The Effectiveness of Balance Training on Chronic Ankle Instability in Increasing Balance

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Abstract. Background. Decreased quality of life caused by balance disorders that occur in Chronic Ankle Instability causes disruption of physical activity such as decreased postural control, impaired joint stability and the occurrence of weakness in the ligaments in the legs. Someone who has a history of Ankle Sprain is at risk for re-injuring his ankle. Mobilization that is too fast and rehabilitation that is not good can cause sequelae and lead to Chronic Ankle Instability (CAI). This injury is a sequel to a previous injury that requires proper rehabilitation and one of them is Balance Training. Balance Training itself is a very effective method to restore balance to Chronic Ankle Instability. objective. Analyzing the Effectiveness of Balance Exercises on Chronic Ankle Instability at the age of 18-30 years in improving balance. Method. Literature review studies were conducted using PICO searches in several databases such as Google Scholar, Science Direct and Pubmed. Results. The results of a literature search found 7 articles that met the criteria and showed that Balance Training was carried out 3 times a week for 4 to 6 weeks with a duration of 45 minutes with a p-value of 0.001 which had a significant effect on increasing joint stability, functional and postural control in Chronic Ankle . Instability. Conclusion. Balance training significantly affects balance in Chronic Ankle Instability.

Key Words. Balance Training, Chronic Ankle Instabilty, Postural Control, Balance

INTRODUCTION

The most common injuries in the ankle area are Ankle Sprains, where almost 85% of Ankle Sprain cases involve ATFL (Anterior Talofibular Ligament).[1] 74%, who experienced this repetitive injury appeared to give up and did not continue therapy until.[2] Ankle sprains can occur due to the mechanism of lateral (lateral) movement of the ankle, including repeated inversion movements when the ankle performs a plantarflexed movement.[3]

Data from American football and basketball report ankle sprains as the most common injury with the highest reported injury prevalence at 1.34 per 1000 in those exposed.[4] Results Based on research from RISKESDAS 2013, the incidence of Ankle Sprain is around 27.5%. According to research by Hunt, 3861 cases of musculoskeletal injury were reported, 27% (1042) of which were ankle sprains.[5] Sports injuries themselves can occur in any part of the body depending on the location of the injury, but the term sports injury always refers to injuries to the musculoskeletal system.[6]

This injury can cause a person to experience disturbances and common sequelae such as pain, instability, crepitus and weakness. A person who has a history of Ankle Sprain is at risk for re-injuring his ankle. Too fast mobilization and poor rehabilitation can cause sequelae and lead to Chronic Ankle Instability (CAI). Decreased function and decreased muscle strength also affect the balance of an injured person in maintaining a static or dynamic body position. Treatment efforts that can be applied to cases of Chronic Ankle Instability in increasing stability and muscle strength in the legs are physiotherapy treatment.

According to the Regulation of the Minister of Health of the Republic of Indonesia No. 65 of 2015 Physiotherapy as a health worker can provide various forms of services to individuals and groups to restore movement and function. One of them is to increase the stabilization of the ankle by providing Balance Training. Balance training is done by doing one of the physical activities that aim to increase body stability by increasing lower extremity muscle strength.[7] Based on the review and some of the literature above, researchers are interested in conducting research on the analysis of the effect of Balance Training on Chronic Ankle Instability in adults in improving the balance of the Ankle area.

Ankle sprain is a condition where there is stretching or tearing of the lateral ligament complex. This happens because the foot is not ready to support it perfectly.[8] Ankle sprains are also often known as ankle injuries or ankle ligament injuries, in general, ankle sprains occur due to tearing of part of the ligament (torn partial ligament) or the entire ligament (torn ligament) and almost 85% of ankle sprains occur in the tissue structures of the lateral part of the ankle. the lateral complex ligament.[9]

Ankle Sprains affect 2 million people in America every year. In 1 year, Ankle Sprain from 2 to 7 per 1000 people increased based on data from emergency unit visits.[10] And nearly 70% of individuals with acute ankle injuries can become CAICAI within a short time after the initial injury. Based on various data sources and populations, it shows that the overall incidence of ankle sprain injuries is higher in women compared to men, namely 13.6 vs 6.9 per 1000 exposures.

There are three classifications of ankle sprain injuries namely: Grade 1: Overstretching of the ligaments, swelling but no instability, Grade 2: There are partial tears in the ligament, swelling and pain occur when doing movement, there is already a little instability, Grade 3: There is a complete tear in the ligament, there is swelling and severe pain when moving, and at this grade requires the help of crutches and a cast to move.[11]

Chronic Ankle Instability is a condition where there is repeated injury in a previous injury history and leaves many sequelae such as pain, edema, "giving away", and limited movement after repeated injuries to the lateral ankle ligament (Hertel, J., $ Corbett, R.O, 2019). Chronic Ankle Instability (CAI) or chronic ankle instability is a condition in the foot that experiences repeated instability at the lateral (giving away) ankle joint.[12]

Balance can be said as the ability to react quickly and also to maintain postural stability and to respond to external disturbances. This balance is very useful in maintaining posture and stability when moving in various positions. If the balance is not noticed, it can interfere with daily activities.[13]

There are 2 types of balance, static and dynamic. Static balance is where you maintain a position when there is no movement, for example when you stand and sit, while dynamic balance involves controlling the body when moving in a room, for example, sitting to standing to stand or walk. Dynamic balance is very important because humans are rarely silent without moving at all.[13]

Balance training is a physical activity whose purpose is to increase stability in the body by increasing strength in the lower extremity muscles.[14] Balance training has been recognized as an effective modality in the rehabilitation and prevention of relapse in patients with CAI.[15] There are several components that control balance in the human body, namely: components of sensory information (visual, somatosensory, vestibular), synergistic muscle responses,

muscle strength, adaptation.[16] Measurements for balance include SEBT (Star Excursion Balance Test), BBS (Berg Balance Scale), FAAM (Foot and Ankle Measure).[17]

There are several Balance Training programs for CAI sufferers, namely:

1. Hop to stabilization: In this exercise the position must be standing and then lifting one leg then doing movements such as jumping and doing it on the other leg alternately. This exercise is done 3x/week with 10x jumps 3 sets for 4 minutes. [18]
2. Single-limb–stance with eyes open and closed: In this exercise the position must be standing with the healthy leg lifted and then held with eyes open and eyes closed. This exercise is done 3x/week by holding for 60 seconds 2 sets for 3 minutes.[19]
3. Wobble board: In this exercise the position must be standing and then climbing onto the wobble board with both feet then this exercise is done 3x/week, holding 40 seconds for 5 sets for 6 minutes.[17]
4. Quadran Hop: In this exercise the position must be standing with one healthy leg lifted and then do this exercise 3x/week 3 sets of 10 repetitions in each direction (clockwise and counterclockwise).

Based on the above background, it can be formulated the problem that Ankle Sprain injury is an injury with a high prevalence. A person who has a history of ankle sprains is at risk for re-injury. Too fast mobilization and poor rehabilitation can cause sequelae and lead to Chronic Ankle Instability (CAI). One of the disorders that can occur in CAI is decreased stability in the ankle area. One of the efforts to deal with CAI in improving balance in the ankle area is by providing Balance Training. Therefore, the researchers formulated the problem in this study, The Effectiveness of Balance Training on Chronic Ankle Instability Ages 18-30 Years Old In Increasing Balance.

METHODS

Literature Search Strategy is The literature search strategy section consists of protocol and registration points, search database, and keywords.

Search Database : This literature review is a comprehensive summary of several research studies that are determined based on the theme of the Benefits of Balance Training on Chronic Ankle Instability at the age of 18-30 years in improving the balance of the Ankle area. The literature search was carried out in October – May 2022. The data used in this study were secondary data that were not obtained from direct observation, but were obtained from the results of research conducted by previous researchers. Search literature in this literature review using three databases, namely Google Scholar, Science Direct and Pubmed.

Keywords : Keywords are phrases that stand out in titles, body notes, and abstracts, which aim to perform a search to find all listings containing these keywords. Search articles or journals using keywords with PICO as follows:

P: Chronic Ankle Instability #1
I: Balance training #2
C:-
O: Improve Balance on ankle #3
Search #1 AND #2 AND #3
Search #1 AND #2 AND #3 AND Randomized Controlled Trial

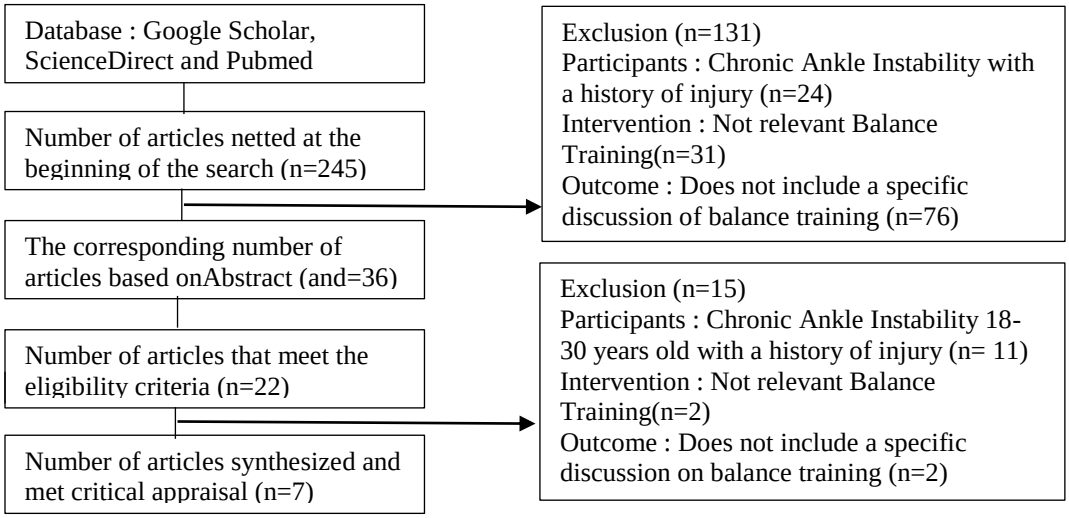
Criteria	Inclusion	Exclusion
Population	Chronic Ankle Instability18-30 years old	Chronic Ankle Instability with a history of seizures, fractures and other musculoskeletal injuries in the lower limbs
Intervention	Balance Training	Besides Balance Training
Comparators	There isn't any	There isn't any
Outcome	All measurement balance	There isn't any
Study Design and Publication Type	Randomized Controlled Trial	There isn't any
Publication years	2011 – 2021	< 2011
Language	English and Indonesian	other than English and Indonesian

Study Quality Assessment : Assessment of study quality is to exclude and include research that will be included in the literature review based on quality. After analyzing the methodological quality in each study (n=7) with a critical appraisal checklist. In the last screening, twenty studies met a 50% higher score and were ready for data synthesis.

Based on the results of a literature search through publications in three databases, namely Google Scholar, ScienceDirect and Pubmed. By using keywords that have been adjusted, the researchers obtained 245 articles. An

initial search found 100 on Google Scholar, then 32 on the Pubmed database, then 113 on the Science Direct database. After finding the article, the researcher did a screening based on the abstract (n=36) and eligibility criteria (n=22) whose theme was adjusted to the theme of the literature review. then at the last screening, we get (n=7).

Scheme 1. Search results



RESULTS

Table 1. Study Characteristics

Reviewer	Participant			Intervention		Measurment	Desain Study
	Stage	Intervention Group	Control Group	Experimental Group	Control Group		
Elsotoh, 2021[20]	Chronic	n= 22 20-21 years old	n= 10 20-21 years old	Cross-Education	No exercise	BBS	RCT
Kim, 2021[19]	Chronic	n= 15 Unknown	n= 15 Unknown	Balance Training Program	No exercise	FAAM	RCT
Uzlaşır, 2021[21]	Chronic	n= 19 Unknown	n= 18 Unknown	Strobe Program	No exercise	SEBT	RCT
Spencer Cain, 2020[22]	Chronic	n= 23 22-24 years old	n= 20 22-24 years old	The resistance-band	No exercise	FAAM	RCT
Minooneja, 2019[23]	Chronic	n= 14 22-23 years old	n= 14 22-23 years old	Hop-Training	No exercise	FAAM	RCT
Ardakani, 2019[24]	Chronic	n= 14 22-23 years old	n= 14 22-23 years old	Hop Stabilization	No exercise	FAAM	RCT
Burcal, Jeon, 2019[25]	Chronic	n= 8 21 years old	n= 7 21 years old	Balance Training Program	No exercise	SEBT	RCT

Based on the literature search strategy, the researcher found that out of 101 results the mean was dominated by 65 women and 36 men with Chronic Ankle Instability, with a mean age of 20-24 years. Of the many literatures found, most of the results came from the United States.

Table 2. Detail of Intervensions

Reviewer	Type of Intervention	Therapeutic Dosage				Duration
		F	I	T	T	
Elsotoh, 2021[20]	Single Limb Stance Exercise, Step-Down with Ssingle-Limb Stance Exercise	3 Sets	Hold for 60 second 10 reps	Balance	40 minutes	3 times a week for 6 weeks
Kim, 2021[19]	Single-Limb Stance on The Floor	2 Sets	Hold for 60 second 10 reps	Balance	44 minutes	3 times a week for 6 weeks
Uzlaşır, 2021[21]	Single-leg balance with eyes open and closed	2 Sets	10 reps	Balance	40 minutes	3 times a week for 6 weeks
Spencer Cain, 2020[22]	Resistance-Band, Biomechanical Ankle Platform System Board Intervention	2 Sets	10 reps	Balance	40 minutes	3 times a week for 4 weeks
Minooneja, 2019[23]	Hopping Side to Side on Both Legs,	2 Sets	10 reps	Balance	60 minutes	3 times a week for 6 weeks
Ardakani, 2019[24]	Hopping Exercise, Square Shape Hop	2 Sets	10 reps	Balance	30 - 40 minutes	3 times a week for 6 weeks
Burcal, Jeon, 2019[25]	Hop to Stabilization, Single limb Eyes-Open and Eyes-Closed	3 Sets	10 reps 3 reps	Balance	30 - 40 minutes	3 times a week for 4 weeks

Based on the research that has been done, the researchers found that there are several types of Balance Training movements to improve balance in Chronic Ankle Instability, namely Single Limb Stance Exercise, Step-Down with Ssingle-Limb Stance Exercise, Single-Limb Stance on The Floor, Single-leg balance with eyes open and closed, Resistance-Band, Intervention Plank Biomechanical Ankle Platform System, Side-to-Side Jumping Both Legs requested on Affected Limbs With Static And Dynamic Components with exercise duration 2 - 3 intensity sets of 10 reps with a time of 30- 40 minutes for 3 times a week for 6 weeks Using the Balance Stability BBS, FAAM, SEBT.

Table 3. Mean of Intervensions

Reviewer	Measurment	Experiment Group		Control Group		V- Palue
		Pre	Post	Pre	Post	
Elsotoh, 2021[20]	BBS	2.20 ± 0,57	1.64 ± 0,42	2.38 ± 0,61	2.38 ± 0,54	P<0,05
Kim, 2021[19]	FAAM	79.6 ± 6.2	69.6 ± 6.2	72.50 ± 9.325	67.29 ± 6.252	P<0,001
Uzlaşır, 2021[21]	SEBT	5.20 ± 0.20	5.11 ± 0.22	4.65 ± 0.20	4.93 ± 0.22	P<0,001
Spencer Cain, 2020[22]	FAAM	87.40 ± 8.07	89.68 ± 9.24	89.07 ± 10.14	91.02 ± 9.38	P<0,001
Minooneja, 2019[23]	FAAM	84.5 ± 4.3	92.4 ± 10.1	81.7 ± 6.2	81.6 ± 6.4	P<0,5
Ardakani, 2019 [24]	FAAM	32.1 ± 12.4	44.3 ± 15.3	32.32 ±11.98	32.32 ± 11.98	P<0,05
Burcal, Jeon, 2019[25]	SEBT	74.71 ± 5.37	80.38 ± 4.03	79.70 ± 4.19	4.99 ± 3.32	P<0,5

Based on the table above, when compared to the control group, the intervention group showed good improvement and significant results.

DISCUSSIONS

Of the seven articles that have been reviewed, Balance Training can improve balance with significant results (p <0.05) given to Chronic Ankle Instability. Balance Training is given with a minimum duration of 30 minutes to 60 minutes and Balance Training is given 6 weeks. These results are supported by research conducted by Elsotoh (2021), Kim (2021), Uzlasir (2021), Minooneja (2019) and Ardakani (2019).[19–21,23,24] As for those who apply Balanced Training with a minimum of 4 weeks to get significant results (P < 0.001) these results are supported by Spencer Cain and Burcal Jeon research.[22,25] In this study the balance training used was the balance training program, strobe program, the resistance-band, hop-taining and hop stabilization with an average frequency of 2-3 sets with an intensity of 10 repetitions for 30-40 minutes.

Balance training is an exercise that is often used to train balance which is useful for ankle instability because it improves static balance and reduces the occurrence of repetitive injuries.[17] In addition to research conducted by Donovan et al., 2016,[8] Anguish & Sandrey, 2018,[7] McKeon et al., 2008[15] states that Balance Training is also aimed at increasing ROM, strength, proprioception, and neuromuscular control in patients CAI. In Elsotohy et al.'s research, 2021;[20] Wright & Linen, 2017;[17] Minonejad et al., 2019;[23] Ardakani et al., 2019[24] stated that Balance Training can help CAI sufferers not to limit physical activity and daily activities for years after injury.

Research conducted by Cruz-Diaz., et all (2014) states that Balance Training exercises can be used to prevent and rehabilitate chronic ankles.[26] These physiological changes can result in more effective proprioceptive feedback, thereby improving balance and ankle joint mechanics. Additionally, Balance Exercises have been shown to be effective in reducing the risk of chronic ankle sprains in those with a history of the injury. Then in a study conducted by Burcal et al., 2017 stated that Balance Training is an effective intervention strategy to improve postural control and reduce the risk of recurrent ankle sprains in those who have a history of ankle sprains.[25]

Several researchers, such as those conducted by Cruz-Diaz et al., 2014; Cruz-Diaz et al., 2015; Kim et al., 2021 also revealed that Balance Training can effectively stimulate the ligaments in the ankle which can increase their sensory output and can improve postural control.[19,26,27] Then in research conducted by Mettler et al., 2015 stated that postural control requires integration of visual, vestibular, and somatosensory input. Somatosensory input combines contributions from skin, articular, and musculotendinous receptors. The afferent information gathered from these 3 sources is processed in the central nervous system and used to control motor commands. Lack of contribution from one of the afferent receptors can lead to reduced postural control. Postural control deficits have been found repeatedly in patients with CAI and therefore balance exercises play an important role in improving postural control for those with a history of CAI injury.

In research conducted by Wright et al., 2017 it is proven that Balance Training can improve functional abilities and reduce pain. Then several studies such as those conducted by Spencer Cain et al., 2020; Uzlaşır et al., 2021; Jain et al., n.d., 2016 stated that Balance Training has been shown to gradually improve individual functional outcomes with CAI.[21,22]

Of the seven sources of literature regarding Balance Training in improving balance in Chronic Ankle Instability, we found that the types of exercises given did not specify which exercises were most effective for ages 18-30 years. So that further research is still needed regarding the type of Balance Training exercise that is most effective in improving balance in CAI aged 18-30 years with the hope that more specific information about some of the exercises can be used as reference material for the community or institutions.

CONCLUSIONS

Balance Training can help cai increase muscle tone in the lower extremities, thereby helping dynamic-static balance changes and reducing the incidence of repetitive injuries. This exercise can be performed both in Europe and Asia with the appropriate dosage accompanied by a professional physiotherapist.

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