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Research Article

The relationship between joint health, kinesiophobia, physical activity level, and functional capacity in hemophilia patients: a case-control study

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ABSTRACT

Objective: The objective of this research was twofold: to compare the physical activity levels and functional capacity of patients with hemophilia A to healthy individuals and to determine the interrelationships among joint health, kinesiophobia, physical activity, and functional capacity.

Methods: In the case-control study, 15 hemophilia A patients with a median age of 36 years (interquartile range (IQR), 27-48) and 15 age- and sex-matched healthy volunteers with a median age of 30 years (IQR, 27-41) were examined. The International Physical Activity Questionnaire - Short Form and a 6-minute walk test were administered to both groups. The Hemophilia Joint Health Score and Tampa Kinesiophobia Scale score were recorded in the hemophilia group.

Results: While there was no statistically significant difference between the 2 groups in terms of total physical activity level (P=.902), hemophilia patients exhibited a lower 6-minute walk distance (6MWD) than healthy controls (P < .001). The median Tampa Scale of Kinesiophobia score for the hemophilia patient group was 41 (IQR, 33-45), with 73.3% (n=11) exhibiting a high degree of kinesiophobia. A negative correlation was observed between the 6MWD and age in hemophilia patients. However, no statistically significant relationship was found between kinesiophobia and Hemophilia Joint Health Score, physical activity level, or 6MWD.

Conclusion: Kinesiophobia is common in adults with hemophilia. Although they engage in similar physical activities as their peers, their decreased functional capacity is related to demographic characteristics such as age, not clinical characteristics such as pain intensity, joint health, or kinesiophobia. The results of this study may help identify the rehabilitation needs of hemophilia patients and factors that may influence the design and implementation of exercise programs for this population.

Level of Evidence: Level III, Prognostic Study.

Introduction

Hemophilia A and B are hereditary hemorrhagic diseases caused by congenital deficiencies of Factors VIII and IX, which play a role in the coagulation system. The prevalence of these conditions is higher in male subjects and is typified by prolonged and excessive bleeding, whether spontaneous or traumatic. Bleeding episodes typically occur in the joints, especially in the knee, elbow, and ankle. Chronic synovitis and cartilage destruction from recurrent joint bleeding lead to hemophilic arthropathy, one of the most significant causes of morbidity in hemophilia.[1] Recent findings indicate that individuals afflicted with severe hemophilia A may experience a more pronounced manifestation of the disease, characterized by joint complications, when compared to those with severe hemophilia B.[2]

Identifying individuals at risk for health issues heavily relies on understanding their physical activity levels and functional capacity. Evaluations of physical activity and functional capacity have proven to offer independent prognostic insights across different populations.[3] Studies on the physical activity levels of patients with hemophilia have shown conflicting results. Some studies indicate that patients with hemophilia are similar to or more active than the general population,[4-8] while others suggest they are less active.[9,10] Furthermore, the reviewed studies reported that the functional capacity values of hemophilia patients, as assessed by the 6-minute walk distance (6MWD), were lower than the reference values reported for the healthy population.[11] To the best of current knowledge, there are no available comparisons with age- and sex-matched healthy individuals in this regard.

Before the implementation of replacement therapy, patients with hemophilia were given restrictive recommendations regarding many physical and sports activities to reduce the risk of hemophilic arthropathy.[12] Today, patients with hemophilia are encouraged to adopt an active lifestyle. Individualized aerobic and strengthening exercises in patients with hemophilia are known to lead to various health-related improvements without increasing bleeding episodes.[13,14] To increase physical activity levels in hemophilia patients, some authors have advised healthcare providers to focus on reducing patients' fear of movement, also known as kinesiophobia.[15] However, the relationship between joint health, kinesiophobia,

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physical activity level, and functional capacity in this population remains to be elucidated.

The objective of the present study was to make a comparison between the functional capacity and physical activity levels of patients suffering from hemophilia and those of healthy individuals. Furthermore, the investigation sought to examine the relationship between joint health, kinesiophobia, functional capacity, and physical activity levels. It is anticipated that these findings will serve as a framework for the evaluation of rehabilitation requirements in patients with hemophilia and the factors that may influence the conceptualization and execution of exercise regimens for this population.

Material and methods

Study design and patients

The present case-control study was conducted at Trakya University Hospital in Edirne, Türkiye, between May 2021 and October 2021. Given the higher prevalence of hemophilia in the male population and the potential differences in clinical manifestations between hemophilia A and B, the study's case group comprised male hemophilia A patients over the age of 18, diagnosed by a hematologist. The control group was composed of age-matched healthy males who were selected through the use of stratified random sampling.

Patients with neurological or other orthopedic diseases that could significantly affect gait and balance functions, those who developed intramuscular or intra-articular bleeding within the last 2 weeks, and those who were unable to complete the assessment tests were excluded.

Demographic information

The age (years), height (m), and weight (kg) of all participants were recorded, and body mass index (BMI) (kg/m^2) was calculated as weight in kg divided by the square of height in meters (kg/m^2). The following weight categories were determined: underweight (BMI <18.5 kg/m^2), normal (BMI 18.5-24.9 kg/m^2), overweight (25.0-29.9 kg/m^2), and obese (≥ 30.0 kg/m^2).[16]

Severity of hemophilia and treatment modalities

The severity of hemophilia A was classified as mild (>5%-<40%), moderate (1%-5%), and severe (<1%) according to endogenous factor VIII activity. The method of hemostatic therapy (on-demand or prophylaxis) for patients was recorded. The aforementioned examinations were conducted by the researcher (U.D.), who is a hematologist.

Lower extremity joint pain rating

Lower extremity joint pain ratings in patients with hemophilia were recorded on the day of enrollment (current pain). A 10-cm visual analog scale was used to rate pain, with a score of 0 representing no pain and 10 representing the worst pain imaginable.[17]

HIGHLIGHTS

- Fear of movement (kinesiophobia) is a frequently reported concern for adults living with hemophilia.
- While individuals with moderate to severe hemophilia report similar total physical activity levels to their peers, objective tests show they have a lower functional capacity.
- Functional capacity in people with hemophilia is negatively correlated with age but shows no correlation with pain severity, joint health status, physical activity level, or kinesiophobia.
- A deeper understanding of physical activity levels and functional capacity in people with hemophilia is essential for tailoring rehabilitation programs and identifying elements that affect how well exercise interventions work.

Hemophilic arthropathy evaluation

A functional evaluation of the joint health of hemophilia patients in terms of hemophilic arthropathy was performed using the hemophilia joint health score (HJHS) version 2.1. Scores from the HJHS were considered abnormal if they were >3 points for patients aged 50 and younger and >8 points for patients older than 50 years.[18]

Kinesiophobia

Kinesiophobia was measured using the Turkish version of the Tampa Scale for Kinesiophobia (TSK) in hemophilia patients. This self-administered instrument consists of a 17-item self-report questionnaire, with each question scored on a 4-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). Four items (4, 8, 12, and 16) are negatively worded and reverse scored. Total scores range from 17 to 68, with higher scores representing stronger fear-avoidance beliefs. The Turkish version of the TSK demonstrated excellent test-retest reliability with an intraclass correlation coefficient of .806.[19] A score greater than 37 is generally considered a high level of kinesiophobia.[20]

Physical activity level

The Turkish version of the International Physical Activity Questionnaire-Short Form (IPAQ-SF) was utilized in the study to assess the physical activity level of all participants.[21,22] The questionnaire consists of seven items that measure the frequency, intensity, and duration of low, moderate, and vigorous physical activities. Metabolic equivalent of task (MET) scores are calculated for each activity, with walking scored at 3.3 METs, moderate activity at 4 METs, and vigorous activity at 8 METs. The total physical activity score is obtained by summing these 3 scores, resulting in MET-minutes per week. The study's data was expressed both as continuous data and categorical scores, which classify individuals as inactive (score below 599 MET-min/week), minimally active (score between 600 and 2.999 MET-min/week), or engaged in Health Enhancing Physical Activity (HEPA) (score above 3.000 MET-min/week).

Functional capacity

The 6-minute walk test (6MWT), a simple and reliable test frequently used to determine physical functional capacity, was applied to all participants.[23,24] Heart rate, oxygen saturation, and blood pressure were measured before the 6MWT. Pretest heart rate and oxygen saturation were measured by oximetry. Dyspnea and exertion were assessed using the modified Borg scale. For 6MWT, patients were asked to walk as fast as possible for 6 minutes in a 30-meter corridor marked at 5-meter intervals. The 6MWD was recorded in meters.[25] The test was administered as a single repetition. The 6-MWT and other assessments in the study were performed by the same researcher (H.Ö.), who is both a physiatrist and a cardiologist, and experienced in these examinations.

Ethical considerations

This study was approved by the Ethics Committee of Trakya University Faculty of Medicine (date: April 26, 2021, number: TÜTF-BAEK 2021/206). The ethical principles of the Declaration of Helsinki regarding medical research on humans were followed. An informed consent form was signed by all participants before inclusion in the study.

Sample size calculation

In the power analysis performed using G*Power software, the effect size was calculated as 1.15, taking the maximal accomplished ascending slope on the treadmill values, indicator of maximal endurance power, from Herbsleb et al's study as reference.[26] The actual power was determined as 0.803, with a power of 0.80 (probability of 1-beta error) and an alpha error probability level of .05, even with a total of 26 participants, 13 participants in each group.

Statistical analysis

SPSS 23.0 (IBM SPSS Corp.; Armonk, NY, USA) was used for statistical analysis. The normality assumption was checked using Shapiro–Wilk's test. Results of the study are presented as median (interquartile range (IQR), 25-75 percentiles) for quantitative variables since they do not follow a normal distribution and frequency for qualitative variables. The Mann–Whitney *U*-test and chi-squared test were used to compare numerical and categorical data, respectively. Correlation between age, BMI, intensity of current pain, HJHS, TSK, physical activity level, and 6MWD in the hemophilia patients was performed using Spearman correlation analysis. All results were considered significant at a level of < .05.

Results

Thirty male participants (15 with hemophilia A and 15 controls) were included in the study. The hemophilia group, with a median age of 36 (IQR, 27-48) years, comprised 14 individuals with severe hemophilia and 1 with moderate hemophilia, all of whom were receiving prophylactic treatment. Thirteen out of the 15 hemophilia patients (86.7%) had hemophilic arthropathy. The median HJHS score of hemophilia patients was found to be 13 (IQR: 6-21). The control group had a median age of 30 (IQR, 27-41) years. No statistically significant differences were observed between the 2 groups in terms of demographic characteristics ($P > .05$) (Table 1).

Both groups were similar in terms of walking, vigorous, and total physical activity levels, except for moderate physical activity, where hemophilia patients exhibited significantly higher levels than controls ($P = .037$). The median 6MWD for hemophilia patients was 480 (IQR, 405-527) meters, compared to 630 (IQR, 580-650) meters for the control group, showing a statistically significant difference between the 2 groups (Table 2). Additionally, 73.3% of hemophilia patients reported knee or ankle pain, with a median VAS score of 3 (IQR, 2-7). The median TSK score for hemophilia patients was 41 (IQR, 33-45). Notably, 73.3% of hemophilia patients had TSK scores above 37, and these patients also reported knee or ankle pain.

Table 3 presents the Spearman correlation coefficients between age, BMI, pain intensity, HJHS, TSK, physical activity levels and 6MWD in hemophilia patients. While there was a positive correlation between age and 6MWD ($r_s = -.612$; $P < .05$), no correlation was observed between IPAQ total activity score or 6MWD and intensity of current pain, HJHS or TSK score ($P > .05$) (Figures 1 and 2).

Discussion

The findings of this study suggest that moderate to severe hemophilia patients, the majority of whom had hemophilic arthropathy, exhibited a lower 6MWD compared to their healthy counterparts. However, these patients reported engaging in a comparable level of physical activity to their peers, with even higher levels of moderate physical activity. Approximately three-quarters of patients with hemophilia experience a considerable degree of kinesiophobia. The study revealed no correlation between the severity of kinesiophobia and age, BMI, pain severity, or hemophilia joint health score. However, the study observed no correlation between physical activity level or functional capacity and pain severity, joint health score, or kinesiophobia, although a negative correlation was identified between functional capacity and age.

Table 1. Demographic characteristics of the hemophilia patients and healthy paticipants

Variable	Hemophilia group (n = 15)	Control group (n = 15)	ES	U/χ^2 statistic	*P*
Age (years), median (IQR)	36 (27-48)	30 (27-41)	.142	96.5	.512
Weight (kg), median (IQR)	74 (70-82)	78 (74-85)	.302	78.5	.161
BMI (kg/cm²), median (IQR)	26.16 (23.78-28.37)	25.10 (23.53-26.53)	.253	84.0	.250
BMI groups, n (%)			.326	3.18	.364
Underweight	1 (6.7)	0			
Normal weight	3 (20.0)	7 (46.7)			
Overweight	9 (60.0)	7 (46.7)			
Obese	2 (13.3)	1 (6.7)			

Data are summarized as median (25th–75th percentiles) and frequency (percentage).
ES (effect size): Rank-biserial correlation for continuous variables (Mann–Whitney *U*-test) and Cramér's V for categorical variables.
BMI, body mass index; IQR, interquartile range.

Table 2. Physical activity and functional capacity in the hemophilia and control groups

Variable	Hemophilia group (n = 15)	Control group (n = 15)	ES	U/χ^2 statistic	*P*
IPAQ activity scores (MET-min/week), median (IQR)					
Vigorous activity					
Moderate activity	0 (0-480)	40 (0-960)	.164	94.0	.461
Walking	360 (80-960)	0 (0-360)	.444	62.5	.037*
Total	990 (396-1386)	693 (495-1386)	.071	104.5	.744
	1070 (462-4026)	1518 (693-2613)	.031	109.0	.902
Physical activity categories, n(%)					
Inactive	4 (26.7)	2 (13.3)	.272	2.22	.329
Minimally active	7 (46.7)	11 (73.3)			
HEPA active	4 (26.7)	2 (13.3)			
6MWD (m), median (IQR)	480 (405-527)	630 (580-650)	.911	10.0	<.001*

Data are summarized as median (25th–75th percentiles) and frequency (percentage).
ES (effect size): Rank-biserial correlation for continuous variables (Mann–Whitney *U*-test) and Cramér's V for categorical variables.
*Statistical significance at level of <.05.
6MWD, 6-minute walk distance; HEPA, health-enhancing physical activity; IQR, interquartile range; IPAQ, International Physical Activity Questionnaire; MET, metabolic equivalent of task.

Table 3. Spearman correlation coefficients between age, BMI, pain intensity, hemophilia joint health score, kinesiophobia, physical activity level, and functional capacity in the hemophilia patients (n=15)

	TSK	IPAQ walking score	IPAQ moderate activity score	IPAQ vigorous activity score	IPAQ total activity score	6MWD
Age	−.280	−.385	−.061	−.147	−.220	−.612*
BMI	.004	−.301	.363	−.324	−.232	−.479
Intensity of current pain	.109	.350	.432	.467	.296	−.140
HJHS	−.241	−.172	.131	.019	−.181	−.291
TSK	—	.281	.072	−.163	−.111	.065
IPAQ total activity score	−.111	.945**	.864**	.799**	—	.477
6MWD	−.065	.433	.369	.437	.477	—

*Correlation is significant at $P < .05$.
**Correlation is significant at P< .001.
6MWD, 6-min walk distance; BMI, body mass index; HJHS, Hemophilia Joint Health Score; IPAQ, International Physical Activity Questionnaire; TSK, Tampa Scale of Kinesiophobia.

Patients with hemophilia may develop kinesiophobia due to factors such as fear of pain, joint damage, and risk of bleeding.[27] According to recent studies, the mean TSK score in hemophilia patients ranges from 30 to 47, which aligns with the findings of the present study.[15,27-29] However, the present study did not identify a significant correlation between TSK scores and age, BMI, current pain intensity, or HJHS. This finding suggests the possibility of kinesiophobia existing independently of these traditional demographic and clinical variables. Specifically, the absence of correlation with HJHS strengthens the hypothesis that patients may fear movement solely due to the expectation of bleeding or pain, independent of the severity of joint damage. This finding partially overlaps with the results of a recent study by Akan and colleagues.[30] In their study, Akan et al[30] demonstrated that kinesiophobia in hemophilia patients remained unaffected by age, education level, marital status, economic status, the presence of target joints, and history of orthopedic surgery or radioisotope synovectomy. Nevertheless, the findings of Akan et al[30] reveal a positive correlation between TSK scores and stigma, thereby indicating that fear of movement is associated with self-management rather than with demographic or disease-related characteristics. In contrast, Feldberg et al[31] reported a correlation between TSK and HJHS; however, this correlation was stated to be weak. Findings in other populations with chronic pain are also consistent with the current study. In a study by Varallo et al[32] on individuals with chronic low back pain, no relationship was found between kinesiophobia and age or BMI. This situation indicates that interventions targeting kinesiophobia in hemophilia treatment should be prioritized independently of physical parameters.

Kinesiophobia is frequently associated with increased pain intensity in populations experiencing chronic musculoskeletal pain. However, as evidenced by counterexamples, the validity of this association is questionable.[33,34] The TSK is the most widely used, valid, and reliable self-report measure for assessing the construct of kinesiophobia in individuals with chronic musculoskeletal pain, such as those with hemophilic arthropathy.[15,35] In their systematic review, Dupuis et al[35] noted that the TSK is weakly or moderately associated with pain and disability, making it unsuitable for assessments based on pain and improvement in physical functioning. In the current study, high levels of kinesiophobia (TSK ≥ 37) were observed in 73.3% of patients.

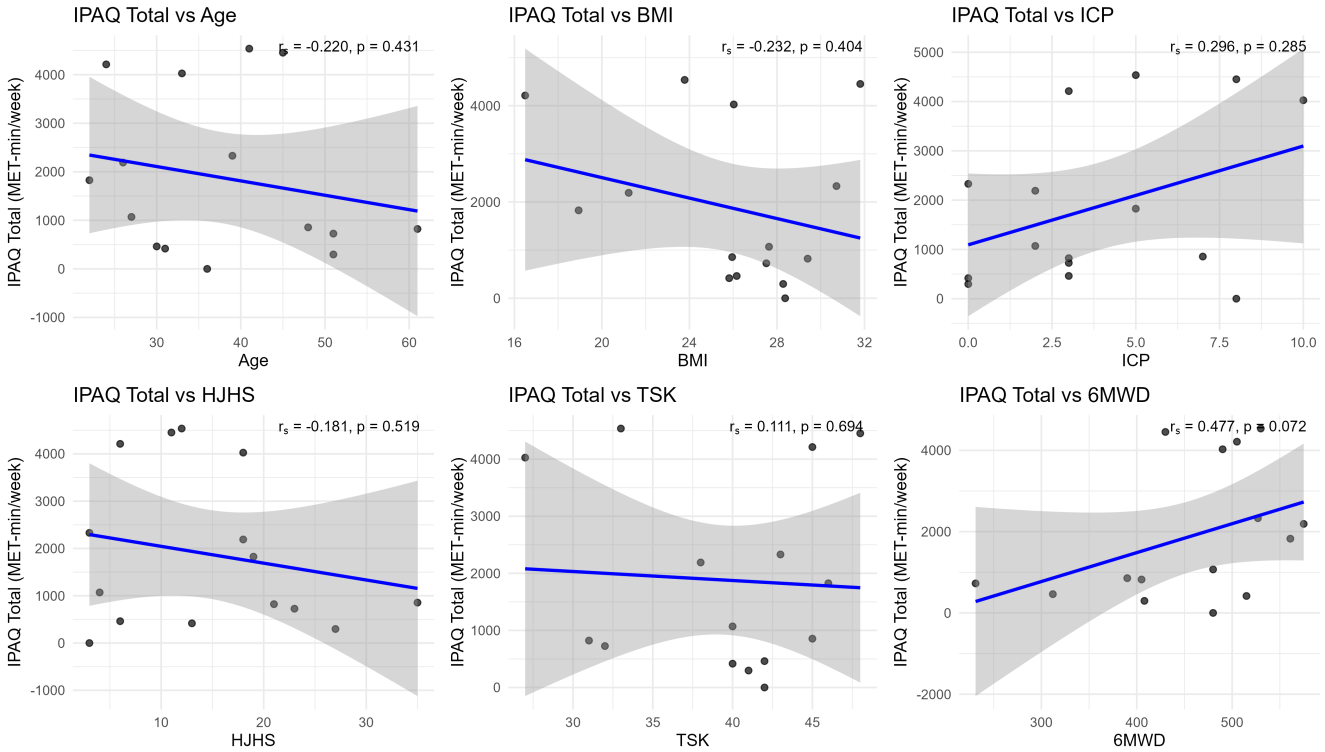

Figure 1. Figure indicates the Spearman correlation test results between IPAQ total activity score and age, BMI, intensity of current pain, HJHS, TSK, and 6MWD. 6MWD, 6-min walk distance; BMI, body mass index; HJHS, Hemophilia Joint Health Score; ICP, intensity of current pain; IPAQ, International Physical Activity Questionnaire; TSK, Tampa Scale of Kinesiophobia.

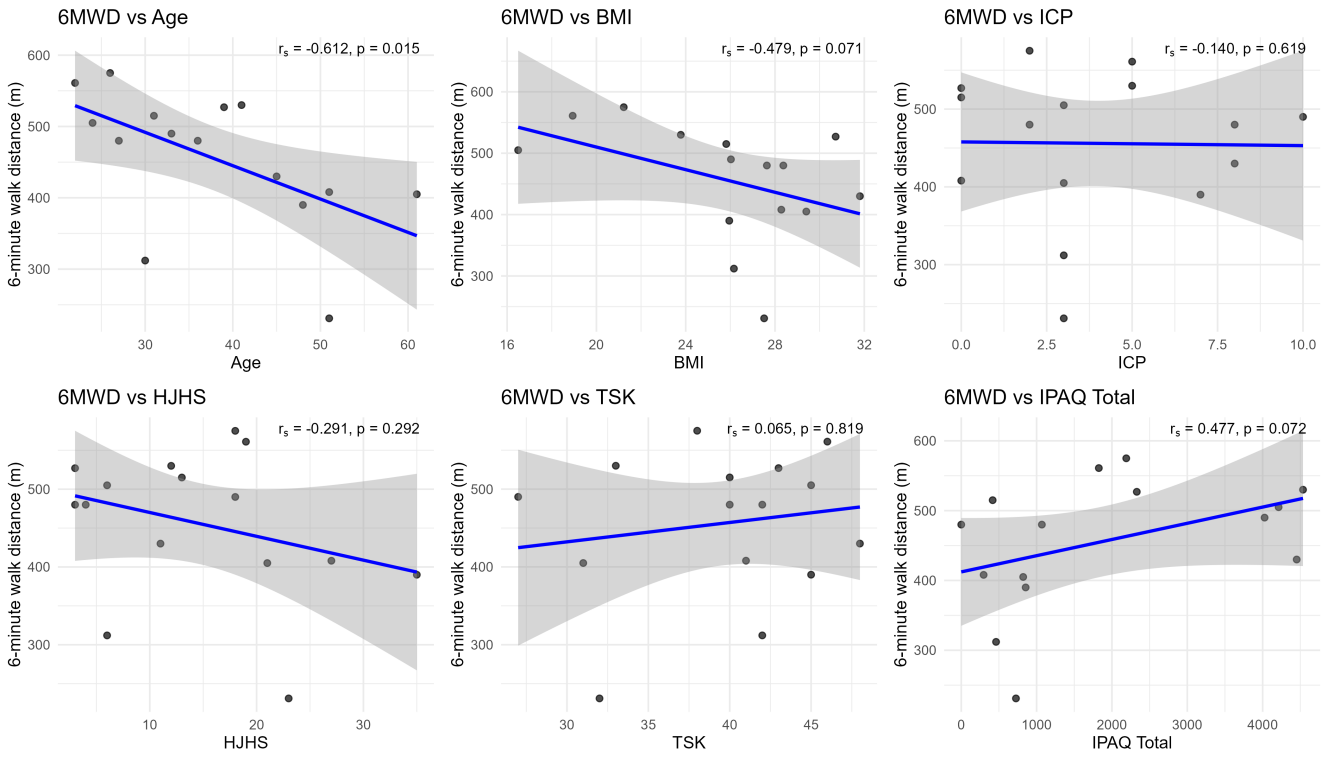

Figure 2. Figure indicates the Spearman correlation test results between 6MWD and age, BMI, intensity of current pain, HJHS, TSK, and IPAQ total activity score. 6MWD, 6-min walk distance; BMI, body mass index; HJHS, Hemophilia Joint Health Score; ICP, intensity of current pain; IPAQ, International Physical Activity Questionnaire; TSK, Tampa Scale of Kinesiophobia.

However, the absence of a direct correlation between current pain intensity and TSK suggests that the fear experienced by hemophilia patients has become independent of incoming sensory information and has evolved into a chronic condition. Moreover, experiencing severe joint bleeding and pain since childhood may lead to the development of a type of cognitive adaptation to pain. A review of the extant literature provides evidence that partially supports this hypothesis. For instance, Ucero-Lozano et al[27,28] reported that these patients exhibited lower scores on the Pain Catastrophizing Scale in comparison to other chronic pain groups and higher scores on the perceived mental health component than the general population. These results were attributed to the adaptation process that patients have developed over the years. Ucero-Lozano et al[27] reported a positive correlation between pain intensity and kinesiophobia in their study. However, the higher mean total HJHS score observed in the present study may have contributed to the different results observed between the 2 studies. The present study suggests that kinesiophobia should be assessed in individuals with hemophilia, even in the absence of severe pain.

The physical activity level of patients with hemophilia is a significant determinant of their quality of life. A number of studies have indicated that the level of physical activity in patients with hemophilia is similar to or higher than that of the general population, as is the case in the present study.[4-8] Conversely, other studies have suggested that patients with hemophilia are more inactive than healthy individuals. The conflicting results of studies on the level of physical activity in hemophilia patients are attributed to the variability in the physical activity assessment methods used in these studies.[36] Future studies employing objective measurements for evaluating the physical activity level, such as accelerometers, in conjunction with self-report questionnaires, will facilitate the delineation of the average pattern of daily activity in hemophilia patients.

On the other hand, patients diagnosed with hemophilia exhibited a substantially diminished functional capacity in comparison to healthy individuals within the study population. This reduction is noteworthy given the established importance of functional capacity as a protective factor against injuries, falls, and recurrent hemarthrosis in individuals with hemophilia.[37] A systematic review by Cruz-Montecinos et al[11] has indicated that 6MWD in adult hemophilia patients is, on average, lower than the reference values established for the healthy population. The present study lends support to this finding through the use of comparative data gathered from age- and sex-matched peers. The negative correlation between age and functional capacity in hemophilia patients is consistent with the chronic and degenerative nature of this condition. This finding suggests that the long-term progression of the disease may inevitably result in a general physical decline, as evidenced by previous studies demonstrating a decrease in muscle strength and overall physical fitness.[38,39] However, the study's notable findings include the observation that neither the IPAQ total activity score nor the 6MWD was statistically correlated with current pain intensity, HJHS, or TSK. The relatively low total HJHS and current pain severity of the patients in the study may have influenced the results. Furthermore, the existence of studies finding that perceived pain intensity (especially at rest) in chronic musculoskeletal diseases has no impact on physical activity level and functional capacity should not be overlooked.[38,40,41] The extant literature contains conflicting opinions regarding the relationship between kinesiophobia and physical activity level in patients with hemophilia. Zhang et al[15] asserted that physical activity has a direct relationship with pain catastrophizing and an indirect relationship through kinesiophobia. In contrast, Aykar et al[42] reported that there is no relationship between physical activity level and kinesiophobia, which is consistent with the findings of the current study. A direct comparison of

this finding is precluded by the absence of a literature study that has directly examined the relationship between functional capacity and kinesiophobia in hemophilia patients. However, the relationship between physical capacity and kinesiophobia, as measured by direct performance-based tests, is known to be weak or absent in some other chronic pain populations.[34,43-46] Vincent et al[47] observed that individuals with chronic low back pain who exhibited high levels of kinesiophobia were still able to walk on a treadmill despite experiencing pain. The researchers concluded that some participants were able to cope with the pain and prioritize walking, resulting in the achievement of long walking times regardless of pain intensity. The findings suggest that the functional capacity of hemophilia patients should be assessed, regardless of the presence or absence of pain, joint problems, or avoidance behaviors, and this is particularly important with increasing age.

The study was conducted in a single center and moderate-to-severe hemophilia A patients were evaluated, which makes it difficult to represent the sample for all hemophilia patients. Blinding could not be performed due to the study methodology and clinical characteristics of the case group. As mentioned previously, a self-reported questionnaire was used to evaluate the level of physical activity. The study also examined the relationship between joint health, physical activity level, functional capacity, and kinesiophobia but did not consider other psychosocial factors that may affect these variables (e.g. pain catastrophizing, self-efficacy). Furthermore, a multivariable model was not used because the study's primary aim was to determine the direction and strength of associations, not to establish causality or identify potential confounding effects. This reliance limits the ability to account for the complex interplay of multiple factors. Given these limitations, future studies should aim to obtain more comprehensive results using different hemophilia types and severities, as well as other psychosocial factors and objective physical activity measures. Noteworthy strengths of the study include the comparison of functional capacity with that of healthy controls and, to the best of current knowledge, the pioneering evaluation of the relationship between joint health, kinesiophobia, physical activity, and functional capacity in hemophilia patients.

In summary, kinesiophobia is a frequently expressed concern among adults suffering from hemophilia. Self-report questionnaires indicate that individuals with moderate to severe hemophilia A engage in comparable levels of physical activity as their peers. However, in comparative objective assessments, their functional capacity exhibits an inverse proportional decline with age. This phenomenon is not contingent upon current pain severity, joint health, or kinesiophobia. It is evident that a greater understanding of the physical activity volume and functional capacity of individuals with hemophilia is crucial for determining their rehabilitation needs and identifying factors that may influence the efficacy of exercise programs.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

Ethics Committee Approval: Ethical committee approval was received from the Ethics Committee of the University of Trakya (Approval no: TÜTF-BAEK 2021/206, Date: 26.04.2021).

Informed Consent: Written informed consent was obtained from the patients/patient who agreed to take part in the study.

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References

1. Leuci A, Dargaud Y. Blood-induced arthropathy: A major disabling complication of haemophilia. *J Clin Med*. 2023;13(1):225. [CrossRef]
2. Melchiorre D, Linari S, Manetti M, et al. Clinical, instrumental, serological and histological findings suggest that hemophilia B may be less severe than hemophilia A. *Haematologica*. 2016;101(2):219-225. [CrossRef]
3. Blair SN, Cheng Y, Holder JS. Is physical activity or physical fitness more important in defining health benefits? *Med Sci Sports Exerc*. 2001;33(6)(suppl):S379-99; discussion S419. [CrossRef]
4. Versloot O, Berntorp E, Petrini P, et al. Sports participation and physical activity in adult Dutch and Swedish patients with severe haemophilia: a comparison between intermediate- and high-dose prophylaxis. *Haemophilia*. 2019;25(2):244-251. [CrossRef]
5. Taylor S, Room J, Barker K. Physical activity levels in men with Haemophilia-a single centre UK survey. *Haemophilia*. 2020;26(4):718-725. [CrossRef]
6. Niu X, Poon JL, Riske B, et al. Physical activity and health outcomes in persons with haemophilia B. *Haemophilia*. 2014;20(6):814-821. [CrossRef]
7. den Uijl I, Biesma D, Grobbee D, et al. Turning severe into moderate haemophilia by prophylaxis: are we reaching our goal? *Blood Transfus*. 2013;11(3):364-369. [CrossRef]
8. González LM, Peiró-Velert C, Devís-Devís J, et al. Comparison of physical activity and sedentary behaviours between young haemophilia A patients and healthy adolescents. *Haemophilia*. 2011;17(4):676-682. [CrossRef]
9. Sherlock E, O'donnell JS, White B, et al. Physical activity levels and participation in sport in Irish people with haemophilia. *Haemophilia*. 2010;16(1):e202-e209. [CrossRef]
10. Goto M, Haga N, Takedani H. Physical activity and its related factors in Japanese people with haemophilia. *Haemophilia*. 2019;25(4):e267-e273. [CrossRef]
11. Cruz-Montecinos C, Núñez-Cortés R, Vasconcello-Castillo L, et al. Exercise capacity in people with haemophilia: A systematic review. *Haemophilia*. 2022;28(6):891-901. [CrossRef]
12. Weigel N, Carlson BR. Physical activity and the hemophiliac: yes or no? *Am Correct Ther J*. 1975;29(6):197-205.
13. Wagner B, Krüger S, Hilberg T, et al. The effect of resistance exercise on strength and safety outcome for people with haemophilia: a systematic review. *Haemophilia*. 2020;26(2):200-215. [CrossRef]
14. Tomschi F, Ransmann P, Hilberg T. Aerobic exercise in patients with haemophilia: A systematic review on safety, feasibility and health effects. *Haemophilia*. 2022;28(3):397-408. [CrossRef]
15. Zhang W, Zhu T, Wang S, et al. Chain-mediating effects of kinesiophobia and self-efficacy on pain catastrophizing and physical activity in haemophilia patients. *Haemophilia*. 2024;30(3):809-816. [CrossRef]
16. Douketis JD, Paradis G, Keller H, et al. Canadian guidelines for body weight classification in adults: application in clinical practice to screen for overweight and obesity and to assess disease risk. *CMAJ*. 2005;172(8):995-998. [CrossRef]
17. Hawker GA, Mian S, Kendzerska T, et al. Measures of adult pain: Visual Analog Scale for Pain (VAS Pain), Numeric Rating Scale For Pain (NRS Pain), Mcgill Pain Questionnaire (MPQ), Short-Form Mcgill Pain Questionnaire (SF-MPQ), Chronic Pain Grade Scale (CPGS), Short Form-36 Bodily Pain Scale (SF-36 BPS), and Measure of Intermittent and Constant Osteoarthritis Pain (ICOAP). *Arthritis Care Res (Hoboken)*. 2011;63(suppl 11):S240-S252. [CrossRef]
18. St-Louis J, Abad A, Funk S, et al. The hemophilia joint health score version 2.1 validation in adult patients study: a multicenter international study. *Res Pract Thromb Haemost*. 2022;6(2):e12690. [CrossRef]
19. Yilmaz O, Yakut Y, Uygur F, et al. Turkish version of the Tampa Scale for Kinesiophobia and its test-retest reliability. *Turk J Physiother Rehabil*. 2011;22(1):44-49.
20. Vlaeyen JW, Kole-Snijders AM, Boeren RG, et al. Fear of movement/(re)injury in chronic low back pain and its relation to behavioral performance. *Pain*. 1995;62(3):363-372. [CrossRef]
21. Craig CL, Marshall AL, Sjöström M, et al. International physical activity questionnaire: 12-country reliability and validity. *Med Sci Sports Exerc*. 2003;35(8):1381-1395. [CrossRef]
22. Saglam M, Arikan H, Savci S, et al. International physical activity questionnaire: reliability and validity of the Turkish version. *Percept Mot Skills*. 2010;111(1):278-284. [CrossRef]
23. Pollentier B, Irons SL, Benedetto CM, et al. Examination of the six minute walk test to determine functional capacity in people with chronic heart failure: a systematic review. *Cardiopulm Phys Ther J*. 2010;21(1):13-21. [CrossRef]

24. Martín-Ponce E, Hernández-Betancor I, González-Reimers E, et al. Prognostic value of physical function tests: hand grip strength and six-minute walking test in elderly hospitalized patients. *Sci Rep*. 2014;4:7530. [CrossRef]
25. Chetta A, Zanini A, Pisi G, et al. Reference values for the 6-min walk test in healthy subjects 20-50 years old. *Respir Med*. 2006;100(9):1573-1578. [CrossRef]
26. Herbsleb M, Hilberg T. Maximal and submaximal endurance performance in adults with severe haemophilia. *Haemophilia*. 2009;15(1):114-121. [CrossRef]
27. Ucero-Lozano R, López-Pina JA, Ortiz-Pérez A, et al. The relationship between chronic pain and psychosocial aspects in patients with haemophilic arthropathy. A cross-sectional study. *Haemophilia*. 2022;28(1):176-182. [CrossRef]
28. Ucero-Lozano R, López-Pina JA, Ortiz-Pérez A, et al. Quality of life and its predictors among adult patients with haemophilic arthropathy. An observational study. *BMC Musculoskelet Disord*. 2021;22(1):448. [CrossRef]
29. Tat NM, Can F, Sasmaz HI, et al. The effects of manual therapy on musculoskeletal system, functional level, joint health and kinesiophobia in young adults with severe haemophilia: a randomized pilot study. *Haemophilia*. 2021;27(2):e230-e238. [CrossRef]
30. Çiftci Akan DÇ, Uğur MC, Oksel E. Investigation of the relationship between self-management and kinesiophobia in haemophiliac individuals experiencing intra-articular bleeding. *Haemophilia*. 2025;31(2):304-312. [CrossRef]
31. Feldberg G, Ricciardi JBS, Zorzi AR, et al. Chronic pain in patients with hemophilia: influence of kinesiophobia and catastrophizing thoughts. *Haemophilia*. 2023;29(1):386-389. [CrossRef]
32. Varallo G, Scarpina F, Giusti EM, et al. Does kinesiophobia mediate the relationship between pain intensity and disability in individuals with chronic low-back pain and obesity? *Brain Sci*. 2021;11(6):684. [CrossRef]
33. Boersma K, Linton SJ. How does persistent pain develop? An analysis of the relationship between psychological variables, pain and function across stages of chronicity. *Behav Res Ther*. 2005;43(11):1495-1507. [CrossRef]
34. Genç AS, Akdemir E, Anıl B, et al. Investigation of the relationship between kinesiophobia and pain, quality of life and physical functions in osteoarthritis patients. *Medical Records*. 2024;6(3):382-388. [CrossRef]
35. Dupuis F, Cherif A, Batcho C, et al. The Tampa Scale of Kinesiophobia: a systematic review of its psychometric properties in people with musculoskeletal pain. *Clin J Pain*. 2023;39(5):236-247. [CrossRef]
36. Kennedy M, O'Gorman P, Monaghan A, et al. A systematic review of physical activity in people with haemophilia and its relationship with bleeding phenotype and treatment regimen. *Haemophilia*. 2021;27(4):544-562. [CrossRef]
37. King JT, Tsevat J, Roberts MS. Cognitive impairment and preferences for current health. *Health Qual Life Outcomes*. 2009;7:1. [CrossRef]
38. Falk B, Portal S, Tiktinsky R, et al. Bone properties and muscle strength of young haemophilia patients. *Haemophilia*. 2005;11(4):380-386. [CrossRef]
39. Seuser A, Boehm P, Kurme A, et al. Orthopaedic issues in sports for persons with haemophilia. *Haemophilia*. 2007;13(suppl 2):47-52. [CrossRef]
40. Hurri H, Mellin G, Korhonen O, et al. Aerobic capacity among chronic low-back-pain patients. *J Spinal Disord*. 1991;4(1):34-38.
41. Altuğ F, Ünal A, Kilavuz G, et al. Investigation of the relationship between kinesiophobia, physical activity level and quality of life in patients with chronic low back pain1. *J Back Musculoskelet Rehabil*. 2016;29(3):527-531. [CrossRef]
42. Aykar S, Can F, Sahin F. Relationship between fear of movement and physical activity levels in adult hemophilic individuals. *Ann Med Res*. 2020;27(1):219-223. [CrossRef]
43. Reneman MF, Jorritsma W, Dijkstra SJ, et al. Relationship between kinesiophobia and performance in a functional capacity evaluation. *J Occup Rehabil*. 2003;13(4):277-285. [CrossRef]
44. Er G, AngIn E. Determining the relationship of kinesiophobia with respiratory functions and functional capacity in ankylosing spondylitis. *Medicine*. 2017;96(29):e7486. [CrossRef]
45. Sakulsriprasert P, Bunprajun T, Hengsomboon N, et al. Structural equation model of knee pain in individuals with knee osteoarthritis-associated knee pain, based on functional capacity, kinesiophobia, muscle thickness, and joint position sense. *Knee*. 2025;54:199-208. [CrossRef]
46. Nijs J, Vanherberghen K, Duquet W, et al. Chronic fatigue syndrome: lack of association between pain-related fear of movement and exercise capacity and disability. *Phys Ther*. 2004;84(8):696-705. [CrossRef]
47. Vincent HK, Seay AN, Montero C, et al. Kinesiophobia and fear-avoidance beliefs in overweight older adults with chronic low-back pain: relationship to walking endurance—part II. *Am J Phys Med Rehabil*. 2013;92(5):439-445. [CrossRef]