ARENA-JPA, ISSN 2285-830X
5, pp. 110-115, 2016

Effects of acute psychological stress measurement in sports – EGIG, an innovative method to state stress response objectively

Arnold Nagy[1], Dóra Almási[2], László Balogh[3]
[1]University of Pécs, Doctoral School of Health Sciences
[2]University of Szeged, Gyula Juhász Faculty of Education, Institute of Physical Education and Sport Sciences
[3]University of Debrecen, Institute of Sport Sciences

Corespondence: László Balogh (e-mail: lasbalogh@yahoo.com)

The aim of this study is to find an objective way to measure the well-researched topic of the zone by stating that electrogatro-intestinography (EGIG) is able to monitor the athletes stress response through the gastric and intestinal motility. **Methods:** 15 healthy team- and motorsports athletes underwent a resting EGIG which took 40 minutes with an audio stimulus (AS) at halftime. Records were made by an Electrogastrographic Myograph System – developed by MDE Co. Ltd. **Results (n=15):** All subjects had valid EGIG records. There were significant responses to the AS in the stomach (p=0,000), small intestine (p=0,000) and great intestine (p=0,001) as well. There were no significant differences between the resting amplitudes prior to and following the AS. **Conclusion:** Stress response can be monitored by EGIG. The great intestine is the most sensitive on stress. The scales of optimal zones are expected by monitoring stress-response of the GI during training and competition compared with personal results.

Key words: stress response, gastric motility, sport, zone

Introduction

Great goal in sport psychology to being able to measure or even monitor the anxiety, thereby determine the optimal zone. This can be the next step improving the peak-performance of professional athletes. Hull declared the correspondence between performance and arousal in the Drive Theory (Hull, 1943). However the Yerkes – Dodson Law stated the best performance is in the optimal arousal zone, which is the peak of the Gauss-graph (Yerkes and Dodson, 1908)

In a modern approach we have to pay attention to the person himself. Therefore Hanin stepped forward and created his theory, the Individual Zones of Optimal Functioning (IZOF). According to the IZOF theory people's reaction to anxiety is different, which means that one will perform well at a lower level of emotions while another can reach peak-performance at a high anxiety level. (Hanin, 2000)

The measurement of the optimal zone can be approached by the Flow (Csíkszentmihályi, 2004). A great amount of researchers have dealt with the Flow in sports (Jackson, 1996; Jackson and Marsh, 1996; Balogh and Domokos, 2013; Balogh 2014). Yet the main methods are paper and pencil test however researches lately have monitored arousal using HR, ECG and acceleration sensors (Kusserow et al. 2010).

An innovative approach of determining the zone is monitoring the gastric and intestinal motility. Researches have proven that certain emotions can cause variations in the gastric motility (Fukunaga et. al., 2000; Vianna and Tranel, 2006; Vianna et. al. 2006.). However there are no researches giving objective numeric data on athletes' response to stress. Using an electrogastro-intestinographic device – which is able to monitor the gastric along with the intestinal motility in a non-invasive way – is a new method in sports.

Methods

15 healthy subjects participated in resting electrogastro-intestinography (EGIG). The participants were female and male, team- and motorsports athletes aging 24 (sd=3,2). Records were made in the morning fasting by an Electrogastrographic Myograph System – developed by MDE Co. Ltd. for Medical Research, Development and Manufacture. The device is a battery powered extracellular amplifier with four individual channels and a built-in recorder.

The EGIG sensors were placed on the abdominal skin and a reference sensor was placed on the right m. quadriceps femoris non-invasively while the subject was lying on a mattress supine position in a silent room. The recording took 40 minutes in total. In the first 20 minutes the subjects were resting. Exactly at 1200000 ms of the recording an audio stimulus (AS) was played by a mobile PA system at 105 dB. The second half of the recording was in rest too.

All the records were transformed by Adware Research Ltd. The transformed data was statistically analyzed in IBM SPSS v22 software. One sample T-tests were used to compare the time of peaks to the time of the AS. Paired sample T-tests were used to compare resting and peak CPM values.

Results

All subjects had valid EGIG records which showed responses of all subjects (n=15) in the first 18 (M18), between 18-25 (MAX), and after 25 minutes (P25), in the stomach, great intestine and small intestine as well.

The mean M18 amplitude of the stomach was 3,16 cycles per minute (CPM) (sd=0,28). Peaks were detected at 21,33 min (sd=2,22) following the AS at 20 min $t(14)=2,320$; $p=0,036$. MAX averaged 5,06 CPM (sd=0,80) which is higher than M18 $t(14)=-7,718$; $p=0,000$; and P25 3,27 CPM (sd=0,39). $t(14)=-7,345$; $p=0,000$. There is no significant difference between M18 and P25 $t(14)=-1,089$; $p=0,294$.

The small intestine M18 mean was 11,13 CPM (sd=0,35). The peaks were detected at 21,26 min (sd=1,75) following the AS t(14)=2,801; p=0,014; with 12,646 CPM (sd=1,26). MAX is higher than M18 t(14)=-4,568; p=0,000; and P25 10,91 CPM (sd=0,58); t(14)=-5,135; p=0,000. There is no significant difference between M18 and P25 t(14)=1,421; p=0,177.

M18 mean of the great intestine was 4,31 CPM (sd=1,46). The peaks were recorded at 21,80 min (sd=2,27) following the AS t(14)=3,066; p=0,008 with 9,96 CPM (sd=2,71). Therefore the MAX is higher than the M18 t(14)=-8,653; and P25 5,42 CPM (sd=2,66); t(14)=-4,002; p=0,001. However there is no significant difference between M18 and P25 t(14)=-1,429; p=0,175. The amplitudes of the great intestine in the three separated periods are shown by figure 1.

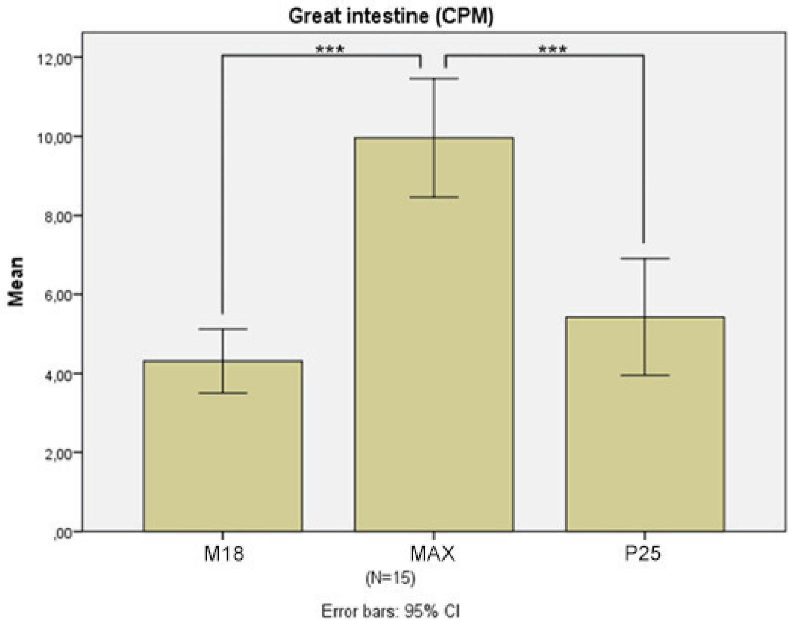

Figure 1. Amplitudes of the great intestine in the three separated periods.

Discussion

The results of the study support the hypothesis: arousal can be monitored by EGIG. All the three examined tracts of the GI reached CPM max significantly after the AS. The resting M18 and P25 amplitudes differed significantly from MAX values within the tracts.

The stomach, small and great intestine reacts similarly to stress however the great intestine is the most sensitive on the stress-response. The resting (M18) CPM was raised by 251% to peak. The small intestine was the only tract which had lower P25 values than M18, although it is not significant.

The relation between the resting and max values in EGIG is similar to ECG and HR monitoring (Dickhut, 2005). This indicates the monitoring methodology for further EGIG in sports. As in HR monitoring, not only the extreme values should be measured but the duration of rising and lowering as well (Yamamoto et al., 2001).

In conclusion the data of this study is the foundation for further researches of the optimal zone. It gives valid resting and basic stress-response CPM values. The scales of optimal zones are expected by monitoring stress-response of the GI during training and competition compared with personal results.

Funding: This work was supported by project PIAC13-1-2013-0201 '*A sportolók felkészítésénél jelentkező stresszhatás mélyrehatóbb vizsgálatához egy metodika és mérőrendszer kidolgozása a gasztrointesztinális motilitás(EGIG) és a kardiális változások alapján*'.

References

1. Balogh, L. (2014): To Be In The Zone – Stress And Sport Performance. In: Baczkó, I., Jost, N., Varró, A.(szerk) (2014): European Section Meeting of the International Academy of Cardiovascular Sciences (IASC). Programme and Abstract Book. IASC, Balatongyörök, pp 12-14.
2. Balogh, L., Domokos, E. (2013): Searching For The Perfect Experience: Through The Comparative Examination Of The Hip – Hop Dance And Handball. In: Baalgué, N., Torrents, C., Vilanova, A., Cadefau, J., Tarrago, R., (szerk) (2013): 18th annual Congress of the European College of Sport Science: Book of Abstracts. European College of Sport Sciences, Barcelona, pp. 265-266

3. Csikszentmihalyi, M. (1990): Flow – The Psychology of Optimal Experience. Harperperennial, London.
4. Dickhut, H.-H. (2010): Sportmedizin für Ärzte. Deutscher Aerzte-Verlag, Köln.
5. Fukunaga, M., Arita, S., Ishino, S., Nakai, Y. (2000): Quantitative Analysis of Gastric Electric Stress Response with Chaos Theory. Biomedical Soft Computing and Human Sciences, 5: 2. 59-64.
6. Hanin, Y. L. (1999): Emotions in Sport. Human Kinetics Pub Inc.
7. Hull, C. L., (1943): Principles of behavior. New York: Appleton- Century-Crofts
8. Jackson, S. (1996): Toward a Conceptual Understanding of the Flow Experience in Elite Athletes. Research Quarterly for Exercise and Sport, 67, 76-90.
9. Jackson S., Marsh H. (1996): Development and Validation of a Scale to Measure Optimal Experience: The Flow State Scale. JOURNAL OF SPORT & EXERCISE PSYCHOLOGY, 18, 17-35.
10. Kusserow, M., Amft, O., Gubelmann, H., Tröster, G., (2010): Arousal pattern analysis of an Olympic champion in ski jumping. Sports technology, 3, 192-203.
11. Vianna, E.P.M., Tranel, D. (2006): Gastric myoelectrical activity as an index of emotional arousal. International Journal of Psychophysiology, 2006: 61, 70-76.
12. Vianna, E.P.M., Weinstock, J., Elliott, D., Summers, R., Tranel, D. (2006): Increased feelings with increased body signals. Soc Cogn Affect Neuroscience 2006: 1, 37-48
13. Yamamoto K, Miyachi M, Saitoh T, Yoshioka A, Onodera S (2001): Effects of endurance training on resting and post-exercise cardiac autonomic control. Medicine and Science in Sports and Exercise 33: 9.1496-1502.
14. Yerkes R.M; Dodson J.D. (1908): "The relation of strength of stimulus to rapidity of habit-formation". Journal of Comparative Neurology and Psychology. 18: 459–482.