

THE IMPACT OF RAISING THE RETIREMENT AGE, OCCUPATIONAL SAFETY AND HEALTH RISKS FOR FIREFIGHTERS

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Abstract

The choice of the topic is justified and topical, as the firefighting staff of the investigated establishment is constantly ageing, the average age is high and will increase even more with the increase of the retirement age. What impact could this have on the plant and its firefighters? No one has addressed this question, even though the majority of the firefighting workforce is between 45 and 55 years old. We think that when we reach the 60–65 age group, the elderly firefighter population will be a problem. That is why we are addressing the issue in our work, looking at the impact and risks of raising the retirement age. We will describe the work activities of firefighters and examine the impact of the stress caused by the constant state of readiness and the passing of the years on the body. Our main objective is to develop a mandatory physical assessment scheme for firefighters aged fifty and over. We propose a continuous change in work activity as they age. Finally, we provide suggestions for age-appropriate firefighter work activities for physical fitness, what kind of light physical work the older firefighter is suited for.

Keywords: fire brigade, ageing, occupational safety and health risk

1. Introduction

According to Eurostat, by 2100 there will be only 7.9 million Hungarians living in Hungary. By then, the ageing of society will have reached even greater proportions. Analyses suggest that to keep our ageing rate, the proportion of retired people, permanently low, the retirement age would have to be raised to 72 in the coming decades.

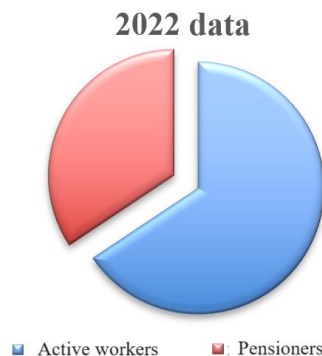


Figure 1. Active and retired workers in 2022
(based on 2022 data from the HCSO, authors' own editing)

The graph shows the share of active workers and pension beneficiaries. This ratio would probably result in an increase in the number of pensioners if the retirement age for active workers were not raised. We should therefore all prepare for the need to continue working as active workers in the future. The ageing process is not the same for all people, with significant individual differences due to genetic factors, environment, lifestyle and work-related influences. In other words, age alone does not determine health and work performance. Gerontology is the science of ageing, with the human being at its centre, since the primary goal is to prolong human life (Semsei, 2008). However, the process of ageing involves changes in physical and mental abilities in all individuals, which also affect work performance. Ageing, as one of the greatest gerontologists of our century, Max Bürger, (1957), put it, is essentially a biomorphosis, a process of change from birth to death, whose complexity and irreversible unidirectionality apply to mental processes as much as to the inner world of the cell. Ageing also applies to individual organs and mental processes, characterised by an uneven rate of damage that varies from person to person. But ageing does not equal disease! In many cases, how old you feel is more important than your actual age, because if you have the energy, vitality, mobility and youthfulness to go about your daily activities, you do not feel old if you are healthy. However, studies show that people start to experience and experience the feeling of ageing in their 50s at the latest. And the state of health associated with all daily activities is either a limit or an opportunity to plan and live the next stages of life, which ultimately affect biological parameters (Lampeck and Rétsági, 2015). The gradual increase in the retirement age also forces firefighters to try to maintain their physical strength and mental freshness through learning for longer and longer to perform their work. In my opinion, lifelong learning, a zest for life, the constant setting of goals, and the ability to remain flexible and change-oriented are the solutions to increasing the working age. One of the consequences of raising the retirement age is the problem of generational differences. Young people have to work with older people who are slower and require more patience, which can lead to friction. But how long can a firefighter be a firefighter? It is easy to see that the retirement age cannot be raised indefinitely. Our company managers should also consider where the age limit is for firefighters to be able to do their job properly. There comes a time in everyone's life when their reaction time becomes longer and their strength begins to decline. This is a handicap in an intervention or damage incident, so older firefighters should be placed in a position appropriate to their changed abilities (e.g. driver, pump operator).

In the case of firefighters, the physical workload of the workers varies greatly.

Firefighters do relatively little physical work, their job is more of a mental activity. His job is to lead the team, take decisions in different situations and manage the integration process of new firefighters.

The physical workload of the colleagues intervening is considerable and they need to have a large amount of knowledge at their disposal.

2. Physical and theoretical examinations for firefighters

Full-time firefighters are required by law to take a theoretical and physical assessment every year. The requirements for completing the physical assessment are developed for 4 age groups. Before the pension age was raised to 65, the age groups by age were as follows:

- Age group I: up to 29 years,
- Age group II: between 30–35 years old,
- Age group III: between 36–40 years,
- Age group IV: between 41 and 49 years old. (Classification based on age in the reference year)

Following the increase of the retirement age to 65, the age groups have changed as follows, based on BM Decree 45/2020:

- Age group I: 18–29 years,
- Age group II: between 30–39 years,
- Age group III: between 40–49 years,
- Age group IV: 50 years and over.

We have only found a partial set of requirements for those aged 50 and over, so we will go into more detail on the definition of the values.

The types of movement used to test physical fitness are:

- a) *front press-up arm extension*,
- b) *curved-arm suspension*,
- c) *bench press*, /with 60 kg/,
- d) *4 × 10 m shuttle run*,
- e) *long jump from a place*,
- f) *supine sit-up*,
- g) *2,000 m flat race*.

The 2,000 m flat run is compulsory, one of the remaining 6 exercises can be omitted. The maximum score for each of the five compulsory exercises is 25 points, giving a maximum of 125 points.

The expected results and the corresponding scores for each age group are given in Annex 5 of ORFK Instruction 35/2020 (XII. 23.), which can be found in Annex 1 of my thesis. Based on the scores, the performance evaluation is as follows:

Age group I:

- For 0–79 points, “Unsatisfactory”
- 80–95 points for “Satisfactory”
- 96–109 points “Good”
- 110–125 points for “Excellent”

Age group II:

- For 0–59 points, “Unsatisfactory”
- 60–85 points for “Satisfactory”
- 86–105 points “Good”
- 106–125 points for “Excellent”

Age groups III and IV:

0–39 points for “Unsatisfactory”

40–59 points for “Satisfactory”

60–100 points for “Good”

For 101–125 points “Excellent”

3. Age 50 and over to develop a physical assessment

After learning about the practices, the values for age group 4 under the new system were determined for those aged 50 and over. The values by age group were adjusted and, taking into account trends, the expected values were reduced or increased. We took into account the decrease in physical strength and measured the current performance of some firefighters in this age group. Due to the General Data Protection Regulation (GDPR), the results of the measurements are not presented by name, but only a summary of the experience is given.

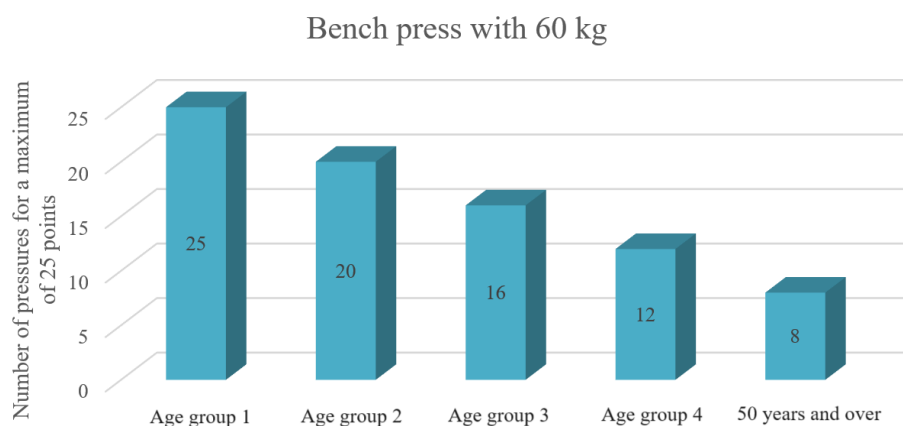


Figure 2. Bench press 60 kg per age group, number of pieces for a maximum of 25 points

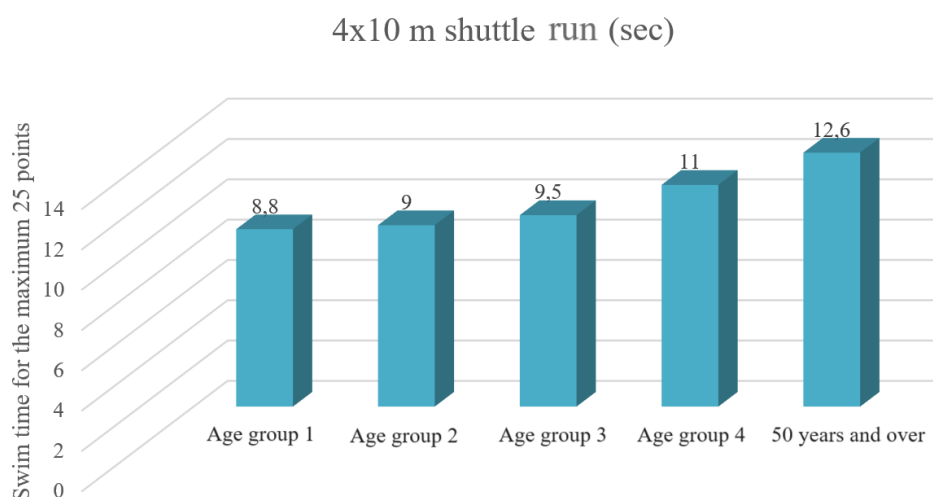


Figure 3. 4 × 10 m shuttle run per age group in seconds for a maximum of 25 points

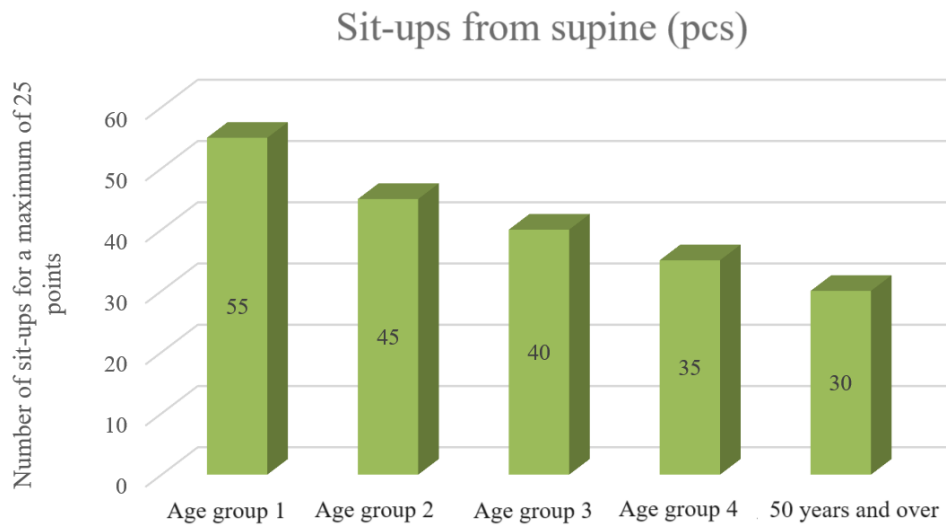


Figure 4. Number of sit-ups per age group for a maximum of 25 points

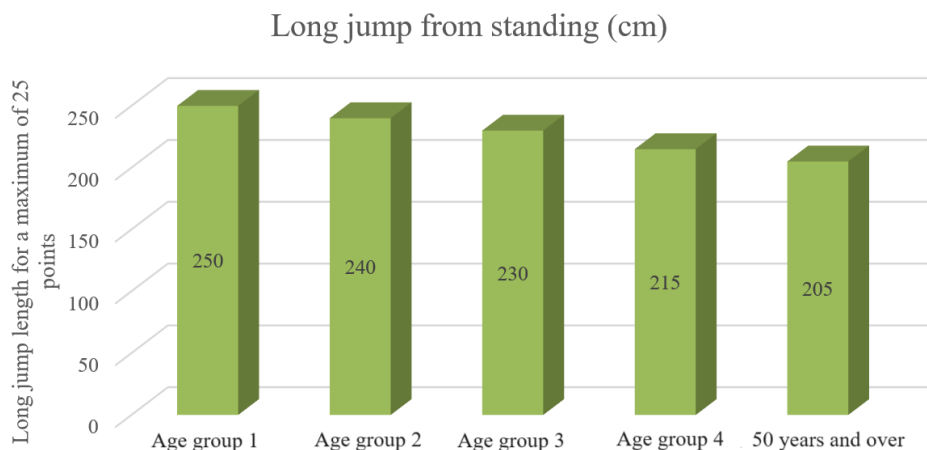


Figure 5. Long jump from a distance of centimetres for a maximum of 25 points per age group

During the tests, we observed that for exercises requiring physical strength (e.g. push-ups), strength decreases more slowly than speed for exercises requiring speed (e.g. shuttle runs). Of course, this applies to firefighters who train on a weekly basis. Those who did regular conditioning and aerobic training did better in all exercises and the ageing process was less pronounced. In terms of body weight, we found that the heavier firefighters did better on the push-up and push-up, while the lighter firefighters did better on the bent-arm hang and the shuttle. However, firefighters who do not do any physical training work have great difficulty in performing these tasks.

Table 1. IV age group scoring system /values in red are my values
(author' own editing)

GROUP 4 (50 years and over)						
Point	Front press-up arm bend- extension in 30 seconds (pieces)	Bent-arm pending time (sec)	Upward pressure with 60 kg (pieces)	4 × 10m shuttle (mp)	Sit-up from supine (db)	Long jump from standing (cm)
25	16	30	8	12.6	30	205
24		28		12.7	29	204
23	15	26		12.8	28	203
22		24	7	12.9	27	202
21	14	22		13	26	201
20		20		13.1	25	200
19	13	19	6	13.2	24	199
18		18		13.3	23	198
17	12	17		13.4	22	197
16		16		13.5	21	196
15	11	15	5	13.6	20	195
14		14		13.7	19	194
13	10	13		13.8	18	193
12		12	4	13.9	17	192
11	9	11		14	16	191
10		10		14.1	15	190
9	8	9	3	14.2	14	189
8		8		14.3	13	188
7	7	7		14.4	12	187
6	6	6		14.5	11	186
5	5	5	2	14.6	10	185
4	4	4		14.7	9	184
3	3	3		14.8	8	183
2	2	2		14.9	7	182
1	1	1	1	15	6	181

According to the table, out of the 6 persons (50 years and over), 1 person was rated “adequate”, 3 “good” and 2 “excellent”, there were no “inadequate” persons.

4. The swelling force decreases over time

First the retirement age was raised to 62, then gradually to 65. However, there is a big difference in the strength and performance of a man aged 40 and 65, as can be seen from the results expected from the physical assessment, *so it is worth examining where the age of a firefighter is at the point where he or she and the person they may be rescuing are at risk.* A firefighter's health is exposed to many adverse effects during his or her years on the job. The most common is smoke inhalation from soot, as respiratory protection is not used for small fires because of its inconvenience. Especially in dry grass fires, we do not wear a respirator, which means that we can inhale a lot of combustion products, smoke and soot. This can lead to the development of lung cancer or testicular cancer, first described by the English physician Sir Percivall Pot (1775), who observed that chimney sweeps were more prone to testicular cancer and realised that it was caused by the large amounts of soot they inhaled. The negative effects of harmful substances inhaled over the years needed to be counteracted. Harmful substances cause free radicals to form in the body, which need to be counteracted by antioxidants. Experience shows that regular exercise helps the body to do this and helps prevent the development of disease. Exercise helps to increase active ageing, thereby delaying the ageing process. Our fire brigade has its own gym, which is constantly being improved. By using it regularly, we can maintain our physical fitness and improve our appearance in uniform, which reflects well on our fire service. The key is regularity, making sport part of our lifestyle. Arnold Schwarzenegger's book, *My Way to the Top* (1988), contains several workout plans to help you put together 3 or 4 suitable workout routines a week. There is a lot of motivation in there, and even if you don't become a 7-time Mister Olympia champion like him, you will have better health and well-being. It has been measured that the average person loses 1% of their muscle mass each year after the age of 50 (without exercise), which is why it is important to strive to maintain muscle. In addition to regular exercise, a healthy diet is important. Firefighters spend a lot of time on standby in addition to their daily activities. This is what the canteen is for. Often, when there is no work, exercise or other work to be done, they eat when they are sleepy. When they do, they take in excess calories, which can lead to obesity in the long term. There is little doubt that too many nutrients can be harmful, so it is a good idea to watch the calories you take in. Carrol Lutz's *Nutrition Science Guide* (2012), a medical handbook with calorie tables in English, can help. Proper nutrition strengthens the immune system, which is responsible for protecting our health, as described in detail in Domonkos Zs. (2010) *Nutrition advice for the upper echelons.* In addition to exercise and good nutrition, adequate rest is also very important. In his book *The secret of good sleep*, dr. M. Mosley (2021) summarises the latest scientific findings to explain why regular good sleep is so important. He explains what happens when we sleep and gives advice on how to achieve restful sleep, highlighting the main causes of common sleep disorders. Fire stations have nets so that they can rest at night while maintaining alertness, which goes a long way to preserving our biological life cycle. So the balance of the triad of sport, food and sleep is an important element of health. *Health must be seen as a value by all*, so that the time needed to reduce the swelling can be extended! In my opinion, the Occupational Health Physician has an important role to play in determining, during the annual fitness examination, whether the employee is still fit to perform the duties of a firefighter involving heavy physical exertion. If he or she considers his or her state of health to be unsatisfactory, he or she should only allow light physical activity, which should be indicated in the medical record. *The mandatory age of 65 for all is, in my opinion, the upper limit for how long a firefighter can still be required to perform heavy physical work.* Further raising the retirement age, in my opinion, already poses a risk to the intervention staff. And everyone cannot do light physical work because it is not relevant to the employer. The most important thing is to keep

healthy, which is in the interest of both the employee and the employer! Steps must be taken in this direction to ensure long-term health maintenance.

PROPOSAL: *Education could be provided on health promotion and nutritional advice could be given to help people adopt the right diet! Furthermore, the experience of the work of ageing firefighters could be shared with other fire brigades and by discussing and listening to good ideas, help the work of this age group.*

The years of service not only put firefighters under physical strain, but the constant readiness and the possibility of being called to a fire or an accident also causes constant stress. I will therefore examine the effects that stress can have on our bodies.

The phenomenon and process of stress:

Stress is a non-specific reaction that our body responds to any significant stimulus that requires coping and adaptation. Stress is a physical and mental reaction triggered by excessive expectations and stress. We experience stress when we perceive that external demands exceed our resources and we will not be able to cope successfully.

Stress = External expectations, pressures > Resources

There are two main types of stress:

- physical stress,
- psychological stress.

What are the reasons?

Physical stress in firefighters:

- difficulty due to the weight of the protective equipment,
- discomfort due to the use of protective equipment,
- difficulty breathing when using a respirator,
- high levels of spinal strain due to the use of a respirator,
- high levels of wear and tear due to heightened nervous state,
- rescue from invisible gases,
- 24-hour service load,
- sleep cycle disruption, night-time alarms.

Psychological stress in firefighters:

- waiting for the alarm to sound,
- alarm sounds, light and sound signals,
- saving lives, if necessary, is the biggest responsibility and source of stress,
- handling and protection of high-value vehicles,
- accidents, injuries and possibly fatalities,
- constant new situations, because we cannot prepare for all possibilities, (improvising),
- family problems at home that the employee “brings” into the workplace (not work-related).

In another formulation, “Stress is on the one hand an influence that affects a person’s physiological/psychological adaptation mechanisms. Stress > demand. On the other hand, it is a psychophysiological state that occurs as a result of stressor effects. It is the non-specific response of the body to stress, a set of physical and psychological changes that occur in response to stressors. Its outcome depends on the degree and timing of the impact.”

In his book *Stress without distress* (1983), dr. János Selye distinguishes 3 stages of stress:

1. Emergency response stage: the body sounds the alarm in response to the appearance of a stressor. Resilience is reduced.

2. Resistance stage: when the body raises its resistance above normal to adapt to the constant presence of a stressor.

3. The exhaustion stage: when the body no longer has the energy to adapt to stress and signs of stress-related illness appear. Beyond the psychological problems caused by anxiety, insomnia and phobias, there are physiological effects.

Stress-related high blood pressure, stomach upsets and weakened immune systems are often seen in firefighters. There is a decrease in the body's endorphin hormone, a protein compound with analgesic effects, and a disruption of the melatonin cycle. Melatonin regulates the sleep-wake rhythm, and its production increases when natural light is reduced, allowing for satisfactory rest. Too many alarms and disruption of the sleep cycle reduce this balance. If a person is exposed to this stress for too long, burnout syndrome can develop, with its characteristic features of over-activity and enthusiasm for work (Smith et al., 2018). The worker over-stresses because he or she wants to work quickly and efficiently. They may then overstep their physical and mental limits, which can lead to burnout. This can also have physical symptoms such as sleep disturbance, rapid heartbeat, mood swings. This may be followed by a second phase, when the worker becomes unmotivated, less able to perform, and becomes inflexible. The third phase is a completely passive attitude, which may even manifest itself in his or her private life. This is difficult to manage and should be prevented if possible. The effects of stress should be made known to firefighters so that they can recognise the signs of it if it occurs and reduce its harmful consequences as soon as possible.

What can we do to protect ourselves from the harmful effects of stress?

Firefighters are also required to undergo periodic medical examinations to check for occupational diseases and the harmful effects of work-related stress. To protect the health of firefighters, blood tests, lung screening, abdominal ultrasounds and other physical examinations are mandatory every year.

5. Adapting the working patterns of ageing firefighters

Ageing is inevitable for all of us. As age advances, the physical and mental performance of firefighters declines, so do the expectations. This is also evident in the physical assessment requirement system. Of course, this decline can be slowed by a healthy lifestyle, good nutrition, sufficient sleep, and regular exercise. Negative stress (distress) should also be avoided as much as possible, or its harmful effects reduced by rest and recuperation. Due to the loss of physical strength and mental capacity, it is advisable for ageing firefighters to consider what lighter work they could do.

Light physical jobs

Light physical work: this is defined as tasks that require moving around the workplace, walking, but with the possibility of sitting down -most evenings. The worker must not lift more than 5-10 kg or work under normal "room temperature" conditions

Establishment of a fire extinguisher repair workshop: older firefighters would carry out these maintenance tasks during working hours, thus making the physical work easier.

Young firefighters can be trained and mentored by an older firefighter with a lot of experience. It is easy to see that a vigorous young firefighter can be more effective in rescue or other physical tasks than his or her pre-retired colleague. A colleague whose health has significantly deteriorated may be on a news monitoring duty, handling incoming calls, keeping in touch with the dispatch service, relaying them to the appropriate person. We can also perform maintenance on your firefighting equipment, reducing your costs.

Washing, drying and rewinding fire hoses can also be a light physical work that we have to do after each exercise. They may also be responsible for keeping the sheds and garages clean and tidy. Measuring explosion concentrations is also a lighter physical job in fire risk work, as is checking fire hydrants, water cannons, installed systems.

Table 2. *Light manual work opportunities and costs* (own compilation)

Light physical work	Cost of implementation
establishment of a fire extinguisher repair and maintenance workshop	about HUF 20 million, but it will pay for itself over the years
basic inspection of fire extinguishers	none
mentoring (training of new recruits)	none
training, education of volunteer firefighters	none
news on-call service (phone handling)	none
maintenance of fire-fighting equipment, hoses, tools and machinery	cost savings
cleaning and tidying up of workshops and garages	cost savings
explosion concentration measurements	none
site insurance	none
checking fire hydrants, water cannons, installed systems	none
disabling, rearming fire alarm systems	none
fire prevention activities, site visits, information gathering	none
retraining firefighters for sedentary work	cost to the employee or employer

If the proportion of older firefighters increases, the tasks could be split up. Older firefighters do the lighter physical work listed in the table, partly relieving the burden on younger firefighters who have more time for other tasks. (e.g. training).

6. Summary

Our aim is to show the effects that firefighters experience during their years of service and how this affects the natural ageing process. We have developed a physical assessment for firefighters aged 50 and over, which encourages older firefighters to take part in sport and exercise. This also helps to maintain physical fitness and health.

We have addressed the occupational safety and health risks of raising the retirement age on a permanent basis, highlighting the changes in working capacity caused by the ageing of the human body. The impact on the body of the stress caused by continuous on-call work was described in detail. In the light of this, we have suggested some lighter physical work for older firefighters.

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References

- [1] Semsei I. (2008). *Magyar gerontológia*. <https://docplayer.hu/17970364-Magyar-gerontologia-dr-semsei-imre-mta-doktor.html>.
- [2] Bürger, M. (1957). *Altern und Krankheit (Öregedés és betegség)*. Leipzig: Georg Thieme.
- [3] Lampek K., Rétsági E. (2015). *Egészséges idősödés – Az egészségfejlesztés lehetőségei idős korban*. <https://www.etk.pte.hu/protected/OktatasiAnyagok/%21Palyazati/sport2/EgeszsegesIdosodesJ.pdf>.
- [4] Pott, P. (1775). *Foglalkozási expozíció okozta rák*. Tanulmány. https://hu.frwiki.wiki/wiki/Carcinome_du_ramoneur.
- [5] Lutz, C., Przytulski, K. (2012). *Táplálkozástudományi kalauz*. Budapest: Zafir Press, pp. 1–144., ISBN: 9786155005213.
- [6] Domonkos Zs. (2018). *Táplálkozási tanácsok felsőfokon*. Szerzői kiadás, pp. 1–268., ISBN: 2399972602687.
- [7] Mosley, M. (2021). *A jó alvás titka*. Budapest: GABO Kiadó, pp. 1–328., ISBN: 9789635660667.
- [8] Selye J. (1983). *Stressz distressz nélkül*. Akadémiai Kiadó, 12–149., ISBN: 2399981091359.
- [9] Smith, T. D., Hughes, K., Dejoy, D. M., & Dyal, M. A. (2018). Assessment of relationships between work stress, work-family conflict, burnout and firefighter safety behavior outcomes. *Safety Science*, 103, pp. 287–292. <https://doi.org/10.1016/j.ssci.2017.12.005>