Introduction

CrossFit is a relatively new strength and conditioning sport, defined as “constantly varied, functional exercises, performed at high intensity” [1]. With over 15,000 affiliated CrossFit gyms worldwide, it has emerged as one of the most popular forms of high-intensity functional training in the global fitness community [2]. Typical CrossFit workouts incorporate a wide range of training modalities, including aspects of weightlifting, gymnastics, and endurance...
training, to promote general physical preparedness [1]. Positive health effects, such as improvements in cardiorespiratory fitness, have been reported in various populations of CrossFit participants [3–6].

Injury risk is a potential drawback of sports participation. The injury rate for CrossFit ranges from 0.2 to 18.9 per 1,000 hours of participation [7], which is comparable to similar training forms and other sports (e.g. weightlifting, traditional training modalities and common forms of exercise or strength training) [8–10]. Identifying injury risk factors is a key step to develop effective injury prevention programs [11]. CrossFit is a relatively new sport and has little injury research compared to older sports. Only two systematic reviews have specifically explored risk factors for CrossFit injuries and concluded that several factors such as previous injury and lack of coach supervision were associated with higher injury rates [7, 12]. However, the limited quality and cross-sectional design of the studies included have prevented researchers from drawing solid conclusions about risk factors in addition to lacking a comprehensive best-evidence synthesis for risk factors.

Therefore, the objective of the current study was to determine potential risk factors for injury in CrossFit participants through a systematic review and – if possible – meta-analysis of the current literature. This is the first systematic review on risk factors for CrossFit injury that provides a best-evidence synthesis combining outcomes of prospective cohort studies. Cross-sectional studies will also be explored to identify potential novel risk factors to be assessed in future research. This should provide updated and structured insight into all potential risk factors to inform future prevention strategies and to comprehensively summarize the current available literature.

Materials and Methods

Protocol and registration

Prior to study initiation we registered our study in the PROSPERO international prospective register of systematic reviews (registration number CRD42020185452). A protocol revision was performed in November 2020 as we decided to use the Quality in Prognostic Studies (QUIPS) tool to assess risk of bias since we observed that this was more appropriate for the studies included than the Newcastle-Ottawa Scale (NOS). This change was made before we started the risk of bias assessment. We deviated from our study protocol as (1) we determined that all cross-sectional studies had a predetermined high risk of bias (ROB) and therefore were not assessed with the QUIPS tool, and (2) we decided to pool only data from cohort studies with a low risk of bias if pooling of data were possible. We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guideline for designing and reporting systematic reviews [13].

Search and data collection

We searched the following databases without time restrictions up to June 2021 to identify relevant CrossFit injury studies: Embase, Medline, Web of Science, Cochrane, CINAHL, Google Scholar, and SportDiscuss. Our search strategy was assisted by a biomedical information specialist and was based on terms including “CrossFit”, “High Intensity Interval Training”, “High Intensity Functional Training”, “Functional Fitness”, “Injury” and (database specific) synonyms (see Appendix 1 for the full search strategy). In addition, references of included articles and of systematic reviews found on CrossFit injuries were hand-searched for relevant studies that were missed by our initial electronic search.

Eligibility criteria

We set the following study inclusion criteria: (i) the study reported on male or female CrossFit participants of all ages; (ii) the study investigated at least one independent variable in association with an injury; (iii) the injury definition included requiring medical attention or time-loss injury; (iv) studies were prospective cohort studies or case-control studies with ≥ 20 participants [14].

We also included cross-sectional studies to identify potential novel risk factors. While the level of evidence from cross-sectional studies is lower than that from cohort or case-control studies, they can identify factors to explore in future research.

We excluded (i) conference abstracts and (ii) studies not written in English.

Study selection

After duplicate removal, two researchers (MM and RW) independently screened titles and abstracts using the Rayyan web application [15]. The same researchers assessed all potentially eligible full-text articles to confirm eligibility. Disagreement regarding eligibility was resolved in a consensus meeting. If no consensus was reached, a third researcher (GV) was consulted.

Data extraction

Two authors (MM and RW) independently performed the data extraction of all studies included using standardized data extraction forms, and discrepancies were resolved in a consensus meeting. If no consensus was reached, a third researcher (GV) was consulted. The following data were extracted: publication details, study design, data collection method, study duration, injured vs. non-injured participant numbers, description of the study population, injury definition, and dependent and independent variables (i.e., type of injury and risk factors respectively).

We extracted risk ratios (RRs), odds ratios (ORs), and mean differences (MDs) with corresponding 95% confidence intervals (CIs) and significance (p-value) for each risk factor. If available, we displayed effects adjusted for confounders. Otherwise, unadjusted effects were displayed. In case of categorical data, we extracted the number of injured and non-injured participants per risk factor and in case of continuous data, we extracted the means with standard deviations (SD). We contacted the corresponding authors of included studies in case any required data were missing, requesting them to provide us the additional needed data for our analyses. If corresponding authors did not reply, reminders were sent in a period of at least two months. If no response after two reminders or if the authors were not able to deliver these data, we finally considered these data as “missing”.

Risk factors were categorized into modifiable and non-modifiable risk factors. Modifiable risk factors were subcategorized into athlete, coaching, and training characteristics.
Risk of bias assessment

We assessed the ROB of cohort studies using the QUIPS tool [16]. The QUIPS scores six distinct topics on multiple criteria: study participation, study attrition, prognostic factor measurement, outcome measurement, study confounding and statistical analysis and reporting (Appendix 2).

Each criterion met scores one point. Studies were then classified similar to previous studies: each topic had to score ≥ 75 % of potential points to be deemed “low ROB.” In case of < 75 % points, the topic was deemed “high ROB.” A study had a “low ROB” if at least five categories including the topic “outcome measurement” were deemed “low ROB.” Otherwise, the study had a “high ROB” [17]. Two authors (MM and RW) individually scored ROB and discussed discrepancies until consensus was reached. If no consensus was reached, a third researcher (GV) was consulted.

We did not assess ROB for cross-sectional studies as these are subject to an inherent high ROB for determining risk factors [18]. Therefore, all cross-sectional studies were predetermined considered of having a high ROB.

Best-evidence synthesis of the risk factors

A best-evidence synthesis according to van Tulder et al. was performed combining all outcomes from cohort studies (▶ Table 1) [19]. The scale rates evidence as strong, moderate, limited, or conflicting based on the risk of bias (ROB) and consistency of the available evidence. Outcomes of cross-sectional studies were not included in the best-evidence synthesis and were analyzed separately to identify potential novel risk factors for future research.

Meta-analysis

If ≥ 3 cohort studies with low ROB assessed the same outcome, a quantitative analysis would be performed. We decided to not pool studies with a high ROB to avoid further compounding of the bias [20].

Results

Study selection

Our electronic search identified 9,452 potential studies, and after duplicate removal 5,129 articles remained. After screening title and abstract, we assessed 57 studies in full text.

▶ Table 1  Level of Evidence

| Level of Evidence | Description |
|------------------|-------------|
| Strong Evidence  | ≥ 2 studies with low risk of bias and generally consistent findings in all studies (≥ 75 % of the studies reported consistent findings). |
| Moderate Evidence| One study with low risk of bias and ≥ 2 studies with high risk of bias and generally consistent results (≥ 75 % of the studies reported consistent findings). |
| Limited Evidence | Finding from 1 study with low risk of bias or generally consistent findings in ≥ 1 study with high risk of bias (≥ 75 % of the studies reported consistent findings). |
| Conflicting Evidence | < 75 % of the studies reporting consistent findings. |
| No Evidence       | No studies could be found. |

A total of 42 studies was excluded after full-text evaluation, as shown in the PRISMA flow chart (▶ Figure 1). We included the remaining 15 studies [8, 21–34] for analysis. These were 3 prospective cohort studies which we included in our best-evidence synthesis and 12 cross-sectional studies informing us about potential novel risk factors. There were no case-control studies that met our inclusion criteria.

Characteristics of the included prospective cohort studies

The characteristics of the prospective cohort studies included are displayed in ▶ Table 2. The studies had follow-up periods ranging from 8 to 12 weeks [24, 28, 31]. A total of 691 participants were included, of whom 172 sustained an injury. Publication dates ranged from 2017 to 2020 and studies were performed in Brazil [31], Denmark [28], and the United Kingdom [24]. The studies included 117 (14 injuries) [24], 168 (25 injured) [28], and 406 (133 injured) [31] participants, respectively. Heterogenous injury definitions were used and are presented in Appendix 4.

Study population across prospective studies

There were 315 male and 376 female participants. The mean (standard deviation, SD) age was 32 ± 8 years. Larsen et al. [28] included only novice participants. All other studies included participants with mixed experience. More detailed characteristics are summarized in ▶ Table 2.

Characteristics of the included cross-sectional studies

The characteristics of the cross-sectional studies are displayed in Appendix 5.

Twelve studies investigated injuries in CrossFit participants that they had sustained over periods of 6 months [22, 23, 25, 26], 12 months [8, 21, 23, 29, 30], or practice lifetime [23, 27, 32–34]. A total of 6,062 participants were included, of whom 2,050 sustained an injury. We included two studies of Feito et al. [8, 30] that were based on the same dataset but investigated different risk factors in the respective studies. Publication dates ranged from 2014 to 2021 and the studies were performed in the United States [8, 22, 25, 26, 30, 34], Brazil [27, 32, 33], Costa Rica [21], Portugal [23], and the Netherlands [29]. Sample sizes ranged from 121 to 3,049 participants (median 270). The number of injured participants per study ranged from 43 to 931 (median 80). Summitt et al. [26] analyzed risk factors for shoulder injuries only and Tawfik et al. [34] for hand and wrist injuries, respectively. All other studies analyzed risk factors for injuries without differentiating for injury location. Heterogenous injury definitions were used among the included studies which are presented in Appendix 4.

Study population across cross-sectional studies

There were 3,153 male and 2,716 female participants. The sex of 192 participants was not described [22, 26].

From the available data, the mean age was 35 ± 9 years, the mean bodyweight was 74 ± 14 kilograms, and the mean height was 1.72 ± 0.6 meters. Three studies used experience in CrossFit as an eligibility criterion: Minghelli et al. [23] and Paiva et al. [33] excluded participants with less than six months of experience. All other
studies included participants with mixed experience. More detailed study characteristics are summarized in Appendix 3.

Risk of bias assessment

The prospective cohort studies were assessed using the QUIPS tool. There was no disagreement on the ROB across studies based on the independent assessments of the reviewers.

The studies scored 78 % of potential points on average. Based on the predefined criteria, two studies were considered having a low and one study of having a high ROB (▶ Table 3). Overall, there was a low ROB in the outcome measurement, study confounding and statistical analysis, and reporting domains. The highest ROB across studies was found in the study participation (57 % of points) and study attrition domains (40 % of points). None of the included studies provided a sample size calculation, two studies did not meet the requirements for an adequate description of the methods used to identify the population and the place of recruitment, and one study did not report on any measures of attrition.

Best-evidence synthesis of the risk factors

Seventeen different risk factors were investigated (▶ Table 4) in the three prospective cohort studies. Results of the best-evidence synthesis are presented in ▶ Figure 2.

Non-modifiable risk factors

Age

There is conflicting evidence that age affects injury risk. One study with low ROB found that lower age is associated with an increased injury risk (OR: 0.998 (0.996–0.999 95 % CI), p < 0.05) [31], while one study with low ROB [28] and one study with high ROB [24] found no association.

Sex

There is conflicting evidence that sex affects injury risk. One study with high ROB [24] found that male participants had increased injury risk compared to female participants, whereas two studies with low ROB found no association [28, 31].

Athletic history and background

There is limited evidence that athletic history and previous sports exposure do not affect injury risk as one study with low ROB [28] and one study with high ROB [24] found no association.

Previous injury

There is conflicting evidence that having sustained any sports injury in the past affects injury risk. One study with low ROB [31] reported that previous injury was associated with increased injury
risk, whereas one study with low ROB [28] and one study with high ROB [24] found no association.

### Modifiable risk factors

#### Athlete characteristics

**Bodyweight and BMI**

There is limited evidence from one study with low ROB [31] that bodyweight does not affect injury risk. There is limited evidence from one study with low ROB [28] and one study with high ROB [24] that BMI does not affect injury risk.

**Lifestyle parameters**

There is limited evidence that achieved recommended daily physical activity and weekly alcohol use do not affect injury risk based on one study with low ROB [28].

**Strength and movement competency**

There is limited evidence that movement competency assessed by the Functional Movement Screen (FMS) score does not affect injury risk based on one study with high ROB [24].

### Coaching characteristics

**CrossFit class characteristics**

There is limited evidence from one study with low ROB [28] that introduction classes do not affect injury risk.

There is limited evidence that variation in coaching (always having the same coach vs. alternating coaches) and demonstration of proper form by coaches do not affect injury risk based on one study with low ROB [31].

**Coach involvement**

There is limited evidence that the level of involvement and coach’s presence do not affect injury risk based on one study with high ROB [24].

### Training characteristics

**Duration of participation**

There is limited evidence from one study with low ROB [31] that increased duration of participation is associated with decreased injury risk (OR: 0.7 (0.5–1.0 95 % CI), p < 0.05).

**Weekly training days, rest days, and exposure characteristics**

There is strong evidence from two studies with low ROB [28, 31] that the number of training days per week does not affect injury risk.
Participation in other sports

There is strong evidence from two studies with low ROB [28, 31] that participation in other sports does not affect injury risk.

Training level

There is limited evidence that switching between prescribed and scaled loads (back and forth) during training is associated with increased injury risk as demonstrated in one study with low ROB (OR 3.5, CI 1.7–7.3, p < 0.05) [31].

Training forms and modalities

There is limited evidence that the number of open gym training days per week (i.e., unsupervised training) does not affect injury risk based on a single study with low ROB [28].

There is limited evidence that the following measures do not affect injury risk based on a single study with low ROB [31]: performing stretching exercises, performing preventive exercises, and using protective equipment during exercise.

Potential risk factors evaluated in cross-sectional studies

In the 12 cross-sectional studies, 33 potential risk factors were explored. The following risk factors were associated with increased injury risk: being a male participant [22, 34], increased body height [25], increased bodyweight [25], engaging in physical activity outside CrossFit [25], being a recreational (versus beginner) athlete [32], and performing intense weight training (compared to light or moderate weight training) [33]. Higher levels of coach involvement was associated with decreased injury risk [22].

Increased injury risk in competitive athletes was reported in two studies [21, 32], whereas one study [23] reported decreased injury risk for this group. Increased duration of participation was associated with increased injury risk in six studies [21, 25, 27, 29, 32, 34] whereas a single study decreased injury risk instead [30]. Training less than three times a week was a risk factor for injury in two studies [8, 23] contrasting another single study that showed that increased weekly training exposure was associated with increased injury risk [25].

No association was found for several risk factors as shown in Appendix 5.

Meta-analysis

As only two studies had a low ROB, we did not meet our predetermined criterium of ≥3 studies assessing the same outcome to pool data and therefore no meta-analysis was performed. Furthermore, there was substantial clinical heterogeneity between the populations included: one study only included novice participants while two other studies included participants with mixed experience.

Discussion

Summary of main findings

This study is the first comprehensive systematic review of risk factors for CrossFit injury that provides a best-evidence synthesis. Our study was designed to identify potential risk factors for injury in CrossFit participants, which subsequently may be used for future research and for the development of injury prevention programs. We identified two prospective cohort studies with a low risk of bias and one prospective cohort study with a high risk of bias. Additionally, we identified 12 cross-sectional studies on potential risk factors.

We found limited evidence that switching between prescribed and scaled loads during training is associated with increased injury risk and that increased duration of participation is a protective factor for injury. There is conflicting evidence for the following risk factors: higher age, male sex, and previous injury. For other potential risk factors there is currently no evidence that they are associated with increased injury risk.

Implications

These findings are relevant in both the clinical and research context given the growing popularity of CrossFit worldwide. We found that training load and level of experience with CrossFit are potentially important factors in injury etiology. This could mean that novice CrossFit athletes and those increasing their training load should have closer supervision by CrossFit coaches. It could also mean that progressive scaling, which is the practice of continually adjusting the difficulty of a workout so that an exhausted athlete can keep moving, should be avoided in (novice) participants [35]. As there are no injury prevention studies based on these risk factors, we cannot be sure whether this would actually decrease injuries. The limited evidence for these risk factors and the relatively small effect sizes should also be taken into account, but these factors are worthy of further exploration in future research.

We found insufficient evidence to establish the presence or absence of a relationship between CrossFit injury and the following factors: previous injury, male participants, and increased age. Previous injury history has been suggested to modify the complex interaction between other injury factors [36] and several studies in other sports have reported previous injury as an important risk factor [37, 38]. Next, several sex differences in sports injury risk and differences in specific injuries between sexes have been reported in previous research in other sports. A potential aspect that possibly plays a part in higher injury risk for males is their higher risk-taking behavior. Compared to females, males are less prone to seek coach supervision [22] and are characterized by more aggressive and competitive behavior, which may contribute to increased injury risk [39]. Nonetheless, some of these sex differences in sports injury risk seemed to be explained by differences in the amount of training [40, 41]. For illustration in a large CrossFit injury study of
In regard to age, the ability to adapt to high training loads gradually diminishes at a certain point in time as athletes age, which is believed to be due to degenerative aging processes, and as a result relatively older athletes may be more prone to sustain injuries [42, 43].

**Comparison with existing literature**

Several systematic reviews examined risk factors for CrossFit injury, mainly in the context of summarizing the existing CrossFit literature [9, 10, 44–47]. Two systematic reviews specifically explored risk factors for CrossFit injury and provided a clear overview of the available literature at that time [7, 12]. Our study significantly adds to these earlier systematic reviews: first, by using a more elaborate search strategy and searching for eligible articles in a larger number of databases. We screened 5,129 articles compared to 280 [7] and 718 [12] articles screened in previous reviews. Two studies from last year are included in our study that have not been previously reviewed. We also provide a best-evidence synthesis for all potential risk factors, resulting in an expanded and comprehensive overview of the currently available CrossFit injury-related literature.

3,049 participants, Feito and colleagues found no significant differences in injury rates between male and female CrossFit participants (0.26 vs. 0.28 per 1,000 hours of training) [8].

**Strengths and limitations**

A strength of this systematic review is that we performed this structured analysis according to the PRISMA guidelines and prospectively registered our study protocol. We provided a best-evidence synthesis including levels of evidence for all potential risk factors, resulting in a comprehensive overview of the currently available CrossFit injury-related literature. Despite our robust research design, there are also methodological limitations. First, we included only studies written in the English language. This may have resulted in selection bias. Second, we were unable to pool data since we identified only two prospective studies with a low ROB. From the 15 identified publications eligible for our study, the majority had a cross-sectional study design with a predetermined high ROB. The strength of the associations could therefore be evaluated only with a best-evidence synthesis and not with a meta-analysis.

Another important consideration is that there is to date no clear consensus of what a CrossFit injury constitutes, as studies used heterogeneous injury definitions. These variations in injury definitions together with varying data collection methods may lead to differing results, making between-study comparisons difficult. We recommend experts involved in the study of CrossFit injuries to reach consensus on injury definitions and data collection for more consistency in methodologies in future CrossFit injury studies, as has been done in soccer injury research [48].

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**Table 2** Results of the best-evidence synthesis. For presentation, some separately investigated risk factors have been combined in this figure.

| Non-modifiable athlete characteristics | Modifiable athlete characteristics | Coaching characteristics | Training characteristics |
|----------------------------------------|-----------------------------------|--------------------------|-------------------------|
| Strong Evidence                        |                                   |                          |                         |
| Number of weekly training days:        |                                   |                          |                         |
| Participation in other sports:         |                                   |                          |                         |
| Moderate Evidence                      |                                   |                          |                         |
| Limited Evidence                       |                                   |                          |                         |
| Athletic history & background:         | Bodyweight & BMI:                 | Introduction classes:    | Increased duration of participation: |
|                                       | Achieved recommended daily        | Variation in coaching &  | Number of open gym training days: |
|                                       | Physical activity & weekly alcohol use: | demonstration of proper form: | Stretching or preventive exercise or protective equipment: |
|                                       | Movement competency (FMS):        | Level of involvement & coaches presence: |                          |
| Conflicting Evidence                   | Increased age: ↑/=                 |                          |                         |
|                                       | Sex (male participants): ↑/=      |                          |                         |
|                                       | Previous injury: ↑/=              |                          |                         |

Abbreviations: Rx, prescribed training load; FMS, functional movement screen; BMI, body mass index. Symbols: =, indicates no effect on injuries; ↑, indicates an increase in injury risk; ↓, indicates a decrease in injury risk. Bold text: indicates factors that were associated with an increase or decrease in injuries.
Recommendations for future research

We recommend that future large prospective cohort studies further evaluate duration of participation and training load characteristics as independent risk factors for CrossFit injuries [14]. Follow-up periods from studies in our review were 8–12 weeks; longer follow-up periods in future studies are desirable. The current CrossFit-related literature is inconclusive whether previous injury, male participants, and increased age are associated with increased injury risk: they may be interesting factors to explore. Finally, higher levels of coach involvement were associated with decreased injury risk in a cross-sectional study; future studies should investigate this potential protective factor in prospective studies (▶Table 4a-d).

Conclusion

Based on three prospective cohort studies from which the majority (67%) had a low risk of bias, there is limited evidence that switching between prescribed and scaled loads during training is associated with increased injury risk and that increased duration of participation is a protective factor for injury. This could mean that novice CrossFit athletes and individuals increasing their training load should have closer supervision by CrossFit coaches. These risk factors should be considered when developing future preventive interventions.

| Table 4a | Non-modifiable athlete characteristics |
| --- | --- |
| Risk factor | Details | Author | Year | n Subjects | Effect | Effect size, means, percentages, significance | Adjusted effect size (confounders) |
| Age | | Larsen$ 2020 168 | = | | | | |
| | | Moran 2017 115 | = | | | | |
| | | Szeles 2020 406 | = | | OR: 0.998 (0.996–0.999 95% CI), p < 0.05 | Not available |
| Sex | | Larsen$ 2020 168 | = | | | | |
| | | Moran 2017 117 | ↑ injury risk for male participants | RR: 4.62 (1.32–16.10 90% CI), p = 0.04 | RR: 4.44 (1.35–14.61 90% CI), p = 0.04 (previous injury and number of asymmetries) |
| Athletic history and background | Sports or exercise participation before CrossFit | Larsen$ 2020 167 | = | | | |
| | Previous Olympic lifting or gymnastics experience | Moran 2017 115 | = | | | |
| Previous injury | Pain, soreness, stiffness or swelling within the last two weeks prior to CrossFit | Larsen$ 2020 168 | = | | | |
| | Previous injury | Moran 2017 116 | = | | | |
| | Previous injury | Szeles 2020 406 | ↑ injury odds for participants with previous injury | OR: 3.0 (1.3–6.9 95% CI), p < 0.05 | OR: 3.2 (1.4–7.7 95% CI), p < 0.05 (training load Rx, scaled or alternating Rx and scaled and CrossFit experience) |

| Table 4b | Modifiable athlete characteristics |
| --- | --- |
| Risk factor | Details | Author | Year | n Subjects | Effect | Effect size, means, percentages, significance | Adjusted effect size (confounders) |
| Bodyweight | | Szeles 2020 406 | = | | | |
| BMI | | Larsen$ 2020 168 | = | | | |
| | | Moran 2017 109 | = | | | |
| Lifestyle parameters | Daily physical activity | Larsen$ 2020 168 | = | | | |
| | Alcohol use | Larsen$ 2020 168 | = | | | |
| Movement competency (Functional Movement Screen) | Composite score | Moran 2017 70 | = | | | |
| | Number of asymmetries | Moran 2017 70 | = | | | |
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Conflict of Interest

The authors declare that they have no conflict of interest.

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Table 4c Coaching characteristics

| Risk factor | Details | Author | Year | n Subjects | Effect | Effect size, means, percentages, significance | Adjusted effect size (confounders) |
|-------------|---------|--------|------|------------|--------|---------------------------------------------|----------------------------------|
| Beginners’ program | Introduction classes (3 vs. 1 vs. 2 vs. none) | Larsen | 2020 | 166 | ↑ | OR: 0.8 (0.6–1.1 95 % CI), not significant | |
| Variation in coaching | Always the same coach vs. coach with assistant vs. alternating coaches | Szeles | 2020 | 406 | ↑ | OR: 0.30 (0.07–0.97), p < 0.05 | Not available |
| Demonstration of proper form | Coaching involvement (all of the time vs. most of the time vs. some of the time vs. never) | Moran | 2017 | 115 | ↑ | | |

Table 4d Training characteristics

| Risk factor | Details | Author | Year | n Subjects | Effect | Effect size, means, percentages, significance | Adjusted effect size (confounders) |
|-------------|---------|--------|------|------------|--------|---------------------------------------------|----------------------------------|
| Duration of participation | | Szeles | 2020 | 406 | ↑ injury risk for ↓ duration of participation | OR: 0.8 (0.6–1.1 95 % CI), not significant | OR: 0.7 (0.5–1.0 95 % CI), p < 0.05 (training load Rx, scaled or alternating Rx and scaled and previous injury) |
| Weekly training days and exposure | Number of system-registered CrossFit class attendance | Larsen | 2020 | 164 | ↑ | | |
| | CrossFit exposure | Szeles | 2020 | 406 | ↑ | OR: 0.9 (0.8–1.0 95 % CI), not significant | Not available |
| Participation in other sports | Number of minutes reported for participation in other sports | Larsen | 2020 | 168 | ↑ | | |
| | Participation in other sports | Szeles | 2020 | 406 | ↑ | | |
| Training level and intensity | Alternating between Rx and scaled vs. solely scaled | Szeles | 2020 | 406 | ↑ odds for injury for those that alternate between Rx and scaled | OR: 3.6 (1.8–7.4 95 % CI), p < 0.05 | OR: 3.5 (1.7–7.3 95 % CI), p < 0.05 (CrossFit experience and previous injury) |
| | Rx vs. scaled | Szeles | 2020 | 406 | ↑ | | |
| Training forms and modalities | Open gym training minutes per week | Larsen | 2020 | 168 | ↑ | | |
| | Stretching exercises | Szeles | 2020 | 406 | ↑ | | |
| | Preventive exercises | Szeles | 2020 | 406 | ↑ | | |
| | Use of protective equipment | Szeles | 2020 | 406 | ↑ | | |
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