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Buhari SM
Coach in Gymnastics, Kerala State Sports Council, Kerala, India

Dr. George Joseph
Associate Professor of Physical Education, Govt. College, Kottayam, Kerala, India

Corresponding Author:
Buhari SM
Coach in Gymnastics, Kerala State Sports Council, Kerala, India

Relationship of gymnastics exercise and hip flexibility on elementary school children

Buhari SM and Dr. George Joseph

Abstract
This study investigates the effect of a structured gymnastics exercise program on hip flexibility in elementary school children. A total of 60 children (Aged 9-12 years) participated, with equal distribution between experimental (n=30) and control (n=30) groups, each comprising 15 boys and 15 girls. Hip flexibility was assessed using the sit-and-reach test before and after a 12-week intervention period. Results indicate that the experimental group showed a statistically significant increase in hip flexibility compared to the control group ($p < 0.05$). Specifically, mean post-test scores significantly improved from pre-test scores in the experimental group (18.33 to 23.57) compared to minimal changes in the control group (18.7 to 20.27). Median scores also reflected this trend, further supporting the efficacy of the gymnastics exercise. Subgroup analysis by gender within the experimental group revealed consistent improvements in flexibility for both boys and girls, with no significant differences observed between genders post-intervention ($p > 0.05$). This suggests that the gymnastics program equally benefited both boys and girls in terms of hip flexibility enhancement. In conclusion, this study underscores the positive impact of gymnastics exercises on hip flexibility among elementary school children. Findings support the integration of structured gymnastics programs in school curricula to promote physical health and performance. Future research could explore long-term effects and additional health benefits associated with regular participation in gymnastics exercises.

Keywords: Enhancement, explore, effects, additional

Introduction
The researcher consistently encourages the provision of ample knowledge to enhance social well-being, encompassing health, wealth, and physical fitness achievements. They diligently impart knowledge to enlighten society and inspire individuals to strive for their best. In this study, efforts are made to explore the relationship between gymnastics exercises and hip flexibility in elementary school children. Many physical fitness test batteries include a hip flexibility assessment, with the sit-and-reach test being widely utilized. Flexibility plays a crucial role in maintaining good posture, improving sports performance, and reducing the risk of injury. Although there is limited research specifically on flexibility and its impact on health and fitness, existing studies suggest a significant correlation between flexibility, performance, and overall well-being. Flexibility as a component of fitness first gained prominence in the early 1900s as the field of physical therapy emerged. Later in that century, circumstances (i.e., two world wars and a polio epidemic) provided further impetus for growth in the professions of occupational and physical therapy and a rise in schools for preparing therapists. In 1980 the first health-related physical fitness test was published (AAHPERD, 1980), and it included a test of flexibility (sit-and-reach). Subsequent U.S. and international health-related test batteries—including the President's Council on Fitness, Sports and Nutrition (PCFSN) and FITNESSGRAM® batteries—have included items to measure flexibility (Pate, 2022).

Statement of the Problem The problem investigated in this study is whether a structured gymnastics exercise program can significantly improve hip flexibility in elementary school children.

Delimitations
A total of 60 elementary school children (N=30 experimental group & N=30 control group) were selected for the study.

- Each group consists of 15 boys and 15 girls.
- The age group of the subjects ranged from 9-12 years.
- The study was delimited to the motor variable hip flexibility.
- A standardized test sit-and-reach was used to assess hip flexibility.
- The study was delimited to the gymnastics exercise.

Limitations

- Other factors beyond the researcher's control may have influenced the responses of the subjects, which could be viewed as limitations of the study.
- The subjects may be involved in other physical activities outside of the research schedule, which might be a limitation of the study.
- Recognize potential confounding variables such as prior gymnastics experience, other physical activities, or developmental differences between boys and girls.

Hypothesis

Research Hypothesis (Experimental vs. Control Group)

- **Null Hypothesis (H_0):** There is no significant difference in hip flexibility between the experimental group and the control group.
- **Alternative Hypothesis (H_1):** There is a significant difference in hip flexibility between the experimental group and the control group.

Research Hypothesis (Boys vs. Girls after Gymnastics Exercise)

- **Null Hypothesis (H_0):** There is no significant difference in hip flexibility between boys and girls after participating in gymnastics exercise.
- **Alternative Hypothesis (H_1):** There is a significant difference in hip flexibility between boys and girls after participating in gymnastics exercise.

Significance of the Study

- This study aims to highlight the importance of gymnastics exercises in enhancing flexibility. By creating awareness, it seeks to educate individuals about the benefits of incorporating gymnastics into their fitness routines, thereby promoting better flexibility and overall physical health.
- Enhancing sports performance is a crucial goal of this study. By investigating the impact of gymnastics exercise on flexibility, the study aims to identify ways to optimize athletic performance.
- Improved flexibility can lead to better agility, range of motion, and reduced risk of injury.

Methodology Selection of Subjects

For the purpose of the study, a total of 60 elementary school children were selected from a school in the Trivandrum district. The total number of subjects was 60 (N=30 experimental group & N=30 control group), consisting of 15 boys and 15 girls in each group. The age group of the subjects ranged from 9-12 years. Participants were randomly assigned to either the experimental or control group to minimize bias and ensure sufficient sample size to achieve statistical power.

Gymnastics Program

- Develop a structured gymnastics exercise regimen focused on enhancing hip flexibility.
- Sessions included stretches, dynamic movements, and specific exercises targeting hip mobility.
- Duration and frequency were standardized (e.g., 3 sessions per week for 12 weeks).

Control Group Activities Participants in the control group maintained their regular activities but refrained from participating in any structured gymnastics or flexibility-focused exercises.

Selection of Variables

Independent Variable

Gymnastics Exercise: This variable represents the type, duration, and intensity of gymnastics exercises performed by elementary school children. It includes specific exercises targeting the flexibility of the hips and other muscle groups.

Dependent Variable

Hip Flexibility: This variable measures the degree of flexibility in the hips of elementary school children. It was assessed using standardized tests such as the sit-and-reach test.

Control Variables (Potential Confounding Factors)

- Age: The age of the children may influence their flexibility.
- Gender: Differences in flexibility between boys and girls were considered.
- Physical Activity Level: Other physical activities outside of gymnastics that may affect flexibility.
- Previous Injury: Any history of injury that could affect current flexibility levels.

Selection of Test Items Given the objectives of exploring the relationship between gymnastics exercise and hip flexibility in elementary school children, the following test was considered:

Sit-and-Reach Test

- **Description:** This test measures the flexibility of the lower back and hamstring muscles.
- **Procedure:** The child sits with legs extended and reaches forward along a measuring scale. The distance reached is recorded.
- **Rationale:** It is a widely used test to assess general flexibility, including hip flexibility, which is crucial in gymnastics and other physical activities.

Test Administration

The subjects were assembled in the school auditorium and given clear instructions on how to perform the test. The researcher demonstrated and explained the test. The scores in centimetres were considered for statistical evaluation. Hip flexibility was measured using standardized tests (sit-and-reach test) at the beginning of the study for all participants. After the completion of the gymnastics program (typically after 12 weeks), hip flexibility was reassessed in both groups using the same standardized tests.

Statistical Technique

Statistical evaluation was done with data collected from subjects. To find out the effects of gymnastics exercise on hip flexibility between the experimental group and control group, boys and girls, an independent t-test was computed. The changes in hip flexibility from baseline to post-intervention

between the experimental and control groups were compared. Statistical tests (e.g., t-tests, ANOVA) were performed to determine if there were significant differences in flexibility gains between boys and girls within each group and between the experimental and control groups.

Analysis of Data and Results of the Study

The statistical analysis of data, results of the study, and discussions of findings are explained below. The aim of the study was to analyze the effect of gymnastics exercise on hip flexibility. To find out the effect of gymnastics exercise on hip flexibility between the experimental and control groups and boys and girls, the independent t-test was computed. The comparison of hip flexibility between the experimental and control groups is presented in Table 1. The comparison of hip flexibility between boys and girls is presented in Table 2.

Table 1: The Comparison of Hip Flexibility Between Experimental and Control Group

Group	Pre-Test Mean	Post-Test Mean	Pre-Test Median	Post-Test Median	Pre-Test SD	Post-Test SD
Experimental	18.33	23.57	18	22.5	3.92	4.26
Control	18.7	20.27	18	19.5	5.67	5.68

T-Test Result

The calculated t-value (4.15) is greater than the critical t-value (2.024) at $\alpha = 0.05$, indicating a significant difference in the mean change of flexibility scores between the experimental and control groups.

Discussion of Findings and Conclusion

- **Mean and Median:** The experimental group shows higher mean and median scores in both pre-test and post-test compared to the control group, indicating that the intervention (gymnastics exercises) had a positive effect on flexibility.
- **Standard Deviation:** The experimental group generally has lower standard deviations compared to the control group, suggesting less variability in the scores within the experimental group.
- **T-Ratio and T-Score:** The calculated t-ratio (0.657) is less than the critical t-value for a typical significance level (e.g., $\alpha = 0.05$). This suggests that there is no significant difference between the experimental and control groups in terms of their post-test scores.
- **Conclusion:** Based on the data and analysis, it can be concluded that while there is a trend towards higher flexibility scores in the experimental group after the intervention, this difference is not statistically significant. This could imply that the gymnastics exercise program did not significantly improve flexibility compared to the control condition under the conditions tested. Further studies with larger sample sizes or different methodologies may be needed to explore this further. This study highlights the importance of rigorous evaluation in determining the effectiveness of interventions aimed at improving physical outcomes like flexibility in educational settings.

Table 2: The Comparison of Hip Flexibility Between Boys and Girls in the Experimental Group

Gender	Pre-Test Mean	Post-Test Mean	Pre-Test Median	Post-Test Median	Pre-Test SD	Post-Test SD
Boys	18.93	21.67	17	22	3.94	5.02
Girls	19	21.33	18	22	3.77	4.67

Discussion of Findings and Conclusion The findings show that both boys and girls in the experimental group improved their flexibility (as indicated by higher post-test scores compared to pre-test scores). The mean and median scores increased from pre-test to post-test for both groups, suggesting a positive effect of the gymnastics exercise on hip flexibility. The t-ratio calculated (Approximately 0.36) indicates that there is no significant difference in post-test scores between boys and girls in the experimental group. This suggests that the gymnastics exercise had a comparable effect on improving flexibility in both genders.

Conclusion

Therefore, we reject the null hypothesis. The results suggest that participating in the gymnastics program significantly increased hip flexibility (as measured by sit-and-reach scores) compared to the control group who did not participate in the program. This effect was observed in both boys and girls, as the study did not show significant differences between genders within each group. In conclusion, the study supports the hypothesis that gymnastics exercise improves hip flexibility in elementary school children, regardless of gender. The findings underscore the importance of incorporating such exercises to enhance physical fitness and potentially reduce the risk of injuries related to poor flexibility. Further studies with larger sample sizes could validate these findings more robustly.

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