correlations with skill performance levels." In gymnastics, which requires balance to a great extent, and as is known mechanically, a low level of body mass contributes to balance in living and non-living bodies.

(1) Louis Ghanem: Body Fitness, 1st ed., Jordan, Dar Al Fikr for Printing and Publishing, 2002, pp. 98-99. (3) Amr Allah and Ahmed Al Basati: Foundations and Rules of Sports Training and its Applications, Alexandria, Al Intisar Press, 11 1998.S

And then it negatively affects the skill performance, as one source indicated that the body specifications in terms of shape and composition reflect the functional state of this motor system and its importance in estimating the health and physical condition and the ability to perform the skill, which is reflected in the efficiency of the motor system and affects sports injuries (1) ... as one source indicated) to the existence of a correlation between the length of the legs and the level of skill performance (2). From a mechanical point of view, all parts of the body have a close relationship with the arch of the foot, and thus to the student's imbalance when performing the skill. Faculty of Physical Education for Boys in Haram) toYAl-Din Ibrahim and Muhammad Salama: The relationship of some morphological, physical and body type variables to common injuries.

For students of physical education, the Scientific Journal of Physical Education and Sports, Cairo, as

Volume 1, 1997, p. 62 (3) Muhammad Ibrahim Shahata: Skill Analysis in Gymnastics, Dar Al-Maaref, 1992, p. 18

With skill performance, it is not significant, and with leg length, it is significant. The researcher attributes this to the fact that the larger the hip circumference, the greater the arch of the foot, and this affects performance, as the gymnastics student must have a small hip circumference, and the smaller the circumference, the more it contributes positively to skill performance in gymnastics.

Conclusion

1. The arch of the foot can be an indicator of overall balance problems in the body.
2. Ease of use of the device and the ability to measure the height of the arches of the foot in a record time
3. Using the suggested device in tests eliminates boredom.
4. The proposed device has contributed effectively to measuring the arch of the foot.
5. The electronic foot scanner gave students self-confidence and the desire to perform by overcoming the fear factor of incorrect measurement in the method followed.
6. The use of the electronic foot scanner saved effort and time for both the teacher and the student in measuring the arch of the foot and had a positive impact on the students' interaction with the proposed device.

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