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## Article

# Post-Exercise Recovery Strategies Employed by Moroccan Football Teams

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**Abstract:** Background: For elite football teams, incorporating recovery strategies during busy schedules is essential to mitigate post-match fatigue, restore optimal performance levels, and minimize injury risks. Football players employed a variety of methods, including natural, nutritional, physical, psychological, and alternative ones. Therefore, our objective was to describe and analyze the use of recovery strategies by Moroccan football teams. Methods: A total of 29 Moroccan football teams, including 16 from Botola Pro D1 and 13 from Botola Pro D2, took part in this study during the 2023-2024 season. Members of the teams' technical or medical staff were asked to complete a questionnaire consisting of 12 sections, aimed at evaluating the post-exercise recovery strategies employed after matches and training sessions. Results: Teams utilized various recovery protocols and combinations; three physical strategies were particularly prevalent in post-competition and training session: cold therapy (used by 96% of the teams), stretching (89%), and massage (86%). Additionally, 64% implemented recovery strategies immediately following exercise, and 75% personalized recovery plans for each player. A multidisciplinary approach was utilized by 86% of the teams in the design and supervision of recovery protocols. Furthermore, 86% of the teams reported having adequate logistical and economic resources to implement recovery protocols. Conclusion: The survey provided valuable insights into how professional football teams in Morocco are currently employing recovery methods, revealing that most teams are incorporating them to varying extents. However, the implementation of recovery strategies is still not as widespread as it is among teams in other countries.

**Keywords:** recovery strategies; football; performance; Moroccan teams; Botola pro

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## 1. Introduction

Recently, the number of matches and competitions in professional football has increased [1]. During particularly busy periods, football teams might participate in as many as 60 competitive matches in a season, averaging 5 to 6 matches each month and up to 3 matches per week [2]. Notably, physical demands (e.g., accelerations, decelerations, high-speed distance, sprint distance and total distance) and technical-tactical exigencies (e.g., number of passes, crosses and shots on target) of match play have also increased [3]. Thus, training workload has also increased to respond to competition requirements. Consequently, optimal recovery strategies turn into a crucial intervention, to prevent long-term fatigue, underperformance or injury [4]. Furthermore, recovery is viewed as a diverse physiological and psychological restorative process that is related to time [5].

Recovery is defined as the full set of processes that leads to an athlete's renewed capacity in order to meet or exceed a preceding performance [6]. Further, the recovery period is also explained as the time necessary for physiological and psychological parameters, which were affected by exercise, to return to resting values [5,6].

Physiologically, exercise imposes stress on athletes, disrupting the homeostasis of various processes such as cardiocirculatory, metabolic, neuromuscular, and central systems, as well as biochemical pathways. In response to this stress, the body initiates adaptive mechanisms post-exercise to counterbalance these changes, highlighting the importance of an adequate recovery period following training [7].

**Recovery practices are designed to enable athletes to resume training and performing more quickly** [5]. Every athlete focus on restoring pre-performance capacities as quickly as possible [8]. However, many coaches count on their past experiences to implement strategies [9], not following evidence-based recommendations [10]. Subjective perception of the football players impacted differently their rate of recovery methods [11], recognized effectiveness is also impacted by players feelings [12]. Additionally, athlete's convictions and their attended behaviors toward recovery are disconnected [13]. Nonetheless, multiple strategies have been validated [14]. A recent systematic review with graded recommendations mentioned that sleep, nutrition, cold water immersion, active recovery and massage were the most commonly used strategies in professional football [1]. Even though, many post-exercise recovery methods exist. It's admitted that, generally, football players are using them [15].

To the authors' knowledge, only 4 studies were conducted exclusively with elite football teams [15–18]. Mainly, studies performed in elite football have proven that recovery methods are very important to mitigate fatigue and improve recovery [15–17].

The present study aimed to determine post-exercise recovery strategies employed by football teams in Morocco. In addition, we analyzed the frequency of their uses after competition's games and after training sessions. Also, we studied time of recovery strategies' use, and if more strategies are used the same time. Therefore, we analyzed the cooperation of multidisciplinary team to conduct recovery process, and the bases taken into consideration to implement the strategies. Individualization of recovery strategies were investigated too. At the last, we analyzed the availability of economics means that can allowed recovery strategies practice.

## 2. Materials and Methods

### *Participants*

The study involved 32 Moroccan football teams from the "Botola Pro D1" and "Botola Pro D2" leagues during the 2023-2024 season. Participants included technical or medical staff members, contacted through personal networks or official team channels.

### *Design and Procedure*

The study utilized an online ad-hoc questionnaire to evaluate the use of post-exercise recovery strategies among these teams. The survey, based on prior studies [15,19,20], included various question formats and was validated by external practitioners before being distributed online. Data collection spanned from November 27, 2023, to March 31, 2024, with completion taking approximately 15 minutes.

The survey comprised 12 sections, covering team demographics, recovery strategies employed, and their frequency, as well as the individuals responsible for implementing these strategies. Recovery strategies were categorized into natural, nutritional, physical, psychological, and alternative/complementary methods.

### *Statistical Analysis*

The study design was observational and cross-sectional, with data analyzed using Google Forms® and Microsoft® Excel, determining frequencies and measures of central tendency and dispersion. Qualitative terms were used to describe the magnitude of observed frequencies, such as "all," "most," and "majority."

### 3. Results

Twenty-nine out of thirty-two surveyed football teams, including all teams from Botola Pro D1 and 81% from Botola Pro D2, participated in the study. Botola Pro D1 teams comprised  $31 \pm 2$  players, playing  $1.25 \pm 0.45$  matches weekly and training  $6.56 \pm 1.15$  sessions per week, averaging  $88 \pm 13.73$  minutes per session. Botola Pro D2 teams had  $31 \pm 4$  players, playing one match per week and training  $5 \pm 0.82$  sessions weekly, averaging  $90 \pm 17.32$  minutes per session.

Most teams employed recovery strategies, with only one team not implementing any.

Teams implemented different recovery strategies (Table 1); Cold therapy, stretching, and massage were the most common strategies (over 85%), followed by active recovery (71%), diet (54%), and supplements (50%). Fewer teams used sleep (32%), heat therapy (29%), medication (21%), and alternative strategies (18%). Strategies like the Mézières method and electrostimulation were also noted.

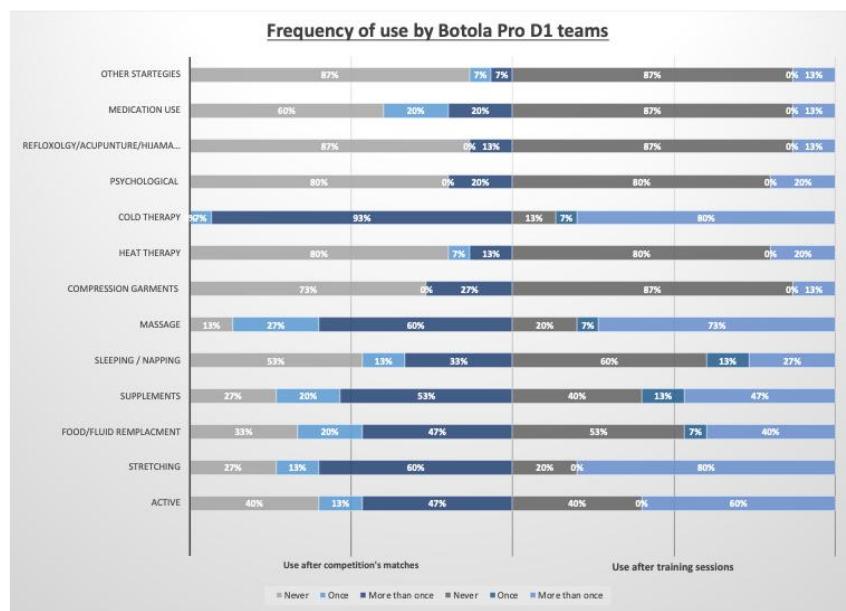
The frequency of use after competition and after training session, for either Botola Pro D1 and Botola Pro D2, are outlined in Figures 1 and 2, respectively.

Time of first application, combination of different approaches, individualization, supervision of recovery process and availability of economics means are summarized in (Table 2).

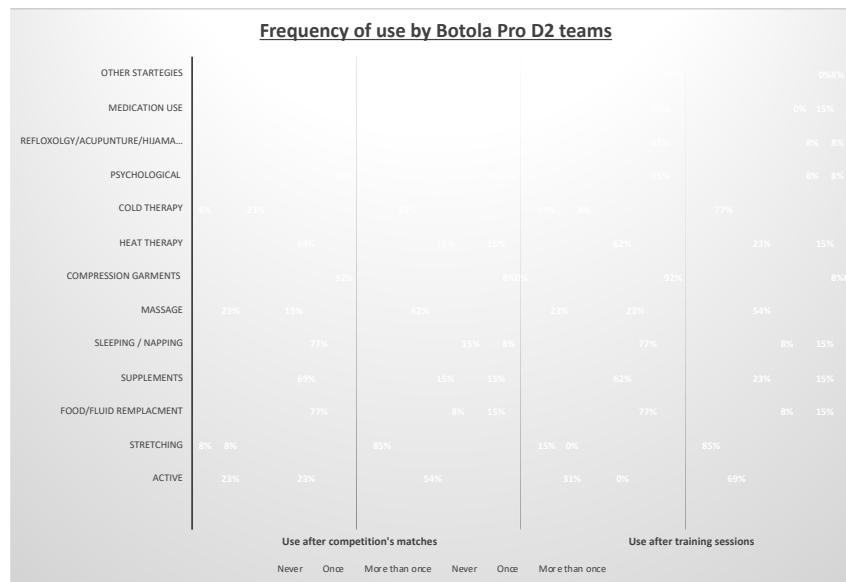
Most teams (64%) applied recovery strategies immediately post-exercise, with 61% following a specific order and 61% tailoring strategies to individuals. Recovery methods were usually developed by medical and technical staff. A majority (93%) based guidelines on scientific research, while 86% had adequate resources for recovery protocols. Only 14% lacked resources, and 4% based guidelines on available resources.

**Table 1.** Recovery strategies used by Moroccan first and second division football teams.

Use of recovery strategies by Moroccan football teams							
Recovery Strategies	D1		D2		Total		
	Nº	%	Nº	%	Nº	%	
Natural	Active recovery	10	67%	10	77%	20	71%
	Stretching	13	87%	12	92%	25	89%
	Sleep	7	47%	2	15%	9	32%
	Nap	5	33%	1	8%	6	21%
Nutritional	Food/fluid replacement	11	73%	3	23%	14	50%
	Supplements	11	73%	4	31%	15	54%
Physical	Massage	15	100%	9	69%	24	86%
	Compression garment	4	27%	1	8%	5	18%
	Heat therapy	3	20%	5	38%	8	29%
	Cold therapy	15	100%	12	92%	27	96%
Psychological	meditation, progressive muscle relaxation	3	20%	2	15%	5	18%
Complementary alternative	Reflexology/ Acupuncture...	2	13%	3	23%	5	18%
	Medication use	6	40%	2	15%	8	29%
Other strategies		1	7%	1	8%	2	7%



**Figure 1.** Frequency of recovery strategies use by teams in the Moroccan 1st division after competition and after training session.



**Figure 2.** Frequency of recovery strategies use by teams in the Moroccan 2nd division after competition and after training session.

**Table 2.** Time of first use, Combination of different strategies, Individualization, Supervision of recovery process and availability of economics means.

	Immediately after the exercise (within 2 hours)		Between 2 hours and 12 hours after the end of the exercise		Between 12 and 24 hours post-exercise		After 24 hours	
When are recovery strategies first used?	D1	D2	D1	D2	D1	D2	D1	D2
Are different recovery strategies combined on the same day?			Yes, in a specific order		Yes, without a specific order		No	
	D1		D2		D1	D2	D1	D2

	9	5	4	8	2	0
Are recovery strategies individualized for each player?	Yes			No		
	D1	D2	D1	D2		
	10	7	5	6		
Who oversees the recovery strategies	Team doctor	Physio-therapist	Fitness coach	Nutritionist	Head coach	Assistant by coach himself
	D1	D2	D1	D2	D1	D2
	10	3	15	9	12	13
Do you have the economic and logistical means to be able to carry out post-exercise recovery strategies in the club?	Yes			No		
	D1	D2	D1	D2	D1	D2
	15		9		0	4
					6	3
					8	2
					4	4

## 4. Discussion

Our findings demonstrate that cold therapy, stretching, massage, active recovery, nutritional strategies (supplements and food/fluid replacement), sleep, heat therapy, pharmaceutical drug, compression garment, psychological, alternative strategies, The Mézières method and electrostimulation were commonly used by Moroccan football teams as post-exercise recovery strategies.

### *Natural Strategies*

Despite not necessitating equipment or financial investment, only 54% of the teams implemented natural recovery strategies. Stretching and active recovery were favored by most teams, whereas the incorporation of sleep and napping did not appear to be common practices among Moroccan teams.

Our findings indicate that stretching is among the most commonly employed methods by Moroccan football teams (89%). This approach is likely the preferred option for athletes at all levels given its accessibility and the ability for athletes to engage in stretching exercises collectively as a team [9]. This finding aligns with earlier studies [15,16,21,22].

Although widely included into recovery protocols, stretching's efficacy remains poorly comprehended [23].

Eventually, the widespread utilization of stretching by athletes at various levels of competition can be explained by a variety of factors. These include its self-administered nature, simplicity, widespread acceptance, equipment-free requirement, adaptability to limited space, and longstanding endorsement as a post-exercise recovery method in mainstream literature and research for many years.

Typically, active recovery methods involve engaging in low-intensity aerobic exercises that target the entire body, such as running, cycling, or swimming. This method employed by the majority of Moroccan football teams (71%), is commonly utilized by athletes globally [15–17].

Active recovery outperformed passive recovery in terms of lactate removal and increasing the perspective recovery [24].

Surprisingly, Most of the Moroccan football teams did not indicate utilizing sleep/napping as a recovery strategy after exercise. The utilization rates for sleep and napping were reported at 32% and 21% respectively among the teams. These results diverge from existing literature, which typically shows widespread adoption of sleep practices among athletes and football teams [9,11,15–17].

Strategies related to sleep seem to have minimal impact on enhancing recovery in terms of physical, physiological, and perceptual aspects [1]. Nevertheless, extending sleep duration can positively influence cognitive function and various aspects of well-being [25], decrease fatigue levels

[26]. Furthermore, a nap protocols had a beneficial impact on muscle soreness (DOMS), sleepiness, rating of perceived exertion (RPE), and physical performance [27,28].

#### *Nutritional Strategies*

Although nutrition plays a crucial part in aiding athletic recovery and enhancing performance, only 52% of Moroccan football teams incorporated nutritional strategies. Among these, 50% focused on food and fluid replacement, while 54% utilized supplementation.

Food/fluid replenishment is viewed as a crucial means of recovery, widely utilized to a significant extent [1,9,15–18]. Furthermore, a well-structured nutritional plan is likely to help professionals in replenishing glycogen stores, speeding up muscle repair, and improving hydration [29].

Dietary supplements are widely used among athletes [15,30]. In football, nutritional strategies frequently incorporate dietary supplements to assist players in improving their performance and recovery [31],

#### *Physical Strategies*

The majority of the teams (57%) utilized physical approaches. The study underscores the widespread use of cold therapy and massage as common recovery methods following matches and training sessions.

Cold therapy, a widely utilized strategy for recovery among football players [15,17,18,32] is one of the most commonly employed methods by Moroccan football teams (96%).

Due to its widespread utilization, This approach was shown to be successful in aiding recovery.

CWI demonstrated advantages in reducing delayed onset muscle soreness DOMS [33], reducing perceived pain levels and perceived fatigue [33,34].

Another frequently used recovery strategy was massage, with 86% of the teams adopting this method. This observation is consistent with findings from earlier research [15–17,22,35]

Yet, there remains a scarcity of research on the effectiveness of massage in facilitating performance restoration and recovery enhancement.

The utilization of heat therapy was quite low, with only eight teams (29%) adhering to it. A discovery that is consistent with other results [15]. The use of local heating is more frequently applied in rehabilitation settings to address musculoskeletal injuries or to shield muscles from potential damage [36].

Compression garments are rapidly becoming a popular recovery technique in sports [37]. Our results indicate that the use of compression garments (CG) by Moroccan teams is considerably lower, with only five teams (18%) utilizing them, than other studies [15–17]. Nevertheless, CG had a significant and positive impact on DOMS and perceived fatigue [33]. However, any significant changes in the recovery phase of DOMS were observed [38].

#### *Psychological Strategies*

Although matches are known to cause significant mental and physical fatigue, only 18% of the teams employed psychological strategies. Some of the psychological techniques utilized included mental imagery, progressive muscle relaxation, breathing techniques, music, prayer. etc., [39,40]. Some teams predominantly employed progressive muscle relaxation techniques [15], whereas imagery was more commonly utilized by other players [39].

The evaluation of potential mental recovery strategies indicates that they seem to positively impact mental states, including concentration, attention, and vigilance [40]. However, there is limited knowledge regarding the application of mental recovery strategies in sports and their beneficial effects [41].

### *Alternative/Complementary Strategies*

Despite the popularity of alternative medicine [42], just 18% of the teams utilized acupuncture or reflexology as part of their recovery strategy. However, medications were also used by a minority (8 teams; 29%). [15,39]. Urroz et al. demonstrated that acupuncture did not enhance physiological recovery following intense exercise [43]. Nevertheless, significant improvements in blood lactic acid levels, maximum heart rate (HR max), and VO<sub>2</sub>max was observed due to acupuncture therapy [44].

### *Additional Information*

The majority of the teams (64%) indicated that they initially employed recovery strategies immediately following a competition or training session. Consistent findings have been documented previously [9,15], revealing that the hour post-exercise was the most frequently utilized period for implementing recovery strategies.

According to our research, 75% of the teams reported that they combined different recovery strategies within the same day. Additionally, 61% of the teams individualized these strategies for each player. This customization was largely based on the players' ages, their injury histories, and the specific body parts involved in their physical activities. Similar findings have been reported in prior studies [15,45].

Twenty-four teams (86%) indicated that recovery protocols were managed within a multidisciplinary team framework. In first division teams, the primary individuals responsible for recovery protocols were the physiotherapist, fitness coach, and doctor. In contrast, in second division teams, the main responsibilities fell to the fitness coach, physiotherapist, and head coach.

Moreover, all the first division teams reported having the financial resources to implement recovery protocols. Conversely, four teams in the second division indicated that they lacked the necessary means to conduct such protocols.

## 5. Conclusions

To our knowledge, this study is the first to examine the use of post-exercise recovery strategies by male football teams in Morocco.

We concluded that physical approaches were more employed than natural, nutritional, complementary, or psychological ones. This finding could be attributed to the accessibility of these strategies, the subjective perceptions of players and coaches or the impact of media and social network.

In addition, the most frequently employed strategies after matches are the same as those used after training sessions by all teams, regardless of the game or training conditions.

Moreover, the personnel in charge of implementing recovery strategies within their team should actively engage with scientific research to deliver evidence-based practices aimed at optimizing player recovery, overall health and well-being, and performance.

The survey results differ from previous research. Therefore, future studies might consider investigating the specific details of each method's use (such as intensity and duration), which are important for understanding the scheduling of recovery techniques. Additionally, examining the discrepancies between theoretical approaches and practical application in professional football could provide valuable insights.

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**Institutional Review Board Statement:** All the details about the study were provided at the beginning of the questionnaire. Participants were invited to participate voluntarily and were given the option to withdraw at any time. Their rights were preserved according to the Law 28-13, of August 4, 2015, relating to the protection of persons participating in biomedical research.

**Informed Consent Statement:** Informed consent was obtained from all participants and their legal guardians prior to any data collection as part of the protocol procedures.

**Data Availability Statement:** The data is available at: [https://docs.google.com/spreadsheets/d/1ApXgbKox1EnsbKzPdk4VH9K5IFH-FytbJf\\_AH5cAqjI/edit?usp=sharing](https://docs.google.com/spreadsheets/d/1ApXgbKox1EnsbKzPdk4VH9K5IFH-FytbJf_AH5cAqjI/edit?usp=sharing).

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**Conflicts of Interest:** The authors state that they don't have any conflicting interests related to the results of this study.

## Abbreviations

The following abbreviations are used in this manuscript:

CWI	Cold Water Immersion
D1	1st Division
D2	2nd Division
DOMS	Delayed Onset Muscle Soreness
HR	Heart Rate
RPE	Rating Perceived Exertion
VO <sub>2</sub> max	maximal oxygen uptake

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