CLINICAL SCIENCE

Negative addiction to exercise: are there differences between genders?

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INTRODUCTION: Regular physical exercise has numerous benefits. However, there is a subset of the exercising population who may develop a compulsion to exercise excessively and who may, as a consequence, display physiological and psychological changes that have a direct influence on their quality of life.

OBJECTIVE: Our objective was to determine if there are differences between male and female athletes' scores on measures of negative addiction symptoms, quality of life, mood and sleep. Methods: 144 female and 156 male athletes participated in this study by answering the following questionnaires: Negative Addiction Scale, Beck Depression Inventory, Trait Anxiety Inventory, Profile of Mood States, SF-36 Quality of Life, Pittsburgh Sleep Quality and Epworth Sleepiness Scale.

RESULTS: Higher dedication to training sessions in the male group, and members of the female group with symptoms of negative addiction to exercise showed a lower score on vigor observed by the Profile of Mood States compared to the males in both situations. We also observed depression symptoms in both members of groups who had negative addiction symptoms when compared with their peers without symptoms, and these figures were even higher in females compared with the male group in the same situation.

CONCLUSION: No differences were seen in the development of negative addiction exercise symptoms in males and females and there were no changes in the quality of life and mood of these athletes. Further studies of eating disorders associated with changes in body image perception could contribute to a better understanding of negative addiction to exercise.

KEYWORDS: Exercise Dependence; Compulsion; Well-being; Body Image; Physical Exercise.

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INTRODUCTION

In general, a large percentage of the population reports feelings of well-being after engaging in physical activity. Zmijewski & Howard,[1] have confirmed this observation; their study showed that 87.2% of individuals reported feeling well after physical exercise. This result points to exercise as a great tool in the promotion of health, as has already been described in the literature, as well as a pleasant activity that may influence mood and quality of life.[2] However, some factors may trigger a craving for this activity that entails harmful consequences to health.[3,4]

Traditionally, we can understand exercise dependence as a process that makes the subject commit to the exercise in spite of an apparent difficulty, such as a lesion or an illness that would normally prevent them from engaging in it. This dependence can result in physiological and/or psychological disorders.[5,6]

Several terms have been used to describe this phenomenon. Glasser[4] used the term ''positive addiction'' because athletes reported an increased sense of euphoria with increased miles of training and used larger doses of exercise to increase feelings of euphoria. Morgan,[3] has suggested the term ''negative addiction'' because the athletes evaluated reported a decreased sense of anxiety and depression after exercise and increased the doses of exercise to obtain this relief, but both studies have demonstrated aspects of exercise dependence: the characteristics of tolerance and withdrawal.

There are speculations on the prevalence of exercise dependence in many populations, but there are no

epidemiological studies of this phenomenon. On the other hand, important data, such as that reported by Anderson et al.[7] have shown a prevalence of 22% in runners, similar to the 26% who considered the exercise mandatory, as reported by Slay et al.[8] In a study that our group carried out using athletes of different sports modalities, we observed a prevalence of 28% of athletes who show negative symptoms of addiction in a sample of amateur and professional soccer athletes. The results showed similar numbers for both groups[9], and 32% of amateur athletes of various modalities also showed signs of negative addiction.[10]

Exercise dependence may co-occur with eating disorders and body image disorders. Jones et al.,[11] have reported that girls with normal total body mass index reported being dissatisfied with their body mass or height, and this excessive preoccupation with body image can also be related to the development of exercise dependence in women, and this fact may be associated with like anorexia and bulimia.

Negative psychological symptoms related to physical exercise have a direct relationship to changes in body image perception,[11] metabolic changes and the compulsive search for higher physical performance.[10] We can assume that there are gender differences relating to negative addiction exercise symptoms, as suggested by Blowers et al.[12] and reported by Cohan & Pope,[13] because there are differences in motivation for physical exercise between the genders, especially with regard to self-image. Therefore, there may be different responses to changes in mood and sleep patterns that occur in these athletes due to their practices.

Therefore, the objective of the present study was to assess if there are differences in the answers to the ''Negative Addiction Scale'' questionnaire between male and female athletes and if those differences could affect the sleep and the mood of that population.

MATERIALS AND METHODS

Before participating, all the volunteers were informed of the procedures, discomfort and risks involved in the evaluation process, and afterward, they gave informed consent. The Committee of Ethics in Research of Universidade Federal de São Paulo/ Hospital São Paulo approved the study (#0616/06).

In this study, 300 volunteers composed the sample: 144 females and 156 males. All of them were amateur athletes with ages ranging from 18 to 40 years and had been practicing their modalities at least five times a week for more than two years. The modalities involved in this data collection were the individual sports athletics (20 females and 28 males), swimming (20 females and 16 males), body building (17 females and 9 males) and artistic gymnastics (12 females and 13 males), and the collective sports soccer (2 females and 28 males), basketball (22 females and 11 males), volleyball (18 females and 26 males), handball (20 females and 4 males) and futsal (13 females and 21 males). The athletes answered the questionnaires on a day off within their regular training schedule, which characterizes the study as cross-sectional. The athletes were distributed into two groups: negative addiction symptoms and no negative addiction symptoms, as determined by scores on the Negative Addiction Scale, and possible differences between genders were analyzed. Athletes who had been away from their sports practice for over a week for any reason were excluded from the sample.

We applied the following questionnaires:

NEGATIVE ADDICTION SCALE (NAS).[14] This scale is our adaptation of the Negative Addiction Scale to Running Practice. The measure was adapted to Portuguese using translation and back-translation, so that there is semantic equivalence between the original and the translated questionnaires.[15] The questionnaire focuses on the ''negative'' psychological aspects of dependence using a scale of 14 items; each item scored 0 = absence or 1 = presence. High values are associated with higher levels of negative addiction symptoms. To define which athletes had negative symptoms of exercise addiction, we used a cutoff score of 5 points; athletes with symptoms above this score were placed in the ''negative addiction symptoms'' group. The questionnaire presented good indices of internal consistency: Cronbach alpha .79, split-half reliability .76, and Guttman split-half .76.

STATE-TRAIT ANXIETY INVENTORY (STAI).[16] The inventory translated into Portuguese and validated for Brazil was used.[17] The State-Trait Anxiety Inventory is a self-evaluation questionnaire of anxiety symptoms in two parts: the first evaluates Trait Anxiety, that is, how the individual ''usually'' feels; and the second evaluates the State Anxiety, that is, how the individual feels ''at the moment'' of the evaluation. The inventory presented reasonable indices of internal consistency: Cronbach alpha .88, split-half reliability .69 , and Guttman split-half .61.

PROFILE OF MOOD STATES (POMS).[18] This test consists of a list of 65 adjectives related to mood state, and the subjects write down how they feel in relation to each item on a scale of 0 to 4. This scale measures six mood factors or affective states: fatigue-inertia, vigor-activity, tension-anxiety, depression-dejection, anger-hostility, and confusion-bewilderment. The internal consistency evaluated by Cronbach alpha was .70, split-half reliability .78, and Guttman split-half .73.

SF-36 QUALITY OF LIFE (SF-36).[19] This questionnaire evaluates an individual's self-perception of health and quality of life on 36 items representing six subscales: Functional Capacity, Physical Aspects, Pain, General State of Health, Vitality, Emotional Aspects, and Mental Health. We used the version translated into Portuguese and validated for Brazil.[20] Each sub-scale may be scored from 0 to 100. High scores indicate better quality of life. The internal consistency evaluated by Cronbach alpha was .71, split-half reliability .74, and Guttman split-half .69.

BECK DEPRESSION INVENTORY.[21] The Brazilian version was used.[22] There are 21 clinical symptoms of depression. Eleven of the 21 items refer to cognitive symptoms of depression, while the remaining 10 items cover affective, behavioral, somatic, and interpersonal aspects of depression. Each item consists of a series of four statements scaled to indicate increasing depressive symptomatology. The inventory presented reasonable indices of internal consistency: Cronbach alpha .70, split-half reliability .62 , and Guttman split-half .62.

PITTSBURG SLEEP QUALITY INDEX.[23] This test was translated and validated for Portuguese (Brazil).[24] It assesses sleep quality using standardized questionnaires that can be easily answered and interpreted, and it differentiates between ''good sleepers'' and ''poor sleepers''. The questionnaire assesses sleep quality over a one-month

period and consists of 19 self-rated questions and 5 questions that should be answered by bedmates or roommates. The latter questions are used only for clinical information. The 19 questions are categorized into 7 components, graded on a score that ranges from 0 to 3. The Pittsburg Sleep Quality Index components are as follows: subjective sleep quality, sleep latency, sleeps duration, habitual sleep efficiency, sleep disturbances, use of sleep medication and daytime dysfunction. The sum of scores for these seven components yields one global score, which ranges from 0 to 21, where the highest score indicates worst sleep quality. A global Pittsburg Sleep Quality Index score greater than 5 indicates major difficulties in at least two components or moderate difficulties in more than three components of sleep.

EPWORTH SLEEPINESS SCALE.[25] This scale was translated and validated for Portuguese (Brazil);[24] it is a self-rated questionnaire that evaluates eight situations involving daily activities, some known to be very soporific. To grade the possibility of falling asleep, respondents use a score between 0 and 3 for each item, where 0 indicates no possibility of falling asleep and 3 means great probability of doing so, taking into account the lifestyle the respondents have led recently. It is important that the differences between falling asleep and feeling tired be understood before using the scale. The global score ranges from 0 to 24 and indicates the level of sleepiness. Scores greater than 10 indicate excessive daytime sleepiness, and scores greater than 16 indicate a high level of sleepiness.

Statistical Analysis

We initially applied the Kolmogorov-Smirnov test to determine the curve of normality. To describe the data, we used the distribution of relative frequencies and the descriptive analysis. The Mann-Whitney U Test was used for a non-parametric analysis of the comparison between gender groups. We used Two-way ANOVA followed by Duncans test for the comparison the effects of gender and presence or not of symptoms of negative addiction. The level of significance adopted for all the analyses was $\alpha \leq 0.05$, and the data are presented as mean $\pm$ standard deviation, percentage or median, where appropriate. We used the software Statistica Statsoft®, Inc., 2004, version 7.0 to carry out all the statistical analyses.

RESULTS

In the sample we studied, 28% of the women and 38% of the men presented negative symptoms for exercise dependence. However, no statistically significant differences were detected when we considered this variable.

Table 1 presents the descriptive data of the sample. For the female group, age (years), body mass (kg), height (m), body mass index (kg/m^2) were, respectively, (21.01 ± 3.06), (59.65 ± 8.73), (1.65 ± 0.06) and (21.78 ± 2.53). For the male group, they are (21.37 ± 6.82), (73.19 ± 9.62), (1.78 ± 0.08) and (22.99 ± 2.30). Data on the characteristics of the training of the athletes are also presented. We can observe significant differences in the number of years of training between the groups, indicating longer dedication of male athletes ($p<0.0001$). Significant differences in the weekly number of hours of training were also detected between the groups ($p<0.0001$), which also shows greater dedication of the male group. The scores in the questionnaire of exercise dependence did not show any significant differences between groups. (TABLE 1)

Table 2 presents the data on mood assessed by the questionnaires STAI (trait and state), POMS, Beck Depression Inventory and presents the data on quality of life assessed by the SF-36 questionnaire, quality of sleep evaluated by the Pittsburgh questionnaire, and excessive sleepiness evaluated by the Epworth questionnaire.

On the POMS questionnaire dimensions, differences were observed only in vigor, where the female group with negative addiction symptoms had lower scores ($p<0.0001$) compared with the male group in the same situation. Of the variables related to mood, higher scores on depression symptoms were observed for female athletes with negative addiction symptoms ($p<0.0001$) when compared to their female peers without symptoms, as assessed by the Beck Inventory. This same variable was higher for females without negative addiction symptoms ($p<0.0001$) compared to males without symptoms.

Of the variables that reflect the quality of sleep, less daytime sleepiness was observed in the female group with negative addiction symptoms ($p<0.05$) compared to both females without negative addiction symptoms and males. Females with negative addiction symptoms also presented higher values in the perception of sleep quality when compared with female without negative addiction symptoms ($p<0.05$) assessed by Pittsburgh questionnaire and Epworth questionnaire (TABLE 2).

Table 1 - Descriptive analysis of the sample and training data.

	Females (144)		Males (156)	
	Mean $\pm$ Standard deviation	Median (25% - 75%)	Mean $\pm$ Standard deviation	Median (25% - 75%)
Age (years)	21.01 $\pm$ 3.06	21.00 (19 – 23)	21.37 $\pm$ 6.82	19.00 (17 – 22,5)
Body Mass (kg)	59.65 $\pm$ 8.73	58.00 (54 – 65)	73.19 $\pm$ 9.62	74.00 (65 – 80)
Height (m)	1.65 $\pm$ 0.06	1.66 (1,61 – 1,68)	1.78 $\pm$ 0.08	1.78 (1.72 – 1.84)
BMI (kg/m^2)	21.78 $\pm$ 2.53	21.55 (20 – 22,68)	22.99 $\pm$ 2.30	23.03 (21.45 – 24.52)
Training time in years	3.73 $\pm$ 2.49*	3.00 (2 – 5)	5.69 $\pm$ 4.04	4.00 (4 – 6)
Weekly training in hours	7.78 $\pm$ 2.53*	8.00 (6 – 9)	12.38 $\pm$ 3.93	10.00 (10 – 15)
NAS Score	3.54 $\pm$ 2.31	3.00 (2 – 5)	3.96 $\pm$ 2.23	4.00 (2 – 6)

*Mann-Whitney U Test, difference between male x female genders, significant results for $p \leq 0,05$.
Data are presented as mean $\pm$ standard deviation and median (25 and 75%).
BMI – Body mass index
NAS – Negative Addiction Scale

Table 2 - Quality of Life, mood and sleep.

		Females (144)		Males (156)	
		Negative Addiction Symptoms (41)	No Negative Addiction Symptoms (103)	Negative Addiction Symptoms (60)	No Negative Addiction Symptoms (96)
STAI	**Trait**	37,41±11,20	38,91±11,17	37,58±8,60	37,93±8,68
	State	38,02±9,96	39,06±10,90	36,58±10,12	37,31±10,20
POMS	**Tension and Anxiety**	3,61±4,89	3,36±4,32	4,23±4,72	3,66±4,63
	Depression	5,51±7,93	4,90±6,37	6,07±7,56	6,14±8,60
	Anger and Hostility	6,17±5,44	5,57±6,23	8,28±7,60	7,14±8,32
	Vigor	17,56±4,71*	17,49±5,34	19,87±4,76	19,65±4,79
	Fatigue	6,34±5,50	7,12±4,99	6,53±5,08	6,67±4,37
	Mental Confusion	1,24±3,88	1,60±3,64	1,52±3,85	1,29±5,21
	Total Mood Disorder	5,41±25,30	5,74±23,67	7,10±25,69	5,50±27,03
SF-36	**Mean Dimensions**	77,92±14,62	79,03±11,82	78,70±13,43	79,96±13,11
	Physical Capacity	96,22±5,68	96,66±6,67	96,90±6,40	95,40±11,81
	Physical Aspects	76,22±33,98	81,19±28,77	77,73±31,49	87,01±23,43
	Pain	66,80±17,98	67,18±20,56	65,83±19,47	66,85±21,86
	General Health Scale	81,27±19,20	82,80±16,06	81,68±20,82	81,38±17,80
	Vitality	63,29±20,33	66,14±16,18	70,12±15,73	66,56±16,05
	Social Aspect	82,62±18,93	80,85±19,62	79,63±20,45	83,84±19,02
	Emotional Aspect	80,49±37,25	78,15±33,51	80,73±34,66	81,99±31,19
	Mental Health	76,39±15,41	78,77±12,30	79,00±16,43	78,57±14,00
Beck Inventory		11,45±6,27#	9,15±5,29*	8,95±5,57#	7,36±6,08
Epworth Sleepiness Scale		8,00±3,56*#	10,11±3,50	9,38±3,61	9,08±3,77
Pittsburgh Sleep Quality		5,24±2,77*	4,63±2,38	4,47±2,09	5,25±2,19

Two-way ANOVA followed by Duncan's test. *differences between male x female genders in the same situation (Negative Addiction Symptoms or No Negative Addiction Symptoms),
differences between Negative Addiction Symptoms or No Negative Addiction Symptoms (intra gender) significant results for $p \leq 0,05$.
Data presented as mean ± standard deviation . Legend: STAI: State-Trait Anxiety Inventory; POMS: Profile Of Mood States; SF-36: SF-36 Quality Of Life.

DISCUSSION

The practice of acute and chronic physical exercise provides benefits in the physical and cognitive domains of the individuals who engage in it.[2] In some individuals, however, the compulsive practice of physical activity, known as Exercise Dependence (ED), might influence some areas of their lives.[1,26,27]

Compulsive athletes frequently report four components of addiction: 1) feeling euphoria after an intense exercise session (runner's high), 2) the need to increase the dose of exercise to obtain feelings of well-being (tolerance), 3) difficulties in the performance of professional or social activities and 4) symptoms of the absence or need, including depression, irritability, and anxiety, when unable to engage in the activity (abstinence).[28,29]

A recently published finding of our group showed that amateur and professional athletes of collective and individual sport modalities reported different prevalence rates of exercise dependence, and the sports modality and competitive and social involvement could be determinants; professional athletes of collective sports presented a better profile of mood and quality of life when compared to professional athletes of individual sports and when compared to amateur athletes from collective or individual sport modalities.[10]

The objective of our study was to assess if male and female practitioners of physical activity show different responses that relate to the onset or the way exercise dependence manifests. It is a pioneer study, as far as studies of dependence on physical exercise are concerned, because our subjects were amateur practitioners of both genders involved in individual modalities (athletics, swimming, body building and artistic gymnastics) as well as collective modalities (basketball, volleyball, soccer, futsal and handball).

In this study, we observed greater dedication to the physical exercise practice in males, which may be related to higher values in the vigor dimension shown by this group, corroborating with Cohane & Pope,[13] who suggest that males have a cultural vision of a more voluminous body and vigorous muscles, unlike the vision observed in females, who seek in physical exercise a way to reduce body weight to present a less vigorous, but more socially acceptable, appearance.

Though the female groups scored higher on the depression variable, these values still do not classify these athletes as having severe symptoms of depression; however, these higher values may be directly related to responses to negative addiction symptoms as cited by Aidman et al.,[28] but they may also be related to other factors of this particular gender, such as changes in real perception of body image as commonly observed in this population.[13]

According to this line of reasoning, the evaluation of mood changes related to exercise dependence must be accompanied by tools for evaluating body image because co-occurrence between disorders of mood and body image seems to be very frequent. This can be seen clearly when we consider the data presented by Oliveira,[30] who shows 71.5% of people engaged in some kind of exercise want to change something in their body, which shows that a relatively large number of people are unsatisfied with their body image and may be using the excessive practice of physical exercise as a strategy for achieving their goals.

However, this recent understanding has revealed a limitation of this study because the male group was evaluated at a time before the females and without an instrument for body image evaluation, making it impossible to compare this variable.

We did not find significant differences in changes in quality of life when comparing male and female samples,

although we observed slight shifts in mood, as mentioned above, which can be explained by the fact that these athletes are engaged in their training daily and are not subjected to a period of abstinence, which would make the observation of changes in quality of life more likely. Separating the groups using an instrument that assesses negative addiction symptoms related to exercise, and perhaps using tools such as the Dependency Scale Exercise,[31] which is able to distinguish athletes with or without exercise dependence, may allow us to optimize the observation of these changes.

However, several studies,[27,32,33] have found no differences in exercise dependence between males and females, similar to the data observed in this study, suggesting that our instrument can give a reliable profile of this variable.

We believe that studies like Crossman et al.,[34] and Pierce et al.,[5] who reported greater feelings of discomfort in males when prevented from exercising, in addition to higher scores on exercise dependence in this gender, is due to the motivation to practice, as mentioned by Veale,[35] which suggests that the dependence on exercise is related to factors extrinsic to the biological response resulting from the practice of it. These factors may vary according to gender, as shown by Weik & Hale[36] who reported higher scores for males on the subscales abstinence, continuity, tolerance, lack of control, time and intent across the range of the Exercise Dependence Scale.[31] However, we observed higher scores for females on the subscales interference, positive rewards, abstinence and other social reasons using a different scale.

From this perspective, the motivation for engaging in sports may be related to some eating disorders because we can observe a higher incidence of anorexia among the female population.[37] According to the DSM-IV,[38] people who have eating disorders, like anorexia and bulimia, have a higher chance of having obsessive-compulsive traits and using exercise as a strategy for weight control, which might lead to concomitant eating disorder symptoms and addiction to exercise.[39] Thus, the data on depression observed in our sample of females with negative addiction symptoms can partly be explained by the possible association of exercise with eating disorders and body image disorders, which are more prevalent in the female population.

More recently, studies have shown that there is a relationship between anorexia, the amount of exercise, and behavioral changes that may result from this association. Kanarek et al.,[40] showed in an animal model that rats on a calorie-restricted diet increased their activity in voluntary exercise wheels. There was a direct relationship between the intensity of the exercise and severity of withdrawal symptoms, but the results were similar in both sexes.

Similar to the study by Kanarek et al.,[40] we did not observe differences in the percentage of individuals with negative addiction symptoms between genders.

However, other factors should be highlighted as motivation to practice sports such as social context, sport modality, and other associated disturbances, which may be essential triggers that lead to negative changes caused by exercise.

CONCLUSION

Similar percentages of men and women may suffer negative addiction symptoms, and these symptoms can lead to a lower quality of life because they can cause major changes in the general mood and changes in sleep patterns. However, the motivation to exercise seems to have different origins in each gender because women have a great motivation to be thin and may add excessive exercise to diets and other strategies to achieve their weight loss goals. Men seem to be involved in sports practice due to social and competitive factors related to vigor. However, the changes observed in our study did not cause significant impact on the quality of life of these athletes, perhaps because other factors are related to these changes and because these athletes are currently practicing their sports. The results could be different in athletes exposed to a period of deprivation from exercise.

The next step will be to conduct studies using other tools that allow for the assessment of eating disorders and body image along with exercise dependence. This will provide better insight into strategies for reducing this behavior among athletes and the endogenous factors that are associated with physical exercise and which could explain the development of addiction and the changes in well-being related to this practice.

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REFERENCES

1. Zmijewski CF, Howard MO. Exercise dependence and attitudes toward eating among young adults. Eat Behav 2003;4:181-95, doi: 10.1016/S1471-0153(03)00022-9.
2. Peluso MAM, Andrade LHSG. Physical activity and mental health: the association between exercise and mood. Clinics 2005. 60;61-70, doi: 10.1590/S1807-59322005000100012.
3. Morgan WP. Negative addiction in runners. Phys Sports Med. 1979;7:56-63.
4. Glasser W. Exercise addiction. New York: Harper & Row, 1976.
5. Pierce EF, Rohaly KA, Fritchley B. Sex differences on exercise dependence for men and women in a marathon road race. Percept Mot Skills. 1997;84:991-4.
6. Hausenblas HA, Downs DS. Relationship Among Sex, imagery, and Exercise Dependence Symptoms. Psychol Addict Behav. 2002;16:169-72, doi: 10.1037/0893-164X.16.2.169.
7. Anderson SJ, Basson CJ, Geils C. Personality style and mood states associated with a negative addiction to running. Sports Med. 1997;4:6–11.
8. Slay HA, Hayaki J, Napolitano MA. Motivations for Running and Eating Attitudes in Obligatory versus Non-obligatory Runners. Int J Eat Disord. 1998;23:267-75, doi: 10.1002/(SICI)1098-108X(199804)23:3<267::AID-EAT4>3.0.CO;2-H.
9. Modolo VB, Antunes HKM, Gimenez PRB, De Mello MT, Tufik S. Escores de dependência de exercício físico, qualidade e queixas de sono em atletas do gênero masculino. In: XI Congresso Brasileiro de Sono, Fortaleza – CE 2007.
10. Modolo VB, De Mello MT, Gimenez PRB, Tufik S, Antunes HKM. Dependência de Exercício Físico: Humor, Qualidade de Vida em Atletas Amadores e Profissionais. Rev. Bras. Med. Esp. 2009;15:355-9.
11. Jones JM, Bennett S, Olmsted MP, Lawson ML, Rodin G. Disordered eating attitudes and behaviours in teenage girls: a school-based study. CMAJ. 2001;165:547-52.
12. Blowers LC, Loxton NJ, Grady-Flesser MG, Occhipinti S, Dawe S. The relationship between socialcultural pressure to be thin and body dissatisfaction in pre-adolescent girls. Eat behav. 2003;4:229-44, doi: 10.1016/S1471-0153(03)00018-7.
13. Cohane G, Pope JRHG. Body image in boys: a review of the literature. Int J Eat Disord. 2001;29:373-9, doi: 10.1002/eat.1033.
14. Hailey BJ, Bailey LA. Negative addiction in runners: a quantitative approach. J of Sport Behav. 1982;5:150-4.
15. Rosa DA, De Mello MT, Souza-Formigoni MLO. Dependência da prática de exercícios físicos: estudo com maratonistas brasileiros. Rev. Bras.Med.Esp. 2003;9:9-14.
16. Spielberger CD. Manual for the State-Trait Anxiety Inventory "self-evaluation questionnaire". Palo Alto, CA 1979: Consulting Psychologists Press.
17. Andrade LHSG, Gorenstein C. Aspectos gerais das escalas de avaliação de ansiedade. Rev Psic. Clín. 1998;25:139-44.

18. Mcnair DM, Lorr M, Droppleman LF. Profile Mood States: Manual. Education and Industrial Testing Service, San Diego, 1971.
19. Ware JE, Sherbourne CD. The MOS 36-item Short-form Health Survey (SF-36): conceptual frame work and item selection. Medical Care. 1992;30:473-83, doi: 10.1097/00005650-199206000-00002.
20. Ciconelli RM. Tradução para o português e validação do questionário genérico de avaliação de qualidade de vida ''Medical outcome study 36-item short-form health survey (SF-36)''. São Paulo. 1997 [Dissertação, Universidade Federal de São Paulo].
21. Beck AT, Ward CH, Mendelson M. An inventory for measuring depression. Arch. Gen. Psyc. 1961;4:53-63.
22. Gorenstein C, Andrade LHSG. Validation of Portuguese version of the Beck Depression Inventory and the State-Trait Anxiety Inventory in Brazilian subjects. Braz J Med Biol Res. 1996;29:453-7.
23. Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res. 1989;28:193-213, doi: 10.1016/0165-1781(89)90047-4.
24. Bertolazi AN.Tradução, adaptação cultural e validação de dois instrumentos de avaliação do sono: Escala de Sonolência de Epworth e Índice de qualidade de sono de Pittsburgh. Universidade Federal do Rio Grande do Sul 2008.
25. Johns MW. A new method for measuring daytime sleepiness: the Epworth sleepiness scale. Sleep 1991;14:540-5.
26. Estok PJ, Rudy EB. Physical, psychosocial, menstrual changes/risks, and addiction in the female marathon and nonmarathon runner. Health Care Women Int. 1986;7:187–202, doi: 10.1080/07399338609515735.
27. Antunes HKM, Andersen LM, Tufik S, DeMello MT. Stress físico e a dependência de exercício físico. Rev. Bras. Med. Esp. 2006;12:234-8.
28. Aidman EV, Woolard S. The influence of self-reported exercise addiction on acute emotional and physiological responses to brief exercise deprivation. Psychol. of Sports and Exerc. 2003;4:224–236.
29. Allegre B, Souville M, Therme P, Griffiths M. Definitions and measures of exercise dependence. Addict Res Theory. 2006;14:631–46, doi: 10.1080/16066350600903302.
30. Oliveira ICV. Adaptação e Validação da Escala de Dependência de Exercício Físico em versão tradicional e informatizada. [Dissertação Universidade Federal do Rio Grande do Norte] 2010.
31. Hausenblas H, Downs DS. How much is too much? The development and validation of the Exercise Dependence Scale. Psychol. and Health 2002;17:387-404, doi: 10.1080/0887044022000004894.
32. Furst DM, Germone K. Negative addiction in male and female runners and exercisers. Percept Mot Skills 1993;77:192-4.
33. Vieira JLL, Rocha PGM, Ferrarezzi RA. A dependência pela prática de exercícios físicos e o uso de recursos ergogênicos. Acta Scientiarum. Health Sciences. 2010;32:35-41.
34. Crossman J, Jamieson J, Henderson L. Responses of competitive athletes to layoffs in training: exercise addiction or psychological relief? J Sports Behav 1987;10:28-38.
35. Veale DME. Does primary exercise dependence really exist?. In J. Annett, B. Cripps and H. Steinberg. Exercise addiction: Motivation for participation in sport and exercise (pp.1-5) Leicester UK. 1995. British Psychol. Society.
36. Weik M, Hale BD. Contrasting gender differences on two measures of exercise dependence. Br J Sports Med. 2009;43:204-7, doi: 10.1136/bjsm.2007.045138.
37. Thompson JK. Body image disturbance: assessment and treatment. 1990. New York: Pergamon.
38. DSM-IV-TR Manual diagnóstico e estatístico de transtornos mentais. Trad. Claudio Dornelles; 4ed. 2002 Rev. Porto Alegre: Artimed.
39. Yates A, Leehey K, Shisslak CM. Running: an analogue of anorexia? New Engl J Med. 1983;308:251-5, doi: 10.1056/NEJM198302033080504.
40. Kanarek RB, D'Anci KE, Jurdak N, Mathes WF. Running and addiction: precipitated withdrawal in a rat model of activity-based anorexia. Behav Neurosci. 2009;123:905–12, doi: 10.1037/a0015896.