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ATHLETES COMPLAINING OF THE FEELING OF HEAVY LEGS: ANALYSIS OF FUNCTIONAL SYMPTOMS USING THE SFMS OVERTRAINING DATABASE

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Abstract: The clearest expression of the overtraining syndrome in sportsmen consists of various psychological and behavioral signs. The "overtraining consensus group" of the French Society for Sports Medicine (SFMS) has developed a standardized questionnaire for the detection of early clinical aspects of this syndrome. Among them, one of the more specific is the feeling of heavy legs (FHL). We recently reported that athletes complaining this symptom in this questionnaire had higher plasma viscosity. This study aims at further characterizing the clinical presentation of these patients on the basis of the multicentric study of this questionnaire performed in sixteen French centers which collected 11 to 447 questionnaires (total Compared to 1214 non FHL). They have similar sex ratio and age, and similar working charge. The score is markedly higher. On the whole what they complain more: tiredness, lost of force, decrease of performance and cramps. Items that differentiate them the best from non FHLs are: "Training seems harder and harder", "I do no bear training so well", "I get tired more easily", "I often feel rotten" and "I do no feel fit". If we then select a group paired for the score of 330 other subjects matched with the 330 "FHLs" for sex ratio, age and training volume, the signs that exhibit the greater difference are: "Training seems harder and harder", "I have a sensation of oppression in my chest", "I often have cramps, muscular pain", "I do no bear training so well" and "During exercise, my heart rate is faster than before". Thus, the FHL detects subgroups of athletes whose score is more than twofold higher and that complain more of tiredness, lost of force, decrease of performance and cramps. These clinical findings obtained from the multicentric database are thus consistent with the concept of FHL being associated with a mild inflammatory pattern which is reflected by increased blood viscosity, as previously reported by our group.

INTRODUCTION

In athletes, the overtraining syndrome (OTS) is characterized by declining performance when maintaining a normal training program [1]. Actually, the term "overtraining" includes the assumption that there is an overload of exercise. However, it is now clear that the clinical signs of this syndrome are also due to stress, psychological as well as physiological, accompanied with inadequate rest, nutritional imbalance, mild inflammatory disorders, etc... [2]. Therefore, it has been recently proposed to re-name this syndrome and to call it the "unexplained underperformance syndrome" [3].

Usually, a mild, rapidly reversible state is defined as "overreaching" while the term "overtraining syndrome", or "staleness", means that a recovery period of months up to a year may be required. Usually, overreaching, a result of short-term overtraining, can be reversed with a resting period of a few days, maybe a week. A milder form is the normal fatigue experienced after several days of hard training. This fatigue is normally reversed after a few days of reduced training. Although there are a variety of symptoms reported on overtrained athletes, the main symptoms are reduced performance and pronounced fatigue.

Although a variety of biological symptoms has been described, none of them is reliable in terms of sensitivity or specificity. For example, reduced postexercise maximal lactate [4], excess cortisol (or even blunted cortisol response in the most severe cases), disturbed autonomic nervous system balance as evidenced by power spectral analysis of beat-to-beat, heart rate variability, have been described [5, 6].

Recently, the French consensus group on overtraining of the Societe Francaise de Medecine du Sport (SFMS) proposed a standardized questionnaire of early clinical symptoms of this elusive syndrome, allowing the calculation of a 'score' that may help to classify on a clinical basis sportsmen submitted to a heavy training program [7]. This score appears to be correlated with markers of muscular damage (creatine kinase, myosin) or neuroendocrine dysfunction (somatotrophic axis), but also with some hematological markers like ferritin. There appears to be a mild dehydration with increased hematocrit, serum Na⁺, and serum K⁺. All this seems to be due to an excess plasma water loss. Since concentrations of blood urea nitrogen and serum glutamic-oxaloacetic transaminase were also increased, without any evidence for water-electrolyte deficiency syndrome, renal dysfunction, or liver cell damage, the authors interpreted these findings as reflecting a persistent mild degree of dehydration and catabolic state noted after intense training [8].

We recently investigated a possible relationship between the OTS score and blood rheology in male elite athletes [9]. The score appeared to be correlated with blood viscosity. This correlation was explained by higher plasma viscosity and hematocrit in individuals with a high overtraining score. By contrast, there was no difference in Red Blood Cells deformability and aggregation. Therefore, the early signs of overtraining in elite sportsmen are associated with a hemorheologic pattern that suggests some degree of reversal of the fitness-associated "autohemodilution" discussed above. In addition, overtrained athletes are frequently iron depleted, a mechanism that may induce additional hemorheological alterations but is unlikely to explain the early hemorheologic tableau of the overtraining syndrome [9].

Current concepts of the pathophysiology of this syndrome may explain this mild hyperviscosity and mild hemoconcentration pattern, since cytokines released by the "overstressed" muscle appear now to be responsible for most of the symptoms [2]. According to this "cytokine hypothesis of overtraining" recently proposed by Smith, high volume/intensity training, with insufficient rest, will produce muscle and/or skeletal and/or joint trauma. Circulating monocytes are then activated by injury-related cytokines, and in turn produce large quantities of proinflammatory IL-1beta, and/or IL-6, and/or TNF-alpha, producing systemic inflammation. Elevated circulating cytokines then co-ordinate the whole-body response by: a) communicating with the CNS and inducing a set of behaviors referred to as "sickness" behavior, which involves mood and behavior changes that support resolution of systemic inflammation; b) adjusting liver function, to support the up-regulation of gluconeogenesis, as well as de novo synthesis of acute phase proteins, and a concomitant hypercatabolic state; and c) impacting on immune function. Theoretically, OTS is viewed as the third stage of Selye's general adaptation syndrome, with the focus being on recovery/survival, and not adaptation, and is deemed to be "protective," occurring in response to excessive physical/physiological stress. The interest of this conception for hemorheologists is thus that OTS appears to be a systemic inflammatory condition which can be monitored by markers of inflammation, such as, obviously, hemorheological ones [2].

These findings of a hemorheological pattern in OTS can also be relevant to some aspects of the clinical symptomatology of overtraining. For instance, the feeling of having "heavy legs" (FHL) is one of the most commonly reported signs. Since FHL is also a sign

of chronic venous insufficiency where it can be corrected by rheo-active drugs we recently investigated whether the FHL is associated with a hemorheologic profile. It appeared that FHL subjects complaining from OTS signs had higher plasma viscosity and a higher red cell aggregation as measured with laser backscattering [10]. These findings suggest that the feeling of heavy legs in overtrained athletes is related to OTS-related hemorheologic disturbances. Clearest expression of the overtraining syndrome in athletes consists of various psychological and behavioral signs. The "overtraining consensus group" of the French Society for Sports Medicine (SFMS) has developed a standardized questionnaire for the detection of early clinical aspects of this syndrome. Among them, one of the more specific is the feeling of heavy legs. We recently reported that athletes complaining this symptom in this questionnaire had higher plasma viscosity.

This study aims at further characterizing the clinical presentation of these "FHL" patients on the basis of the multicentric study of this questionnaire performed in sixteen French centers which collected a total of 1984 questionnaires.

METHODS

The questionnaire is presented here below. The database consists of 1984 questionnaires filled between 1990 and 1999 in sixteen French centres which collected 11 to 447 questionnaires. A total of 31064 items have been checked. A full report of the multicentric study is in press (Freddy Maso, in press).

Appendix: the SFMS questionnaire (English translation)

The number of answers quoted "yes" gives a score between 0 and 54. According to the French multicentric study (F. Maso, in press), scores >20 are highly suggestive of overreaching and are constantly found in overtly overtrained individuals.

Overtraining questionnaire

Sex M F

Date of birth:

What is your profession?

If you are a student, are you in period of examinations? Yes No

What is your main sport or game?

How many hours do you practise per week? 6-8 h 8-10 h more than 10 h

If you practise other sports or games, write them:

This month, has there been any significant event which may have disturbed your private or professional life? Yes No

This month:

1 - My level of sport performance /my state of form has decreased: Yes No

2 - I am not as attentive as before: Yes No

3 - My close friends think that my behaviour has changed: Yes No

4 - I have a sensation of oppression in my chest: Yes No

5 - My heart seems to beat faster: Yes No

6 - I have a lump in my throat: Yes No

7 - I have less appetite than before: Yes No

8 - I eat more: Yes No

9 - I do not sleep as well as before: Yes No

10 - I drowse and yawn in the daytime: Yes No

11 - The lapse of time between training sessions seems to me too short: Yes No

12 - My sexual appetite has decreased: Yes No

13 - My performances are poor:	Yes	No
14 - I frequently catch a cold:.....	Yes	No
15 - I have put on weight:	Yes	No
16 - I have memory problems:	Yes	No
17 - I often feel tired:	Yes	No
18 - I underestimate myself:.....	Yes	No
19 - I often have cramps, muscular pain:.....	Yes	No
20 - I suffer from headaches more frequently:.....	Yes	No
21 - I do not feel fit:	Yes	No
22 - I sometimes feel dizzy, on the point of fainting:.....	Yes	No
23 - I do not confide in others so easily:.....	Yes	No
24 - I am often seedy:	Yes	No
25 - I have a sore throat more often:.....	Yes	No
26 - I feel nervous, insecure, anxious:	Yes	No
27 - I do not bear training so well:	Yes	No
28 - At rest, my heart rate is faster than before:.....	Yes	No
29 - During exercise, my heart rate is faster than before:.....	Yes	No
30 - I often feel rotten:	Yes	No
31 - I get tired more easily:	Yes	No
32 - I often have digestive disorders:.....	Yes	No
33 - I feel like staying in bed:.....	Yes	No
34 - I am not so confident in myself:.....	Yes	No
35 - I get injured more easily:	Yes	No
36 - I have more difficulties in organizing my thoughts:	Yes	No
37 - I have more difficulties in concentrating in my sports activity:.....	Yes	No
38 - My sporting gestures are less precise, less skilful:.....	Yes	No
39 - I have lost force and aggressiveness:.....	Yes	No
40 - I feel as if I had no one to talk to:.....	Yes	No
41 - I sleep longer:	Yes	No
42 - I cough more often:.....	Yes	No
43 - I do not enjoy practising my sports as much:.....	Yes	No
44 - I do not enjoy my leisure activities as much:	Yes	No
45 - I get irritated more easily:	Yes	No
46 - I am less efficient in my school or professional activity:	Yes	No
47 - People around me think that I have become less pleasant:.....	Yes	No
48 - Training seems harder and harder:	Yes	No
49 - It is my fault if my results are worse:	Yes	No
50 - My legs feel heavy:.....	Yes	No
51 - I lose my personal things more easily (wallet, keys, etc.):	Yes	No
52 - I am pessimistic, I have the blues:.....	Yes	No
53 - I have lost weight:	Yes	No
54 - My motivation, will and tenacity are weaker:.....	Yes	No

Put a cross to range between these two opposite states

My physical level:

Great form <-----> Bad form

I feel fatigued:

More slowly <-----> More quickly

I recover from my state of tiredness:

More quickly <-----> More slowly
 I feel:
 Very relaxed <-----> Very anxious
 I have the feeling that my muscular strength has:
 Increased <-----> Decreased
 I have the feeling that my endurance has:
 Increased <-----> Decreased
 Have you had any difficulties in understanding some of the questions?..... Yes No
 If yes, which questions did you find difficult to understand (write the numbers)?

RESULTS

Compared to 1214 non FHLs they have similar sex ratio and age (20 ± 0.3 vs 20.5 ± 1.2) and similar working charge (8.8 ± 0.2 hr/wk vs 8.2 ± 1.2). Their score is markedly higher (16.7 ± 0.5 vs 7.2 ± 2.5 $p < 0.01$). On the whole what they complain more: tiredness (68%), lost of force (51%), decrease of performance (51%), cramps (43%). Items that differentiate them the best from non FHLs are "Training seems harder and harder" (16.06% vs 2.39%), "I do not bear training so well" (31.52% vs 7.17%), "I get tired more easily" (48.18% vs. 14.66%), "I often feel rotten" (20.91% vs. 6.43%), "I do not feel fit" (30.30% vs. 9.47%).

If we then select a group paired for the score (16.7 ± 0.5 vs. 16.2 ± 0.6 NS) of 330 other subjects matched with the 330 "FHLs" for sex ratio, age and training volume (8.8 hr/wk), the signs that exhibit the greater difference are: "Training seems harder and harder" (16.06% vs. 7.58%), "I have a sensation of oppression in my chest" (13.64% vs. 6.67%), "I often have cramps, muscular pain" (43.33% vs. 26.97%), "I do not bear training so well" (31.52% vs. 21.21%), "During exercise, my heart rate is faster than before" (23.64% vs. 17.58%).

CONCLUSIONS

Thus, the FHL detects subgroups of athletes whose score is more than twofold higher and that complain more of tiredness (68%), lost of force (51%), decrease of performance (51%) and cramps (43%).

These clinical findings obtained from the multicentric database are thus consistent with the concept of FHL being associated with a mild inflammatory pattern which is reflected by increased blood viscosity, as previously reported by our group.

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