

A reciprocal effects model of the temporal ordering of motivation and burnout among youth table tennis players in intensive training settings

GUILLAUME MARTINENT¹, JEAN-CLAUDE DECRET², EMMA GUILLET-DESCAS¹ & SANDRINE ISOARD-GAUTHEUR³

¹Université de Lyon-Université Claude Bernard Lyon 1, Centre de Recherche et d'Innovation sur le Sport, Villeurbanne, France, ²French Federation of Table Tennis, Paris, France and ³Univ. Grenoble Alpes, Laboratoire SENS, Grenoble, France

(Accepted 1 April 2014)

Abstract

Using self-determination theory (SDT) (Deci, E.L., & Ryan, R.M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York, NY: Plenum) as the theoretical framework, we conducted a longitudinal investigation of the temporal ordering between motivation and burnout among youth athletes in intensive training setting. Data were collected from 145 table tennis players in intensive training centres at three time points during a 2-month period characterised by a simultaneous increase in social, physical and psychological demands for these athletes. Structural equation modelling of cross-lagged panel models was used to test the hypotheses. Results showed significant paths leading from athlete burnout – especially sport devaluation and reduced sense of accomplishment – at time 1 to amotivation, intrinsic and extrinsic motivations at times 2 and 3. Only two significant paths leading from motivation (introjected regulation at time 1) to burnout (emotional/physical exhaustion at time 2 and reduced sense of accomplishment at time 3) were identified. Overall, our results suggest that athlete burnout predicts motivation over time but motivation did not predict athlete burnout over time. Results are discussed in terms of current research findings on SDT.

Keywords: burnout, reciprocal effects model, self-determination theory, structural equation modelling

1. Introduction

Athlete burnout can result from intensive sport participation and may lead to detrimental consequences such as illness or dropout (Gould & Dieffenbach, 2002). Preventing burnout has thus been viewed by several scholars as an important issue (Eklund & Cresswell, 2007; Goodger, Gorely, Harwood, & Lavalley, 2007). Early studies investigating athlete burnout were based on a variety of conceptual definitions that lead to confusion regarding the nature of the concept (Lonsdale & Hodge, 2011). In recent years, growing empirical research has provided evidence that athlete burnout can be defined as a syndrome characterised by emotional and physical exhaustion, sport devaluation and a reduced sense of accomplishment (Raedeke, 1997). The clarification of the burnout concept allows investigation of potential athlete burnout antecedents. As a result, the past decade has seen an increase in the number of studies published on this topic (Cresswell & Eklund, 2005a; Lonsdale & Hodge, 2011).

Youth athletes in intensive training centres seem particularly vulnerable to burnout due to the high physical, psychological and social demands inherent in their situation (Isoard-Gauthier, Guillet-Descas, & Duda, 2013). Intensive training centres are structures that receive the best young athletes in France. These training centres focus on helping athletes to reach the highest levels of performance as well as to have good academic results (Isoard-Gauthier et al., 2013). Throughout their tenure in the centre, the athletes will be evaluated several times and involved in numerous intra-individual competitions. It is paramount that youth athletes involved in these training centres demonstrate and develop their personal competence as well as achieve success (Isoard-Gauthier et al., 2013). Consequently, negative outcomes resulting from their total devotion to their goals or excessive training could lead to athlete burnout (Gould & Dieffenbach, 2002). Losses resulting from the early retirement of young elite athletes due to burnout can lead to an individual unfulfilled human potential and a reduction of national team

performance (Kallus & Kellmann, 2000). As a result, it can be useful to identify antecedents of burnout in youth athletes involved in intensive training centres.

Targeting this intensive training context, studies have emphasised the role of motivational factors as potential athlete burnout antecedents (Isoard-Gautheur et al., 2013; Lemyre, Hall, & Roberts, 2007). In particular, self-determination theory (SDT) is a useful theoretical framework to examine the potential motivational antecedents of athlete burnout (Cresswell & Eklund, 2005a; Lemyre, Treasure, & Roberts, 2006). SDT (Deci & Ryan, 1985, 2000) premises that three basic psychological needs (competence, autonomy and relatedness) should be fulfilled by a social environment to increase an individual's well-being. The degree in which these three basic psychological needs are fulfilled results in types of motivation that vary in their degree of self-determination (Deci & Ryan, 1985).

Intrinsic motivation is completely self-determined and refers to the participation in activities for the feeling of enjoyment and satisfaction in the activities themselves (e.g., fun, challenge or learning). SDT also postulates different extrinsic motivations (i.e., benefits of engagement in activity are different from activity itself) that vary in the extent to which they are self-determined. Integrated regulation is the highest self-determined type of extrinsic motivation and refers to individuals participating in the activity because it has been assimilated with one's sense of self (e.g., an athlete who practices sport as part of a healthy lifestyle and aligns sport with their other valued life goals). Identified regulation refers to behaviours that occur when individuals perceive the activity as important to their goals and values (e.g., an athlete who volitionally engages in sport sessions because it feels personally valuable for health). Introjected regulation refers to individuals participating in the activity to avoid guilt and is characterised by a contingent self-worth (e.g., an athlete who feels ashamed if she or he misses a training session). External regulation is the lowest self-determined type of extrinsic motivation and refers to individuals engaged in activities for external reasons such as rewards or because they feel pressured and controlled by family and friends. Finally, amotivation refers to the absence of motivation towards the activity. Intrinsic motivation and identified and integrated regulations represent autonomous, self-determined forms of motivation because they refer to behaviours performed by choice (Deci & Ryan, 2000). Conversely, introjected and external regulations are viewed as controlling forms of motivation because the individual lacks the sense of autonomy and choice (Deci & Ryan, 1985, 2000).

From a theoretical viewpoint (Deci & Ryan, 2000), it is expected that (a) non-self-determined forms of motivation would be positively related to maladaptive outcomes (e.g., athlete burnout) and negatively related to adaptive outcomes (e.g., effort, persistence or well-being) and (b) self-determined forms of motivation would be negatively related to negative outcomes and positively related to adaptive outcomes. Previous research has supported these predictions (Deci & Ryan, 2000). For example, cross-sectional research has shown positive relationships between athlete burnout and controlling forms of motivation as well as negative relations between athlete burnout and self-determined forms of motivation (see for a meta-analysis Li, John Wang, Pyun, & Kee, 2013). Nevertheless, the prevalence of correlational studies in the literature has prevented the exploration of temporal ordering between motivation and burnout. Examining the temporal ordering between motivation and burnout is a critical issue not only for theorists but also for practitioners who try to prevent or minimise athlete burnout. As a result, longitudinal research designs are needed to disentangle the temporal ordering of motivation and burnout (Lonsdale & Hodge, 2011).

In this instance, it is expected from a SDT perspective that motivation will predict athlete burnout over time (Cresswell & Eklund, 2005a). However, it seems also possible that burnout will predict motivation over time. Specifically, an increase in burnout could lead to a shift over time in the quality of an athlete's motivation, from autonomous to controlled motivation (Lonsdale & Hodge, 2011). Sport devaluation involves a negative attitude towards sport, whereas reduced sense of accomplishment involves the tendency to evaluate oneself negatively in terms of accomplishments (Raedeke & Smith, 2009). Because youth athletes involved in intensive training centres must demonstrate their personal competence and achieve success, when they will experience reduced accomplishment and sport devaluation, they might feel they have the obligation to participate to receive desired outcomes such as coach approval. As such, negative burnout symptoms might be associated with an increase in motivation towards gaining external rewards or to comply with social pressure.

To the best of our knowledge, few studies have examined the relationship between motivation and athlete burnout using a longitudinal design (Cresswell & Eklund, 2005c; Isoard-Gautheur, Guillet-Descas, & Lemyre, 2012; Lemyre et al., 2006; Lonsdale & Hodge, 2011). Cresswell and Eklund (2005c) explored relationships between motivation and burnout among a sample of professional rugby players. Whereas changes in burnout were associated with changes in motivation, the analyses they computed did not shed light on the

temporal ordering of motivation and burnout over time. Another important limitation of their study involved collapsing the different forms of extrinsic motivation into one composite construct. This approach seems problematic because a fundamental tenet of SDT is that self-determined forms of extrinsic motivation would be adaptive, whereas non-self-determined forms of extrinsic motivation would be maladaptive. Lemyre et al. (2006) also used a longitudinal design among a sample of swimmers. Decreases in self-determined motivation over the season predicted the three dimensions of athlete burnout at the season's end. Nevertheless, a limitation of their study was that burnout was only measured at the end of the season. As a consequence, prediction of athlete burnout at the season's end from decrease in self-determined motivation over the season could be a spurious result. Specifically, this relationship could be due to the correlations between burnout over the season and burnout at the season's end as well as between burnout and motivation over the season (Lonsdale & Hodge, 2011; MacCallum & Austin, 2000). Therefore, the temporal ordering of motivation and burnout cannot be safely inferred from their results.

To address this limitation, Isoard-Gautheur et al. (2012) examined the prospective relationships between the different forms of motivation at the beginning of the season and the three dimensions of athlete burnout at the season's end (with prediction of burnout at time 2 by burnout at time 1). Their results confirmed that non-self-determined forms of motivation predicted athlete burnout. However, in this study, the authors did not examine the relationships between burnout at time 1 and motivation at time 2. Finally, Lonsdale and Hodge (2011) determined the temporal ordering of burnout and motivation among a sample of elite athletes using a two-wave cross-lag panel design. They showed that the relationship between motivation and burnout varied depending on the type of motivation assessed: (a) amotivation and the non-self-determined forms of extrinsic motivation (introjected and external regulations) at time 1 positively predicted burnout at time 2, (b) burnout at time 1 negatively predicted self-determined forms of extrinsic motivation (integrated and identified regulations) at time 2 and (c) no relationship over time was identified between intrinsic motivation and burnout. However, due to inclusion of athletes from a variety of sports, they collected data at two time points corresponding with rather crude training cycle indicators (preseason/early season at time 1 and mid/late season at time 2). Future research should collect data at a greater number of time points that correspond with potentially meaningful situations (Cresswell & Eklund, 2005b; Lonsdale & Hodge,

2011). The present study fills these gaps by collecting data at three time points during a 2-month period characterised by a simultaneous increase in social, physical and psychological demands for athletes involved in intensive training centers.

In sum, the main purpose of the current study was to examine temporal ordering between burnout and motivation from a SDT perspective among youth athletes in intensive training setting. This goal was accomplished by using a cross-lag panel design, an approach commonly employed to disentangle temporal ordering between two theoretical constructs (e.g., Marsh, Chanal, & Sarrazin, 2006). Although it was deemed premature to formulate specific hypotheses, on the basis of existing research (Lonsdale & Hodge, 2011), we broadly anticipated that external regulation and introjected regulation (non-self-determined forms of extrinsic motivation) will predict athlete burnout over time, whereas athlete burnout will predict identified regulation (self-determined form of extrinsic motivation) over time.

2. Methods

2.1. Participants

A sample of 145 French table tennis players involved in elite training centres (99 males and 46 females) participated in this study. They trained an average of 15.46 hours a week ($s = 5.92$). Their mean age was 13.89 years ($s = 2.03$) and their average playing experience in their sport was 6.23 years ($s = 2.22$). Power analysis with G*Power 3 software (Faul, Erdfelder, Lang, & Buchner, 2007) revealed that to achieve a 95% confidence interval in the current study, a minimum of 134 athletes were needed to be recruited.

2.2. Procedure

The research was conducted in accordance with international ethical guidelines that are consistent with American Psychological Association norms and was approved by a university institutional review board. Coaches from each training centres were contacted to obtain permission to approach their athletes for participation in the study. The athletes' participation was voluntary, and written informed consent was obtained from each individual prior to data collection (and also from their parents for minor age athletes). Data collection occurred at three time points (1 month between each completion) during a 2-month period (T1 in March; T2 in April; T3 in May). This 2-month period was selected because it represented a key point time in the season. The athletes had been in the structure for 6–8 months, it was the last school term (several exams

and more homework) and it was almost the end of the competitive season with really important matches for the players (longer training periods, more pressure). So, in this period, athletes must cope with ever-increasing social, psychological and physiological demands that can lead to an increase in athletes' burnout (Gustafsson, Kenttä, Hassmén, & Lundqvist, 2007).

2.3. Measures

The French version (Isoard-Gautheur, Oger, Guillet, & Martin-Krumm, 2010) of the Athlete Burnout Questionnaire (ABQ, Raedeke & Smith, 2001, 2009) was used to assess burnout. It contains three subscales designed to measure reduced sense of accomplishment, sport devaluation and emotional/physical exhaustion. Isoard-Gautheur et al. (2010) used CFA to assess psychometric properties of ABQ. They concluded there was a good fit for the hypothesised model on a sample of 895 young French involved in competitive sport or physical education at school ranging in age from 11 to 19 years (NNFI = 0.95, CFI = 0.96, GFI = 0.95, RMSEA = 0.07; Isoard-Gautheur et al., 2010). Participants respond on a 5-point Likert scale with values ranging from 1 (almost never) to 5 (most of the time). Internal consistency was acceptable with Cronbach's alphas ranging from 0.66 to 0.92 (Table I).

The French version of the Sport Motivation Scale (SMS; Brière, Vallerand, Blais, & Pelletier, 1995) was used to measure motivation. The SMS is derived from the tenets of SDT (Deci & Ryan, 1985) and comprises seven subscales that assess different types of motivation: intrinsic motivation to know, intrinsic motivation towards accomplishment, intrinsic motivation to experience stimulation, identified regulation, introjected regulation, external regulation and amotivation. Each item was rated on a 5-point Likert scale ranging from 1 (does not correspond at all) to 5 (corresponds exactly). Previous research lent credence to the validity and reliability of SMS (see Vallerand & Losier, 1999, for a review). Recent studies (e.g., Boiché, Sarrazin, Grouzet, Pelletier, & Chanal, 2008; Isoard-Gautheur et al., 2012) on the French SMS items showed that the intrinsic motivation to know and towards accomplishment items loaded on a unique factor, and so, in the current study, we used a factor aggregating these two subscales together. The alpha coefficients indicated that the reliability was acceptable with Cronbach's alphas ranging from 0.68 to 0.92, excepted for intrinsic motivation to know and towards accomplishment at time 1 ($\alpha = 0.60$). Some scholars find Cronbach's alpha tends to increase with an increase in the number of items in

Table I. Descriptive statistics and time 1, time 2 and time 3 correlations.

	1	2	3	4	5	6	7	8	9
1. Reduced accomplishment									
2. Sport devaluation	0.52*/0.46*								
3. Emotional/physical exhaustion	0.09/0.09	0.47*							
4. Intrinsic motivation to know and towards accomplishment	-0.17*/-0.19*	0.02/0.12							
5. Intrinsic motivation to experience stimulation	-0.15*/-0.16	-0.26*/-0.16							
6. Identified regulation	0.11/0.12	0.22*/0.27*	0.05/0.10						
7. Introjected regulation	0.20*/0.19*	0.28*/0.29*	0.06/0.05	0.56*/0.62*					
8. External regulation	0.33*/0.31*	0.47*/0.44*	0.13/0.17*	0.32*/0.37*	0.23*/0.29*				
9. Amotivation	0.50*/0.48*	0.56*/0.56*	0.01/0.01	0.31*/0.34*	-0.28*/-0.17*	0.52*/0.58*			
T1 Mean	2.43	1.79	0.02/0.03	-0.17*/-0.17*	-0.35*/-0.30*	0.31*/0.35*	0.27*/0.34*		
T1 s	0.71	0.90	3.09	-0.26*/-0.23*	4.30	0.26*/0.21*	0.15/0.18*	0.60*/0.62*	
T2 Mean	2.34	0.90	0.89	3.72	0.72	2.55	2.66	1.44	1.42
T2 s	0.71	1.77	2.94	0.68	0.72	0.85	0.80	0.62	0.68
T3 Mean	2.39	1.82	2.89	3.65	4.21	2.64	2.54	1.40	1.41
T3 s	0.76	0.87	0.93	0.75	0.86	0.89	0.84	0.54	0.62
T1 Cronbach's alpha	0.66	0.88	0.96	0.90	0.96	0.97	0.89	0.68	0.61
T2 Cronbach's alpha	0.67	0.81	0.89	0.60	0.77	0.81	0.77	0.78	0.84
T3 Cronbach's alpha	0.74	0.84	0.91	0.68	0.86	0.87	0.83	0.68	0.79
			0.92	0.82	0.92	0.89	0.86	0.82	0.82

Notes: * $P < .05$. Time 1 correlations listed above the diagonal, time 2/time 3 correlations listed below the diagonal.

scale (e.g., Clark & Watson, 1995), leading several researchers to suggest a cut-off value of 0.60 for subscale of four items (e.g., Hair, Anderson, Tatham, & Black, 1998). Other researchers prefer the use of the raw mean inter-item correlation as a statistical marker of internal consistency. For this, a rule of thumb is offered by Clark and Watson (1995) who recommend that the average inter-item correlation fall in the range of 0.15–0.50. The mean inter-item correlation for intrinsic motivation to know and towards accomplishment at time 1 was 0.27.

2.4. Statistical analyses

The participants with missing data (six participants) were excluded because they did not respond on one of the completion due to the fact that they were injured. This analytical strategy seems justified based on the rationale that the missing data are unrelated to any variable in the model (i.e., missing completely at random). Before conducting the main analyses, we screened the data set for multivariate outliers and examined the normality of the distributions. We tested our hypotheses using structural equation modelling (maximum likelihood estimation) with LISREL (Version 8.71, Jöreskog & Sörbom, 2004). Each model was a cross-lag panel design (e.g., Lonsdale & Hodge, 2011; Marsh et al., 2006) with two or three time points (see Figure 1). We tested three series of models (reduced sense of accomplishment in the first series, exhaustion in the second and sport devaluation in the third) with six models in each series (one model for each dimension of the SMS). These three series of models were tested with two (T1 and T3) as well as three time points (T1, T2 and T3). As burnout is considered to be an enduring phenomenon, substantial time seems needed to note changes (Raedeke, 1997).

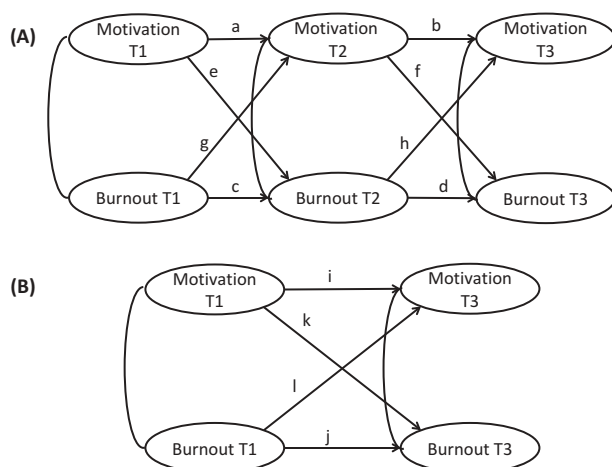


Figure 1. Reciprocal model of motivation and athlete burnout with three (A) and two (B) measurement occasions.

Nevertheless, it is not clear how long this period needs to be (Isoard-Gautheur et al., 2012; Lonsdale & Hodge, 2011). As a result, it would be useful to conduct analyses on two distinct intervals (1 month for three time point models vs. 2 months for two time point models) to highlight the role of time interval in relationships between motivation and burnout over time.

To retain a reasonable degree of freedom for the model, it was decided to reduce the variables and hence each construct was measured by two random aggregates of items (Coffman & MacCallum, 2005; MacCallum & Austin, 2000). As recommended by Marsh, Byrne, and Yeung (1999), all analyses presented in this study included correlated uniquenesses posited *a priori* to account for method effects associated with the same parcels administered on different consecutive occasions in longitudinal research. It seems important to emphasise that all correlated uniquenesses (a) were for the same parcels administered at T1 and T2 as well as T2 and T3 for the three time point models and at T1 and T3 for the two time point models, (b) were hypothesised *a priori* and (c) did not include correlated uniquenesses between different (non-matching) parcels (Marsh et al., 2006). As can be seen in Figure 1, all possible paths between latent variables were estimated. As a result, the fit indices for the measurement models were necessarily the same as those for the structural models and are therefore not reported separately (Lonsdale & Hodge, 2011).

To achieve a comprehensive evaluation of fit (Hu & Bentler, 1999; MacCallum & Austin, 2000), we considered the Bentler-Bonett non-normed fit index (NNFI), the comparative fit index (CFI), the root mean squared error of approximation (RMSEA) and the standardised root mean square residual (SRMR) as well as conducting the normal theory chi-squared test statistic. The CFI and NNFI vary along a continuum from 0 to 1 where values greater than 0.90 and 0.95 are typically taken to reflect acceptable and excellent fits to the data (Hu & Bentler, 1999; Marsh et al., 2006). RMSEA and SRMR of less than 0.05 and 0.08 are taken to reflect a close fit and a reasonable fit, respectively (Hu & Bentler, 1999; Marsh et al., 2006).

3. Results

Time 1, time 2 and time 3 correlation matrix are shown in Table I.

Results from the two series of structural equation modelling – with three and two measurement occasions – designed to test the reciprocal effects model for motivation and burnout are summarised in Tables II and III respectively. All structural equation models of the two time points fit the data well, with

Table II. Models testing with three measurement occasions.

Model	χ^2 (35)	P	CFI	NNFI	SRMR	RMSEA	a (T1 mot → T2 mot)	b (T2 mot → T3 mot)	c (T1 bur → T2 bur)	d (T2 bur → T3 bur)	e (T1 mot → T2 bur)	f (T2 mot → T3 bur)	g (T1 bur → T2 mot)	h (T2 bur → T3 mot)
1. Amotivation														
Exhaustion	76.41	0.00	0.97	0.95	0.06	0.09	0.79**	0.77**	0.75**	0.80**	0.03	-0.05	-0.06	-0.09
Reduced	46.10	0.09	0.99	0.99	0.04	0.05	0.80**	0.49**	0.89**	0.99**	-0.04	-0.22	-0.08	0.34**
accomplishment														
Sport devaluation	75.57	0.00	0.98	0.97	0.04	0.09	0.63**	0.56**	0.96**	0.80**	-0.04	0.02	0.19	0.29*
2. External regulation														
Exhaustion	77.17	0.00	0.97	0.95	0.07	0.09	0.70**	0.79**	0.76**	0.80**	-0.08	0.02	-0.03	-0.10
Reduced	69.75	0.00	0.98	0.95	0.05	0.08	0.68**	0.72**	0.87**	0.93**	-0.01	-0.09	0.01	0.10
accomplishment														
Sport devaluation	57.96	0.01	0.99	0.98	0.04	0.07	0.57**	0.72**	0.96**	0.83**	-0.06	-0.03	0.20	0.09
3. Introjected regulation														
Exhaustion	75.31	0.00	0.98	0.96	0.05	0.09	0.89**	0.90**	0.74**	0.79**	0.15*	0.03	-0.07	0.07
Reduced	64.84	0.00	0.98	0.97	0.04	0.08	0.88**	0.91**	0.86**	0.89**	0.04	0.03	0.03	0.04
accomplishment														
Sport devaluation	89.60	0.00	0.98	0.95	0.04	0.10	0.87**	0.91**	0.94**	0.81**	-0.03	0.03	0.05	-0.01
4. Identified regulation														
Exhaustion	65.15	0.00	0.99	0.97	0.04	0.08	0.91**	0.85**	0.75**	0.80**	0.05	0.01	-0.06	0.06
Reduced	50.82	0.04	0.99	0.98	0.04	0.06	0.90**	0.86**	0.86**	0.90**	-0.04	-0.04	0.03	0.00
accomplishment														
Sport devaluation	52.70	0.03	0.99	0.98	0.03	0.06	0.87**	0.85**	0.94**	0.80**	-0.04	0.04	0.12*	0.06
5. Intrinsic motivation to experience stimulation														
Exhaustion	46.79	0.09	0.99	0.99	0.03	0.05	0.86**	0.87**	0.75**	0.80**	0.02	0.02	0.08	0.09
Reduced	61.69	0.00	0.98	0.97	0.05	0.07	0.88**	0.93**	0.84**	0.89**	-0.12	-0.00	0.03	0.14*
accomplishment														
Sport devaluation	61.36	0.00	0.99	0.97	0.03	0.07	0.86**	0.90**	0.90**	0.80**	-0.10	-0.04	0.01	0.08
6. Intrinsic motivation to know and towards accomplishment														
Exhaustion	57.86	0.01	0.98	0.96	0.04	0.07	0.96**	0.83**	0.75**	0.80**	0.02	0.01	0.01	0.03
Reduced	58.08	0.01	0.98	0.96	0.06	0.07	0.99**	0.90**	0.85**	0.88**	-0.02	-0.09	0.14	0.21*
accomplishment														
Sport devaluation	42.31	0.19	0.99	0.99	0.04	0.04	0.99**	0.83**	0.91**	0.83**	-0.06	0.05	0.16	0.00

Notes: * $P < .05$, ** $P < .01$. Letters a-h refer to paths from Figure 1.

Table III. Models testing with two measurement occasions.

Model	$\chi^2(10)$	P	CFI	NNFI	SRMR	RMSEA	i (T1 mot → T3 mot)	j (T1 bur → T3 bur)	k (T1 mot → T3 bur)	l (T1 bur → T3 mot)
1. Amotivation										
Exhaustion	14.20	0.16	0.99	0.98	0.04	0.05	0.72**	0.65**	0.00	-0.02
Reduced accomplishment	10.26	0.42	1.00	1.00	0.03	0.01	0.56**	0.88**	-0.20	0.24
Sport devaluation	17.68	0.06	0.99	0.98	0.03	0.07	0.45**	0.70**	0.06	0.39**
2. External regulation										
Exhaustion	4.63	0.92	1.00	1.00	0.02	0.00	0.67**	0.66**	-0.03	0.01
Reduced accomplishment	15.19	0.13	0.99	0.98	0.05	0.06	0.61**	0.80**	-0.14	0.15
Sport devaluation	11.51	0.32	1.00	1.00	0.02	0.03	0.55**	0.72**	0.08	0.21*
3. Introjected regulation										
Exhaustion	10.57	0.39	1.00	1.00	0.07	0.02	0.85**	0.64**	-0.01	-0.01
Reduced accomplishment	7.57	0.67	1.00	1.00	0.03	0.00	0.84**	0.74**	0.16*	0.07
Sport devaluation	13.34	0.21	1.00	0.99	0.02	0.05	0.85**	0.73**	0.09	0.01
4. Identified regulation										
Exhaustion	6.99	0.73	1.00	1.00	0.02	0.00	0.81**	0.65**	-0.06	0.02
Reduced accomplishment	10.80	0.37	1.00	1.00	0.06	0.02	0.81**	0.77**	-0.12	0.07
Sport devaluation	3.15	0.98	1.00	1.00	0.02	0.00	0.76**	0.76**	0.01	0.21**
5. Intrinsic motivation to experience stimulation										
Exhaustion	6.88	0.74	1.00	1.00	0.03	0.00	0.83**	0.65**	-0.02	0.14*
Reduced accomplishment	8.78	0.55	1.00	1.00	0.03	0.00	0.88**	0.74**	-0.01	0.19*
Sport devaluation	11.06	0.35	1.00	1.00	0.02	0.03	0.85**	0.73**	-0.13	0.07
6. Intrinsic motivation to know and towards accomplishment										
Exhaustion	9.36	0.50	1.00	1.00	0.04	0.00	0.79**	0.64**	0.00	0.01
Reduced accomplishment	15.50	0.12	0.99	0.97	0.04	0.06	0.91**	0.73**	-0.06	0.33*
Sport devaluation	9.03	0.53	1.00	1.00	0.02	0.00	0.82**	0.76**	0.00	0.09

Notes: * $P < 0.05$, ** $P < 0.01$. Letters i to l refer to paths from Figure 1.

goodness of fit indices surpassing the stated criteria (e.g., CFI and NNFI ≥ 0.97 , see Table III). For the structural equation models of the three time points in which amotivation, external regulation, identified regulation, intrinsic motivations to experience stimulation or to know and towards accomplishment were the motivation variables, the goodness of fit indices demonstrated that the ability of these models to fit the data was acceptable or good. Structural equation models of the three time points in which introjected regulation was the motivation variable showed some evidence of good fit (e.g., CFI > 0.95) but also some evidence of marginal fit (e.g., RMSEA ≥ 0.08). Thus, caution should be exercised when examining results of these models.

Not surprisingly, the largest effects were observed for the autoregressive paths of the structural equation models – effect of a variable at time t on the same variable at time $t + 1$ ($0.45 \geq \beta \geq 0.99$). Of greater interest, however, are the cross paths – paths involving simultaneously motivation and burnout variables. For the three time point structural equation models (Table II), few significant cross paths have been identified. Time 2 reduced sense of accomplishment significantly predicted time 3 intrinsic motivation to experience stimulation ($\beta = 0.14$, 95% confidence interval (CI) = 0.02–0.27), time 3 intrinsic motivation to know and towards accomplishment ($\beta = 0.21$, 95% CI = 0.03–0.38) and time 3 amotivation ($\beta = 0.34$, 95% CI = 0.08–0.60). Time 1 sport devaluation significantly predicted time 2 identified regulation ($\beta = 0.12$, 95% CI = 0.02–0.23), whereas time 2 sport devaluation significantly predicted time 3 amotivation ($\beta = 0.29$, 95% CI = 0.06–0.52). Time 1 introjected regulation significantly predicted time 2 emotional/physical exhaustion ($\beta = 0.15$, 95% CI = 0.02–0.29). However, this latter finding should be interpreted with caution, as fit indices for this model were marginal.

For the two time point structural equation models (Table III), results are more convincing and suggest mainly that athlete burnout predicted motivation over time, whereas motivation did not predict athlete burnout. Specifically, time 1 reduced sense of accomplishment significantly predicted time 3 intrinsic motivation to know and toward accomplishment ($\beta = 0.33$, 95% CI = 0.07–0.59) and time 3 intrinsic motivation to experience stimulation ($\beta = 0.19$, 95% CI = 0.04–0.34). Time 1 sport devaluation significantly predicted time 3 amotivation ($\beta = 0.39$, 95% CI = 0.15–0.64), time 3 external regulation ($\beta = 0.21$, 95% CI = 0.02–0.40) and time 3 identified regulation ($\beta = 0.21$, 95% CI = 0.09–0.33). Time 1 emotional/physical exhaustion significantly predicted time 3 intrinsic motivation to experience stimulation ($\beta = 0.14$, 95%

CI = 0.02–0.26). The only significant influence of motivation on burnout was the prediction of time 3 reduced sense of accomplishment from time 1 introjected regulation ($\beta = 0.16$, 95% CI = 0.01–0.30).

4. Discussion

The purpose of this study was to examine temporal ordering between athlete burnout and motivation from a SDT perspective among youth athletes in intensive training setting using a cross-lag panel design. Overall, our results suggest that athlete burnout predicts motivation over time but motivation does not predict burnout. Results also reveal some differences depending on the dimension of motivation and burnout assessed. As expected from previous cross-sectional research (e.g., Cresswell & Eklund, 2005a; Raedeke & Smith, 2001), amotivation and non-self-determined forms of extrinsic motivation – external and introjected regulations – correlate positively with sport devaluation and reduced sense of accomplishment at times 1, 2 and 3. However, our results contradict temporal ordering suggested by Lonsdale and Hodge (2011) who showed that amotivation, external regulation and introjected regulation at time 1 predicted athlete burnout at time 2. In the present study, amotivation and external regulation do not predict athlete burnout symptoms, whereas reduced sense of accomplishment and sport devaluation predict amotivation or external regulation.

Because amotivation is characterised as “lacking in motivation”, it should come as no surprise that reduced sense of accomplishment and sport devaluation are related to an increase in amotivation (Holmberg & Sheridan, 2013). An examination of psychological underpinnings of external regulation also indicates a potentially crucial connection between this controlled motivation and the hallmarks of athlete burnout. Sport devaluation is defined as a negative attitude towards sport, reflected by lack of concern about sport and performance quality (Raedeke, 1997). Reduced sense of accomplishment is characterised by feelings of inefficacy and a tendency to evaluate oneself negatively in terms of sport performance and accomplishments (Raedeke & Smith, 2009). One could argue that these negative burnout symptoms can be associated with an increase in motivation towards gaining external rewards/praise and/or to comply with social pressure in the context of intensive training settings. Youth athletes involved in intensive training centres are evaluated several times, must demonstrate their personal competence and achieve success (Isoard-Gautheur et al., 2013). Nevertheless, when they experience reduced accomplishment and sport devaluation, these athletes could feel they “have to”

participate (obligation) to receive desired outcomes such as coach approval. In these circumstances, their actions could be dependent on, and directed by, significant other (e.g., coach or parents), leading to an increase in external regulation (Deci & Ryan, 1985).

In some respects, the fact that burnout is associated with increases in amotivation and external regulation is contradictory, as according to SDT, athletes high in amotivation and external regulation would show an increase in athlete burnout over time (Lonsdale & Hodge, 2011). The timing of data gathering of our study could explain these inconsistent findings. Because athlete burnout is considered to be an enduring phenomenon, substantial time seems to be needed to note changes (Isoard-Gautheur et al., 2012). The potential lack of burnout variability in the present study due to a relatively short period of data gathering (2 months) may have masked increases in burnout among athletes with higher amotivation or external regulation. Nevertheless, previous studies suggested that it is not clear how long this period needs to be. Cresswell and Eklund (2005a) showed that burnout varied during the course of a 3-month tournament. Lonsdale and Hodge (2011) judged 4 months to be an adequate period for any changes in burnout to occur, whereas Isoard-Gautheur et al. (2012) used an interval of 6 months in their longitudinal study on burnout and SDT. Results of the present study shed light on this topic by showing that a 2-month period seems both *sufficient* to detect an association between burnout and an increase in motivation over time and *insufficient* to detect an association between motivation and an increase in burnout over time. The fact that the results are more convincing for the two time point structural equation models (2 months interval) than for the three time point models (1 month interval) seems to confirm this hypothesis.

Concerning identified regulation – a self-determined form of extrinsic regulation – results are in line with those of Lonsdale and Hodge (2011). Specifically, sport devaluation at time 1 predicts identified regulation at times 2 and 3 but identified regulation does not predict athlete burnout. Nevertheless, contrary to Lonsdale and Hodge (2011) who showed a negative relationship between sport devaluation and identified regulation over time, results of the present study indicate that sport devaluation positively predicts identified regulation over time. This is particularly surprising because over time, as the athlete begins to feel somewhat “burned-out” and, in particular, lacks of concern about sport and performance quality, then he/she would be less likely to be motivated by factors such as perceived benefits (i.e., identified regulation). It is possible that the positive relationship observed

between sport devaluation and identified regulation over time would be attributable to the context in which the study was conducted (i.e., intensive training settings). Young athletes in intensive training centres must demonstrate and develop their personal competence as well as achieve success, and these centres help athletes to reach the highest levels of performance as well as to have good academic results (Isoard-Gautheur et al., 2013). Thus, sport devaluation does not seem to be an appropriate feeling or attitude in this context. As a result, it is possible that an athlete who feels a negative attitude towards sport might try to persuade himself that sport is important (in reference to his goals and values), leading to increases in identified regulation over time. Future research should test this relationship again to see if it emerges in other samples or whether it was a result sample specific.

Results also show that reduced sense of accomplishment at times 1 and 2 predicts intrinsic motivation (to know and towards accomplishment as well as to experience stimulation) at time 3. The prediction of intrinsic motivation from reduced sense of accomplishment is inconsistent with the results of Lonsdale and Hodge (2011) who observed that neither intrinsic motivation nor athlete burnout predicted changes in the other over time. Additionally, a somewhat surprising result concerns the nature of the relationship between intrinsic motivation and reduced sense of accomplishment. Although these variables are significantly negatively correlated at times 1, 2 and 3 (as expected from a SDT perspective), our analyses also indicate that reduced sense of accomplishment at times 1 and 2 *positively* predicts intrinsic motivation at time 3. From a SDT perspective, reduced sense of accomplishment leading to an increase in intrinsic motivation is a particularly unexpected finding.

These results could be explained by the characteristics of our sample. Participants reported relatively low scores of the three dimensions of burnout, high scores of intrinsic motivation and low scores of external regulation and amotivation at times 1, 2, and 3. As a result, when participants reported higher scores of reduced sense of accomplishment at time t , it is possible that they (actively or automatically) try to restore lower level of this burnout dimension at time $t + 1$ through coping, self-regulation and emotional regulation strategies. This could also lead to increase their levels of intrinsic motivation from time t to $t + 1$. Another explanation could be related to reaction of significant others (e.g., coaches, peer or parents). In response to seeing their athletes experiencing higher levels of reduced accomplishment at time 1, significant others could have provided emotional support through messages about athletes' ability and the value of being involved in intensive

training settings. From a SDT perspective, support from significant others might foster athletes' fulfilment of their psychological need of relatedness and competence, leading to increases in their levels of intrinsic motivation at time $t + 1$ (Deci & Ryan, 2000). Because this is the first study, to our knowledge, that has reported a positive association between reduced sense of accomplishment and intrinsic motivation over time, future research should test this relationship again to see if it emerges in other samples or whether it was a result specific to the current sample.

Given the specificity of our sample (youth table tennis players in intensive training centres), caution should be exercised before generalising the findings. Further research should continue this line of research by comprehensively examining the temporal ordering of motivation and burnout among male and female athletes of various sports, ages and levels. Another limitation of the present study refers to the self-report questionnaire used to measure motivation (i.e., SMS). Specifically, the results in this study are perhaps different from those reported by Lonsdale and Hodge (2011) because of the poor reliability of evidence related to several extrinsic motivation subscale scores of the SMS (e.g., Cresswell & Eklund, 2005b; Lonsdale & Hodge, 2011; Raedeke & Smith, 2001). Further research should use a self-report questionnaire that is not subject to psychometric problems to measure sport motivation, such as the Behavioral Regulation in Sport Questionnaire (Lonsdale, Hodge, & Rose, 2008). Other constructs outlined in SDT (e.g., psychological need satisfaction and thwarting) should also be included in the design of future study. From a SDT perspective, degree in which three basic psychological needs (competence, autonomy and relatedness) are fulfilled results in different types of motivation that vary in their degree of self-determination (Deci & Ryan, 1985). As a result, it would be fruitful to test whether the influence of the satisfaction and thwarting of psychological needs on athlete burnout symptoms was mediated by different types of motivation postulated in SDT.

Despite these limitations, our investigation has shed light significant theoretical insights on the temporal ordering between motivation and burnout. Previous research has only suggested that low levels of self-determination and, in particular, the presence of controlled motivation were antecedents of increased athlete burnout (e.g., Isoard-Gautheur et al., 2012; Lemyre et al., 2006; Lonsdale & Hodge, 2011). In contrast, results of the present study highlight that athlete burnout predicts motivation reported by athletes from 1 to 2 months later, whereas motivation does not predict burnout over time among a sample of youth table tennis players

involved in intensive training settings. To unambiguously depict the temporal ordering between motivation and burnout, intervention studies (e.g., promoting an autonomy-supportive coaching climate) designed to prevent or minimise athlete burnout would be a particularly fruitful avenue for future research, especially as the athlete burnout literature currently suffers from a lack of this type of study.

Funding

This research was supported by the French Federation of Table Tennis.

References

- Boiché, J. C. S., Sarrazin, P., Grouzet, F. M. E., Pelletier, L. G., & Chantal, J. P. (2008). Students' motivational profiles and achievement outcomes in physical education: A self-determination perspective. *Journal of Educational Psychology, 100*, 688–701. doi:10.1037/0022-0663.100.3.688
- Brière, N. M., Vallerand, R. J., Blais, M. R., & Pelletier, L. G. (1995). On the development and validation of the French form of the Sport Motivation Scale. *International Journal of Sport Psychology, 26*, 465–489.
- Clark, L. A., & Watson, D. (1995). Constructing validity: Basic issues in objective scale development. *Psychological Assessment, 7*, 309–319. doi:10.1037/1040-3590.7.3.309
- Coffman, D. L., & MacCallum, R. C. (2005). Using parcels to convert path analysis models into latent variable models. *Multivariate Behavioral Research, 40*, 235–259. doi:10.1207/s15327906mbr4002_4
- Cresswell, S. L., & Eklund, R. C. (2005a). Motivation and burnout among top amateur rugby players. *Medicine and Science in Sports and Exercise, 37*, 469–477. doi:10.1249/01.MSS.0000155398.71387.C2
- Cresswell, S. L., & Eklund, R. C. (2005b). Changes in athlete burnout and motivation over a 12-week league tournament. *Medicine and Science in Sports and Exercise, 37*, 1957–1966. doi:10.1249/01.mss.0000176304.14675.32
- Cresswell, S. L., & Eklund, R. C. (2005c). Motivation and burnout in professional rugby players. *Research Quarterly for Exercise and Sport, 76*, 370–376. doi:10.1080/02701367.2005.10599309
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York, NY: Plenum.
- Deci, E. L., & Ryan, R. M. (2000). The “what” and “why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11*, 227–268. doi:10.1207/S15327965PLI1104_01
- Eklund, R. C., & Cresswell, S. L. (2007). Athlete burnout. In G. Tenenbaum & R. C. Eklund (Eds.), *Handbook of sport psychology* (pp. 621–641). Hoboken, NJ: Wiley.
- Faul, F., Erdfelder, E., Lang, A. -G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*, 175–191. doi:10.3758/BF03193146
- Goodger, K., Gorely, T., Harwood, C., & Lavallee, D. (2007). Burnout in sport: A systematic review. *The Sport Psychologist, 21*, 127–151.
- Gould, D., & Dieffenbach, K. (2002). Overtraining, underrecovery and burnout in sport. In M. Kellmann (Ed.), *Enhancing recovery: Preventing underperformance in athletes* (pp. 25–35). Champaign, IL: Human Kinetics.

- Gustafsson, H., Kenttä, G., Hassmén, P., & Lundqvist, C. (2007). Prevalence of burnout in competitive adolescent athletes. *The Sport Psychologist*, 21, 21–37.
- Hair, F., Anderson, R., Tatham, R., & Black, W. (1998). *Multivariate data analysis with readings*. 5th ed. Englewood Cliffs, NJ: Prentice Hall.
- Holmberg, P. M., & Sheridan, D. A. (2013). Self-determined motivation as a predictor of burnout among college athletes. *The Sport Psychologist*, 27, 177–187.
- Hu, L., & Bender, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6, 1–55. doi:10.1080/10705519909540118
- Isoard-Gauthier, S., Guillet-Descas, E., & Duda, J. L. (2013). How to achieve in elite training centers without burning out? An achievement goal theory perspective. *Psychology of Sport and Exercise*, 14, 72–83. doi:10.1016/j.psychsport.2012.08.001
- Isoard-Gauthier, S., Guillet-Descas, E., & Lemyre, P. -N. (2012). A prospective study of the influence of perceived coaching style on burnout propensity in elite adolescent athletes: Using a self-determination theory perspective. *The Sport Psychologist*, 26, 282–298.
- Isoard-Gauthier, S., Oger, M., Guillet, E., & Martin-Krumm, C. (2010). Validation of a French version of the Athlete Burnout Questionnaire (ABQ) in competitive sport and physical education context. *European Journal of Psychological Assessment*, 26, 203–211. doi:10.1027/1015-5759/a000027
- Jöreskog, K., & Sörbom, D. (2004). *LISREL 8.71 for windows (computer software)*. Lincolnwood, IL: Scientific Software International.
- Kallus, K. W., & Kellmann, M. (2000). Burnout in athletes and coaches. In Y. L. Hanin (Ed.), *Emotions in sport* (pp. 209–230). Champaign, IL: Human Kinetics.
- Lemyre, N. P., Treasure, D. C., & Roberts, G. C. (2006). Influence of variability in motivation and affect on elite athlete burnout susceptibility. *Journal of Sport & Exercise Psychology*, 28, 32–48.
- Lemyre, P.-N., Hall, H. K., & Roberts, G. C. (2007). A social cognitive approach to burnout in elite athletes. *Scandinavian JOURNAL of Medicine and Science in Sports*, 18, 221–234. doi:10.1111/j.1600-0838.2007.00671.x
- Li, C., John Wang, C. K., Pyun, D. Y., & Kee, Y. H. (2013). Burnout and its relations with basic psychological needs and motivation among athletes: A systematic review and meta-analysis. *Psychology of Sport & Exercise*, 14, 692–700. doi:10.1016/j.psychsport.2013.04.009
- Lonsdale, C., & Hodge, K. (2011). Temporal ordering of motivational quality and athlete burnout in elite sport. *Medicine and Science in Sports and Exercise*, 43, 913–921. doi:10.1249/MSS.0b013e3181ff56c6
- Lonsdale, C., Hodge, K., & Rose, E. A. (2008). The development of the Behavioral Regulation in Sport Questionnaire (BRSQ): Instrument development and initial validity evidence. *Journal of Sport & Exercise Psychology*, 30, 23–35.
- MacCallum, R. C., & Austin, J. T. (2000). Applications of structural equation modeling in psychological research. *Annual Review of Psychology*, 51, 201–226. doi:10.1146/annurev.psych.51.1.201
- Marsh, H. W., Byrne, B. M., & Yeung, A. S. (1999). Causal ordering of academic self-concept and achievement: Reanalysis of a pioneering study and revised recommendations. *Educational Psychologist*, 34, 155–167. doi:10.1207/s15326985ep3403_2
- Marsh, H. W., Chanal, J. P., & Sarrazin, P. G. (2006). Self-belief does make a difference: A reciprocal effects model of the causal ordering of physical self-concept and gymnastics performance. *Journal of Sports Sciences*, 24, 101–111. doi:10.1080/02640410500130920
- Raedeke, T. D. (1997). Is athlete burnout more than just stress? A sport commitment perspective. *Journal of Sport & Exercise Psychology*, 19, 396–417.
- Raedeke, T. D., & Smith, A. L. (2001). Development and preliminary validation of an athlete burnout measure. *Journal of Sport & Exercise Psychology*, 23, 281–306.
- Raedeke, T. D., & Smith, A. L. (2009). *The athlete burnout questionnaire manual*. Morgantown: West Virginia University, Fitness Information Technology.
- Vallerand, R. J., & Losier, G. F. (1999). An integrative analysis of intrinsic and extrinsic motivation in sport. *Journal of Applied Sport Psychology*, 11, 142–169. doi:10.1080/10413209908402956

Copyright of Journal of Sports Sciences is the property of Taylor & Francis Ltd and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.