



The relationship between upper cross syndrome posture and shoulder disability

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ABSTRACT

Background: Crossfit is a high-intensity sport that has the potential for injury risk. Upper cross syndrome posture increases muscle tension in the upper region, resulting in pressure on the neck and shoulders, pain, numbness, and decreased body function. This research aimed to determine the relationship between upper cross syndrome posture and shoulder functionality among cross fitter in Bali.

Methods: The study was an analytical observational study with a cross-sectional design conducted from November 2023 to February 2024 with the main target population for this study being CrossFit practitioners at Crossfit Bali who experienced upper cross syndrome posture. The exclusion criterion is a history of a shoulder injury. The sample size was 50 people who had upper cross syndrome posture. This study used purposive sampling and the measurement of upper cross syndrome posture was used the REEDCO posture test Tragus to Wall test and Shoulder Pain and Disability Index.

Results: It was found that 35 people had forward heads, 30 people had rounded shoulders, 33 people had uneven shoulders, and 8 people had tilted heads. Results of the decrease in functional shoulder using the SPADI test showed a mild decrease in 47 people (94%) and a moderate decrease in 3 people (6%). Results of the correlation test with the Spearman rho test, which is 0.647, it is stated the results are not related.

Conclusion: There was no relationship between upper cross syndrome and functional shoulders in CrossFit in Bali.

Keywords: CrossFit, functional shoulder, and upper cross syndrome.

Cite This Article: Wiranatha, M.B.K., Putra, I.P.Y.P., Saraswati, P.A.S., Kinandana, G.P. 2024. The relationship between upper cross syndrome posture and shoulder disability. *Physical Therapy Journal of Indonesia* 5(2): 137-141. DOI: 10.51559/ptji.v5i2.209

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Received: 2024-03-02

Accepted: 2024-06-07

Published: 2024-07-12

BACKGROUND

The world of sports is evolving rapidly, and one of the most popular is CrossFit. Crossfit currently exists in 142 countries with more than 10,000 workouts.¹ Crossfit is a sport focusing on functional daily movements with a combination of various types of competitive exercises, which aim to train cardiovascular endurance and increase stamina, strength, flexibility, speed, coordination, agility, and individual balance.² Crossfit performed at high intensity at a fast pace and consecutively with limited rest periods is known as a work of the day (WOD). WOD are designed for each cross fitter with different times and intensities. High intensity of WOD in crossfit has the injury potential in crossfitter. Most injuries are caused by several factors, such as overuse, external factors (improper selection of

intensity, duration, and type of exercise), and internal factors (lack of coordination between muscles and joints, lack of warm-up and cool-down, and movement errors). These conditions can be exacerbated by the practitioner's behavior by positioning the body posture improperly when exercising.³

Upper cross syndrome is a posture abnormality on the upper body region, due to muscle imbalance. Muscle imbalance occurs because of the weak muscles and tense muscles. For weak muscles, such as rhomboid m., serratus anterior m., middle trapezius m., and lower trapezius m., for tense muscles, which are upper trapezius m., pectoralis major m., and levator scapula m.⁴ These abnormalities can cause structural changes in the body, such as forward shoulders, kyphosis, forward head posture, rounded shoulders, humpback, a reduced degree of lordosis

in the cervical, and the occurrence of emphasis on the neck and shoulder, and can cause pain, numbness, can reduce neurological function, musculoskeletal function, and biokinematic function of the body.⁵ In addition, upper cross syndrome can interfere with shoulder function. Especially in an athlete who performs overhead movements continuously or provides excessive loading to the shoulder will lead to muscle imbalance a high risk of injury and decreased performance and functional movement in athletes.⁶ The high intensity of CrossFit exercises can cause high shoulder injuries, especially in the upper body region, namely the shoulder. One of the causes of these injuries is the practitioner's body posture such as upper cross syndrome, this is caused by decreased neurological function, musculoskeletal function, and biomechanical function in CrossFit practitioners.

METHODS

The study was an analytical observational study with a cross-sectional design conducted from November 2023 to February 2024 with the main target population for this study being CrossFit practitioners at Crossfit Bali who experienced upper cross syndrome posture. For this reason, it requires several inclusion criteria, such as having practiced CrossFit for a minimum of 5 months, aged 20-50 years, and having upper cross syndrome posture. As well as exclusion criteria, which is a history of shoulder injury. The sample size was 50 people who had upper cross syndrome posture.

In this study, the upper cross syndrome is a postural problem in a person with the involvement of muscle weakness and tension resulting in abnormalities in the person's posture. Measurement of the upper cross syndrome can be conducted by two measurements, namely the Tragus to Wall Test to obtain data objectively with categories, which are category 0 = <10 cm; category 1 = 10-12.9 cm; category 2 = 13-15.9 cm; category 3 = 16-18.9 cm; category 4 = 19-21.9 cm; category 5 = 22-24.9 cm; category 6 = 25-27.9 cm; category 7 = 28-30.9 cm; category 8 = 31-33.9 cm; category 9 = 34 -36.9 cm; category 10 = \geq 37 cm. As well as the REEDCO posture test to determine the type of data subjectively. The level of decline in shoulder motion function objectively can be measured using the shoulder pain and disability index (SPADI). The final results of this SPADI value can be categorized into 5 pieces, namely mild shoulder pain and disability (0-20), moderate shoulder pain and disability (21-40), severe shoulder pain and disability (41-60), very severe shoulder pain and disability (61-80), extremely severe shoulder pain and disability (81-100).

RESULTS

In this study, the research subjects were practitioners aged 21-50 years at Crossfit Bali, with purposive sampling. Based on Table 1, 31 people (62%) were male and 19 people (38%) were female. Based on age, namely 21-30 years of age totaling 21 people (42%), 31-40 years of age totaling 16 people (32%), 41-50 years of age 13

Table 1. Characteristics and frequency of subject

Characteristic	Frequency	Percentage (%)	Mean	SD
Age				
21 - 30	21	42		
31 - 40	16	32		
41 - 50	13	26		
Total	50	100	34.42	± 7.86
Gender				
Male	31	62		
Female	19	38		
Total	50	100		
Duration of Crossfit				
5 month \leq x < 1 year	14	28		
1 \leq x < 3 year	10	20	3.49	± 3.015
3 \leq x < 5 year	10	20		
5 \leq x \leq 11 year	16	32		
Total	50	100		
Tragus to wall score				
Positive	46	92		
Negative	4	8		
Category TTW score				
0 (<10 cm)	4	8		
1 (10 - 12,9 cm)	21	42		
2 (13 - 15,9 cm)	21	42	12.73	± 1.97
3 (16 - 18,9 cm)	4	8		
Total	50	50		
Type of UCS				
Forward head	35	70		
Rounded shoulder	30	60		
Uneven shoulder	33	66		
Tilted head	8	16		
Total	50	100		
Spadi score				
Mild	47	94		
Moderate	3	6	8.06	± 7.43
Total	50	100		

SD, standard deviation.

Table 2. The correlation between upper cross syndrome and functional movement of the shoulder

Variable Collation	Correlation coefficient	p-value
Upper cross syndrome	0.066	0.647
Functional movement of shoulders		

people (26%).

Based on Table 1 about the frequency of doing CrossFit exercises, namely the range of 5 months \leq x < 1 year with a frequency of 14 people (28%), exercises from 1 \leq x < 3 years with a total of 10 people (20%), 3 \leq x < 5 years totaling 10 people (20%), 5 \leq x \leq 11 years totaling 16 people (32%).

Table 1 also describes the interpretation of the Tragus to wall (TTW) Score, the results obtained are positive interpretations (with the results of the tragus position more than 10 cm), namely a total of 46 people (92%), and negative results, namely a total of 4 people (8%).

Based on the Tragus to wall (TTW) Score category, the results showed that a total of 4 people were included in category 0, with a tragus distance < 10 cm, then 21 people were included in category 1 with a tragus distance of around 10 - 12.9 cm. And 21 other people belong to category 2, namely with a tragus distance of 13-15.9 cm. Another 4 people are included in category 3 by having a tragus distance of 16-18.9 cm.

Based on Table 1 about the type of upper cross syndrome based on the REEDCO postural test forward head was 35 cases (70%), then those experiencing

rounded shoulders were 30 cases (60%), uneven shoulders were 33 cases (66%) and tilted head cases were 8 cases (16%). Based on the decrease in functional shoulder motion, it only decreased slightly, namely to a mild level with a frequency of 47 people (94%), while the decrease to a moderate level only occurred in 3 people (6%).

According to the results of the relationship between both upper cross syndrome posture and functional movement of the shoulder, there is no relationship between the two. This is evidenced by the result of p -value=0.647, where there is a relationship if $p < 0.05$.

DISCUSSION

It was found that the population of CrossFit practitioners was dominated by men, 31 people (62%), and women 19 people (38%). The prevalence of men participating in competitive, strength and aerobic exercises regularly is greater than that of women, where women dominate in walking exercises and recreational exercises. This is because there is a barrier that causes women to exercise less. After all, they take care of the household, children, or parents, and in addition, the male-dominated room can cause a sense of intimidation and burden for women for various reasons.⁷ In terms of performance such as trunk stability, power, mobility, balance, repetitions, and functional movements of the whole body, men are superior to women. However, gender itself cannot be said to be an indicator of the cause of changes in body posture in a bad direction, because changes in posture are generally caused by the lifestyle and workload of the individual.⁸

The highest age doing crossfit exercises at Crossfit Bali is dominated by 21-30 years old which amounted to 21 people (42%), then 31-40 years old with a total of 16 people (32%), and 41-50 years old as many as 13 people (26%). The high number of young people who do CrossFit exercises is because there has not been any muscle mass loss which is a direct cause of decreased muscle strength.⁹ Changes in muscle mass occur due to disturbances in protein synthesis and degradation that occur from the age of 30 years and over, which will affect body balance, decrease

functional movement, and will be able to change the body posture of the athlete. So when you are still in your 20s, it is the peak age for explosive power performance from both the upper body and lower body, as well as sprint events.¹⁰

The experience of doing CrossFit exercises is very diverse, starting from a range of 5 months to less than 1 year with a frequency of 14 people (28%), exercises from a range of 1 year to less than 3 years with a total of 10 people (20%), a range of 3 years to less than 5 years totaling 10 people (20%), a range of 5 years to 11 years totaling 16 people (32%). The more routine aerobic exercises and functional movement exercises for at least 6 weeks, such as running, jumping, lunges, and so on. It can increase functional movement and also help to improve body posture.¹¹ However, from research conducted by Salsali, *et al.*, 2023, it appears a lack of influence between the time of doing physical activity such as exercising on the shape of the body's posture.¹²

Based on the results of the measurement of the upper cross syndrome. The Tragus To Wall (TTW) Score, objective results were obtained, namely positive interpretation (with the results of the tragus position more than 10 cm) in 46 people (92%), and negative results in 4 people (8%). With the following category results, a total of 4 people are included in category 0, by having a tragus distance of less than 10 cm, then 21 people are included in category 1 with a tragus distance of around 10 - 12.9 cm. Another 21 people belonged to category 2, with a tragus distance of 13-15.9 cm. Four other people are included in category 3 by having a tragus distance of 16-18.9 cm. According to Haryo, *et al.*, 2021 the prevalence of forward head posture at the age of 20-30 years is around 60%.^{13,14} Women are more likely to experience forward head posture with a ratio of 24.1% and men are only 9.1%.¹⁵

Based on the subjective results examination for upper cross syndrome using the REEDCO posture test, it was found that forward head cases were 35 cases, then those with rounded shoulders were 30 cases, those with uneven shoulders were 33 cases and those with tilted head cases were 8 cases. The high number who experience upper cross syndrome

can be caused by work and daily habits, especially when playing smartphones, or watching TV with poor body posture for a long period. So that it can cause pain and changes in body kinematics.¹⁶ As well as the movement of exercises in CrossFit such as pull-ups, clean squats, push-ups, rowing, planks, and so on require power and endurance from muscle groups to complete one repetition and set.¹⁷ When there is one muscle weakness in the muscle group, the power, and endurance will be greater in the muscles that are not experiencing weakness, which can result in more dominant or stronger movements on one side. As well as facilities and classes to train specifically muscle weaknesses are still insufficient.¹⁸

Based on the examination of functional movement in the shoulder, it was found that it only decreased slightly reaching the mild level by a frequency of 47 people (94%), while this moderate level decrease only occurred in 3 people (6%). This low SPADI score obtained is due to two things, one of them is that CrossFit serves to improve the movement ability of each individual by doing a variety of exercises such as gymnastic exercises, weightlifting, and metabolic exercises. According to Bashir M., *et al.*, 2022 states that if performing functional movement exercises for at least 6 weeks regularly, such as running, jumping, lunges, and so on.¹⁹ It can increase the functional movement of athletes. As well as the duration of training each week can also affect the functional shoulder, the more often the person exercises, the lower the percentage of functional shoulder movement decreases.²⁰ So the results of the SPADI score are quite low, which is caused by the pain scale value which is quite low after 10-20 minutes of doing exercises. Muscle pain is experienced the highest after 10 minutes of doing exercises, with a Visual Analogue Scale value of 4/10, and will decrease after 24 hours.²¹

This study shows the results that there is no relationship between upper cross syndrome and functional shoulder in CrossFit practitioners, this is indicated by a p -value of 0.647 which is below the significance value of the p -value of 0.05. Previously in the hypothesis it was stated that having upper cross syndrome could

reduce the functional movement of the person. This hypothesis is different from the results obtained from this study.²² Although a person has a bad upper body posture that can reduce the functional movement of the shoulder or can cause pain in the sample. Posture does not always cause pain and reduce functional movement, but when the upper body muscles have been trained, the decline can be overcome.²³

Decreased functional movement and pain due to exercise can be caused by delayed onset muscle soreness (DOMS), which occurs 12-24 hours after exercise and will subside in 5-7 days. DOMS occurs due to repetitive eccentric and concentric movements that cause small tears in the muscles resulting in pain and limitation of body movement.^{24,25} These repetitive movement patterns also occur in CrossFit sports. However, in this study, the researchers conducted the study right after the practitioners performed CrossFit exercises, which had minimal chances of functional movement shoulder decrease.²⁶ Decreased functional movement is due to increased muscle stiffness and muscle pain after exercises. The highest increase in muscle stiffness was 24 hours after the exercises with a value of 462.66 ± 47.33 Joules (measured by myometer). However, the muscle stiffness value for 10 minutes after the exercises was only around 438.10 ± 36.62 Joules. This means that muscle stiffness after exercise can cause soreness in the sample so that there is a decrease in functional movement especially for 12-24 hours after exercise and will experience a decrease in muscle stiffness in the next hour.²⁷

In this study, there were several limitations. Firstly, researchers were less able to control external factors, which is to pay further attention to the impact of decreased functional movement on the shoulder after 12 hours of CrossFit exercises. This study paid less attention to BMI, intensity, and duration of exercises each week, as well as the type of work and activity of the research sample, which is important to review the causes of body posture conditions and the possibility of decreased functional movement and review pain.

CONCLUSION

Based on the results of this study, the correlation results obtained which ranged from 0.647 which means that there is no relationship between upper cross syndrome and functional shoulder in CrossFit practitioners in Bali.

ETHICAL CLEARANCE

The Research Ethics Commission, College of Medicine, Universitas Udayana, stated that this research is ethically feasible with number 2723/UN14.2.2.VII.14/LT/2023.

CONFLICT OF INTEREST

The author declares that there is no conflict of interest.

FUNDING

No organization has provided funding for or sponsorship of this study.

AUTHOR CONTRIBUTIONS

MBKW conceived the study design, collected and analyzed the data, and drafted the manuscript; PAM, IAIPD, NMWHA, GAKATD, and AAIQMP interpreted the data analysis and drafted the manuscript.

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