

Intermittent Fasting with Sports Performance

Subjects: **Nutrition & Dietetics**

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Intermittent fasting is one of the most popular types of diet at the moment because it is an effective nutritional strategy in terms of weight loss. The effects that intermittent fasting has on sports performance are analyzed. Physical capacities are analyzed: aerobic capacity, anaerobic capacity, strength, and power, as well as their effect on body composition.

exercise

intermittent fasting

sports performance

1. Introduction

The role that nutrition plays today in the sports performance of athletes is clear. However, in recent years, different dietary patterns and protocols have emerged that have tried to amplify or reduce the adaptations derived from physical exercise to try to achieve an improvement in the athlete's sports performance ^{[1][2][3]}. Within these strategies, intermittent fasting has been acquiring special renewed interest due to its supposed effects on health and improvement of body composition in patients with different pathologies of great predominance nowadays. Intermittent fasting is a popular type of dietary pattern based on timed periods of fasting. This dietary protocol focuses on timed fasting/eating periods with different time intervals ^{[4][5]}.

Despite this recent popularity, currently, its effects on performance do not seem to be clarified. This has special importance in the physical and cognitive performance of those athletes who frequently perform this type of dietary pattern or temporary caloric restrictions, as happens with Islamic athletes during the religious practice of Ramadan ^{[5][6][7]}.

2. Intermittent Fasting with Sports Performance

Within the reviewed bibliography, researchers found that the majority highlighted that the subjects were athletes ^{[8][9][10][11][12][13][14][15][16][17][18][19]}. Another did not specify if they were athletes ^[20], but due to their intervention, it was included, while the rest indicated that the subjects were physically active ^{[21][22][23][24][25]}.

Most of them showed time-restricted feeding (TRF) with a 16 h fasting window and 8 h feeding window ^{[8][9][10][11][13][15][18][21][22][23][26]}. Other studies analyzed 14/8 fasting during the Ramadan period ^{[11][17][27]}, while another article analyzed overnight fasting ^[14].

In addition to this, it should be noted that two studies used more variables in their studies, such as the intake of supplementation in addition to the fasting follow-up, namely hydroxy methyl butyrate (HMB) and two types of whey protein: whey protein concentrate (WPC) and hydrolyzed whey protein (WPH) [23][28]. Another article sought to compare the difference between protein-loaded and carbohydrate-loaded fasting [19]. For the most part, a control group with no fasting and an experimental group performing fasting are identified [22].

Data are shown in **Table 1**, based on performance, specifically aerobic performance, eight articles were included that used different tests, among them: 20 min cycling test [28], 10 km test [10], repeated sprints test [14][25], treadmill test [15], and test at 45% of maximum power [8]. Regarding anaerobic performance, six articles used different tests to evaluate different parameters of the sample such as stress tests [8][10], Wingate test [21][25][28], submaximal exercise [19], repeated sprints test [25], and interval training [19]. Regarding muscular strength and power, eight included studies that evaluated muscular strength through maximal strength and endurance strength tests and power through peak power (PPO) and average power (W) [9][13][17][18][23][24][25][26]. Finally, regarding body composition and health, researchers included the 15 studies that evaluated any body composition variable such as body fat mass, lean mass, and anthropometric folds [8][9][10][13][15][16][17][18][20][22][23][24][27][29][30][31][32].

Table 1. Results of IF on aerobic capacity, anaerobic capacity, muscular strength and power, and body composition and health.

No.	Reference and Date	Impact Index	Type of Study	Study Size	Duration of Fasting	Objective of the Study	Parameters Analyzed	Conclusions
Aerobic capacity								
1.	Moro T, et al., 2020 [8]	5.159 (IF) 22/88 (Q1)	Experimental	16 young cyclists	Intermittent fasting TRF (16/8)	IF in 4 weeks of high-level resistance training.	Body composition, resting metabolism, and performance tests.	Does not affect performance.
2.	Kang J, et al., 2021 [26]	3.571 (IF) 57/109 (Q3)	Review	23 randomized studies	TRF fasting	Effects on metabolic and anthropometric parameters.	Strength, power, and aerobic capacity.	Does not reduce aerobic capacity.
3.	Tovar AP, et al., 2021 [10]	6.706 (IF) 15/90 (Q1)	Experimental	15 male runners	Intermittent fasting TRF 16/8	Effects on the performance of endurance runners.	Body composition, stress test, and 10 km test.	No effect on performance.
4.	Aird TP, et al., 2018 [12]	3.631 (IF) 11/83 (Q1)	Meta-analysis	46 studies	NT	To determine the effects of IF on aerobic and anaerobic	Aerobic capacity.	Aerobic exercise performance does not differ

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						exercise performance.		when following IF vs. other nutrition.
5.	Terada T, et al., 2019 [14]	1.432 (IF) 67/85 (Q4)	Experimental	20 participants	Overnight fasting	Effects on subjects in sprint training and aerobic capacity.	Aerobic capacity.	Improved sprint fasting vs. carbohydrate abundance.
6.	Brady AJ, et al., 2021 [15]	6.289 (IF) 9/88 (Q1)	Experimental	17 participants	Fasting TRF (16/8)	Effect of 8 weeks of TRF in conjunction with training.	Body composition, aerobic capacity, and biomarkers.	No alteration in endurance running performance indices.
7.	NaHarudin, et al., 2018 [25]	2.376 (IF) 29/83 (Q2)	Experimental	20 participants	Intermittent fasting	Effect of IF on high-intensity exercise, Wingate test, and HIIT cycling test.	Wingate test.	Attenuated performance at the start of practice.
8.	Aird TP, et al., 2021 [28]	5.900 (IF) 36/146 (Q1)	Experimental	28 male participants	Intermittent fasting	Compare performance and metabolic adaptations of short-term SIT with fasting and with WPH or WPC supplementation.	Body composition, aerobic exercise.	No significant results.
Anaerobic capacity								
1.	Moro T, et al., 2020 [8]	5.159 (IF) 22/88 (Q1)	Experimental	16 young cyclists	Intermittent fasting TRF (16/8)	IF in 4 weeks of high-level resistance training.	Body composition, resting metabolism, and performance test.	No effect on performance.
2.	Correia JM, et al., 2021 [21]	4.614 (IF) 100/279 (Q2)	Experimental	12 healthy males	Fasting TRF 16/8	Short- and long-term effects in trained young people.	Body composition and Wingate test.	No significant results in terms of performance improvement.
3.	Terada T, et al., 2019 [14]	1.432 (IF)	Experimental	20 participants	Overnight fasting	Effects on subjects in sprint	Aerobic capacity.	Improved sprint fasting vs.

No.	Reference and Date	Impact Index	Type of Study	Study Size	Duration of Fasting	Objective of the Study	Parameters Analyzed	Conclusions
		67/85 (Q4)				training and aerobic capacity.		carbohydrate abundance.
4.	Naharudin, et al., 2018 [25]	2.376 (IF) 29/83 (Q2)	Experimental	20 participants	Intermittent fasting	Effect of IF in high-intensity exercise, Wingate test, and HIIT cycling test.	Wingate test, Body composition, aerobic exercise.	Attenuated performance at the start of practice.
5.	Aird TP, et al., 2021 [28]	5.900 (IF) 36/146 (Q1)	Experimental	28 male participants	Intermittent fasting	Compare performance and metabolic adaptations of short-term SIT with fasting and with WPH or WPC supplementation.	Aerobic and anaerobic performance.	No significant results.
6.	Rothschild JA, et al., 2021 [19]	6.706 (IF) 15/90 (Q1)	Experimental	17 trained cyclists and triathletes	Intermittent fasting	Effects versus a protein-rich and a carbohydrate-rich meal on cycling performance.	Submaximal exercise, high-intensity exercise.	No difference versus CHO in HIIT. Like PRO, uncompromised performance in shorter duration and higher intensity sessions.
Muscular strength and power								
1.	Moro T, et al., 2016 [9]	3.786 (IF) 30/128 (Q1)	Experimental	34 participants	TRF (16/8)	Effects during endurance training in healthy males.	Body composition, strength, and biomarkers.	Improvement of biomarkers related to health, fat loss, and maintenance of muscle mass.
2.	Kang J, et al., 2021 [26]	3.571 (IF) 57/109 (Q3)	Review	23 randomized studies	TRF fasting	Effects on metabolic and anthropometric parameters.	Strength, power, aerobic capacity.	Improvements in body composition and no alteration in muscle mass synthesis.
3.	Tinsley GM, et al.,	2.576 (IF)	Experimental	18 participants	TRF fasting	To examine changes in body	Strength and body	Variation in fat mass loss

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	2017 [13]	22/81 (Q2)				composition and strength in strength training in males.	composition.	versus diet, but not in muscle mass gain.
4.	Tinsley GM, et al., 2019 [23]	6.766 (IF) 6/89 (Q1)	Experimental	Healthy women aged 18–30 years	TRF fasting	TRF + HMB in strength training vs TRF without HMB.	Body composition and muscle performance.	TRF did not slow adaptations in hypertrophy and performance vs. other diets.
5.	Martínez-Rodríguez A, et al., 2021 [24]	4.614 (IF) 100/279 (Q2)	Experimental	14 active women	Intermittent fasting	Effects of HIIT training and muscular and anaerobic performance.	Body composition, grip strength, jumping, Wingate cycling test.	Decreased fat mass and increased jumping performance.
6.	Naharudin, et al., 2018 [25]	2.376 (IF) 29/83 (Q2)	Experimental	20 participants	Intermittent fasting	Effect of IF in high-intensity exercise, Wingate test, and HIIT cycling test.	Wingate test, Body composition, aerobic exercise.	Attenuated performance at the beginning of practice.
7.	Abaidia AE, et al., 2020 [17]	11.140 (IF) 2/88 (Q1)	Meta-analysis	11 studies	Fasting 14/10 (Ramadan)	Effects of 1 month of Ramadan on physical performance.	Aerobic performance, maximal power, strength, jump height, sprints.	No decrease in performance if nutrition is correct.
8.	Correia JM, et al., 2020 [18]	5.719 (IF) 17/88 (Q1)	Experimental	Individuals between 18 and 39 years	Intermittent fasting	Effects on sports performance.	Muscular strength, aerobic capacity, anaerobic capacity, and body composition.	Positive results in fat mass reduction, without significant results in terms of strength.
Body composition and health								
1.	Moro T, et al., 2020 [9]	5.159 (IF) 22/88 (Q1)	Experimental	16 young cyclists	Intermittent fasting TRF (16/8)	IF in 4 weeks of high-level endurance training.	Body composition, resting metabolism,	Improved body composition and

No.	Reference and Date	Impact Index	Type of Study	Study Size	Duration of Fasting	Objective of the Study	Parameters Analyzed	Conclusions
							and performance testing.	inflammatory markers.
2.	Moro T, et al., 2016 [9]	3.786 (IF) 30/128 (Q1)	Experimental	34 participants	TRF (16/8)	Effects during endurance training in healthy males.	Body composition, strength, and biomarkers.	Improved health, fat loss, and maintenance of muscle mass.
3.	Hosseini S, et al., 2015 [27]	NT	Experimental	50 healthy subjects	Ramadan	Effects of Ramadan and physical activity on biochemical parameters.	Body weight, fat percentage, biomarkers.	Reductions in anthropometric parameters, lower cholesterol.
4.	Laza V. 2020 [29]	NT	Magazine article	NT	TRF fasting	Effects on the performance and health of athletes.	Biomarkers, body composition.	Decreased blood glucose, body fat, cholesterol, testosterone levels, improved insulin sensitivity, increased hepcidin levels, improved immune system, and maintenance of muscle mass.
5.	Zouhal H, et al., 2020 [30]	NT	Review	71 studies	ICR, ADF, and TRF fasts	Identifying the effects of IF together with physical exercise.	Body composition, metabolic adaptations, sports performance.	Decreased circulating insulin levels and improved glucagon levels. Reduction of body fat.
6.	Tovar AP, et al., 2021 [10]	6.706 (IF) 15/90 (Q1)	Experimental	15 male runners	Intermittent fasting TRF 16/8	Effects on the performance of endurance runners.	Body composition, stress test, and 10 km test.	Improvements in fat mass reduction and muscle mass maintenance.
7.	Isenmann E, et al.,	6.706 (IF)	Experimental	35 subjects	TRF 16/8	Effects on body composition and	Weight, fat mass, BMI.	Improvements in weight, body

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No.	Reference and Date	Impact Index	Type of Study	Study Size	Duration of Fasting	Objective of the Study	Parameters Analyzed	Conclusions	and
	2021 [22]	15/90 (Q1)				adherence.		composition, BMI, and hip and waist circumference.	
8.	Haupt S, et al., 2021 [31]	6.064 (IF) 75/297 (Q2)	Review	NT	TRF 16/8	Summarize fasting information on metabolic and hormonal responses.		Improvements in blood pressure, insulin sensitivity, and body composition. Increased lipid utilization.	R.; , 901–
9.	El-Outa A, et al., 2022 [32]	0.678 (SJR) (Q2)	Experimental	80 participants	TRF 16/8	Assess VO2max in addition to other parameters.	VO2max, weight, body composition, biomarkers.	Reductions in glucose levels, LDL, HDL, and body weight. No significance in VO2max.	ng
10.	Tinsley GM, et al., 2017 [13]	2.576 (IF) 22/81 (Q2)	Experimental	18 participants	Fasting TRF	Examine changes in body composition and strength in strength training in males.	Strength and body composition.	Variation in fat mass loss vs. diet, but not in muscle mass gain.	npeting 022, 56,
11.	Brady AJ, et al., 2021 [15]	6.289 (IF) 9/88 (Q1)	Experimental	17 participants	Fasting TRF (16/8)	Effect of 8 weeks of TRF together with training.	Body composition, aerobic capacity, and biomarkers.	Decrease in fat mass.	ports
12.	Martínez-Rodríguez A, et al., 2021 [24]	4.614 (IF) 100/279 (Q2)	Experimental	14 active women	Intermittent fasting	Effect of HIIT training and muscular and anaerobic performance.	Body composition, gripper strength, jumping, Wingate cycling test.	Decrease in fat mass.	P.; sm, ance-
13.	Naharudin, et al., 2018 [25]	2.376 (IF) 29/83 (Q2)	Experimental	20 participants	Intermittent fasting	Effect of IF on high-intensity exercise, Wingate test, and HIIT cycling test.	Wingate test, body composition, aerobic exercise.	Attenuated performance at the beginning of practice.	at

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14.	Hammouda O, et al., 2013 [16]	3.534 (IF) 8/55 (Q1)	Experimental	15 soccer players	Fasting 14/10 (Ramadan)	Effects of Ramadan on lipoprotein fluctuation during exercise.	Body composition, biomarkers.	Reductions in fat mass and LDL without affecting muscle mass and increase in HDL (significant reduction in YO-YO test).	Boulé, training 7–365.
15.	Correia JM, et al., 2020 [18]	5.719 (IF) 17/88 (Q1)	Experimental	Individuals between 18 and 39 years old	Intermittent fasting	Effects on sports performance.	Muscle strength, aerobic capacity, anaerobic capacity, and body composition.	Positive results in fat mass decrease, no significant results in strength.	ating in ouachi, Al, B, S ONE ce: A

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