78 - BEHAVIOR OF HEART RATE VARIABILITY IN HIGH PERFORMANCE ATHLETES

MARCELO DE A. VALIO;
SORAYA G. AUDI
FACULDADES METROPOLITANAS UNIDAS
SÃO PAULO; S.P.; BRASIL
mvalio@globo.com

OBJECTIVE

To observe the behavior of the autonomic nervous system after intense training of elite athletes, people who practice athletics, through a specific computerized system.

INTRODUCTION

Regular exercise is associated with a decreased overall mortality rate [1]. The beneficial effects of regular exercise contribute to health in a global way and to reduce cardiovascular mortality including, for example, influences on lipid metabolism [2], improves insulin resistance [3], and also has effects on system function autonomic nervous [4].

The heart rate variability means the oscillation in the interval between successive heartbeats as well as the oscillation between successive heartbeats snapshots and R-R intervals [5].

The cardiac autonomic modulation is the main regulator of HR variability (HRV), so HR variability is an indirect, qualitative and quantitative indicator of function of the autonomic nervous system [5].

HR is primarily controlled by the direct activity of the autonomic nervous system in the own rhythm of the sinoatrial node, its two branches (sympathetic and parasympathetic).

At rest the vagal (parasympathetic) activity prevails, which is progressively inhibited with increasing exercise where shall prevail sympathetic activity. Immediately after exercise what is found is prevalence of sympathetic activity and parasympathetic inhibition.

The sports training used in this study was the metabolic workout , which is characterized by a stress on energy metabolism in general and / or cardio respiratory system . exe : works that stimulate the generation of energy systems via aerobic or anaerobic lactic or alactic.

This study aimed to analyze the behavior of the sympathetic and parasympathetic nervous system in high performance athletes, people who practice athletics through heart rate variability by a specific computer system, verifying also the possibility of using this type of analysis as a screening test for the presence of autonomic disturbances that may interfere with the physiology and consequently the performance of athletes.

The study is justified for the following reasons: the importance of quantifying the levels of recovery of the athlete after training, need for individualization of training prescription and recovery after effort and need for more practical measuring recovery conditions.

MATERIALS E METHODS

1. Characterization of the Study

This study is a clinical, prospective, consecutive, on an individual descriptive, featured as a case study.

This is an investigation not controlled by not showing a control group of healthy individuals in their development.

2. Characterization of the subjects

The study used four athletes, two men and two healthy women, members of the Brazilian team athletics.

Patient evaluation included the test with the Nerve-Express for measuring the activity of the sympathetic and parasympathetic nervous system through the analysis of HRV. The Nerve-Express (NE) is a non-invasive, fully automatic computerized system for the quantitative analysis of the activity of the autonomic nervous system.

The test mode within the chosen method was the Nerve-Express Test upright standing. The patient remained lying in supine position with legs and arms relaxed at their side and with eyes closed. Polar was placed on his body to the level of the xiphoid process and the sensor was attached to his waist and connected to the computer. This sensor sent heartbeat information to the microcomputer that were captured by Polar and there, were interpreted by software Nerve-Express, which would form a graph on the screen. This procedure lasted approximately 4 minutes and after this period the microcomputer emitted a signal that warned the time to move to a standing position. The patient remained well, relaxed, however, and about 4 minutes without performing any specific activity. At the end of the process, Polar and sensor were removed from the patient.

The NE allows to identify three types of pattern in response: autonomic balance (homeostasis vegetative), sympathetic prevalence and parasympathetic prevalence.

The NE automatically recognizes the 74 SNA states representing different relationships between the activities of the SNS and PSNS and variations on their balance.

The NE then records the parasympathetic activity in the horizontal or X axis and sympathetic activity on the Y axis or vertical. The point of intersection of the axes is the sympathetic and parasympathetic autonomic balance point. To the right and above this equilibrium point, the NE shows an area of sympathetic and parasympathetic activity increased by 4 degrees. Decreases in the activities of the SNS and PSNS are shown to the left and below the equilibrium point.

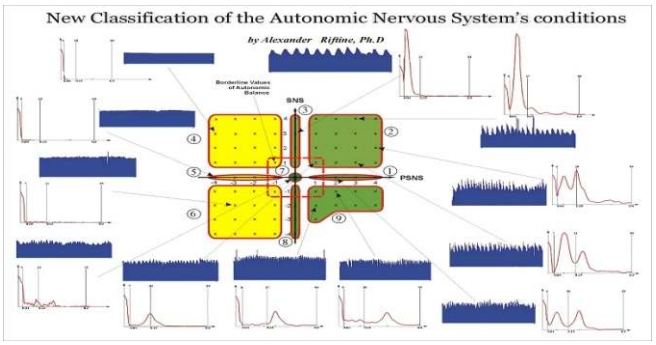
Figure 1 - Representation of the 74 states of the SNA

-The 74 SNA states are divided into 9 categories:
- Category 1 - Prevalence of SNPS with average level of SNS activity.
- Category 2 - Increase in both activities simultaneously (SNS and PSNS), with different variations.
- Category 3 - Prevalence of SNS (mild, moderate, significant, acute).
- Category 4 - Decreased SNPS with increased SNS.
- Category 5 - Decreased SNPS with an increase in the average level of SNS activity.

- Category 6 - General increase in the activities of the SNS and PSNS.
- Category 7 - A point on the value 0 indicates the coordinate system of the SNA balance.
- Category 8 - Decrease NHS average level of activity SNPS
- Category 9 - Increased SNPS with decreased SNS (Graphic 1).

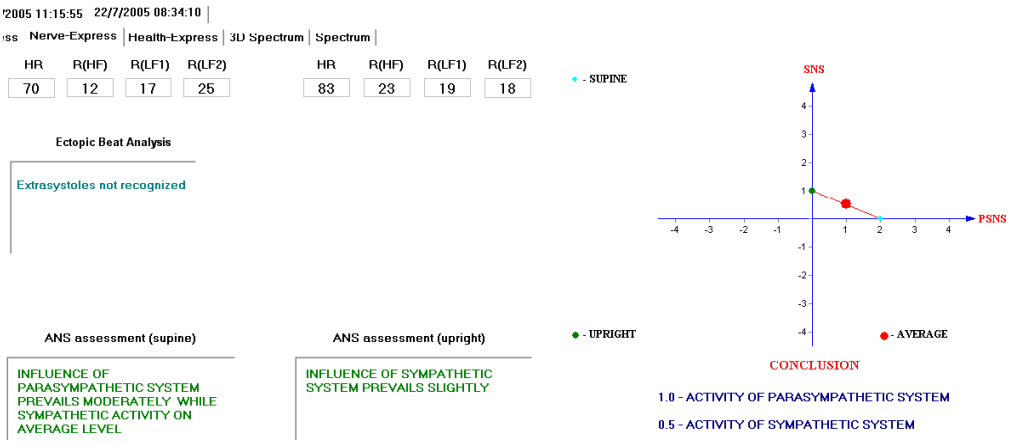
In the Cartesian system of sympathetic nervous system / parasympathetic nervous system, the basic principle is that the parameters shown in equilibrium standalone (SNPS> or = 0) or to the right represent basically healthy people, while those facing the left (SNPS <0) mostly represent temporary dysfunctions or chronically ill people.

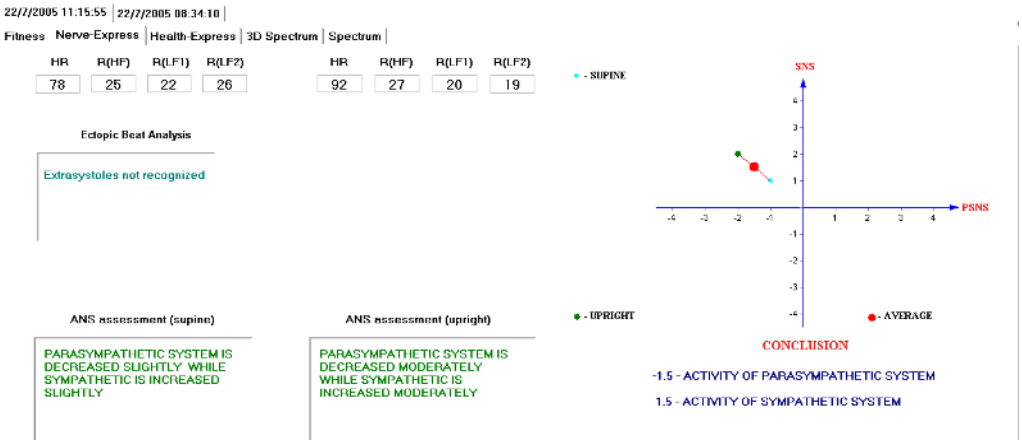
When using the NE it is necessary to consider the fact that any expected SNA reaction SNA depends not only on the type and intensity of the impacting factor, but is determined by the functional state of the SNA itself and its ability to react.

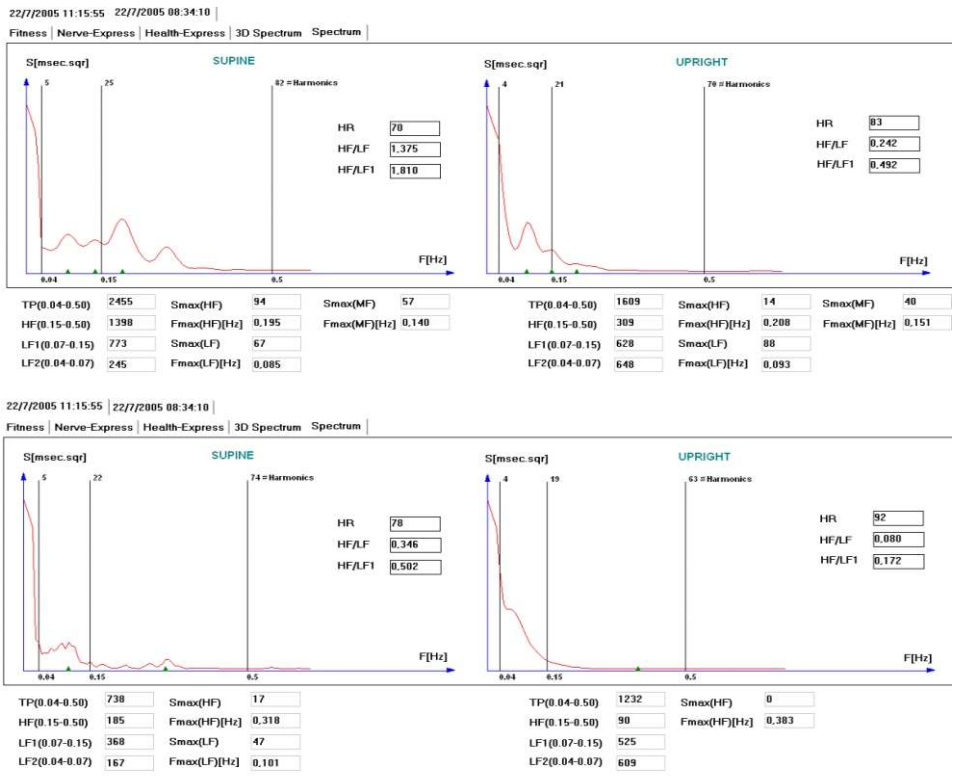


RESULTS

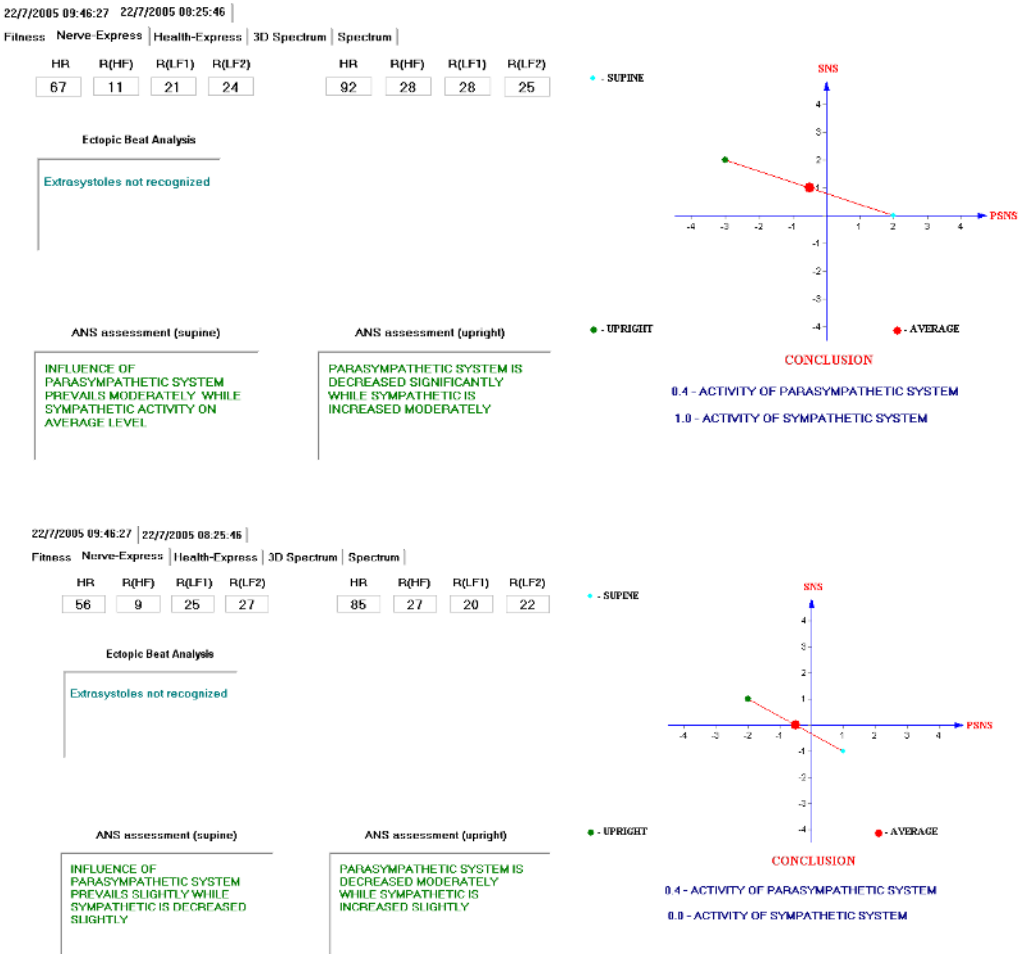
Three athletes presented in the pre-training test in category two, which is characteristic of most healthy individuals, and presented in the immediate post-training tests in category four, this category can be applied to individuals clinically ill or clinically healthy (defined as those which do not require hospitalization). However, the use of the word healthy is not always appropriate because of functional imbalance that happens in stress, physical exhaustion, nervous tension, infections, poisoning (including drugs or alcohol), exacerbation of chronic conditions, and many other causes can be present. An athlete presented already in pre-training test in category four and immediate post-training tests presented in five categories, this category can often reflect a depression of SNPS receptors, indicating the possibility of diseases or any chronic situation (Graphics 2, 3, 4, 5, 6, 7, 8 and 9).

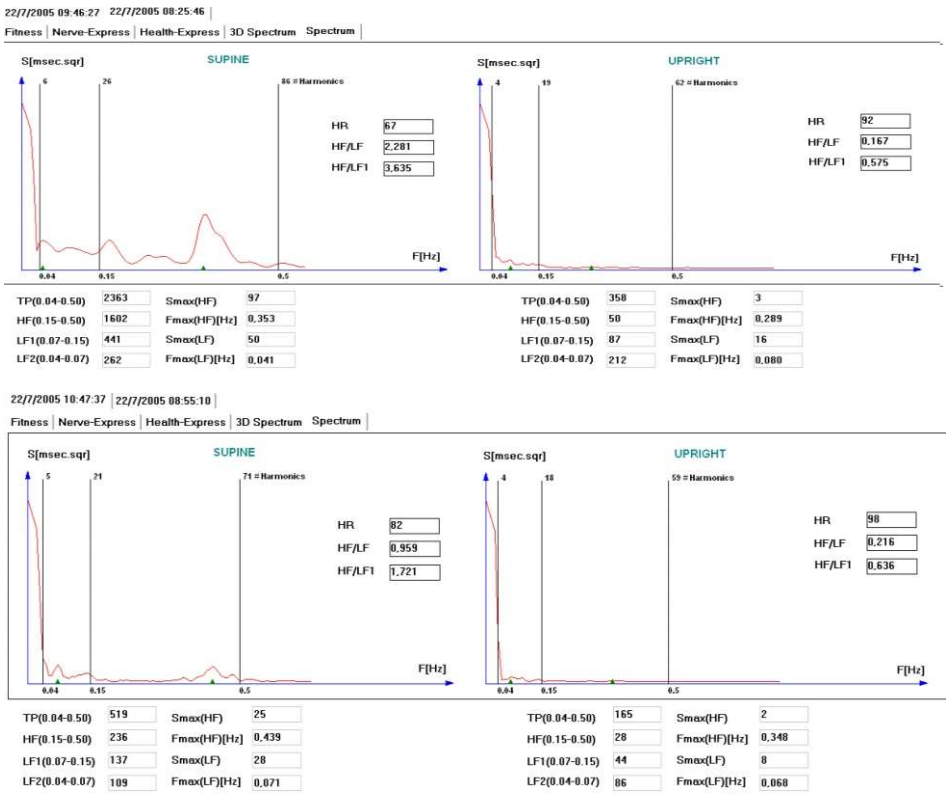






Graphics 2, 3, 4 and 5 - example of SNA level of 3 athletes pre-training, and immediately post-training





Charts 6, 7, 8 and 9 - example of level of SNA of 1 athlete in the pre-training and post-training immediately

Description of findings of 3 athletes:

Test before training: Displays the category of the two quadrant chart that is characterized by a simultaneous increase in PSNS and SNS, this category is subdivided into 16 possible combinations of the two systems. It is characteristic of the majority of healthy individuals.

Test post training: Displays the category 4 quadrant chart that is characterized by a decrease of SNPS and an increase in the NHS, this category is subdivided into 16 possible combinations of the two systems. This could be clinically applied to this category can be applied to individuals clinically ill or clinically healthy (defined as those which do not require hospitalization). However, the use of the word healthy is not always appropriate because of functional imbalance that happens in stress, physical exhaustion, nervous tension, infections, poisoning (including drugs or alcohol), exacerbation of chronic conditions, and many other causes can be present. In these cases we can observe a decrease of SNPS due to a depression of the nerve centers of SNPS, simultaneous to an adrenergic activation of the SNS, which is activated by the struggle of the autonomic nervous system to acquire balance

Description of the findings of one athlete:

Test before training: Displays the category 4 quadrant chart that is characterized by a decrease of SNPS and an increase in the NHS, this category is subdivided into 16 possible combinations of the two systems. This could be clinically applied to this category can be applied to individuals clinically ill or clinically healthy (defined as those which do not require hospitalization). However, the use of the word healthy is not always appropriate because of functional imbalance that happens in stress, physical exhaustion, nervous tension, infections, poisoning (including drugs or alcohol), exacerbation of chronic conditions, and many other causes can be present. In these cases we can observe a decrease of SNPS due to a depression of the nerve centers of SNPS, simultaneous to an adrenergic activation of the SNS, which is activated by the struggle of the autonomic nervous system to acquire balance.

Test post training: Displays the category 5 of the quadrant chart that is characterized by a decrease of SNPS with an average level in the NHS, this category is transitional . Everything that belongs to the fourth category is related to this, but in this case, the activity of the SNS is within average values . This means that stress, nervous exhaustion or overload is unlikely. This category can often reflect a depression of SNPS receptors, indicating the possibility of diseases or any chronic situation.

DISCUSSION

Organic reactions consisted on three athletes showing the same type of physiological reaction of the SNA, which was expected by the references.

In this particular case, an individual showed a decrease of SNPS and increased SNS in the pre-training response of decrease in the average level of SNPS and after SNS activity, reflecting depression of SNPS receptors, with the possibility of dysfunction, which is confirmed the individual report, highlighting hypoglycemia history.

The equipment showed efficiency in order to capture the data with graphs for easy interpretation and reading and a very convenient collection.

Test results are corroborated by the findings in the literature regarding the behavior of SNA front exercise

CONCLUSION

There was SNA stress condition in all cases.

Efficiency was observed for capturing, recording and documentation of the findings from the system used for collection.

REFERENCES
[1] Sandvik L, Erikssen J, Thaulow E, Erikssen G, Mundal R, Rodahl K. Physical fitness as a predictor of mortality among healthy middle-aged Norwegian men. N Engl J Med (1993); 328: 533–537.
[2] Durstine IL, Haskell WL. Effects on exercise training on plasma lipids and lipoproteins. Exercise Sport Sci Rev (1994); 22: 477–521.
[3] Koivisto VA, Yki-Ja¨rvinen H, Defronzo RA. Physical training and insulin. sensitivity. Diabetes Metab Rev (1996); 1: 445–481.
[4] Seals DR, Chase PB. Influence of physical training on heart rate variability and baroreflex circulatory control. J Appl Physiol (1989); 66: 1886–1895.
[5] Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysilogy Heart Rate Variability. Standards of measurement, physiological interpretation, and clinical use. Eur Heart J (1996); 17: 354–381.

Endereço: R. Alves Guimarães 150 Apt. 711,
São Paulo, SP; CEP. 05410-000
mvalio@globo.com

BEHAVIOR OF HEART RATE VARIABILITY IN HIGH PERFORMANCE ATHLETES

ABSTRACT
The autonomic nervous system regulates the internal functions of the human body, presenting hormonal responses associated with their condition. In this sense, the practice of motor activity seems to result in changes that provide system homeostasis imbalances in the individual, especially in high levels of performance. However, although it may be relevant to the control of variables related to the autonomic behavior of the athlete in order to verify the actual organic internal imbalances that training can provide, there are few studies that show the responses resulting from this effort. In the present study, the levels of activity of the sympathetic and parasympathetic nervous of high performance athletes practicing athletics were observed by analysis of heart rate variability (HRV). The test results of 03 athletes showed high level of autonomic balance in pre-training test and sympathetic prevalence in immediate post workout. The test showed a prevalence of 01 athlete sympathetic pre-workout and depression of parasympathetic receptors in the immediate post-workout. These findings confirm what is described in literature, showing that HRV analysis through software Nerve-Express consists of a new method, effective and non-invasive to the identification of problems related to the autonomic nervous system, and it can be used as test screening to assess changes in the SNA prematurely.
KEY-WORDS: variability, athletes, sympathetic

COMPORTEMENT DE LA VARIABILITÉ DE LA FRÉQUENCE CARDIAQUE EN ATHLÈTES HAUTES PERFORMANCES

RÉSUMÉ
Le système nerveux autonome réglemente les fonctions internes du corps humain, montrant les réponses hormonales associées à leur condition. En ce sens, la pratique d'activité motrice semble entraîner de changements de ce système fournissant des déséquilibres de l'homéostasie de l'individu, en particulier à des niveaux élevés de performances. Cependant, bien qu'il peut être pertinent de contrôler les variables liées au comportement autonome d'athlète, afin de vérifier les déséquilibres réels organique interne, qui le entraînement peut fournir, il y a quelques études qui montrent les réponses résultant de cet effort. Dans cette étude, les niveaux d'activité du sympathique et parasympathique système nerveux des athlètes de haute performance pratiquant l'athlétisme ont été observés à travers l'analyse de la variabilité de la fréquence cardiaque (VFC). Objectif: observer le comportement du système nerveux autonome après formation intense des athlètes d'élite, les praticiens de l'athlétisme, par système informatisé spécifique. Los resultados de las pruebas de evaluación 3 los atletas presentan nivel de equilibrio autonómico en la prueba pre-entrenamiento y prevalencia amable inmediatamente después de la capacitación. Ces constatations confirment ce qui est décrit dans la littérature, montrant que le VRC analyse via le logiciel Nerve-Express il consiste en une nouvelle méthode, efficaces et non invasives, à l'identification des problèmes liés au système nerveux autonome, et peut être utilisée comme examen de dépistage pour évaluer les changements de SNA si tôt.
MOTS-CLÉS: variabilité, les athlètes, sympathique

COMPORTAMIENTO DE LA VARIABILIDAD DE LA FRECUENCIA CARDIACA EN LOS ATLETAS DE ALTO RENDIMIENTO

RESUMEN
El sistema nervioso autónomo regula las funciones internas del cuerpo humano, mostrando las respuestas hormonales asociados con su condición. En este sentido, la práctica de la actividad motriz parece ser el resultado de los cambios de este sistema de desequilibrios en la homeostasis del individuo, especialmente en los niveles más altos de rendimiento. Sin embargo, a pesar de que puede ser pertinente para controlar las variables relacionadas con el comportamiento autonómico de atleta, que el entrenamiento puede proporcionar, pocos son los estudios que muestran las respuestas resultantes de este esfuerzo. En este estudio, los niveles de actividad del sistema nervioso simpático y parasimpático de los atletas de alto rendimiento practicante el atletismo fueron observados mediante el análisis de la variabilidad de la frecuencia cardiaca (VFC). Objetivo: Observar el comportamiento del sistema nervioso autónomo después de una intensa formación de deportistas de élite, los practicantes de atletismo, por sistema informático específico. Los resultados de las pruebas de evaluación 03 los atletas presentan nivel de equilibrio autonómico en la prueba pre-entrenamiento y prevalencia amable inmediatamente después de la capacitación. Estos resultados confirman lo que se describe en la literatura, lo que demuestra que el análisis de la VFC a través del software Nerve-Express Consiste en un nuevo método, eficaz y no invasivo, para la identificación de los problemas relacionados con el sistema nervioso autónomo, y se puede utilizar como examen previo para evaluar los cambios de SNA.
PALABRAS CLAVE: Variabilidad, atletas, simpático

COMPORTAMENTO DA VARIABILIDADE FREQUÊNCIA CARDÍACA EM ATLETAS DE ALTA PERFORMANCE

RESUMO

O sistema nervoso autônomo regula as funções internas do organismo humano, apresentando respostas hormonais associadas à sua condição. Nesse sentido, a prática da atividade motora parece resultar em alterações desse sistema proporcionando desequilíbrios na homeostase do indivíduo, sobretudo em elevados níveis de performance. Contudo, embora possa ser relevante o controle das variáveis relacionadas ao comportamento autonômico do atleta no sentido de verificar os reais desequilíbrios orgânicos internos que o treinamento possa proporcionar, são escassos os estudos que mostram as respostas resultantes desse esforço. No presente estudo, os níveis de atividade do sistema nervoso simpático e parassimpático dos atletas de alta performance praticantes de atletismo foram observados através da análise da variabilidade da frequência cardíaca (VFC). Os resultados dos testes de 03 atletas avaliados apresentaram nível de equilíbrio autonômico no teste pré-treino e prevalência simpática no pós-treino imediato. O teste de 01 atleta apresentou prevalência simpática no pré-treino e depressão dos receptores do parassimpático no pós-treino imediato. Estes achados confirmam o que é descrito na literatura, mostrando que a análise da VFC através do software Nerve-Express consiste em um novo método, eficaz e não invasivo, para a identificação de problemas relacionados ao sistema nervoso autônomo, podendo ser utilizado como exame de screening para avaliar alterações do SNA de forma precoce. Objetivo: Observar o comportamento do sistema nervoso autônomo após treinamento intenso de atletas de elite, praticantes de atletismo, por sistema informatizado especifico

PALAVRAS-CHAVE: variabilidade, atletas, simpático