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A 4-Year Analysis of the Incidence of Injuries Among CrossFit-Trained Participants

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Original Research

A 4-Year Analysis of the Incidence of Injuries Among CrossFit-Trained Participants

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Investigation performed at Kennesaw State University, Kennesaw, Georgia, USA

Background: High-intensity functional training (HIFT) is a new training modality that merges high-intensity exercise with functional (multijoint) movements. Even though others exist, CrossFit training has emerged as the most common form of HIFT. Recently, several reports have linked CrossFit training to severe injuries and/or life-threatening conditions, such as rhabdomyolysis. Empirical evidence regarding the safety of this training modality is currently limited.

Purpose: To examine the incidence of injuries related to CrossFit participation and to estimate the rate of injuries in a large cross-sectional convenience sample of CrossFit participants from around the world.

Study Design: Descriptive epidemiology study.

Methods: A total of 3049 participants who reported engaging in CrossFit training between 2013 and 2017 were surveyed.

Results: A portion (30.5%) of the participants surveyed reported experiencing an injury over the previous 12 months because of their participation in CrossFit training. Injuries to the shoulders (39%), back (36%), knees (15%), elbows (12%), and wrists (11%) were most common for both male and female participants. The greatest number of injuries occurred among those who participated in CrossFit training 3 to 5 days per week ($\chi^2 = 12.51$; $P = .0019$). Overall, and based on the assumed maximum number of workout hours per week, the injury rate was 0.27 per 1000 hours (females: 0.28; males: 0.26), whereas the assumed minimum number of workout hours per week resulted in an injury rate of 0.74 per 1000 hours (females: 0.78; males: 0.70).

Conclusion: Our findings suggest that CrossFit training is relatively safe compared with more traditional training modalities. However, it seems that those within their first year of training as well as those who engage in this training modality less than 3 days per week and/or participate in less than 3 workouts per week are at a greater risk for injuries.

Keywords: HIFT; high-intensity functional training; injury; training; safety; exercise; sports

High-intensity functional training (HIFT), which merges high-intensity exercise with functional (multijoint) movements, has emerged as a new training modality.[9,22] Although limited research exists, several studies have demonstrated HIFT as a viable modality to improve aerobic capacity, muscular strength, and overall fitness.[21,22,34] CrossFit training, a type of HIFT regimen, is one of the fastest growing fitness programs today.[39] Overall, the aim of CrossFit training is "to forge broad, general, and inclusive fitness" to prepare people for any physical challenge, and it specializes in "not specializing."[16] Unlike other fitness programs, this methodology consists of "constantly varied, high-intensity, functional movements" that are believed to help people improve the breadth and depth of their physical adaptations and gain strength, endurance, and power.[16] Although several reports have linked CrossFit to severe injuries and/or life-threatening conditions, such as rhabdomyolysis,[18,30,43] empirical evidence regarding the safety of HIFT and CrossFit training is currently limited.

Previous investigators have examined the nature of injuries related to CrossFit training, and none has substantiated the notion that this training program might be any more "extreme" or dangerous than other exercise training programs.[19,32,46] In fact, the rate of injuries reported by

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these investigators is between 2.0 and 3.5 injuries per 1000 hours of training, which is lower than more traditional forms of training.[24] Most recently, Poston and colleagues[36] compared the risk of injuries during HIFT with traditional training among military personnel and suggested that HIFT exhibited a similar or even lower potential for injuries than more traditional training activities in this population.

Although informative, one of the biggest drawbacks to these aforementioned studies is the small sample utilized to calculate the risk of injuries, limiting their generalizability to a larger population in addition to increasing the potential errors associated with these estimates. With over 13,000 affiliates around the world, CrossFit training is one of the largest training modalities, with millions of participants. Therefore, and considering the limited evidence, we conducted a retrospective study that evaluated the incidence of injuries among CrossFit participants over a 4-year period. Our aim was to (1) examine the incidence of injuries related to CrossFit training among a large sample of participants and (2) estimate the rate of injuries among a large cross-sectional convenience sample of CrossFit participants from around the world.

METHODS

This observational study was designed to reach the greatest number of participants and provide a large cross-sectional convenience sample of CrossFit athletes. For this purpose, we created an electronic version of a survey tool using a Google-based form in English and Spanish. Adults older than 18 years with more than 3 months of CrossFit experience were asked to participate in this study. We used snowball sampling[2] to distribute our survey among members of the CrossFit community using social media outlets, email, and word of mouth. The survey was completed anonymously. Based on previous research, we considered this an appropriate survey methodology for this study.[3,38] Our survey was distributed before the beginning of the competition season in consecutive years (2013-2017) between mid-December and the end of February of the following year. We chose this time frame to appropriately capture injuries that occurred within the previous year only.

We used an online application (Bitly) to track the number of "clicks" that our survey obtained to estimate our global reach and response rate. This tracking was completely anonymous and did not store IP addresses from any computer. All participants provided consent before beginning the survey, and the study protocol was approved by the Kennesaw State University Institutional Review Board.

Questionnaire

We were interested in obtaining the most information possible regarding individual participation in CrossFit training. Thus, we used a mixed-methods design,[33] in which most questions required a predetermined response, while others were open ended and allowed participants to elaborate on their individual responses. The questionnaire inquired about the frequency of participation in CrossFit training and history of injuries while participating in this training modality. Biological variables (eg, age and sex) were included in the questionnaire as descriptive variables. To gauge their CrossFit training regimen, all participants were asked about their weekly participation and number of weekly workouts.

Considering the limited information on this topic and the lack of evidence regarding the most common injuries experienced by those involved in CrossFit training, we asked survey respondents if they had suffered any injury related to their participation in CrossFit training during the previous 12 months. To avoid misinterpretation of what constitutes an injury, we used the definition provided by Weisenthal and colleagues,[46] who defined an injury as "any muscle, tendon, bone, joint, or ligament injury sustained while doing CrossFit that resulted in your consultation with a physician, or health care provider, AND caused you to stop or reduce your usual physical activity, your typical participation in CrossFit, or caused you to have surgery." In addition, we asked survey respondents to identify the injured body part as well as to briefly elaborate on their type of injury. This type of descriptive information allows for future evaluations of the type of injuries commonly reported by participants engaged in this training modality. Although respondents were able to choose as many body parts as needed and described their injuries in an open-ended question, we dichotomized their responses to either a single injury or multiple injuries (if they chose multiple sites or the same site multiple times).

Injury Incidence

Incidence refers to the number of new cases of a health condition in a population at a designated period of time and provides an indication of the extent of a health problem.[11] Our survey queried participants about the number of injuries experienced during the previous 12 months as a result of their participation in CrossFit training (ie, "During the past year, how many times would you say you have been injured because of your participation in CrossFit training?"). Overall, incidence measurements are proportions and are expressed herein as percentages (%).

Injury Rates

In addition to examining the incidence of these injuries, we were interested in determining the actual injury rate. While incidence data provide an indication of how common a problem can be, injury rates give us the actual measurement and provide a way to compare between participants.[29] In our case, the population in question was people who participated in CrossFit training and had sustained injury to a body part. Considering the differences in how often people participate in CrossFit training, we were interested in determining the total amount of time that a person was exposed (workouts) instead of the number of people reporting injuries.[29] Therefore, we used the total number of injuries reported by participants during the previous year as our numerator for the injury rate. For our denominator, we created a variable that would "balance" the exposure of a participant to sustain bodily damage (a workout hour). To this effect, we assumed that every participant completed an hour workout (time), similar to other studies,[41,46] and multiplied that to their reported frequency of weekly workouts, and then we multiplied it by the total number of weeks throughout the year (ie, 1 hour/session × frequency of workouts/week × weeks/year). Because both the frequency of weekly workouts and the time participated were reported in ranges, we created minimum and maximum approximations for each range. Because we wanted to examine the risk of injuries over a year, we considered that 50 weeks would be an appropriate minimum approximation of training for most participants and used 52 weeks as our maximum approximation. Analyzing the data for this type of range provides a more accurate estimate of the "real risk" of this activity, considering that those with greater exposure may inevitably be more prone to injuries, not necessarily because of the activity per se but simply because of their exposure. Considering that these rates are typically very small numbers, we report injury rates per 1000 workout hours.

Statistical Analysis

Means and SDs were calculated for different age groups. Frequency counts and percentages were computed for all categorical variables. To compare categorical variables, we used the chi-square test. Incidence is presented as proportions (%) based on the total number of surveys completed, and incidence rates are calculated based on an assumed minimum of 50 weeks of training within the previous calendar year and an assumed maximum of 52 weeks of training within the previous calendar year.

All data were collected and downloaded into Excel 2011 (Microsoft). Statistical analyses were conducted using R 3.3.6 (R Core Team). A significance level of alpha = 0.05 was chosen to denote statistical significance; *P* values are reported as 2-tailed.

RESULTS

Participants

The online application reported a total of 5141 total clicks to our survey from 42 different countries. Of those clicks, 3079 participants responded to our survey. Therefore, we estimate our completion rate as 60%. Thirty participants did not complete all the questions in the survey. Because we were unable to identify why they did not complete all questions, we eliminated their surveys from the total number of responses. Thus, our final analysis included 3049 participants with a mean age of 36.8 ± 9.8 years (Table 1). The survey was open to anyone with internet access, with 88% of respondents identifying themselves as living in the United States and 99% completing the survey in English (Figure 1).

TABLE 1
Distribution of Age by Sex[a]

Age, y	Female	Male	Total
<25	112 (3.7)	151 (5.0)	263 (8.6)
25-29	268 (8.8)	260 (8.5)	528 (17.3)
30-34	312 (10.2)	318 (10.4)	630 (20.7)
35-39	272 (8.9)	266 (8.7)	538 (17.6)
40-44	184 (6.0)	208 (6.8)	392 (12.9)
45-49	164 (5.4)	166 (5.4)	330 (10.8)
50-54	98 (3.2)	111 (3.6)	209 (6.9)
≥55	73 (2.4)	86 (2.8)	159 (5.2)
Total	1483 (48.6)	1566 (51.3)	3049 (100.0)

[a]Data are shown as n (%).

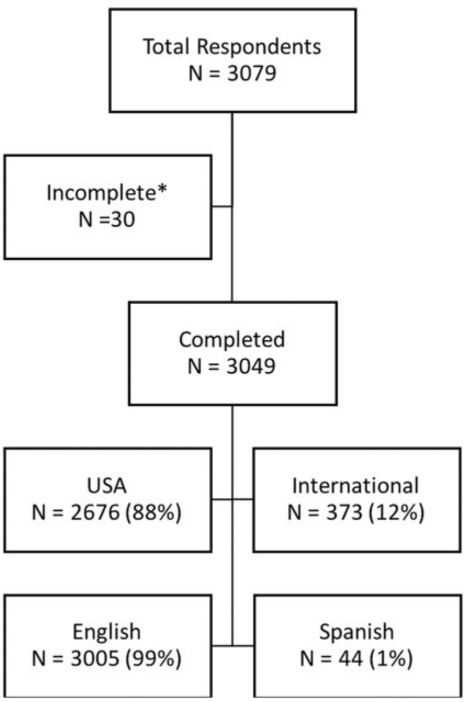

Figure 1. Flowchart of the total number of respondents and surveys completed.

Injury Incidence

Of the 3049 participants who completed the survey, 931 (30.5%) reported suffering an injury related to their participation in CrossFit training (Table 2). Overall, no significant differences were observed between male and female participants who reported experiencing an injury (females: 14.3% [n = 436]; males: 16.2% [n = 495]; $\chi^2 = 1.65$; $P = .1989$). Of those who reported an injury, 62.4% (n = 581) reported an injury to a single body part, while 37.6% (n = 350) reported injuries to multiple body parts. Overall, male participants reported a greater number of injuries

TABLE 2
Distribution of Injuries, Training, and Participation in CrossFit by Sex[a]

	Female	Male	Total	P
Experienced an injury				.1989
Yes	436 (14.3)	495 (16.2)	931 (30.5)	
No	1047 (34.3)	1071 (35.1)	2118 (69.5)	
No. of injuries (n = 931)				.0037
Single	294 (31.6)	287 (30.8)	581 (62.4)	
Multiple	142 (15.3)	208 (22.3)	350 (37.6)	
Experience in CrossFit training, y				.0461
<1	348 (11.4)	324 (10.6)	672 (22.0)	
1-3	553 (18.1)	563 (18.5)	1116 (36.6)	
>3	582 (19.1)	679 (22.3)	1261 (41.4)	
Weekly participation, d/wk				<.001
<3	162 (5.3)	112 (3.6)	274 (9.0)	
3-5	804 (26.4)	799 (26.2)	1603 (52.6)	
>5	517 (17.0)	655 (21.5)	1172 (38.4)	

[a]Data are shown as n (%).

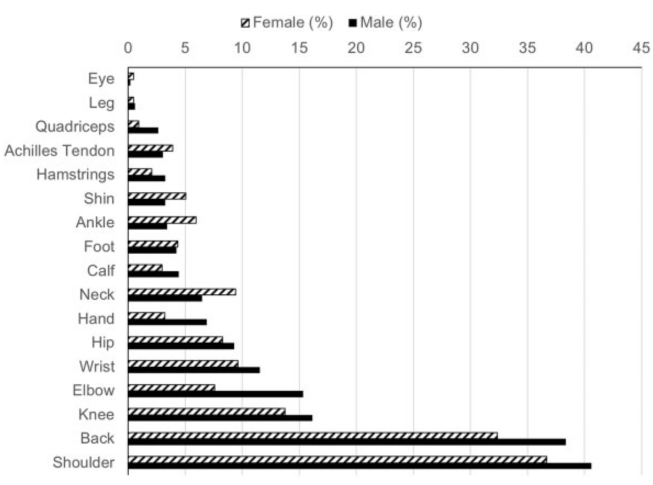

Figure 2. Distribution of the location of injuries between male and female participants.

compared with female participants ($\chi^2 = 8.43$; $P = .0037$); however, the location of those injuries was similar between the 2 groups. The shoulders (39%), back (36%), knees (15%), elbows (12%), and wrists (11%) were the most common sites of injury (Figure 2). A total of 6 cases (0.6%) of exertional rhabdomyolysis were reported among this sample.

Among those who reported experiencing an injury, the proportion of injuries was dependent on how long a participant had participated in CrossFit training. Those with more than 3 years of experience reported more injuries (43.1%) compared with those with 1 to 3 years (38.8%) and those with less than 1 year (18.0%) of experience ($\chi^2 = 12.51$; $P = .0019$). In addition, significant differences existed between female and male participants when comparing years of experience ($\chi^2 = 6.15$; $P = .0461$). When further examining sex-based differences and years of experience, only male participants with the most experience reported having suffered a CrossFit training–related injury more often compared with those with 1 to 3 years and those with less than 1 year of experience (28.3%, 15.8%, and 12.6%, respectively; $P = .013$). There were no significant diffferences in injury incidence among female participants, regardless of experience. When we examined the incidence of injuries based on how often participants engaged in CrossFit training (Table 2), we found that those who engaged in this training modality 3 to 5 days per week reported a greater number of injuries compared with those who participated less than 3 days per week and those who participated more than 5 days per week ($\chi^2 = 1.3529$; $P = .5084$). Significant differences existed between these 3 groups and between sexes ($\chi^2 = 23.15$; $P < .001$).

Injury Rates

The injury rate distribution resulted in a severely right tail–skewed data set, with the majority of participants reporting low injury rates. Based on the assumed maximum number of workout hours per week, the injury rate was 0.27 per 1000 hours (females: 0.28; males: 0.26), whereas the assumed minimum number of workout hours per week resulted in an injury rate of 0.74 per 1000 hours (females: 0.78; males: 0.70). Considering the skewness of the data, we felt that using the median value was the most appropriate measure for the overall injury rate.[45] When stratified by sex, female participants had higher injury rates for both the assumed maximum (0.28/1000 hours) and minimum (0.78/1000 hours) when compared with the assumed maximum (0.26/1000 hours) and minimum (0.70/1000 hours) for male participants (Table 3); however, no significant differences were observed between male and female participants. No significant differences were observed between age groups for participants experiencing injuries ($\chi^2 = 11.302$; $P = .1260$).

When we compared the injury rates based on the frequency of CrossFit training participation, we observed a significantly higher rate of injuries among those who reported CrossFit training less than 3 days per week (minimum, 2.46/1000 workout hours; maximum, 0.54/1000 workout hours) compared with those engaging in this training modality 3 to 5 days per week (minimum, 0.90/1000 workout hours; maximum, 0.30/1000 workout hours) and those engaging more than 5 days per week (minimum, 0.53/1000 workout hours; maximum, 0.22/1000 workout hours) (Table 3).

Last, we examined injury rates among participants based on how long they reported participating in CrossFit training. Overall, those with less than 6 months of experience had the highest rates of injuries (minimum, 3.90/1000 workout hours; maximum, 1.15/1000 workout hours), followed by those with 6 to 12 months of experience (minimum, 3.21/1000 workout hours; maximum, 1.01/1000 workout hours). Based on these data, the rate of injuries was inversely proportional to years of experience (Table 3).

In addition, we stratified our analysis to include sex and workout frequency and observed that those who participated in the least number of workouts per week, regardless

TABLE 3
Number of Injuries and Incidence Rates per 1000 Hours[a]

	No. of Injuries	Incidence Rate per 1000 Hours	
		Minimum	Maximum
Overall	931	0.74	0.27
Sex			
Female	436	0.78	0.28
Male	495	0.70	0.26
Age group, y			
<25	67	0.80	0.27
25-29	147	0.68	0.25
30-34	183	0.73	0.26
35-39	170	0.71	0.27
40-44	123	0.73	0.27
45-49	114	0.82	0.30
50-54	72	0.84	0.30
≥55	55	0.73	0.28
Weekly participation, d/wk			
<3	76	2.46	0.54
3-5	488	0.90	0.30
>5	367	0.53	0.22
No. of weekly workouts			
1-3	158	3.61	0.61
4-6	607	0.81	0.29
7-9	126	0.39	0.17
≥10	40	0.26	0.11
Experience in CrossFit training			
<6 mo	36	3.90	1.15
6-12 mo	132	3.21	1.01
1-3 y	361	1.57	0.34
3-5 y	312	0.50	0.20
>5 y	90	0.25	0.14

[a]Minimum has the assumptions of the lowest weekly participation, lowest frequency of weekly workouts, and 50 weeks per year of CrossFit training. Maximum has the assumptions of the highest weekly participation, highest frequency of weekly workouts, and 52 weeks per year of CrossFit training.

of sex, had a higher risk of injuries compared with those who participated most often (Table 4).

DISCUSSION

The present study describes the incidence of injuries among CrossFit participants and suggests that, unlike some media reports, the incidence of injuries among participants in this popular training modality may not be as high as previously suggested. Overall, CrossFit training seems to be a safe exercise program that has provided an avenue for thousands of people around the world to become physically active; although participation numbers worldwide are debatable, the significant rise in the number of affiliates since 2009 (from 1000 in February 2009 to over 13,000 in January 2018[7]) and the rising number of participants in the CrossFit Open[8] suggest an increase in the popularity of this training modality. To our knowledge, this is the first study to include a large multiyear sample of participants involved

TABLE 4
Incidence Rates per 1000 Hours by Sex, Weekly Participation, and Age Group

	n	Incidence Rate per 1000 Hours	
		Minimum	Maximum
Female			
<3 d/wk			
<25 y	9	3.48	0.47
25-29 y	23	1.54	0.35
30-34 y	33	2.87	0.48
35-39 y	24	3.08	0.69
40-44 y	24	1.67	0.33
45-49 y	26	3.46	0.63
50-54 y	13	2.38	0.63
≥55 y	10	1.85	0.48
3-5 d/wk			
<25 y	43	1.48	0.41
25-29 y	119	0.96	0.32
30-34 y	169	0.87	0.27
35-39 y	161	0.84	0.29
40-44 y	107	0.81	0.26
45-49 y	98	0.93	0.31
50-54 y	59	0.95	0.34
≥55 y	48	0.77	0.27
>5 d/wk			
<25 y	60	0.81	0.28
25-29 y	126	0.63	0.22
30-34 y	110	0.64	0.25
35-39 y	87	0.51	0.21
40-44 y	53	0.79	0.30
45-49 y	40	0.46	0.20
50-54 y	26	0.29	0.11
≥55 y	15	0.37	0.18
Male			
<3 d/wk			
<25 y	5	—	—
25-29 y	15	2.20	0.47
30-34 y	21	2.25	0.60
35-39 y	18	2.10	0.60
40-44 y	17	4.49	0.75
45-49 y	13	1.08	0.25
50-54 y	11	2.46	0.53
≥55 y	12	3.90	0.97
3-5 d/wk			
<25 y	53	1.27	0.37
25-29 y	103	0.79	0.27
30-34 y	149	0.90	0.30
35-39 y	148	0.93	0.32
40-44 y	118	0.81	0.29
45-49 y	106	0.93	0.33
50-54 y	72	1.13	0.37
≥55 y	50	0.79	0.28
>5 d/wk			
<25 y	93	0.56	0.20
25-29 y	142	0.50	0.20
30-34 y	148	0.51	0.20
35-39 y	100	0.40	0.17
40-44 y	73	0.44	0.19
45-49 y	47	0.64	0.28
50-54 y	28	0.44	0.18
≥55 y	24	0.43	0.19

in CrossFit training. Overall, our findings suggest that the rate of injuries for less engaged participants was 0.74 injuries per 1000 hours compared with 0.27 injuries per 1000 hours for those more engaged. In addition, male participants were more likely to report an injury compared with female participants, while those participating in CrossFit training less often (<3 d/wk) and with less experience (<1 year) were more likely to report an injury compared with those who were more engaged in this training modality.

Although a rationale for these findings may be speculative, we believe that these injury rates are appropriate, considering the nature of this training modality and the skill needed to complete many of the tasks associated with it. Keeping in mind the "constantly varied" nature of CrossFit training, it makes sense that those with the least experience may be more prone to injuries as a result of strength and/or flexibility issues that may hinder their ability to complete some of the more basic exercises. Moreover, those who described themselves as "less experienced" in this study may not necessarily be inexperienced exercisers; it may be that those with less experience in CrossFit training, but who are more athletic, push themselves more and therefore put themselves at greater risk for injuries. Our speculations here are supported by the fact that those with greater experience reported injuries less often than those with less experience. As a result, it is important that participants engaging in CrossFit training initially undergo an introduction to the training modality and work within their abilities to prevent potential injuries.

In this study, 30.5% of respondents reported experiencing an injury over the previous 12 months. These findings are in agreement with those of Sprey et al,[41] who reported an injury incidence of 30% among 566 Brazilian CrossFit participants, and Montalvo and colleagues,[31] who stated that 55% of the athletes surveyed reported acute injuries. In addition, our findings are similar to those of Moran et al,[32] who reported that male participants experienced an injury more often than female participants. Investigators have provided insight to the rates of injuries among different leisure-time activities,[20,35,37] and although we cannot make direct comparisons with our findings, it is interesting to note the similar inverse relationships in which inactive participants are more likely to experience an injury as a result of lower fitness levels.[20]

Considering the popularity of this training program, and the differences found between men and women as well as among levels of experience, it is important to describe injuries in a manner that can be compared between studies. As such, it is important to compare injury rates instead of simply the incidence of injuries, as exposure to training (ie, how often) will have an impact on the likelihood of experiencing an injury. Although we have provided injury estimates based on participation, our overall findings are well below previously reported injury rates.[15,19,28,46] For example, Hak et al[19] reported on 132 participants (19-57 years old) and calculated an injury rate of 3.1 per 1000 hours. Meanwhile, Weisenthal et al[46] reported on 486 CrossFit training participants and reported an incidence of injuries of 20%, without a specified injury rate. However, this injury rate was later reported as 2.4 injuries per 1000 hours of training.[15] Most recently, Mehrab and colleagues[28] surveyed 553 Dutch CrossFit athletes and reported a 50% incidence of injuries, and although they did not provide an injury rate, they reported that athletes with less than 6 months of experience had a nearly 4 times greater risk of injuries compared with those with more than 24 months of experience. We believe that the differences seen in the injury rates in our study, compared with those previously mentioned, have to do with how we calculated our rate of injuries, which included the number of workouts per week versus the total number of days a workout was completed. This method provides a more accurate assessment of the injury risk, as every session serves as a potential period in which an injury can occur.

Over the past several years, CrossFit training has been scrutinized in the mainstream media because of the supposed high incidence of injuries; however, these statements seem not to be supported by empirical evidence.[6,23] Although several case studies exist documenting injuries from this training modality,[10,25] these often provide a case of a single athlete, which although unfortunate may not apply to the entire population of CrossFit participants. These cases should serve as reminders to coaches and practitioners that unfortunate events can occur but should not be generalizable to the thousands of participants who engage in this training modality annually.

Additionally, this training modality has been linked with reports of rhabdomyolysis,[18,43] a potentially lethal condition resulting from the breakdown of muscle tissue characterized by pain, weakness, swelling, and blood in the urine, which can lead to renal failure and death.[5] Although the incidence of rhabdomyolysis in the general population is unknown, its development may be associated with genetic (eg, McArdle disease and sickle cell trait) or acquired conditions (eg, trauma, drug use, infection).[5] The most common causes of rhabdomyolysis in adults include illicit drugs, alcohol abuse, and trauma (ie, crush injuries)[26]; nonetheless, while rare, several reports exist of people experiencing rhabdomyolysis after engaging in exercise training and other sports.[1,13,14,27,40,42] In addition, more common leisure-time physical activities such as indoor cycling,[42] resistance training,[13] and ultimate Frisbee[27] have also resulted in reports of exertional rhabdomyolysis. In our study, 6 participants (0.6%) reported a medical diagnosis of exertional rhabdomyolysis because of their participation in CrossFit training. Future studies should be designed to further investigate the occurrence of this condition among active adults engaged in this training modality to elucidate the real risk of developing rhabdomyolysis as a result of CrossFit training.

Although surveys are subject to recall bias, and some participants may have underreported their injuries, the use of surveys to retrospectively describe injury data is common in the literature.[12,44] Unlike other investigators who used message boards and direct mailings, we distributed our survey using social media outlets, which have been considered effective tools for recruiting study participants.[4,17] Nonetheless, we acknowledge that our sample size was limited to only a small portion of those who engage in this training modality around the world and that the survey was primarily completed by those who spoke English and had access to the internet.

The lack of randomization could have potentially biased our results, as participants with a history of injuries might have been more likely to respond to our survey. Nevertheless, our method of producing a minimum and maximum for injury rates based on a participant's workout frequency created a more complete assessment of the exposure to CrossFit training, depicting a data set that may offer a more accurate representation of the level of risk related to CrossFit training compared with previous studies,[15,19,28,46] which have reported a single injury rate. To our knowledge, this is the first study to provide this type of range in the literature. Moreover, if our sample was indeed partial toward those with injuries, then future studies should result in a lower incidence of injuries and potentially lower injury rates. Additionally, previous investigators have studied the validity of self-reporting the injury history,[12,44] suggesting that injuries that have a longer period of symptoms or require the attention of a medical professional are more likely to be remembered than minor injuries. Additional studies should continue to examine the potential implication of these measures among this group of active people.

CONCLUSION

This study provides valuable contributions to a currently scarce body of literature. Overall, CrossFit training seems to be a safe training modality for most participants; however, our findings suggest that there are 3 main groups that might be at a greater risk for injuries, including those who (1) are within their first year of participation, (2) engage in this training modality less than 3 days per week, and (3) participate in less than 3 workouts per week. As such, and considering these findings, we encourage fitness professionals to pay close attention to these people and potentially develop "beginner" programs that promote skill progression within the first year of participation to minimize the risk of injuries.

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