AIRES®

New Medical Technologies Foundation. BIP International Association Research Center www.aires.spb.ru

新醫療技術基金會。BIP 國際協會研究中心 www.aires.spb.ru

Research on Aires Defender's Influence on the Variability of Heart Rhythm

《Aires Defender 對心律變異性影響之研究》

S. Datova, Tyumen, 2013

S. Datova，秋明，2013 年

Research objective: Verify the effectiveness of using Aires Defender's to enhance the body's ability to adapt, through heart rhythm analysis.

研究目的：透過心律分析，驗證使用 Aires Defender 增強身體適應能力的有效性。

Introduction 引言

Heart rate variability (HRV) is an expression of fluctuations in the frequency of heart contractions relative to its average level [1]. Determining HRV is presently recognized as the most informative noninvasive quantitative way to estimate autonomic regulation of heart rhythm [4]. As an important tool for assessing the function of the autonomic nervous system (ANS) and the body's overall adaptive response under the influence of various stressors, research based on HRV analysis is already experiencing renewed popularity in our country. Its initially came into vogue at the end of the 1970s when articles by R.M. Bayevsky, who researched strain on the body's adaptive systems, described numerous HRV-based studies in the field of space medicine. An HRV estimate reflects the activity of the regulatory systems that allow the body to adapt to various environmental conditions. It is based on interpreting the functioning of the cardiovascular system as an indicator of the body's adaptive responses.

心率變異性（HRV）是指心臟收縮頻率相較於其平均水平的波動表現[1]。目前，HRV 被公認為估計心律自主調節最具資訊性的非侵入性量化方法[4]。作為評估自主神經系統（ANS）功能及身體在各種壓力源影響下整體適應反應的重要工具，基於 HRV 分析的研究在我國正重新受到重視。其最初流行於 1970 年代末期，當時 R.M. Bayevsky 針對身體適應系統的壓力所發表的多篇文章，描述了許多基於 HRV 的太空醫學研究。HRV 評估反映了調節系統的活動，這些系統使身體能夠適應各種環境條件。它基於將心血管系統的功能解讀為身體適應反應的指標。

The relevance of questions related to humans' ability to adapt to actual living conditions today has increased sharply due to the systematic effects of man-made electromagnetic fields on the body. And with the appearance of more and more new sources of electromagnetic radiation, the electromagnetic safety of the public has become a socially significant problem.

關於人類適應當今實際生活條件能力的相關問題，由於人為電磁場對機體的系統性影響，其重要性急劇提升。隨著越來越多新型電磁輻射源的出現，公眾的電磁安全已成為一個具有社會意義的問題。

As high-tech universal systems for protecting the body from the negative effect of man-made electromagnetic radiation, Aires coherent transformers, which were developed by Aires Technologies, solve this problem by triggering a spatial-temporal amplitude-frequency harmonization of the spatial domain's structural characteristics, instead optimizing the body's physiological functions.

作為保護機體免受人為電磁輻射負面影響的高科技通用系統，Aires Technologies 開發的 Aires 相干變壓器，通過觸發空間域結構特性的時空振幅頻率協調，從而優化機體的生理功能，解決了這一問題。

To achieve the established objective, we used the Omega M system of hardware and software, which was designed to analyze the body's biological rhythms extracted from a wide band of frequencies. The method is founded on a new information technology for analyzing biorhythmic processes - fractal neurodynamics. Because any physiological system, as a result of its fractal structure, is regularly reflected in other systems, an analysis of rhythmic heart activity provides a real-

time cross-section of information about body state from all fundamental levels of function regulation, specifically:

為達成既定目標，我們使用了 Omega M 硬體與軟體系統，該系統設計用於分析從寬頻帶中提取的身體生物節律。此方法基於一種分析生物節律過程的新資訊技術——分形神經動力學。由於任何生理系統因其分形結構，會定期反映在其他系統中，心律節奏活動的分析即提供了關於身體狀態的即時橫截面資訊，涵蓋所有基本功能調節層面，具體包括：

secondary or autonomous, reflecting the regulatory state of cardiac activity at the level of the heart;

次級或自主層面，反映心臟活動在心臟層級的調節狀態；

AIRES®

New Medical Technologies Foundation. BIP International Association Research Center www.aires.spb.ru

新醫療技術基金會。BIP 國際協會研究中心 www.aires.spb.ru

2) autonomic, reflecting the ratio of sympathetic and parasympathetic influences at the level of centers of autonomic innervation in the medulla.

2）自主神經，反映延腦自主神經支配中心交感與副交感影響的比例。

3) pituitary-hypothalamus, reflecting the state of higher autonomic centers that simultaneously perform nervous and humoral regulation;

3）腦下垂體-下視丘，反映同時執行神經與體液調節的較高自主神經中樞狀態；

4) central, reflecting both regulation of neurohumoral body functions and the body's connection with its environmental conditions, indicating the body's overall ability to adapt.

4）中樞，反映神經體液調節身體功能及身體與環境條件的連結，顯示身體整體的適應能力。

Method of analyzing heart rhythm variability

心律變異性分析方法

Temporal and frequency HRV analysis are different. Temporal analysis includes geometric (graphical) and statistical methods of studying intervals between consecutive heart contractions (RR intervals). Frequency HRV analysis is most frequently performed using a spectral method. Spectral analysis is based on a physical transformation of the heart rhythm fluctuations into simple harmonic oscillations (fast Fourier transform) with a different frequency.

時間域與頻率域的心率變異性（HRV）分析有所不同。時間域分析包括幾何（圖形）和統計方法，用以研究連續心跳間隔（RR 間隔）。頻率域 HRV 分析最常使用頻譜法進行。頻譜分析基於將心律波動轉換為不同頻率的簡諧振動（快速傅立葉轉換）的物理變換。

In our research, we evaluated the heart rhythm variability analysis using the following indicators: Mode (Mo) - the range of values of the most frequently encountered cardiac signals. This indicates the predominant level at which the sinoatrial node is operating. The mode normally varies between 0.7 to 0.9 .

在本研究中，我們使用以下指標評估心律變異性分析：眾數（Mo）—最常出現的心跳信號值範圍。此指標反映竇房結運作的主要水平。眾數通常介於 0.7 至 0.9 之間。

Mode amplitude (AMo) - the ratio of the number of RR intervals equal to the Mo to the total number of RR intervals, expressed as a percentage. Normal values are $30 - 50\%$. This indicator reflects the degree of rigidity of the rhythm.

眾數振幅（AMo）—RR 間隔等於眾數的數量與 RR 間隔總數的比率，以百分比表示。正常值為 $30 - 50\%$ 。此指標反映心律的剛性程度。

Variability range (VR) - the difference between the maximum and minimum cardiac signal values. VR is treated as a parasympathetic indicator. Normal VR values range from 0.15 to 0.45 .

變異範圍（VR）—最大與最小心跳信號值之差。VR 被視為副交感神經指標。正常 VR 值範圍為 0.15 至 0.45。

Index of Regulatory System Stress IRSS $= \mathrm{AMo}/2 * \hat{}\mathrm{X} * \mathrm{Mo}$ - reflects the degree of centralization of heart rhythm regulation. It normally fluctuates between 10-100 c.u. This indicator is sensitive to increased tonus of the sympathetic nervous system.

調節系統壓力指數 IRSS $= \mathrm{AMo}/2 * {}^{\wedge}\mathrm{X} * \mathrm{Mo}$ **- 反映心律調節的集中程度。通常在 10-100 c.u.之間波動。此指標對交感神經系統張力增加非常敏感。**

Index of Autonomic Equilibrium $\mathrm{IAE} = \mathrm{AMo}/{}^{\wedge}\mathrm{X}$ - indicates the ratio of activity of the sympathetic and parasympathetic areas of the ANS. Normal values range from 35 to 145 c.u. Autonomic Rhythm Indicator $\mathrm{ARI} = 1/\mathrm{Mo}^{*\wedge}\mathrm{X}$ - makes it possible to judge the autonomic balance in terms of the autonomic regulatory circuit. Normal values fall between 0.25 and 0.6 .

自主平衡指數 $\mathrm{IAE} = \mathrm{AMo}/{}^{\wedge}\mathrm{X}$ **- 表示交感與副交感神經系統活動的比例。正常值範圍為 35 至 145 c.u. 自主節律指標** $\mathrm{ARI} = 1/\mathrm{Mo}^{*\wedge}\mathrm{X}$ **- 可用於判斷自主調節迴路中的自主平衡。正常值介於 0.25 至 0.6 之間。**

AIRES®

New Medical Technologies Foundation. BIP International Association Research Center www.aires.spb.ru

新醫療技術基金會。BIP 國際協會研究中心 www.aires.spb.ru

Regulatory Processes Adequacy Indicator RPAI=AMo/Mo - reflects the consistency between the activity of the parasympathetic area of the ANS and the sinoatrial node's leading functional level. Normal values are between 15 and 50 c.u.

調節過程適足性指標 RPAI=AMo/Mo - 反映自主神經系統副交感區域活動與竇房結主導功能水平之間的一致性。正常值介於 15 至 50 c.u.之間。

High-Frequency Spectral Component Power (HF - $0.15 - 0.40$ Hz)- reflects the preeminent role of the parasympathetic area of the ANS in the generation of fluctuations in this frequency range. The power in this frequency range increases while breathing with a certain frequency and depth. Low-Frequency Spectral Component Power (LF - $0.04 - 0.15$ Hz) - The physiological interpretation of this indicator is complex. It is believed that the power in this range is affected by changes in both the tonus of the parasympathetic and the sympathetic areas of the nervous system.

高頻譜成分功率（HF - $0.15 - 0.40$ Hz **）- 反映自主神經系統副交感區域在此頻率範圍內波動產生中的主導作用。此頻率範圍的功率會隨著特定頻率與深度的呼吸而增加。低頻譜成分功率（LF -** $0.04 - 0.15$ Hz **）- 此指標的生理解釋較為複雜。一般認為此頻率範圍的功率受自主神經系統副交感與交感區域張力變化的共同影響。**

Very Low-Frequency Spectral Component Power (VLF - 0.003-0.04 Hz) - The physiological meaning of these frequency ranges is unclear. However, some believe that the power of these frequency ranges grows considerably as the body's regulatory systems are distressed. There is data suggesting that VLF is a sensitive indicator of control of metabolic processes and characterizes the activity of the sympathetic area of the ANS from the level of super-segment regulation.

極低頻譜成分功率（VLF - 0.003-0.04 Hz）— 這些頻率範圍的生理意義尚不明確。然而，有些人認為當身體的調節系統受到壓力時，這些頻率範圍的功率會顯著增加。有資料顯示，VLF 是代謝過程控制的敏感指標，並從超節段調節層級描述自主神經系統交感區的活動。

Power ratio LF/HF - characterizes the ratio of sympathetic and parasympathetic influences. Moreover, if the tonus of the sympathetic area rises, this indicator increases significantly. In the event of sympathetic imbalance, the opposite happens. Reciprocal changes in LF and HF power have been noted in many instances. LF power has been observed to rise significantly in healthy persons under mental stress and a moderate physical load. Thus, recently the opinion was spread that power in the LF range and the LF/HF indicator reflect the activity of the sympathetic area of the ANS.

功率比率 LF/HF **— 描述交感與副交感影響的比例。此外，當交感區的張力上升時，此指標會顯著增加。若交感失衡，則會出現相反的情況。許多情況下已觀察到 LF 與 HF 功率的相互變化。健康人在心理壓力及中度體力負荷下，LF 功率顯著上升。因此，近來普遍認為 LF 範圍的功率及 LF/HF 指標反映自主神經系統交感區的活動。**

Full Spectrum (TP) - (less than 0.40 Hz) is an integrated indicator that reflects the influence of both the sympathetic and parasympathetic areas of the autonomic nervous system. Increased sympathetic influence leads to lower overall spectral power, while the activation of sympathetic imbalance leads to the opposite effect.

全頻譜（TP）－（低於 0.40 Hz）是一個綜合指標，反映自主神經系統中交感神經與副交感神經區域的影響。交感神經影響增加會導致整體頻譜功率降低，而交感神經失衡的活化則會產生相反的效果。

1. Methodological issues

1. 方法論問題

1.1. How the research was organized and conducted

1.1. 研究的組織與執行方式

The research employed a computer version of heart rhythm variability analysis in accordance with the “Standards of Measurement, Physiological Interpretation, and Clinical Research of Heart Rhythm Variability”, which were developed by a group of experts at the European Society of Cardiology and the North American Association of Rhythmology and Electrophysiology (European Heart Journal, 1996).

本研究採用電腦版心律變異性分析，依據由歐洲心臟學會與北美節律學及電生理學協會專家團隊制定的《心律變異性測量標準、生理解釋及臨床研究準則》（European Heart Journal, 1996）。

13 apparently healthy volunteers, ages 40 to 59, participated in the study. The research was conducted in stages during the day.

13 位年齡介於 40 至 59 歲的表面健康志願者參與了本研究。研究於白天分階段進行。

Registration of cardiac signals by recording 300 RR intervals.

透過記錄 300 個 RR 間期來登錄心臟訊號。

AIRES®

New Medical Technologies Foundation. BIP International Association Research Center www.aires.spb.ru

新醫療技術基金會。BIP 國際協會研究中心 www.aires.spb.ru

Placement of the Aires Defender on the projection of the celiac plexus on the chest below the xiphoid process for 20 minutes.

將 Aires Defender 置於胸部劍突下腹腔神經叢投影處，持續 20 分鐘。

Another registration of the cardiac signal by recording 300 RR intervals.

再次記錄心臟訊號，記錄 300 個 RR 間期。

1.2. EKG recording method

1.2. 心電圖記錄方法

The electrodes are placed on the subject’s hands near the wrists. The EKG is recorded with the subject in “sitting” position. The hands must be relaxed and immobile on the subject’s knees.

電極置於受試者手腕附近。心電圖在受試者「坐姿」下進行記錄。雙手須放鬆且靜止於受試者膝上。

To reduce noise during the EKG registration, other persons must not move within a radius of 1.5-2 meters of the subject.

為了減少心電圖登記過程中的雜訊，其他人在受試者周圍 1.5 至 2 公尺範圍內不得移動。

During EKG registration, the remote module must not be placed near sources of electromagnetic radiation.

在心電圖登記期間，遠端模組不得放置於電磁輻射源附近。

1.3. Research conditions

1.3. 研究條件

The research is conducted after a 10 -minute rest with peaceful breathing.

研究在受試者靜息 10 分鐘並保持平穩呼吸後進行。

The heart rhythm should be recorded on an empty stomach or 1.5-2.0 hours after a meal.

心律應在空腹或餐後 1.5 至 2.0 小時進行記錄。

The length of the recording required for a proper statistical sampling must be 300 cardiac signals (roughly 5 minutes).

為了獲得適當的統計樣本，記錄時間需包含 300 個心跳訊號（約 5 分鐘）。

The room where the research is conducted must provide comfortable conditions (temperature, humidity).

進行研究的房間必須提供舒適的環境條件（溫度、濕度）。

1.4. Reproducibility of the features of heart rhythm variability

1.4. 心律變異特徵的重現性

Due to the research methodology, the reproducibility of heart rhythm variability (HRV) results depends on the research subject and the task assigned to him or her by the researcher.

由於研究方法的關係，心律變異性（HRV）結果的重現性取決於研究對象及研究者指派給其的任務。

In methodological recommendations regarding HRV research, R.M. Bayevsky et al. [5] note the impossibility of achieving 100% reproducibility of HRV research results. Moreover, when discussing the reproducibility of results of HRV analysis, we must consider the autonomic nervous system's high sensitivity to external and internal influences, and the subject's typological features and health".

在關於 HRV 研究的方法學建議中，R.M. Bayevsky 等人[5]指出無法達到 HRV 研究結果的完全重現性。此外，在討論 HRV 分析結果的重現性時，必須考慮自主神經系統對外部及內部影響的高度敏感性，以及受試者的類型特徵與健康狀況。

AIRES®

New Medical Technologies Foundation. BIP International Association Research Center www.aires.spb.ru

新醫療技術基金會。BIP 國際協會研究中心 www.aires.spb.ru

Research results and discussion

研究結果與討論

Because the HRV is subject to considerable changes with the subjects' age [2], when interpreting the results we evaluated indicators for the 40-59 year old group, in accordance with guidelines for this group (as per O.V. Korkushko, 2002).

由於心率變異性（HRV）會隨受試者年齡產生顯著變化[2]，在解讀結果時，我們依據 40 至 59 歲年齡組的指標進行評估，符合該組別的指導方針（參考 O.V. Korkushko，2002 年）。

The high degree of differences between subjects was notable, even within the same age group. It should be noted that the subjects' baseline indicators differed in their stress level. In 76.9% of subjects the IRSS exceeded normal values and 50% of these exceeded by a factor of 2-4, which is indicative of a condition of long-term stress on the body's regulatory systems.

即使在相同年齡組內，受試者之間的差異程度仍相當顯著。值得注意的是，受試者的基線指標在壓力水平上存在差異。在 76.9% 的受試者中，IRSS 超出正常值，其中 50% 的受試者超出 2 至 4 倍，這顯示身體調節系統處於長期壓力狀態。

HRV indicators, which characterize the state of various parts of the body's autonomic regulation before and after the application of the Aires Defender (AD), are shown in Tables 1, 2, and 3. The following may be noted with respect to how the indicators in the spectral HRV analysis changed when the AD was applied (Table 1):

表 1、表 2 及表 3 展示了應用 Aires Defender（AD）前後，反映身體自主調節各部分狀態的 HRV 指標。關於 AD 應用後頻譜 HRV 分析指標的變化（表 1），可注意到以下幾點：

Autonomic imbalance toward a stronger parasympathetic tonus (HF, LF - increased; LF/HF reduced; for example, see 3, 4, 5, 6, 7, 8, 10), which may be interpreted as a reduction in stress on the body's regulatory systems.

自律神經失衡傾向於較強的副交感神經張力（HF、LF 增加；LF/HF 減少；例如，參見 3, 4, 5, 6, 7, 8, 10 ），這可解釋為身體調節系統壓力的減輕。

Increased activity of the vasomotor center, stronger connection of the central and autonomic regulatory circuits (LF, VLF, LF/HF - increased; for example, see 1, 11), which may suggest greater harmonization of the system at every level.

血管運動中樞活動增加，中樞與自律調節迴路連結更強（LF、VLF、LF/HF 增加；例如，參見 1、11），這可能暗示系統在各層級的更大和諧。

Increased activity at the level of energy- and metabolic regulation (HF, LF - decreased; VLF, LF/HF - increased; for example, see 2 ; LF, VLF - increased; for example, see 1, 3, 7, 8, 10, 11) may be the result of activation of central regulatory mechanisms (the pituitary-hypothalamus level).

能量與代謝調節層級的活動增加（HF、LF 減少；VLF、LF/HF 增加；例如，參見 2；LF、VLF 增加；例如，參見 1, 3, 7, 8, 10, 11 ）可能是中樞調節機制（腦下垂體-下視丘層級）活化的結果。

The VLF parameters characterize the highest autonomic centers' influence on the cardiovascular subcortical center and are used as a reliable indicator of the connection between autonomic (segmental) levels of circulatory regulation and supersegmental levels, including the pituitary-hypothalamus and cortical levels [3].

VLF 參數描述最高自律中樞對心血管皮質下中樞的影響，並被用作自律（節段性）循環調節層級與超節段層級（包括腦下垂體-下視丘及皮質層級）之間連結的可靠指標[3]。

In order to achieve a useful adaptive result, we may observe that the activity in one area of the ANS declines while it increases in another due to the principle of "functional synergy" [6]. Subject 6 is an example of this interaction (HF - decreased, LF - increased, IAE - increased as per Table 3).

為了達成有用的適應性結果，我們可以觀察到由於「功能協同」原則[6]，自主神經系統（ANS）中某一區域的活動下降時，另一區域的活動會增加。受試者 6 即為此互動的例子（高頻 HF 下降，低頻 LF 上升，IAE 增加，詳見表 3）。

Spectral HRV analysis revealed the relative value of each of the components of total power (TP), as a percentage.

頻譜心率變異性（HRV）分析揭示了總功率（TP）各組成部分的相對值，以百分比表示。

Based on the research results (Table 2), in which the HF and LF indicators increased in 77.8% of subjects, while the VLF indicator decreased in 88.9% of subjects, it may be stated that the AD produces a pronounced effect on the various levels of autonomic regulation, enhancing the system's ability to adapt to various stressors.

根據研究結果（表 2），其中 HF 和 LF 指標在 77.8% 名受試者中增加，而 VLF 指標在 88.9% 名受試者中下降，可說明 AD 對自主神經調節的各個層面產生明顯影響，增強系統對各種壓力源的適應能力。

The reduction in ARI and simultaneous increase in IAE in subjects 2 and 7 may be viewed as a result of the activation of the highest autonomic centers and the cortex in the regulatory process, which is confirmed by the increased in the VLF indicator in these subjects.

受試者 2 號與 7 號的 ARI 下降及 IAE 同時上升，可視為在調節過程中最高自主神經中樞與大腦皮層被激活的結果，這一點由這些受試者 VLF 指標的增加所證實。

The rise in activity of the autonomic regulatory circuit (ARI - increased, IAE and RPAI decreased in 69.2% of subjects; this may be illustrated by the examples of subjects 1, 3, 4, 5, 8, 9, 10, 11, and 12 as per Table 3).

自主神經調節迴路的活動增加（ARI 上升，IAE 與 RPAI 在 69.2% 名受試者中下降；可參考表 3 中受試者 1, 3, 4, 5, 8 、 9, 10, 11 及 12 的例子來說明）。

In all, the vagotropic type of the cardiovascular system's response to the influence of the AD (TP - increased in 92.3% of subjects) may suggest the activation of the system's self-regulatory mechanisms in order to increase the level of its harmonization.

整體而言，心血管系統對 AD 影響的迷走神經型反應（TP 在 92.3% 名受試者中上升）可能暗示系統自我調節機制的啟動，以提升其協調水平。

The AD's influence on the change of activity of various parts of autonomic regulation normalizes the autonomic balance, which may reflected by the reduction of the IRSS indicator in 92.3% of subjects, in whom the greatest change was observed in those with considerable baseline stress.

AD 對自主調節各部分活動變化的影響，使自主神經平衡恢復正常，這可能反映在 92.3% 受試者的 IRSS 指標下降，其中基線壓力較大者變化最為顯著。

An assessment of the effectiveness of AD's influence on the body, based on integrated indicators of functional state, is shown in Table 4.

基於功能狀態綜合指標對 AD 對身體影響效果的評估如表 4 所示。

The adaptive effect obtained, which reflects the various levels of the regulatory system, is determined by an increase in the following indicators:

所獲得的適應效應反映了調節系統的多層次，表現為以下指標的增加：

Adaptation level of the cardiovascular system - 13.5%

心血管系統的適應水平 - 13.5%

Level of autonomic regulation - 11.5%

自主神經調節水平 - 11.5%

Level of central regulation - 9.7%

中樞調節水平 - 9.7%

Indicator of psycho-emotional condition - 8.8%

心理情緒狀態指標 - 8.8%

Integral health indicator - 10.9%

整體健康指標 - 10.9%

Conclusions **結論**

We may draw the following conclusions based on the research results:

根據研究結果，我們可以得出以下結論：

Aires Defender affects the mechanisms of autonomic regulation, enabling optimization of indicators of autonomic balance.

Aires Defender 影響自律神經調節機制，使自律神經平衡指標得以優化。

Aires Defender's influence reduces tension on the body's regulatory systems, having an anti-stress effect and increasing the body's adaptive abilities.

Aires Defender 的影響減輕了身體調節系統的壓力，具有抗壓效果，並提升身體的適應能力。

The use of heart rhythm variability analysis as a method to assess the body's adaptive ability may be of practical interest when conducting research on the effect of electromagnetic radiation on the body.

心律變異性分析作為評估身體適應能力的方法，在進行電磁輻射對身體影響的研究時，可能具有實際的應用價值。

AIRES®

New Medical Technologies Foundation. BIP International Association Research Center www.aires.spb.ru

新醫療技術基金會。BIP 國際協會研究中心 www.aires.spb.ru

The selected research method proved to be adequate for the established objective. The results may serve as the basis for further research in this area.

所選擇的研究方法證明對既定目標是適當的。研究結果可作為該領域進一步研究的基礎。

Bibliography **參考文獻**

R.M. Bayevsky, O.I. Kirillov, S.Z. Kletskin. Mathematical Analysis of Changes in Heart Rhythm under Stress. M. 1984; 39-93.

R.M. Bayevsky, O.I. Kirillov, S.Z. Kletskin。《壓力下心律變化的數學分析》。莫斯科，1984；39-93。

S.A. Boytsov, I.V. Belozertseva, A.N. Kuchmin. Age-Related Features of Changes in Heart Rhythm Variability in Apparently Healthy People.//Vestnik Aritmologii, Vol. 26, 2002, pg. 57. 3. Heart Rhythm Variability: Theoretical Aspects and

Opportunities for Clinical Application. Institute of Medical and Biological Problems. Dinamika Research Laboratory, Saint Petersburg; 2002.

S.A. Boytsov, I.V. Belozertseva, A.N. Kuchmin。《表面健康人群心律變異性隨年齡變化的特徵》。//《心律學報》，第 26 卷，2002 年，第 57 頁。3. 心律變異性：理論層面及臨床應用機會。醫學與生物問題研究所。Dinamika 研究實驗室，聖彼得堡；2002 年。

D.I. Zhemaytite, G.A. Varonetskas, G.A. Zhilyukas. Ability to Assess Autonomic Regulation of Cardiac Activity in Patients with Coronary Heart Disease Using Non-Invasive Research Methods. Cardiology 1988; 4:35-41.

D.I. Zhemaytite, G.A. Varonetskas, G.A. Zhilyukas。《利用非侵入性研究方法評估冠心病患者心臟自主調節能力》。《心臟病學》1988；4：35-41。

Methodological Recommendations for HRV Analysis when Using Various Electrocardiographic Systems. R.M. Bayevsky et al. //Vestnik Aritmologii 2002, 24, pgs. 65-86.

使用各種心電圖系統進行心率變異性分析的方法學建議。R.M. Bayevsky 等人 //Vestnik Aritmologii 2002，24，頁 65-86。

N.B. Khaspekova. Regulation of Heart Rhythm Variability in Healthy Persons and Patients with Psychogenic and Organic Pathologies of the Brain. Dissertation of Doctor of Medical Sciences, M., Institute of Higher Nervous Activity, 1996. pg. 236

N.B. Khaspekova。《健康人與腦部心理性及器質性病變患者心律變異性的調節》。醫學博士論文，莫斯科，高等神經活動研究所，1996 年，第 236 頁

AIRES®
New Medical Technologies Foundation. BIP International Association Research Center www.aires.spb.ru

新醫療技術基金會。BIP 國際協會研究中心 www.aires.spb.ru

Appendix **附錄**

Table 1. Spectral analysis indicators (m/s^2)

表 1. 頻譜分析指標（ m/s^2 ）

No. 編號	HF		VLF		LF		LF/HF		TP	
	Baseline 基線	AD	Baseline 基線	AD	Baseline 基線	AD	Baseline 基線	AD	Baseline 基線	AD
1	446	615	133	395	253	417	0.3	0.64	832	1427
2	56	36	398	274	375	519	7.04	7.56	829	830
3	9	16	105	150	158	212	12.25	9.39	272	378
4	159	487	72	213	239	118	0.45	0.44	470	888
5	246	1833	785	1923	1473	1116	3.19	1.05	2505	4872
6	246	154	96	293	79	70	0.39	1.91	422	517
7	259	363	211	270	288	366	0.81	0.74	759	999
8	338	613	451	733	480	1086	1.33	1.19	1269	2433
9	177	177	307	443	725	292	1.74	2.5	1209	912
10	122	229	128	153	98	230	1.04	0.67	348	612
11	40	40	165	425	94	266	4.17	11.02	299	430
12	1373	1723	513	1024	1119	895	0.37	0.59	3005	3642
13	220	1440	2020	943	785	610	9.16	3.65	3025	2993

Table 2. Spectral diagram indicators (relative to the total power

表 2. 頻譜圖指標（相對於總功率）

No. 編號	HF		LF		VLF	
	Baseline 基線	AD	Baseline 基線	AD	Baseline 基線	AD
1	54	43	16	28	30	29
2	4	7	33	48	63	45
3	3	4	39	40	58	56
4	34	60	15	26	51	14
5	10	38	31	39	59	23
6	58	30	23	57	19	13
7	34	36	28	27	38	37
8	27	25	36	30	38	45
9	15	19	25	49	60	32
10	35	37	37	25	28	38
11	13	5	55	58	31	36
12	46	47	17	28	37	25
13	7	48	67	32	26	20

AIRES®
New Medical Technologies Foundation. BIP International Association Research Center www.aires.spb.ru

新醫療技術基金會。BIP 國際協會研究中心 www.aires.spb.ru

Table 3. Indicators of variational pulsometry

表 3. 變異脈搏測量指標

No. 編號	IAE		ARI		RPAI		IRSS	
	Baseline 基線	AD	Baseline 基線	AD	Baseline 基線	AD	Baseline 基線	AD
1	285	114	0.15	0.21	44.0	37.9	142.9	88.6
2	282	296	1.17	0.15	46.6	45.8	141.1	137.2
3	695	485	0.11	0.15	78.2	71.0	434.2	288.7
4	446	326	0.15	0.17	66.9	55.6	293.6	185.4
5	120	56	0.32	0.36	38.3	20.5	75.0	29.4
6	519	554	0.13	0.30	68.5	70.9	360.0	385.2
7	265	272	0.20	0.19	53.8	50.6	166.1	162.2
8	224	97	0.26	0.30	57.6	29.3	147.8	55.3
9	302	210	0.21	0.27	63.0	56.8	186.3	146.4
10	732	368	0.11	0.15	83.7	53.6	435.9	200.0
11	446	286	0.18	0.21	80.3	60.0	349.0	198.7
12	89	84	0.28	0.30	25.2	25.2	46.6	42.1
13	101	100	0.39	0.33	39.5	33.8	73.7	63.3

Table 4. Integrated indicators of the functional state of subjects by group

表 4. 各組受試者功能狀態綜合指標

No. 編號	Characteristics 特徵	Indicators (normal: 60-100%) 指標（正常範圍：60-100%）	
		Before application of AD AD 使用 AD 前	After application of 使用後
1	ADAPTATION LEVEL OF THE CARDIOVASCULAR SYSTEM 心血管系統的適應程度	42.2	55.7
2	LEVEL OF AUTONOMIC REGULATION 自主神經調節水平	45.5	57.0
3	LEVEL OF CENTRAL REGULATION 中樞調節水平	38.9	48.6
4	INDICATOR OF PSYCHO-EMOTIONAL STATE 心理情緒狀態指標	40.0	48.8
5	INTEGRAL INDICATOR OF HEALTH 整體健康指標	41.5	52.4