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EFFECT OF STRENGTH TRAINING OF LOWER LIMBS BY COMPAIRING Y BALANCE TEST SCORES IN UNTRAINED YOUNG ADULTS STUDYING IN PHYSIOTHERAPY COLLEGES. – AN EXPERIMENTAL STUDY.

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Abstract: The aim of the study is to see the effect of strength training of lower limbs in untrained young adults studying in physiotherapy colleges in and around Pune.

A total of 96 untrained young adults studying in physiotherapy colleges falling between age group of 18 to 25 years were the subject population of this study.

Y balance test was used to compare the effect of strength training protocol in the participants. LEFS is used in this study to evaluate the effectiveness of an intervention. YBT and LEFS scores were assessed before and after the intervention to evaluate dynamic balance and effectiveness of the protocol. All the participants had a highly significant increase in their lower extremity functional test scores. All the participants had a good significance in the increase in y balance test scores

Index Terms **- strength training, y balance test, LEFS, dynamic balance, untrained young adults.**

I. INTRODUCTION

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INTRODUCTION

Worldwide, musculoskeletal problems related to the job can affect an individual's capacity to work, go about their daily life, and quality of life.
During this period, the largest frequency (7.1 claims per million hours worked) and prevalence (18%) of occupational musculoskeletal disorder claims were recorded by the healthcare and social assistance sectors. Workforce shortages in the healthcare industry may result from subsequent loss of function, low job satisfaction, decreased productivity, and incapacity to engage in work-related activities.[16]
Untrained young adults are those individuals between the ages of 18 to 25 who have not completed formal vocational or academic training beyond high school.
The study of musculoskeletal diseases in health professionals at work has primarily looked at physiotherapists and nurses. For everyone to be healthy and fit overall, strength training is essential.
Strength training may also help you:
• Build strong bones: Strength exercise can lower your risk of osteoporosis and increase bone density by putting stress on your bones.
• Control your weight: Strength training can aid in weight management or loss, as well as raising your metabolism to aid in increased caloric expenditure.
• Improve your quality of life: Strength training can help you live a better life and be more capable of performing daily tasks.

Additionally, strength exercise can help keep your joints injury-free. Gaining muscle can also help you balance better and possibly lower your chance of falling. As you get older, this can help you keep your freedom.
• Manage chronic illnesses: Many chronic conditions, including diabetes, obesity, heart disease, arthritis, and back pain, can have their signs and symptoms lessened by strength training.
• Develop your ability to think. According to some research, older persons' cognitive and learning abilities may be enhanced by consistent strength training and cardiovascular activity.

Principles of Strength Training[6]
The basic principles of a strength training programs are:
Overload Principle: To overcome muscular accommodation and produce and maintain physiological adaptations from strength training, it is critical to gradually overload the musculoskeletal system. A load that is greater than the muscle's metabolic capacity must be imposed if muscular performance is to increase; in other words, the muscle must be forced to work harder than it is used to.

The SAID principle: (specific adaptation to imposed demands) suggests that a framework of specificity is a necessary foundation on which exercise programs should be built.
Individuality: Each individual will have a different response to the training stimulus and thus programs need to be individually tailored.
Reversibility: If the training stimulus is taken away for an extended length of time, the training effects will be reversed. Resistance exercise-induced adaptive changes in the body's systems, like enhanced strength or endurance, are only temporary unless the person engages in a maintenance program of resistance exercises or uses their training-induced gains for functional activities on a regular basis.

The Y Balance Test (YBT) is a clinical assessment tool that measures dynamic balance and functional stability.[10]
It indirectly reflects strength and neuromuscular control; here's how the Y Balance Test is related to strength:
1.Muscle Activation and Control: The Y Balance Test necessitates both controlled and coordinated movement patterns. Sufficient strength is required to keep control and stability throughout the test.
2. The Y Balance Test heavily weighs eccentric strength, or a muscle's capacity to control lengthening or slowing down movement. Eccentric control is needed while you reach and move in different directions in order to slow down and regulate your body's movements. Better control and stability during dynamic motions are provided by muscles with strong eccentric contractions.
3. Dynamic Stability: Dynamic stability is the capacity to retain balance and control throughout dynamic movements. The Y Balance Test evaluates this ability. The muscles involved in this need to be strong and stable in addition to have balance.
During the test, weak or unstable muscles may find it difficult to keep their balance and composure.

Twenty items about a person's capacity to carry out daily duties make up the Lower Extremity Functional Scale (LEFS).[11] Clinicians can use the LEFS to measure patients' baseline function, follow-up progress, and results, as well as to establish functional goals.
A patient who suffers from a condition affecting one or both lower limbs can have their functional impairment assessed using the LEFS. It can be applied to assess the efficacy of an intervention as well as to continuously monitor the patient.

The objective of this study is to observe the effect of strength training of lower limbs in untrained young adults (18-25) studying in physiotherapy colleges.
To compare the pre and post scores of y balance test after strength training of lower limbs.
To compare the pre and post lower extremity functional scale scores.

NEED OF THE STUDY.

- As a medical student, you may face various musculoskeletal issues due to the demanding nature of your studies and the long hours spent studying, attending lectures, and performing clinical rotations.
- Standing for long periods during clinical rotations or spending extended hours on your feet can cause foot and leg pain and swelling.
- Reduced lower limb strength in young adults can be caused by various factors like Sedentary lifestyle: Lack of physical activity and prolonged sitting can lead to muscle weakness.[17] Encourage regular exercise, includes strength training
- Imbalanced muscle development: Certain muscles may be overused while others are underused, leading to muscle imbalances. Include exercises that target all major muscle groups in the lower limbs, such as squats, lunges, deadlifts, and calf raise.
- Poor nutrition: Inadequate intake of essential nutrients like protein, calcium, and vitamin D can contribute to muscle weakness. Encourage a well-balanced diet that includes lean proteins, dairy products, green leafy vegetables, and fortified foods.
- Postural issues: Poor posture and alignment can contribute to muscle imbalances and weakness in the lower limbs.
- Focus on maintaining proper posture during daily activities, and consider consulting a physical therapist or a posture specialist for guidance.
- Psychological factors: Stress, anxiety, and mental health conditions can impact physical strength and overall well-being. Encourage stress management techniques like regular exercise, relaxation exercises.
- There is evidence to suggest that lower limb weakness is a common issue among young adults.[1] Here are a few relevant points:

- Sedentary lifestyle: With the increasing prevalence of sedentary behaviours and a decrease in physical activity levels, many young adults may experience reduced lower limb strength. Sedentary occupations, excessive screen time, and a lack of exercise can contribute to muscle weakness. It is important to note that maintaining lower limb strength is crucial for overall health, functional abilities, and injury prevention. Regular exercise, including strength training, can help improve lower limb strength and reduce the risk of musculoskeletal issues.
- The study we will be doing would help them see the effect of training on their lower limbs by comparing ybt scores pre and post protocol.
- We would also be comparing lefs scores pre and post.
- There is a set protocol that would be for four weeks and week wise progression would be done.

RESEARCH METHODOLOGY

- **STUDY DESIGN:** Pre-post Experimental study.
- **SAMPLE SIZE :**96
- **SAMPLING METHOD:** Convenient sampling.
- **STUDY POPULATION:** Students studying in physiotherapy colleges.
- **STUDY SETTING:** In and around Pune.
- **STUDY DURATION:** 6 Months.
- **INTERVENTION DURATION:** 20 to 30 mins ,3 days per week

Study was presented in front of the ethical committee of PES Modern College of Physiotherapy Pune. Based on the inclusion and exclusion criteria participants was selected. Study was explained to the participants. Consent was taken for the same from the participants. Demographic Data was taken.
The LEFS was filled from the subjects.
They were shown the demonstration of y balance test, instructions were given. Then the test was performed.
After that lower limb strengthening protocol was demonstrated.
After the last day of 4th week protocol, their post lefs and ybt scores were collected.
All the data was collected and analyzed.

STRENGTH TRAINING PROTOCOL

- **WARMUP FOR 5 TO 7 MINS**
- **STRENGTHENING 20 MINS**
- **COOLDOWN FOR 5 TO 7 MINS**

WARM UP EXERCISES (5 TO 7 MINS)
ARM CIRCLES 5 REPS
HIP CIRCLES EACH LEG 5 REPS
HIGH STEPPING EACH 5 REPS
WAIST CIRCLES 5 EACH CLOCKWISE THEN ANTICLOCKWISE
ON SPOT SMALL JUMPS 15 REPS

STRENGTHENING FOR LOWER LIMBS

WEEK 1(3 DAYS PER WEEK)
QUARTER SQUATS 5 REPS
LUNGES 5REPS EACH LEG
SIDE LUNGES 5 REPS EACH
GLUTE BRIDGING 5 REPS
STEP UP AND DOWN 10 REPS
CALF RAISES 10 REPS

WEEK 2

FULL SQUATS 5 REPS
LUNGES 7 REPS EACH LEG
GLUTES BRIDGING 5 SEC HOLD WITH 5 REPS
SIDE LUNGES 7 REPS
CALF RAISES 20 REPS
QUADRUPED ONE LEG LIFT 5 REPS EACH LEG

WEEK 3

SUMO SQUATS 5 REPS
FIRE HYDRANT 5 REP EACH LEG
SINGLE LEG BRIDGING 5 REPS

BULGARIAN SPLIT SQUAT 5 EACH LEG
CALF RAISES 10 REPS WITH 5 SEC HOLD
WALL SIT 10 SECS

WEEK 4

SQUAT JUMPS 7 REPS
FIRE HYDRANT 5 REPS WITH 5 SEC HOLD
BULGARIAN SPLIT SQUAT 7 REPS EACH LEG
CALF RAISES 15 REPS 7 SEC HOLD
WALL SIT 20 SECS
JUMP LUNGES 5 REPS EACH LEG

COOL DOWN 5 TO 7 MINS

LIGHT JOGGING 1 MIN
KNEE TO CHEST 5 EACH LEG
STANDING QUADRICEPS STRETCH 5 EACH LEG
STANDING FORWARD BEND 3 REPS 5 SEC HOLD
CALF STRETCH
HAMSTRING AND GLUTES STRETCH 3 REPS 5 SEC HOLD.

IV. RESULTS AND DISCUSSION

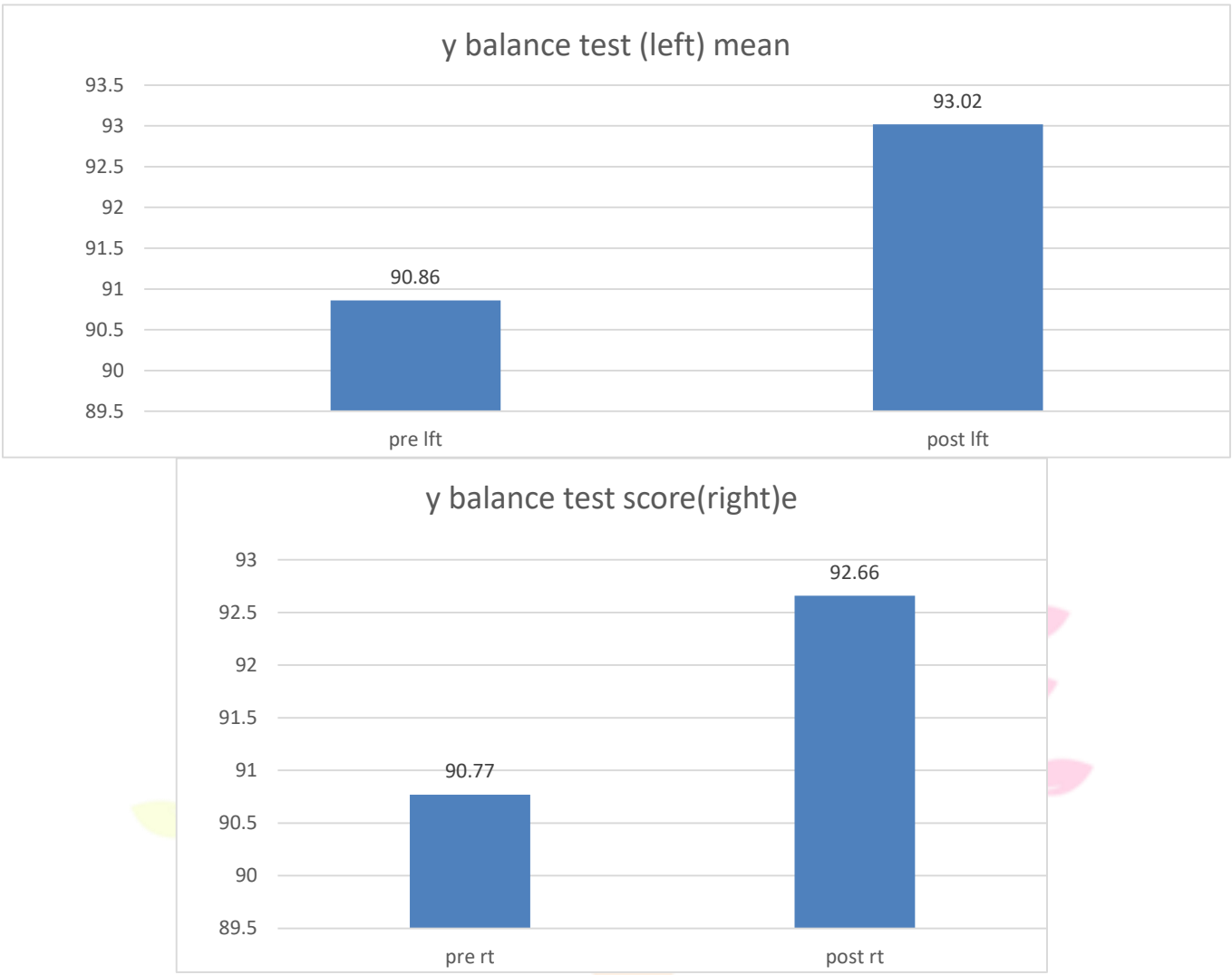
The data that fulfilled the inclusion criteria was further analysed.
96 subjects were included in the study according to the inclusion criteria.
Data has been statically analysed with the help of graph pad using t – test.

VARIABLES	**MEAN ± SD**
AGE	21.32 ± 0.97

Table 1: Demographic characteristics of the participants (n= 96)

Para meters	Pre		Post		P value	result
	mean	SD	Mean	SD		
Y balance test scores (right)	90.77604	7.023221	92.66146	6.587266	0.0008	significant

Table2: y balance test scores(right) pre and post after lower limb strength



Graph 1: Comparison between pre and post y balance test scores (right) following lower limb training

- Good significant changes can be seen in the y balance test scores of right lower limbs after lower limb strengthening.

Para meters	pre		post		P value	result
	mean	SD	Mean	SD		
Y balance test scores (left)	90.86979	6.913848	93.02604	7.089046	0.0003	significant

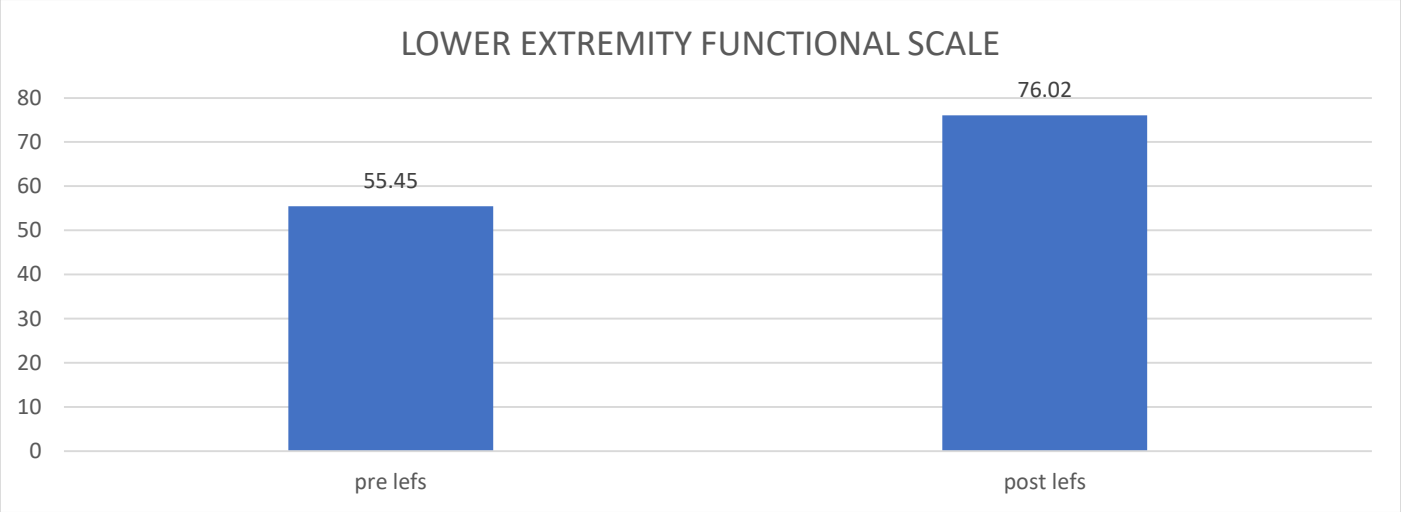
TABLE 3: y balance test scores(left) pre and post after lower limb strength

Graph 2: Comparison between pre and post y balance test scores (left) following lower limb training

- Good significant changes can be seen in the y balance test scores of left lower limb after lower limb strengthening.

Table 4: LEFS pre and post scores after lower limb strength

Para meters	pre		Post		P value	result
	mean	SD	Mean	SD		
LEFS	55.45833	2.966184	76.02083	2.483542	0.0001	Highly significant



Graph 3: Comparison between pre and post LOWER extremity functional scale test scores following lower limb strengthening training

- Highly significant changes can be seen in lower extremity functional scale after lower limb strengthening.

RESULT

A total of 96 untrained young adults studying in physiotherapy colleges falling between age group of 18 to 24 years were the subject population of this study

The result of the study was examined by applying "t" test to find out whether any significance difference between the means of pre and post of y balance test scores after a period of 4 weeks of lower limb strengthening protocol and is presented through tables and figures, which are given above. Mean score, standard deviation and p- value of y balance test scores (right and left) and lower extremity functional scale scores are taken.

From the above tables it is seen that after applying t test the t ratio is 0.0008 for right ybt scores which is extremely statically significant and 0.0003 for left ybt scores which is highly significant.

After applying t test the t ratio is 0.0001 for lefs scores which is extremely statically significant.

All the participants had a good significant increase in their lower extremity functional scale scores and y balance test scores.

DISCUSSION

The aim of the study is to see the effect of strength training of lower limbs in untrained young adults studying in physiotherapy colleges in and around Pune.

A total of 96 untrained young adults studying in physiotherapy colleges falling between age group of 18 to 25 years were the subject

population of this study.
Y balance test was used to compare the effect of strength training protocol in the participants. LEFS is used in this study to evaluate the effectiveness of an intervention.
Untrained young adults are operationally defined as individuals between the ages of 18 to 25 who have not completed formal vocational or academic training beyond high school.
Strength training is a widely recognized intervention for enhancing lower limb function and overall performance in various populations, including untrained young adults. In this experimental study, we aimed to investigate the effect of strength training on lower limb performance assessed through the Y Balance Test (YBT) among untrained young adults studying in physiotherapy colleges.
The findings of this study provide insights into the potential benefits of introducing structured strength training interventions in populations with limited prior experience in such activities.
Our research showed that YBT scores significantly improved after a regimented strength training program that targeted the lower limbs. These findings are in line with earlier studies showing how strength training improves stability, balance, and functional movement patterns. There are other reasons for the observed rise in Y balance test results. First, it's possible that the strength training regimen increased lower limb strength, which is necessary to preserve stability and control during dynamic movements. Exercises like lunges and squats have important muscle groups related to proprioception and balance, which enhances general functional ability. The training program's gradual progression helped the body adapt better. It also improved balance performance through systematic challenge and adjustment of the body.

Strength training helps improve an individual's ability to control their motions by focusing on the particular muscle groups that are involved in both dynamic movement and lower limb stability. In this study we have taken composite score of y balance test. Different activation patterns were seen in studies examining spinal and corticospinal excitability during the performance of a strength or balance-related task.
Physiotherapy programs that emphasize the value of strength training in preserving functional capacity and lowering the risk of injury can support a comprehensive approach to healthcare that includes preventative measures in addition to rehabilitation.

The subjects in our study showed notable gains in YBT performance despite having no prior strength training experience, demonstrating the neuromuscular system's responsiveness to structured exercise stimuli. Enhancing general body control and proprioception through strength training is beneficial for preserving stability and balance during dynamic exercises.
It is important to note that although Y balance test scores showed considerable increases, each person's improvement may have varied in size.
The degree of progress might vary depending on a number of factors, including the individual's responsiveness to exercise stimuli, training program adherence, and baseline fitness level.
Our researched showed a very significant change in the pre and post LEFS scores, hence we can say that the strengthening protocol which we used was effective on the participants.
Our results emphasize the need for personalized exercise prescription based on individual characteristics and training goals to optimize outcomes. With regards to the implications for training, our findings indicate that programs including all three components (i.e., balance, strength, and power) should be conducted to increase balance and muscular strength/power. This is supported by a study of Lacroix A, Klessig RW, Muehlbauer T, et al.
Comparative studies investigating different strength training modalities, dosages, and exercise progressions are warranted to identify the most effective training protocols for enhancing lower limb function in untrained young adults.

This experimental investigation concludes that a 4-week strength training program improves the Y balance test scores of young individuals without prior training enrolled in physiotherapy colleges. The significance in YBT scores that has been found highlights the effectiveness of focused strength training programs in improving dynamic balance and neuromuscular control in untrained young adults without training who are enrolled in physiotherapy colleges. The results highlight how crucial it is to include structured exercise programs in clinical and educational contexts in order to improve functional performance and musculoskeletal health. Through the promotion of a culture that values physical activity and exercise, healthcare providers may enable people to take charge of their own health and well-being.

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REFERENCES

[1] Shaffer SW, Tyeken DS, Lorenson CL, et al. Y balance test: a reliability study involving multiple raters. Military medicine. 2013;178(11):1264-1270

[2.] Butler RJ, Lehr ME, Fink ML, Kiesel KB, Plisky PJ. Dynamic balance performance and noncontact lower extremity injury in college football players: an initial study. Sports Health. 2013;5(5):417-422.

[3.] (2014) ACSM's guideline for exercise testing and prescription

[4.] Women's Health, published by Hearst, is a lifestyle magazine centred on health, sex, nutrition, and fitness. It is published ten times a year in the United States and has a circulation of 1.5 million readers.

[5.] Health behaviours & problems among young people in India: Cause for concern & call for action

[6.] Colbey Kinser edition 5th

[7.] American College of Sports Medicine: ACSM's Guidelines for Exercise Testing and Prescription, ed 6, Lippincott Williams & Wilkins, Philadelphia, 2000.

[8.] Chandler, JM, et al: Is lower extremity strength gain associated with improvement in physical performance and disability in frail, community-dwelling elders.

[9.] Muehlbauer, Thomas et al. "Associations Between Measures of Balance and Lower-Extremity Muscle Strength/Power in Healthy Individuals Across the Lifespan: A Systematic Review and Meta-Analysis." Sports medicine (Auckland, NZ)

[10] 2015 Functional Movement Systems, Gray Cook and Phil Plisky.

[11] The Lower Extremity Functional Scale (LEFS): scale development, measurement properties, and clinical application. North American Orthopaedic Rehabilitation Research Network. Phys Ther. 1999 Apr;79(4):371-83

[12] RELATIONSHIP BETWEEN THE Y BALANCE TEST SCORES AND SOFT TISSUE INJURY INCIDENCE IN A SOCCER TEAM Alfonso Calvo Gonell, MsN1 José Aurelio Pina Romero, MsN2 Loreto Macie Soler, PhD3

[13] Fusco A, Giannotti GF, Fuchs PX, Wagner H, da Silva RA, Cortis C. Y balance test: Are we doing it right? J Sci Med Sport. 2020 Feb;23

[14] Lee DK, Kim GM, Ha SM, Oh JS. Correlation of the Y-Balance Test with Lower-limb Strength of Adult Women. J Phys Ther Sci. 2014 May;26

[15]. RELATIONSHIP BETWEEN THE Y BALANCE TEST SCORES AND SOFT TISSUE INJURY INCIDENCE IN A SOCCER TEAM. Int J Sports Phys Ther. 2015 Dec;10

[16] Workplace musculoskeletal problems in occupational therapy students. BMC Public Health. 2021 Apr 26.

[17]. Eating Behaviour, Physical Activity and Exercise Training: A Randomized Controlled Trial in Young Healthy Adults. Nutrients. 2020 Nov

[18]. Title: "Effects of progressive resistance training on balance performance in older adults"
Authors: Liu-Ambrose T, Donaldson MG

[19]. Zouita S, Zouhal H, Ferchichi H, Paillard T, Dziri C, Hackney AC, Laher I, Granacher U, Ben Moussa Zouita A. Effects of Combined Balance and Strength Training on Measures of Balance and Muscle Strength in Older Women With a History of Falls. Front Physiol. 2020 Dec 23;11:619016. doi: 10.3389/fphys.2020.619016. PMID: 33424642; PMCID: PMC7786296.

[20]. Lacroix A, Kressig RW, Muehlbauer T, Gschwind YJ, Pfenninger B, Bruegger O, Granacher U. Effects of a Supervised versus an Unsupervised Combined Balance and Strength Training Program on Balance and Muscle Power in Healthy Older Adults: A Randomized Controlled Trial. Gerontology. 2016;62(3):275-88. doi: 10.1159/000442087. Epub 2015 Dec 9. PMID: 26645282.

[21]. Lesinski M, Hortobágyi T, Muehlbauer T, Gollhofer A, Granacher U. Effects of Balance Training on Balance Performance in Healthy Older Adults: A Systematic Review and Meta-analysis. Sports Med. 2015 Dec;45(12):1721-38. doi: 10.1007/s40279-015-0375-y. Erratum in: Sports Med. 2016 Mar;46(3):457. PMID: 26325622; PMCID: PMC4656699.

[22]. Zuo C, Bo S, Wang T, Zhang W. Functional and Traditional Resistance Training Are Equally Effective in Increasing Upper and Lower Limb Muscular Endurance and Performance Variables in Untrained Young Men. Front Physiol. 2022 Aug 31;13:868195. doi: 10.3389/fphys.2022.868195. PMID: 36117686; PMCID: PMC9471151.