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Physical Performance in Young Adult Women With High Femoral Anteversion

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Abstract

Tuncer, D, Altay, E, and Furuncu, B. Physical performance in young adult women with high femoral anteversion. *J Strength Cond Res* XX(X): 000–000, 2025—Women with high femoral anteversion (HFA) demonstrate significantly increased hip internal rotation and anteversion angles than controls, which may affect lower extremity biomechanics. This cross-sectional observational study aimed to evaluate the impact of HFA on physical performance in young adult women. Twenty-two women with HFA (age 21.36 ± 1.89 years) and 22 age-matched controls (age 22.23 ± 2.05 years) were assessed. Femoral anteversion was assessed using both the Craig test and goniometric measurements of hip internal and external rotation. Physical performance was evaluated using sit-and-reach flexibility test, hand-grip strength, back-leg-chest dynamometry, double- and single-leg horizontal jump tests, and 6-minute walk test. The HFA group exhibited significantly increased internal rotation and decreased external rotation ranges of motion, along with higher femoral anteversion angles as determined by the Craig test ($p < 0.001$). No statistically significant differences were found between groups for most physical performance measures ($p > 0.05$), although back-leg-chest strength tended to be lower in the HFA group ($p = 0.05$, moderate effect size). These findings suggest that despite marked anatomical differences, physical performance in young adult women with HFA is largely comparable with controls. Future research should investigate symptomatic individuals and the potential functional impact of higher anteversion angles.

Key Words: femoral torsion, hand-grip strength, isometric trunk strength, functional performance

Introduction

Femoral anteversion refers to the anterior inclination of the femoral head and neck relative to the femoral shaft. This angle typically measures 30°–40° at birth and gradually decreases to 10°–15° in adulthood (51). When the angle exceeds these normal values, it is defined as high femoral anteversion (HFA), a condition that can lead to biomechanical alterations and maladaptations during daily activities such as walking and running (1,10,35).

Sex-related differences have been noted in femoral anteversion, with female subjects generally exhibiting greater anteversion angles and increased hip internal rotation during gait than male subjects (36,43). In addition, it was observed that female subjects might exhibit greater femoral anteversion during static alignment because they landed with smaller thigh abduction angles and approximately 10% less isolated thigh abduction motion than male subjects (13,43). Because the hip and pelvis function as a critical force transmission link between the trunk and lower extremities, abnormalities in these regions can affect the biomechanics of the entire kinetic chain (9).

As HFA alters normal lower-extremity loading patterns, it may heighten the risk of tripping, falling, and fatigue-related musculoskeletal injuries, potentially shortening young athletes' sporting careers (35). It may also contribute to compensatory external tibial torsion, increasing the Q angle and leading to instability of the knee and patellofemoral joint, and a heightened risk for anterior cruciate ligament (ACL) injury (28,37).

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Physical performance, which encompasses the ability to perform daily or athletic tasks, is influenced by multiple factors such as age, sex, body composition, muscular strength, endurance, flexibility, coordination, agility, and movement quality (7,20,58,59). Among these, lower limb alignment plays a crucial role in optimizing movement efficiency and preventing injury. Malalignments such as HFA can disrupt normal biomechanics and have been linked to musculoskeletal issues including anterior knee pain, patellofemoral instability, and overuse injuries, all of which may compromise functional performance (19,26,30,45,46). Furthermore, femoral torsional and coronal deformities are associated with hip pain, labral pathology, and the development of hip osteoarthritis (19,21,46). Excessive femoral anteversion has also been implicated in femoroacetabular impingement syndrome, increasing the likelihood of labral tears and disrupting intra-articular force distribution, thereby affecting joint function and physical capacity (4,18,21,45). These associations underscore the importance of understanding how structural deviations such as HFA may influence physical performance.

Emerging evidence suggests that HFA may contribute to non-contact ACL injuries by promoting increased hip internal rotation, tibial external rotation, and knee valgus—biomechanical patterns that are particularly detrimental during high-demand tasks involving jumping, deceleration, or directional changes (2,42). These altered movement strategies are especially relevant for injury prevention and performance optimization in athletic and physically active populations.

Despite the clinical relevance of HFA, most existing studies have focused on children and adolescents, primarily examining gait characteristics and functional outcomes (1,35,38). However, there is a lack of research investigating how HFA affects physical

performance components in young adults. Based on the literature and the known biomechanical implications of HFA, it was hypothesized that young adult women with bilateral HFA would demonstrate altered physical performance compared with healthy controls. Therefore, this study aimed to investigate whether bilateral HFA was associated with measurable differences in physical performance, specifically in flexibility, strength, and functional performance, in this population.

Methods

Experimental Approach to the Problem

This cross-sectional, observational study was designed to evaluate the physical performance of young adult women with bilateral HFA and a control group with normal bilateral anteversion. The study aimed to explore differences in flexibility, hand-grip strength, overall trunk muscle strength by back-leg-chest dynamometry, and functional performance, which was evaluated using jump tests and the 6-minute walk test (6MWT), between the two groups. The independent variable was group classification based on femoral anteversion status (HFA group vs. control group with normal anteversion). The dependent variables included flexibility, hand-grip strength, trunk muscle strength, and functional performance measures (jump tests and 6MWT).

Subjects

The study was approved by the Bezmialem Vakif University Non-Interventional Clinical Research Ethics Committee (number: 26.04.2023-105444) and adhered to the ethical guidelines outlined in the Declaration of Helsinki. All subjects provided informed consent before participation.

The study included 22 young adult women with bilateral HFA, aged 19–26 years, and a control group of 22 young adult women with bilateral normal anteversion. The inclusion criteria for the HFA group required the presence of bilateral HFA, defined as hip internal rotation >60°, external rotation <45°, and an anteversion angle between 20° and 40° as determined by the Craig test. Subjects in both groups had a body mass index (BMI) within normal limits (18.5–24.9 $kg \cdot m^2$), and no history of neurologic or psychiatric disorders, intellectual disabilities, or participation in any exercise or physiotherapy program within the past 6 months. The exclusion criteria included recent Botulinum Neurotoxin Type A injection, surgery, leg length discrepancies, third degree of pes planus, or a Beighton score of ≥4. The control group shared the same inclusion and exclusion criteria, except for having a bilateral normal anteversion angle as an inclusion criterion.

Sample Size

G-Power 3.1 (Universitat Kiel, Germany) was used for determining the sample size (23). In the calculation of the sample size, according to the analysis performed based on the data measured with the back-leg-chest dynamometer in the study of Caglar et al. (11), while $\alpha = 0.05$ and the power of the test was 85%, the sample size was calculated as 22 for each group ($d = 0.82$, $\alpha = 0.05$).

Study Procedures

Hip Rotation Measurements. Passive hip internal and external rotations were assessed in the prone position with the knee flexed to 90° using a standard universal goniometer (Figure 1).

Craig Test Measurement. Craig test is one of the most commonly used clinical methods for assessing femoral anteversion. Its results have been shown to strongly correlate with established radiographic measurement techniques, demonstrating a high validity with a correlation coefficient of $r = 0.93$ (49). The test was performed to assess femoral anteversion in all subjects. The test was conducted by a single physiotherapist with >15 years of clinical experience in evaluating lower extremity alignment and gait abnormalities, particularly in children and adolescents, ensuring consistent and reliable measurements.

During the test, subjects were positioned prone on the examination table with their knees flexed to 90°. The assessor palpated the greater trochanter of the femur and internally and externally rotated the hip until the greater trochanter reached its most prominent lateral position. At this point, the angle of femoral anteversion was measured using a universal goniometer aligned with the tibia. The measured angle represents the degree of femoral anteversion (Figure 2).

All testing procedures were performed at Bezmialem Vakif University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation. Demographic and clinical

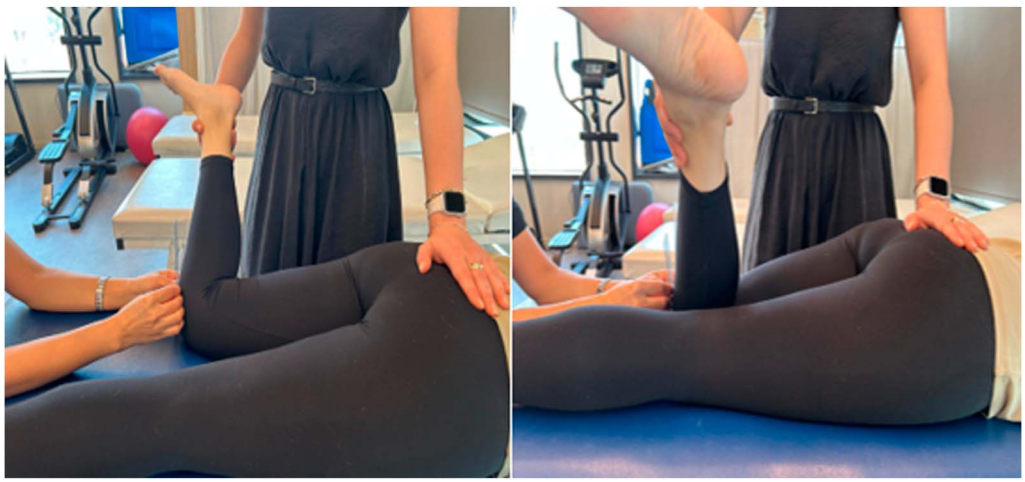

Figure 1. Measurement of hip internal and external rotation range of motion.

Figure 2. Craig test for femoral anteversion measurement.

information were recorded for all subjects before testing. The subjects did not perform any warm-up or stretching exercises before the tests. The following tests for both groups were performed on the same day, with a 15-minute interval between tests.

Physical Performance Tests. Sit and Reach Test. The test was administered to assess flexibility. The subjects placed their feet against a box measuring 23 centimeters in height at foot level. They were then asked to reach forward with both hands as far as possible while keeping their knees extended and in contact with the floor. The test was repeated three times, and the highest value was recorded in centimeters, following the protocol of the President's Challenge Physical Fitness Program (24). The sit-and-reach test has demonstrated moderate validity for hamstring extensibility, with Pearson correlation coefficients ranging from 0.46 to 0.67, whereas its validity for lumbar flexibility is relatively low (correlation coefficients between 0.16 and 0.35) (40).

Hand-Grip Strength Test. The test was performed with a hydraulic hand dynamometer (Jamar, Patterson Medical, Warrenville, IL) in the position recommended by the American Association of Hand Therapists. The subject was placed in a chair with a back support and no armrests, 90° elbow flexion, a neutral forearm position, and asked to squeeze with maximum force. Three bilateral measurements were performed, and the results are expressed in kilogram-force (44). The Jamar dynamometer was found to be highly reliable (ICC [3, 1] = 0.98) and valid (ICC (2, K) = 0.99) for measuring hand-grip strength (8).

Back-Leg-Chest Muscle Strength Test. An analog-dial back leg-chest dynamometer (Baseline, New York, NY) was used to assess isometric trunk muscle strength (56). The base of the dynamometer ensures a safe stance, while the chain length is adjusted to accommodate height differences or change the point of force. The subjects were instructed to pull the dynamometer handle vertically upward with maximal effort while maintaining a slightly forward-tilted body after placing their feet on the dynamometer with their knees and elbows extended. The best score was recorded after three repetitions of traction. The back-leg-chest dynamometer demonstrated high test–retest reproducibility, with ICCs >0.92, indicating excellent reliability in healthy adults and adolescents (56).

Horizontal Jump Tests. Functional performance was assessed using both double-leg and single-leg horizontal jump tests. The double-leg jump test was conducted based on the Eurofit test battery (16), while the single-leg jump test was included as a validated method to assess unilateral lower limb power and functional performance (5). Because all subjects had bilateral HFA, both tests were used to obtain a comprehensive profile of their lower extremity function.

Double-Leg Horizontal Jump Test. The subjects were instructed to stand with their legs slightly apart, knees bent, forearms extended forward, and toes parallel to the ground behind the starting line on a stable, nonslip floor. They were asked to jump as far as they could while releasing their arms and to simultaneously land on both legs on the ground. The best distance was recorded in centimeters after the test was repeated twice (16). The double-leg horizontal jump test is a valid and reliable measure of lower-body explosive muscular strength in adults. It demonstrates high test–retest reliability (ICC = 0.94) and explains 78% of the variance in key strength variables such as maximal horizontal power and lean mass (39).

Single-Leg Horizontal Jump Test. The test was performed on the dominant extremity. Kicking the ball, stepping onto a 20-cm platform, and stepping off a 20-cm platform were used to determine the lower extremity dominance. The subject was positioned behind the starting line and asked to jump forward while standing on the dominant leg with the other leg bent at the knee, and the point from toe to heel was measured. The best distance was recorded in centimeters after the test was repeated twice (5). The single-leg horizontal jump test is a reliable and valid method to assess unilateral lower limb power and functional performance, with reported test–retest ICC values >0.90 in healthy adults (5).

Six-Minute Walk Test. The functional capacity was measured using the 6MWT in accordance with the American Thoracic Society criteria (3). Subjects were asked to walk as far as possible but without running in a 30-meter straight corridor for 6 minutes, and the distance they covered was recorded in meters (6MWD = 6-minute walk distance). The blood pressure was monitored with a cuffed analog sphygmomanometer, and SpO_2 and heart rate were monitored with a pulse oximeter before and after the test. Six-minute walk test demonstrated excellent test–retest reliability (ICC = 0.99) and good criterion-related validity, with significant correlations to measured $\dot{V}O_2$max (maximum oxygen uptake) and low systematic error, confirming its accuracy for assessing cardiorespiratory fitness in adults (12).

Statistical Analysis

The statistical tests were performed using SPSS statistical software (IBM SPSS Statistics 20; Chicago, IL). Data are expressed as the mean ± *SD*. Analyzing the data for normal distribution was evaluated with histograms, probability plots, and the Kolmogorov–Smirnov/Shapiro–Wilk test. A comparison of differences between groups was performed using the Independent Samples T test or Mann–Whitney *U*-test, depending on the distribution properties of the data. The 1-sample *t* test was used to compare the HFA group with the normative values in the literature. The alpha level for determining statistical significance was set at 0.05.

Results

The demographic and anthropometric characteristics of the HFA and control groups are summarized in Table 1. There were no statistically significant differences between the groups in terms of age, height, weight, BMI, or leg length ($p > 0.05$).

Significant differences were observed between the HFA and control groups in all hip rotation measurements and Craig test angles (Table 2). Internal rotation angles were significantly higher in the HFA group than in controls on both right ($p < 0.001$) and left sides ($p < 0.001$). Conversely, external rotation angles were significantly lower in the HFA group on both right ($p < 0.001$) and left sides ($p < 0.001$). Similarly, the Craig test angles were significantly greater in the HFA group on both sides ($p < 0.001$). Effect sizes (Cohen's *d*) indicated large differences between groups for all variables.

The comparison of physical performance test scores between the HFA and control groups is presented in Table 3. There were no statistically significant differences between groups in the sit and reach test, hand-grip strength (right and left), double-leg horizontal jump test, single-leg horizontal jump test, or 6MWD ($p > 0.05$). However, the back-leg-chest dynamometer values tended to be lower in the HFA group than in controls, approaching statistical significance ($p = 0.05$). Effect sizes (Cohen's *d*) indicated small-to-moderate differences across the tests.

Discussion

This study aimed to investigate the effects of HFA, a common lower extremity malalignment, on physical performance in asymptomatic young adult women. Given the higher prevalence of HFA among women (36,43), both the HFA and control groups were composed exclusively of female subjects to reduce potential sex-based confounders. Contrary to our hypotheses, the results did not reveal statistically significant differences between the groups across the selected physical performance parameters.

Physical performance is a multidimensional construct encompassing musculoskeletal, cardiorespiratory, and nervous system functions, and can be objectively assessed through tests targeting strength, flexibility, speed, or endurance (7,33). Functional performance, as a subdomain, reflects the ability to perform specific tasks that require integrated strength, power, endurance, and coordination. Functional performance is frequently assessed using various jump tests—both single leg and double leg—to evaluate lower limb power, symmetry, and readiness for return to sport, particularly in athletic populations (50). The 6MWT is another widely used measure of functional performance, providing insight into aerobic capacity and submaximal endurance (17). In this study, functional performance was assessed as a component of physical performance, using double-leg and single-leg horizontal jump tests to evaluate power and symmetry, and the 6MWT to assess functional capacity and endurance. These tests were selected as valid and practical indicators of functional performance within the overall assessment of physical performance.

When the literature is examined, as far as we know, there is one study showing the effect of HFA on physical performance conducted by Staheli et al. (54) in 1977. Staheli et al. investigated the relationship between HFA and physical performance in nine adults with HFA and 10 healthy peers who were subjected to physical performance testing. They also evaluated the running speed of 249 high school students, whose degree of hip rotation was only measured. Those with the greatest internal rotation were isolated and compared with the total group. The findings of the study reported that the results failed to demonstrate a correlation between physical performance and femoral anteversion. Although the outcome measures used for physical performance were different, our findings were parallel to this study.

Although no significant group differences emerged in performance outcomes, prior research has emphasized the biomechanical relevance of HFA. Parker et al. (46) linked excessive femoral anteversion (>24°) with the severity of hip osteoarthritis, while Hogg et al. (26) demonstrated altered knee biomechanics and potential ACL injury risk in individuals with HFA or passive internal rotation. These findings highlight the clinical and structural implications of HFA, yet studies directly examining its impact on physical performance parameters remain scarce, especially in asymptomatic individuals. Our findings underscore the complexity of this relationship and suggest that the absence of pain or pathology may mask subtle functional consequences of HFA.

Isometric strength, evaluated using the back-leg-chest dynamometer, also did not differ significantly between groups. Because this test isolates trunk muscle strength, it may not fully capture whole-body force production capacity. Using the back-leg-chest isometric dynamometer, Koley et al. (32) reported that back strength showed a significant positive correlation with leg strength among Indian interuniversity cricketers. In this study, no significant differences were found between the women with HFA and the control group for overall trunk muscle strength. Because we performed the test for only trunk muscles, limited information about muscle function was provided for the strength all over the body.

In addition, it has been suggested that grip strength may be a possible indicator of overall body strength (25,57). According to a study (31), out of 100 healthy young adult women, the back-leg-chest strength was 63.08 ± 13.28 and the hand-grip strength

Table 1

Comparison of demographic and anthropometric characteristics between the HFA and control groups.*

Variables	HFA group $n = 22$	Control group $n = 22$	p
Age (y)	21.36 ± 1.89	22.23 ± 2.05	0.153†
Height (cm)	166.77 ± 6.74	168.95 ± 9.70	0.641
Body mass (kg)	62.68 ± 12.61	67.18 ± 11.59	0.225†
BMI ($kg \cdot m^{-2}$)	22.45 ± 3.44	23.85 ± 3.84	0.217†
Leg length (cm)			
Right	86.00 ± 4.89	87.55 ± 5.32	0.321
Left	87.41 ± 5.39	85.95 ± 4.80	0.350

*HFA = high femoral anteversion; BMI = body mass index. Data are reported as mean ± *SD*.
†Mann–Whitney *U*-test. Significance level set at $p < 0.05$.

Table 2

Comparison of hip rotation and Craig test between individuals with HFA and healthy controls.*

Variables	HFA group $n = 22$	Control group $n = 22$	p	Cohen's d	95% CI
Internal rotation (°)					
Right	67.18 ± 7.85	48.32 ± 4.86	**<0.001**	2.89	[2.04, 3.73]
Left	65.86 ± 7.43	48.00 ± 4.46	**<0.001**	2.91	[2.07, 3.76]
External rotation (°)					
Right	31.14 ± 5.10	46.659 ± 4.97	**<0.001**	−3.08	[−3.96, −2.21]
Left	30.73 ± 5.09	45.36 ± 5.69	**<0.001**	−2.71	[−3.53, −1.89]
Craig test (°)					
Right	25.59 ± 3.78	12.82 ± 2.95	**<0.001**	3.77	[2.78, 4.75]
Left	23.27 ± 4.00	13.73 ± 3.51	**<0.001**	2.54	[1.74, 3.33]

*HFA = high femoral anteversion; BMI = body mass index. Data are reported as mean ± *SD*. Significance level set at $p < 0.05$.

was 24.04 ± 3.72. In our study, the hand-grip and back-leg-chest strength scores did not show a statistically significant difference between the HFA group and their healthy peers. Based on this literature, we compared the hand-grip and back-leg-chest dynamometer scores of the HFA group with normative values using one-sample *t*-tests, and observed that nondominant hand-grip strength ($p = 0.609$) was statistically similar, whereas dominant hand-grip strength ($p = 0.034$) and back-leg-chest strength ($p < 0.001$) were significantly lower than these normative values. These findings collectively point to a tendency toward reduced overall strength in women with HFA, particularly in isometric trunk performance and hand-grip force, which may reflect subtle deficits in general muscle function.

Although statistical significance was not achieved in any of the physical performance outcomes, effect size analysis revealed small-to-moderate differences, favoring the control group. For example, the back-leg-chest dynamometer scores had a borderline *p*-value ($p = 0.05$) with a moderate effect size (Cohen's $d = -0.60$), indicating a possible trend toward lower isometric strength in the HFA group. Similarly, both double-leg ($d = -0.50$) and single-leg ($d = -0.29$) horizontal jump tests also showed lower mean values in the HFA group, albeit without statistical significance. These findings suggest that while the differences did not reach significance, they may still have practical or clinical relevance, particularly in populations exposed to higher physical demands.

Despite no statistically significant differences in jump performance, prior biomechanical studies propose that HFA may influence high-force movements such as jumping and sprinting because of altered joint kinematics during dynamic activities (13). Increased internal hip rotation, for example, has been associated with valgus alignment and abnormal landing mechanics, which may influence task performance even without manifest pathology (22,35,49,55). In our cohort, performance on single- and double-leg horizontal jump tests did not significantly differ between groups, possibly reflecting compensatory mechanisms or the subclinical nature of the deviation.

Regarding functional performance, the 6MWT did not reveal a difference between groups. Literature suggests that 6MWT performance is more sensitive to strength and power at the distal lower limb—particularly the ankle and knee—rather than proximal regions such as the hip (6,29,41). Based on the literature, the fact that hip strength and power have a lesser effect on 6MWT than on the distal may be the reason for the insignificant difference between the groups. Also, because our sample consisted of asymptomatic, healthy young adults, the 6MWT might have been insufficiently sensitive to detect minor deficits.

In addition, the coefficient of variation was higher in the HFA group for strength-related outcomes, particularly in the back-leg-chest test, suggesting greater interindividual variability. This increased variation may be related to unmeasured biomechanical differences, such as variations in Q angle or mild foot posture deviations such as pes planovalgus, which were not systematically assessed. These factors may have influenced performance in some individuals, potentially obscuring group-level differences in mean values despite moderate effect sizes.

A criterion for detecting HFA is that the internal rotation of the hip is >60° and the external rotation is <25° (48,52,53). However, it has been stated that the reliability of the Craig test is higher than the internal rotation angle measurement (49). A Craig test result between 15° and 20° is considered normal for femoral anteversion (14). The Craig test and hip internal/external rotation degrees showed a statistically significant difference between the groups. Although there was no significant difference between the groups on the physical performance tests scores we used in our study, it will be interesting to observe how these tests performed in the future in both male and female individuals with higher degrees of femoral anteversion. Owing to the fact that the research lacks

Table 3

Comparison of physical performance test scores between HFA and control groups.*

Variables	HFA group $n = 22$	Control group $n = 22$	p	Cohen's d	95% CI
Sit and reach test (cm)	29.46 ± 7.59	26.26 ± 8.59	0.19	0.39	[−0.20, 0.99]
Hand-grip strength (kgf)					
Right	26.30 ± 7.95	27.14 ± 8.66	0.74	−0.10	[−0.69, 0.49]
Left	23.25 ± 8.02	23.47 ± 8.53	0.93	−0.03	[−0.62, 0.56]
Back-leg-chest dynamometer (kgf)	40.73 ± 16.54	50.50 ± 15.52	0.05	−0.60	[−1.21, −0.01]
Double-leg horizontal jump test (cm)	142.73 ± 17.94	155.05 ± 29.49	0.10	−0.50	[−1.11, 0.09]
Single-leg horizontal jump test (cm)	120.95 ± 13.35	128.00 ± 30.80	0.33	−0.29	[−0.89, 0.29]
6MWD (m)	563.55 ± 64.47	541.77 ± 60.81	0.25	0.34	[−0.25, 0.94]

*HFA = high femoral anteversion; 6MWD = 6 minute walk distance. Data are presented as mean ± *SD*. Significance level set at $p < 0.05$.

consensus on what constitutes pathologically HFA, with values ranging from >30° to 50° (15,27), future studies may examine the role of the higher degree of femoral anteversion in physical performance.

Future studies should consider incorporating more physically demanding assessments, such as running or agility-based tests, to better capture potential performance differences in this population. In addition, functional tasks such as single-leg or bilateral squats—which challenge both neuromuscular control and dynamic alignment—may provide further insight into performance limitations associated with HFA and should be considered in future studies. Also, we did not assess frontal plane parameters such as *Q* angle or dynamic valgus, which may be altered in individuals with HFA. Given that excessive femoral anteversion can be associated with genu valgum and pes planovalgus, future studies should investigate the impact of these coexisting deformities on physical performance.

This study has a number of limitations. First, considering that our study included only asymptomatic, healthy young adult women with HFA, it cannot be generalized for other populations with HFA. Second, the study was not conducted as an assessor-masked cross-sectional study. Although this study solely examined the impact of HFA on young adult women's physical performance, future research should further examine this topic using more advanced instruments and people with higher degrees of anteversion for both sexes. Third, although the Craig test measurements were performed by an experienced physiotherapist, intratester reliability was not formally assessed in this study. Future studies should consider including formal reliability testing or multiple assessors to strengthen the validity of the findings.

Practical Applications

This study suggests that HFA alone may not significantly impair general physical performance in asymptomatic young adults, as measured by standard strength and functional tests. However, this does not rule out the potential impact of HFA under different conditions or in the presence of coexisting alignment deviations, such as increased *Q* angle, pes planovalgus, or external tibial torsion. It is possible that such biomechanical alterations, when combined with higher degrees of femoral anteversion or tested under more demanding functional tasks, could reveal performance differences not captured in this study. Future research clarifying the relationship between HFA severity and functional outcomes could better inform tailored training and rehabilitation approaches, ultimately supporting enhanced physical performance and injury prevention strategies.

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