fizjoterapia polska

POLISH JOURNAL OF PHYSIOTHERAPY

OFICJALNE PISMO POLSKIEGO TOWARZYSTWA FIZJOTERAPII

THE OFFICIAL JOURNAL OF THE POLISH SOCIETY OF PHYSIOTHERAPY

NR 5/2022 (22) KWARTALNIK ISSN 1642-0136

Application of non-invasive brain stimulation with the use of repetitive transcranial magnetic stimulation or transcranial direct current stimulation in the treatment of dysphagia following an ischemic stroke

Zastosowanie nieinwazyjnej stymulacji mózgu z wykorzystaniem przezczaszkowej stymulacji magnetycznej lub przezczaszkowej stymulacji prądem stałym w terapii dysfagii w następstwie udaru niedokrwiennego mózgu

Aktywność fizyczna i czynniki ryzyka u osób z pęcherzem nadreaktywnym

Physical activity and risk factors in subjects with overactive bladder

mindray
healthcare within reach

ULTRASONOGRAFIA W FIZJOTERAPII

Autoryzowani dystrybutorzy

Mar-Med

+48 22 853 14 11

info@mar-med.pl

Ado-Med

+48 32 770 68 29

adomed@adomed.pl

MAR-MED
OD 1995 ROKU

ADO-MED®
APARATURA MEDYCZNA

Zawód Fizjoterapeuty dobrze chroniony

Poczuj się bezpiecznie

INTER Fizjoterapeuci
Dedykowany Pakiet Ubezpieczeń

Zaufaj rozwiązaniom sprawdzonym w branży medycznej.
Wykup dedykowany pakiet ubezpieczeń INTER Fizjoterapeuci, który zapewni Ci:

- ochronę finansową na wypadek roszczeń pacjentów – NOWE UBEZPIECZENIE OBOWIĄZKOWE OC
- ubezpieczenie wynajmowanego sprzętu fizjoterapeutycznego
- profesjonalną pomoc radców prawnych i zwrot kosztów obsługi prawnej
- odszkodowanie w przypadku fizycznej agresji pacjenta
- ochronę finansową związaną z naruszeniem praw pacjenta
- odszkodowanie w przypadku nieszczęśliwego wypadku

Nasza oferta była konsultowana ze stowarzyszeniami zrzeszającymi fizjoterapeutów tak, aby najskuteczniej chronić i wspierać Ciebie oraz Twoich pacjentów.

► Skontaktuj się ze swoim agentem i skorzystaj z wyjątkowej oferty!

Towarzystwo Ubezpieczeń INTER Polska S.A.
Al. Jerozolimskie 142 B
02-305 Warszawa

www.interpolska.pl

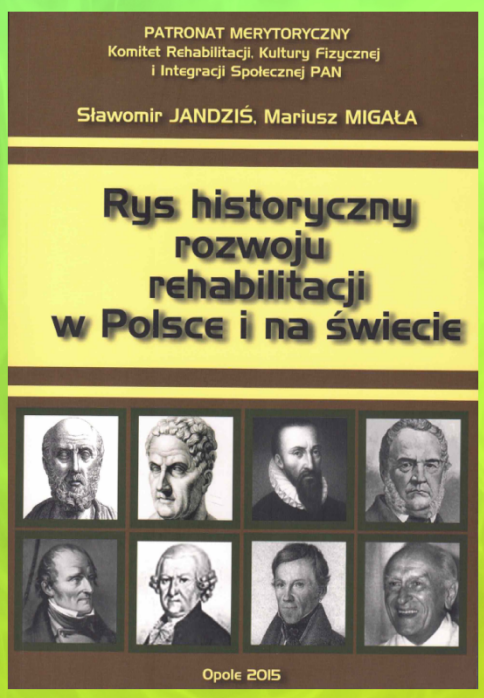
inter UBEZPIECZENIA

fizjoterapia polska

STUDIO

sklep internetowy: www.djstudio.shop.pl

w sklepie dostępne między innymi:
·archiwalne numery Fizjoterapii Polskiej w wersji papierowej
·artykuły w wersji elektronicznej
·książki poświęcone fizjoterapii
·prenumerata Fizjoterapii Polskiej



KALMED
Iwona Renz, Poznań

ARTROMOT®
WYŁĄCZNY PRZEDSTAWICIEL
WWW.KALMED.COM.PL

DJO GLOBAL

SPRZEDAŻ I WYPOŻYCZALNIA ZMOTORYZOWANYCH SZYN CPM ARTROMOT®

Nowoczesna rehabilitacja CPM stawu kolanowego, biodrowego, łokciowego, barkowego, skokowego, nadgarstka oraz stawów palców dłoni i kciuka.

ARTROMOT-H

ARTROMOT-F

ARTROSTIM
FOCUS PLUS

ARTROMOT-K1 ARTROMOT-SP3 ARTROMOT-S3 ARTROMOT-E2

Najnowsze konstrukcje ARTROMOT zapewniają ruch bierny stawów w zgodzie z koncepcją PNF (Proprioceptive Neuromuscular Facilitation).

KALMED Iwona Renz
ul. Wilczak 3
61-623 Poznań
www.kalmed.com.pl

tel. 61 828 06 86
faks 61 828 06 87
kom. 601 64 02 23, 601 647 877
kalmed@kalmed.com.pl

Serwis i całodobowa
pomoc techniczna:
tel. 501 483 637
service@kalmed.com.pl

NOWOŚĆ W OFERCIE

ASTAR.

PhysioGo.Lite SONO

NIEWIELKIE URZĄDZENIE
EFEKTYWNA **TERAPIA ULTRADŹWIĘKOWA**

Zaawansowana technologia firmy Astar to gwarancja niezawodności i precyzyjności parametrów. Urządzenie, dzięki gotowym programom terapeutycznym, pomaga osiągać fizjoterapeucie możliwie najlepsze efekty działania fal ultradźwiękowych.

Głowica SnG to bezobsługowe akcesorium o dużej powierzchni czoła (17,3 cm^2 lub 34,5 cm^2 w zależności od wybranego trybu działania). Znajduje zastosowanie w klasycznej terapii ultradźwiękami, fonoferezie, terapii LIPUS i zabiegach skojarzonych (w połączeniu z elektroterapią).

wsparcie merytoryczne
www.fizjotechnologia.com

ul. Świt 33
43-382 Bielsko-Biała

t +48 33 829 24 40
astarmed@astar.eu

www.astar.pl

POLSKI PRODUKT WYBIERASZ I WSPIERASZ

mindray
healthcare within reach

ULTRASONOGRAFIA

W FIZJOTERAPII

Autoryzowani dystrybutorzy

Mar-Med

+48 22 853 14 11

info@mar-med.pl

Ado-Med

+48 32 770 68 29

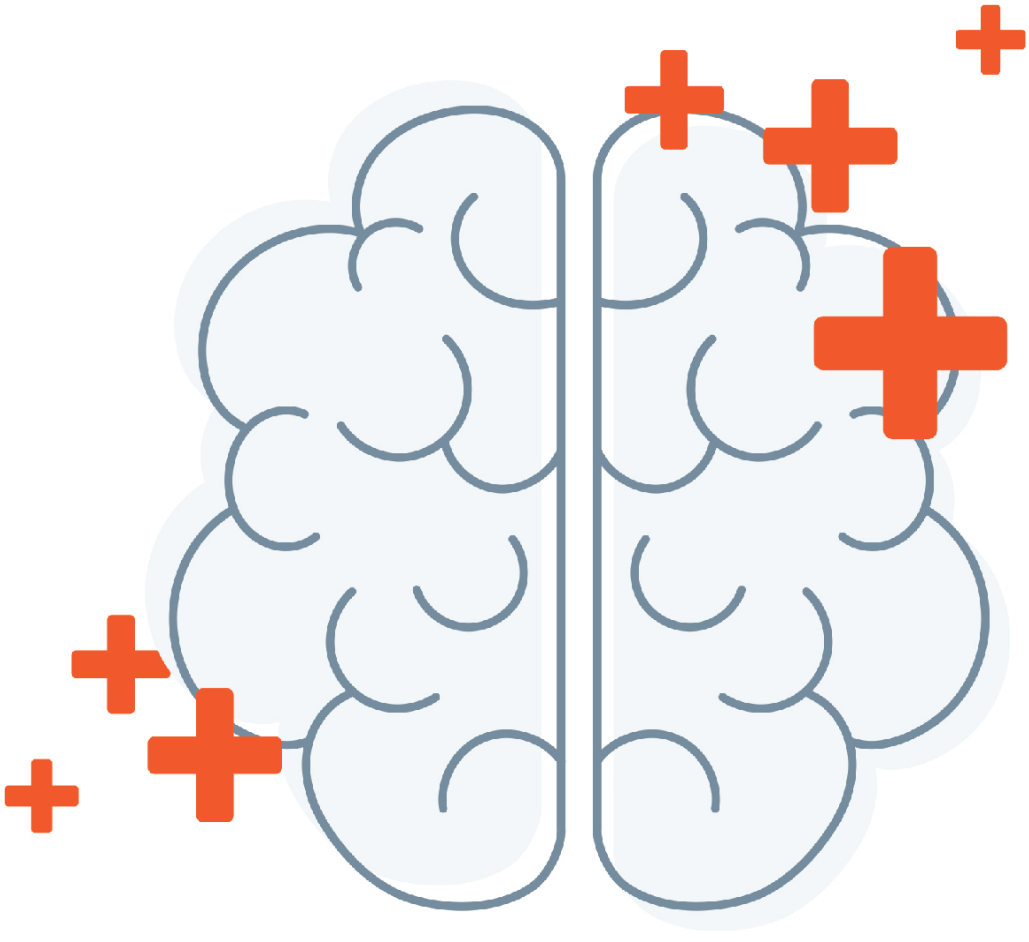
adomed@adomed.pl

MAR-MED
OD 1995 ROKU

ADO-MED®
APARATURA MEDYCZNA

POMAGAMY ODZYSKAĆ SPRAWNOŚĆ PO UDARACH I URAZACH MÓZGU

Program Po Urazie Głowy realizowany przez ogólnopolską Fundację Moc Pomocy to kompleksowe wsparcie dla osób, które doznały urazu głowy w wyniku wypadku lub przeszły udar mózgu. Program wspiera także rodziny osób, które doznały urazu i nie są w stanie samodzielnie podejmować działań na drodze do sprawności.



W ramach programu oferujemy pacjentom:

- Opiekę Menadżera Rehabilitacji
- Pozyskanie funduszy na rehabilitację i zakup sprzętu
- Wsparcie psychologiczne
- Konsultacje specjalistów
- Rehabilitację neurologiczną w ośrodkach na terenie kraju
- Pomoc w doborze zaopatrzenia
- Wsparcie w likwidacji barier architektonicznych

Masz pytanie odnośnie programu. Napisz do nas lub skontaktuj się telefonicznie z naszymi menadżerami rehabilitacji:

+48 881 035 005
lub +48 793 003 695

biuro@pourazieglowy.pl
www.pourazieglowy.pl

Dr. Comfort®

Nowy wymiar wygody.

Obuwie profilaktyczno-zdrowotne o atrakcyjnym wzornictwie

NAGRODA POLSKIEGO TOWARZYSTWA REHABILITACJI

ACCEPTED
AMERICAN PODIATRIC MEDICAL ASSOCIATION

APROBATA AMERYKAŃSKIEGO MEDYCZNEGO STOWARZYSZENIA PODIATRYCZNEGO

CE WYRÓB MEDYCZNY

Miękki, wyścielany kołnierz cholewki
Minimalizuje podrażnienia

Stabilny, wzmocniony i wyścielany zapiętek
Zapewnia silniejsze wsparcie łuku podłużnego stopy

Wyścielany język
Zmniejsza tarcie i ulepsza dopasowanie

Lekka konstrukcja
Zmniejsza codzienne zmęczenie

Antypoślizgowa, wytrzymała podeszwa o lekkiej konstrukcji
Zwiększa przyczepność, amortyzuje i odciąża stopy

Zwiększona szerokość i głębokość w obrębie palców i przodostopia
Minimalizuje ucisk i zapobiega urazom

Wysoka jakkość materiałów - oddychające siatki i naturalne skóry
Dostosowują się do stopy, utrzymują je w suchości i zapobiegają przegrzewaniu

Ochronna przestrzeń na palce - brak szwów w rejonie przodostopia
Minimalizuje możliwość zranień

Trzy rozmiary szerokości

Podwyższona tęgość

Zwiększona przestrzeń na palce

WSKAZANIA

• haluksy • wkładki specjalistyczne • palce młotkowate, szponiaste • cukrzyca (stopa cukrzycowa) • reumatoidalne zapalenie stawów • bóle pięty i podeszwy stopy (zapalenie rozcięgna podeszwowego - ostroga piętowa) • płaskostopie (stopa poprzecznie płaska) • bóle pleców • wysokie podbicie • praca stojąca • nerwiak Mortona • obrzęk limfatyczny • opatrunki • ortezy i bandaże • obrzęki • modzele • protezy • odciski • urazy wpływające na ścięgna, mięśnie i kości (np. ścięgno Achillesa) • wrastające paznokcie

KALMED
Iwona Renz, Poznań

ul. Wilczak 3
61-623 Poznań
tel. 61 828 06 86
fax. 61 828 06 87
kom. 601 640 223, 601 647 877
e-mail: kalmed@kalmed.com.pl
www.kalmed.com.pl

www.butydlazdrowia.pl

www.dr-comfort.pl

fizjoterapia polska
nr 5/2022 (22)

The interlimb and between gender differences in the performance of Y-balance test in healthy athletic students

Różnice między kończynami i między płciami w teście równowagi Y-balance u zdrowych i wysportowanych studentów

Marwan M Aljohani[1(A,B,C,D,E,F)], Abdulmohsen M Alroumi[2(A,B,C,D,E,F)], Ayman M Alawamer[3(A,B,C,D,E,F)], Osama Ahmed Khalid[4(A,B,C,D,E,F)]

[1]Department of Physical Therapy, College of Medical Rehabilitation Sciences, Taibah University, Madinah, Saudi Arabia
[2]Department of Physical Therapy, College of Applied Medical Sciences, Shaqra University, Saudi Arabia
[3]Department of Physical Therapy, Medical Rehabilitation Hospital, Madinah, Saudi Arabia
[4]Department of Basic Science, Faculty of Physical Therapy, Cairo University, Cairo, Egypt

Abstract

Objectives. To investigate the gender effect on the performance of Y-balance test (YBT) and the interlimb differences in males and females.

Methods. Thirty-six healthy athletic students aged 22 ± 2 years voluntarily participated in this study. YBT scores in cm for anterior, posteromedial, posterolateral, and composite scores for dominant and non-dominant limbs were measured. YBT scores were used for the analysis. Independent t-test was used to investigate the gender differences in YBT scores. Paired t-test was used to examine the interlimb differences of YBT for males and females.

Results. Males athletic student demonstrate greater reach scores in all direction for the non-dominant and dominant leg except the posteromedial reach direction for the dominant leg. In addition, male athletic students demonstrated significant interlimb differences in the posteromedial reach direction.

Conclusions. Male athletic students demonstr`ated better dynamic balance compared to females. However, there was a significant interlimb differences in the posteromedial reach direction which is known to be risk factor for non-contact injury for who participate in soccer.

Keywords

Y-balance test, dynamic balance, interlimb, gender differences

Streszczenie

Cel. Badanie wpływu płci na wyniki testu równowagi Y-balance (YBT) i różnic między kończynami u studentów płci męskiej i żeńskiej.

Metody. W badaniu wzięło udział 36 zdrowych i wysportowanych studentów płci męskiej i żeńskiej w wieku 22 ± 2 lata. YBT zmierzono w cm dla zasięgów przednich, tylno-przyśrodkowych, tylno-bocznych; przedstawiono też wyniki łączone dla kończyn dominujących i niedominujących. Wyniki YBT wykorzystano w celu przeprowadzenia analizy. Niezależny test t został wykorzystany do zbadania różnic w wynikach YBT między płciami. Sparowany test t został użyty do zbadania różnic YBT między kończynami.

Wyniki. Wysportowani studenci płci męskiej osiągali lepsze wyniki w zakresie zasięgu we wszystkich kierunkach dla kończyny niedominującej i dominującej, z wyjątkiem zasięgu tylno-przyśrodkowego dla kończyny dominującej. Ponadto studenci wysportowani płci męskiej wykazali znaczące różnice między kończynami w zasięgu tylno-przyśrodkowym.

Wnioski. Wysportowani studenci płci męskiej wykazali się lepszą równowagą dynamiczną w porównaniu ze studentkami. Wystąpiły jednak znaczące różnice między kończynami w zasięgu tylno-przyśrodkowym, który jest czynnikiem ryzyka urazów bezkontaktowych u osób uprawiających piłkę nożną.

Słowa kluczowe

Test równowagi Y-balance, równowaga dynamiczna, różnice między kończynami, różnice między płciami

doi.org/10.56984/8ZG20A24g

Introduction

Lower extremities injury is common in sports. Anterior cruciate ligament injury is one of the most devastated knee injuries reported in sports. Up to 250,000 ACL injuries occur in the US alone [1]. Moreover, the rate of injury is increasing in the last 20 years. Females have higher risk of developing a non-contact injury compared to males [2, 3]. In ACL injuries, females are 1.5 times more likely to get injured compared to males [2, 4]. According to a recent systematic review and meta-analysis, the incidence rate is highest in the amateur female athletes compared amateur male athletes [2]. However, there is still a need to understand how to mitigate non-contact injury's risk factors for females.

Y-balance test (YBT) is a valid dynamic balance test used to assess the athletes' ability to maintain balance during movement while single limb stance [5, 6]. This test was developed form the star excursion balance test (SEBT), in order to make the test more accessible and recue the reaching directions from 8 in SEBT to 3 (i.e., anterior, posteromedial, and posterolateral) in YBT [7]. It is commonly used with athletes and it has an excellent intra rater and inter-rater reliability. [8, 9]. Numerous studies have found a strong link between non-contact ACL injuries and poor performance of YBT or SEBT [11–15]. For example, a study concluded that individuals with ACL injury demonstrated lower scores of SEBT compared to non-injured individuals [11]. Moreover, it has been shown that SEBT and YBT was proven to be predictive of lower extremity injury and can be used as a tool to identify individuals with greater risk of developing injury [12–14]. In basketball, YBT and SEBT were used to identify player at greater risk of developing lower extremity injuries [12]. Furthermore, athletes with poor performance of dynamic balance test are 2.5 more likely to develop an injury compared with good performance. Plisky et al., [12]. found that football players with low scores of SEBT have greater risk developing lower extremity injury compared to players with high scores of SEBT. In addition, athletes are at greater risk of non-contact injuries if they demonstrated between limb asymmetries (i.e., dominant and non-dominant) of 4 cm or more in the anterior reach direction [13, 14]. Even though there is a strong link between the injury and YBT score, there is a lack of knowledge regarding the factors that affect the YBT score such as gender.

Previous research still controversial regarding the effect of gender on the performance of YBT. As some studies showed that there were no significant differences between men and women in all reaching directions [15, 16]. However, previous research suggested that females may have better performance in normalized reaching distances compared to males [17]. On the other hand, a number of studies have found that males may demonstrate greater reaching distance compared to females [18, 19]. Alhusaini et al., investigated the effect of gender on the performance of YBT and found that men showed better performance compared to women in all reaching direction and composite score [19]. However, a recent systematic review and meta-analysis found that men demonstrated better performance of YBT in the posteromedial and posterolateral but not in anterior, or composite scores [10]. As these inconclusive results still exist, there is still a lack of understanding the effect of gender on the performance of YBT.

Limited number of studies have investigated the interlimb reach asymmetry differences between dominant and non-dominant legs for men and women. [13, 16, 19, 21]. A recent study on untrained healthy individuals showed no significant asymmetry between dominant and non-dominant leg in any reach direction for men and women [20]. However, a study suggested that in division 1 college athletes, males may have greater interlimb anterior asymmetry compared to females [13]. Moreover, another study on non-athletic college students found that men may have greater posteromedial asymmetry compared to females [19]. In other words, males performed greater reach direction when standing on the left leg during posteromedial reach. Given the fact that females may be at greater risk of developing a non-contact injury and there is a there is a strong link between injury and interlimb asymmetry level, it is might important to investigate the gender differences in interlimb asymmetry. Understanding this may potentially help to reduce the risk of injury by improving the injury screening. Therefore, the purpose of this study was to investigate the gender differences in YBT performance, and to investigate the interlimb differences between dominant and non-dominant for men and women. We hypothesized that males would demonstrate better performance of YBT, and lower interlimb asymmetry compared to females.

Methods

Thirty-six healthy recreational athletes (17 females and 19 males) participated in this study with a mean age of 22 ± 2. The inclusion criteria include that all participants must have no history of surgery, musculoskeletal or neuromuscular injury. An injury was defined as any injury that prevented the player from training or playing sport for at least seven days. In addition, all participants must participate regularly in sports at least three times a week. Each participant signed an informed consent that was approved by Taibah University. Official approvals were obtained from the ethics committee of scientific research at Taibah University.

Data collection

Y-balance testing

Leg length in centimeters was measured first from the anterior superior iliac spine to the medial malleolus in supine position. The participants were asked to reach as far as possible using one leg while single leg stance without losing balance and returning to the starting position in three directions (i.e., anterior, posteromedial, and posterolateral). To increase reliability, participants performed 9 trials in which six were practice trails and three were the actuals trails that was used for the analysis [21]. The test was repeated for both leg and the starting leg was randomly selected by shuffled cards. The anterior, posteromedial, and posterolateral maximum reach direction were measured in centimeters. Normalized reach distance was calculated by dividing the reach distance by leg length and multiply the result by 100. To calculate the normalized composite reach distance. The sum of the maximum reach distance for each direction were divided by 3 times leg length then multi-

doi.org/10.56984/8ZG20A24g

plied by 100. The interlimb asymmetry was calculated by the absolute differences between the dominant and non-dominant for each reaching direction.

Statistical analysis

Shapiro-Wilk test was used to test the normality of the data. Independent t-test was performed to determine differences in YBT variables between males and females. The independent variable was gender, and dependent variables were anterior, posteromedial, posterolateral, and composite score for both dominant and non-dominants leg. The interlimb differences for males and females was investigated using paired t-test. SPSS version 24 (SPSS, Inc, Chicago, IL, USA) was used for the statistical analysis. The significance level was $\alpha = 0.05$.

Results

Table 1 shows the mean and standard deviation of participants characteristics for age, height, weight, and leg length. The mean and standard deviation YBT scores of dominant and non-dominant leg are shown in table 2. There was a significant different between males and females in all YBT reach directions for dominant and non-dominant leg except posteromedial direction for the dominant leg ($p = 0.18$) Also, composite scores were similar for males and females in both dominant ($p = 0.5$) and non-dominant side ($p = 0.6$). In addition, there was no significant differences between dominant and non-dominant legs for males and females for all anterior or posterolateral (Table 3). However, males demonstrated significant asymmetry between dominant and non-dominant leg in the posteromedial direction ($p = 0.01$)

Table 1. Demographic data

	Males	Femalese
Age [years]	21 ± 1	22 ± 2
Weight [kg]	74 ± 13	60 ± 17
Height [cm]	174 ± 7	160 ± 8
Leg length [cm]	94.2 ± 5	87 ± 5

Data presented in the form of: Mean ± SD

Table 2. YBT scores

	Leg	Males Mean ± SD	Females Mean ± SD	Mean gender differences (95% CI)	p-value
Anterior	Dominant	76.7 ± 6	68 ± 9	8.6 (3–14)	0.003*
	Non-dominant	78.8 ± 8	71.1 ± 13	7.7 (0.4–15) *	0.040*
Posteromedial	Dominant	97 ± 0.11	91 ± 13	4 (−2–13)	0.187
	Non-dominant	103 ± 14	92 ± 15	5 (0.9–21) *	0.033*
Posterolateral	Dominant	103 ± 10	91 ± 12	11.4 (4–19) *	0.005*
	Non-dominant	101 ± 12	92 ± 12	9.6 (1–18) *	0.026*
Composite	Dominant	98.3 ± 10	96.3 ± 13	2.0(−6–10)	0.616
	Non-dominant	101 ± 13	98 ± 14	2.9 (−6–12)	0.543

** Significant difference between gender ($p < 0.05$)*

Table 3. Interlimb differences of the YBT scores for males and females

Variables	Males	Femalese
Anterior	2 ± 6.3	3 ± 7.9
Posteromedial	6.6 ± 9.5*	1.2 ± 8.1
Posterolateral	1.4 ± 11	0.4 ± 9.5

*Data presented in the form of: Mean ± SD , * Significant interlimb difference ($p < .05$)*

doi.org/10.56984/8ZG20A24g

Discussion

This study investigated the differences in dynamic balance and the interlimb differences between collegiate males and females using YBT. The main findings of the current study are that men demonstrated greater reach distances in anterior, posterolateral and posteromedial reach distances for non-dominant leg compared to women. Also, anterior and posterolateral reach distances were greater in males compared to females. Moreover, males have a significant asymmetry in the posteromedial reach direction. However, there was no significant interlimb differences between men and women in any reach direction. The hypothesis of this study was partially supported. The result of this study is important.

In the current study, males collegiate demonstrated better dynamic balance compared to females. As males showed greater anterior, posteromedial and posterolateral reach direction for the non-dominant leg and all reaching direction for dominant leg except posteromedial. A possible explanation for better dynamic balance performance in men could be explained by the larger muscle mass compared to women. As previous research suggested that there is a significant positive correlation between hip and knee muscle strength and the performance of YBT [22, 23]. In addition, male collegiate may receive more appropriate training than female collegiate in Saudi Arabia. This result is consistent with previous research [19, 24]. Alnahdi et al., investigated gender differences in dynamic balance using YBT and found that males have greater normalized reach direction in all three directions [19]. However, they also found that composite score was significantly greater in males compared to females, whereas in the current study composite score did not differ between genders. Similarly, a systematic review suggested that composite scores do not differ between males and females [20]. This discrepancy can be explained by the differences in the population's characteristics between the two studies. In the current study, the inclusion criteria include the participation regularly in sports at least three times a week, whereas in Alnahdi et al does not require participation in sports. As both males and females in the current study participate in sports regularly, it may reduced the mean differences between males and females in all three reach directions, which therefore lead to non-significant differences in the composite scores. In contrary, some studies found no gender differences in YBT performance [15, 16]. Gribble PA and Hertel J, also found no gender differences using SEBT [15]. Chimera et al, found that there were no significant differences between males and females [16]. Based on previous research there is a high heterogeneity in YBT performance that differs among populations (i.e., age, sports, physical activity level, occupation, and competition level) [10, 19].

Current study shows that males have significant interlimb differences in the posteromedial reach direction. This result contradicts our hypothesis that females will demonstrate significant interlimb differences. Male participants in the current study had an asymmetry > 4 cm (i.e., 6.6 cm), which based on previous research, may increase the risk of lower extremity injuries [14]. Gonell et al, suggested that soccer players with an asymmetry of 4 cm or more in the posteromedial reach direction have four times greater risk of developing a non-contact injury. However, the reason for this asymmetry is not well understood. Including muscle activation pattern and movement pattern may add more information to that may help to understand the reason for the asymmetry in the posteromedial reach direction in men.

The current study has some limitations. In the current study there was no control for the skill level and type of sport that participants of this study performed, which may affect interlimb asymmetry values. Therefore, future research should include skill level and type of sports in the analysis.

One of the limitations is that current study investigated on healthy individuals. Therefore, the results may not reflect the population of individuals with injury. Future research should investigate the gender differences in muscle activation and movement pattern during YBT which may add more information the gender difference in YBT performance.

Conclusion

The results of this study indicate that males demonstrate greater reach distance in all reaching directions of the YBT. Therefore, males may have better dynamic balance compared to females. However, males have significant asymmetry in the posteromedial reach direction, which is known to a factor that is associated with high risk of lower limb injuries.

Adres do korespondencji / Corresponding author

Marwan M Aljohani

E-mail: mmjohani@taibahu.edu.sa

Acknowledgement

The author would like to thank Raghad Aljohani, Atheer Alahmad, Arwa Alfiradi, Razan Aljabri, Rima Aljohani, Shatha Alhusayni, and Lama Alahmidi for the contribution for this research.

Piśmiennictwo/ References

1. Yu, B., & Garrett, W. E. Mechanisms of non-contact ACL injuries. British Journal of Sports Medicine, 2007; 41(suppl 1), i47-i51.

2. Montalvo, A. M., Schneider, D. K., Yut, L et al., "What's my risk of sustaining an ACL injury while playing sports?" A systematic review with meta-analysis. British Journal of Sports Medicine, 2019; 53(16), 1003-1012.

doi.org/10.56984/8ZG20A24g

3. Beynnon, B. D., Vacek, P. M., Newell, M. K et al., The effects of level of competition, sport, and sex on the incidence of first-time noncontact anterior cruciate ligament injury. The American Journal of Sports Medicine, 2014;42(8), 1806-1812.
4. Ardern, C. L., Ekås, G. R., Grindem, H et al., 2018 international olympic committee consensus statement on prevention, diagnosis and management of paediatric anterior cruciate ligament (ACL) injuries. British Journal of Sports Medicine, 2018; 52(7), 422-438.
5. Butler, R. J., Southers, C., Gorman, P. P et al., Differences in soccer players' dynamic balance across levels of competition. Journal of Athletic Training. 2012; 47(6), 616-620.
6. Bressel, E., Yonker, J. C., Kras, J., Heath, E. M. Comparison of static and dynamic balance in female collegiate soccer, basketball, and gymnastics athletes. Journal of Athletic Training, 2007; 42(1), 42.
7. Hertel, J. Sensorimotor deficits with ankle sprains and chronic ankle instability. Clinics in Sports Medicine, 2008; 27(3), 353-370.
8. Plisky, P. J., Gorman, P. P., Butler, R. J et al., The reliability of an instrumented device for measuring components of the star excursion balance test. North American Journal of Sports Physical Therapy: NAJSPT, 2009; 4(2), 92.
9. Powden, C. J., Dodds, T. K., & Gabriel, E. H. The reliability of the star excursion balance test and lower quarter Y-balance test in healthy adults: A systematic review. International Journal of Sports Physical Therapy, 2019; 14(5), 683.
10. Plisky, P., Schwartkopf-Phifer, K., Huebner, B et al., Systematic review and meta-analysis of the Y-balance test lower quarter: Reliability, discriminant validity, and predictive validity. International Journal of Sports Physical Therapy, 2021; 16(5), 1190.
11. Herrington, L., Hatcher, J., Hatcher, A., McNicholas, M. A comparison of star excursion balance test reach distances between ACL deficient patients and asymptomatic controls. The Knee, 2009; 16(2), 149-152.
12. Plisky, P. J., Rauh, M. J., Kaminski, T. W., Underwood, F. B. Star excursion balance test as a predictor of lower extremity injury in high school basketball players. Journal of Orthopaedic & Sports Physical Therapy, 2006; 36(12), 911-919.
13. Smith, C. A., Chimera, N. J., & Warren, M. Association of y balance test reach asymmetry and injury in division I athletes. Medicine and Science in Sports and Exercise, 2015; 47(1), 136-141.
14. Calvo Gonell, A., Pina Romero, J. A., Maciá Soler, L. Relationship between the Y balance test scores and soft tissue injury incidence in a soccer team. International journal of sports physical therapy, 2015; 10(7), 955.
15. Gribble, P. A., & Hertel, J. Considerations for normalizing measures of the star excursion balance test. Measurement in Physical Education and Exercise Science, 2003; 7(2), 89-100.
16. Chimera, N. J., Smith, C. A., & Warren, M. Injury history, sex, and performance on the functional movement screen and Y balance test. Journal of Athletic Training, 2015; 50(5), 475-485.
17. Gribble, P. A., Robinson, R. H., Hertel, J., Denegar, C. R. The effects of gender and fatigue on dynamic postural control. Journal of Sport Rehabilitation, 2009; 18(2), 240-257.
18. Sabin, M. J., Ebersole, K. T., Martindale, A. R et al., Balance performance in male and female collegiate basketball athletes: Influence of testing surface. The Journal of Strength & Conditioning Research, 2010; 24(8), 2073-2078.
19. Alhusaini, A. A., Alnahdi, A. H., Melam, G et al., Normative values of Y balance test and isometric muscle strength among saudi school children. Physikalische Medizin, Rehabilitationsmedizin, Kurortmedizin, 2017; 27(03), 164-170.
20. Tsvetkova-Gaberska, M., & Pencheva, N. Determination of lower quarter dynamic balance in healthy adults.Journal of Physical Education and Sport, 2022; 22(3), 775-781.
21. Linek, P., Sikora, D., Wolny, T., & Saulicz, E. Reliability and number of trials of Y balance test in adolescent athletes. Musculoskeletal Science and Practice, 2017; 31, 72-75.
22. Wilson, B. R., Robertson, K. E., Burnham, J. M et al., The relationship between hip strength and the Y balance test. Journal of Sport Rehabilitation, 2018; 27(5), 445-450.
23. Lee, D., Kim, G., Ha, S., Oh, J. Correlation of the Y-balance test with lower-limb strength of adult women. Journal of Physical Therapy Science, 2014; 26(5), 641-643.
24. Gorman, P. P., Butler, R. J., Rauh, M. J et al., Differences in dynamic balance scores in one sport versus multiple sport high school athletes. International Journal of Sports Physical Therapy, 2012; 7(2), 148.

doi.org/10.56984/8ZG20A24g