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**Physiological effects of food and drinking  
water used and consumed by the Hungarian  
Armed Forces, the investigation of these  
effects with particular regard to the  
importance of nutrition and microflora**

**Theses Booklet**

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## THE BACKGROUND OF TOPIC SELECTION

The individual's state of health is determined by several combined factors. Basically, it is



influenced by the economic, physical and social environment, the health care system and the cultural environment. A person's genetic make-up and lifestyle also affect their health in their later life. In the 21st century, health-conscious behavior plays an important role in the preservation of health. Members of the armed forces, who are part of the society, are no exception to this. Soldiers sometimes have to perform unusual tasks, e.g. in a war.

**Figure 1. General, social, economic, cultural, environment conditions**

According to the glossary of health sciences, health-conscious behavior includes all purposeful human behavior that requires active participation in screening tests, knowledge of the possible outcomes of diseases, patients' rights, preventive health behavior, behaviors that promote health maintenance and health development, such as nutritional control ,doing sports,the use of seat belt, or safe sexual behavior. Studies show that these behaviors are the result of active decisions, which demonstrate a high level of health awareness. It is difficult to maintain health-conscious behavior in certain life situations and jobs. In this regard, special attention should be paid to those working in the armed forces and those who work in law enforcement . Here, the maintenance of health is an essential condition due to the fact that they can be enlisted any time. The physical and mental demands associated with this service often generate a process in the wrong direction. This is also an extremely important and decisive finding, because the extension of the retirement age in the professional workforce falls exactly on the interval

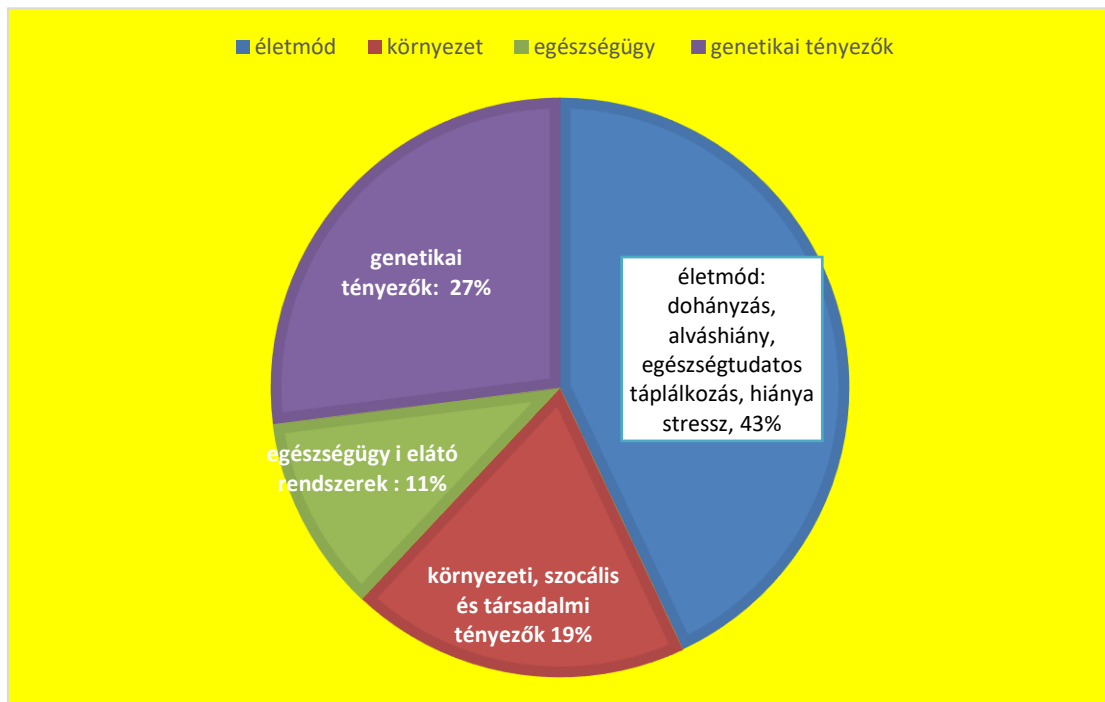
when the mortality and morbidity indicators of the Hungarian population - taking into account similar data from European states - put our country in second last place. As a result, it would be important to prognosticate the occurrence of diseases in the career of the workers of armed forces and law enforcement from the point of view of health-conscious behavior.

## **A SCIENTIFIC PROBLEM**

As a result of the accelerated modern lifestyle, people's nutrition has also changed. It was first defined as "diseases of civilization" by Hugh Macdonald Sinclair (1910–1990), an English doctor and nutritionist in the middle of the 20th century. In his research report published in "The Lancet" in 1956, he listed the following diseases (diabetes, cardiovascular disorders, cancer, etc.) in the development of which factors related to nutrition play a primary role.

In 1974, the Canadian Minister of Health and Welfare, Marc Lalonde, published a publication entitled "A new perspective on the health status of Canadians". The most important point of the publication is that improving the environment (structural approach) and human behavior (lifestyle approach) would result in a significant reduction in morbidity and premature death. As a result of the report, the Canadian government changed its policy from the treatment of diseases to their prevention and, ultimately, to the promotion of health.

Pie chart 1 illustrates the model developed by Lalonde, which divides the factors affecting the health status of the population into four parts : genetic background, lifestyle, quality of health care, and environmental and social factors. From the chart, it can be seen that our lifestyle influences our health in 43%, and within this, it attributes great importance to nutrition, but also to exercise.



**Figure 2. The model developed by Lalonde**

Within lifestyle, nutrition and sports play a major role in preserving the fighting ability of soldiers. Unhealthy nutrition means consuming excessive amounts of improperly composed, foods high in energy but poor in nutrients. These are mostly foods rich in simple carbohydrates, saturated fats, and animal proteins and they are low in fiber. Fluid intake is inseparable from nutrition. There is a significant correlation between dehydration, i.e. the degree of lack of fluid, and the decrease in performance. The greater the lack of fluids, the more physical strength and concentration decrease. Obesity is closely related to nutrition and a sedentary lifestyle. Obesity has become a global epidemic; already in 2014, 60% of the Hungarian population was obese, and this symptom was also present among soldiers and NATO personnel. In my dissertation, I mainly dealt with military nutrition.

How current the topic is also indicated by the fact that in recent years, 20-25% of the health-related unfit ratings among the staff applying for missions were related to or influenced by lifestyle and nutrition (e.g. obesity, high blood pressure). Over the past 30 years, obesity, one of the most characteristic data of body composition, has also shown an increasing trend among members of the armed forces. The number of abnormally obese people has more than doubled since 1980. Obesity (obesitas) increases the risk of many civilizational diseases, and the already existing diseases get worse. Thus, the

worldwide spread of obesity can have serious consequences for the army as well. It can question not only the soldier's physical fitness, but also his medical fitness. The primary purpose of determining the physical fitness and body composition prescribed in the army has always been to select and keep the most suitable persons for military service. Overweight and obese soldiers undergo medical treatment more often or for a longer period of time, i.e. they are temporarily unfit for service or permanently unfit and are forced to leave the army.

Nutrition, movement, the body's biorhythm, stress, and quality sleep all affect the human microflora, which - based on continuous research - plays an increasingly important role in human health. The proportion of beneficial microbes in the intestinal flora of the Hungarian population is a total of 12% compared to the optimal 45%. This rate is over 40% on average in the European Union.

A healthy intestinal flora contributes greatly to our health. A global pandemic breaking out today is not only associated with a rapid increase in civilizational diseases, but also with the spread of infectious diseases, as it was in past centuries. An example of this is that the COVID-19 SARS-COV"2 pandemic that broke out at the beginning of 2020 significantly changed people's lifestyles. During the lockdown, the majority of people stopped their usual, regular work, many lost their jobs permanently, and at the same time, the members of the professional staff of the national defense and health workers were subjected to extreme physical and mental strain. The daily news about the epidemic was often a source of stress in itself. The changed rhythm of life and the lack of sleep upset the energy balance. The significant increase in the price of food makes healthy eating even more difficult. Unhealthy eating habits significantly increase the risk not only of civilizational diseases, but also the risk of serious complications of the infection.

The immune system weakens as a result of an unbalanced diet, stress, little exercise, and lack of sleep. Replacing of trained soldiers is difficult, takes a long time and is expensive, and it is even more difficult in the case of airmen, which is why primary prevention, i.e. the prevention of diseases, is important.

## **RESEARCH OBJECTIVES**

In connection with my thesis, I defined the following research goals:

- In the case of personnel performing increased physical activities, including a brief historical review, I will reveal the nutritional and fluid consumption habits, how they affect the ability to fight and the preservation of health.
- With the help of the analyzed menus, I should highlight the shortcomings, and in order to facilitate the work of the menu designers, I should propose the use of a modern menu analysis program (NutriComp).
- I investigated the nutritional and fluid consumption habits of personnel serving in climates different from ours with a questionnaire survey. Based on the study of the German and Italian MRE package, as well as the questionnaire survey, I recommend the modernization of the Hungarian package.
- I summarize the practical importance of the human microflora - especially probiotic strains - and make recommendations for the selection of suitable strains and their use in the armed forces, which can contribute to the improvement of the mental and physical endurance of personnel

## **HYPOTHESES**

In my thesis, I want to prove the following hypotheses:

- 1.** In my dissertation I wish to prove the following hypotheses: Food industry leaders find it difficult to provide the conditions for health-conscious eating for food standards. This is indicated by the fact that HM Decree 14/2018 (IX.17) is based on Decree 37/2014 (IV.30) on nutrition standards for public catering. In contrast to the EMMI regulation, it does not define energy values or guidelines for individual groups of norms.
- 2.** Food management significantly improved by introducing a menu analysis program.
- 3.** The unhealthy diet caused by different and often compelling circumstances is closely related to the diseases of civilization that appear more and more frequently among the personnel of the Hungarian Defence Forces. The performance of soldiers serving in climates different from our country significantly depends on fluid consumption and nutrition.

4. During the foreign service, MRE packages are often consumed, the modernization of the domestic MRE package is justified.

5. The currently known expectations of healthy eating in various fields of operation cannot be realized. Non-communicable diseases resulting from poor nutrition can be effectively prevented by using probiotic strains.

## **RESEARCH RESULTS**

1. I was the first to summarize the dietary recommendations in force for the different groups of norms regarding the personnel of the Hungarian Army, and based on the conclusions drawn from them, I proposed to modernize the current food supply.

2. I have clearly demonstrated that raising the standard costs, which will allow the purchase of higher quality raw materials, is not in itself sufficient to create the conditions for healthy eating, and that educating the military on health-conscious nutrition is also a necessary condition. If these factors are available, then the menu design can be.....

3. Based on the interviews carried out, I found that the II and III norm systems also partly follow the principles of sports nutrition, however, due to its unpredictability, this cannot be implemented under mission conditions as a special norm.

4. With my questionnaire survey, I identified the dilemma I raised in my hypothesis 4 that the personnel serving in the mission do not consume enough fluids. I have shown that about 65% of those involved in the service consume 2 litres or more of water and dehydrating liquids such as soft drinks, coffee, rarely energy drinks in addition to water, even under mission conditions.

5. During the comparative examination of foreign and Hungarian MRE packages, I found that the content of foreigners is different from the Hungarian one. The energy content of the Hungarian package is also satisfactory, however, it can be proposed to supplement it with a water disinfection pill and the offer raised during the questionnaire survey to expand the range with more solid complementary foods

6. I have proven with my research, supported by literature recommendations, that the use of *Saccharomyces Boulardii* strain is also effective in the mission for the treatment and prevention of diarrhoea during travel, i.e. prolonged targeted use of the appropriate probiotic strain leads to results.



## **RESEARCH METHODS**

I used the following research methods:

1. 14/2018 on the food supply of the Armed Forces. (IX. 17.) HM decree contains the rules for food supply. Since January 2019, I have been continuously collecting the menus of the different norm groups. In my dissertation, I present a menu analysis based on a nutrient table. (Attachment 1)
2. I compiled a sample menu related to norm group III (Attachment 2)
3. I analyze a breakfast in terms of minerals, vitamins and macronutrients with Nutricomp, the most modern of the various menu analysis programs. (Attachment 3)
4. In order to test the legislation on food, I conducted structured interviews using retrospective methods (the results of which are described in details in Chapter I.) With the help of the MH Logistics Center, I conducted a questionnaire survey among members of the armed forces serving in countries with different climates, and sometimes open questions were also used.
5. The practical use and popularity of probiotics were investigated as a deductive method with a questionnaire survey containing closed questions and drew conclusions regarding the armed forces. I studied the strains found in randomly selected preparations that can be purchased at the pharmacy, according to the criteria for probiotic strains.
6. I took part in professional conferences, trainings and courses, and I constantly followed the current professional literature.

## **LIMITATIONS OF RESEARCH WORK**

In the interviews presented in the first chapter, with the exception of two units, the food department managers and canteen managers were readily available to me. With one or two exceptions, the locations of the interviews were in the countryside, I organized them myself and covered their costs. I had to obtain different entry permits for the different formations, so I arranged the interviews weeks in advance. However, I can consider myself lucky that I managed to complete all the interviews by the first week of March, before the declaration of the 2020 state of emergency. For the interviews

presented in the thesis, I had to ensure complete anonymity, so I did not describe the units I visited in details.

Unfortunately, I did not have access to the Nutricomp program recommended in my dissertation at university. I even contacted dr. Lajos Bíró, the developer of the program who explained the various menu analysis programs in details and offered a discount for the purchase, but he could not provide free access either. At the HM Health Center, I had to request a special research permit from the medical director. I have been collecting menus continuously since the first year, but due to the lack of a menu analysis program, a detailed analysis was not possible. Another problem with the menus was that they lacked the raw material specification, which is essential for using the program, so I calculated the average with the help of a cookbook. As the respondents skipped several questions in the questionnaire especially in the probiotic questionnaire, the evaluation was more difficult.

## **SUMMARY OF THE RESEARCH**

I draw the following conclusions from the interviews mentioned in the first chapter:

In 2018, product data sheets were developed for thousands of products based on the food book in order to achieve better quality meals. However, instead of using the product data sheets, the previous contract has been extended, which does not guarantee quality, since the supplier companies are competing in terms of prices. In order to control the quality, it would definitely be justified to maintain an independent food testing laboratory at the national defense.

In order to implement a healthy diet - especially in mass catering - the acquisition of a menu analysis program (e.g. Nutricomp) is essential and recommended, but it is even more important to educate soldiers on health-conscious behavior.

Allergens, macronutrients and energy values must always be listed on menus.

Regarding my analyzed menu, I draw the following conclusions:

Quantity plays an important role in meals as well, and this is an important aspect in case of soldiers when compiling menus. When someone feels full depends on the filling value of the food and it differs in every person. Variety of food is something that should definitely be strived for, this applies to taste, raw materials, and state of matter as well. The repetition of one type of food should preferably occur every 3-4 weeks. Exceptions

to this are fruits, salads and raw vegetables. It is important that successive courses have different tastes. The variety of food textures is also important.

Of course, kitchen technology must also be taken into account when planning the menu, more specifically, the equipment and the level of mechanization of the kitchen. In terms of daily nutrient needs, breakfast covers 25-30%, lunch approximately 50%, and dinner 20-25% so it really matters what kind of meal the food caterers serves. It is also important to know the nutritional content of foods. The necessary caloric value should be covered primarily from complex proteins and slow-absorbing carbohydrates, and the consumption of foods fried in fat and sugar should be moderated.

Tradition plays a big role in the diet, i.e. the manager of the restaurant must know the needs of the consumers.

During the menu planning, the meat dish is planned first, then the accompanying side dish, then the soup, followed by the dessert or fruit. In the course of menu planning, the revision of the recipes would be justified, although some units indicated that this had already happened, but it is not clear whether new recipes were included or the old ones were rewritten, for example a side dish was replaced. I also consider it necessary to indicate the calorie content and allergens, and some units have already done so. I agree that in the absence of a menu analysis program, this is almost impossible; calculating the calorie content of food is a task that requires a separate person.

Eating determines both our well-being and mood. Its further socio-political significance is that it affects the culture of nutrition and, not least, changes lifestyles in the right direction. If there is no serious need for dietary meals, I do not consider it necessarily justified. Based on the interviews, I saw that this problem only affects few people, so it really wouldn't be norm-effective.

In my opinion, it would not be appropriate to define the content within the norm group in legislation, but it would be helpful to make recommendations and summarize it in a booklet.

By further increasing the norm, a better quality service can be achieved, but even with the current norm alone, much healthier food could be prepared if modern kitchen technology equipment was available. The kitchens should be renovated and modernized, the workforce, especially the cooks, should be motivated, and the receiving party, i.e. the members of the armed forces, should also be open to health-conscious nutrition.

In Chapter 2, food safety, I presented the most common food contaminations in the 21st century and the factors that affect food safety.

In the 3rd chapter about missions, my questionnaire survey focused on nutrition and fluid consumption habits. I also asked a few questions about the MRE package. Members of the armed forces suggested supplementing the contents of the MRE package with various foods, such as bread, coffee. Since I wanted to make a proposal to supplement the MRE package, I summarized the contents of the MRE packages of some countries in a table. According to the study, the members of the armed forces generally paid attention to calorie and energy intake, and were mostly satisfied with the taste and the selection of food. Energy intake and maintaining hydration require a lot of attention in climates different from ours. Both cold weather and extreme heat significantly increase fluid consumption.

In general, it can be said about the soldiers who filled out the questionnaire in the mission that they drank little liquid, approx. 2 liters were consumed. Most of the soldiers drank coffee, which causes dehydration, and in the evenings, soft drinks and energy drinks during the foreign service. The performance capacity of a dehydrated body decreases depending on the degree of fluid deficiency.

In chapter 4, after the description of the microbiome and the factors influencing the intestinal flora, I described the possibilities for restoring intestinal health. I would highlight probiotic bacteria strains and prebiotics, of course as a supplement to a healthy diet. The diversity of the intestinal flora, the number of beneficial bacteria, is key to maintaining intestinal health.

Summarizing the results of my research, I drew attention to the fact that the strains should be used in a targeted manner, so I created a summary table that contains which products have the particular strains used in case of different diseases. I compiled the table according to the criterion system of probiotics, so I tried to suggest safer products. In addition, I investigated the awareness of probiotics among patients who suffered from various diseases and took these drugs.

I illustrated the results of this study with a bar chart. I used an excel table to create the diagrams and processed the data. I found that probiotics are not yet popular enough, they have not spread as much as needed, but when a similar product was needed, patients chose safer products

## **RECOMMENDATION**

I recommend my dissertation primarily to members of the armed forces, emphasizing that the pursuit of health-conscious nutrition is less likely to be realized due to the lack of health-conscious behavior. But it can also be useful for those preparing for military careers and the civilian population, especially considering that fluid consumption and quality food affect health.

Nutrition, as a sub-field of public health, can help in the health policy decisions of the Ministry of National Defense when further modifying the norm system, from the point of view of the technical-technological development of kitchens. By providing modern kitchen technology tools and improving the situation of kitchen workers, the cooks would also be more motivated. The chefs' high level knowledge is proven by the fact that they successfully participated in several international professional competitions. I would like to point out that no dietician is involved in menu planning. Considering that his cooperation is an essential condition, I definitely recommend his employment.

Due to the findings from the interviews, the thesis can also provide useful knowledge to the professionals involved in catering.

The trainers of the units going on missions received feedback from the questionnaire survey about the liquid consumption and eating habits of the soldiers; the positive experience of these should be made aware of health education specialists.

The thesis may also be useful for military medical professionals. With my test results, I provide practical help to other healthcare workers in choosing the right products. I have often experienced that the products are not recommended strain-specifically. The development of MRE packages is also continuous, so further research in this area is also justified.

Over the years, the continuously rising food prices, the increasing climate change, and the impact of more and more infections on the army require further investigation.

## **USABILITY OF RESEARCH RESULTS**

The workplace affects our health. Although genetic factors also play a role in an individual's health, health status also depends to a large extent on the influence of the health, economic, psychosocial, social, political and physical environment. In addition to the physical, chemical and biological characteristics of the physical environment and

residence and workplace, which directly affect our health, supporting amenities and tools are necessary for a healthy lifestyle. Workplace health promotion programs directly play a major role in health-conscious behavior and a healthy lifestyle. With the help of mandatory screening programs known in the armed forces, diseases can be recognized at an early stage and can ensure suitability for military service.

The organization of programs related to supplementary nutrition, in addition to the mandatory screening tests, is also recommended for consideration at the university in the framework of various health days, in order to educate the military on health-conscious behavior. In order to maintain physical activity and fitness, it is necessary to introduce more frequent fitness tests, as soldiers often train only before the announced test.

Health communication can be one of the tools for educating about healthy eating. Within this framework, healthy nutrition could be taught in a playful way, not only during the lectures, but also as part of interactive communication. Tools for this are various board games, e.g. nutritional mobile film, or contests with smaller prizes. Emphasis should be placed on reducing dietary risks, considering that the adult population, including the military, has misconceptions about nutrient intake.

Specialists from various health promotion programs, food managers, and dieticians play a major role in this. In view of the above, the results and recommendations of my dissertation can also be used in practice by food managers, health professionals and members of the armed forces.

## **AUTHOR'S LIST OF PUBLICATIONS IN THE TOPICS OF DISSERTATION**

### **Book chapter**

1. Lívía Horváth: The relationship between soft laser light, photosensitivity and drugs: The relationship between photosensitivity, laser light and drugs, In: Sandra Sándor (ed.) Soft laser therapy I-II. 955 p. Budapest: San-Ergonómia Kft., 2016. pp. 448-468. (ISBN:978-963-12-5068-8)

### **Peer-reviewed journals**

2. Lívía Horváth, Judit Wacha: Application of probiotics in various clinical symptoms. Pharmacy October 2014, pp. 601-608.
3. Ferenc Budán, Péter Diós, Lívía Ildikó Horváth, Kitti Andreidesz, Ildikó Horváth, Zoltán Gyöngyi, Pál Szilárd, Béla Kocsis, Krisztián Szigeti, Domokos Máthé: New perspectives - through technological breakthroughs: investigation of active substance dissolution in vivo by X-ray with CT., Health Science, LVIII. year 2014. 4 issues, ISSN: 0013-2268, Index 25201 p. 64-66.
4. Ferenc Budán, Lívía Ildikó Horváth, Kitti Andreidesz, Zoltán Gyöngyi, Béla Kocsis, Microecological changes – macroscopic effects?
5. University of Pécs, ÁOK, Institute of Medical Ethnology; Institute of Medical Microbiology, Health Sciences, LVIII. year 2014. 4 issues, ISSN: 0013-2268 Index 25201 63-64. She.
6. Lívía Horváth, László Svéd: Alternative methods of pain relief in order to avoid overuse of medication from the perspective of a practicing pharmacist Honvédorvos, 2015.1-2. issue, pp. 34-45.
7. Lívía Horváth: The role of health awareness in the diseases of civilization. Military Review, 2016. IX. Issue 1, 346-357. She.
8. Lívía Horváth: Manifestations and therapy of stress in the professional workforce.
9. Military Science Review 2016. IX. No. 2, pp. 305-319.

1. Lívía Horváth, Tamás Berek: Physiological effects of the use of personal protective equipment for chemical protection - water loss., Army engineer special issue 2017. XII. year No. 1 pp. 48-58.
2. Lívía Horváth: Protection of the immune system of those serving in the operational area, with particular regard to nutrition. Military Review, 2017. X. No. 2. pp. 422–436.
3. Lívía Horváth: Nutrition recommendations for the military in a climate different from ours. Military Review, 2017. X. 4th volume, pp. 412-427.
4. Lívía Horváth: Chemical substances in our diet, their dietary intake and their health risks. Military Logistics, 1-2 of 2018. No. 79-107.
5. Lívía Horváth: The role of functional foods and probiotics in maintaining health in the armed forces. Military Review, 2018. XI. year Number 1. pp. 307-324.
6. Lívía Horváth: The transformation of our nutrition and the relationship between civilizational diseases affecting the military. Military Review, 2019. Year XII. No. 1, 246-262. She.
7. Lívía Horváth: The importance and forms of military food nowadays. Military Logistics, 2019. 1-2 issue 160-174. She.
8. Lívía Horváth: The popularity of probiotics in gastroenterology. Military Science Review, 2019. No. 4
9. Lívía Horváth: The importance of liquid consumption for military personnel,  
10. Military Logistics 2019. Issue 4 pp. 160-174.
11. Lívía Horváth: Overview of military food. Military Logistics, 2020. 1-2. issue, pp. 242-261.

**Peer-reviewed journal, foreign language article**

12. Lívía Horváth: Der Zusammenhang zwischen den Zivilisationskrankheiten und dem Gesundheitsbewusstsein. Military engineer 13.2018. volume 1, pp. 326-335.

**Non-peer reviewed journal**

13. Lívía Horváth: Traditional Chinese medicine depending on the knowledge of the human genome. Studium et praktikum 2011. IX. Point 1.



## **PROFESSIONAL BIOGRAPHY**

Dr. Lívía Horváth graduated from the Semmelweis University Faculty of Pharmacy in 2006. After that, he was employed in the public administration, first in the OGYÉI as an officer pharmacist, and then he worked in the Pharmaceutical and Medical Technology Department of the Ministry of Health. During this time, he passed his professional examination and completed the legal training of the Faculty of Law and Political Science of Pázmány Péter Catholic University. After the Ministry of Health, she worked in a hospital and then in a public pharmacy. She has been working in a public pharmacy in Valkó since 2015, as a responsible manager for 3 years. Lívía Horváth has published 1 non-peer-reviewed and 19 peer-reviewed articles, including 1 foreign-language article and 1 book chapter. The title of the book: "Soft laser beam. The relationship between photosensitivity and drugs." She continuously holds advanced training courses, primarily for pharmacists and healthcare workers, in relation to the human microbiome. She competed several times in the Mátyás Rózsnyai Memorial Competition as a pharmacist, in which she obtained a certificate. She is a member of the Hungarian Pharmaceutical Society, the Chamber of Pharmacists and the Hungarian Military Society. She has a type "C" language exam in English and German. Her hobbies are classical music and sports.