ISSN: 2392-5442 ESSN : 2602-540X		Sport system journal
V/13 N/02 Year/2026		International scientific journal published by: Ziane Achour –Djelfa- Algeria
P 672 - 682		Received: 2026-05-01A ccepted: 2026-08-09

Training Load, physical, emotional, and relational tension among female Volleyball players

Akache Mokrane [1]*, Bougandoura Fares [2]

[1] University of Bejaia, Faculty of Humanities and Social Science, Algeria
mokrane.akache@univ-bejaia.dz

[2] University of Bejaia, Faculty of Humanities and Social Sciences, Algeria
fares.bougandoura@univ-bejaia.dz

Abstract:
This study aims to understand how the different tensions manifest themselves during the preparatory phase, and how these tensions are affected by the training load. This is a descriptive study conducted with 17 female volleyball players from a Béjaïa team. For statistical analysis, correlation coefficients and principal component analysis were used. This study indicates the existence of several cases of significant correlation between variables of tension. The variables studied are reduced to two components: humor tension and another of training load and aggression tension, together they explain nearly 64 % of the observed variations. Based on this, players are spread across 4 profile zones. Approximately a quarter in zone 1, 17,65 % in zone 2, while 47% in zone 3, and 11,75 % in zone 4.

Keywords: Training load; Emotional tension; Physical tension; Relational tension.

***Corresponding author:** mokrane.akache@univ-bejaia.dz

1. INTRODUCTION

Tension is a degree of activation and internal pressure linked to an individual's strategies. It most often manifests during situations of overload (training, competition, work, studies). Thus, it is a form of bodily adaptation which, when prolonged, can transform the relationship to the body and to effort. It can be physical, emotional, or relational, for (Rinehart, R. E, 1980) It's simply one form among many of stress, it closely resembles inflammation, chills, or other reactions to harmful and unpleasant stimuli.

Physical tension in athletes is closely linked to the physiological constraints induced by the training load and the resulting fatigue mechanisms. Indeed, the training load, characterized by variations in frequency, duration, and intensity, imposes physiological stress on the body, which is necessary for adaptation and performance improvement (L.Halson, 2014).

Emotional tension in athletes is linked to the psychological responses generated by stressful situations encountered during training and competition (Lazarus, R. S, 2000). Thus, emotions directly influence performance depending on how the athlete perceives and manages the demands of the situation.

While relational tension in sport is linked to the quality of interactions between individuals, it often arises from a lack of mutual understanding, differing objectives, or insufficient communication, leading to inevitable misunderstandings, sometimes exacerbated by a lack of commitment and trust. (Jowett, S, 2005).

In the Algerian context, almost all these studies are limited to examining the effect of training load or stress on athletes' well-being. (L. Snani and A. Younsi, 2025) discussed the role of psychological adjustment in sport, explaining how it contributes to psychosocial adaptation from childhood. In a literature review (Jalal kanan fahmi dababse, Maksimenko Igor Georgievich, Mahmoud Alatrash, 2026) revealed several fields covered by sports research, including neuromuscular training and mental health in recovery. For their part (f.mahfoud, M. Yahyaoui, 2024) examined the level of psychological flexibility of athletes practicing team sports to better manage the pressures encountered during a competition.

In general, all of this research shows that tension is a multifactorial phenomenon, resulting from the interaction between training load, individual physiological responses, fatigue, and the risk of injury. This necessitates an integrated and individualized approach to optimize performance while preserving athletes' health.

This study aims to understand how physical, emotional, and relational tensions manifest themselves during the preparatory phase, and how these tensions are affected by the training load.
The results provide coaches with a tool to understand athletes' responses in order to better manage stressful situations that can influence their performance.

2- METHODS AND MATERIALS :

2.1. Participants :

We conducted research on 17 female volleyball players. A questionnaire was used to evaluate daily load, and different tensions.

2.2. Survey methodology:

The players of the Bejaia women's team were given questionnaire as part of a descriptive cross-sectional survey. Questions about the identification of the different types and levels of tensions that players face during the sports season .
They also expressed their individual perception of exertion (RPE), which accurately conveys their feelings about the stress caused by physical or psychological training. This technique evaluates internal load while considering personal emotional responses to effort. In order to gauge the subjective nature of the training sessions, the players utilized Borg's CR-10 scale to express their emotions. Players provided their opinions on the training session by answering a basic question such as 'How did you find this session?' or. Their subjective perceptions of the effort they put in were analyzed, with each response resulting in an individual RPE score .

2.3. Statistical analysis :

For the analysis of our results, we used the open-source program R, version 4.5.1. R code used to analyzing is available as appendices associated with this article. For all statistical analysis, we considered a significance level of P-values < 0.05. These statistical analyses included the following:
A correlation matrix was created to identify the significantly correlated variables.
Principal component analysis was performed to identify the dimensions of the study's variables.
The adequacy of the analysis was verified using the KMO index and Bartlett's test of sphericity. Two factors were retained, explaining 63,82% of the total variance, which is sufficient to represent the multidimensional structure of the variables in

the nutritional, energy, load, and well-being categories. The distribution of players according to their adaptive profiles was illustrated using the factorial map.

3. Results:

3.1. Correlation matrix:

Table 1. Correlation matrix

	Load	Back pain	difficulty relaxing	bad mood	dizziness	sadness	aggressivity
Load	—	0.04	-0.17	0.05	0.12	0.09	0.28
Back pain	0.04	—	0.01	0.5*	0.16	0.38	-0.19
difficulty relaxing	-0.17	0.01	—	0.54*	0.25	0.37	0.03
bad mood	0.05	0.5*	0.54*	—	0.7**	0.81***	0.31
dizziness	0.12	0.16	0.25	0.7**	—	0.66**	0.57*
sadness	0.09	0.38	0.37	0.81***	0.66**	—	0.16
aggressivity	0.28	-0.19	0.03	0.31	0.57*	0.16	—

Meaning codes: 0 < *** < 0.001 < ** < 0.01 < * < 0.05

Source: results of the field study

This matrix (Table 2) indicates the following correlations:

Very strong and positive correlations are found between: humor- dizziness (r = 0,7), humor- Sadness (r= 0,81), dizziness- sadness (r= 0,66),

Strong and positive correlations: Sadness- Aggressiveness (r= 0,57), back pain- humor (r=0,5), Difficulty relaxing- humor (r=0,54).

Pre-PCA tests:

3.2. Principal component analysis

Before proceeding with principal component analysis, its feasibility must be verified using KMO and Bartlett's tests.

KMO = 0,55, this is an acceptable value, so the sample is sufficient for principal component analysis .In the other hand because Bartlett's test of sphericity is significant (p. value of Bartlett = 0,001 <0,05), the correlation matrix differs greatly from an identity matrix (χ^2 = 47,16). Consequently, the correlations between variables are great enough to do a principal component study.

Degrees of liberty:

Since df = p(p-1)/2, p indicates the number of variables (which is 7 variables in our case), calculated df = 21.

for p =7; df = 7*(7-1)/2=21. So, the calculation is accurate

Principal component analysis.

variance expressed:

Table 2. eigenvalue and percentage of variance

Components	Eigen value	% of variance	Cumulative %
1	3.02	43.16	43.16
2	1.45	20.66	63.82
3	1.12	16.05	
4	0.69	9.86	
5	0.43	6.18	
6	0.20	2.85	
7	0.09	1.24	

Source: results of the field study

The table of eigenvalue and percentage of variance (table.4) indicates that the first component alone represents 43.16 % of the total information of all variables, while the second component represents 20.66 % of the total information of all variables. Adding both components together gives us 63.82 % of the total information for all variables.

Component Loadings

Table 4. Component Loadings

Variable	PC1	PC2
Load	0,138	0,606
Back pain	0,432	-0,475
difficulty relaxing	0,512	-0,348
bad mood	0,951	-0,16
dizziness	0,84	0,298
sadness	0,868	-0,155
aggressivity	0,436	0,771

Source: results of the field study

Component Loadings (table.5) shows the two principal component PC1 and PC2 and variables that constitute the two principal components, as well as the contribution of each variable to each component. The results are presented as follows:

First principal component: Difficulty relaxing (0,51), humor (0,95), Dizziness (0,84), sadness (0,87).

Second component: training load (0,61), Back pain (-0,47), Aggressiveness (0,77).

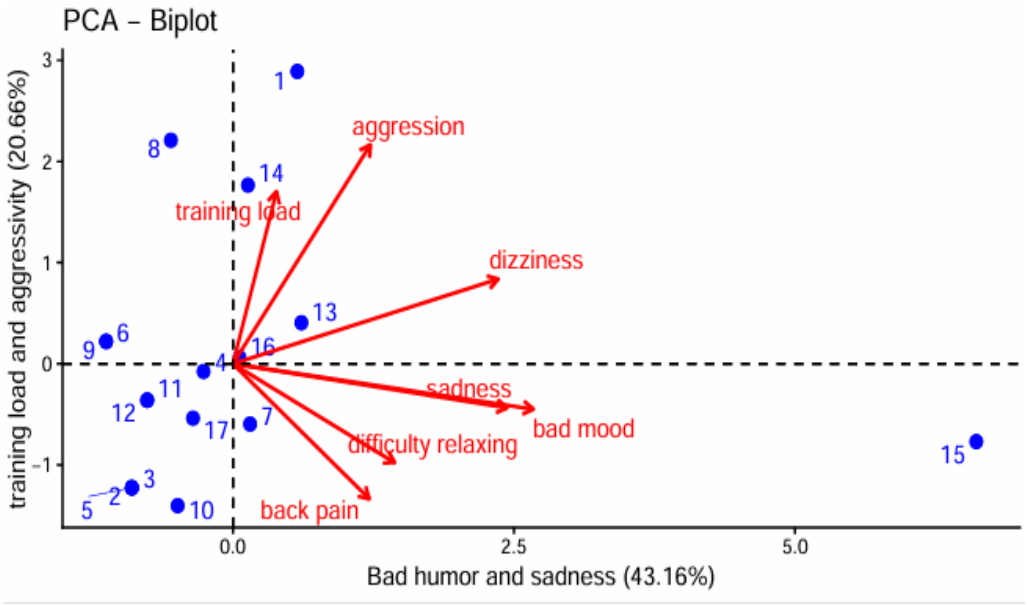


Figure 1. factorial map

The biplot presented in (Figure.1) revealed a dispersion of individuals along the two components:

The first quadrant, representing 23,53 % of individuals (1, 13, 14, 16), is characterized by exhibited high humor and training load tension.

The second quadrant, representing 17,65 % of individuals, (6, 8, 9), exhibits low humor tension and high training load and aggressiveness tension.

The third quadrant, 47,06 % of individuals, (2, 3, 4, 5, 10, 11, 12, 17) displays low humor and training load tension .

Finally, the fourth quadrant: 11,75% of individuals, (7,15) is distinguished by high humor tension and weak training load tension.

4. Discussion

This study aimed to investigate the correlations between different variables of tension in order to understand how female volleyball players are affected.

The present study shows the following significant correlation values through Correlation matrix :

The very strong and positive correlation between humor- dizziness (r= 0,7) and dizziness- sadness (r= 0,66) can be explained by the connection of the vestibular system, responsible for balance and perception, to anxiety centers such

as the amygdala, hippocampus, prefrontal cortex, insula, hypothalamus, and brainstem as indicated by (Brandt, T., & Dieterich, M, 2020).

Regarding the strong positive correlation between Sadness and Aggressiveness (r = 0,57), Several studies show that many unpleasant emotions (including sadness) can trigger thoughts and reactions related to anger and emotional aggression: emotional suffering paves the way for anger and acting out if it is not regulated, as highlighted by (Berkowitz, L, 1990).

The correlation between back pain and humor (r=0,5) is based on biological, psychological, and social factors, notably chronic lower back pain, which is associated with an increased risk of anxiety symptoms, as shown in the study by (Fernandez, M., Colodro-Conde, L., Hartvigsen, J., Ferreira, M. L., Refshauge, K. M., Pinheiro, M. B., ... & Ferreira, P. H, 2017)

Difficulty relaxing is also strongly correlated to humor (r=0,54), This means that the pressure of the result, injuries, and uncertainty make relaxation more difficult, as confirmed by (Nuetzel, B, 2023).

Principal component analysis (PCA) of training load, back pain, difficulty relaxing, humor, dizziness, Sadness and aggressiveness reveal two key factors that together explain 63.82 % of the observed variations (table 6). The first factor, representing slightly 43.16 % of the variance, and the second, approximately 20.66 %, highlight the complex relation between these different variables in a context of tension management .

First principal component:

This component is composed of Difficulty relaxing (0,512), humor (0,951), Dizziness (0,84), Sadness (0;87). It can be interpreted as a dimension of humor and training load tension. This configuration reflects a consistency between humor and pain, typical of the humor profile of players.

Second principal component:

This component, composed of training load (0,61), Back pain (-0,475), Aggressiveness (0,77). This component can be interpreted as a dimension of training load and aggressivity, reflecting the Attitude towards others .

Regarding the dispersion of individuals into four zones according to their coordinates on these two dimensions :

Area 1 includes individuals (1, 13, 14, 16) characterized by high humor and training load tension. This is a profile of aggressiveness and mental vulnerability as described in sports psychology research (Terry, P. C., & Parsons-Smith, R. L, 2021).

Area 2 includes individuals (6, 8, 9) characterized by low humor tension and high training load and aggressiveness tension, profile corresponding to aggressiveness.

Area 3 includes individuals (2, 3, 4, 5, 10, 11, 12, 17) characterized by low humor and training load tension. Profile of individuals who are in balance or at rest.

Area 4 includes individuals (7, 15) characterized by high humor tension and weak training load tension.

These results highlight the importance of an individualized and contextualized approach to monitoring athletes during the sports season .

Conclusion:

In this study, two cases of significant correlation between the different variables :

Very strong and positive correlations with (humor- dizziness (r= 0,7.(

Strong positive correlation: Sadness and Aggressiveness (r = 0,57), back pain and humor (r=0,5), difficulty relaxing - humor (r=0,54)

The principal component analysis, shows that there are two main dimensions in the profile of female volleyballers during sport season: dimension of humor and training load tension and dimension of training load and aggressivity .

These results confirm the need to adopt a multidimensional approach to monitoring players, including both of physical care and psychological preparation They also highlight the importance of individualizing training loa, this PCA provides a means of understanding athletes' Physical and psychological state during the sports season, in order to guide coaching towards better performance.

5. Conclusion

In this study, two cases of significant correlation between the different variables :

Very strong and positive correlations with (humor- dizziness (r= 0,7.(

Strong positive correlation: Sadness and Aggressiveness (r = 0,57), back pain and humor (r=0,5), difficulty relaxing - humor (r=0,54)

The principal component analysis, shows that there are two main dimensions in the profile of female volleyballers during sport season: dimension of humor and training load tension and dimension of training load and aggressivity .

These results confirm the need to adopt a multidimensional approach to monitoring players, including both of physical care and psychological preparation They also highlight the importance of individualizing training loa, this PCA provides a means of understanding athletes' Physical and psychological state during the sports season, in order to guide coaching towards better performance.

Bibliographie

Berkowitz, L. (1990). On the formation and regulation of anger and aggression. A cognitive-neoassociationistic analysis. *The American psychologist, 4*(5), pp. 494-503. doi:doi:https://doi.org/10.1037//0003-066x.45.4.494

Brandt, T., & Dieterich, M. (2020). Excess anxiety'and 'less anxiety: both depend on vestibular function. . *Current Opinion in Neurology, 33*(1), pp. 136-141.

f.mahfoud, M. Yahyaoui. (2024). Level of psychological flexibility of team sports athletes. *Sport system journal, 11*(2), pp. 475- 464.

Fernandez, M., Colodro-Conde, L., Hartvigsen, J., Ferreira, M. L., Refshauge, K. M., Pinheiro, M. B., ... & Ferreira, P. H. (2017). Chronic low back pain and the risk of depression or anxiety symptoms: insights from a longitudinal twin study. *The spine journal, 17*(7), pp. 905-912.

Jalal kanan fahmi dababse, Maksimenko Igor Georgievich, Mahmoud Alatrash. (2026). Advancing Athlete Health and Performance: A Bibliometric Study of Injury Prevention and Rehabilitation Techniques. *Sport system journal, 13*(1), pp. 26 – 54.

Jowett, S. (2005). the coach–athlete relationship. *Solutions in sport psychology*, pp. 16–31.

L. Snani and A. Younsi. (2025). Children's Psychological Adjustment from a Sport Psychology Perspective. *Sport system journal, 12*(1), pp. 113 – 125.

L.Halson. (2014). Monitoring training load to understand fatigue in athletes. . *Sports Medicine*, pp. 139–147.

Lazarus, R. S. (2000). How Emotions Influence Performance in Competitive Sports. *The Sport Psychologist*, pp. 229–252.

Mon psychotherapeute. (2026). Récupéré sur https://www.mon-psychotherapeute.com/

Nuetzel, B. (2023). Coping strategies for handling stress and providing mental health in elite athletes: a systematic review. *Frontiers in Sports and Active Living*. doi:https://doi.org/10.3389/fspor.2023.1265783

Rinehart, R. E. (1980). Tension and stress. In Stress and tension control Boston. *Springer US*, pp. 3-5.

Terry, P. C., & Parsons-Smith, R. L. (2021). Mood profiling for sustainable mental health among athletes. *Sustainability, 13*(11).