A cluster analysis of coping among young table tennis players: relationship with stress, recovery, and burnout

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Abstract: this study aimed at examining the ways in which different young table tennis players may combine the use of several coping strategies and at testing whether stress, recovery, and burnout differ across distinctive profiles of coping. The sample consisted of 159 young French table tennis players in intensive training settings who completed self-report questionnaires designed to measure coping, burnout, stress and recovery between 2 to 5 times with delay of one month between each completion, resulting in 693 subjects. The results of hierarchical (Ward's method) and nonhierarchical (k means) cluster analyses indicated that athletes could be classified in four groups according to their use of coping strategies. Results of MANOVA revealed that stress, recovery and burnout significantly differed across the coping profiles. Overall, these findings suggested that research should move from coping strategies to coping profiles in order to provide a deeper understanding of how different athletes cope with stress.

Keywords: burnout, cluster analysis, coping, recovery, stress, young table tennis players.

1. INTRODUCTION

Athletes are confronted with a series of physical, technical, tactical, and psychological demands in training and sport competitions. Young athletes in intensive training settings seem particularly vulnerable to these high demands because they must cope in their everyday life with lots of stressors (e.g. practice and training, school, competition) [1]. Personal, sport, school and family requests may bring young people to lose their motivation, to set too high goals and feel exhausted [1]. Total dedication to the goals they have set, excessive trainings, lack of recovery and a low perceived social support can lead these young people to never realize their full athletic potential [1]. To some extent, the achievement of performance goals and the psychological well-being of athletes may depend on their capacity to cope effectively with these various demands [2].

Although coping strategies of athletes have received increasing empirical attention during the last decade, potentially important individual differences in preferred coping mechanisms have yet to be investigated more thoroughly [2]. Coping is a multidimensional self-regulation construct that represents the constantly changing behavioral and cognitive mechanisms used to manage the ongoing internal and external demands of a specific stressful episode [3]. Although athletes are using a wide variety of coping actions to manage the demands of a sport competition [2], hierarchical models of coping have been proposed to regroup coping strategies into a meaningful and parsimonious set of coping dimensions. Task-oriented coping, which represents strategies aimed at dealing directly with the stressful situation and the resulting thoughts and affects [2], includes strategies such as effort expenditure, active coping, and thought control. Disengagement-oriented coping represents the strategies through which a person withdraws from the process of actively striving toward the realization of desirable outcomes, and includes strategies such as behavioral disengagement or denial. In recent years, a third dimension, distraction-oriented coping, has been proposed to capture the strategies used to momentarily focus the attention on external and internal stimuli unrelated to the stressful situation [2] and includes strategies such as distancing and mental distraction.

A challenge for researchers who have examined the relationships between the different coping strategies and their key correlates has been how to represent coping in a way that captures the multidimensionality of the construct. One approach examined each type of coping strategy individually, thus allowing researchers to examine how each type of coping strategy relates independently to theoretically relevant variables. However, this approach (bivariate relationships between different strategies of coping and some other variables) neglected the fact that individuals could use several types of coping strategy to cope with a particular competitive and/or training stressor [2-4]. The identification of distinct coping profiles of individuals who share similar coping characteristics would provide insights into the complexity of coping [4].

A useful way to address this issue could be to identify subgroups of individuals with unique or unexpected coping profiles using cluster analysis [4]. It is a statistical process that uses multivariate techniques to group participants based on their characteristics (different types of coping strategy) by maximizing both the homogeneity of cases within a group and the heterogeneity between the clusters [5]. To date, studies exploring the different combinations of coping strategies that exist in real-world settings have been especially limited in sport settings [2]. The first aim of this study is to examine whether young table tennis players in intensive training settings are clustered in meaningful ways based on their different types of coping. Understanding how different coping profiles may operate is a fundamental issue not only for theorists

(e.g. number and types of clusters that differ qualitatively in their degree of different types of coping) but also for practitioners who work with the complexities associated with individuals (e.g. tailoring intervention efforts to the needs of unique groups of young athletes in intensive training settings leading to an implementation of more effective intervention programs to manage efficiently high demands of everyday life).

In cluster analysis, using different variables than those used to create groups has proven an efficient technique for validating this type of analysis [5]. The aforementioned multivariate coping profiles should offer a promising platform to re-examine the relationship between the different coping strategies used by young table tennis players, but also their complex interplay with stress, recovery and burnout. Thus, the second purpose of this study was to investigate how young table tennis players in each of the clusters identified in the data analyses differed across stress, recovery and burnout.

Burnout could be conceptualized as the result of chronic exposure to stress and insufficient recovery leading to detrimental consequences such as difficulties in motivation, poorer coping behavior, drastically performance decrements and/or dropout of sport [1]. Young elite athletes seem particularly vulnerable to burnout because of the high demands they must cope in their everyday life (e.g. overloaded with practice and training time, pressure to win by significant others) [1]. The use of different coping strategies by athletes to cope with everyday life demands could (a) regulate the risk for young table tennis player in intensive training settings to develop burnout, (b) modulate the stress experienced by these young players in their everyday life, and (c) regulate the recovery of these young players to their personal, sport, school and family requests inherent to their everyday life.

This study aimed at examining the ways in which different young table tennis players may combine the use of several coping strategies and at testing whether stress, recovery, and burnout differ across distinctive profiles of coping.

2. METHODS

2.1. Participants

A total of 159 (50 girls and 109 boys) young French table tennis players (M_{age} = 14.07, SD = 2.07) in intensive training centers ($M_{hours\ of\ training\ per\ week}$ = 15.04, SD = 5.78) voluntarily participated in this study. On average they have been competing in their sport for 6.36 years (SD = 2.24). They participated in regional (N = 32), national (N = 82) or international sport events (N = 45). Intensive training centers are structures that receive the best young athletes in France. These training centers focus on helping athletes to reach the highest levels of performance as well as to have good academic results. Throughout their tenure in the center, the athletes will be evaluated several times and involved in numerous intra-individual competitions. It is paramount that the young athletes involved in these training centers demonstrate and develop their personal competence as well as achieve success. Consequently, negative outcomes resulting from their total devotion to their goals and/or excessive training could lead to athlete burnout. Participants completed 2 to 5 times questionnaires with delay of one month between each completion, resulting in 693 subjects.

2.2. Measures

The Coping Inventory for Competitive Sport (CICS) [2] was used to asses coping strategies used by table tennis players to cope with their everyday life stress. It is a French questionnaire containing nine four-item subscales and one three-item subscale that can be organized in second-order dimensions representing task-oriented coping (mental imagery, thought control, effort expenditure, seeking support, logical analysis, and relaxation), distraction-oriented coping (mental distraction and distancing), and disengagement-oriented coping (venting of unpleasant emotions and disengagement/resignation). Each item was rated on a 5-point Likert scale ranging from 1 (does not correspond at all) to 5 (corresponds very strongly). The alpha coefficients indicated that the reliability was acceptable with Cronbach's alpha coefficients varying from 0.65 to 0.84 (see Table 2 for more details).

The French version of the REcovery STress Questionnaire for athletes (RESTQ-Sport) [6] provides a picture of current recovery-stress state. It includes general dimensions concerning stress (general stress, emotional stress, social stress, fatigue, lack of energy, conflicts/pressure, somatic complaints) and recovery (success, somatic relaxation, general well-being, sleep quality), as well as specific dimensions which aim at addressing more details of the stress (disturbed breaks, emotional exhaustion and fitness/ injury) and recovery (fitness/being in shape, personal accomplishment, self-efficacy and self-regulation) processes from a physical, emotional, behavioral and social perspective [1]. The version used in the present study consisted of 71 items: 17 scales with 4 items each plus one scale (conflicts/ pressure) with 3 items. A Likert-type scale has been used with values ranging from 0 (never) to 6 (always) indicating how often the respondent participated in various activities during the preceding three days and nights. Alpha coefficients varied from 0.62 to 0.83 (except for the success subscale, α = 0.59), indicating adequate reliability (see Table 2 for more details).

The French version of the Athletes Burnout Questionnaire [7] was used to assess athlete burnout. It contains three 5-item subscales designed to measure: (a) reduced sense of accomplishment (e.g. "I am not achieving much in sport"), (b) sport devaluation (e.g. "I have negative feelings towards sport"), and (c) emotional/physical exhaustion (e.g. "I am exhausted by the mental and physical demands of my sport"). Participants responded on a five-point Likert scale with

values ranging from 1 (almost never) to 5 (most of the time). Consistent with previous reports, internal consistency was adequate in the present investigation with alphas of 0.91, 0.81 and 0.71 for the emotional/physical exhaustion, sport devaluation and reduced accomplishment subscales, respectively.

2.3. Procedure

The research was conducted in accordance with international ethical guidelines that are consistent with American Psychological Association norms. Coaches from each team were contacted to obtain permission to approach their athletes for participation in the study. The athletes' participation was voluntary, written informed consent was obtained from each individual prior to data collection, and the athletes' anonymity was ensured. Participants completed the CICS, the RESTQ-Sport, and the ABQ in individual or collective (with a maximum of 15 athletes simultaneously) sessions.

2.4. Statistical analyses

To increase our confidence in the stability of the emergent clusters, hierarchical and non-hierarchical cluster analyses were conducted using a two-step process [5]. We used the standardized CICS scores [5]. The first stage involved a hierarchical cluster analysis using Ward's linkage method with squared Euclidian distance measure to determine the number of clusters in the data [5]. The second stage involved a k means (nonhierarchical) cluster analysis by specifying the most appropriate cluster solution from stage 1.

After identifying the coping profiles, we performed a MANOVA with external variables (stress, recovery and burnout) entered as the dependent variables to explore difference between cluster groups. In the analyses, a significant multivariate effect ($p < 0.05$) was followed up with post hoc comparisons of group means using Bonferroni adjustment of the p value (0.0025) to guard against inflation of Type I error rates because of multiple comparisons. Partial eta squared (η^2) provided an index of effect size.

Finally, we examined if cluster group were confounded by demographic variables such as age, years of playing experience, and hours of training per week. We thus performed a MANOVA with continuous demographic variables (age, years of playing experience, and hours of training per week) entered as the dependent variables to explore difference between cluster groups.

3. RESULTS

3.1. Coping profiles

A hierarchical cluster analysis was conducted using Ward's method with a squared Euclidean distance measure on the standardized CICS scores. The agglomeration schedule coefficient and the dendrogram [4] suggested the retention of a four-cluster solution. The four-cluster solution was also the best fit according

to empirical (e.g. number of participants in each group) and conceptual considerations (e.g. interpretability of the cluster solution). Then, we conducted a k means cluster analysis on the standardized CICS scores by specifying a four-cluster solution. The non-hierarchical procedure provided support for the hierarchical analysis because the four clusters obtained were similar in the two cluster analyses.

In cluster analysis, the F tests should be used only for descriptive purpose because the clusters have been chosen to maximize the differences among participants in different clusters. Nevertheless, a MANOVA detected a significant multivariate effect of cluster membership on the ten coping dimensions (Wilk's lambda = 0.10, $F_{(30, 1996)} = 78.98$, $p < 0.001$, $\eta^2 = 0.54$). Follow-up analyses of variance (ANOVA) revealed that the four clusters were significantly different ($p < 0.001$) on all dimensions of coping ($F_{mean} = 149.67$, $\eta^2_{mean} = 0.39$, see table 1), thus providing a solid indication for the tenability of the cluster solution.

Table 1 and Fig. 1 present descriptive statistics of the four coping clusters. Aligned with previous research employing cluster analyses [5], we employed a standardized score of ± 0.50 to indicate high and low levels, with scores in between (i.e. + 0.50 to − 0.50) to indicate moderate levels. Descriptive labels for these clusters are: (a) *average coping* representing 150 young players who had moderate scores of distraction- and disengagement-oriented coping and moderate to low scores of task-oriented coping, (b) *task-oriented coping* representing 241 young players who had high scores of task-oriented coping, moderate scores of distraction-oriented coping and low scores of disengagement-oriented coping, (c) *disengagement- and distraction-oriented coping* representing 129 players who had particularly high scores of distraction- and disengagement oriented coping and low scores of task-oriented coping, and (d) *low coping* representing 173 young players who had low scores of task-, distraction- and disengagement-oriented coping.

3.2. Cluster group differences on stress, recovery and burnout

We investigated how table tennis players in each of the four clusters differed across stress, recovery and burnout. Results of MANOVA was significant (Wilk's Lambda = 0.33, $F_{(63,1991)} = 14.28$, $p < 0.001$, $\eta^2 = 0.31$). After a Bonferroni correction ($p < 0.0025$), the results of univariate ANOVA indicated that all external variables differed significantly across the four clusters. Results of post hoc comparisons, using Tukey's HSD, are presented in Table 2.

3.3. Cluster group differences on demographic variables

Results of a MANOVA yielded a significant multivariate effect on the demographic variables (age, years playing experience, and hours of training per week) as a whole (Wilk's lambda = 0.90, $F_{(9, 1672)} = 8.42$, $p < 0.001$, $\eta^2 = 0.04$). After a Bonferroni correction

($p < 0.016$), the results of univariate ANOVA indicated that hours of training per week differed significantly across clusters. Results of post hoc comparison (Tukey's HSD) showed that *task-oriented coping* profile had higher hours of training per week in comparison to the other three coping profiles (16.93 *vs*. 13.50, 12.87 and 14.74).
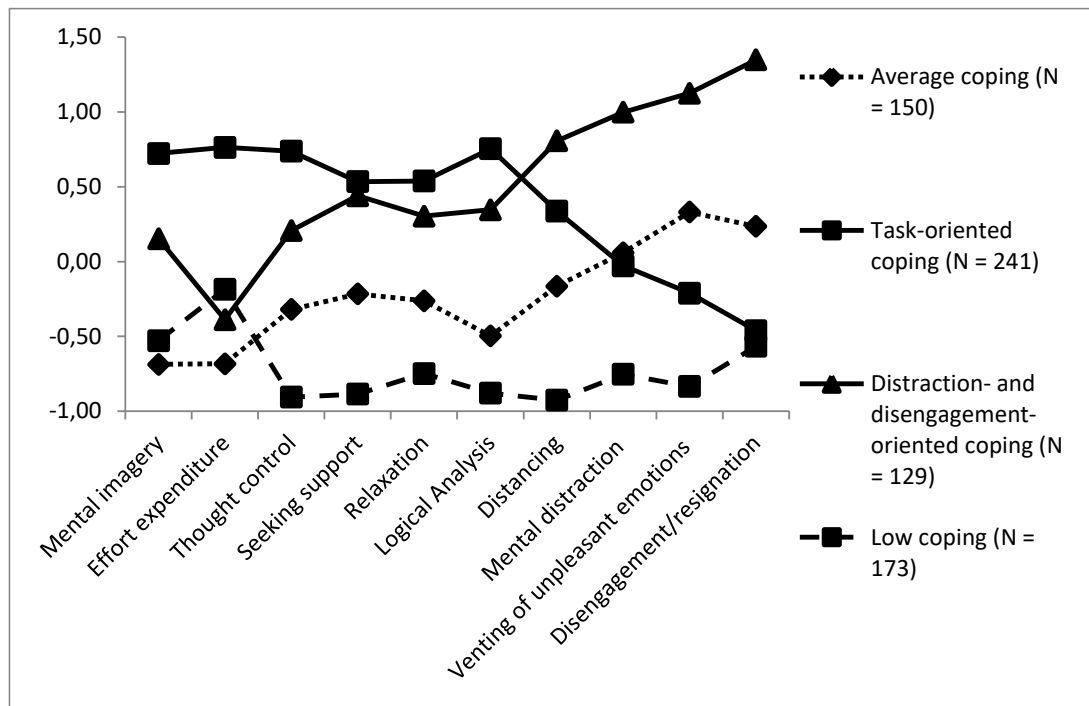

Fig.1 Standardized score of coping strategies across the four profiles of coping.

Table 1 Standardized CICS scores across the four coping profiles.

	Average coping (N = 150)		Task-oriented coping (N = 241)		Disengagement- and distraction- oriented coping (N = 129)		Low coping (N = 173)		α	$F_{(3, 689)}$	p	η^2
	M	SD	M	SD	M	SD	M	SD				
Mental imagery	-.69	.74	.72	.80	.16	.77	-.53	.88	.65	128.44	< .001	.36
Effort expenditure	-.68	.93	.76	.64	-.38	.71	-.19	.99	.79	118.41	< .001	.34
Thought control	-.32	.71	.74	.76	.21	.72	-.91	.83	.66	169.76	< .001	.43
Seeking support	-.22	.78	.53	.92	.44	.80	-.89	.68	.77	119.10	< .001	.34
Relaxation	-.26	.84	.54	.93	.30	.77	-.75	.82	.81	86.08	< .001	.27
Logical Analysis	-.50	.71	.75	.72	.35	.60	-.88	.84	.68	201.61	< .001	.47
Distancing	-.16	.78	.34	.97	.80	.74	-.93	.51	.70	140.73	< .001	.38
Mental distraction	.06	.81	-.03	.91	.99	.91	-.75	.60	.83	111.51	< .001	.33
Venting of unpleasant emotions	.33	.79	-.21	.79	1.13	.69	-.83	.67	.84	188.20	< .001	.45
Disengagement/resignation	.24	.81	-.46	.51	1.35	1.00	-.57	.57	.81	232.90	< .001	.50

Table 2 Comparison of external variables across the four clusters

Dependent variables	(1) Average coping (N = 150)		(2) Task-oriented coping (N = 241)		(3) Disengagement- and distraction-oriented coping (N = 129)		(4) Low coping (N = 173)		α	F*	η²	Tuckey's HSD**
	M	SD	M	SD	M	SD	M	SD				
RESTQ-Sport subscales												
General stress	5.25	3.71	3.51	3.15	8.08	4.35	2.17	2.85	.83	78.60	.26	3>1; 3>2; 3>4;1>2; 1>4; 2>4
Emotional stress	6.77	3.28	5.07	3.18	9.54	4.17	3.34	2.67	.77	98.24	.30	3>1; 3>2; 3>4;1>2; 1>4; 2>4
Social stress	6.90	3.34	7.17	3.43	9.57	3.65	4.64	2.83	.81	56.85	.20	3>1; 3>2; 3>4; 1>4; 2>4
Conflict/pressure	6.30	3.22	5.77	3.39	8.33	3.57	3.12	2.56	.72	68.14	.23	3>1; 3>2; 3>4; 1>4; 2>4
Fatigue	9.33	4.31	9.00	4.75	11.10	4.66	6.23	4.44	.79	30.77	.12	3>2; 3>4; 1>4; 2>4
Lack of energy	8.25	3.31	6.72	3.24	9.91	3.12	4.68	3.08	.62	73.48	.24	3>1; 3>2; 3>4;1>2; 1>4; 2>4
Somatic complaints	7.57	3.86	6.79	3.77	9.55	4.28	4.17	3.39	.72	51.54	.19	3>1; 3>2; 3>4; 1>4; 2>4
Success	10.17	3.33	13.02	3.47	11.37	3.20	9.44	3.64	.59	42.17	.15	2>1; 2>3; 2>4; 3>4
Somatic relaxation	11.47	2.61	13.10	2.57	11.64	2.78	12.26	3.05	.65	13.85	.06	2>1; 2>3
General well-being	15.40	3.13	18.22	2.99	14.22	3.83	17.81	3.18	.79	57.40	.20	2>1; 2>3; 4>1; 4>3
Sleep quality	15.02	4.27	17.25	4.42	13.86	5.16	18.53	3.75	.81	34.85	.14	2>1; 2>3; 4>1; 4>3
Disturbed breaks	5.79	4.03	5.44	4.26	8.45	4.20	3.25	3.82	.80	40.80	.15	3>1; 3>2; 3>4; 1>4; 2>4
Emotional exhaustion	7.91	3.44	6.66	3.65	10.71	3.94	4.13	3.66	.66	81.64	.27	3>1; 3>2; 3>4; 1>4; 2>4
Fitness/injury	9.17	4.58	8.82	4.83	11.92	4.43	5.69	4.41	.78	46.29	.17	3>1; 3>2; 3>4; 1>4; 2>4
Fitness/being in shape	12.07	4.14	15.73	4.19	12.31	3.44	14.28	4.54	.83	31.89	.12	2>1; 2>3; 4>1; 4>3
Personal accomplishment	10.11	3.88	14.07	4.26	11.51	2.99	8.89	4.40	.66	63.86	.22	2>1; 2>3; 2>4; 3>4
Self-efficacy	11.37	4.32	17.04	3.64	11.64	3.75	13.91	4.36	.82	82.27	.27	2>1; 2>3; 2>4; 4>1; 4>3
Self-regulation	10.93	5.81	16.29	3.61	11.85	3.45	11.17	4.67	.70	68.28	.23	2>1; 2>3; 2>4
ABQ subscales												
Reduced accomplishment	11.00	2.62	8.34	2.33	11.97	2.58	8.22	2.65	.71	89.34	.28	3>2; 3>4; 1>2; 1>4
Sport devaluation	8.06	3.75	6.02	2.52	9.98	3.78	5.68	2.20	.81	65.73	.23	3>1; 3>2; 3>4; 1>2; 1>4;
Emotional/physical exhaustion	11.31	3.93	12.68	3.76	12.60	3.26	9.75	3.83	.91	24.53	.10	2>1; 2>4; 3>4; 1>4

Notes. * all F are significant at p < 0.0025 (Bonferroni correction), ** all Tukey's HSD are significant at p < 0.0025

4. DISCUSSION

In this study, we proposed that within-person configurations of coping strategies used by young table tennis players in intensive training settings to cope with their everyday demands should offer a robust heuristic to examine coping within a more holistic approach to unpack the complex associations of several coping strategies with key athletic outcomes. Thus, this study examined the ways in which different young table tennis players may combine the use of several coping strategies and tested whether stress, recovery, and burnout differ across distinctive profiles of coping. Young table tennis players were categorized in four clusters not confounded by age or year of playing experience. Our confidence in the parsimony and stability of the four-cluster solution was enhanced by the fact that four similar coping profiles of players emerged across two different cluster analyses (hierarchical and non-hierarchical).

Providing additional evidence for this cluster solution, all external variables examined in the present study (stress, recovery and burnout) differed significantly across the subgroups of young table tennis players.

Studies conducted in competitive sport settings have indicated that task-oriented coping strategies correlated negatively with disengagement-oriented ones [2, 4]. Not surprisingly, two distinctive profiles of coping have emerged from the cluster analysis, representing athletes having a preference for task-oriented (task-oriented coping profile, N = 241) or disengagement and disctraction-oriented coping strategies (disengagement- and distraction-oriented coping profile, N = 129).

Indeed, a large number of young table tennis players

(35% of the sample) were characterized by a task-oriented coping profile. These young table tennis players had high scores of task-oriented coping, moderate scores of distraction-oriented coping and low scores of disengagement-oriented coping. This coping profile bears resemblance to a cluster observed in a previous study among a sample of French-Canadian individual and team sport athletes from 14 to 22 years of age [4]. Furthermore, in the present study, athletes from this coping profile are more likely to have high scores of recovery as indicated by the RESTQ-Sport. Specifically, young table tennis players comprising this coping profile were characterized by higher score than the other coping profiles on the dimensions of success, somatic relaxation, general well-being, sleep quality, being in shape, personal accomplishment, self-efficacy as well as self-regulation. These results suggested that task-oriented coping was associated with a better adjustment in everyday life than the other coping profiles. These results confirm previous research which showed that the task-oriented coping cluster had experienced lower levels of anger-dejection as well as higher levels of self-referenced goal attainment, positive affective state, and experience of control than the disengagement-oriented coping cluster [4]. Sport psychologists should thus develop interventions aiming specifically at encouraging the use of task-oriented coping to support the everyday life demands inherent to intensive training settings.

The athletes comprising the disengagement- and distraction-oriented coping profile had particularly high scores of distraction- and disengagement oriented and low scores of task-oriented coping. Furthermore, young table tennis players from this coping profile are more likely to have higher scores of stress and burnout than the other coping profiles. Specifically, young table tennis players comprising this coping profile were characterized by higher score than the other coping profiles on the dimensions of general stress, emotional stress, social stress, conflict/pressure, fatigue, lack of energy, somatic complaints, disturbed breaks, emotional exhaustion, injury, reduced accomplishment and sport devaluation. These results suggested that the use of distraction- and disengagement-oriented coping without the simultaneous use of task-oriented coping was associated with a lower adjustment in everyday life than the other coping profiles. Sport psychologists should develop interventions aiming specifically at abating the only use of disengagement and distraction-oriented coping in response to their everyday life demands [4].

A final result bore on the group of athletes who have used low levels of task- disengagement-, and distraction-oriented coping (low coping, $N = 173$). According to the theory of stress and coping [3], individuals start using coping actions when they perceive that something is at stake in the situation and/or when a particular situation creates a challenge. Compared to athletes from the other coping profiles, those who have used coping strategies to a lesser extent (low coping profile) might have perceived the competition as less challenging, unthreatening, or less relevant to one's ego-involvement [4]. As such, they might have coped less intensively during the course of their everyday life because they had less stress to contend with. The fact that the young table tennis players comprising this coping profile were also characterized by the lowest scores of burnout subscales (reduced accomplishment, sport devaluation and emotional/physical exhaustion) as well as stress subscales (general, social and emotional stress, conflict/pressure, disturbed breaks) seems to confirm these suggestions.

This study has presented an alternative methodology that may provide researchers with a useful way of examining distinctive combinations of coping strategies use to cope with everyday life demands in intensive training settings. Not only did different individuals use different combinations of coping strategies, but these different coping profiles were associated differently with stress, recovery, and burnout. Acknowledging the exploratory nature of this study, our results should be replicated in order to provide a better understanding of the different ways in which athletes may combine the use of several coping strategies. Overall, these findings suggest that future research should move from coping strategies to coping profiles in order to provide a deeper understanding of how different individuals cope with their everyday life stress [4].

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