

Article

Training Habits, Injury Prevalence, and Supplement Use in CrossFit Practitioners

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Abstract

Background: CrossFit® is a high-intensity functional training modality with increasing popularity, yet limited evidence describes the general profile of its practitioners. **Objective:** To characterize CrossFit® athletes based on their training habits, injury prevalence, and nutritional supplement use, with specific consideration given to sex and age. **Methods:** An online questionnaire was completed by 358 practitioners (182 women; mean age 35.6 ± 9.1 years) from various Spanish regions. Descriptive and comparative analyses (χ^2 and ANOVA; $p < 0.05$) were conducted for training patterns, injury history, and supplement consumption. **Results:** Over half of the sample had practiced CrossFit® for more than three years, typically training 3–4 days per week in one-hour sessions. Participants primarily reported social and health-related motivations and identified as non-competitive. Overall, 42.2% experienced at least one CrossFit®-related injury, most frequently affecting the shoulder (15.6%) and lumbar spine (10.1%), largely attributed to repetitive overload. Supplement use was widespread (81.8%), with creatine (60.3%) and protein (49.4%) being the most commonly consumed. **Conclusions:** CrossFit® practitioners train consistently, value the social environment, and show an injury pattern similar to that of other strength-based disciplines. Supplement consumption is highly prevalent across groups. Coaches and health professionals should prioritize injury-prevention strategies, promote safe load progression, and guide responsible supplement use.

Keywords: CrossFit®; training injury prevalence; nutritional supplements; athlete profiling



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1. Introduction

Physical inactivity represents one of the most significant public health challenges worldwide. In this context, the fitness industry has emerged as a dynamic sector characterized by an increasing diversity of training methodologies aimed at promoting an active and healthy lifestyle [1]. Current trends in Spain, as identified by the National Survey of Fitness Trends, reflect this focus, highlighting weight loss exercise, personal and small-group training, high-intensity functional training (HIFT), and senior fitness programs as the most dominant practices [2].

In this sense, HIFT has solidified its position as a leading trend within the fitness sector [3]. Among its advantages, HIFT has demonstrated higher participant adherence compared to traditional modalities like bodybuilding or weightlifting. This is partly because HIFT is time-efficient, requiring less time to complete a training session [4]. This specific

characteristic of high-intensity training, temporal efficiency, directly addresses one of the most frequently cited barriers to maintaining a regular exercise program which is the lack of time [5].

A prominent modality that has surged in popularity within the HIFT framework is CrossFit (CF) [6]. CF is a strength and conditioning program based on high-intensity functional movements. CF is designed to optimize physical competence across multiple fitness domains, including cardiovascular endurance, strength, flexibility, power, speed, coordination, agility, balance, and accuracy [7]. A key distinction between CF and traditional high-intensity interval training is the absence of prescribed rest periods in a typical CF workout. This structure requires participants to sustain a high-power output (the relationship between force and velocity) throughout the entire session [8].

The CF methodology is founded on three fundamental pillars: functional movements (from daily life), constantly varied workouts (each session is different), and execution at high intensity. Consequently, CF aims to prepare participants for any physical contingency by training them to respond to unknown situations and a wide variety of physical demands that may arise in daily life [9]. To this end, most movements in this discipline mimic natural motor patterns, such as pushing, carrying, and throwing, with the goal of enhancing the athlete's competence in meeting real-world physical demands [10].

A typical CF session follows a structured format that includes a warm-up, a strength or technique-focused segment, and a main component known as the "Workout of the Day" (WOD), which usually lasts between 5 and 30 min. The WOD itself can be structured in various modalities, including: (a) AMRAP (As Many Rounds/Reps as Possible); (b) EMOM (Every Minute on the Minute); (c) For Time; and (d) Tabata [11]. The exercises are primarily selected for their functional nature, drawing from disciplines such as gymnastics (e.g., ring muscle-ups), weightlifting (e.g., squats, power cleans, and barbell presses), and cardiovascular activities (e.g., rowing, cycling, or running) [12].

Regular practice of CF has been associated with improvements in key health markers, including blood glucose, lipid profile, insulin sensitivity, and blood pressure. These improvements contribute to the prevention and management of chronic diseases such as type 2 diabetes, hypertension, and obesity [13]. Supporting this, a recent meta-analysis concluded that CF effectively improves body composition, metabolic health, and cardiorespiratory fitness in overweight and obese adults [14]. Apart from these benefits, previous studies have demonstrated that CF enhances the development of motor skills and bone density [15]. These findings underscore the role of skeletal muscle as an endocrine organ, as physiological adaptations to intense exercise stimulate the production and release of myokines that act on other tissues to promote lipid oxidation, enhance glucose uptake, and regulate inflammatory processes [16].

Furthermore, Zhang et al. [17] compared the effects of conventional training versus CF, finding that the latter led to greater improvements in physical self-esteem and self-efficacy among adolescents, thereby boosting their confidence in their abilities and self-control. The psychological benefits of CF are also well-documented. In a systematic review of psychological variables, Dominski et al. [18] found that CF practice is positively linked to motivation and satisfaction. Participants reported high levels of perceived exertion, intrinsic motivation, and engagement driven by enjoyment, challenge, and a sense of community.

In this context, the intrinsic demands of CF, such as high intensity, multi-joint movements performed at high velocity, and heavy loads, carry an associated risk of musculoskeletal injury [19,20]. However, a systematic review conducted by Klimek et al. [21] concluded that injury rates in CF are lower than those in sports such as Olympic weightlifting, long-distance running, rugby, soccer, and ice hockey. Subsequent research has further

indicated that the injury rate in CF is similar to that of other strength sports like weightlifting and powerlifting [22]. It is important to note that a significant portion of injuries associated with CF are attributed to improper management of skill progression, load, and exercise scaling [23]. Therefore, many injuries may stem more from the intensity at which movements are performed rather than the complexity of the movements themselves [24]. In this context, previous studies have demonstrated that individuals who train more than five days per week exhibit a lower risk of injury [10,25]. This may be because frequent practitioners develop better technique and superior neuromuscular parameters [26].

Regarding the anatomical location of injuries, previous studies have consistently identified the shoulder, lower back, and knee as the most common sites for musculoskeletal injuries in CF [6]. In this sense, Rodríguez et al. [22] conducted a systematic review of 25 studies involving 12,709 CF practitioners. Their results showed that the shoulder, lumbar spine, and knee were the most frequently injured areas. Similarly, a systematic review conducted by Brandsema et al. [19] which included 18 studies, aimed to determine the prevalence, location, and causative movements of injuries concluded that shoulder injuries were the most common among CF participants, followed by lumbar and hand/wrist injuries.

Given the high physical demands of CF, many practitioners turn to dietary supplements to optimize performance, delay fatigue, and enhance muscle recovery. Supplement use is particularly prevalent in sports that combine strength and endurance elements, such as this modality [27]. In this regard, a survey of 2576 participants conducted by Brisebois et al. [28] found that 82.2% regularly used supplements, with protein, creatine, and pre-workout/energy products being the most common. Participants reported that their primary reasons for supplement use were to improve recovery, enhance overall health, also increase muscle mass and strength. In addition, dos Santos et al. [29] carried out an online questionnaire with 112 participants, concluding that whey protein and creatine were the most widely used supplements among CF practitioners.

In this context, training habits, injury incidence, and supplement use should be considered collectively, as they form an integral part of the comprehensive profile of a CF athlete. However, the available evidence on the general characteristics of CF practitioners remains limited, hindering the establishment of a clearly defined profile for this population. Therefore, the objective of this study was to characterize CF athlete based on their training habits, injury prevalence, and nutritional supplement use, with specific consideration given to sex and age.

2. Materials and Methods

A total of 358 participants from 18 to 60 years old (mean age = 35.58 ± 9.07 years) who practice CF at various Spanish sports centres took part in this cross-sectional study (182 women: mean age = 35.19 ± 9.08 years, and 176 men: Mean age = 36.01 ± 9.09 years). To examine the effect of age on CF, participants were divided into three age groups (Young: 18–30, Adults: 31–45, Older: 46–60) according to previous studies [26,30]. The inclusion criteria were: (a) being 18 years or older, and (b) having practiced CF regularly (2 or more days per week) at an affiliated box for at least the six months preceding the survey. Data were collected using a self-administered online questionnaire created with Google Forms. The questionnaire was distributed to practitioners affiliated with the CF database of various sports centres across Spain and was active between March and May 2025.

The study was approved by the University of Jaén Ethics Committee (reference MAR.17/1) and was conducted in accordance with the ethical principles of the Declaration of Helsinki. All participants were informed about the study's details and objectives on the first page of the questionnaire. They were also informed about data handling, indi-

cating that only the principal investigator would have access to the data and that it would be treated anonymously at all times, in compliance with Spanish Organic Law March 2018 on Personal Data Protection and Digital Rights Guarantee. Participation was voluntary, and respondents were required to check a box providing informed consent before they could proceed to complete the questionnaire.

2.1. Data Collection

A self-administered questionnaire was developed ad hoc for this study <https://forms.gle/BtFMrg8FvV5V768o9> (accessed on 12 January 2025). Content validity was assessed using the Delphi method with a panel of five experts in sports science, all of whom were certified CF coaches. Experts evaluated each item for relevance, clarity, and congruence using a 5-point Likert scale; items were refined based on consensus feedback. The questionnaire comprises 40 questions divided into four sections. The first section includes 8 questions on sociodemographic variables. The second contains 12 questions regarding CF training habits. The third contains 10 questions about any injuries sustained during practice, training, or competition in the last year. Notice that a CF-related injury was defined in this study as any musculoskeletal complaint attributed to CF practice resulting in pain, training modification, or temporary cessation of training, including acute injuries and chronic conditions exacerbated by overload. The fourth consists of 8 questions related to dietary supplementation. The questions were primarily closed-ended, featuring both multiple-choice formats and 5-point Likert scale items, where 1 corresponded to “not important at all” and 5 to “very important.” Additionally, question 33 was dichotomous (Yes/No), with “Yes” indicating supplement consumption and “No” indicating no consumption.

2.2. Procedure

The questionnaire was distributed using several strategies. The primary method involved digital platforms, including CF-specific communication channels, various social media networks, and the internal chat systems of CF affiliates (box), through which a direct link to the questionnaire was disseminated. Furthermore, direct contact was established with the managers of various CF establishments, who were requested to promote the survey among their members. Coaches, instructors, and box owners were also encouraged to share the questionnaire with other centres, with the objective of reaching the largest possible number of practitioners nationwide.

2.3. Statistical Analysis

Sample size calculation was performed using G*Power software (version 3.1). For a fixed-effects ANOVA with a significance level of $\alpha = 0.05$, a statistical power of $1 - \beta = 0.80$, and a medium effect size ($f = 0.25$), a minimum sample of 278 participants was required. Statistical analyses were conducted using IBM SPSS Statistics (Version 24 for Windows). Content validity of the questionnaire was established using the Delphi method with a panel of five experts in Sport Science and CF. The experts rated item congruence, relevance, and clarity on a 5-point Likert scale. Subsequent analyses were stratified by sex and age groups. Categorical variables were analysed using contingency tables and the Chi-square (χ^2) test to identify significant associations. When expected cell frequencies were lower than five, Fisher's exact test was applied instead of the chi-square test. For quantitative variables, an Analysis of Variance (ANOVA) was used to compare group differences, with results expressed as frequencies and percentages (%). The significance level was set at $p < 0.05$.

3. Results

Inter-rater agreement, as quantified by Fleiss' Kappa, reached a value of 0.811, reflecting a high degree of concordance among raters. Internal consistency, estimated using

Cronbach's alpha, was 0.803, indicating satisfactory internal reliability of the measurement instrument.

A total of 358 CF athletes (182 women and 176 men; height = 1.70 ± 0.09 m; BMI = 24.77 ± 3.9 kg/m²) completed the questionnaire. Most participants were single (57.0%, n = 204), followed by married (34.9%, n = 125), and separated (8.1%, n = 29). Regarding academic background, 110 athletes (30.7%) held a Bachelor's degree, 100 (27.9%) a Master's degree, and 12 (3.4%) a Doctoral degree.

3.1. CrossFit Training and Practice Habits

Table 1 displays the characteristics related to CF practice habits separated by sex. Regarding experience, 57.5% of participants reported practicing this discipline for more than 3 years, a proportion that was significantly higher in men (62.0%) than in women (48.2%) ($p = 0.031$). The most common weekly training frequency was 3–4 days per week (54.8% of the total) ($p = 0.292$). Similarly, most participants (70.9%) trained for approximately 1 h per session, with a trend towards a longer daily training volume in men ($p = 0.051$). Concerning motivation for practice, 31.0% of the surveyed considered CF very important in their lives, with this being more prevalent among women (36.8%) than men (25.0%) ($p = 0.050$). Only 9.8% reported participating in competitions, a proportion significantly higher in men (14.8%) than in women (4.9%) ($p = 0.002$). Finally, most respondents identified with a scaled performance level (65.9%), a finding that was significantly more common among women (76.9%) than men (54.5%) ($p < 0.001$).

Table 1. Description of CrossFit sports practice differentiated by sex.

CrossFit		Total N = 358 (%)	Women N = 182 (%)	Men N = 176 (%)	p-Value
Number of years practicing CF	1 year 2 years +3 years	76 (21.12) 76 (21.2) 206 (57.5)	41 (22.5) 44 (24.1) 97 (48.2)	35 (19.9) 32 (18.2) 109 (62)	0.031
Training days per week	2 3 4 5 6 7	25 (7) 98 (27.4) 98 (27.4) 80 (22.3) 47 (13.1) 10 (2.8)	16 (8.8) 56 (30.8) 44 (25.8) 40 (22) 19 (10.4) 4 (2.2)	9 (5.1) 42 (23.9) 51 (29) 40 (22.7) 28 (15.9) 6 (3.4)	0.292
Training hours per day	1 1.5 2 2.5 3	254 (70.9) 64 (17.9) 30 (8.4) 3 (0.8) 7 (2.0)	137 (75.3) 32 (17.6) 9 (4.9) 0 (0.0) 4 (2.2)	117 (66.5) 32 (18.2) 21 (11.9) 3 (1.7) 3 (1.7)	0.051
Main reason for practicing CF: To connect with other people	Not important. Somewhat important Neutral Important Very Important	15 (4.2) 30 (8.4) 85 (23.7) 117 (32.7) 111 (31)	4 (2.2) 12 (6.6) 42 (23.1) 57 (31.3) 67 (36.8)	11 (6.3) 18 (10.2) 43 (24.4) 60 (34.1) 44 (25)	0.050
Do you join in CF competitions?	Yes No	35 (9.8) 323 (90.2)	9 (4.9) 173 (95.1)	26 (14.8) 150 (85.2)	0.002
Sport level according RX	Scaled level RX, No competition RX, Competition	236 (65.9) 98 (27.4) 24 (6.7)	140 (76.9) 37 (20.3) 5 (2.7)	96 (54.5) 61 (34.7) 19 (10.8)	<0.001
Exercises that you enjoy most in CF	Weightlifting Gymnastics Cardiovascular Mixed WODs	87 (24.3) 41 (11.5) 20 (5.6) 210 (58.7)	47 (25.8) 19 (46.3) 8 (4.4) 108 (59.3)	40 (22.7) 22 (12.5) 12 (6.8) 102 (58.7)	0.647
Training modality	CrossFit Endurance Weightlifting Gymnastics Kettlebell	182 (51.7) 56 (15.9) 62 (17.6) 43 (12.2) 9 (2.6)	86 (48.3) 25 (14) 35 (19.7) 25 (14) 7 (3.9)	96 (55.2) 31 (17.8) 27 (15.5) 18 (10.3) 2 (1.1)	0.192

CF: CrossFit; WOD: Workout of the day; RX: Training modality in which the workload is not adapted to the participant.

Table 2 outlines CF practice characteristics according to age groups. Significant differences were observed between groups for years of practice ($p < 0.001$). Similarly, the

youngest group showed less training experience (<1 year) with respect to the other groups ($p < 0.001$). Concerning weekly training frequency, the older group showed a higher proportion of individuals training 5 days/week (34.5%) compared to adults (18.0%) and young participants ($p = 0.086$). Regarding the social motivation for practice, the adult group consider this reason as important or very important (59 participants; 33.1%).

Table 2. Preferences of CrossFit practitioners differentiated by age groups.

CrossFit		Total N = 358 (%)	Young (a) 18–30 Years N = 123 (%)	Adults (b) 31–45 Years N = 178 (%)	Older (c) 45–60 Years N = 55 (%)	p- Value	Post Hoc
Number of years practicing CF	1 year	76 (21.2)	47 (37.6)	22 (12.4)	7 (12.8)	<0.001	a > b; a > c **
	2 years	76 (21.2)	28 (21.6)	37 (21.3)	10 (20.0)		
	+3 years	206 (57.5)	51 (40.8)	118 (66.3)	37 (67.2)		a < b, a < c **
Training days per week	2	25 (7.0)	4 (3.2)	18 (10.1)	3 (5.5)	0.086	
	3	98 (27.4)	39 (31.2)	51 (28.7)	8 (14.5)		
	4	98 (27.4)	35 (28.0)	49 (27.5)	14 (25.5)		
	5	80 (22.3)	29 (23.2)	32 (18.0)	19 (34.5)		
	6	47 (13.1)	15 (12.0)	24 (13.5)	8 (14.5)		
	7	10 (2.8)	3 (2.4)	4 (2.2)	3 (5.5)		
Training hours per day	1	254 (70.9)	77 (61.6)	132 (74.2)	45 (81.8)	0.127	
	1.5	64 (17.9)	28 (22.4)	28 (15.7)	8 (14.5)		
	2	30 (8.4)	16 (12.8)	13 (7.3)	1 (1.8)		
	2.5	3 (0.8)	2 (1.6)	1 (0.6)	0 (0.0)		
	3	7 (2.0)	2 (1.6)	4 (2.2)	1 (1.8)		
Main reason for practicing CF: To connect with other people	Not important	15 (4.2)	4 (3.2)	5 (2.8)	6 (10.9)	0.303	c > a, c > b **
	Somewhat important	30 (8.4)	13 (10.4)	14 (7.9)	3 (5.5)		
	Neutral	85 (23.7)	29 (23.2)	41 (23.0)	15 (27.3)		
	Important	117 (32.7)	41 (32.8)	59 (33.1)	17 (30.9)		
	Very important	111 (31.0)	38 (30.4)	59 (33.1)	14 (25.5)		
Do you join in CF competitions?	Yes	35 (9.8)	13 (10.4)	20 (11.2)	2 (3.6)	0.242	
	No	323 (90.2)	112 (89.6)	158 (88.8)	53 (96.4)		
Sport level according RX	Scaled level	236 (65.9)	80 (64.0)	114 (64.0)	42 (76.4)	0.321	
	RX, No competition	98 (27.4)	37 (29.6)	49 (27.5)	12 (21.8)		
	RX, Competition	24 (6.7)	8 (6.4)	15 (8.4)	1 (1.8)		
Exercises that you enjoy most in CF	Weightlifting	87 (24.3)	36 (28.8)	44 (24.7)	7 (12.7)	0.133	
	Gymnastics	41 (11.5)	19 (15.2)	17 (9.6)	5 (9.1)		
	Cardiovascular	20 (5.6)	7 (5.6)	9 (5.1)	4 (7.3)		
	Mixed WODs	210 (58.7)	63 (50.4)	108 (60.3)	39 (70.9)		
Training modality	CrossFit	182 (51.7)	69 (55.6)	86 (49.4)	27 (50.0)	0.003	b > a, b > c **
	Endurance	56 (15.9)	11 (8.9)	29 (16.7)	16 (29.6)		
	Weightlifting	62 (17.6)	26 (21.0)	32 (18.4)	4 (7.4)		
	Gymnastics	43 (12.2)	16 (12.9)	24 (13.8)	3 (5.6)		
	Kettlebell	9 (2.6)	2 (1.6)	3 (1.7)	4 (7.4)		c > a, c > b **

CF: CrossFit; WOD: Workout of the day; RX: Training modality in which the workload is not adapted to the participant. Lowercase letters mean significant differences among groups (i.e., a, b, c); ** $p < 0.01$.

Furthermore, competition participation progressively decreased with age, with rates of 3.6% in the older group compared to 10.4% in the young and 11.2% in the adult groups. Finally, “CF-specific training” was the most selected preferred modality across all three groups, significantly surpassing weightlifting, endurance, and gymnastic training, with kettlebell training being the least chosen option ($p = 0.003$). However, the adult group showed a greater preference for endurance training compared to the young group, with the older group showing the highest preference ($p < 0.01$).

3.2. CrossFit and Injuries

Table 3 presents data on the occurrence of injuries associated with CF practice during the last year, their duration, and related factors.

Table 3. Main injuries of CrossFit practitioners, differentiated by sex.

Injuries		Total N = 358 (%)	Women N = 182 (%)	Men N = 176 (%)	p-Value
Injury resulting from CF	Si No	151 (42.2) 207 (57.8)	59 (32.4) 123 (67.6)	92 (52.3) 84 (47.7)	<0.001
Duration of injury (weeks)	1	89 (24.8)	35 (19.2)	54 (30.7)	0.025
	Between 1–3	28 (13.1)	16 (9.1)	12 (6.6)	
	>3	33 (9.2)	13 (7.1)	20 (11.4)	
	No injury	208 (58.1)	122 (67)	86 (48.9)	
How did the injury occur?	Training	112 (31.3)	44 (24.2)	68 (38.6)	0.006
	Competition	10 (2.8)	7 (4.0)	3 (1.7)	
	Other	17 (9.3)	15 (8.5)	32 (8.9)	
	No injury	204 (57)	85 (48.3)	119 (65.4)	
Is it a new or recurring injury?	New	100 (28.2)	36 (19.8)	65 (36.9)	0.001
	Previous	50 (14.5)	28 (15.4)	24 (13.6)	
	No injury	208 (57.3)	118 (64.8)	87 (49.4)	
What was the cause of the injury?	Overload	67 (18.7)	28 (15.4)	39 (22.2)	0.030
	Bad technique	39 (10.9)	16 (8.8)	23 (13.1)	
	Fatigue	23 (6.4)	9 (4.9)	14 (8.0)	
	No warm-up	4 (1.1)	2 (1.1)	2 (1.1)	
	Other	27 (7.5)	10 (5.5)	17 (9.7)	
	No injury	198 (55.3)	117 (64.3)	81 (46)	
	CrossFit	70 (19.6)	32 (17.6)	38 (21.6)	
Type of training that has suffered the most injuries	Endurance	8 (2.2)	2 (1.1)	6 (3.4)	0.260
	Weightlifting	36 (10.1)	14 (7.7)	22 (12.5)	
	Gymnastics	34 (9.5)	12 (6.6)	22 (12.5)	
	Kettlebell	2 (0.6)	1 (0.5)	1 (0.6)	
	None	208 (58.1)	121 (66.5)	87 (49.4)	

CF: CrossFit.

Injury prevalence showed significant differences between sexes, being higher in men (52.3%) than in women (32.4%) ($p < 0.001$). Regarding injury duration, most cases resolved in less than one week, with a significant difference observed between sexes ($p = 0.025$). Most injuries occurred during regular training ($p = 0.006$), and new injuries were significantly more common than those stemming from a previous injury ($p = 0.001$).

In terms of attributed cause, overuse from repetitive movements was the most frequently reported reason ($p = 0.030$), followed by poor technique and accumulated fatigue. Although the highest number of injuries was associated with classic CF training (19.6%), no significant differences were found between different training types as the primary cause of injury ($p = 0.260$).

Table 4 shows the prevalence and characteristics of injuries associated with CF practice by age group. Regarding injury occurrence, 9.8% of participants reported a practice-related injury. A higher proportion was observed in the 31–45 age group (11.2%) compared to the 45–60 group (3.6%) ($p = 0.242$). Concerning injury duration, 24.8% of injured participants reported a recovery time of less than one week, while 9.2% reported a duration exceeding three weeks. The latter was more frequent in the oldest age group (14.5%) ($p = 0.220$). Most injuries occurred during training (31.3%), particularly in the 45–60 age group (45.5%). The post hoc analysis showed that new injuries were more frequent in the oldest group than in the young and adult groups ($p > 0.01$).

Table 4. Injuries in athletes who practice CF separated by age groups.

Injuries		Total N = 358 (%)	Young (a) 18–30 Years N = 123 (%)	Adults (b) 31–45 Years N = 178 (%)	Older (c) 45–60 Years N = 55 (%)	p- Value	Post Hoc
Injury resulting from CF	Yes	35 (9.8)	13 (10.4)	20 (11.2)	2 (3.6)	0.242	
	No	323 (90.2)	112 (89.6)	158 (88.8)	53 (96.4)		
Duration of injury (weeks)	1	89 (24.8)	28 (22.4)	43 (24.2)	18 (32.7)	0.220	
	Between 1–3	8 (7.8)	6 (10.1)	18 (7.3)	4 (7.3)		
	>3	33 (9.2)	8 (6.4)	17 (9.6)	8 (14.5)		
	No injury	208 (58.1)	83 (66.4)	100 (56.2)	25 (45.5)		
How did the injury occur?	Training	112 (31.3)	28 (22.4)	59 (33.1)	25 (45.5)	0.135	
	Competition	10 (2.8)	4 (3.2)	5 (2.8)	1 (1.8)		
	Other	32 (8.9)	10 (8.0)	18 (10.1)	4 (7.3)		
	No injury	204 (57)	83 (66.4)	96 (53.9)	25 (45.5)		
Is it a new or recurring injury?	New	101 (28.2)	28 (22.4)	49 (27.5)	24 (43.6)	0.002	c > a, c > b **
	Previous	52 (14.5)	11 (8.8)	34 (19.1)	7 (12.7)		
	No injury	205 (57.3)	86 (68.8)	95 (53.4)	24 (43.6)		
What was the cause of the injury?	Overload	67 (18.7)	14 (11.2)	34 (19.1)	19 (34.5)	0.027	c > a; c > b *
	Bad technique	39 (10.9)	11 (8.8)	21 (11.8)	7 (12.7)		
	Fatigue	23 (6.4)	9 (7.2)	13 (7.3)	1 (1.8)		
	No warm-up	4 (1.1)	1 (0.8)	3 (1.7)	0		
	Other	27 (7.5)	8 (6.4)	14 (7.9)	5 (9.1)		
	No injury	198 (55.3)	82 (65.6)	93 (52.2)	23 (41.8)		
Type of training that has suffered the most injuries	CrossFit	70 (19.6)	18 (14.4)	39 (21.9)	13 (23.6)	0.060	
	Endurance	8 (2.2)	1 (0.8)	4 (2.2)	3 (5.5)		
	Weightlifting	36 (10.1)	17 (13.6)	15 (8.4)	4 (7.3)		
	Gymnastics	34 (9.5)	6 (4.8)	22 (12.4)	6 (10.9)		
	Kettlebell	2 (0.6)	0	2 (1.1)	0		
	None	208 (58.1)	83 (66.4)	96 (53.9)	29 (52.7)		

CF: CrossFit. Lowercase letters mean significant differences among groups (i.e., a, b, c); * $p < 0.05$; ** $p < 0.01$.

Significant differences were observed for the nature of the injury, with a higher proportion of new injuries in the 45–60 age group (43.6%) compared to the others ($p = 0.002$). Furthermore, overuse from repetitive movements was the most frequent cause (18.7%), with a significantly higher incidence in the oldest age group (34.5%) ($p = 0.027$). In addition, the older group reported overload as the main cause of injury compared to the other groups ($p > 0.001$). Finally, regarding the type of training associated with the injury, the CF modality was the most reported (19.6%), particularly among participants over 31, showing a non-significant trend ($p = 0.060$).

Figure 1 shows the prevalence of the most common injury locations in the total sample and stratified by age group. The shoulder was the most frequently injured anatomical region in the overall sample (15.6%), followed by the lumbar spine (10.1%) and the knee (7.8%). This distribution was generally consistent across age groups. In the young group, shoulder injuries were the most prevalent (16.8%), whereas the prevalence of lumbar spine injuries increased progressively with age, reaching its highest value among older participants (11.5%). Knee injuries also showed a gradual increase with age, from 6.2% in

young participants to 9.1% in the older group. Injuries to the wrist/hand and ankle/foot were less common across all age groups.

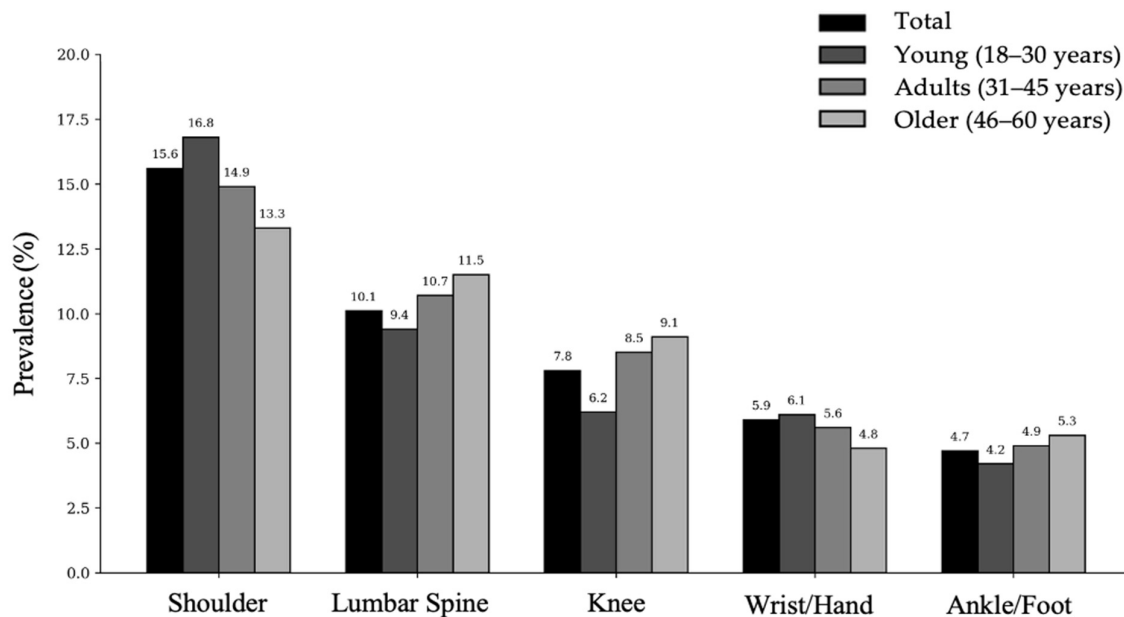


Figure 1. Prevalence of the most common injury locations in the total study population and by age group expressed in percentages (%).

3.3. CrossFit and Sport Supplements

Table 5 presents data on nutritional supplement consumption by sex. Overall, 81.8% of participants reported being in favour of their use, with a significantly higher proportion among men (85.8%) than women (78.0%) ($p = 0.013$). Regarding the timing of consumption, 57.8% of the total sample reported using supplements primarily on training days, while 14.8% used them during both training and competition periods. Regarding sex differences, supplement intake on training days was similarly frequent in men (57.4%) and women (58.2%). However, notable differences were observed in intake during both training and competition periods, which was more frequent in men (73.1%) than in women (8.2%) ($p < 0.001$).

Significant differences were also observed for the primary reason for consumption ($p < 0.001$). Women most frequently cited health improvement as their main reason (30.2%), whereas men more often indicated post-workout recovery (34.6%) and performance enhancement (21.6%). Regarding the perceived effectiveness, 53.4% of users reported experiencing improvements with supplement use, a perception that was significantly higher in men (61.9%) than in women (45.1%) ($p = 0.016$). The most common frequency of use was daily (46.1% of users), with a significant difference between sexes ($p = 0.018$), showing a higher prevalence among men. Notably, the most commonly consumed supplements among participants were protein (49.4%) and creatine (60.3%), with both supplements being used significantly more frequently by men than by women ($p = 0.003$ and $p < 0.001$, respectively).

Table 6 displays nutritional supplement consumption patterns by age group. Regarding the predisposition towards use, 81.8% of participants were in favour. A significant, progressive decrease in this predisposition was observed with increasing age (88.0% in the 18–30 group; 79.8% in the 31–45 group; 74.5% in the 46–60 group; $p = 0.036$). Concerning the primary reason for consumption, the oldest group most frequently cited health as their main priority (32.7%), whereas the youngest group more often reported performance enhancement (21.6%) ($p = 0.174$). Among the groups, performance enhancement was the

most frequently reported reason for the intake of nutritional supplements in the young group compared to the older group ($p > 0.01$). In terms of perceived benefits, 53.4% of users reported noticing improvements, with no significant differences across age groups ($p = 0.300$).

Table 5. Consumption of sport supplements in CrossFit according to sex.

Sport Supplements		Total N = 358 (%)	Women N = 182 (%)	Men N = 176 (%)	p-Value
Have you considered the use of sport supplements?	Yes	293 (81.8)	142 (78.0)	151 (85.8)	0.013
	No	18 (5.0)	7 (3.8)	11 (6.3)	
	NA	47 (13.1)	33 (18.1)	14 (8.0)	
Which days do you consider intake supplements	Training	207 (57.8)	106 (58.2)	101 (57.4)	<0.001
	Training and competition	53 (14.8)	15 (8.2)	38 (73.1)	
	No intake	61 (31.3)	37 (21.0)	98 (26.3)	
Main reason for supplement consumption	Health	89 (24.8)	55 (30.2)	34 (19.4)	<0.001
	Recovery	93 (26)	32 (17.6)	61 (34.6)	
	Performance	59 (16.5)	21 (11.5)	38 (21.6)	
	Diet support	28 (7.8)	20 (11.0)	8 (4.5)	
	No intake	89 (24.9)	54 (1.1)	35 (19.9)	
Have you noticed any improvement with the use of supplements?	Yes	191 (53.4)	82 (45.1)	109 (61.9)	0.016
	No	10 (2.8)	6 (3.3)	4 (2.3)	
	Not sure	69 (19.3)	42 (23.1)	27 (15.3)	
	No intake	88 (24.6)	52 (28.6)	36 (20.5)	
Frequency of supplement consumption (days/week)	1–2 days	14 (3.9)	8 (4.4)	6 (3.4)	0.018
	3 days	28 (7.8)	17 (9.3)	11 (6.3)	
	4 days	19 (5.3)	5 (2.7)	14 (8.0)	
	5 days	38 (10.6)	13 (7.1)	25 (14.2)	
	Every day	165 (46.1)	83 (45.6)	82 (46.6)	
	No intake	94 (26.3)	56 (30.8)	38 (21.6)	
Protein intake	Yes	177 (49.4)	76 (41.8)	105 (57.4)	0.003
	No	181 (50.6)	106 (58.2)	75 (42.6)	
Creatine intake	Yes	216 (60.3)	92 (50.5)	124 (70.5)	<0.001
	No	142 (39.7)	90 (49.5)	52 (29.5)	
Caffeine intake	Si	92 (25.7)	40 (22.0)	52 (29.5)	0.101
	No	266 (74.3)	142 (78)	124 (70.5)	
Magnesium intake	Si	136 (38)	74 (40.7)	62 (35.2)	0.290
	No	222 (62.0)	108 (59.3)	114 (64.8)	
Omega 3 intake	Si	101 (28.2)	49 (26.9)	52 (29.5)	0.582
	No	257 (71.8)	133 (73.1)	124 (70.5)	

NA: No answer.

Table 6. Consumption of sport supplement in CrossFit according to age.

Supplement Consumption		Total N = 358 (%)	Young (a) 18–30 Years N = 123 (%)	Adults (b) 31–45 Years N = 178 (%)	Older (c) 46–60 Years N = 55 (%)	p- Value	Post Hoc
Have you considered the use of sport supplements?	Yes	293 (81.8)	110 (88.0)	142 (79.8)	41 (74.5)	0.036	c > a *; c > b *
	No	18 (5.0)	1 (5.6)	11 (61.1)	6 (10.9)		
	NA	47 (13.1)	14 (11.2)	25 (14.0)	8 (14.5)		
Which days do you consider intake supplements	Training	207 (57.8)	68 (54.4)	106 (59.6)	33 (60.0)	0.567	
	Training and competition	53 (14.8)	25 (20.0)	22 (12.4)	6 (10.9)		
	No intake	98 (27.4)	31 (25.6)	50 (28.1)	16 (29.1)		
Main reason for supplement consumption	Health	89 (24.8)	25 (20.0)	46 (25.8)	18 (32.7)	0.174	a > c *
	Recovery	93 (26.0)	30 (24.0)	48 (26.9)	15 (27.3)		
	Performance	59 (16.5)	27 (21.6)	29 (16.3)	3 (5.5)		
	Diet support	28 (7.8)	13 (10.4)	12 (6.7)	5 (5.5)		
	No intake	89 (24.9)	30 (24.0)	42 (23.6)	15 (27.3)		
Have you noticed any improvement with the use of supplements?	Yes	191 (53.4)	70 (56.0)	96 (53.9)	25 (45.5)	0.300	
	No	10 (2.8)	2 (1.6)	8 (4.5)	0		
	Not sure	69 (19.3)	22 (17.6)	32 (18.0)	15 (27.3)		
	No intake	88 (24.6)	31 (24.8)	42 (23.6)	15 (27.3)		
Frequency of supplement consumption (days/week)	1–2 days	6 (1.7)	1 (0.8)	4 (2.2)	1 (1.8)	0.763	
	3 days	8 (2.2)	4 (3.2)	4 (2.2)	0		
	4 days	28 (7.8)	8 (6.4)	18 (10.1)	2 (3.6)		
	5 days	19 (5.3)	7 (5.6)	8 (4.5)	4 (7.3)		
	Every day	38 (10.6)	11 (8.8)	22 (12.4)	5 (9.1)		
	No intake	165 (46.1)	62 (49.6)	77 (43.3)	26 (47.3)		
Protein intake	Yes	177 (49.4)	61 (48.8)	91 (51.1)	25 (45.5)	0.751	
	No	181 (50.6)	64 (51.2)	87 (48.9)	30 (54.5)		
Creatine intake	Yes	216 (60.3)	76 (60.8)	107 (60.1)	33 (60.0)	0.991	
	No	142 (39.7)	49 (39.2)	71 (39.9)	22 (40.0)		
Caffeine intake	Yes	92 (25.7)	39 (31.2)	42 (23.6)	11 (20.0)	0.189	
	No	266 (74.3)	86 (68.8)	136 (76.4)	44 (80.0)		
Magnesium intake	Yes	136 (38.0)	34 (27.2)	76 (42.7)	26 (47.3)	0.007	b > a *; c > a
	No	222 (62.0)	91 (72.8)	102 (57.3)	29 (52.7)		
Omega 3 intake	Yes	101 (28.2)	30 (24.0)	49 (27.5)	22 (40.0)	0.086	
	No	257 (71.8)	95 (76.0)	129 (72.5)	33 (60.0)		

NA: No answer. Lowercase letters mean significant differences among groups (i.e., a, b, c); * $p < 0.05$.

The most consumed supplements across all groups (Figure 2) were creatine (60.3%) and protein (49.4%), with no significant age-based differences in their usage ($p = 0.991$ and $p = 0.751$, respectively). However, significant differences were found for magnesium consumption ($p = 0.007$), which was higher in the older age groups. Additionally, the post hoc analysis showed that magnesium intake was higher in the older group compared to the young and adult groups ($p > 0.01$). In contrast, the use of caffeine and omega-3 showed no significant variation between groups.

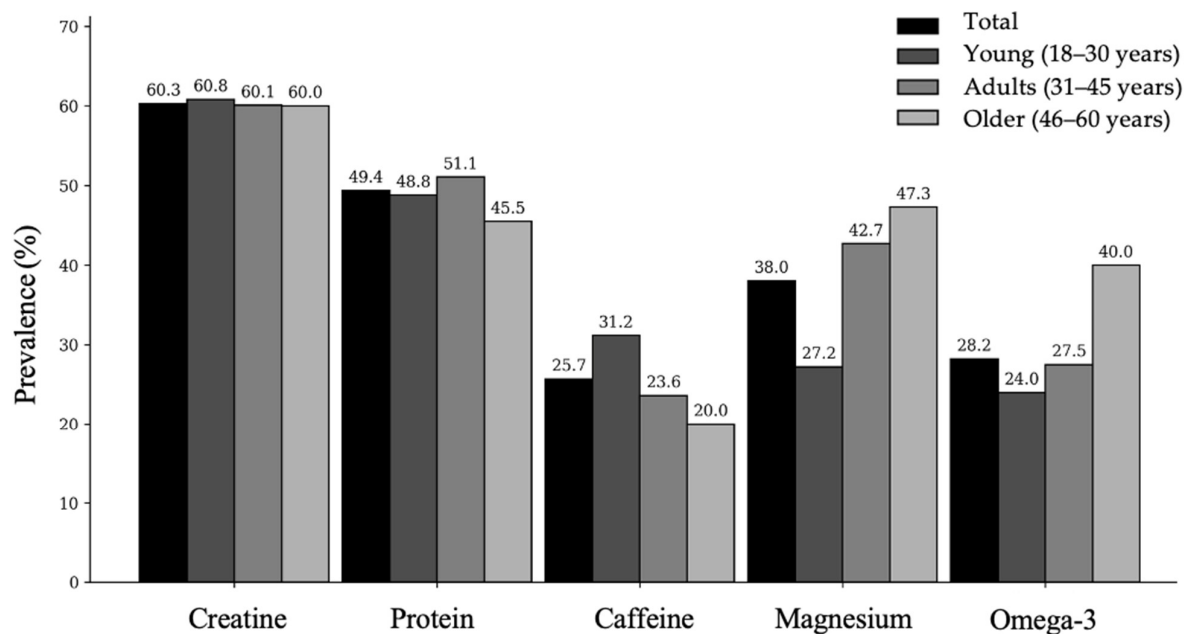


Figure 2. Prevalence of supplement consumption in the total sample and by age group expressed in percentage (%).

4. Discussion

The aim of this study was to characterize CF practitioners based on their training habits, injury prevalence, and nutritional supplement use, with specific consideration given to sex and age. The main findings of this study indicate that sex is not a determining factor in participation, as men and women engage in the discipline in similar proportions. Regarding training habits, most participants reported training three to four days per week with sessions of approximately one hour in duration. A positive attitude toward the use of nutritional supplements was observed in both sexes, with creatine and protein being the most commonly consumed, primarily to improve health and facilitate post-exercise recovery. Concerning injuries, men showed a higher prevalence than women. Moreover, most injuries occurring during training and commonly associated with repetitive overload. The shoulder and lumbar spine were the most frequently affected anatomical regions.

In relation to age groups, the findings in the current study showed that younger participants demonstrated greater competitive involvement and performance-oriented motivations, whereas older group tended to prioritize health benefits and participated less frequently in competitions. Notice that an exploratory analysis within the youngest group, stratified by sex, revealed broadly similar training habits between men and women. However, men more frequently reported RX performance levels and participation in competitive events. This finding may be partially explained by sex-related physiological differences, such as greater absolute strength and muscle mass, which can influence training loads and performance orientation [10,22]. Nevertheless, given the cross-sectional nature of the study, these results should be interpreted with caution and cannot be considered causal. The findings in the current study are consistent with previous research reporting that younger CF athletes exhibit stronger competition-oriented motives and higher training intensities, while older practitioners focus more on health, functionality, and long-term adherence [18]. Similarly, age-related analyses indicate that younger athletes rely more on ergogenic supplements, whereas older athletes favour health-oriented products [28]. Likewise, epidemiological analyses have reported that older CF practitioners typically adopt a more conservative training approach, displaying lower injury rates and emphasizing health maintenance over performance enhancement [31]. However, this pattern may also reflect

the presence of survival bias, whereby individuals who sustained injuries earlier in their CF participation discontinued practice, leaving a healthier and more resilient subgroup at older ages. This potential bias should be considered when interpreting age-related differences in injury prevalence in cross-sectional studies such as the present study. Together, these findings highlight meaningful age-linked differences in training patterns, injury rate, and supplement consumption within CF practitioners.

With respect to training adherence, more than half of the participants reported having practiced CF for three years or more, suggesting high long-term engagement. This may be related to the social component inherent to CF training, which involves group dynamics, partner or team-based exercises, and shared goals that reinforce social cohesion and adherence [32,33]. Additionally, when exercise intensity is self-regulated, as is typically the case in CF, athletes demonstrate greater tolerance to high-intensity training, which supports sustained participation [34]. The training pattern observed here (1 h per day, 3–4 days per week) has also been shown to produce meaningful musculoskeletal and cardiovascular benefits with a lower time commitment compared to traditional strength training programs [18,35]. This is particularly relevant given that lack of time is one of the most frequently reported barriers to engage in physical activity program [36]. It is noteworthy that older participants reported a higher weekly training frequency than younger age groups. This pattern does not necessarily indicate a greater cumulative training load, but may reflect greater training regularity, lower session intensity, and a predominantly health-oriented approach to CF practice [31]. This interpretation is consistent with previous evidence indicating that older practitioners tend to prioritize health maintenance, functional capacity, and long-term training sustainability over performance-oriented goals [22].

Regarding injuries, the findings in the current study showed that more than half of the surveyed reported no injury occurrence, indicating a moderate overall incidence among CF practitioners. Nevertheless, a significantly higher injury rate was observed in men compared to women. This higher injury prevalence in men may be explained by their greater participation in RX and competitive categories, which are typically associated with higher training volumes, heavier external loading, and reduced exercise scaling [10,29]. These training characteristics may lead to increased mechanical stress, cumulative load exposure, and fatigue during high-intensity functional training, thereby elevating injury risk [21,25]. Similar sex-related differences have been reported in previous studies, suggesting that injury risk in CF is more closely related to training exposure and load management than to sex itself [19,22].

Beyond differences in injury prevalence between sexes, analysis of injury distribution by anatomical location showed that, among those participants who reported injuries, the shoulder and lumbar spine were the most commonly affected, which is consistent with previous literature. In this sense, Lastra-Rodríguez et al. [37] conducted research with Spanish CF practitioners, concluding that injuries were minor and of short duration, with the shoulder being the most frequently injured region. Furthermore, Alekseyev et al. [38] reported a higher prevalence of back and shoulder injuries in a sample of 885 CF athletes who were surveyed using an online questionnaire. Similarly, Schlegel et al. [23] identified the shoulder, spine, and palm as common injury sites in 456 CF athletes who responded to an online survey, with younger participants showing a higher injury rate. Notice that Feito et al. [10] identified three high-risk profiles: individuals in their first year of practice, those training fewer than three days per week, and those completing fewer than three WODs weekly. Although the injury rate in CF does not appear to exceed that of other strength sports, further research is needed to clarify specific risk factors, considering variables such as age, sex, BMI, injury history, and the lack of technical supervision [22]. It should be noted that although in this study injury severity was not clinically classified, the

predominantly short reported recovery durations suggest a limited functional impact in most cases.

Regarding supplement consumption, participants in this study primarily reported using supplements to enhance health and athletic performance. These findings are consistent with those of Brisebois et al. [28], who, in an online survey, found that most participants consumed at least one supplement to enhance their health and increase muscle mass. Protein, creatine, and pre-workout supplements were the most commonly reported. Similarly, dos Santos et al. [29] collected data via an online questionnaire from over 112 participants and concluded that 77.7% used supplements five or more times per week, a frequency that was especially high among RX (Training modality in which the workload is not adapted to the participant) or elite-level athletes. Their primary reasons were to enhance performance and muscle mass, with protein and creatine being the most frequently used supplements. Notably, the participants in our study reported a consumption frequency of 3–5 days per week. This is lower than the frequencies observed in studies involving RX or elite-level athletes, suggesting that an individual's competitive level may be a significant factor influencing supplement use patterns. It should be noted that the prevalence and patterns of supplement consumption observed in this study are comparable to those reported in other strength- and endurance-based sports, including resistance training, weightlifting, and endurance disciplines [29,35]. This suggests that supplement use in CF reflects broader trends in physically demanding sports rather than modality-specific behaviours.

4.1. Limitations and Strength

This study has several limitations that are important to acknowledge: (1) The cross-sectional design does not allow for the establishment of causal relationships between the analysed variables. Also, the non-probabilistic sampling based on social media and internal dissemination among BOX, could limit the generalizability of the results. (2) Multivariate analyses were not conducted to identify independent risk factors for injury, and potential confounding variables such as technical skill level, training intensity, previous injury history, exercise type, and underlying health conditions were not controlled for. In addition, injury data were self-reported and not validated against medical or training centre records, which may have introduced recall bias and led to underreporting of mild or moderate injuries. (3) The questionnaire did not collect detailed clinical information on injury diagnosis, treatment, or functional outcomes, thereby limiting the clinical interpretation of injury severity.

Despite these limitations, the study also has notable strengths. The first is the size and composition of the participants, which includes CF practitioners of different sexes and age groups. This allows for a broad and representative characterization of the practice profile in this sports modality. The second lies in the inclusion of variables related to training habits, injury history, and supplement use. This integration provides a holistic view of the CF athlete's behaviour, contributing to a more comprehensive understanding of the phenomenon under study.

4.2. Practical Applications

The findings of this study offer highly relevant insights for coaches and professionals working in CF environments. Firstly, the high adherence rates observed suggest that the social and collaborative dimension of training is a crucial factor for practice continuity and should therefore be maintained and strengthened. Secondly, the identification of the shoulder and lumbar spine as the most frequently injured areas underscores the need to implement targeted injury-prevention strategies. Specifically, these strategies should include structured load progression with gradual increases in external load and volume, rigorous

technical supervision during Olympic lifts and gymnastic movements, and individualized exercise scaling for less experienced athletes. Thirdly, the widespread use of supplements highlights the importance of providing qualified nutritional guidance to prevent practices based solely on informal peer recommendations. Finally, the implementation of ongoing technical supervision is recommended. This is particularly critical for less experienced practitioners to minimize the risk of injury and safely and effectively optimize performance.

5. Conclusions

The typical CF athlete trains with a frequency of 3 to 4 days per week, for approximately one hour per session. They place significant importance on the social dimension of training, with the majority not participating in competitions and currently identifying at a “scaled” performance level. The injury profile of CF practitioners is comparable to that of other strength-focused disciplines such as weightlifting and powerlifting. The shoulder joint and lumbar spine are the most common sites of injury. In general, CF practitioners consume dietary supplements primarily to improve their health and athletic performance. Creatine and protein are the most widely used supplements, a trend that remains consistent regardless of the participant’s level, sex, or age. Together, these findings may assist coaches and practitioners in designing safer, more sustainable training programs that promote long-term adherence, reduce injury risk, and support informed decision-making regarding supplement use.

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Data Availability Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Abbreviations

The following abbreviations are used in this manuscript:

HIFT	High-Intensity Functional Training
WOD	Workout of the day
CF	CrossFit®
RX	Training modality in which the workload is not adapted to the participant

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