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**USING EMWAVE2 IN BIATHLON SKIING IN ORDER TO
INCREASE SPORT PERFORMANCE**

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Abstract

Purpose of study: The purpose of this study is to optimize the performance of athletes in biathlon skiing by creating a good overall self-confidence in both training and competitions. We need to identify a certain technique that will reduce stress and increase sport, mainly by using psychological training techniques. The main objective of the research is to measure the values of some physiological indicators as a result of mental formation through the technique of coherence and the combined technique of psycho physiological regulation. Methods: We have used the EmWave2 (like an ECG) that helps to optimize the rhythm. Physiological consistency is indicated by the device through three levels of correlation indicated by 3 colors: low (red), medium (blue), high (green). Findings and Conclusions: the EmWave2 The statistical results showed that the state of consistency was established following the use of the EmWave2 device and the neurophysiologic combination technique.

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1. Introduction

Personal experience has made us question about the lack of resistance, career speaking to some sportsmen, long term thinking.

We are wondering why some athletes manage to achieve and sustain high performances, and other athletes do not. Stress and anxiety before and during the competition raises problems that can lead to a real failure, despite the efforts and psychological training before the competition, as shown by (Biddle, 1995; Weinberg & Gould, 2011). It is important to know the factors that predispose and influence the psychological mechanisms in order to keep them under control so that we can optimize performance.

Besides the individual component, the performance has an enhanced social dimension, the appreciation of the value being shared, appreciated and validated socially (Iluț, 2004; Spielberger, 2004). Recent theories and studies have brought spectacular developments in combining perspectives and techniques in sports physiology, sports science, sports psychology, sociology, and so on. The pyramid defined by Danish, (2001), refers to the things that embrace and influences peak performance.

2. Problem Statement

Specialized literature deals extensively with emotions in activities that involve effort, concentration, and performance stakes, which is obvious for athletes (Lazarus, 2000; O'Connor, 2005). Many times, emotions escape conscious from control and become sources of dysfunctions in doing activities.

In the preparation phase of the competition, various emotional manifestations may occur: loss of concentration, loss of clarity in thought and expression, lack of attention to the technician or coach's suggestions, loss of technique or tactical strategy, physiological reactions (pallor, clamping, sweating, digestive disorders, apathy, hyper excitation or irritability, etc.) (Bergland, 2015; Robinson, 2017). It is obvious, therefore, that strong emotion affects cognition, relationship to the context and control of one's own states, occurring errors of perception and coordination, mistakes in motion and tactics, thus installing the tract. That is why it is so important to know the mechanisms that once installed will interfere with the performance and balance of the athletes, and then treat them with specific methods, mental training and mind-body coordination (Robinson, 2017).

The motivation for choosing this theme was to develop an intervention strategy to reduce stress and competitive anxiety (Grosu, Motică, Ordean, & Grosu, 2018) through psychological training techniques by finding new effective methods and techniques in biathlon skiing. We believe that by testing these techniques we can bring valuable added value in the field of sports psychology. Psychological training methods have been constructed as their own techniques by applying to the athletes performance before and after the competition

Our own research was built on the principles of causality, compared to other articles. Thus, the mental training through coherence technique and the combined technique of psychophysiological regulation was the independent variable, and stress, anxiety, self-esteem and motivational persistence - dependent variables on which we followed the effect of mental training techniques on the experimental group, comparing the results obtained by applying standard tests and measurements for the two batches.

3. Research Questions

We wanted to know if by applying the coherence and the combined psycho physiological regulation on biathlon skiers we will obtain statistically significant effects.

4. Purpose of the Study

This particular and complex sport has lead us to think about the possibility of building a harmonious and coherent connection between the long-term psychosocial resistance of biathlon skiers and the practice of biathlon skiing.

By testing the stress and anxiety levels, we can assess whether mental formation through coherence technique and combined technique of psycho physiological regulation has statistically significant effects on biathlon skiers. Optimizing the mental formation by the coherence technique and combined psycho physiological adjustment is a strategy that we want to establish.

4.1. Organizing and conducting the research

The research took place between February 2015 and February 2016. We have applied the established tools as well as some ways to reduce the stress, personally built, the latter being addressed to the subjects of the experimental group, for the initial and final testing.

The control lot (I) consisted of 15 biathlon skiers, Vatra Dornei School Sports Club. They did not participate in this constant application program of the EmWave2 technique,

The experimental lot (II) consisted of 15 athletes, biathlon skiing section, the Baia Sprie – Sportive Club. The experimental lot was subject to rapid technique of achieving coherence and combined psycho physiological regulation technique (6 times during one year).

To the athletes from the experimental group were given initial and final tests for measurements, such as: attention, coordination and response speeds, self-esteem and motivational persistence as well as stress and anxiety.

4.2. Statistical indicators

The statistical processing was performed with the StatsDirect v.2.7.2 program and the Excel application (from the Microsoft Office 2010 package). The graphical representation of the results was done with the Excel application (from the Microsoft Office 2010 package). Statistical analysis: Shapiro-Wilk test, T test for normal distribution testing, non-parametric Mann-Whitney (U) tests for two non-paired samples, Wilcoxon - for two non-uniform distribution values; ANOVA test for normal distribution data or Kruskal-Wallis nonparametric test - for non-uniform distribution values or ranges for analysis of three or more samples.

5. Research Methods

The mental training techniques represent our applicative contribution to the psycho physiological training methodology, expressed by reducing the stress and anxiety

In this study, we want to contribute to the improvement of mental training techniques: the cohesive technique proposed by the HeartMath Institute with the EmWave device and the combined psycho

physiological adjustment technique to alpine skiers. We have used mental training techniques, which were the independent variable, assuming that the results of psycho physiological tests and measurements will be different after applying the intervention program. These methods of reducing stress and anxiety are our contribution to knowledge in the field of sports psychology, an applicative contribution.

EmWave2, as an ECG, helps us to optimize heart rate to create a physiological coherence throughout the body with three levels of consistency (low, medium, high) highlighted by the colors: red, blue and green. The authors (McCraty, Atkinson, Tomasino, & Bradley, 2009; McCraty & Zayas, 2014) have shown that this technique can rapidly bring the heart rate to the state of consistency. Combined programs used to measure consistency and to achieve consistency to reduce overall stress by specific relaxation techniques are EmWave2 composed of: EmWave Desktop and EmWave Personal Stress Reliever.

5.1. The intervention program

The intervention program consisted in achieving the technique of coherence through the following stages: focus on the heart, breathing of the heart, "feeling with the heart". While maintaining the focus on the heart area and breathing, a positive feeling is activated. It is preferable to apply this technique in the morning, before training or contests, before a physical activity, or shooting technique. Methods of managing stress on different areas of mental activation are: physical relaxation, mental imagery and setting goals (Bergland, 2015; Brown, 2015,;Inner, 2017; Morton, 2017).

6. Findings

We have interpreted and compared the results in the two lots, by analyzing, discussing and verifying the validation of the proposed psychological training techniques during the investigation. In the EmWave2 test, we can see positive effects of the coherence technique combined with the psycho-physiological technique, manifested in psychological balance and stress management on both batches even if to the control group these techniques were applied only once. However, the effects on the experimental group are visible (differences between the scores and the level of coherence with statistical significance). These results can be interpreted through the multidimensional theory of anxiety (Goldin & Gross, 2100). (see table 1, 2)

Table 01. The results in EmWave2 test (medium values for testing 1 and 2)

Lot	Coherence rate	Test 1	Test 2	Statistical significance (p) Test 1 - Test 2
I	Low	25.67	24.00	> 0.9999
	Medium	25.60	26.13	0.8629
	High	48.73	49.87	0.7738
	Time (seconds)	314.40	612.53	< 0.0001
	Score	73.60	138.87	< 0.0001
	FC medium	89.07	71.87	< 0.0001
II	Low	21.27	22.13	0.7638
	Medium	23.80	24.67	0.7657
	High	54.93	53.20	0.6637
	Time (seconds)	314.47	612.67	< 0.0001
	Score	78.87	162.60	< 0.0001
	FC medium	75.53	72.67	0.0245

Comparing the lots we can see that the level of consistency in the experimental group has higher "high" levels, and that the distribution of these values is more restricted (the experimental group seems to be more evenly in comparison with the control group). The statistical analysis of mean heart rate values produced a statistically significant difference between the two groups ($p < 0.001$): for group I, we have a mean heart rate (median value of 91 cycles/minute) higher than in group II (with a median of 76 cycles/minute), the experimental group being more balanced on this indicator.

The effects on the experimental group are highly significant; the experimental group had a coherence score of 162.60, while those in the control group only 138.87. The difference is due to the interaction programs performed with the athletes using the technique measured with EmWave2. (see figure no 1)

Table 02. The results in EmWave2 test in the studied lots and statistical significance, initial testing

Lot	Coherence rate	Average	Standard error	Median	Standard deviation	Minim	Maxim	Statistical significance (p) Test 1 - Test 2
I	Low	25.67	5,0101	24	19,4042	3	66	L-M-H
	Medium	25.60	2,8881	27	11,1854	8	41	0,0038
	High	48.73	5,5887	49	21,6448	13	82	
	Time (seconds)	314.40	0,1633	314	0,6325	313	315	
	Score	73.60	6,9630	75	26,9677	29	125	L-H 0,0049
	FC medium	89.07	2,0736	91	8,0309	76	99	M-H 0,0014
II	Low	21.27	3,2300	23	12,5098	0	48	L-M-H
	Medium	23.80	2,5750	23	9,9728	5	39	8,54 x 10⁻⁸
	High	54.93	5,0826	53	19,6849	13	95	
	Time (seconds)	314.47	0,5422	315	2,0999	307	316	
	Score	78.87	6,9315	76	26,8458	32	140	L-H 8,54 x 10⁻⁸
	FC medium	75.53	0,6084	76	2,3563	71	79	M-H 8,54 x 10⁻⁸
Statistical significance (p) Lot I versus Lot II			L	0,7050	Scor	Time	FC medium	
			M	0,6454	0,7375	0,0038	<0,0001	
			H	0,4187				

In EmWave2 test, correlating the values of score and medium cardiac frequency we have found in first lot an acceptable and same sense correlation between the two indicators; in the second lot a lack of correlation. Considering the relation between the coherence rate established by EmWave model and medium cardiac frequency, the subjects in the first lot have more modest results compared to the ones in the second lot, the difference being not significant.

To achieve consistency, those in lot II had a much lower average time distribution, indicating a more homogeneous profile of the experimental group versus the control group, indicating a positive effect of the mental training techniques applied regularly for a year, on the speed at which most athletes worked, they manage to relax.

In table 3 we can see the results for the EmWave indicators, final testing.

Table 03. The results in EmWave2 test in the studied lots and statistical significance, final testing

Lot	Coherence rate	Average	Standard error	Median	Standard deviation	Minim	Maxim	Statistical significance (p) Test 1 - Test 2
I	Low	24,00	2,5635	22	9,9283	9	49	L-M-H
	Medium	26,13	1,4828	26	5,7429	17	39	5,38x10⁻⁹
	High	49,87	3,3436	51	12,9497	21	74	
	Time (seconds)	612,53	0,7028	614	2,7220	605	615	L-M 0,4789
	Score	138,87	7,0257	134	27,2105	104	188	L-H 1,72x10⁻⁶
	FC medium	71,78	0,5595	71	2,1668	68	76	M-H 3,23x10⁻⁶
II	Low	22,13	2,2443	22	8,6921	7	37	L-M-H
	Medium	24,67	2,3637	25	9,1548	4	38	1,71 x 10⁻⁹
	High	53,20	3,9620	51	15,3446	32	88	
	Time (seconds)	612,67	0,8489	614	3,2878	604	615	L-M 0,4435
	Score	162,60	17,3734	142	67,2870	83	343	L-H 7,45 x10⁻⁷
	FC medium	72,67	0,7475	72	2,8950	68	78	M-H 2,61x10⁻⁶
Statistical significance (p) Lot I versus Lot II		L	0,5881	Scor	Time	FC medium		
		M	0,6040	0,0017	0,4567	0,3994		
		H	0,5257					

It can be observed, compared to the first test, that the differences in the level of consistency, for each lot, are higher ("significantly significant" versus "very significant" in group I one year ago, in the experimental group these differences remain "highly significant"). These results call for reflection: it seems that the simple test in the control group had a visible effect, without realizing the specific EmWave mental training. The experimental lot has a more solid outside in this case, indicating a consistent effect of the coherence technique.

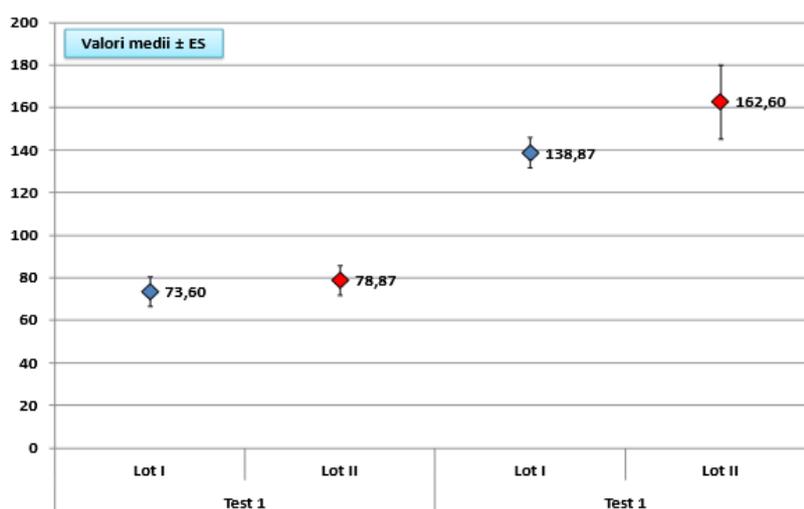


Figure 01. Test EmWave2 in the studied lots-score-testing 1 and 2

By comparing the batch results we can see the effectiveness of repeated application to each group, illustrated by average cardiac frequency. (see figure no 2)

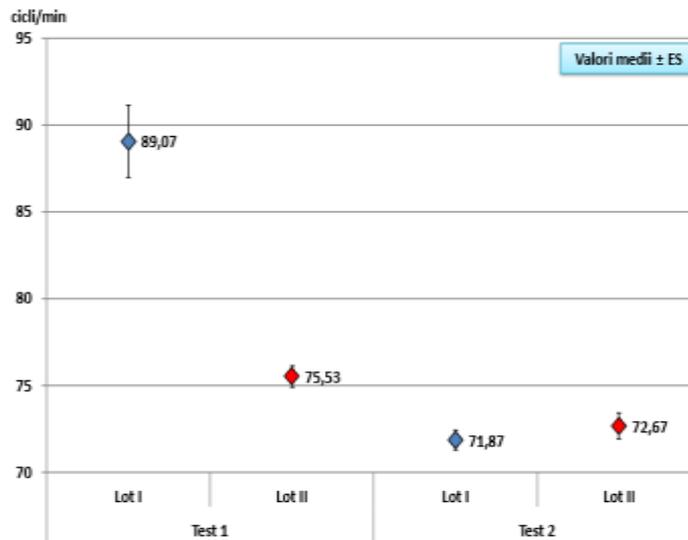


Figure 02. Test EmWave2 in the studied lots-score-testing 1 and 2

Analyzing the level of consistency (low, medium, high), the experimental lot obtained a visually higher value than the control group: 53.20 compared to 49, 87. (see figure no 3)

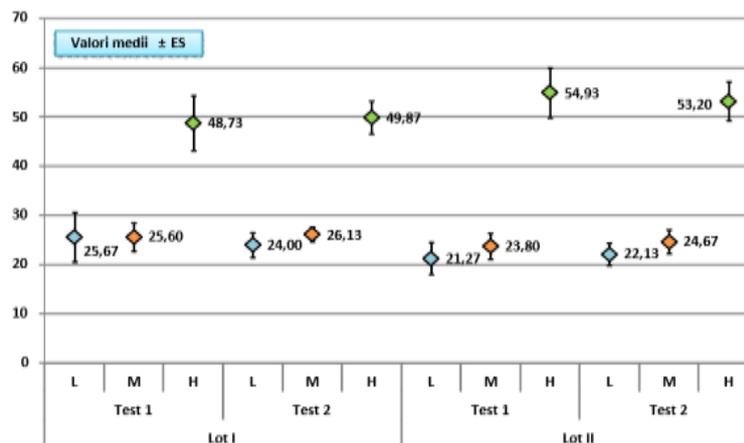


Figure 03. Test EmWave2 in the studied lots-levels (coherence rate)- testing 1 and 2

However, it is normal for some differences to occur, even if they did not intervene experimentally, given some natural conditions that intervene (equivalent batches, but more homogeneous athletes in terms of coherence indicators for lot II). A similar interpretation is also for the "duration of the test" variable, the coherence being reached by the athletes in the experimental group much more homogeneous (as a median value) compared to the athletes in the control group, although the actual time (the average number of minutes) is almost identical for the two tested groups.

6.1. Discussions

The desire to win is associated with stimulating emotions, increased confidence and psycho-physical resources involved in this approach, overcoming the previously estimated physical barriers where a series

of neurotransmitters and hormones (dopamine, adrenaline) are activated, a phenomenon also called "sporting fury" (Lazarus, 2000; McCraty & Tomasino, 2009)

When a coherent pattern of cardiac rhythm appears, physiologically it can be said that the subject is in an optimal state of efficiency, so that not only it feels better but it also feels a well-being state in all parameters: physical, emotional and mental. Coherence is not the same as being in a relaxed state; rather it is what athletes call the area of performance.

Researches have shown that stress and emotions of all kinds are reflected in our heart rate pattern. This is because what we feel causes changes in activity in our nervous system that affect the pattern of heart rate. This pattern is transmitted from the heart to the upper brain centers and influences how the brain processes the information. Feelings of frustration and anxiety determine the heart rate to become more disordered and irregular, inhibiting the superior ability of the brain to function and causing a leak of energy. On the other hand, feelings of love and appreciation generate a constant heart rate model that promotes the superior functioning of the central brain, increasing discernment in problem solving and refreshing memory. Positive emotions produce more orderly and coherent heart rhythms that reduce nervous system imbalance due to stress and facilitate cortical function (McCraty et al., 2014).

7. Conclusion

By applying the Emwave test in the two lots we have found the followings: from the comparison of batches, it results that the level of consistency in the experimental group has higher "high" levels, and that the distribution of these values is narrower (the lot looks more uniform after the high level, compared to the control group); the statistical analysis of the score values did not indicate statistically significant differences between the two groups ($p > 0.05$), initial testing therefore starts from an equal level of the batches, according to the average values of the scores and the EmWave levels. The final testing indicates a positive effect, after applying a mental training technique during one year, most of the subjects being able to relax.

The subjects in the experimental group were able to better manage their emotional responses and increased their level of coherence by using the Coherence Coach. Even though the control group was not regularly subjected to combined neurophysiologic control technique, the analysis of the EmWave2 test values showed positive effects in state coherence.

The specialists who work in the field of sport (technicians, coaches, researchers, sports sociologists, sports psychologists) systematically outlined the idea that sport science requires an interdisciplinary approach (Gill, 2006), where there are a series of problems related to motivation, innate abilities, personality features, training, socialization, material basis, stimulation, optimization, psychological training, etc. This integrative vision is all the more important when the goal is to achieve sporting performance.

Multimodal therapy and the mindset in stress and anxiety training proposed by Bergland (2017), Morton (2017) and Siegel (2017) in four steps show that the combined psycho-physiological adjustment technology is adapted to psycho- multimodal theory and mental formation.

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References

- Bergland, C. (2015). *The Athlete's Way. 5 Neuroscience Based Ways to Clear Your Mind*. Retrieve from <https://www.psychologytoday.com/blog/the-athletes-way/201504/5-neuroscience-basedways-clear-your-mind>, posted Apr 15, 2015.
- Biddle, S.J. (1995). *European Perspectives on Exercise and Sport Psychology*. Champaign, IL: Human Kinetics.
- Brown, S. (2015). 3 Strategies to Reduce Stress and Increase Athletic Performance. Retrieve from <http://www.stack.com/a/3-strategies-to-reduce-stress-and-increase-athletic-performance>
- Danish, S. (2001). *Sport psychology: Performance enhancement*. In D. Baltes & N. Smelser (Eds.), *International Encyclopedia of Social and Behavioral Sciences*. Oxford: Pergamon Press.
- Gill, D.L. (2006). *Psychology and the study of sport*. In J. Coakley & E. Dunning (Eds.), *Handbook of Sports Studies* (pp. 228-240). London: Sage Publications.
- Goldin, P.R., & Gross, J.J. (2010). Effects of mindfulness-based stress reduction (MBSR) on emotion regulation in social anxiety disorder. *Emotion*, 10(1), 83-91. <http://dx.doi.org/10.1037/a0018441>
- Grosu, E., F. Motică, F., C. Ordean, M., N., & Grosu, V. T. (2018). Increase Performances in Ski-Biathlon by Reducing Anxiety Stress Using Mental Training Techniques, *The International Scientific Conference eLearning and Software for Education*; Bucharest Vol. 3, :268-273. Bucharest: "Carol I" National Defence University, <http://dx.doi.org/10.12753/2066-026X-18-18>.
- Iluț, P. (2004). *Valori, atitudini și comportamente sociale. Teme actuale de psihosociologie*. [Values, attitudes and social behaviors. Current themes of psychosociology] Iași: Ed. Polirom.
- Inner, J. (2017). The Stress of Competition: Alleviating Athletes' Anxiety. Retrieve from <https://www.psychologytoday.com/blog/stress-remedy/201707/the-stress-competition-alleviating-athletes-anxiety>, posted Jul 22, 2017.
- Lazarus, R.S. (2000). *How emotions influence performance in competitive sports*. *The Sport Psychologist* 14: 229-252.
- McCraty, R., Atkinson, M., Tomasino, D., & Bradley, R.T. (2009). The coherent heart: Heartbrain interactions, psychophysiological coherence, and the emergence of system-wide order. *Integral Review* 5(2): 10-115.
- McCraty, R. & Zayas, M. (2014). Cardiac coherence, self-regulation, autonomic stability, and psychosocial well-being. *Frontiers in Psychology*, 5 (September): 1-13.
- Morton, C. (2017). *Stress Management Techniques for Sports*. Retrieve from <https://www.livestrong.com/article/551260-overcoming-fear-after-a-sports-injury/>
- O'Connor, M. (2005). *A history of Fear*. Professor Joanna Bourke in an interview.
- Robinson, A. (2017). *Dealing with stress in athletes*. Retrieve from <http://believeperform.com/performance/dealing-with-stress-in-athletes/>
- Siegel, D.J. (2017). *Mind: A Journey to the Heart of Being Human*. New York: WW Norton & Company.
- Spielberger, Ch.D. (Ed.) (2004). *Encyclopedia of Applied Psychology*, vol I-III. Elsevier Academic Press.
- Weinberg, R.S. & Gould, D. (2011). *Foundations of Sport and Exercise Psychology* (5th. Ed.). Champaign, IL: Human Kinetics.