ALEXITHYMIA, BODY PERCEPTION AND DISMORPHISM: A STUDY CONDUCTED ON SPORTIVE AND NON-SPORTIVE SUBJECTS

Calogero Iacolino, Monica Pellerone, Ivan Formica, Ester Maria Concetta Lombardo, Giacomo Tolini

Abstract

Objective: The present research aims to investigate the relationship between body perception and the ability to identify and communicate emotional states in young adults.

Method: The research involved a group of 200 Italian students, including 100 sportive subjects with an average age of 25 (*S.D* = 7.3) and 100 non-sportive subjects with an average age of 23 (*S.D* = 4.89).

The subjects complited the following tools: *Toronto Alexithymia Scale* (Bagby et al. 1994), designed to measure the difficulty describing and identifying feelings, and externally-oriented thinking style; *Body Uneasiness Test* (Cuzzolaro et al. 2006) to investigate body perception and its possible distortions.

Results: Data analysis seems to confirm the hypothesis that there is a difference between the two groups regarding body disperception. With regard to the gender variable, the analyses show that women seem to be more concerned about body image than men, who seem to attribute greater importance to body weight.

Conclusions: It is possible that bodily disperception, associated with an inability to recognise emotions, leads to an exaggerated practice of sport that can lead to addiction.

Key words: alexithymia, body perception, dismorphism, sport

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Calogero Iacolino[1], Monica Pellerone[1], Ivan Formica[2], Ester Maria Concetta Lombardo[1], Giacomo Tolini[1]

[1] "Kore" University of Enna
[2] University of Messina

Corresponding author
Monica Pellerone
Psychologist, Psychoterapist, Ph.D, Assistant Professor
"Kore" University of Enna, Faculty of Human and Social Sciences,
Via Cittadella Universitaria s.n.c - Enna (EN), Italy, Sicily, 94100
E-mail: monica.pellerone@unikore.it
Phone: +39 3294324311

1. Introduction

The body image is a multidimensional construct, which does not just refer to the body as an individual sees it in front of a mirror, but also and above all to the perception and evaluation individuals have of it (Mian 2006). No one can see a faithful image of their body; this is not due to perceptual deficits as the image is built, and it is not the reproduction of an anatomical structure and does not coincide with what individuals know at the level of consciousness of themselves (Galimberti 1983).

The body is the representation of an imaginative body that changes continuously and of which individuals are trying to maintain a coherent image. However during development, individuals need to interpret a new body image in order to adapt to changes in body shape, above all during puberty and adolescence (Lemma 2005).

The term "Dismorphophobia" was coined and used for the first time by an Italian psychiatrist Enrico Morselli in 1886, to describe a subjective feeling of physical deformity or defect, for which the patients feel that they are observed by others, despite the fact that their appearance is within the limits of the norm.

Janet (1903) used the expression "obsesion de la honte du corps", depicting it as a common and often overlooked disorder which, because of the great shame it entails, can also lead to a serious social retreat. Emil Kraepelin (1909) spoke of "Dismorphophobic Syndrome", classifying it as a compulsive neurosis because of the persistent and egotistical nature of the symptoms. Freud (1909) described a case of dismorphophobia, speaking of "the man of wolves" and of his hypochondriac paranoia; this patient refused to live his life because he was totally absorbed by the state of his nose, which was over-sized and had holes and scars.

The DSM-5 defines Body Dismorphic Disorder as the inability to recognize in the reflected mirror image the characteristics and peculiarities of one's own person. In clinical practice, the term dismorphophobia refers to corpus dysmorphism, classified as belonging to Obsessive-Compulsive and Related Disorders, and characterized by concern for one or more perceived facial defects and imperfections that are not observable or appear mild to others; manifestation of repetitive behaviors (e.g. looking in the mirror continuously) or mental actions (e.g. comparing physical appearance to that of others) in response to look-alike concerns (APA 2013).

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The core of Body Dismorphism is therefore a concern for one's body perceived as inadequate, and in continuous attempts to adapt it to its ideal of perfection; the body is overburdened with expectations, until it is believed that its change will improve the whole existence of the subject. The faults found by the subject, however, are, in most cases, minimal and irrelevant, and mainly concern the shape, symmetry or size of some parts of the body (Schimmenti et al. 2017).

The individual is forced to focus on that part of his defective and judged body by an internal hypercritical voice. Furthermore, constantly looking at one's image in the mirror, the subject seems fought between the desire to escape that reflex which he finds unattractive, and the desire, accompanied by a strong anxiety, to examine it and correct it (Dalla Ragione and Mencarelli 2012). The dissatisfaction with one's own body image is due to subjective discontent for one' body in general or the size of some parts of it (Thompson et al. 1999).

The psychological discrepancy that a person experiences between his own body and the ideal one can cause a negative feeling of self and also harmful behaviors for health (Cash 2002, Thompson 2004). Unfortunately, one of the most important consequences that follows these concerns is social retreat, dictated by the desire to escape the gaze of others, perceived as judging and over-critical (Ferraro et al. 2015).

In addition, subjects usually misinterpret the expressions of others referring to themselves as hostile, increasing the concern for perceived ugliness in a vicious spiraling circle (Buhlmann et al. 2006); these subjects, therefore, tend to avoid those situations where they could not hide the perceived defect (Phillips 2004, Pellerone et al. 2017a), resulting in anxious and somatic symptoms (Pellerone et al. 2016a, Pellerone et al. 2017b).

1.2 "Body Dismorphism, Alexithymia and sporting practive

Body Dismorphism is closely linked to controlled and assiduous sporting practice, used as a principled approach to achieving the ideal image: through a precise organizing of times, method and gestures, it makes the individual virtuous and allows him to reach more than the ideal he aspires to. Another important feature is the achievement of immediate gratification: the dominant psychological dimension is that of deferred satisfaction, for which sportive subjects are willing to undergo great sacrifices in the name of performance quality, forgetting themselves and their body instead of taking care of it (Porro 2008).

Initially, the criterion used to distinguish Sports Addiction was the quantitative one (it was referred to as overtraining). Subsequently, qualitative criteria have also been recognised, which has included the characteristics of both dependence and compulsion in the dependency of sport; in fact, practicing sports produces relief from anxiety states, and there is a failure of attempt to control it, despite its negative consequences (Goodman 1990).

This definition is supported by the presence of the distinctive features of the addiction: salience, mood swings, tolerance, withdrawal symptoms, personal conflict, abstinence and relapse (Brown 1993, Griffiths 2005, Szabo 2010). On the emotional level, the implications of sports addiction are related to the personality characteristics of the individual, and include sadness and guilt for not training, and anger and aggression towards those who - according to the subject - are hindering the implementation of the behavior (Gervasi et al. 2017). Practicing sports, on the other hand, sets a series of positive feelings, especially after the training session, which lead the subject to perpetuate the implementation of the sportive behavior (Ferrari 2011). It seems that sporting practice is accompanied by a feeling of lightness (Goldberg 1988), which depends on the release of endorphins, that have a similar effect to morphine and, as a result, can cause dependence (Farrell et al. 1982).

Other theories on the etiology of sports addiction have examined the psychological and personality factors of the individual; the cognitive assessment hypothesis (Szabo 2010), for example, states that once sport is stated as a strategy for reducing stress, the subject is forced to practice it more and more frequently. In addition, the subject uses rationalization to justify increasingly intense training sessions and manifests ill health if he is forced to give up.

The *Theory of Affective Regulation* (Hamer and Karageorghis 2007), however, suggests that sport has two effects on the mood of the subject: an improvement in mood in general after training sessions, and a decrease in negative emotional states (anxiety, irritability and sense of guilt); furthermore, while the positive effects are temporary, the negative ones are greater when the training sessions are further apart (Ferraro et al. 2016, Trotta et al. 2013). In particular, studies have suggested that mood states could play a role in the development or in the maintenance of exercise dependence. Consistent with affect regulation hypothesis for sporting dependence (Hamer and Karageorghis 2007), physical activity results in improvements in positive mood states and decreased in negative mood states; as the exercise cycle continues, increased amounts of exercise are needed to experience improvement in affect and general mood.

It is therefore interesting to study the relationship between ability to regulate and express emotions, perception of body image, and propensity to carry out physical activity.

Despite the importance of the subject, the literature only analysed the relationship between emotional regulation ability and body perception in clinical groups. For example, according to Carano and colleagues (2006), in subjects with alexithymia and eating disorders, the difficulty of discriminating between emotional states and bodily sensations would lead to bodily image dispersions, that could compromise the construction of a unitary identity determining an intense physical activity.

Similarly Fenwick and Sullivan (2011) highlight the associations between alexithymia and body dysmorphia in an eating-disordered treatment-seeking sample, suggesting that participants with high levels of dysmorphic concern (imagined ugliness) have more difficulty with the affective elements of alexithymia, in identifying and describing feelings.

These results underline that the inability of an individual to discriminate between emotional states may thus represent an affective vacuum which determines an exaggerated focus on the physical details of one's own body; so, alexithymia could be interpreted as a function of an individual's shame-based inability to process emotions (Franzoni et al. 2013, Pellerone et al. 2017c).

Hence, poor emotional expression could be a predictor of body dissatisfaction in clinical and non-clinical groups, as confirmed in a study by De Berardis and colleagues (2009) aimed to investigate in a non-clinical sample of undergraduate women,

the relationships between alexithymia, dissociative experiences and body dissatisfaction. Confirming limitated literature, authors showed that alexithymics had higher dissociative experiences and body dissatisfaction than the non-alexithymics. The alexithymic, in fact, tend to use the intensive sportive exercises more than non-alexithymic, in order to cope with the psychological discomfort, resulting from the negative body

2. Objectives and research hypotheses

The present research aims to investigate the relationship between intensive sporting practice, body dismorphism and alexithymia. In order to do this, a group belonging to the sport population was compared with a group belonging to the non-sport population, assuming as a hypothesis that:

a. body disperception is more widespread in the sport population than in the non-sport population, and this fosters the exaggerated practice of sports;
b. the sport population, compared to the non-sport one, has greater difficulty in identifying and communicating feelings;
c. in the sport population there is a correlation between bodily disperception and difficulty in identifying and communicating feelings;
d. being female, belonging to the non-sport population, and having a higher level of difficulty identifying feelings are predictive of the general level of body uneasiness.

3. Method

3.1 Participants

The study involved a group of 200 subjects including 35.3% men and 62.7% women. The group was stratified into:

a) a group of 100 sport subjects with an average age of 26.71 years (S.D = 8.83);
b) a group of 100 non-sport subjects with an average age of 23.29 years (S.D = 4.90).

The sport group consists of subjects belonging to Sicilian sports centres and enrolled in the Faculty of Motor Science of the "Kore" University in Enna. The subjects belonging to the first group were selected according to the amount of sport practiced: subjects who participated in at least one non-agonistic competition over the past 12 months, and who practised a minimum of four weekly training sessions for at least two hours, during the last 12 months. The non-sport subjects were recruited among the students enrolled in the Faculty of Psychology at the "Kore" University, and had not practiced sports in the last 12 months. The criterion used to distinguish between the sport group and non-sport group was the quantitative one, and was referred to as overtraining (Goodman 1990).

The questionnaires were distributed by qualified researchers, and participants were given 30 minutes to complete them. The questionnaire data were collected anonymously. The Internal Review Board (IRB) of the Faculty of Human and Social Sciences at the "Kore" University of Enna approved the present research.

3.2 Measures

Subjects have compiled the following tools: *Identifying Information Form*, *Toronto Alexithymia Scale* (Bagby et al. 1994) and *Body Uneasiness Test* (BUT, Cuzzolaro et al. 2006).

The *Identifying Information Form* is used to measure the following anamnestic data: age, gender, education level, sport practiced in the last 12 months, number of weekly workouts, number of hours for each training session and participation at non-agonistic competitions over the past 12 months.

The 20-item *Toronto Alexithymia Scale* (Italian Validation by Bressi et al. 1996) is a self-report questionnaire investigating three dimensions that characterize alexithymia: the difficulty describing (DDF) and identifying feeling (DIF), and externally-oriented thinking style (EOT). The total score calculation allows to identify not alexithymic subjects that score less than 51; borderline subjects whose score is between 51 and 60, and alexithymic those of which score is higher than 60.

The *Body Uneasiness Test* (Cuzzolaro et al. 2006) is a self-report questionnaire designed to investigate the body's perception of the subject and its possible distortions. It consists of 71 items with multiple choice answers, divided into two parts: BUT a, consisting of 34 clinical items; BUT b, consisting of 37 items that list body parts, to which the subject should assign their degree of liking. The Body Uneasiness Test also includes five factors: Weight Phobia (WP), Body Image Concerns (BIC); Avoidance (A), Compulsive Self-Monitoring (CSM), and Depersonalization (D).

The presence of significant discomfort with respect to perception of your body is unlikely if the Global Severity Index score (GSI) is less than 1.2; It is probable if this score is greater than 1.2; The evaluation of the score of the other factors, on the other hand, informs about the problematic areas of body perception that deserve to be thorough (Cuzzolaro et al. 2006).

4. Data analysis

In order to verify the first hypothesis of research, regarding the presence of different bodily dismorphism between the two groups (sports versus non-sports), a T test for independent groups was conducted.

The same data analysis was conducted to verify the second research hypothesis, concerning the possible difference in the difficulty of identifying and describing feelings between the two groups (sports versus non-sports).

A correlation analysis was carried out in order to verify the third hypothesis, concerning the presence of a significant relationship between the sub-dimensions of TAS 20 and BUT, only in the sports group.

The multiple linear regression analysis was used to measure the predictive variables of the body disperception, including into the model the following dimensions: gender, age, sportive versus non-sportive group, education level, difficulty identifying and describing feelings, and externally-oriented thinking style.

5. Results

With respect to the total scores obtained by Toronto Alexithymia Scale (**table 1**), significant differences emerged ($p < .05$) between sportive subjects (Group 2) and non-sportive subjects (Group 1): in particular, Group 2 seemed to obtain a higher mean scores (M = 44.17, S.D = 11.04) than Group 1 (M = 40.35, S.D = 12.42). Statistically significant differences between

Table 1. *T test for independent groups (sports vs. non-sports): TAS-20*

Variables	Sports Group (G2)		Non-Sports Group (G1)		T Test	
	M	DS	M	SD	t (df=198)	P
a. Total TAS	44.17	11.04	40.33	12.43	-2.29	.02
b. Difficulty identifying feeling	14.12	5.13	14.11	5.96	-.01	.99
c. Difficulty describing feeling	12.37	4.65	11.42	5.30	-1.35	.18
e. Externally-oriented thinking style	17.68	5.307	14.82	3.83	-4.38	<.000

Abbreviations: M=mean; SD=standard deviation
Note: ***p < .001, two-tailed; *p < .05, two-tailed

the groups also emerged in the sub-scale of externally-oriented thinking style (p < .001), in which the sportive group presented higher average scores (M = 17.68, S.D = 5.30) than the non-sportive group (M = 14.82, S.D = 3.83).

Concerning the Body Uneasiness Test (**table 2**), the differences between the two groups appeared statistically significant (p < .05): the mean score analysis showed that the sports group manifested lower average scores than the non-sports group in the following dimension: body image concern, avoidance and depersonalization.

Furthermore, the correlation analysis showed, in the sports group (**table 3**), the presence of positive and statistically significant correlations among all sizes of TAS 20 and the BUT scale, except for weight phobia and size of total TAS 20.

As previously specified, a linear regression analysis was used to detect the predicting variables of body perception in all participants.

The first analysis showed how that: being female, but above all, having a higher level of difficulty identifying feeling were predictive of the general level of body uneasiness (BUT), and they explained 19% of the overall variance (**table.4**).

Similarly, the second analysis showeh how being female, and above all, manifesting difficulty identifying feeling are predictive of the body image, and they only

Table 2. *T test for independent groups (sports vs. non-sports): BUT*

Variables	**Sports Group (G2)**		**Non-Sports Group (G1)**		**T Test**	
	M	***DS***	**M**	***SD***	***t (df=198)***	***P***
a. Total BUT	29.16	22.32	35.24	26.97	1.74	.08
b. Weight phobia	1.60	1.15	1.40	1.02	1.80	.20
c. Body image concern	.98	.83	1.29	1.02	-1.28	.02
d. Avoidance	.31	.54	.50	.81	2.40	.04
e. Compulsive Self-Monitoring	.97	.87	1.04	.83	2.03	.59
f. Depersonalization	.39	.47	.60	.71	.55	.02
g. GSI	.89	.67	1.06	.80	2.40	.07
h. PSDI	.72	.72	.82	.68	.98	.33

Abbreviations: M=Mean; SD=Standard Deviation; GSI= Global Severity Index; PSDI=Positive Symptom Distress Index.
Note: ***p < .001, two-tailed; *p < .05, two-tailed

Table 3. *Correlation analysis among dependent variables in the sports group*

Variables	a.	b.	c.	d.	e.	f.	g.	h.	i.	l.	m.
a. Total TAS	-										
b. DIF	.685**	-									
c. DDF	.795**	.367**	-								
d. EOT	.723**	.137	.424**	-							
e. Total BUT	.350**	.274**	.198*	.289**	-						
f. GSI	.338**	.257**	.190	.287**	.987**	-					
g. WP	-.006	-.106	-.077	.158	-.003	.012	-				
h. BIC	.260**	.194	.152	.221*	.905**	.896**	-.071	-			
i. A	.324**	.233*	.244*	.234*	.720**	.700**	-.019	.623**	-		
l. CSM	.339**	.210*	.177	.346**	.805**	.794**	.063	.572**	.439**	-	
m. D	.381**	.369**	.150	.304**	.768**	.752**	.025	.624**	.697**	.593**	-
n. PSDI	.052	.104	-.016	.022	.530**	.521**	-.031	.516**	.448**	.391**	.455**

Abbreviations: GSI=Global Severity Index; PSDI=Positive Symptom Distress Index; DIF=Difficulty Identifying Feeling; DDF=Difficulty Describing Feeling; EOT=Externally-Oriented Thinking Style; WP=Weight Phobia; BIC=Body Image Concerns; A=Avoidance; CSM=Compulsive Self-Monitoring; D= Depersonalization.
Note: **p < .01, two-tailed; *p < .05, two-tailed

Table 4. *Model summary of hierarchical regression analyses that predicts the total level of BUT*

Measures	R^2	Adjusted R^2	SE	*β*	*T*	*P-value*
Gender	.44	.19	3.84	0.21	2.75	.01
Age			0.26	-0.01	-0.14	.89
Sports versus non sports			4.19	-0.04	-0.53	.60
Education level			2.94	0.09	1.15	.25
Difficulty identifying feeling			0.35	0.32	4.12	.00
Difficulty describing feeling			0.43	-0.01	-0.16	.88
Externally-oriented thinking			0.40	0.15	1.90	.06

Abbreviations: SE=Standard Error; β=beta standardized coefficients.
Note: ** p <.01; * p <.05.

Table 5 *Model summary of hierarchical regression analyses that predicts the body image*

Measures	R^2	Adjusted R^2	SE	*β*	*T*	*P-value*
Gender	.42	.17	0.15	0.20	2.69	.01
Age			0.01	0.00	-0.02	.98
Sports versus non sports			0.16	-0.08	-0.95	.34
Education level			0.11	0.08	1.08	.28
Difficulty identifying feeling			0.01	0.28	3.48	<.001
Difficulty describing feeling			0.02	0.02	0.23	.82
Externally-oriented thinking			0.02	0.10	1.33	.19

Abbreviations: SE=Standard Error; β=beta standardized coefficients.
Note: *** p <.001; * p <.05.

explained 17% of the overall variance (see **table 5**).

Moreover, being female (B=-.15; t=-2.00; p<.05) and, above all, having a higher level of difficulty identifying feeling (B=-.33; t=-4.14; p<.001) were predictive of avoidance explaining 17% of the overall variance.

Furthermore, having an elevated difficulty identifying feelings (B=-.27; t=-3.28; p<.01) and externally-oriented thinking style (B=-.24; t=-3.01; p<.01) were predictive of compulsive self-monitoring (CSM), explaining 14.5% of the overall variance.

The only predictor of the depersonalization was a higher level of difficulty identifying feelings (B=-.38; t=-4.90; p<.001), explaining 21.6% of the overall explained variance.

Another regression analysis showed how a lower level of education (B=-.20; t=-2.64; p<.01), and an elevated difficulty identifying feelings (B=.27; t=-3.30; p<.001) were predictive of the Positive Symptom Distress Index (PSDI), although they only explained 11.4% of the overall variance.

Finally, being female with an elevated difficulty identifying feeling and externally-oriented thinking style were predictive of global severity index of body uneasiness (GSI), explaining 19.4% of the overall variance (see **table 6**).

6. Discussion and conclusion

The present study compared two groups of young adults, one made up of sportive individuals and the other of non-sportive subjects, investigating the relationship between body dismorphism and the ability to identify and communicate their emotional states. The above results allow us to detect the existence of some statistically significant differences between the two groups.

To confirm the first research hypothesis, there are significant differences between the two groups on the perception of their own body image, in particular, the

Table 6. *Model summary of hierarchical regression analyses that predicts the Global Severity Index*

Measures	R^2	Adjusted R^2	SE	*B*	*T*	*P-value*
Gender	.44	.19	0.11	0.20	2.61	.01
Age			0.01	0.00	0.00	1.00
Sports versus non sports			0.12	-0.06	-0.66	.51
Education level			0.09	-0.09	-1.18	.24
Difficulty identifying feeling			0.01	0.33	4.16	.00
Difficulty describing feeling			0.01	-0.01	-0.16	.87
Externally-oriented thinking			0.01	0.15	1.94	.05

Abbreviations: SE=Standard Error; β=beta standardized coefficients.
Note: *** p <.001; * p <.05.

sports group seems to get lower scores than the non-sports group; this body disperception in sport population fosters the exaggerated practice of sports.

To confirm the second research hypothesis, statistically significant differences between the groups emerge in the total scale of alexithymia and in the sub-dimension of external-oriented thought; in particular, the sports group seems to get higher scores than the non-sports group.

Although the average scores of the research participants do not exceed the cut-offs provided, the literature (Caretti and La Barbera 2005) underlines that there is a strong correlation between alexithymia and dependence on sporting activity, because practicing sports creates a series of positive feelings, especially during the training phase, which lead to perpetuate sportive behavior (Ferrari 2011).

Confirming the third research hypothesis there is a positive and significant correlation between the level of alexithymia and all sub-dimensions of dysfunctional bodily perception, except for the level of body phobia; in details, subjects with difficulty identifying feelings seem to manifest a high level of body uneasiness, tendency to avoidance, compulsive self-monitoring and depersonalisation; individuals with difficulty describing feelings seem to present an elevated level of avoidance; finally, subjects characterised by externally-oriented thinking seem to manifest a high level of body image concern, tendency to avoidance, compulsive self-monitoring and depersonalization. This is in line with the literature which underlines that those who have a dispersion of their own body image avoid places where they can not hide the perceived defect (Phillips 2004), resulting in somatic anger, hostility and social phobias.

Finally, confirming the last hypothesis, being female, and having a higher level of difficulty identifying feelings are predictive of the general level of body uneasiness, avoidance and body image concerns. It is interesting to note that an elevated difficulty identifying feelings and externally-oriented thinking style are predictive of the compulsive self-monitoring and the global severity index of body uneasiness; furthermore, a lower level of education and an elevated difficulty identifying feeling can be considered as predictors of the positive symptom distress towards their body.

Moreover, it seems interesting that externally oriented thinking is significantly different in the between-group comparison (sports versus non-sports), while difficulty identifying feelings is the only predictive variable to the outcomes of body perception and general distress. Our finding is that the externally oriented thinking subscale is composed of some items – such as, "I find examination of my feelings useful in solving personal problems" - which are hard to understand for an adolescent; these items probably are more understandable for Psychology students, who are more accustomed to reflect on their mental states, by self-administration of psychodynamic tools.

This research is confirmed in the literature which demonstrates the presence of the relationship between body disturbance and gender, and how this relation is more common in females, especially in reference to Western culture, where women feel dissatisfied with their body in dealing with the beauty standards proposed by the media company based on the idealization of thinness and denigration of obesity (Carta et al. 2008, Ramaci et al. 2017).

The present research has shown how bodily perception is more distorted among the sports population, and how this differs from the non-sports population in terms of avoidance, depersonalization and body image worries. It is therefore possible that the sports population's distorted perception of their own bodies, leads to an exaggerated practice of sport into a vicious circle in which the two factors incite each other.

Based on the results described herein, it is appropriate to emphasise the limits of this work, namely: the absence of a sampling method, which prevents the presence of a representa¬tive sample, the generalization of the results, and the external validity; in addition, the absence of a longitudinal-type study design, which is more suitable for research involving adolescents and their identity development (Pellerone et al. 2017d, Pellerone et al. 2017e, Pellerone et al. 2016b).

Overall, the results showed that sport adolescents, compared to non-sport adolescents, in terms of alexithymia and its components, were better. According to the findings, encouraging students to participate in physical activity and exercise in their teenage years can reduce their psychological problems, help to control these problems, and help to improve mental health. It is therefore necessary for officials, and those involved in educating and training students in youth sports, to be more sensitive and carry out short-term and long-term planning in this context in order to provide necessary facilities for this stratum of society. It is important to repeat this study in Universities in other cities to discover whether or not the results obtained in this study are true for others. It is suggested that relevant authorities are applied to in order attempt to reduce and control mental and emotional problems in adolescents and young adults, such as alexithymia and its components. This can be done by giving more attention to sport and physical activity and in research and planning relating to the control and reduction of psychological problems (Gazzillo et al. 2017).

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