Correlation between motivational regulations and recovery states in athletes of individual sports

Correlación entre las regulaciones motivacionales y los estados de recuperación en deportistas de disciplinas individuales

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Abstract

Introduction: Recovery is the time-dependent psychophysiological process through which the body restores its functional capacity after training. Objective: The aim was to verify the correlation between the dimensions of motivational regulation and perceived states of recovery and stress. Methodology: Triathlon and martial arts athletes (N=41) were asked to complete the Sports Motivation Scale and the Recovery and Stress Questionnaire for Athletes. The results allow us to ponder that the motivational dimensions may be moderately related ($r>0.3$; $r<0.8$) in different ways with the states of recovery. Results: Demotivation levels correlated positively ($p<0.05$) with "general stress", "emotional stress", "social stress", "lack of energy", "somatic complaints" and "emotional exhaustion" subscales, whereas inversely correlated ($p<0.05$) with "success", "general well-being", "sleep quality", "being in shape" and "self-efficacy". The self-determination index was associated ($p<0.05$) with "general well-being" and "self-efficacy". The subscale "being in shape" were associated ($p<0.05$) with intrinsic motivational dimensions. The subscale "personal acceptance" were associated with dimensions of introjection ($p<0.05$) and identification. Finally, the dimensions of identification was also associated ($p<0.05$) with "social stress" and "fatigue" subscales. Discussion: Improving the understanding of this theme, the results obtained in this study indicate that these relationships between motivation and recovery may vary, depending on the dimension of the motivation evaluated. Conclusions: It is concluded that, while levels of impersonal orientation are associated with states of stress and deficits in recovery, self-determined behaviours are associated with the occurrence of positive psychological states that can benefit the recovery process.

Keywords

Motivational regulation, states of recovery, stress; self-determination theory; sport.

Resumen

Introducción: La recuperación es un proceso psicofisiológico dependiente del tiempo mediante el cual el cuerpo restablece su capacidad funcional después del entrenamiento.
Objetivo: Verificar la correlación entre las dimensiones de la regulación motivacional y los estados percibidos de recuperación y estrés en deportistas de disciplinas individuales.
Metodología: Participaron atletas de triatlón y artes marciales (N=41), quienes respondieron la Escala de Motivación Deportiva y el Cuestionario de Recuperación y Estrés para Deportistas.
Resultados: Los resultados mostraron que las dimensiones motivacionales se correlacionaron moderadamente ($r>0,3$; $r<0,8$) con diferentes estados de recuperación y estrés. La desmotivación se correlacionó positivamente ($p<0,05$) con el estrés general, emocional y social, la falta de energía, las quejas somáticas y el agotamiento emocional; y negativamente con el éxito, el bienestar general, la calidad del sueño, la condición física y la autoeficacia. El índice de autodeterminación se asoció ($p<0,05$) con el bienestar general y la autoeficacia. "Estar en forma" se asoció ($p<0,05$) con las dimensiones de conocer y de logro de metas. "Aceptación personal" se correlacionó con introyección e identificación. La identificación también se relacionó ($p<0,05$) con el estrés social y la fatiga.
Discusión: Estos hallazgos son coherentes con la literatura previa, que indica que la motivación autodeterminada contribuye a resultados psicofisiológicos positivos, mientras que formas menos autónomas se vinculan al malestar psicológico.
Conclusiones: Se concluye que las orientaciones motivacionales impersonales se asociaron con el estrés y una menor recuperación, mientras que los comportamientos autodeterminados se relacionaron con estados psicológicos positivos que pueden favorecer el proceso de recuperación.

Palabras clave

Regulación motivacional; estados de recuperación; estrés; teoría de la autodeterminación; deporte.

Introduction

Recovery is the regimen of restoring an individual's functional capacity following strenuous effort (Geurts & Sonnentag, 2006; Zijlstra et al., 2014). In sports, it is a stage of the training cycle that can be defined as the totality of psychophysiological processes dependent on time and personal resources that occur in the body after a given training load (Heidari et al., 2019; Kellmann et al., 2018). Its physiological perspective involves restoring biological resources and alleviating fatigue through dietary strategies, muscle relaxation, rest, and sleep hygiene (Bishop et al., 2008).

However, recovery also has a close relationship with stress. In adverse situations that promote high levels of stress and, in turn, exceed the capacity in which the individual can deal with the demands, psychological exhaustion and impaired recovery process (under-recovery) can occur (Codonhato et al., 2018; Kellmann et al., 2009). In this sense, since changes in training load are reflected in the subjective states and mood of athletes (Lathlean et al., 2019; Mendoza et al., 2023), psychological, behavioral and social aspects should be considered as facets of the same recovery process (Kellmann et al., 2018; Kellmann & Kallus, 1999; van Hooff et al., 2018).

The psychological perspective of recovery is related to the identification of a current state of fatigue and detachment from stressors (physical and psychological stressors from training loads and competitions) aiming at adequate conditions for recovery (Balk & Englert, 2020; Geurts & Sonnentag, 2006; Kellmann et al., 2018). Detachment can occur by engaging in social and leisure activities or employing actions with a view to reestablishment (Zijlstra et al., 2014; van Hooff et al., 2018). Social bonds can promote positive psychological states and support biological processes of recovery through relaxation, good mood, and well-being (Balk & Englert, 2020; Kellmann & Kallus, 1999; Uvnas-Moberg & Petersson, 2005).

In their turn, the athlete can engage in recovery activities in a guided manner (active and passive strategies instructed by coaches) or voluntary manner (proactive strategies) that promote recovery and aim to achieve physical and mental readiness for the next time that a sporting task will be performed (Balk & Englert, 2020; Kellmann et al., 2018). In their investigation, Venter et al. (2010) observed that, among several recovery strategies used by elite South African athletes (cryotherapy, massage, low-intensity exercises), there are also proactive activities that do not require complex and burdensome circumstances, such as listening to music after competitions and training sessions, used to promote relaxation.

In this sense, Kellmann et al. (2018) suggest that the implementation of proactive strategies is related to motivational regulation, as they arise from the choice and execution of activities based on individual needs, availability, preferences and skills. Additionally, it is possible that volitional and motivational aspects, observed when internalized and autonomous behaviors occur, provide positive psychological states, which, in their turn, facilitate relaxation and recovery (Beckmann & Kellmann, 2004). This assertion corroborates the results found by (Martinent & Decret, 2015), which suggest that athletes with this motivational regulation, in addition to showing higher levels of recovery, seem to deal better with stressors and daily demands, possibly interacting better with their context of life and using strategies that fit into their daily routines and that ensure adequate recovery. Furthermore, athletes tend to prefer and implement recovery strategies in which they have knowledge and perception of competence (mastery) (Crowther et al., 2017). In sum, recent findings from a systematic review suggest that high-quality motivation and adequate recovery perception are key factors for adaptive outcomes in sport, contributing to performance maintenance and reducing the risk of burnout and dropout (Dias et al., 2024).

Motivation can be defined as an intentional process, directed towards a certain goal, mediated by the interaction between the direction and intensity of efforts, and involving personal (intrinsic) and environmental (extrinsic) factors. In the sports scenario, motivation is the key component for entering and maintaining a successful sporting participation and is evidenced through inherent pleasure, interest and curiosity during the performance of an activity and mediated by personal factors (expectations, motives, needs and interests) and environmental factors (enablers, challenges, attraction of tasks, and social influences), which, in their turn, may change depending on current needs and opportunities (Ryan & Deci, 2017; Taylor, 2015; Weinberg & Gould, 2019).

Among the various motivational theories, the Self-Determination Theory (SDT) conceives that it is the essence of organisms to have a propensity to develop, integrate and interact with a larger social structure, in order to create a sense of "self", allowing the individual to be the causal agent in relation to their future, that is, to have intentional behaviors that favor human development (Ryan & Deci, 2017). The SDT has stood out in the understanding of behavioral regulation and contributed as a theoretical background to investigations of motivational phenomena in sports and competitive environments (Li et al., 2013; Taylor, 2015).

However, these activities are not always associated with pleasure and fun, as sporting participation includes several reasons, such as ensuring conditions that favor performance improvement (improvement of physical conditioning, recovery from training loads, and prophylaxis of injuries), rewards, a desire to impress others, win a competition, or avoid punishment (Taylor, 2015). Individuals have different propensities and motivations that guide their behavior in situations in which they can exercise their autonomy, comply with controls, or fear the consequences of their actions. These orientations are boosted by contexts that can make these motivational orientations more or less likely to occur (Ryan & Deci, 2017). In this sense, the Causality Orientations micro theory conceives a continuum of regulatory motivational styles (impersonal, controlled and autonomous) based on the internalization of social regulations and the satisfaction of basic psychological needs, in order to suggest regulations and motivational dimensions that guide behavior (Koestner & Levine, 2023; Ryan & Deci, 2017).

Impersonal orientation refers to the loss of behavior intentionality and disinterest, in which the individual experiences anxiety and a feeling of inability to achieve desired results. This orientation can occur due to frustrations concerning basic psychological needs and the absence of personal ownership regarding the motives of action, oftentimes promoting demotivation. In its turn, controlled orientation refers to behavior guided by external or introjected sources, in which actions are performed with a view to obtaining rewards or avoiding punishment or embarrassment. In addition to controlled orientation not being related to states of well-being, the autonomy of individuals with this orientation may be prone to being frustrated in situations where it involves the prospect of rewards (Ryan & Deci, 2017).

Finally, autonomous orientation is associated with intrinsic motivation, health and well-being, referring to actions performed for interest and pleasure. Individuals with this orientation may display greater vigor, willingness, and greater levels of personal ownership to act in accordance with values and interests. This orientation may reflect the satisfaction of basic psychological needs and is less likely to be undermined by the prospect of rewards. Thus, while intrinsic motivation is associated with positive emotions, on the other side of the continuum, demotivation is a variable that can predict decreased performance, negative emotions, and dropout (Ryan & Deci, 2017; Taylor, 2015).

Although research on the relationship between motivation and states of recovery is relatively recent, interactions of these variables with athletic outcomes have been observed (Martinent et al., 2018; Martinent & Decret, 2015). Demotivation and poor recovery have been related to emotional and physical exhaustion, which, in their turn, can increase the risk of overtraining and burnout (Fagundes et al., 2019; Lemyre et al., 2007). In their study, Martins and Pedro (2017) suggest a relationship between motivational regulations and the recovery processes of athletes, in the sense that situations of under-recovery can incur psychological and affective damages for athletes and compromise their performance and sports continuity. Additionally, measures of motivation and recovery for athletes at the beginning of their sports career have also offered prognostic information that contributes to assessing their risk of dropout (Martinent et al., 2018).

Since motivational aspects and states of recovery can be influencing variables in the sports context, it becomes relevant to deepen knowledge about the potential relationship between these variables. In this sense, how can motivation be associated with states of recovery? Thus, the objective of this study was to verify the association between the dimensions of motivational regulation and perceived states of recovery and stress.

Method

The present research is cross-sectional, of a quantitative character and correlational descriptive nature, in which the use of the survey technique was chosen to verify the perceptions of recovery and motivational regulation among practitioners of sports activities and, subsequently, to explore relationships between these variables (Thomas et al., 2015). This research project has been conducted in accordance with the principles set forth in the Helsinki Declaration and was approved by the São Judas Tadeu University's Research Ethics Committee under legal opinion No. 5.642.640, 14/09/2022, and CAAE 63220322.9.0000.0089. Moreover, the research did not receive institutional or external sponsorship for data collection.

Participants

The sample consisted of athletes from individual sports and was selected by criterion of convenience, based on the researchers' prior access to and contact with training centers. A total of 54 athletes (♂=40; ♀=14), practitioners of triathlon and combat sports modalities (CSM), initially participated in the study. Participants were drawn from two facilities located in the cities of São Paulo and Jaguaquara (Brazil), which specialize in triathlon and martial arts, respectively. Participants who were training with the expectation of participating in national competitions were included. Thirteen participants who incompletely filled out the questionnaires were excluded. Thus, the final sample of the study consisted of 41 (♂=32; ♀=9) participants who practiced Triathlon (n=15) and CSM (n=26), with the latter comprising Jiu-Jitsu (n=22) and Aikido (n=4). The participants had a mean age of 3 34.49 ± 10.50 years, and 9.22 ± 9.42 years of experience in their respective modalities.

Procedure

The coaches of the modalities were contacted and received an invitation letter requesting authorization in order for the athletes to participate in the study. After the coaches' authorization, the practitioners of the modalities were contacted, invited to participate in the study and informed in detail about the research objectives. All the necessary precautions to guarantee the privacy of the volunteers were taken, and all the participants signed a free and informed consent form, being aware that they could, at any time and without constraint, abandon the research procedure. The participants received a set of questionnaire, with a version of the Sports Motivation Scale (SMS), the Recovery Stress Questionnaire for Athletes (RESTQ-Sport), and 3 additional introductory questions about length of experience in the sport, training volume, and number of days that each participant reserved for recovery from the training loads. Data collection took place in April 2022, during the athletes' regular training routines, and the questionnaires were completed individually under the supervision of the researchers.

Instrument

The SMS was translated and validated to Portuguese by Costa et al. (2011) and has 28 items related to the reasons why the athlete practices their modality. It is answered on a 7-point Likert scale, where 1 refers to "does not correspond at all" and 7 refers to "corresponds exactly". These questions make it possible to identify seven motivational regulations based on the motivational continuum proposed by the Causality Orientations microtheory: "Intrinsic motivation to know" (IMK); "Intrinsic motivation to achieve goals" (IMAG); "Intrinsic motivation for stimulating experiences" (IMSE); "Extrinsic motivation of external regulation" (EMER); "Extrinsic motivation of introjection" (EMIN); "Extrinsic motivation of identification" (EMID) and "Demotivation".

Since these regulations are found in a continuum of self-determination, in the present study the choice was to use the Self-Determination Index (SDI), as proposed by Vallerand (2001), in order to obtain a single score to represent the relative level of the individual's self-determined motivation. The SDI can range from -18 to 18, so higher scores indicate higher levels of intrinsic regulation. The SDI calculation involves assigning weights to different regulations. Intrinsic regulations and the identified regulation receive, respectively, the weights of +2 and +1, while introjected and external regulations receive the weight of -1. Finally, demotivation is given a weight of -2. Thus, the SDI is obtained by the following equation:

$$SDI = [2x(IMK + IMAG + IMSE)/3 + 1x\ EMID] - [(1x\ EMIN + 1x\ EMER)/2 + 2x\ Demotivation]$$

In its turn, the RESTQ-Sport is a questionnaire translated and validated by Costa; and Samulski (2005), developed to measure, in an associated way, one's state of stress and state of recovery. It is composed of 77 Likert-scale questions (where 0 equals "never", and 6 equals "always") that describe mental states, emotional states, physical well-being or activities performed by athletes in the last 3 days/nights. It makes it possible to identify 19 subscales, with 10 subscales referring to states of stress (General Stress; Emotional Stress; Social Stress; Conflicts/Pressure; Fatigue; Lack of Energy; Somatic Complaints; Disturbances during Breaks; Emotional Exhaustion; Injuries), and 9 subscales referring to states of recovery (Success; Social Recovery; Physical Recovery; General Well-Being; Sleep Quality; Being in Shape; Personal Acceptance; Self-efficacy; Self-regulation). The assessment of states of stress and recovery is performed quantitatively, considering the subjective assessment of potentially stressful events and states of recovery, as well as their subjective consequences, based on the concepts of overload and stress. The adoption of these instruments was based on the fact that, at the time of the study, the validated versions were among the most accessible and psychometrically robust tools available in the Brazilian context for assessing motivational regulation and recovery in athletes.

Data analysis

Statistical analysis was conducted with the aid of the SPSS software, version 25.0, adopting a significance value of $p<0.05$. The descriptive information and scores obtained by the questionnaires are presented as mean and standard deviation. To verify the distribution of data normality, the Kolmogorov-Smirnov and Shapiro-Wilk tests were conducted. Student's t test was used to conduct data comparisons related to descriptive aspects of training between modalities. Thus, the Effect Size (ES) was calculated using the Hedges' g. When the data set related to training information did not meet the normal distribution, comparisons of these variables between the modalities were conducted using the Mann-Whitney U test and the ES obtained by calculating the z-value divided by the square root of the sample size, as proposed by Field (2013). The interpretation of the ES magnitude was considered as proposed by Sawilowsky (2009). To establish the associations between the scores of the recovery subscales and the dimensions of motivational regulation, Pearson's correlation test was conducted. When the data set did not meet the normal distribution (non-parametric data), Spearman's correlation test was conducted.

Results

Descriptive statistics in relation to mean scores of motivational regulations are presented in Table 1. It is noted that, despite high values of the intrinsic dimensions of motivation, a median SDI score is observed.

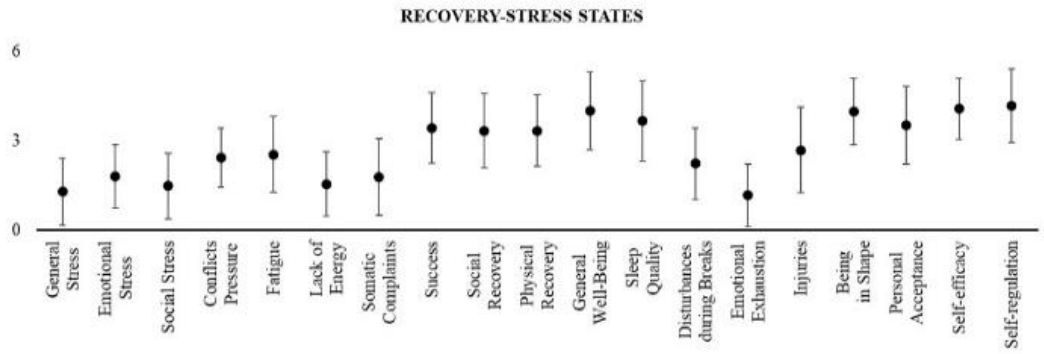
Table 1. Training information and scores related to motivational dimensions and recovery states.

TRAINING INFORMATION	$\bar{X}$ (±)
Weekly training frequency (days)	5.09 ± 1.58
WTV (minutes)	715.68 ± 436.98
Recovery (days)	1.29 ± 1.24
MOTIVATION DIMENSIONS	
Intrinsic motivation to know	5.68 ± 1.56
Intrinsic motivation to achieve goals	5.62 ± 1.40
Intrinsic motivation for stimulating experiences	6.13 ± 0.98
Extrinsic motivation of identification	4.39 ± 1.52
Extrinsic motivation of introjection	4.63 ± 1.74
Extrinsic motivation of external regulation	2.38 ± 1.34
Demotivation	1.51 ± 0.96
SDI	9.48 ± 3.23

SDI = Self-Determination Index; WTV = Weekly Training Volume
Notes: Author et al. (2025).

The profile of the participants' states of stress and recovery is presented in Figure 1. As proposed by Kellmann et al. (2009), a pattern of greater recovery and lower stress (i.e. higher scores on the recovery subscales in relation to the stress subscales) suggests that individuals are not subjected to high training loads or stressful social situations.

Figure 1. Participants' recovery profile.



Fuente: Author et al. (2025).

Regarding training information of the general sample, on average, the participants included in this research train 5.09 ± 1.58 days per week and accumulate 715.68 ± 436.98 minutes per week in their respective modalities, with approximately 1.29 ± 1.24 days for recovery. Comparisons involving age, experience in the modality, training volume and recovery days between triathlon practitioners and combat sports fighters are presented in Table 2. Although there are no differences in practice experience time between the sports modalities, it appears that triathlon practitioners are older ($p<0.05$), have a greater training volume ($p=0.001$) and fewer days for recovery ($p<0.001$). While the effect sizes for age were large (0.8-1.2), the effect sizes for training volume and recovery days were medium (0.5-0.7). Additionally, most triathlon athletes reported training for 7 days with no rest/recovery breaks during the week.

Table 2. Comparison of training information between the modalities.

	Triathlon (n=15)	**Combat Sports Modalities (n=26)**	***t/z***	**p**	**effect size**
Age (years)	39.73 ± 8.38	31.46 ± 10.53	2599£	0.013*	0.826ω
Exp.Mod (years)	11.07 ± 9.07	8.15 ± 9.63	-1465¥	0.143	0.229λ
Weekly training frequency (days)	6.67 ± 0.90	4.17 ± 1.08	-4831¥	<0.000**	0.754λ
Weekly Training Volume (minutes)	931.87 ± 260.52	590.96 ± 472.54	-3205¥	0.001**	0.501λ
Recovery (days)	0.13 ± 0.52	1.96 ± 1.03	-5035¥	<0.000**	0.786λ

£ = Student's t-test; ¥ = Mann-Whitney's u-test; ω = Hedges' g; λ = r-statistic; * = p<0,05; ** = p<0,01

Notes: Author et al. (2025).

The correlations between the recovery subscales and dimensions of motivational regulation are presented in Table 3.

Table 3. Correlations between the Recovery-Stress subscales and dimensions of motivational regulation.

Correlations			*Coefficient*	*p*
General Stress	*x*	SDI	-0.178†	0.265
		IM-K	0.133†	0.407
		IM-AG	0.073†	0.648
		IM-SE	0.113†	0.481
		EM-ID	0.255†	0.108
		EM-I	0.300†	0.057
		EM-ER	0.237†	0.136
		Demotivation	0.341†	0.029*
Emotional Stress	*x*	SDI	-0.293§	0.063
		IM-K	-0.012†	0.942
		IM-AG	-0.108†	0.500
		IM-SE	0.051†	0.754
		EM-ID	0.130†	0.419
		EM-I	0.298§	0.059
		EM-ER	0.227§	0.153

Correlations			*Coefficient*	*p*
		Demotivation	0.345†	0.027*
Social Stress	*x*	SDI	-0.180†	0.261
		IM-K	0.062†	0.699
		IM-AG	-0.012†	0.943
		IM-SE	0.146†	0.364
		EM-ID	0.310†	0.049*
		EM-I	0.300†	0.057
		EM-ER	0.248†	0.117
		Demotivation	0.409†	0.008**
Conflicts / Pressure	*x*	SDI	0.073§	0.650
		IM-K	0.114†	0.479
		IM-AG	0.063†	0.696
		IM-SE	-0.035†	0.826
		EM-ID	0.207§	0.195
		EM-I	0.226§	0.156
		EM-ER	0.123†	0.443
		Demotivation	0.199†	0.212
Fatigue	*x*	SDI	0.055§	0.734
		IM-K	0.114†	0.478
		IM-AG	0.180†	0.261
		IM-SE	0.060†	0.711
		EM-ID	0.337§	0.031*
		EM-I	0.139§	0.387
		EM-ER	0.167†	0.295
		Demotivation	0.143†	0.371
Lack of Energy	*x*	SDI	-0.149§	0.354
		IM-K	0.091†	0.572
		IM-AG	-0.053†	0.744
		IM-SE	0.001†	0.997
		EM-ID	0.222§	0.164
		EM-I	0.269§	0.089
		EM-ER	0.218†	0.171
		Demotivation	0.393†	0.011*
Somatic Complaints	*x*	SDI	-0.131§	0.415
		IM-K	0.023†	0.885
		IM-AG	0.014†	0.931
		IM-SE	-0.192†	0.230
		EM-ID	0.162§	0.310
		EM-I	0.086§	0.594
		EM-ER	0.149†	0.352
		Demotivation	0.337†	0.031*
Success	*x*	SDI	0.075§	0.643
		IM-K	0.026†	0.872
		IM-AG	0.179†	0.263
		IM-SE	-0.147†	0.359
		EM-ID	-0.008§	0.960
		EM-I	0.136§	0.398
		EM-ER	0.044†	0.784
		Demotivation	-0.372†	0.017*
Social Recovery	*x*	SDI	0.201§	0.209
		IM-K	0.080†	0.619
		IM-AG	0.107†	0.506
		IM-SE	-0.034†	0.832
		EM-ID	0.206§	0.195
		EM-I	0.071§	0.660
		EM-ER	0.028†	0.863
		Demotivation	-0.193†	0.226
Physical Recovery	*x*	SDI	0.243§	0.126
		IM-K	0.099†	0.537
		IM-AG	0.266†	0.093
		IM-SE	0.043†	0.787
		EM-ID	0.144§	0.370
		EM-I	0.219§	0.168
		EM-ER	0.071†	0.658
		Demotivation	-0.248†	0.118
General Well-Being	*x*	SDI	0.357§	0.022*
		IM-K	0.181†	0.257
		IM-AG	0.281†	0.075
		IM-SE	-0.068†	0.674
		EM-ID	-0.013§	0.935
		EM-I	-0.091§	0.570
		EM-ER	-0.120†	0.456
		Demotivation	-0.418†	0.006**
Sleep Quality	*x*	SDI	0.131§	0.415
		IM-K	0.009†	0.954
		IM-AG	0.090†	0.578

Correlations			*Coefficient*	*p*
		IM-SE	0.047†	0.772
		EM-ID	-0.177§	0.269
		EM-I	-0.135§	0.400
		EM-ER	-0.182†	0.256
		Demotivation	-0.315†	0.045*
Disturbances during Breaks	*x*	SDI	-0.003§	0.983
		IM-K	0.098†	0.542
		IM-AG	0.246†	0.121
		IM-SE	-0.097†	0.546
		EM-ID	0.200§	0.211
		EM-I	0.158§	0.325
		EM-ER	0.020†	0.903
		Demotivation	0.048†	0.766
Emotional Exhaustion	*x*	SDI	-0.259†	0.102
		IM-K	-0.150†	0.351
		IM-AG	-0.006†	0.971
		IM-SE	-0.277†	0.079
		EM-ID	0.175†	0.273
		EM-I	-0.042†	0.793
		EM-ER	0.231†	0.145
		Demotivation	0.493†	0.001**
Injuries	*x*	SDI	-0.085§	0.595
		IM-K	0.082†	0.611
		IM-AG	0.203†	0.204
		IM-SE	0.012†	0.939
		EM-ID	0.249§	0.116
		EM-I	0.024§	0.884
		EM-ER	0.194†	0.225
		Demotivation	0.266†	0.093
Being in Shape	*x*	SDI	0.300§	0.057
		IM-K	0.372†	0.017*
		IM-AG	0.328†	0.036*
		IM-SE	0.300†	0.056
		EM-ID	0.248§	0.118
		EM-I	0.223§	0.161
		EM-ER	0.123†	0.442
		Demotivation	-0.322†	0.040*
Personal Acceptance	*x*	SDI	0.082§	0.611
		IM-K	0.223†	0.161
		IM-AG	0.220†	0.166
		IM-SE	0.288†	0.068
		EM-ID	0.333§	0.033*
		EM-I	0.446§	0.003**
		EM-ER	0.243†	0.126
		Demotivation	-0.198†	0.214
Self-Efficacy	*x*	SDI	0.359§	0.021*
		IM-K	0.123†	0.445
		IM-AG	0.207†	0.195
		IM-SE	0.149†	0.351
		EM-ID	0.208§	0.192
		EM-I	-0.010§	0.950
		EM-ER	0.182†	0.255
		Demotivation	-0.309†	0.049*
Self-Regulation	*x*	SDI	0.224§	0.159
		IM-K	0.129†	0.421
		IM-AG	0.141†	0.379
		IM-SE	0.296†	0.060
		EM-ID	0.266§	0.092
		EM-I	0.063§	0.696
		EM-ER	0.119†	0.459
	Demotivation		-0.166†	0.299

SDI = Self-Determination Index; IM=K= Intrinsic motivation to know; IM-AG = Intrinsic motivation to achieve goals; IM-SE = Intrinsic motivation for stimulating experiences; EM-ID = Extrinsic motivation of identification; EM-I = Extrinsic motivation of introjection; EM-ER= Extrinsic motivation of external regulation; † = Spearman's rho coefficient; § = Pearson's r coefficient; * = p<0.05; ** = p<0.01

Notes: Author et al. (2025).

Significant and moderate correlation coefficients were observed for the following associations: "*General Stress x Demotivation*" (r=0.341; p=0.029); "*Emotional Stress x Demotivation*" (r=0.345; p=0.027); "*Social*

Stress x EM-ID" (r=0.310; p=0.049); "*Social Stress x Demotivation*" (r=0.409; p=0.008); "*Fatigue x EM-ID*" (r=0.337; p=0.031); "*Lack of Energy x Demotivation*" (r=0.393; p=0.011); "*Somatic Complaints x Demotivation*" (r=0.337; p=0.031); "*General Well-Being x SDI*" (r=0.357; p=0.022); "*Emotional Exhaustion x Demotivation*" (r=0.493; p=0.001); "*Being in Shape x IM-K*" (r=0.372; p=0.017); "*Being in Shape x IM-AG*" (r=0.328; p=0.036); "*Personal Acceptance x EM-ID*" (r=0.333; p=0.033); "*Personal Acceptance x EM-I*" (r=0.446; p=0.003); "*Self-Efficacy x SDI*" (r=0.359; p=0.021). Significant inverse correlations of moderate magnitude were observed for "*Success x Demotivation*" (r= -0.372; p=0.017); "*General Well-Being x Demotivation*" (r=-0.418; p=0.006); "*Sleep Quality x Demotivation*" (r=-0.315; p=0.045); "*Being in Shape x Demotivation*" (r=-0.322; p=0.040); "*Self-Efficacy x Demotivation*" (r=-0.309; p=0.049). It was not possible to observe significant correlations for the other associations (p>0.05).

Overall, the results showed that demotivation was positively associated with multiple stress-related dimensions and negatively correlated with recovery-related variables. In contrast, self-determined forms of motivation were positively associated with recovery states. These findings suggest a consistent pattern in which higher quality motivation is linked to more favorable recovery states, while demotivation tends to correlate with markers of stress and fatigue.

Discussion

Research on the interactions between motivation and recovery is relatively recent, and most previous studies (Beckmann & Kossak, 2018; Dias et al, 2024; Martinent & Decret, 2015; van Hooff et al., 2018) have reported that levels of intrinsic motivational regulations are accompanied by perceptions of well-being and greater states of recovery. In this sense, it is suggested that individuals with this regulation can interact better with the context and be more inclined to perform tasks (Martinent et al., 2018; van Hooff et al., 2018). Improving the understanding of this theme, the results obtained in this study indicate that these relationships between motivation and recovery may vary, depending on the dimension of the motivation evaluated.

As the main result of this investigation, the relevance of the "demotivation" dimension is verified, which correlated with 11 of the 19 recovery-stress subscales. Since this dimension was positively associated with some stress subscales and inversely associated with some recovery subscales, it is suggested that demotivation may be related to suppressive aspects of recovery. Demotivation is the state of lack of intention to act or resistance to carrying out the behavior, which can occur due to unclear decisions, lack of interest, perception of incompetence or disbelief in the result (Xu et al., 2025; Ryan & Deci, 2017). These aspects can instigate the individual to move away from an activity in order to seek temporarily more interesting and pleasant alternatives (Beckmann & Kossak, 2018). The absence of volition can result in continuous rumination, marked by state orientation processes, which prevent or interfere with recovery (Beckmann & Kossak, 2018). In this sense, the relationship between demotivation and the subscale "Lack of Energy" may denote that individuals with some level of dysregulation also present inefficient behaviors, such as lack of concentration, unwillingness and decision-making errors.

Demotivation also implies a greater perception of stress or difficulty dealing with stressors (Holden et al., 2019). In competitive environments, individuals with some level of demotivation tend to have difficulties in maintaining performance and, consequently, exhibit higher levels of stress (Park et al., 2012). Therefore, even with moderate magnitudes, the positive correlations between the "demotivation" dimension and the subscales of "general stress", "social stress", "emotional stress" and "emotional exhaustion" indicate that impersonal behaviors may be accompanied by deficient states of recovery under the influence of stress, such as disturbances in social bonding, conflicts with team members, irritability and disappointment in the sporting context. Since stress can destabilize biological processes, such as muscle recovery (Stults-Kolehmainen & Bartholomew, 2012), the relationship between "demotivation" and "somatic complaints" suggests that individuals with some level of demotivation tend to present more symptoms of pain and physical ailments.

During a sports season, behavioral fluctuations can occur due to the training process and performance expectations, which can cause negative effects such as stress, anxiety and tension (Rosa et al., 2020). Although athletes are used to and trained to deal with competitive stressors, the emergence of different situational demands and stressors related to personal life domains (outside the sports context) can

exceed their abilities and psychological resources (Hill et al., 2018). Combined, these events lead to a cascade of deleterious conditions, such as psychological exhaustion and limited reestablishment ability, characteristics of underrecovery, a deficient state of recovery (Codonhato et al., 2018; Kellmann et al., 2018). That is, if the athlete is not able to regulate his emotions or behaviors that allow him, on his own, to deal with the stressful demand, the recovery process is compromised and adverse situations such as fatigue or exhaustion may arise (Balk & Englert, 2020). In this direction, a recent systematic review has reinforced that demotivation and controlled forms of regulation are frequently associated with maladaptive outcomes in sport, including emotional exhaustion, reduced recovery, and increased vulnerability to burnout and dropout (Dias et al., 2024).

Similarly, athletes with some level of demotivation, in addition to presenting high levels of sport-specific stress, tend to recover inadequately from the training sessions to which they are submitted (Fagundes et al., 2019). Thus, the inverse correlations of demotivation dimension with the subscales "General Well-Being" and "Being in Shape" indicate that the lack of personal appropriation regarding the reasons for training are accompanied by aspects of insufficient recovery, indicated by reduced levels of relaxation, pleasure with activity and vitality. In turn, correlations with "Success" and "Self-Efficacy" suggest that athletes with this regulation tend to have lower expectations about performance while practicing and preparing for competitions. Finally, the relationship between the demotivation dimension and the "Sleep Quality" subscale expresses that the absence of volition impacts on limited self-regulatory resources and difficulties in avoiding debilitating sleep behaviors and, consequently, reduced probability of effectively recovering. Since sleep is a way of restoring energy resources, the psychological aspect of recovery demands the performance of behaviors that favor sleep hygiene (Sonnentag, 2018).

Corroborating these results, previous studies (Fagundes et al., 2019; Lemyre et al., 2007; Martinent et al., 2018) that have observed the association between levels of demotivation and deficient states of recovery indicate that these measures were also accompanied by greater probabilities of negative sporting outcomes, such as overtraining, burnout and dropout. Indeed, while autonomous forms of motivation are usually related to desirable outcomes (personal ownership concerning training motives, psychological well-being or persistence), controlled forms of motivation or absence of regulation are usually related to negative consequences, such as difficulties in performing tasks, low levels of self-efficacy, stress and anxiety in situations of evaluation, exhaustion and withdrawal from sports practice (Ryan & Deci, 2017; Taylor, 2015).

On the other hand, as a second result, it is verified that higher levels of self-determined behavior, observed when there is greater engagement, identification and enjoyment with sports, were associated with greater perception of well-being, occurrence of relaxation, good mood, vitality and preparation for the sporting task. Indeed, athletes with higher levels of autonomous motivation – particularly intrinsic motivation and identified regulation – tended to adopt more effective recovery strategies, demonstrate better stress management, and experience greater psychological well-being (Dias, 2024). From this perspective, the results of the present study suggest that individuals who perceive personal ownership over their training motives find a favorable state of mind to initiate actions and perform tasks, which can reduce feelings of powerlessness, lack of control, and increase the perception of well-being (Ryan & Deci, 2017). These factors, in their turn, can increase the likelihood of athletes reaching high states of recovery (Beckmann & Kellmann, 2004). Since recovery involves a biopsychosocial perspective and is related to everyday situations, positive psychological states are important and pertinent aspects of the process (Balk & Englert, 2020; Kellmann & Kallus, 1999).

Hence, it is observed that the occurrence of relaxation, well-being, pleasant social contacts, and levels of good mood can benefit the process through detachment from exposure to the stressor agent (Balk & Englert, 2020; Geurts & Sonnentag, 2006; Heidari et al., 2018). In their study involving hospital staff, van Hooff et al. (2018) observed associations between meeting BPNs (autonomy, competence and social relationship) and the experience of positive emotional states, vigor, recovery and reestablishment of personal resources, as well as inverse associations between BPNs and perceptions of fatigue, mood disorders and anxiety. In this sense, the authors suggest that the satisfaction of BPNs and social bonds can be a relevant factor for the recovery process, offering a detachment from the stress of work, in addition to facilitating and expanding the possibilities for individuals to better interact with the environment in their everyday context. In line with this, recent evidence indicates that a positive

motivational climate can enhance performance outcomes (Prayoga et al., 2024; Ventaja-Cruz et al., 2025).

Variables resulting from the interaction between biopsychosocial domains, such as modulations of hormonal states, are also important in the training and recovery process. Social bonds and positive emotions can provide a feeling of relaxation and stimulate the production of oxytocin, which, in its turn, is related to reduced levels of cortisol secreted during situations of physical or psychological stress (Heinrichs et al., 2003; Uvnas-Moberg & Petersson, 2005). In their turn, at different moments of a Paralympic cycle, Rosa et al. (2020) note that intrinsic regulations are accompanied by higher scores as to states of recovery and testosterone concentrations. Reinforcing this finding, cortisol concentrations have been associated with subscales of stress, demotivation, and the extrinsic dimensions of motivation.

However, it is important to highlight that self-determined behaviors, by themselves, are not always sufficient to explain recovery. While identified regulation was related to the perception of fatigue and disturbances in the social bond, athletes with identified and introjected regulations also had a greater perception of integration with teammates. These results enable considerations that motivational regulations may be related differently to states of recovery. Athletes with high levels of autonomous and controlled motivation, as well as those with high obsessive passion scores , may also present high levels of physical and emotional exhaustion and a higher risk of developing burnout (Gillet et al., 2012; Vallerand, 2001). Furthermore, involvement during the recovery process is oriented as a means to an end and not towards the activity itself (Martins & Pedro, 2017). It is necessary for the individual to regulate their behavior to perform a task (rest, sleep early, eat properly, etc.) that is not interesting or requires self-control, aiming at an external factor (Balk & Englert, 2020).

The identified regulation is associated with the internal perception of the locus of causality and awareness of the values of a given behavior. In turn, introjected regulation tends to exhibit behaviors reinforced by anxiety and the need for recognition due to internal pressures and conflicts. Introjection is a process that involves some degree of internalization and adoption of a regulation, even if partially and incompletely (Ntoumanis & Moller, 2025; Ryan & Deci, 2017). The association between introjected regulation and the “personal acceptance” subscale partially corroborates the results found by Martins and Pedro (2017) in athletes practicing Olympic wrestling. The authors suggest that the recovery process of athletes with this regulation may be based on external sources, with social recognition being necessary, such as perceptions of appreciation and empathy within the team.

The low scores on the stress subscales and high scores on the recovery subscale observed in the present study may indicate that the participating athletes are not subjected to high training loads and to social and psychological situations, which lead to less stress during recovery moments (Kellmann et al., 2009). Although a considerable weekly training volume was observed, training intensity was not assessed and, therefore, it is possible that the high perception of recovery derives from lighter total training loads. As observed by Pillay et al. (2020), during the period of isolation against the COVID-19 pandemic, as well as the resumption of activities after the end of the restrictions, sports training has been conducted with lighter and smaller loads than normal. The authors found that most athletes were training with moderate exercise intensity and a length of 30-60 minutes per day. In this sense, it is possible that teams are still returning to pre-pandemic training load parameters, offering supervised training opportunities and access to places with adequate equipment, as a strategy for athletes to deal with detraining (Latella & Haff, 2020; Pillay et al., 2020).

Finally, although a relationship between the variables was observed, the present study has as a limitation the use of perceptual measures of recovery, which did not consider the assessment of biological or performance parameters. Even though an assessment isolated from biological parameters is questionable (Coutts et al., 2007), the quality of data from subjective measures of recovery can be impaired if athletes enter values that do not correspond to their actual condition (Heidari et al., 2019). Likewise, as observed by Martinent and Decret (2015), fluctuations in the measures of motivation dimensions may occur as a function of everyday situations, which requires a deeper analysis. In this sense, it is worth suggesting studies that investigate recovery using multidimensional assessments (biological, performance, psychological aspects) and their respective interaction with motivational regulations, considering the fluctuation of these states as a function of circumstances and over time.

Conclusions

This study proposes considerations on different ways in which motivational regulations can be related to states of recovery. It concludes that, while levels of impersonal orientation are associated with states of stress and deficits in recovery, self-determined behaviors are associated with the occurrence of positive psychological states that can benefit the recovery process. The practical implication of these results allows coaches to consider the interaction of motivational regulations and states of recovery with a variable that affects one's physical disposition and readiness to perform sporting tasks.

Avoid presenting conclusions that are not a consequence of what is stated in the results or repeating those previously presented.

Practical Applications

During the recovery process, the psychological aspects and social context of the athlete's life must be considered, which can benefit or hinder the recovery and, consequently, the readiness to perform the sport task.

It is important that coaches promote motivational climates, as it is verified that higher levels of self-determined behavior, observed when there is greater engagement, identification and pleasure with the sport, were associated with greater perception of well-being, occurrence of social contacts, good mood, and relaxation.

Likewise, the positive association of scores in the "demotivation" dimension with some stress subscales and conversely with some recovery subscales indicate that some level of non-regulation or impersonal locus of control may be accompanied by deficient recovery states.

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