



Injury Causes and Recovery Management Strategies among Singapore CrossFitters

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Abstract

CrossFit is a combination of movements from various sport disciplines such as Olympic Weightlifting, Powerlifting and Gymnastics executed at high intensity. It has shown to bring about physiological and psycho-social benefits to members, increasing exercise adherence. Established in 2005, CrossFit has seen an exponential growth since, with 13,991 CrossFit affiliates worldwide. The popularity of the program despite its disposition to injury requires greater attention to its safety. This research aims to understand (1) reasons of injury among CrossFitters; (2) Injury management techniques among CrossFitters. In-depth interviews were conducted with nine CrossFitters from five Singapore CrossFit affiliates. Data was transcribed and thematically analyzed. Findings revealed that causes of injury include poor workout program designs, insufficient physiological knowledge passed down from coaches to athletes, athlete's impatience when learning new skills as well as athletes conforming to performance and peer pressures. Further, Crossfitters manage their injuries through self-care physiological means and with professional guidance. The study concludes that coaches play a vital role in both the prevention and management of injuries. Therefore, they should design their programs with the athlete's safety in mind and foster an environment that values patience, strength building discipline and safety. Athletes should also pay extra attention to their movement technique and be self-reflective in their physical capabilities. All athletes should regularly practice conservative physiological recovery methods and seek treatment or diagnosis from medical practitioners when necessary.

INTRODUCTION

CrossFit is a strength and conditioning program which aims to optimize physical competencies across 10 fitness domains – cardiovascular, endurance, stamina, strength, flexibility, power, speed, coordination, agility, balance and accuracy (CrossFit, 2019). This fitness regimen incorporates movements from a variety of sports – Olympic Weightlifting, Powerlifting and Gymnastics amongst many others (CrossFit, 2019). CrossFitters are presented a Workout of the Day (WOD) daily, consisting of a combination of functional movements executed at high intensity. Emphasis is placed on either (1) maximum repetitions in a given time or (2) finishing a certain number of repetitions in the shortest time possible, focusing on movement efficiency (Summitt et al., 2016). CrossFit prides itself for its scalability in terms of load progressions and movement modifications, keeping it accessible for individuals of varying strength and fitness levels (Montalvo et al., 2017). Established in 2005, CrossFit now has 13,991 CrossFit affiliates worldwide (CrossFit, n.d.). The number of athletes worldwide signing

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up for the annual CrossFit Opens, a 5-weeks CrossFit online competition, has also increased substantially, from approximately 26,000 athletes in 2011 (Tabata Times, 2014) to 358,646 in 2019 (Balf, 2019).

Past studies reported the physiological benefits of CrossFit, including improvements in body composition and maximal aerobic capacity after 10 weeks (Smith et al. 2013). Improvements in work capacity were also experienced by US army soldiers after 6 weeks (Paine et al., 2010). When compared to conventional gym members, CrossFitters experience a significantly greater sense of belonging to their community (Kuhn, 2013; Dawson, 2017). Higher levels of intrinsic motivation such as enjoyment and challenge were also experienced by CrossFitters (Fisher et al., 2016). Such positive experiences were reported to be positively correlated to higher exercise adherence rates as compared to standard aerobic and resistance training groups (Heinrich et al., 2014; Meyer et al., 2017).

However, CrossFit has also received a reputation of being high injury in nature. It has been criticized for the high volumes of technically demanding movements and the lack of proper education among CrossFit coaches (Simmons, 2014). CrossFit also has been criticized for not adhering to recognized fitness guidelines such as the lack of rest between sets and high-volume training sessions, thereby promoting high levels of overuse, overreaching and overtraining among athletes (Bergeron et al., 2011). The lack of sports science knowledge among CrossFit coaches, high volumes of technically demanding movements, and athletes performing exercises with flawed techniques were also discussed as potential causes of injuries (Mullins, 2015). Fatigue induced from the high intensity demands of CrossFit was also shown to decrease concentration levels, leading to athletes performing multi-joint power movements or lifting heavy weights with erroneous technique, increasing injury risk (Montalvo et al., 2017; Parkkari et al., 2008; Keogh & Winwood, 2017). Furthermore, rhabdomyolysis was also known among CrossFitters, which is when muscles break down during excessive exercise, inducing kidney intoxication (Robertson, 2017; Ross, 2018).

Past studies have analyzed injury prevalence rates among CrossFitters through survey instrumentation. However, the timelines to which researchers looked into differed across studies, resulting in mixed results. Injuries sustained 6 months prior to survey completion provided mixed results of 56.1%, 26% and 19.4% (Mehrab et al., 2017; Montalvo et al., 2017; Weisenthal et al., 2014). A higher injury prevalence rate of 30.5% was reported for injuries sustained 12 months prior to completing the survey (Feito et al., 2018). Similarly, when researchers looked into injuries sustained during CrossFit, with no specific timeline given, a higher prevalence rate of 34%, 73.5% and 31% were obtained (Aune & Powers, 2017; Hak et al., 2013; Sprey et al., 2016).

The most common injury locations include the knee, lower back and shoulder (Aune & Powers, 2017; Feito et al., 2018; Hak et al., 2013). This is similar to injuries attained among Olympic weightlifters and powerlifters (Aasa et al., 2017). Shoulder injuries were attributed mainly to executing gymnastics and Olympic weightlifting movements while lower back injuries were mainly due to powerlifting movements (Claudino et al., 2018; Summitt et al., 2016; Weisenthal et al., 2014; Klimek et al., 2018). Other factors such as competitiveness, height, mass and lack of experience were also found to increase injury risks (Aune & Powers, 2017; Feito et al., 2018; Mehrab et al., 2017; Montalvo et al., 2017). Athletes commonly attributed their injuries to overexertion, improper technique and relapse of old injuries (Aune & Powers, 2017; Mehrab et al., 2017; Summitt et al., 2016).

Currently, there exists many quantitative studies on the prevalence of injuries among CrossFitters. However, a limited body of qualitative studies have been done on this topic. Qualitative studies utilize the experiences and thoughts of CrossFitters to gain a deeper and holistic understanding on why injuries occur. Thus, allowing CrossFit coaches and athletes to pay more attention to injury-causing behaviors, hopefully reducing the frequency of injuries. Previous studies have also yet investigate ways CrossFitters manage their injuries for them to sustain their training regimen and prevent future injuries. This research aims to understand (1) reasons of injury among CrossFitters; (2) Injury management techniques among CrossFitters.

METHODS

Participants

Participants with a minimum of 2 years CrossFit experience, actively training in a Singapore CrossFit affiliate and with previous musculoskeletal injuries from CrossFit were eligible for the study. Following similar studies, a musculoskeletal injury was defined as “any new musculoskeletal pain, feeling, or discomfort as a result of a CrossFit workout that met one of the following criteria: (1) Total

removal from CrossFit training and other outside routine physical activities for >1 week; (2) Modification of normal training activities in duration, intensity, or mode for >2 weeks; (3) Any physical complaint severe enough to warrant a visit to a health professional” (Aune & Powers, 2017; Feito et al., 2018; Mehrab et al., 2017).

Purposive sampling was done to recruit 9 participants from 5 Singapore CrossFit affiliates. 6 participants identified as CrossFit coaches (3 recreational athletes, 3 competitive athletes) while the other 3 identified as recreational athletes. Athletes sustained an average of 2 injuries (range = 1 to 3) from CrossFit, with most of its injuries sustained at the lower back (n= 7) followed by shoulders (n= 6) then wrist (n= 4) and knees (n= 2). Characteristics on the various participants were presented in Table 1. Participants were referred to by numbers throughout the report to protect their identities.

Table 1. *Characteristics of Participants*

Participant No.	Age	Training Experience	Coaching Experience	Training Sessions per Week	Training Hours per Week	Location of injuries
1	28	4 years	4 years	9	18	LB, K, W
2	31	9 years	5 years	7	7	LB
3	30	10 years	6 years	5	5	LB, W, S
4	22	3 years	-	5.5	11	LB, S
5	22	6.5 years	-	3	3	LB, W, S
6	27	2 years	-	6	6	S
7	24	2 years	6 months	9	22.5	LB, W
8	26	4 years	2.5 years	6	12	S, K
9	26	8 years	6 months	10	20	LB, S

Note. LB = Lower Back; K = Knee; W = Wrist; S = Shoulder

Data Collection

Upon approval from the institutional research ethics board, semi-structured in-depth face-to-face interviews were conducted at a conducive location and time provided by the participants. Prior to the interview sessions, the researcher explained the background and aims of the study before getting participants to sign the required consent forms (appendix B). Interviews lasted 30 to 45 minutes and were digitally recorded by the researcher’s personal hand-held device. The interviews consisted of broad open-ended questions followed by spontaneous probes and follow-ups (appendix C) (Schneider et al., 2017). Interview questions focused on understanding (1) the participants; (2) What and how participants sustained their injuries; (3) How participants managed their injuries; (4) What will Coaches tell their clients when they do sustain an injury. The intimate yet focused conversation provides a comfortable setting for participants to provide diverse, in-depth and detailed thoughts and responses as well as giving participants the chance to contribute novel ideas that may not have been thought of by the researcher (Schneider et al., 2017). After the interview, participants were sent their transcripts with the relevant interpretations for member check.

Data Analysis

All interviews were transcribed in verbatim. Transcription notations were adapted for easier comprehension (Poland, 2002). Interviews were thematically analyzed following the guidelines offered by Braun and Clarke (2006) and Langdridge (2004). There were 3 steps following this data analysis – Descriptive coding, interpretative coding, generating overarching themes. The researcher got familiar with the contents of the transcripts 1 by 1, before highlighting and commenting on relevant material. Descriptive codes were then established. Descriptive codes from all the transcribes were then clustered together and interpreted, forming interpretative codes. Interpretative codes were then clustered and grouped under higher order, more abstract themes.

RESULTS AND DISCUSSION

Semi-structured in-depth interviews were conducted with nine participants (five males, four

females) to gain a deeper and holistic understanding of the reasons for injury and injury management techniques among CrossFitters. Two overarching themes were generated to answer the two research questions respectively.

Causes of Injuries among CrossFitters

Accounts revealed that poor program designs, passing down insufficient physiological knowledge as well as athletes' skewed mindset towards training were causes of injury among CrossFitters.

Program Design

Participants mentioned that program designs could put athletes at risk of injury. The lack of proper warm-up prior to WODs was said to be one of the reasons for participants to sustain injuries.

In 1 hour, the Coach would have to squeeze...a strength portion, WOD portion and then the warming up portion... Usually like 5 minutes or like 10 minutes with minimum warming up... I guess different people need different amount of warming up and probably for me that day, I just need more. (Participant 4)

Furthermore, many participants attributed the high intensity and weights used during WODs as a reason for their injuries. Participant 5 mentioned "I was tired, and it was heavy" Similarly, participant 9 mentioned "I was just doing a fast workout, so I was doing cleans to box jumps to a max out row... It (lower back) just tighten up straight away". The fatigue experienced during WODs could also lead to a decrease in focus on technique, increasing the risk of accidental injuries from occurring. Participant 1 mentioned "We workout under fatigue right... You are not focusing. Shit happens".

Insufficient Physiological Knowledge

Accounts mentioned the lack of physiological knowledge passed down from the coaches to athletes as another cause of injury. Athletes associated carrying lighter weights with the lack of muscular development. Participant 2 mentioned "if I go lighter this week then you know, like I will get weaker" which led her to carry the same weight every week despite feeling pain in her lower back. Similarly, participants observed that CrossFitters pushed themselves to the maximum every training session. The misconception athletes had was that full benefit from every workout could only be attained through giving your 100%. Participant 1 mentioned "people don't realize that... its ok to be training at an 80% intensity, you will still improve". Furthermore, athletes associated taking rest days to muscle atrophy. "They feel uncomfortable if they don't do it for the day... Maybe they are afraid of losing their gains" (participant 5).

In addition, majority of participants associated their injury experiences with executing movements with the wrong technique or with improper muscle activations. In relation to her shoulder injury, participant 4 mentioned "engaged more of the traps compared to using more of the scaps to hold the weight on top of my head". Similarly, participant 7 correlated his lower back injury to "no tension at all from my posterior chain" when executing a heavy deadlift. This suggests a lack of guidance from the coaches, which could have corrected such faulty techniques. This issue was further amplified when coaches focused their attention on the weights used. Participant 9 mentioned "some coaches... put the weight on, come on, let's go, get a PB".

Impatience

Even though CrossFit is scalable, athletes are always looking to learn new skills or more efficient movement patterns. Participant 9 mentioned "You want to have that first kipping pull up or your first muscle up, it's like a massive thing for some Crossfitters". It was found that injuries occur when athletes lacked patience and rushed through learning new skills. Participant 6 mentioned "they try to... rush to the next progression... Think that oh, I have already mastered this progression without spending much time at that level".

But they haven't got the base...the requirements for that (ring muscle-up) would be at least 5 strict pull ups and then 5 strict ring dips and then you got to learn that movement pattern... You have that false grip and then transition from your pull-up to your dip and people don't have the patience to do it and they don't have the muscles, haven't got enough like muscle unit recruit-

ment so it's literally like you're asking for injuries. (Participant 9, Coach)

In addition, when athletes do learn a more efficient movement pattern (i.e. butterfly pull ups), they usually stick to them during WODs which may induce a sudden trauma to their connective tissues, inducing injuries. Participant 8 associated her shoulder injury to "doing butterfly for high volume... I went too fast too soon." Participant 3 (coach) mentioned "we look for mechanics, then you go consistent in the movement then you go for intensity". Efficient movement patterns usually utilize a bigger range of motion (ROM), causing more stress on the tissues. Hence, without learning the proper technique and having a solid muscular foundation, undue stress is placed on the connective tissues when done in high repetitions.

Performance & Peer Pressure

The performance and peer pressures experienced by CrossFitters was another cause of injury mentioned by participants. WODs are conducted in a group setting where athletes are prescribed the same workout program and weights (RX). Athletes were pressured to hit the RX in order to feel a sense of belonging with the rest of the class. This was mentioned by participant 2 "fear of missing out" and participant 8 "when you compare to someone else or you... see why is the class progressing but I'm still here then you will try to push yourself a little bit more than you are able to handle". This issue is further heightened when athletes partner up during WODs. Participant 2 mentioned "this buddy is starting to progress more than you are... You also push yourself to hit the same weight... Maybe your body is not ready to be hitting that weight" Similarly, participant 5 mentioned "When I'm doing with people that like are slightly above my level then I try to push myself" The desire to be at the same level with others pressures athletes to perform over their own limits.

However, accounts revealed that athletes may simply enjoy the challenge of pushing their limits. Participant 4 mentioned "RX weight was like super heavy... Yah, and I just went ahead". Similarly, participant 5 mentioned "It was particularly heavy that day". Despite knowing that the weight was heavy, participants still went ahead with the RX weight. Participant 1 (coach) mentioned "they think their body can handle it but no they can't". The pressure to perform and push one's boundaries could be beneficial in improving individual's fitness levels but coaches felt that this should still be done within the confinements of safety.

Recovery Management of Injuries among CrossFitters

Management of injuries comprised of both self-care and seeking professional care. Such methods were used by athletes to manage current injuries and also to prevent similar injuries from occurring.

Recovery Fundamentals

Participants expressed the need for sufficient rest before going back to training. Participant 1 mentioned "I will rest for 4 days or 1 week." Several participants stopped CrossFit for a week after sustaining their injuries. Furthermore, participants emphasized the need for sufficient sleep and supplementing the body with proper nutrients as vital for injury recovery. Participant 8 mentioned "once you have a lot of perseverative in your food, your body will have to deal with that instead of the injury". Participant 1 also mentioned "Do you drink enough water? Do you eat enough fruits? Do you have enough greens?"

Mobilization and Tissue Release

Accounts also revealed the importance of regular mobilization and tissue release in managing injuries and preventing further injuries from occurring. Participants reported that mobility was underappreciated before an injury occurred and only stretched regularly after sustaining injuries.

When you roll and you stretch right, it targets the root of the problem. Em, towards you getting more injury. Because it helps you get more flexibility, become like more. You have more mobility when you stretch and roll. So like when you have better range of movement, it decreases your chances of getting injured. (Participant 4)

The aim of mobilization was to help increase one's ROM, preventing further injuries from oc-

curring. In addition to mobilization, athletes also frequent the use of self-myofascial release (SMR) to release tensions. A large portion of participants utilized foam rolling while a handful of participants utilized the lacrosse ball. Participant 2 mentioned “cause that spot is injured, the muscles around it will tighten up so it (lacrosse ball) just loosens it up”. Electrical muscular stimulator (EMS) such as PowerDot was also utilized by athletes to release tension build-up. However, a few participants expressed that they don’t use it frequently due to the cumbersome nature of it.

Coach’s Care

Coaches should be prepared to develop regimes to help athletes work around their injuries. Participant 1 (coach) mentioned “anything that causes pain, just don’t do it”. Similarly, participant 2 (coach) mentioned “my rule is always, if there is pain, then don’t do it”. Athletes could use this time of injury to build other physical competencies. Participant 9 mentioned “I will still be on an assault bike or on a rower, getting my engine still.” Mental support from Coaches was also deemed as essential by participants.

She (coach) was very calm about it... Which is what you need. Rather than someone who is like OMG, don’t do this don’t do that... Rather than limit my training in terms of like train less, more like work around it, what else can we do.... It’s more assuring that I’m not helpless and I’m not crippled by the injury. (Participant 8)

In addition, participants recalled their coaches teaching them rehabilitation techniques. Participant 7 mentioned “he has been giving me a lot of advice on what to do to activate my lats, what to do to activate my scapular, traps and all that”. When asked what he would do when his athletes got injured, participant 3 mentioned “I would prescribe rehab. I mean I do research on that”. Majority of participants expressed the importance of rehab in recovery. Participant 9 mentioned “if you got bad shoulders, you should do activation exercises for that shoulder. Get those little muscles stronger”

Medical Practitioners

Participants revealed the importance of visiting the doctor for injury diagnosis. However, a few noted the inadequacies of visiting the doctor. Participant 1 mentioned “you go to a MRI, it is just for you to double confirm you got a herniated disk or not. So what does that help? That didn’t help anything”. Similarly, participant 6 mentioned “They also didn’t find a problem with my MRI” despite feeling pain.

Most of the participants visited a physiotherapist to aid in their injury recovery. However, only participant 5 found it beneficial. He mentioned that the physiotherapist taught him “stretches and everything”. Other participants felt that the sessions did not help. Participant 8 mentioned “with those physios sometimes they are very conservative, and they treat you like a grandma who also needs physiotherapy... I don’t feel like I need it.”

Participants 5 and 9 sought help from chiropractors. Both mentioned that the chiropractor realigned them and helped release muscle tensions. Participant 5 mentioned “I feel less pain, I feel looser... I feel more mobile”.

Majority of participants sought treatment from Traditional Chinese Medicine (TCM) practitioners. Some participants expressed TCM as beneficial for general body maintenance while others mentioned how TCM looked for muscle imbalances and inactivation. Participant 2 mentioned “she will do test on you to check where your imbalance is or like certain muscle that is not firing well then she will give you drills to do to work on that”. Accounts also mentioned how TCM helped alleviate pain experienced. Participant 4 mentioned “I go when I cannot take the pain anymore.”. Similarly, participant 7 mentioned TCM “release some pressure on the lower back”.

Coaching

CrossFit coaches undertake full responsibility in planning “safe, efficient and effective” programs (CrossFit., 2019). In spite of the limited time CrossFit classes have, a proper warmup should not be overseen for athlete’s safety. Warm-ups increase the elasticity and length to failure of the muscle-tendon unit (Safran et al., 1998). Recommended by Reynolds (2008), a well-crafted warm-up starts with a relatively easy aerobic activity followed by sport-specific dynamic warm-up.

Coaches should also be wary of the specifics of the WOD in terms of the order of movements,

repetition scheme and prescribed weights (RX). Exhaustion caused by high intensity anaerobic exercise could lead to a decrease in concentration and skill ultimately increasing risk of injury (Montalvo et al., 2017). This is especially so since technical skills such as Olympic weightlifting and powerlifting are incorporated into CrossFit (Mullins, 2015). Guidelines provided by American College of Sports Medicine include executing multijointed exercises before single-joint exercises as well as having 1 to 2 minutes rest between sets when carrying heavy loads (1-6 Repetition Maximum (RM)) (Kraemer et al., 2002). Coaches could design their programs around such guidelines and tailor the RX weights to individuals by providing them % 1RM instead. Furthermore, coaches could emphasize the purpose of the workouts (i.e. metabolic conditioning, muscle hypertrophy, barbell cycling) and ensure weights used are within the boundaries of the athlete's safety.

Furthermore, coaches need to be alert towards athletes executing complex movements such as Olympic lifts and powerlifting (Mullins, 2015). In the heat of intensity, athletes usually overlook the importance of technique. Hence, coaches need to be more active in observing, assessing and correcting athletes during workouts. Scaled movements could also be taught with the reassurance on the importance of focusing on technique rather than on intensity.

Mutual Surveillance and Pressure

CrossFitters are prescribed the same WOD and are exercising at the same time and space, promoting mutual surveillance and competitiveness as well as pushing one another to keep going despite exhaustion (Crockett & Butryn, 2018). It was mentioned that only when the researcher showed his ability to match others was he then respected rather than "invisible" (Crockett & Butryn, 2018). This was similar to participants' accounts that mentioned the pressure to use certain weights to be accepted by the community. This could be explained by individuals wanting to satisfy their need for belongingness which is innate among humans (Maslow, 1943). Participants also mentioned the pressure to level with their partners during workouts. As athletes usually partner others who are of similar abilities, when they observe their partners executing certain movements or lifting certain weights, they start to believe that they are able to and would also attempt to do the same. This is in accordance with the social learning theory that when people observe others of the same ability doing something, they believe that they themselves can do the same (Bandura & Walters, 1977).

The athletes' score in terms of their time to finish or the total number of repetitions done in the prescribed timeframe are usually written on the whiteboard (Crockett & Butryn, 2018). Athletes use such scorings to compare themselves to others (Crockett & Butryn, 2018). Such a public acknowledgment of scoring pressures athletes to focus on movement efficiency rather than on technique (Crockett & Butryn, 2018). Hence, coaches need to be proactive in instilling a cautious mentality into athletes, educating them on the risks involved and progressions they can take when learning new movements. Appendix D provides a skill progression chart that coaches could utilize to educate athletes learning new skills. Athletes need to put in the time to develop strength in the connective tissues and supportive muscles before proceeding on to more advanced movement patterns. Furthermore, coaches need to be more observant and stop athletes when they see that they are over-pushing themselves. Before WODs, coaches need to properly set the intention of trainings and emphasize the need to focus on self rather than on others (Gagnon & Long, 2019).

Self-care

Sufficient rest, proper nutrition and regular mobilization were among self-care methods participants used to manage injuries. Studies show that a few days of immobilization post-injury is favorable to allow the formation of scar tissues strong enough to withstand forces (Järvinen et al., 2007). However, immobilization should be limited to a week before muscle atrophy occurs (Järvinen & Lehto, 1993). Self-care methods should be recommended for all athletes, regardless of injuries. During the Non Rapid Eye Movement (NREM) sleep phase, there is a release of growth hormones and an increase in protein synthesis which are essential for tissue regeneration (Fullagar et al., 2015).

Participants also discussed the need for regular mobilization in preventing future injuries from occurring. Mobilization such as stretching increases flexibility and mobility of muscles and tendons, helping athletes increase their ROM (Bandy et al., 1998). A good ROM ensures athletes can get into positions comfortably, reducing strain placed on connective tissues. Furthermore, after sustaining an injury, scar tissues may form at the joint, resulting in joints having limited ROM. To stretch the joint capsule, low load, prolong duration (LLPD) stretching could be utilized where low load is applied for

a period of time at the end of the joints' current ROM (Three-Dimensional Physical Therapy, 2019).

The usage of SMR tools such as foam roller, lacrosse ball and EMS were frequent by all participants to release tension build-up. During exercise, the fascia surrounding the muscles get tight, restricting blood flow to those areas (Ganfield, 2009). Myofascial release stretches and loosens the fascia so that the patient's ROM is restored (Ganfield, 2009). Furthermore, SMR increases joint ROM and aids with muscle recovery through reducing muscle soreness (Cheatham et al., 2015; Schroedar & Best, 2015).

Professional care

When athletes sustain an injury, it is punitive for athletes to consult a medical professional such as a doctor or physiotherapist to get a diagnosis (Hackney, 1994), which many of the participants did. Accounts have also revealed that almost all participants visited a TCM practitioner to ease their pain. TCM practitioners utilize tui na, acupuncture and cupping among other techniques to help patients maintain good health (Cosio & Lin, n.d.). Tui na was reported to help increase blood flow and aid in lower back pain when coupled with core stability exercises (Lei et al., 2015; Tang et al., 2016). Acupuncture and cupping methods were also reviewed to help alleviate pain (Fletcher, 2018; Huzar, 2019).

In addition, accounts revealed that coaches played a vital role in easing athletes back into training. Coaches need to help maintain the general fitness of athletes and restrain premature return of athletes (Hackney, 1994). This could be done through the provision of scaling options or alternate workout regimens for athletes to work around their injuries. Coaches could also take the initiative to educate athletes on rehabilitation techniques. The aim of rehabilitation is to rebuild the anatomy and physiology of the injured area. Rehabilitation helps with the flexibility, joint ROM, proprioception and coordination of the injured areas (Physiopedia, n.d.).

Limitations and Future Studies

The time between when athletes sustained their injuries and the interviews provided potential for selective recall especially when the injury may have happened years ago. Future research could explore prescribing CrossFit coaches with a more comprehensive understanding of human anatomy and potential causes of injuries as well as a detailed rehabilitation program for CrossFit specific injuries. Observation methodologies in addition to interviews could substantiate future research to garner a more in-depth understanding of why CrossFitters get injured.

CONCLUSION

The lack of qualitative studies done restricts coaches' understanding on the reasons behind CrossFitters' injuries. Hence, this study wanted to gain a more holistic understanding on the reasons behind injury and injury management techniques among CrossFitters through interviewing. Causes of injury include poor workout program designs, insufficient physiological knowledge passed down from coaches to athletes, athlete's impatience when learning new skills as well as athletes conforming to performance and peer pressures. Therefore, coaches should design their programs with the athlete's safety in mind and foster an environment that values patience, strength building discipline and safety. Athletes should also pay extra attention to their movement technique and be self-reflective in their physical capabilities. All athletes should regularly practice conservative physiological recovery and seek treatment from medical practitioners when necessary.

Quantitative studies were effective in measuring the prevalence of injuries among CrossFitters but were unable to effectively understand why injuries occurred. Hence, through this qualitative study was deeper and more detailed answers provided to understand why CrossFitters got injured. Risk factors like impatience when learning new skills or athletes being pressured to perform during workouts were not accounted for in previous research. Through the efforts of the coaches and active awareness of athletes, such a mindset could be changed.

REFERENCES

Aasa, U., Svartholm, I., Andersson, F. & Berglund, L. 2017. Injuries among Weightlifters and Powerlifters: a Systematic Review. *British Journal of Sports Medicine*, 51 (4): 211-219. <https://doi.org/10.1136/bjsports-2016-096444>

- org/10.1136/bjsports-2016-096037
- Aune, K.T. & Powers, J.M. 2017. Injuries in an Extreme Conditioning Program. *Sports Health*, 9 (1): 52-58. <https://doi.org/10.1177/1941738116674895>
- Balf, C. 2019. *2020 CrossFit Open Registration Numbers Show Drop from 2019*. Retrieved from: <https://barbend.com/2020-crossfit-open-numbers/>
- Bandura, A. & Walters, R.H. 1977. *Social Learning Theory (Vol. 1)*. US: Englewood Cliffs, NJ, Prentice-hall.
- Bandy, W.D., Irion, J. M. & Briggler, M. 1998. The Effect of Static Stretch and Dynamic Range of Motion Training on the Flexibility of the Hamstring Muscles. *Journal of Orthopaedic & Sports Physical Therapy*, 27 (4): 295-300. <https://doi.org/10.2519/jospt.1998.27.4.295>
- Bergeron, M.F., Nindl, B.C., Deuster, P.A., Baumgartner, N., Kane, S.F., Kraemer, W.J. & O'Connor, F.G. 2011. Consortium for Health and Military Performance and American College of Sports Medicine Consensus Paper on Extreme Conditioning Programs in Military Personnel. *Current Sports Medicine Reports*, 10 (6): 383-389. <https://doi.org/10.1249/jsr.0b013e318237bf8a>
- Braun, V. & Clarke, V. 2006. Using Thematic Analysis in Psychology. *Qualitative Research in Psychology*, 3 (2): 77-101. <https://www.tandfonline.com/doi/abs/10.1191/1478088706qp063oa>
- Cheatham, S.W., Kolber, M.J., Cain, M. & Lee, M. 2015. The Effects of Self-Myofascial Release Using a Foam Roll or Roller Massager on Joint Range of Motion, Muscle Recovery, and Performance: a Systematic Review. *International Journal of Sports Physical Therapy*, 10 (6): 827. <https://pubmed.ncbi.nlm.nih.gov/26618062/>
- Claudino, J.G., Gabbett, T.J., Bourgeois, F., de Sá Souza, H., Miranda, R.C., Mezêncio, B. & Amadio, A.C. 2018. Crossfit Overview: Systematic Review and Metaanalysis. *Sports Medicine-Open*, 4 (11): 1-14. <https://doi.org/10.1186/s40798-018-0124-5>
- Cosio, D. & Lin, E.H. n.d. *Traditional Chinese Medicine Techniques*. Retrieved from <https://www.practicalpainmanagement.com/patient/treatments/alternative/6-traditional-chinese-medicine-techniques>
- Crockett, M.C. & Butryn, T. 2018. Chasing Rx: A spatial Ethnography of the CrossFit Gym. *Sociology of Sport Journal*, 35 (2): 98-107. <https://doi.org/10.1123/ssj.2017-0115>
- CrossFit Level 1 Training Guide. 2019. *CrossFit Inc*.
- CrossFit Inc. n.d. *Official CrossFit Affiliate Map*. Retrieved from https://map.crossfit.com/?_ga=2.60663213.102027535.1571933800-563792764.1570185148.
- Dawson, M.C. 2017. CrossFit: Fitness Cult or Reinventive Institution?. *International Review for the Sociology of Sport*, 52 (3): 361-379. <https://doi.org/10.1177%2F1012690215591793>
- Feito, Y., Burrows, E.K. & Tabb, L.P. 2018. A 4-Year Analysis of the Incidence of Injuries among CrossFit-Trained Participants. *Orthopaedic Journal of Sports Medicine*, 6(10). <https://dx.doi.org/10.1177%2F2325967118803100>
- Fisher, J., Sales, A., Carlson, L. & Steele, J. 2016. A Comparison of the Motivational Factors between CrossFit Participants and Other Resistance Exercise Modalities: a Pilot Study. *Journal of Sports Medicine and Physical Fitness*, 57 (9): 1227-1234. <https://doi.org/10.23736/s0022-4707.16.06434-3>
- Fletcher, J. 31 May 2018. *Dry Needling vs. Acupuncture: Benefits and Uses*. Retrieved from <https://www.medicalnewstoday.com/articles/321989.php>.
- Fullagar, H.H., Skorski, S., Duffield, R., Hammes, D., Coutts, A.J. & Meyer, T. 2015. Sleep and Athletic Performance: the Effects of Sleep Loss on Exercise Performance, and Physiological and Cognitive Responses to Exercise. *Sports Medicine*, 45 (2): 161-186. <https://doi.org/10.1007/s40279-014-0260-0>
- Hackney, R.G. 1994. Nature, Prevention, and Management of Injury in Sport (ABC of Sports Medicine. *British Medical Journal*, 308 (6940): 1356-1360. <https://doi.org/10.1136/bmj.308.6940.1356>
- Hak, P.T., Hodzovic, E. & Hickey, B. 2013. The Nature and Prevalence of Injury during Cross-Fit Training. *Journal of Strength and Conditioning Research*, 22. <https://doi.org/10.1519/jsc.0000000000000318>
- Heinrich, K.M., Patel, P.M., O'Neal, J.L. & Heinrich, B.S. 2014. High-Intensity Compared to Moderate-Intensity Training for Exercise Initiation, Enjoyment, Adherence, and Intentions: an Intervention Study. *BMC Public Health*, 14 (1): 789. <https://doi.org/10.1186/1471-2458-14-789>
- Huzar, T. 28 March 2019. *Does Cupping Therapy Work and What are the Benefits?* Retrieved from <https://www.medicalnewstoday.com/articles/324817.php>.

- Järvinen, M.J. & Lehto, M.U. 1993. The effects of Early Mobilisation and Immobilisation on the Healing Process Following Muscle Injuries. *Sports Medicine*, 15 (2): 78-89. <https://doi.org/10.2165/00007256-199315020-00002>
- Järvinen, T.A., Järvinen, T.L., Kääriäinen, M., Äärimaa, V., Vaittinen, S., Kalimo, H. & Järvinen, M. 2007. Muscle Injuries: Optimising Recovery. *Best Practice & Research Clinical Rheumatology*, 21 (2): 317-331. <https://doi.org/10.1016/j.berh.2006.12.004>
- Keogh, J.W. & Winwood, P.W. 2017. The Epidemiology of Injuries Across the Weight-Training Sports. *Sports Medicine*, 47 (3): 479-501. <https://doi.org/10.1007/s40279-016-0575-0>
- Klimek, C., Ashbeck, C., Brook, A.J. & Durall, C. 2018. Are Injuries More Common with CrossFit Training than Other Forms of Exercise?. *Journal of Sport Rehabilitation*, 27 (3): 295-299. <https://doi.org/10.1123/jsr.2016-0040>
- Kraemer, W.J., Adams, K., Cafarelli, E., Dudley, G.A., Dooly, C., Feigenbaum, M.S. & Newton, R.U. 2002. American College of Sports Medicine. American College of Sports Medicine Position Stand. Progression Models in Resistance Training for Healthy Adults. *Medicine & Science in Sports & Exercise*, 34 (2): 364-80. <https://doi.org/10.1249/mss.0b013e3181915670>
- Kuhn, S. 2013. *The Culture of CrossFit: A Lifestyle Prescription for Optimal Health and Fitness*. Senior Theses. United States: Illionis State University.
- Langdridge, D. 2004. *Introduction to Research Methods and Data Analysis in Psychology*. Harlow: Pearson Education.
- Lei, F., Min, F., Shichao, J. & Hua, C. 2015. Optimization of Parameters of Yi Zhi Chan Tuina Manipulation Promotes Peripheral Circulation. *Journal of Traditional Chinese Medicine*, 35 (5): 558-563. [http://dx.doi.org/10.1016/S0254-6272\(15\)30139-4](http://dx.doi.org/10.1016/S0254-6272(15)30139-4)
- Gagnon, P. & Long, Z. 2019. *Skills Progression Chart, The Barbell Physio*. Retrieved from <http://bit.ly/tbpcchart>
- Ganfield, L. 2009. *Myofascial Release Therapy- SPINE-Health*. Available from <https://www.spine-health.com/treatment/physical-therapy/myofascial-release-therapy>
- Maslow, A.H. 1943. A Theory of Human Motivation. *Psychological Review*, 50 (4): 370-396. <https://psycnet.apa.org/doi/10.1037/h0054346>
- Mehrab, M., de Vos, R.J., Kraan, G.A. & Mathijssen, N.M. 2017. Injury Incidence and Patterns among Dutch CrossFit Athletes. *Orthopaedic Journal of Sports Medicine*, 5 (12), 2325967117745263. <https://doi.org/10.1177/2325967117745263>
- Meyer, J., Morrison, J. & Zuniga, J. 2017. The Benefits and Risks of CrossFit: a Systematic Review. *Workplace Health & Safety*, 65 (12): 612-618. <https://doi.org/10.1177/2165079916685568>
- Montalvo, A.M., Shaefer, H., Rodriguez, B., Li, T., Epnere, K. & Myer, G.D. 2017. Retrospective Injury Epidemiology and Risk Factors for Injury in CrossFit. *Journal of Sports Science & Medicine*, 16 (1): 53-59. <https://pubmed.ncbi.nlm.nih.gov/28344451/>
- Mullins, N. 2015. CrossFit: Remember what You Have Learned: Apply What You Know. *Journal of Exercise Physiology Online*, 18 (6): 32-44. https://www.researchgate.net/publication/290123696_CrossFit_Remember_what_you_have_learned_apply_what_you_know
- Paine, J., Uptgraft, J. & Wylie, R. 2010. *CrossFit Study*. Fort Leavenworth: Command and General Staff College. http://library.crossfit.com/free/pdf/CFJ_USArmy_Study.pdf
- Parkkari, J., Kannus, P., Natri, A., Lapinleimu, I., Palvanen, M., Heiskanen, M. & Järvinen, M. 2004. Active Living and Injury Risk. *International Journal of Sports Medicine*, 25 (3): 209-216. <https://doi.org/10.1055/s-2004-819935>
- Physiopedia. n.d. *Rehabilitation in Sport*. Retrieved from https://www.physiopedia.com/Rehabilitation_in_Sport
- Poland, B.D. 2002. *Transcription Quality*. In J.F. Gubrium and J.A. Holstein (eds), *Handbook of Interview Research: Context & Method*. CA: Sage.
- Reynolds, G. 2008. *Stretching: the Truth*. The New York Times. <https://www.nytimes.com/2008/11/02/sports/playmagazine/112pewarm.html>
- Robertson, E. 2017. *CrossFit's Dirty Little Secret*. Retrieved from https://www.huffpost.com/entry/crossfithabdomyolysis_b_3977598?utm_hp_ref=mostpopular.
- Ross, B. 2018. *The Controversy behind CrossFit*. Retrieved from <https://www.livestrong.com/article/545200-the-fall-of-fitness/>.
- Safran, M.R., Garrett, W.E., Seaber, A.V., Glisson, R.R. & Ribbeck, B.M. 1988. The role of Warmup in Muscular Injury Prevention. *The American Journal of Sports Medicine*, 16 (2): 123-129. <https://doi.org/10.1177/089801018801600201>

- doi.org/10.1177/036354658801600206
- Schneider, N.C., Coates, W. C. & Yarris, L.M. 2017. Taking Your Qualitative Research to the Next Level: a Guide for the Medical Educator. *AEM Education and Training*, 1 (4): 368-378. <https://dx.doi.org/10.1002%2Faet.10065>
- Schroeder, A.N. & Best, T.M. 2015. Is Self Myofascial Release an Effective Preexercise and Recovery Strategy? A Literature Review. *Current Sports Medicine Reports*, 14 (3): 200-208. <https://doi.org/10.1249/jsr.0000000000000148>
- Simmons, E. 2014. *Why I don't do CrossFit*. Retrieved from https://www.huffpost.com/entry/why-i-dont-docrossfit_b_5411771?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAABhYnVHT_0s4Gnd_vsPEYxydlnXW3-HLjtxK-kTKaNWDr21NIIfgfEEVVfkFZlbFuBgHHzN10_Fyh8wigV_3MVKwRIBfqesBGmJWQVG-t5nYSXMbKbWFSSUYlycH0LLeOBZ4qxrRsR46dKKfKsl8Ww80QJ7Rz6zhOOgBmIXbQ-il.
- Smith, M.M., Sommer, A.J., Starkoff, B.E. & Devor, S.T. 2013. Crossfit-based Highintensity Power Training Improves Maximal Aerobic Fitness and Body Composition. *The Journal of Strength & Conditioning Research*, 27 (11): 3159-3172. <https://doi.org/10.1519/jsc.0b013e318289e59f>
- Sprey, J.W., Ferreira, T., de Lima, M.V., Duarte Jr, A., Jorge, P.B. & Santili, C. 2016. An Epidemiological Profile of Crossfit Athletes in Brazil. *Orthopaedic Journal of Sports Medicine*, 4 (8). <https://doi.org/10.1177/2325967116663706>
- Summitt, R.J., Cotton, R.A., Kays, A.C. & Slaven, E.J. 2016. Shoulder Injuries in Individuals who Participate in CrossFit Training. *Sports Health*, 8 (6): 541-546. <https://doi.org/10.1177/1941738116666073>
- Tabata Times. 2014. *How Fast are the CrossFit Games Growing? The Numbers Tell the Story*. Retrieved from: <https://web.archive.org/web/20140709055050/http://www.tabatatimes.com/how-fast-are-the-crossfit-games-growing-the-numbers-tell-the-story/>
- Tang, S., Qian, X., Zhang, Y. & Liu, Y. 2016. Treating Low Back Pain Resulted from Lumbar Degenerative Instability Using Chinese Tuina Combined with Core Stability Exercises: a Randomized Controlled Trial. *Complementary Therapies in Medicine*, 25: 45-50. <https://doi.org/10.1016/j.ctim.2016.01.001>
- Three Dimensional Physical Therapy. 30 July 2019. *How to Improve Joint Range of Motion When Stretching Isn't Enough*. Retrieved from <https://3dpt.com/how-toimprove-joint-range-of-motion-when-stretching-isnt-enough/>.
- Weisenthal, B.M., Beck, C.A., Maloney, M.D., DeHaven, K.E. & Giordano, B.D. 2014. Injury Rate and Patterns among CrossFit Athletes. *Orthopaedic Journal of Sports Medicine*, 2 (4). <https://doi.org/10.1177/2325967114531177>