

INCREASE IN MILITARY LEADERSHIP SKILLS AND COMPETENCES OF FUTURE LEADERS THROUGH STRESS RESEARCH FINDINGS

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Abstract:

The article describes the term “stress”, how stress is measured and how conclusions for an effective and efficient training can be drawn to increase officer cadets’ leadership skills and competences based on stress measurements. With the so-called Clinical Stress Assessment method, which was invented by a prestigious stress-researcher, Austrian and Czech officer cadets have been examined for the last years by taking a capillary blood sample of 100 microliters from the fingertip. The blood sample is analysed within three minutes by special equipment and recorded by special software. After interpretation of the discovered data, adequate proposals how to organize a proper education and training can be made. In this paper, there are presented especially those findings which are related to leadership skills and competences; for example, how the sequences of education and training should be organised and which circumstances prospective, future military leaders should take into consideration in order to increase their personal and their future subordinates’ performance. At the end of the article the reader will know – because of understanding the term “stress” – that a “stressless” education and training will not create any improvement of skills and competences; without any mental and/or physical burdens there is no effect.

Keywords:

cadets, competences, leadership, overcompensation, stress

INTRODUCTION

It is known without any doubt that if officers face serious circumstances, such as in combat when the risk of death is present, the burden level is higher than in an everyday situation. Moreover, the officers take the responsibility for their subordinates’ lives; they have to make use of their leadership skills and competences which may be



reduced by an increased stress level. Hence, the author together with a prestigious stress researcher started in 2008 a project with Austrian officer cadets which aims at preparing future officers as good as possible for their profession; this project has been in progress ever since. This article summarizes the researches' findings and recommends some helpful ideas concerning an increase of military leadership skills and competences to persons at Basic Officer Education Institutions (BOEIs) who are responsible for the education, as well as to the officer cadets themselves.

1. METHODOLOGY

1.1 What is Stress?

The term "stress" is very often mixed up with the term "stressor". The latter expression describes a certain burden for an individual. According to stress-researchers, the definition of stress is: an individual reaction of the human being body to a physical and/or mental burden or stimulus [6], [7]. This reaction can be aptly measured by metabolic data and its interpretation detected with special technological equipment.

As a reaction to a physical and/or mental burden the individual's blood acquire more acid. Acid blood reduces the transport capacity of oxygen which is needed for the brain and muscles to work properly; therefore, the body has developed automatic systems to change the blood into more alkaline again. But the turn to alkaline does not stop at the usual blood pH-value, which is on average at 7.4, it turns more to the alkaline side – this is called "overcompensation"; it only takes place in recreation periods [6]. The purpose of the overcompensation is to prepare the individual better for future burdens – in other words it is called "training"; the entire metabolic system of the changes is called stress. Assuming that military leadership skills and competences are trained and if during this training the quantity of burdens can be measured properly, effective and efficient ways of training can be developed and valid conclusions can be drawn. The following figure illustrates the above mentioned overcompensation.

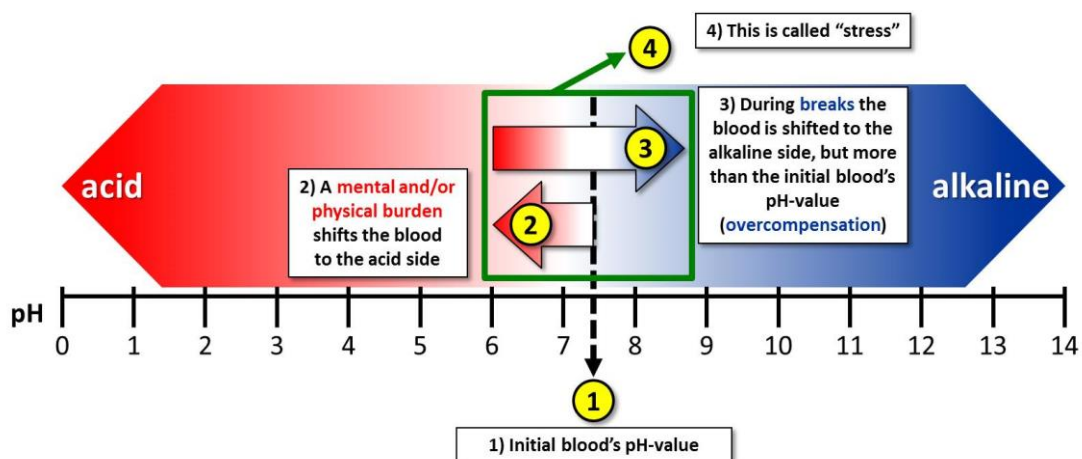


Fig. 1. Illustration of overcompensation

Source: Own study



1.2 The Clinical Stress Assessment (CSA) Method

A persons' workload, stress compatibility, duration of stress, intensity and a type of stress can be determined within three minutes by Prof. Porta's CSA method [1] by collecting about 100 microliters of capillary blood, usually from the fingertip. The sample is routinely analysed for pH, pCO₂, pO₂, O₂-saturation, ionized magnesium, ionized potassium, ionized calcium and ionized sodium, lactate, blood glucose, base excess and HCO₃ [3]. All this data is determined by special technical equipment and it can be analysed with CSA software to quantify the individual's burden. The technical equipment can be also used in the field.



Fig. 2. Taking of a blood sample in the field before and after a leadership task

Source: Own study



Fig. 3. Analysing of a blood sample with the Nova Biomedical Phox-M device

Source: Own study



The blood samples are analysed with a so-called Nova Biomedical Phox-M device. As mentioned above, within a few minutes the results are recorded by special software. Thereafter, through comparing the blood's composition and changes before and after specific military leadership burdens, the following conclusions can be drawn: how stressed the tested persons are (even before a given task), how much time they need to rest, how often and intensive training they need – in short, an effective and efficient training can be proposed. Simultaneously, it is possible to detect a lot of other findings with reference to military leadership – they are described in the next section.

2. FINDINGS WITH REFERENCE TO MILITARY LEADERSHIP SKILLS AND COMPETENCES

The first experiments were conducted during a 2-week entrance exam when candidates for officer cadets competed for a place to study at the Theresan Military Academy (TMA). During the exam the candidates were tested in 40 different disciplines. It can be assumed that they took all the exams seriously, because their finally achieved total number of points was decisive if they were accepted as officer cadets or not. The benefit was to be able to compare all the ascertained metabolic data with the achieved points – which allowed for drawing various conclusions.

An interesting assumption could be drawn when comparing the lactate status before the obstacle course competition with the points achieved after the run. Three outsiders could be determined. The following figures show the results before and after eliminating these outsiders from the statistics.

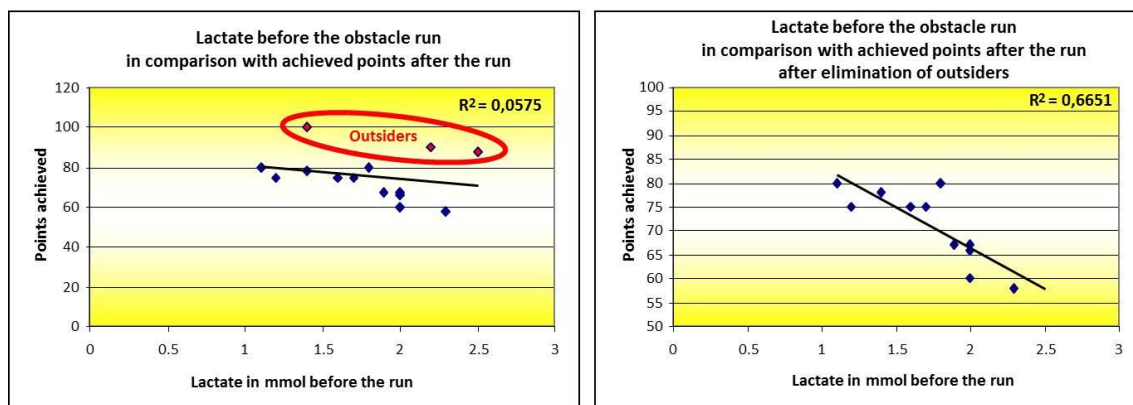


Fig. 4. Comparison of lactate before an obstacle run with points achieved afterwards [2]

Source: Prof. Porta's CSA software; figure reshaped by the author

Interpretation with reference to military leadership:

- after a talk with the three outsiders it appeared that they knew before the run that they would not receive a study place because of failing in tests before. This means that with measuring the blood, the attitude for fulfilling a certain task can be determined; all research is done before the task starts. Hence, if a Commanding Officer has this information available, he can select the right persons for the right tasks;



- the same total number of achieved points means that the candidates ran the same time, but the real efforts were different – it is shown by the lactate values. The officers always need additional reserves for leadership tasks – and this ability must be trained; therefore, even if the number of achieved points of different persons is the same – a given person must be trained more because there is a danger that in serious situations not enough individual reserves are available. The CSA-method can exactly determine who needs an additional training, independently, if there is a need for a mental or a physical training.

Another blood samples were taken before, during and after the exam which provided the most achievable points, the military leadership task. The candidates had to launch an attack according to the military principles with soldiers they had never seen before. The following figures show a comparison of pH-values before the exam with the points achieved afterwards – again before and after eliminating the outsiders whose situation was still mentioned above.

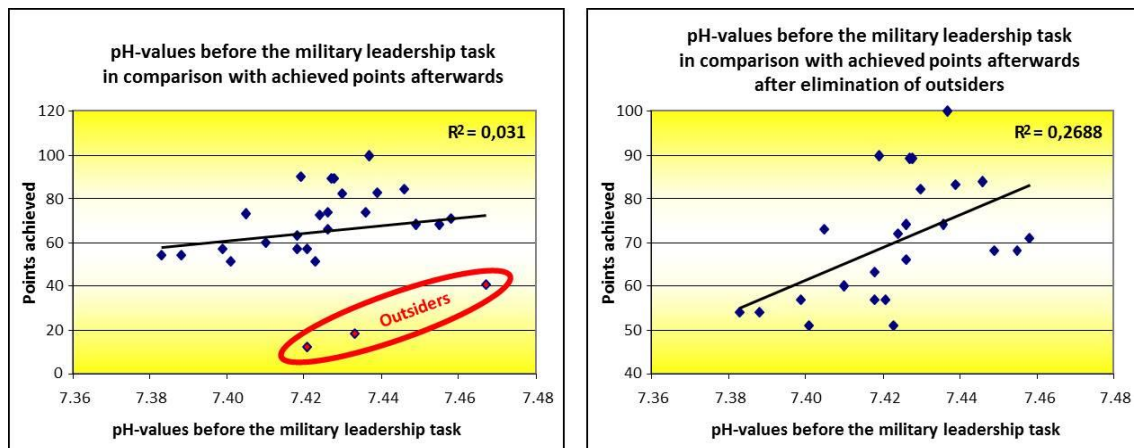


Fig. 5. Comparison of pH-values before the military leadership task with points achieved afterwards [2]

Source: Prof. Porta's CSA software; figure reshaped by the author

Interpretation with reference to the military leadership:

- again, the three outsiders knew that they would fail in the exam before; that is why their attitude was not the best – it could be identified with their metabolic data;
- the exam was a typical military leadership task. Those ones who had a more acid pH-value before the task showed worse performance afterwards – it was an indicator that they were nervous in terms of being burdened before the task. Being aware of these facts, an officer responsible for officer cadet training schemes is able to create an efficient and effective training specifically designed for weaker persons.

During the test phases, by organisational failure, the candidates had to wait in an assembly area up to an entire day until they were called for the exam. The figure herein-



after shows the changes of base excess values which are a feedback control system of the body to avoid that the blood becomes acid – compared with the duration of the waiting period.

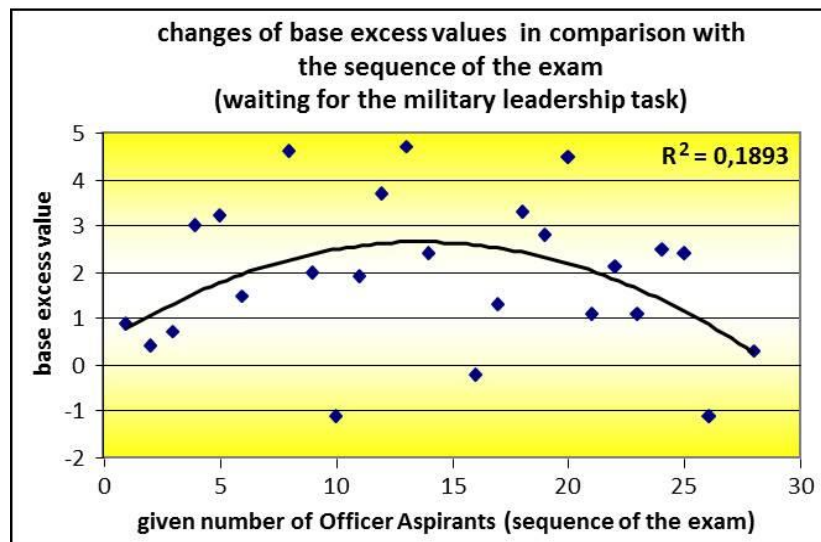


Fig. 6. Comparison of base excess values' changes during waiting for the military leadership exam [2]

Source: Prof. Porta's CSA software; figure reshaped by the author

Interpretation with reference to the military leadership:

- the measurement results showed that at the beginning of the day the candidates were nervous, in the middle of the day not that much – the author concludes that because of receiving some tasks such as organising the supply, and towards the end of the day they became more and more nervous again;
- based on other test phases such as with officer cadets from the University of Defence in Brno in 2015 it can be concluded that waiting periods without any tasks make soldiers more and more nervous. Being burdened with a serious task after the waiting period causes a reduction of body-reserves in such a way that the upcoming task cannot be accomplished properly;
- therefore, military leaders should never let their soldiers just wait without any task. Conducting some light tasks would be helpful. Furthermore, any information concerning next steps of the unit after the waiting period will reduce nervousness and ensure reserves for the upcoming task.

When the future military leaders are trained or, when after graduation they have to organise a training for the subordinate personnel, the sequence of burdens and recreation phases is to be adjusted accordingly. On the one hand, without a burden there is no training effect and individuals will not become better. On the other hand, too many burdens within a short period of time will create negative effects. It even may happen



that too much training within a short period of time causes becoming worse – which is called “overtraining”. The following sketch illustrates these effects.

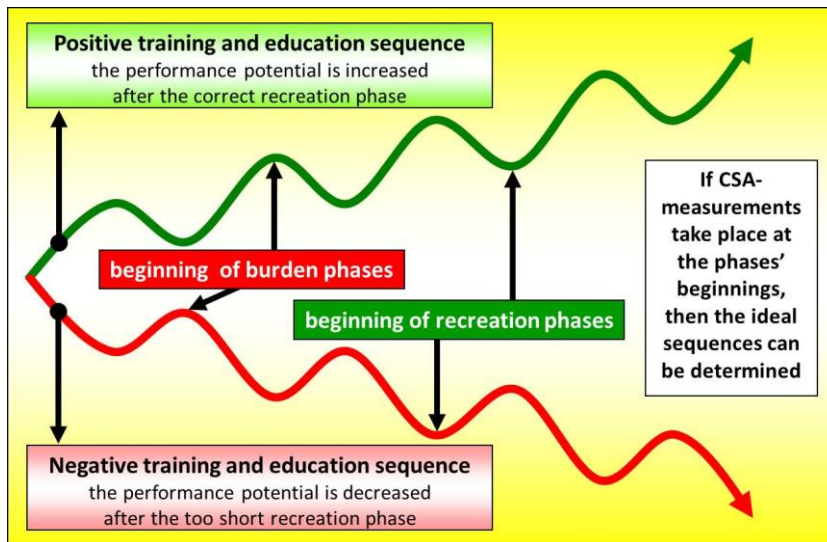


Fig. 7. Illustration of training effects

Source: Own work

During research-weeks at TMA, the officer cadets were burdened mentally to determine the correct training sequence according to Figure 7. In a lecture room they had to fulfil challenging tasks in tactics led by a very tough instructor for two hours. Even though the cadets knew that it was a research experiment with no effect on their grades, considerable metabolic changes in their bodies were recorded. The following graphs show the group-average changes before and after the mental burdens of the pH-value, lactate and base excess. The latter is an indicator for the initiating of the overcompensation. All the graphs show that the officer cadets were burdened heavily.

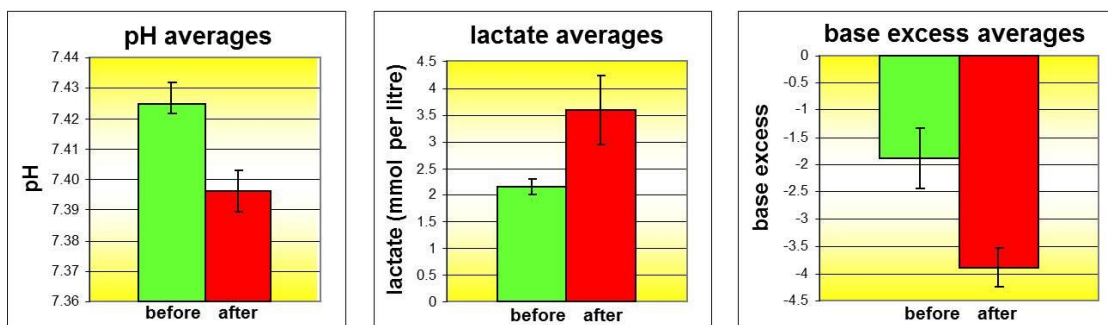


Fig. 8. Comparison of group metabolic changes caused by just mental burdens [2]

Source: Prof. Porta’s CSA software; figure reshaped by the author

Interpretation with reference to the military leadership:

- further measurements with the same group showed that the officer cadets needed two weeks for reaching the metabolic baseline values again. This means that just a 2-hour mental burden requested two weeks of recovery! Within these two weeks the chances for fulfilling other challenging tasks



properly were reduced. Based on the above, it can be stated that for increase of military leadership competences, mental burdens must be trained – for the beginning of the training a challenging mental burden every two weeks would be an ideal approach. After some sequences, the time frame may be reduced according to the training effect;

- the officer cadets belong to a so-called primary group; it means that they are selected in a roughly equal way and that during their education the physical and mental burdens are applied essentially equal. In spite of that, they are of course individuals and react on the burdens in different ways. If now, metabolic measurements for each burden are not available, which is logical from the practical point of view, the best way to train officer cadets is to treat them equally. This concerns also their responsibility for their later subordinate personnel. Other measurements with the candidates for officer cadets confirmed this finding, i.e. during the exercise, a few of them had to carry heavy equipment – such as heavy machine guns – they had no chance for recovery and their performance became worse and worse.

With the CSA-method the blood samples are also investigated concerning the Magnesium (Mg) level. One of the most important functions of Mg is the transport of energy to the muscles and to the brain. A lack of Mg reduces performance automatically [4], [5]. Because of the lack of Mg in the daily meals, a daily its substitution of about 300 milligrams is recommended to reach an average performance [6]. During a longer period of sleep deprivation the Austrian officer cadets were measured with the CSA method. The Figure 9 shows their Mg-status (left) [2] in comparison with the Czech officer cadets (right) who were measured with their base values, after a 2,400-meter run and after an approximate 2-hour recreation period.

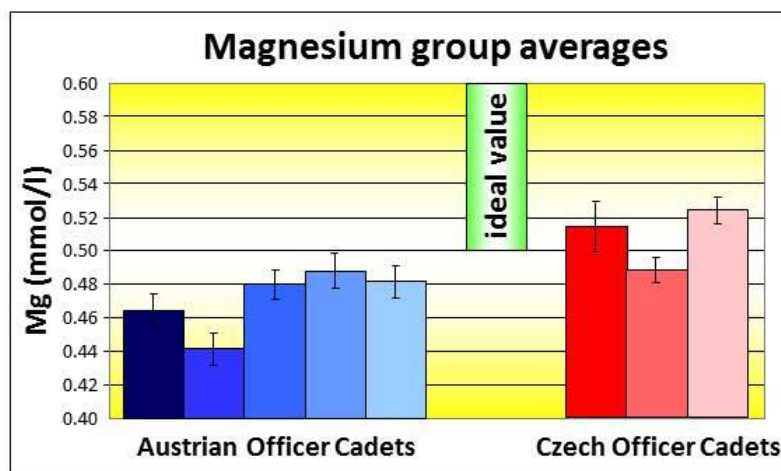


Fig. 9. Comparison of group Magnesium values of the Austrian and Czech officer cadets [2]

Source: Prof. Porta's CSA software; figure reshaped by the author

Interpretation with reference to the military leadership:

- the Figure 9 shows that the Austrian officer cadets have a lower Mg-value, most probably because of their more intensive burdens during a 36-hour



sleep deprivation. The Mg-values of both groups taken immediately after a 2,400-meter run are quite similar; they are: the three right pillars of the Austrians and the middle pillar of the Czechs. It can be concluded that both groups faced a similar reduction of the Mg-value. If such an effect happens, the energy transport to the muscles and to the brain is reduced – there are limited reserves for potential leadership tasks. Since all the Mg-values are either below or at the bottom of the ideal value, the cadets need a proper Mg-substitution in order to fulfil their tasks properly. The leaders should take this finding into consideration and apply correspondingly when requesting a certain performance;

- other measurements have showed that an alcohol level up to 0.5 per mille does not have a considerable effect on the Mg-value. Yet, when the alcohol level is above 0.5 per mille, the Mg-value decreases progressively. If challenging tasks are forthcoming, this knowledge must be essential for a military leader.

Another research on changes in metabolic data of the officer cadets was done with reference to internationalisation. Since a considerable number of them are sent abroad, the author wanted to examine if, apart from the other data, changes of the blood-ingredients may have also any effect on the leadership competences. For that purpose basal data blood samples of the officer cadets who spent a semester abroad were compared with those ones who were not abroad. The results, mainly differences in base excess, calcium and potassium, as well as correlations between the pH-value with pCO_2 and pO_2 showed astonishing results.

- The base excess, calcium and potassium of the non-mobility officer cadets are significantly lower; it is an unanimous indicator of increased basal metabolism. In other words, those officer cadets who spent a semester abroad achieved during this period competences to manage challenges better in comparison with the non-mobility ones. The reason for the better competences is quite speculative, but it can be stated for sure that the result is a positive one;
- The comparison between the blood pH-value and pCO_2 , as well as the blood pH-value and pO_2 is a possibility to determine mental arousals. When comparing this data, the results showed that the non-mobility officer cadets need for the same pH-value a double increased exhalation which is an indicator for mental infuriation. Simultaneously, the mobility officer cadets have 65% better saturation of oxygen, that is why they profit from a better oxygen-supply to the muscles and the brain.

As a consequence, it can be stated that going abroad for longer periods causes an increase in competences of officer cadets because the chances to manage challenges better and their resilience in terms of having more reserves available are increased. Of course, the reasons for the abroad achieved competences are still uncovered, but the



positive effect can be measured. These results may also encourage the BOEIs personnel that implemented a strategy of internationalisation to continue their way.

CONCLUSIONS

In terms of increase in the leadership skills and competences the Clinical Stress Assessment method is a useful tool to discover the effective and efficient avenues of approach. The metabolic changes – called “stress” – in different situations with different burdens can be measured very accurately. The results of this data can advise individuals and groups – in fact those persons who are responsible for education and training, as well as those ones who are undergoing it – how to train the skills and competences in the best way with the best sequence. If we determine “stress” as the individual reaction on a mental and/or physical burden, then it can be concluded that a stressless education does not have any training effect at all; moreover, it is actually vice versa, skills and competences decrease progressively.

SUMMARY

The persons being responsible for the Basic Officer Education have the commitment to organise it in the most effective and efficient way. Thus, some years ago at the Theresan Military Academy the research project started. It applies the so-called Clinical Stress Assessment method to measure officer cadets’ metabolic data for the purpose to educate and train them efficiently; it also increases their skills and competences with main focus on the leadership ones. Among other findings, by measuring the metabolic data, the following predictions can be made: how somebody will fulfil a certain task, how to deal with waiting periods, how to train mental burdens to have more reserves for leadership tasks available, how to train a group, how much Magnesium is needed to fulfil tasks properly and how to deal with alcohol. Finally, based on the measurements, it is stated if officer cadets’ competences increase by exchange periods.

REFERENCES

1. Author’s remark: Univ. Prof. Dr. Sepp PORTA is the Head of the Institute for Applied Stress-Research in Dillach/Austria. He has developed a new method for stress-diagnostics. Within the framework of this stress research project the Theresan Military Academy cooperates with him mainly for the purpose to detect new methods for increasing leadership skills and competences of officer cadets.
2. Gell H., *Führungskräfteauswahl – Optimierung der Führungskräfteauswahl für Einsatzorganisationen (First Responder) durch neue Methodiken mit besonderer Berücksichtigung der Auswahl beim Militär*. Translated into English: *Selection of Leaders – Optimisation the Selection of Leaders for Emergency Organisations (First Responder) by new Methods, with special Consideration onto the Selection within Military*. Books-on-demand, Berlin 2011, p. 130, 135-137, 152, 155, 224, 230-231. ISBN 978-3-86386-112-4.



3. Porta S., Desch G., Gell H., *CSA – Clinical Stress Assessment*. Biomedical Science, Engineering and Technology, Chapter 20. Rijeka 2012, p. 489-490. ISBN 978-953-307-471-9.
4. Porta S., Gell, H. et al, *Direct correlation between Mg⁺⁺ changes and awarded scores in military steeplechase (HIB)*. Dustr publishing company, Deisenhofen, 2009, volume 26/4th quarter, p. 177-180. DOI 10.5414/TEP26177.
5. Porta S., Gell H. et al, *The role of ionized magnesium in metabolic changes during 54 hours of exhaustive sleep deprivation – a case report*. Dustr publishing company, Deisenhofen, 2011, volume 28/2nd quarter, p. 83-87. DOI 10.5414/TEP28083.
6. Porta S., Hlatky M., *Stress verstehen – Burnout besiegen*. Translated into English: *Understand stress – defeat burnout*. Publishing company of the medical doctors. 1st ed. Vienna 2009, p. 15, 74-84, 135. ISBN 978-3-902552-43-3.
7. Selye H., *The Stress of Life*. McGraw-Hill, edition 1978. University of Michigan 1956, p. 61, p. 472. ISBN 0070562121, 9780070562127.

ABBREVIATIONS

BOEIs	Basic Officer Education Institutions
CSA	Clinical Stress Assessment
HCO ₃	Hydrogen Carbonate (Backing Soda)
Mg	Magnesium
mg	Milligram
mmol/l	Millimoles per Litre
O ₂	Dioxygen
O ₂ -saturation	Dioxygen Saturation
pCO ₂	Partial Pressure of Carbon Dioxide
pH-value	Power of Hydrogen / Potential Hydrogenii (Acid-Base Value)
pO ₂	Partial Pressure of Dioxygen
TMA	Theresan Military Academy

BIOGRAPHICAL NOTE

Harald GELL, PhD, MSc, MSD, MBA is the Chairman of the Implementation Group which has the task to implement the goals of the “European Initiative for the Exchange of Young Officers Inspired by Erasmus” on EU level. He is also the Head of International Office and Senior Lecturer at the Theresan Military Academy and is responsible for all international activities. He has combined years of stress research in 89 publications, in 18 scholarly books and module descriptions, and in 52 international conferences with



findings from international exchanges to propose effective and efficient increase of the military leadership skills and competences.

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