Impact of hip abductor and adductor strength on dynamic balance and ankle biomechanics in young elite female basketball players.

Domínguez-Navarro Fernando
University of Valencia
Josep Carles Benitez-Martínez (josep.benitez@uv.es)
University of Valencia
Borja Luna-Ricart
Valencia Basket Club
Pedro Cotolí-Suárez
Valencia Basket Club
Jose María Blasco-Igual
University of Valencia
Jose Casaña-Granell
University of Valencia

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Abstract

Muscles weakness can affect to injury risk, in lower limb hip abductor (ABD) and adductor (AD) muscles have not been elucidated how affect in female basketball players, such as balance and ankle mobility. This study aimed to investigate hip ABD and AD strength and their relation in balance and ankle dorsiflexion mobility in young elite female basketball players. Observational study in a total of 60 trainee-level elite female basketball players (13–17 years old) were included. Hip ABD and AD isometric strength values were collected. The correlation study showed that hip ABD strength had a low-moderate correlation with balance and ankle mobility in the homolateral and contralateral leg, while there was a low-moderate correlation between hip AD strength and balance and ankle mobility only in the homolateral leg. On the other hand, the ABD-AD ratio was not found to correlate with balance or mobility scores, nor the degree of muscle imbalance between legs. Hip ABD and AD strength affects balance and ankle mobility in trainee level female basketball players. These findings should thus be taken into consideration when designing strategies aimed at reducing the risk of limb injury, which has a high prevalence in women's basketball.

1. Introduction

Over the last decades the number of female basketball players has grown enormously, both in senior and trainee categories[1], becoming one of the most practiced disciplines in Europe and the United States[2]. This situation has generated greater scientific and sporting interest when reporting and analyzing the most frequent sports injuries in this discipline and developing effective prevention strategies[3].

In this regard, the most frequent injuries reported affect the lower limb (LL) due to loss of balance in jumping and landing[4]. Specifically, ankle sprains and tears of the anterior cruciate ligament (ACL) are the two most prevalent injuries in this discipline,[2] while the risk of suffering an ACL injury has been reported between 2 and 8 times higher in female than in male basketball players[5]. Both injuries have a negative impact on the physical function and performance of players[6,7], as well as significant economic consequences[8].

The functional condition of the hip muscles is considered a relevant factor in the risk of injury[9], and therefore, an important aspect to assess in female basketball players[10]. In addition, the study of the hip abductor (ABD) and adductor (AD) muscles is especially interesting, due to the marked relevance of these muscle groups in typical basketball movements, such as lateral displacements, changes of direction or single-leg balance situations[11]. With regard to hip ABD muscles, some studies suggest the influence of muscle strength[12] or fatigue[13] on factors related to the risk of LL injuries. Balance[14] or dorsiflexion mobility[15] may also play a role. On the other hand, the potential role of AD muscle strength is less studied in the basketball population, the evidence being limited to studies that assess its involvement in sports performance and physical function in other sports disciplines[16].

Moreover, recent scientific studies propose to evaluate in athletes hip ABD and AD strength not only alone, but also relatively[17]. Relative evaluation measures the strength of a muscle group in relation to the strength of antagonist muscles, namely, the ratio of hip AD:ABD strength; as well as in relation to the homologous muscles of the contralateral limb to assess possible asymmetries between legs[18].

Despite its relevance in sports, there are still few studies that have assessed in this specific population the influence of hip ABD and AD strength on factors related to the risk of LL injury, such as balance and ankle dorsiflexion mobility. To our knowledge, there is no study in this population that has combined the isolated and relative evaluation of hip ABD and AD strength. We consider that such a study is necessary to establish the extent to which the strength of these two muscle groups affects aspects related to the risk of LL injury. Accordingly, our study aims to evaluate, in an isolated and relative manner, hip ABD and AD strength and to study to what extent these factors are related to balance and ankle dorsiflexion mobility in young elite female basketball players. Our hypothesis is that, at least, hip ABD strength is correlated with balance and ankle mobility.

2. Methods

Study design and subjects

This study took place at the premises of the Alquería del Basket, (Valencia, Spain) belonging to the Valencia Basket Club, during the months of June and July 2020, coinciding with the Valencia Basket Female Summer Camp. A total of 60 trainee-level elite female basketball players (13-17 years old) agreed to take part in the study. All the players belonged to First Division Spanish teams of women's basketball (Dia league).

Players were excluded from the study in the following cases: (I) acute injury/condition that limited physical function; (II) lower limb injury within the past 6 months.

Both participants and parents/legal guardians gave their written consent to participate in the study, in accordance with the ethical guidelines of the Declaration of Helsinki and subsequent updates. The requirement of informed consent for images publication was obtained from the woman player and the researcher who appear in the figures. This study obtained the ethical approval of the Ethics Committee of the University of Valencia (UV-INV_ETICA-1603599). The research was developed and reported according to the recommendations of STrengthening the Reporting of OBservational studies in Epidemiology (STROBE)[19].

Outcomes

First, the demographic and anthropometric data of the participants were collected. A standard 8-minute warm-up was then performed (running, joint mobility exercises and neuromuscular activation exercises) prior to the recording of results derived from the following assessments: isometric strength of hip ABD and AD, the Y balance test and the dorsiflexion Lunge test.

All tests were verbally explained and a first attempt for familiarization with the test was allowed without the results being recorded. Two members of the research team collected the data and then uploaded such data to a digital platform.

Hip strength outcomes

The isometric strength of the hip ABD and AD muscles was collected using the ForceFrame Strength Testing System® device (Vald Performance Albion, Australia). For implementation, participants were asked to lie in a supine position with hips and knees bent 90º. The height of the bar was adjusted to each player to ensure that they maintained the angle.

Participants were first asked to perform isometric contraction of the hip AD for 5 seconds and then, after a 5-second rest, a 5-second isometric contraction of the ABD (Figure 1, 2). After a 45-second rest, the same procedure was repeated to be recorded or take the second attempt.

This evaluation protocol is based on previous studies and has demonstrated high reliability for strength measurement with an interclass coefficient of 0.94[20].

From the results obtained, two more parameters were calculated: the ratio of hip AD:ABD strength, calculated for each leg using the following formula: hip AD strength/hip ABD strength of the homolateral leg; and strength imbalance between limbs, both in the case of AD and ABD, the formula being: [(right leg muscle strength - left leg muscle strength)/right leg muscle strength] x 100.

Y Balance Test

It is a functional test used to evaluate the dynamic balance, postural control and functional performance of the lower limbs from the sliding movement of one leg.

The Y Balance test is the simplified version of the Star Excursion Balance Test, whose modification involves analyzing the performance in only 3 of the 8 original directions: one, anterior; and the other two, aligned at 135º in the posterolateral and posteromedial directions respectively.

For the performance of the test, three lines of tape were placed on the floor. Participants were asked to move from an initial two-leg position to a single-leg position while maximally reaching the multidirectional lines set with the opposite leg and lightly touching the tape with the distal end of the reaching foot, without compromising balance. The participants were barefoot to perform the test. The distance reached by the moving leg in the three dimensions was collected, and the balance score was calculated based on the sum of the three. The difference between the scores obtained for each leg was also calculated and expressed as a percentage.The adaptation of the Y Balance test from the original Balance Star Excursion test appears as a simpler tool for evaluating functional performance and balance, while replicating the validity and reliability of the test[21]. In addition, the Y Balance test has been previously used in scientific articles on basketball players[22].

Weight bearing ankle dorsiflexion test

The Lunge test was used to evaluate the dorsiflexion of the ankle joint in a weight bearing position, according to Hoch and McKeon[23], collecting the distance covered in centimeters.

A line of tape with metric marks (from 0 to 30 cm) was placed on the floor, perpendicular to the wall. Participants were asked to remain in a stride position in front of the wall, with both hands resting on the wall. The evaluated foot was placed forward, parallel to the tape and with the toe and heel touching the floor. The non-evaluated foot was placed comfortably behind the other foot with the knee extended. The participant took a stride with the forward knee flexed as much as possible anteriorly, with the foot evaluated and the heel touching the floor. A metal rod was used to determine the perpendicular projection of the knee to the floor and the distance reached was recorded. This method has reported excellent interrater (ICC = 0.82) and intrarater (ICC = 0.88) reliability[24].

Two members of the research team collected the data and then uploaded such data to a digital platform.

Data management

Descriptive data included the mean and standard deviation of the variables used. The normality of the data was verified by the Kolmogorov-Smirnov test. The participants were divided into three groups according to competition category: age ≤ 14 years (subgroup U14), age between 14 and 16 (subgroup U16), age between 16 and 18 years (subgroup U18). The difference in means between the three groups for all variables evaluated using ANOVA was compared.

For the correlation analysis, the variables derived from the hip strength assessment were considered independent parameters, and the other variables were dependent parameters. Variables were normalized where appropriate. Pearson's R was used to explore the correlation of each of the dependent and independent parameters. Confidence intervals were set at 95%. The correlation effect size was interpreted as follows: <0.1, trivial; 0.1-0.3, low; 0.3-0.5, moderate; 0.5-0.7, large; 0.-0.9, very large; > 0.9, almost perfect. SPSS 24.0 software was used to perform statistical analysis[25].

3. Results

Table 1 shows the scores derived from the various variables evaluated, including demographic outcomes, dependent and independent parameters, classified according to the participant’s competition category: U14, U16 and U18.

Tables 2, 3, 4, and 5 show the results derived from the correlation analysis for the whole sample, group U14, U16 and U18 respectively. Here it is noted how the degree of correlation varies according to the age group studied, but overall, hip AD strength was found to correlate with ankle dorsiflexion and the performance in the Y balance test in the homolateral leg, and the hip ABD strength were correlated in both the homo and contralateral leg. The correlations found were classified as low and moderate. On the other hand, the hip AD:ABD strength ratio and hip strength imbalances between limbs revealed no significant correlation.

4. Discussion

Accordingly, our study aims to evaluate, in an isolated and relative manner, hip ABD and AD strength and to study to what extent these factors are related to balance and dorsiflexion mobility in young elite female basketball players.

This research aimed to measure the isolated and relative strength of hip ABD and AD, through a novel assessment approach in female basketball players, as well as to establish the degree to which the strength of these muscle groups correlated with factors related to the risk of LL injury, such as balance and ankle dorsiflexion mobility. The results derived from this study show that both hip AD and ABD strength affect the scores obtained in these tests. In particular, it seems that hip AD strength exhibits an improved correlation with the performance of these tests on the homolateral leg, and especially, in the U16 and U18 competition categories. On the other hand, hip ABD strength seems to have a more global influence on these aspects, since there was correlation with both the values obtained for the homolateral leg and those for the contralateral leg.

These data reveal the influence of the functional condition of hip AD and ABD muscles on the biomechanics and dynamic balance of female basketball players, and therefore, its possible relevance in the risk of LL injuries. These findings thus constitute a basis to suggest that, in this population, training focused on improving the strength of the hip AD and ABD muscles, may lead to improvements in LL biomechanics and dynamic balance, and, therefore, has an impact on the risk of LL injury.

Precarious balance has been described as a risk factor for knee and ankle injuries in basketball[26]. Pliski et al.[27] further reported that the Y balance test was a useful tool when predicting the incidence of LL injuries in this sport. Our findings show that performance in this test correlates positively with hip ABD and AD strength. Other studies are consistent with our findings in describing a low-moderate sized correlation between hip ABD strength and performance in this test, both in physically active healthy population[28] and in subjects with LL injuries[29]. In addition, this correlation has also been replicated in a specific population of basketball players[27]. It should also be noted that our study found a relationship between the performance of the Y balance and ABD strength, both when assessing the weight-bearing leg and the limb in motion. We believe that this is due to the action of hip ABDs, especially the gluteus medius and the gluteus minimus when stabilizing the hip and pelvis, which allows the moving leg to optimize its movement while the pelvis remains stable[30].

On the other hand, the results obtained in terms of the impact of hip AD strength on balance and ankle mobility represent a new contribution of evidence to a still underdeveloped issue in the world of women's basketball. However, there is a larger amount of evidence in this regard in sports such as football or hockey, with studies reporting results consistent with ours, suggesting that the strength of these muscles influence physical performance and sports performance, and that strengthening hip ADs is an effective strategy for LL injury prevention[16,31,32]. It would thus be desirable to conduct further studies in women's basketball with this objective in order to establish whether also, in this discipline, AD strengthening should be included in injury prevention programs.

Decreased ankle mobility has also been reported as a risk factor in ankle and knee injuries in basketball[15]. Other studies have pointed to the relationship between hip ABD condition and different biomechanical aspects of the ankle and gait[33]. Likewise, this study shows that the hip muscles have an influence on another biomechanical aspect such as the dorsal flexion of the ankle. Again, the strength of both muscle groups correlate with this aspect, which suggests that good ankle mobility requires high levels of muscle strength in both hip AD and ABD muscles. There are several studies that point to the convenience of hip ABD training for the prevention and treatment of chronic ankle sprains with restricted dorsal mobility, as does this study, further proposing the improvement of hip AD strength[34].

In terms of the analysis of hip ABD and AD strength evaluated in a relative manner, according to this study, it is not clear whether the hip AD:ABD strength ratio or AD and ABD muscle imbalance between legs can be related to factors that predict the risk of LL injury, since the results obtained varied according to the age group, making a clear analysis impossible. On the one hand, it is logical that these values are different depending on the age of the participants, as reported by other authors[35]. Moreover, in order to compare these results with those of the existing literature, we must again refer to studies carried out on young footballers. Here both the difference between legs and the strength ratio have been described that as injury risk predictors, and therefore, important aspects to be accounted for when designing the physical training program[18,20]. Likewise, other authors have proposed that hip ABD and AD muscles play different roles (although important in both cases) in football and basketball.

Accordingly, this research contributes to support the existing evidence that hip ABD strength is, in female basketball players, an important aspect to consider in the design of LL injury prevention strategies. It also opens up the possibility that hip AD muscle health, which has barely been studied in this population, may also affect injury prevention-related aspects, further studies being needed in this regard that asses AD and ABD strength both in isolation and in a relative way.

Clinical application

The findings derived from this study suggest that in women's basketball, where the incidence of LL injuries is high, ABD and AD muscle strength is an important aspect to take into account when designing protocols for the assessment, monitoring and training of physical abilities and risk of injury, since it affects aspects related to this risk, such as balance and ankle mobility.

Limitations

This study was carried out with a sample of 60 subjects, which may be considered sufficient, although it is true that a greater number of participants would have helped to make it more representative. On the other hand, only healthy subjects with no recent history of injury were included in this study, so data cannot be applied to those recovering from an injury. Another important consideration is that the sample is comprised of players between 13 and 18 years old, so some of these athletes are still experiencing muscle development, and therefore, there may be changes until they reach physical maturity. Although this has been taken into account and subgroups have been formed based on age, it may happen that players in the same subgroup are at different maturity points. Also, only one time point of the season has been studied, so it is unknown if values fluctuate throughout the season and how relevant this may be. The injury records of the participants have not been studied directly. It would be convenient in future studies with adult players to take this into account. Lastly, these findings may only be applied to young trainee basketball players, and therefore, they cannot be extrapolated to senior players, which would require future studies.

5. Conclusions

This study collected values for hip ABD and AD strength, both in isolation and relatively, of elite female basketball players, finding that the strength levels of these muscle groups have an impact on balance and ankle mobility, these being factors related to the risk of lower limb injury. Hence, these findings should be taken into consideration when proposing and designing hip ABD and AD strengthening programs, being aware of the implications in terms of injury prevention-related factors in young elite female basketball players.

Declarations

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Competing interests

The authors declare no competing interests.

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Tables

Table 1: Scores derived from the demographic outcomes, independent and dependent parameters evaluated, classified according to the competition category of the participants: age ≤ 14 years (subgroup U14), age between 14 and 16 (subgroup U16), age between 16 and 18 years (subgroup U18).

	U14 (n=17)	U16 (n=31)	U18 (n=12)	Total (n=60)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Demographic outcomes				
Age (years)	13.4 (0.9)	15.2 (0.6)	17.3 (0.7)	15.2 (2.0)
Height (cm)	163.2 (6.1)	167.5 (4.9)	171.1 (5.7)	167.8 (5.5)
Weight (kg)	53.1 (4.8)	58.3 (5.0)	61.0 (5.8)	58.0 (5.3)
Dominant leg (n (percentage))				
Right	15 (88.2%)	27 (87.1%)	10 (83.3%)	52 (86.6%)
Left	2 (11.8%)	4 (12.9%)	2 (16.7%)	8 (13.4%)
Independent parameters				
AD hip strength left leg (w)	226.0 (54.3)	233.2 (47.7)	236.8 (45.1)	232.9 (45.1)
AD hip strength right leg (w)	241.0 (59.3)	242.8 (46.4)	235.4 (45.2)	241.1 (49.3)
ABD hip strength left leg (w)	218.8 (55.7)	242.6 (36.0)	261.6 (40.1)	239.7 (45.0)
ABD hip strength right leg (w)	208.1 (58.8)	234.6 (42.2)	263.0 (40.7)	232.7 (50.2)
Inter-limb AD hip strength difference (%)	6.5 (5.2)	5.8 (4.4)	4.7 (2.6)	5.8 (4.3)
Inter-limb ABD hip strength difference (%)	7.3 (5.0)	6.1 (5.5)	6.2 (4.2)	6.5 (5.1)
AD:ABD ratio activation left leg (0 to 2)	1.0 (0.2)	1.0 (0.1)	1.0 (0.5)	1.0 (0.3)
AD:ABD ratio activation right leg (0 to 2)	1.2 (0.2)	1.1 (0.5)	0.9 (0.2)	1.1 (0.4)
Dependent parameters				
Ankle DF test right leg	12.1 (2.3)	12.2 (2.9)	12.4 (3.3)	12.1 (2.9)
Ankle DF test left leg	12.6 (2.2)	12.4 (2.9)	12.5 (3.2)	12.5 (2.8)
Compound Y Balance Test left leg (cm)	79.2 (5.1)	82.9 (6.8)	91.7 (4.6)	83.5 (7.3)
Compound Y Balance Test right leg (cm)	76.6 (4.4)	81.7 (7.0)	89.6 (2.7)	81.6 (7.2)
Inter-limb Difference in compound Y Balance Test (%)	4.6 3.9)	4.0 (2.4)	3.5 (2.2)	4.1 (2.9)

w: watts DF: Dorsiflexion; AD: Adductor; ABD: Abdcutor.

Table 2: Correlation study for the total sample of the study (n=60). Pearson correlation (p values).

	Ankle DF test left	Ankle DF test right	Compound Y Balance test left	Compound Y Balance test left Right	Inter-limb Difference in compound Y Balance test
Hip AD Left	**0.356 (0.005)***	0.237 (0.068)	**0.275 (0.049)***	0.099 (0.451)	0.181 (190)
Hip AD Right	0.221 (0.090)	**0.267 (0.039)***	0.174 (0.184)	0.145 (0.631)	0.183 (0.185)
Hip ABD Left	**0.334 (0.007)***	**0.331 (0.010)***	**0.343 (0.007)***	**0.295 (0.022)***	0.078 (0.577)
Hip ABD Right	0.184 (0.159)	0.198 (0.129)	**0.401 (0.001)***	**0.348 (0.006)***	0.029 (0.835)
Inter-limb Hip AD difference	-0.170 (0.194)	-0.088 (0.502)	-0.109 (0.408)	0.044 (0.736)	-0.165 (0.233)
Inter-limb Hip ABD difference	0.062 (0.639)	0.051 (0.697)	-0.158 (0.227)	-0.189 (0.148)	0.212 (0.123)
Ratio AD:ABD Left	0.141 (0.281)	0.098 (0.456)	-0.21 (0.872)	-0.183 (0.162)	0.237 (0.084)
Ratio AD:ABD Right	0.018 (0.889)	-0.100 (0.446)	-0.185 (0.156)	-0.209 (0.119)	0.183 (0.185)

DF: Dorsiflexion; AD: Adductor; ABD: Abdcutor. * indicates statistically significant correlation (p<0.05)

Table 3. Correlation study for the U14 category (n=17). Pearson correlation (p values).

	Ankle DF test left	Ankle DF test right	Compound Y Balance Test Left	Compound Y Balance Test Right	Inter-limb Difference in compound Y Balance Test
Hip AD Left	0.301 (0.240)	0.237 (0.359)	0.335 (0.189)	0.199 (0.444)	0.043 (0.871)
Hip AD Right	0.196 (0.450)	0.138 (0.598)	0.300 (0.241)	0.243 (0.347)	0.122 (0.642)
Hip ABD Left	0.118 (0.651)	0.035 (0.894)	0.236 (0.362)	0.282 (0.273)	0.288 (0.262)
Hip ABD Right	0.006 (0.981)	-0.103 (0.695)	0.299 (0.244)	**0.492 (0.045)***	0.292 (0.255)
Inter-limb Hip AD difference	-0.435 (0.081)	-0.259 (0.315)	0.019 (0.941)	0.332 (0.194)	**0.438 (0.048)***
Inter-limb Hip ABD difference	0.154 (0.555)	0.334 (0.191)	0.123 (0.638)	-0.056 (0.830)	**-0.574 (0.016)***
Ratio AD:ABD Left	0.224 (0.387)	0.179 (0.491)	-0.020 (0.939)	-0.066 (0.800)	-0.385 (0.127)
Ratio AD:ABD Right	0.217 (0.403)	0.272 (0.291)	-0.070 (0.788)	-0.018 (0.944)	-0.420 (0.093)

DF: Dorsiflexion; AD: Adductor; ABD: Abdcutor. * indicates statistically significant correlation (p<0.05)

Table 4: Correlation study for the U16 sample (n=31). Pearson correlation (p values)

	Ankle DF test left	Ankle DF test right	Composite left Y Balance score	Composite right Y Balance score	Inter-limb Difference in compound Y Balance Test
Hip AD Left	0.307 (0.093)	0.314 (0.085)	0.005 (0.789)	-0.084 (0.654)	0.191 (0.330)
Hip AD Right	0.325 (0.074)	**0.355 (0.045)***	-0.023 (0.902)	.0.131 (0.484)	0.119 (0.300)
Hip ABD Left	**0.376 (0.037)***	**0.506 (0.004)***	0.158 (0.395)	0.110 (0.555)	0.138 (0.484)
Hip ABD Right	0.219 (0.235)	**0.363 (0.045)***	0.222 (0.231)	0.155 (0.405)	0.055 (0.783)
Inter-limb Hip AD difference	0.148 (0.427)	0.243 (0.189)	0.018 (0.924)	0.152 (0.415)	0.011 (0.954)
Inter-limb Hip ABD difference	0.009 (0.963)	-0.079 (0.672)	-0.199 (0.283)	-0.129 (0.490)	0.021 (0.914)
Ratio AD:ABD Left	-0.006 (0.977)	-0.118 (0.526)	-0.074 (0.694)	-0.209 (0.259)	0.165 (0.401)
Ratio AD:ABD Right	-0.139 (0.456)	-0.258 (0.161)	-0.108 (0.561)	-0.265 (0.149)	0.222 (0.257)

DF: Dorsiflexion; AD: Adductor; ABD: Abdcutor. * indicates statistically significant correlation ($p<0.05$)

Table 5: Correlation study for the U18 sample (n=12). Pearson correlation (p values)

	Ankle DF test left	Ankle DF test right	Compound Y Balance Test Left	Compound Y Balance Test Right	Inter-limb Difference in compound Y Balance Test
Hip AD Left	**0.540 (0.025)***	0.411 (0.184)	0.488 (0.107)	**0.678 (0.015)***	0.361 (0.306)
Hip AD Right	0.316 (0.073)	0.436 (0.157)	0.498 (0.100)	**0.734 (0.007)***	0.447 (0.195)
Hip ABD Left	0.328 (0.298)	0.207 (0.519)	0.202 (0.529)	0.379 (0.224)	0.197 (0.585)
Hip ABD Right	0.196 (0.542)	0.199 (0.536)	0.204 (0.524)	0.445 (0.147)	0.328 (0.356)
Inter-limb Hip AD difference	-0.386 (0.216)	-0.387 (0.213)	-0.231 (0.470)	-0.451 (0.141)	-0.407 (0.062)
Inter-limb Hip ABD difference	0.133 (0.680)	0.014 (0.965)	-0.554 (0.061)	-0.318 (0.314)	**0.589 (0.017)***
Ratio AD:ABD Left	0.418 (0.085)	0.478 (0.116)	0.171 (0.595)	0.480 (0.114)	0.377 (0.108)
Ratio AD:ABD Right	0.368 (0.074)	0.380 (0.223)	0.394 (0.205)	0.530 (0.076)	0.300 (0.400)

DF: Dorsiflexion; AD: Adductor; ABD: Abdcutor. * indicates statistically significant correlation ($p<0.05$)

Figures

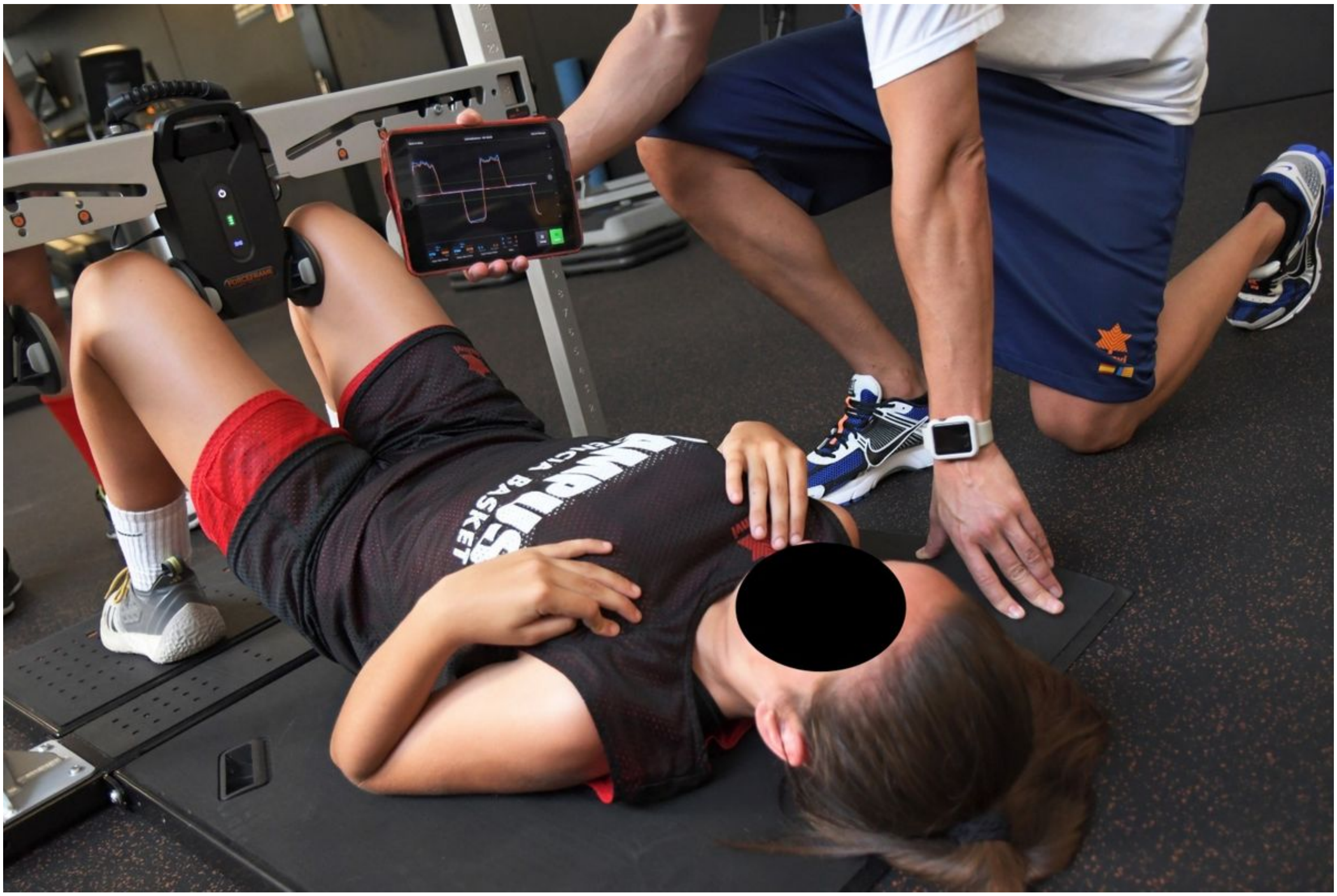

Figure 1

Subject position to evaluate the adductor (foam plate inside the knees) and abductor (foam plate outside the knees) muscles with ForceFrame Strength Testing System® device and showing feedback information. Frontal view, it can see the strength measurement device and the feedback shown to the subject while the testing was achieved.

Figure 2

Lateral view, it can see the subject position for both abductor and adductor muscles, specially the foam plate outside the knees for abductor muscles.