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Original Research Article

Aerobic capacity in adults with mild hemophilia compared to healthy adults: a cross-sectional study

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ABSTRACT

Background: Hemophilia is an X-linked inherited bleeding disorder that not only affects the joints, and muscle but can also affects other organs. It has been determined that aerobic capacity protects individuals with hemophilia (PWH) from joint impairment. The impact of aerobic capacity on PWH, however, is little understood. Evaluation of aerobic capacity in individuals with hemophilia is a critical aspect of comprehensive care. The integration of these assessments helps tailor the management strategies accordingly.
Methods: 30 participants (males) with the age group of 18-30 years were selected via a convenient sampling method. 30 participants were divided into 2 groups, the hemophilic group (15) and the control group (15). The aerobic capacity was measured with a 6-minute walk test and Queen College step test.
Results: Results from the study showed a mean value of 6-minute walk test and Queen College step test in the control group was 450.8 m 42.5 ml/kg/minute and in the hemophilic group was 324 m 25.7 ml/kg/minute respectively. The data also revealed that the aerobic capacity of the control group and hemophilic groups differed statistically significantly.
Conclusions: Hemophilia affects aerobic capacity in a significant way. These findings highlight the need for attention in physical activity prescription and promotion for patients with hemophilia and need to engage in aerobic or resistive exercise for their health benefits.

Keywords: Activity, Adults, Exercise, Hemophilia, Walk test

INTRODUCTION

Hemophilia is a blood-clotting disorder that causes bleeding in the muscles and joints and is caused by an insufficiency of factor VIII or factor IX.[1] It is a recessive illness connected to chromosomal X. As a result, 50% of grandparents' grandchildren contract the disease from their daughters (who are known carriers but do not have the condition). Still, occasionally, spontaneous mutations occur.[2] There are three categories of hemophilia based on the amount of clotting component: mild hemophilia (>5-40% FVIII/FIX), which causes bleeding during major injuries or operative procedures; moderate hemophilia (1-4% FVIII/FIX), which causes bleeding during minor trauma or injury; and severe hemophilia (<1% FVIII/IX), which causes spontaneous bleeding.[3] Recurrent bleeding into joints, muscles, and soft tissues is the main symptom of severe hemophilia. Patients usually experience their first joint bleed early in life. Both recurrent and spontaneous bleeding can lead to arthropathy, chronic discomfort, and muscular atrophy, which can ultimately result in incapacity.[4] 80% of the time, haemorrhages impact the musculoskeletal system, 2% the neurological system, and 20% other systems.[5] Frequent musculoskeletal bleeding can result in discomfort, decreased range of motion, activity limitations, hemophilic arthropathy, and a

lowered quality of life.[6] Hemophilic arthropathy progresses and the joint deteriorates, resulting in abnormalities and reduced mobility.[7] Hemophilia B, however, is probably associated with less severe disability and fewer bleeding episodes.[8] Hemophilia's clinical symptoms include a variety of bleeding phenotypes.[9] PWH were previously discouraged from playing sports and engaging in other physical activities because of the perceived risk of bleeding, but a recent review has demonstrated the advantages of exercise for people with congenital bleeding disorders.[10] Before providing the exercise prescription to the patients it is important to check the aerobic capacity in hemophilics. There is literature on aerobic capacity in hemophilic patients and no literature on mild hemophilic patients. So, to fill this gap of study we aimed to evaluate the aerobic capacity of hemophilic and normal population.

Objective

Assessing the adults in the mild hemophilia group's ability to exercise and comparing the variations between the hemophilia group and the control group were the main objectives of the research.

METHODS

This case study was conducted (April 2023 to March 2024) on 30 male hemophilic patients at the PGIMS Rohtak Hemophilia Daycare Centre. Ethical clearance was taken from the ethical committee of Pandit B. D. Sharma, University of Health Sciences, Rohtak vide letter number BREC/23/017. Using a convenient sample technique 15 male hemophilic persons and 15 normal individuals in the control group, both between the ages of 18 and 30, were chosen from a group of 30 male subjects. Patients with hemophilia A and B were both included in this study. The research included mild hemophilic patients. Participants (hemophilic group) who have hemophilia A or B, recurrent bleeding episodes, mild or moderate hemophilia, or any other disease were not allowed for the study. In the control group the person who had neurological disorders, fractures, or psychiatric conditions that interfered with the examination was omitted from the research. To measure the aerobic capacity 2 outcomes measures 6-minute walk test (6MWT) and Queen College step test were used.

Procedure

6-MWT

All participants received a practice session before the 6MWT evaluation in line with published research showing a learning effect that fades after one training session. The 6MWT was carried out on a level, non-carpeted walking surface indoors in a thermoneutral setting. A pylon and colored tape were used to mark the ends of the 20-meter walking course on the floor. Throughout the test, participants were told to "cover as much distance as possible". Verbal encouragement has been demonstrated to impact 6MWT outcomes.[11]

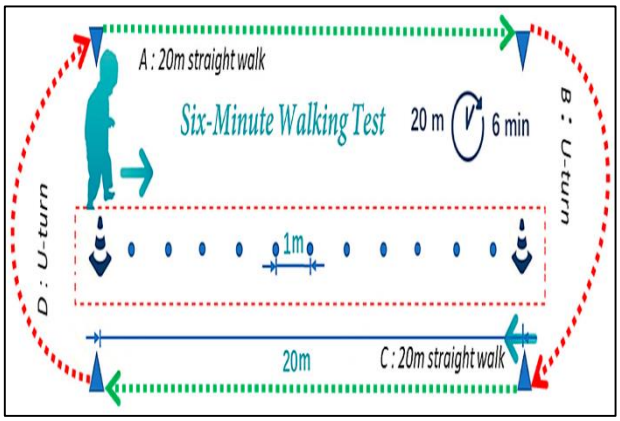

Figure 1: 6-minute walk test.[12]

Queen College step test

An instrument of 16.25 inches in height was used to conduct the step test. A metronome was used to set the pace of the stepping, which was 24 steps up per minute for men and 22 steps up per minute for women for three minutes. The carotid pulse rate was recorded from the fifth to the twentieth seconds of the recovery time following the exercise. The following equation predicted VO_2 max after the 15-second pulse rate was converted to beats per minute.[13]

For men: (0.42 × pulse rate beats/minute) - VO_2 max

Figure 2: Queen College step test.

Statistical analysis

The SPSS statistical package (version 27.0) was used to analyze the data. The average and standard deviation were determined using descriptive statistics. To determine if there was a difference between the hemophilic and control groups, a student-independent t-test was utilised. A p value of 0.05 or less was regarded as a significant difference for all statistical tests.

RESULTS

There were 15 male participants in the control group with a mean age 25.48±5.48 years and 15 male participants in the hemophilic group with a mean age 26.64±6.84 years as Table 1. Table 2 shows mean±SD value of the 6-minute walk test, while the Table 3 shows the VO_2 max in both control and hemophilic group. There was a statistically significant difference in distance measured by the 6-minute walk test and VO_2 max between the control group and the hemophilic group ($p \leq 0.05$). Figures 3 and 4 represent a bar graph showing a comparison of walking distance measured by the 6-minute walk test and VO_2 max by using the Queen College step test respectively between the control group and hemophilic group participants.

Table 1: Demographic data.

Variable	Experimental group	Control group
	Mean±SD	Mean±SD
Age (years)	26.64±6.84	25.48±5.48

Table 2: Aerobic capacity by 6-minute walk test.

	Control group	Hemophilic group	T value	P value
	Mean±SD	Mean±SD		
6MWT (m)	450.8±85	324±67	-8.67	0.000*

Table 3: Aerobic capacity by Queen College step test.

VO_2 max	Control group	Hemophilic group	T value	P value
	Mean±SD	Mean±SD		
Queen College step test	42.5±9.02	25.7±4.7	-6.78	0.001*

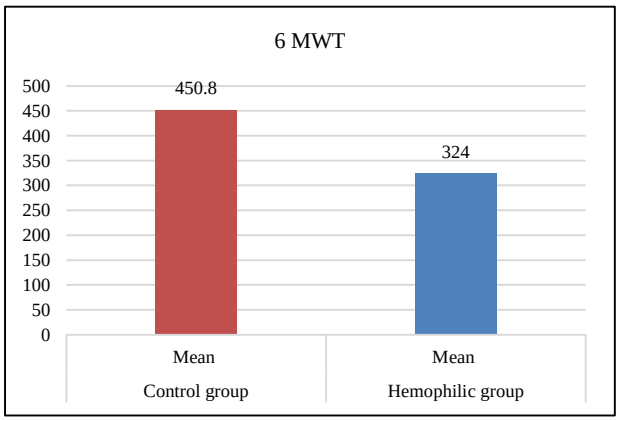

Figure 3: Bar graph showing a comparison of 6-minute walk test's mean value between the conrol group and hemophilic group.

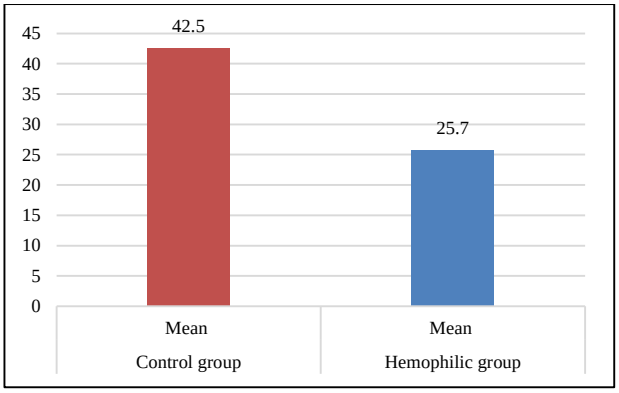

Figure 4: Bar graph showing comparison of Queen College step test's mean value between conrol group and hemophilic group.

DISCUSSION

There are limited studies on the rate of aerobic capacity, particularly in people with mild hemophilia. This study was carried out to ascertain the exercise ability of the mild hemophilic population. There has been little previous study on functional abilities, joint health, aerobic capacity, quality of life, walking ability, physical activity, and changes in adaptive, emotional, and behavioural functioning in children and adolescents with hemophilia.[5,14-19] In this study, two groups were used: the hemophilic group and the control group. The aerobic capacity was measured using the Queen College step test and the 6-minute walk test.

The present study confirmed that there were significant variations in exercise ability. This discrepancy may result from joint issues that hemophiliac patients have, which might alter their VO_2 max capacity and interfere with their ability to travel long distances safely. Joint arthropathy, particularly in the knee joint, can also result in joint limitation and deformities such as fixed flexion deformity, which impair patients' freedom and create a variety of symptoms.

The study's findings indicate that hemophiliac patients' ability to exercise is not as high as that of the general adult population. The hemophilic group's average distance and VO_2 max were lower than those of the normal group, and they reached a statistically significant level. These results are consistent with a previous study by Monticinos et al, which found that moderate hemophiliac patients are less able to exercise than their healthy counterparts.[17]

Both males and females should be included as in our hemophilia day care centre females are also enrolled and the wide age group was also the one of limitation.

CONCLUSION

Hemophilia affects aerobic capacity in a significant way. These findings highlight the need for attention in physical

activity prescription and promotion for patients with Hemophilia and the need to engage in aerobic or resistive exercise for their health benefits.

Recommendations

Future research should use a greater sample size for better efficacy of results and use more variables to measure aerobic capacity.

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Ethical approval: The study was approved by the Institutional Ethics Committee of Pandit B. D. Sharma, University of Health Sciences, Rohtak vide letter no. BREC/23/017

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