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Dear colleagues and friends,

The present Supplement J.IMAB serves as a source for publications of papers, presented at the 11-th SEEC in a joint forum of 31-st Annual Assembly of IMAB, 28-31 October 2021, in Plovdiv, Bulgaria, and approved for a full-text presentation.

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Editorial Board,
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Varna, Bulgaria, 2021/2022

Ergonomic Assessment of the Workplace Factors among Workers in Administration

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Introduction:

The modern forms of work are characterized by hypokinesia in the workplace, increasingly frequent presence of ergonomic risk factors and excessive stress at work [1]. Characteristic of the daily work of the employees in the administration is that they work in a forced working position, their work is on a computer, there is a lack of good lighting in most workplaces, low physical activity, poor eating habits, less sun exposure, higher levels of stress and psychophysical overexertion is common [2].

Ergonomics Risk Factors at computer workers such as repetitive movements, doing work in awkward postures and static postures while prolonged seating at workers are related to Musculoskeletal Disorders (MSDs) commonly [3]. As a result the employees will experience a variety of symptoms such as discomfort in the neck, pain in the shoulders, elbows, hands, fingers, hips and knees. An awkward posture for computer users has been characterized as having excessive tilt of the neck, trunk bent forward, rounded shoulders, wrists and ulnar deviation [4, 5]. Intensive keyboard use has been associated with an increased risk of developing MSD of the hand, wrist, and forearm [6].

Materials and methods:

In the present study was used a sociological method (questionnaire). The results of the study are presented by descriptive statistics and Chi - square test.

The survey was conducted in the period September - November 2020, and surveyed employees are 386. The average age of the participants is 46.65 +/- 9.45 years. The youngest participant is 23 years old and is female, and the oldest is 63 years old and again is female. The oldest participant is 58 years old and is male. The gender distribution shows that 92.8% of the participants are women and 7.2% are men. The share of participants with total work experience over 10 years is 82%, and participants with special length of service over 10 years are 58.9%.

Results and discussion:

We are presenting the results by subjective perception (from the survey) of the participants and objective data from the health analyzes for 3 years period – from 2018 to 2020 year.

The first question from the survey is: “Is you’re your work boring/ monotonous?”. Positive answers are 8.8%. The distribution by sex show that positive answer give 70% from women and 30% from men. Negative answer give 95.15% from women and 4.85% from men.

The next question is: “Do you perform several tasks simultaneously?”. Negative answers of the question are 18.6% and positive are 81.4%. The distribution by sex of the question shows that 100% of the negative answers are given from women. The distribution of positive answers is: 92.8% form women and 7.2% from men.

The participants who claim that the floors are uneven and there is a risk of tripping are 38.1%. The distribution by sex shows that 2.3% of negative answers are from men and 97.7% are from women. The distribution of positive answers is: 10% from men, 90% from women.

The respondents who claim that their workplace is dimensioned in a way that provides enough space to change work posture and work movements are 46%, with “No” answer 54%. The distribution by sex

show that 1.9% of negative answers are from men and 98.1% are from women. Positive answers are 11.5% from men and 88.5% from women.

The workplace occupies an average of 4.5 square meters area or more of 38.1% of respondents. It's interesting that there are not men with such workplace.

It gives an impression that 59.3% of participants complain of neck and shoulder pain. Negative answers for neck pain give 19.6% of men and 80.4% of women and for shoulder pain – 17.4% of men and 82.6% of women. With a positive answer for the neck pain respond 1.65% of men and 98.4% of women, but for shoulder pain – 3% of men and 97% of women.

The next questions are about the pain in lower back, in hands and thenars and legs and feet. The results are shown in fig. 1.

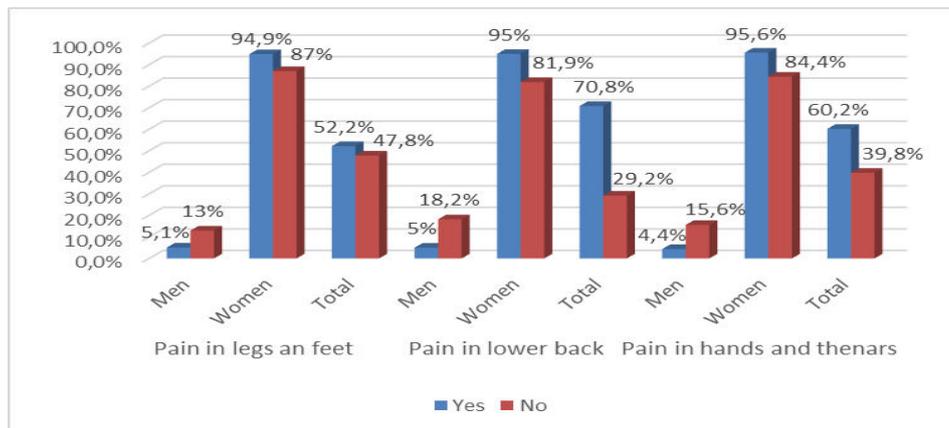


Fig. 1. Pain in legs and feet, lower back and hands and thenars – distribution by sex

The participants which get swelling, stiffness or joint pain are 47.8%. The distribution of the negative answers by sex show that negative answer give 15.3% of men and 84.7% of women. A positive answer give 2% of men and 98% of women.

The respondents who get a feeling of stiffness in their palms and foots are 25.7%. Negative answers are 9.5% from men and 90.5% from women. The distribution by sex of positive answers is: 6.9% of men and 93.1% of women.

Headache have 71.7% of respondents. The distribution by sex of positive answers show that 1.2% of men and 98.8% of women answer with “Yes” of the question.

Results of health analyzes – temporary incapacity at work:

- 2020 year - 332 hospital sheets – 35 are with MSDs, the average length of the hospital sheet is 10,44 days, the average length of the hospital sheet from MSDs is 23,82 days;
- 2019 year – 353 hospital sheets – 34 are with MSDs, the average length of the hospital sheet is 8,4 days, the average length of the hospital sheet from MSDs is 17,76 days;
- 2018 year - 338 hospital sheets – 30 are with MSDs, the average length of the hospital sheet is 7,58 days, the average length of the hospital sheet from MSDs is 16,25 days.

The results of our study confirm the data obtained in others around the world [7,8]. It makes strong impression the prevalence of female participants in our survey. MSDs among workers are common in our study and worldwide [2, 3, 5, 8].

Conclusions:

The results from hospital sheets show clear trend of increasing of the number of MSDs and the length of the hospital sheet is significantly higher than the average for the year. The neck pain, the shoulder pain, lower back pain, pain in hands and thenars, pain in legs and feet, swelling, stiffness or joint pain, feeling of stiffness in palms and foots and headache are common among the employees in administration.

The results of our study once again confirm the importance of ergonomic risk factors in the workplace and the fact how common they are. Urgent action is needed to address these factors in the workplace in the organization. It is necessary to procure ergonomic work equipment, consistent with the individual needs of each employee, appropriate introduction of a physiological regime of work and rest must be introduced, as well as conducting of annual mandatory periodic preventive examinations at the workplace.

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Breastfeeding duration and prevention of allergies in infants

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Abstract:

Proper nutrition in the first year of a child's life is an important factor determining the physical and intellectual capabilities of a person at a later age. **The aim** of our study was to research the influence of exclusive breastfeeding and the duration of breastfeeding on the frequency of food allergies. **Material and methods:** We conducted a transversal study among 94 parents of children from 0 to 12 months of age (average age 5.47 ± 2.24 months) from Pleven and the region in 2020. **Results:** We found that shorter duration of breastfeeding is associated with a higher frequency of allergic diseases, most often allergy to cow's milk in infants. The duration of breastfeeding of the surveyed mothers was influenced by the level of education, ethnicity and place of residence. Over 93% of infants with initial manifestations of allergy were fed with infant formula, and only 2.3% - exclusively breastfed. **Conclusion:** Exclusive breastfeeding and longer breastfeeding for more than 4 months are with a protective effect and reduce the risk of allergic diseases in children.

Key words: breastfeeding duration, infants, allergies

The promotion and support of breastfeeding has emerged as a national public support in recent years. Many health care professionals have made great efforts to support and improve breastfeeding success by following the guidance and principles of the American Academy of Pediatrics, American College of Obstetricians and Gynecologists and American Academy of Family Physicians. The WHO and UNICEF recommend exclusive breastfeeding until six months of age, without the intake of water and other foods and fluids (except vitamins and medicines when necessary) (1, 2). The considerable spread of food allergies, as well as the presence of some diagnostic problems in the early detection and different approaches of treatment and prevention of food allergies in children attract the attention of researchers to this problem (4, 5). In economically developed countries the spread of food allergies among children in early age is 6-8%, while among adolescents is 2-4%. Cow's milk protein allergy is leading among food allergies in infants and children up to three years of age, with frequent manifestation of allergic colitis. It occurs within the first few days to a few weeks after the introduction of cow's milk or infant formula (3). **The aim** of our study was to research the influence of exclusive breastfeeding and the duration of breastfeeding on the frequency of food allergies.

Material and methods:

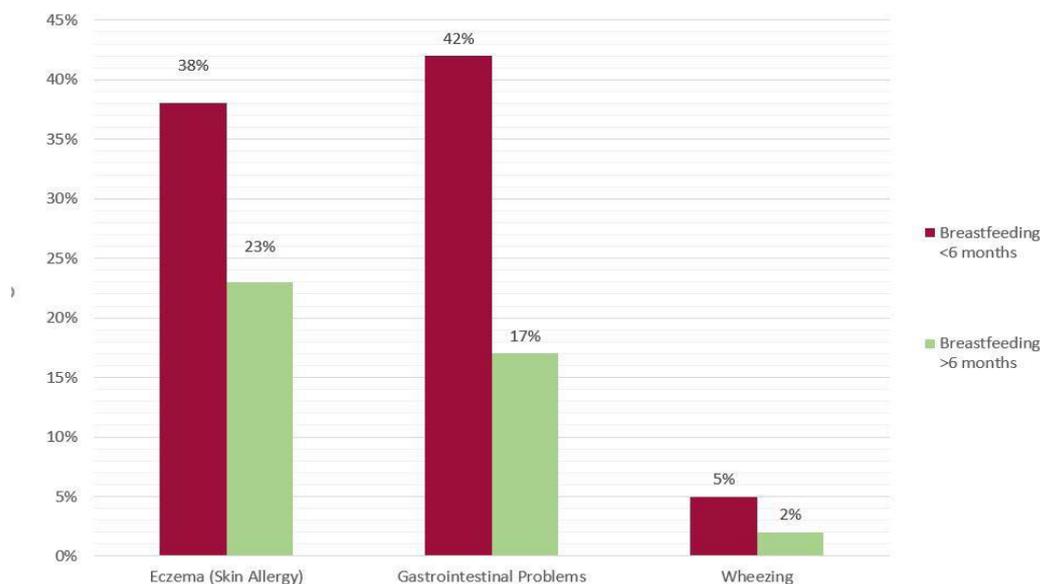
We conducted a transversal study among 94 parents of children from 0 to 12 months of age (average age 5.47 ± 2.24 months) from Pleven and the region in 2020. In the study we used a questionnaire filled in by the children's parents, clinical signs of allergy and analytical review of paraclinical blood tests (tests of IgE IU/ml, Hb g/l, Eo %). During the study, the national recommendations were exclusive

breastfeeding for the first six months of life, introduction to complementary foods at six months, continued breastfeeding up to one year of age. These recommendations were in line with World Health Organization. We classified study participants into three groups based on infant feeding practices: exclusively breastfed, mixed-fed (breastfed and bottle-fed) and formula-fed.

Results and discussion:

We found that the shorter duration of breastfeeding is associated with a higher frequency of allergic diseases, most often allergy to cow's milk in infants. The average age of lactation in children with allergic manifestations was 2.12 ± 2.73 months. The duration of breastfeeding of the surveyed mothers was influenced by the level of education, ethnicity and place of residence. A leading role in motivating the mother to breastfeed was her education even during pregnancy. The mother's decision to breastfeed was influenced by the doctors from the women's consultation, as well as her GP due to the high degree of trust in them. The gender and personal experience of the trainers were important for the success of the training - the mothers listened to the advice and shared their worries and problems with a medical representative who is a woman. The reduced hospital stays of the mother after birth had a beneficial effect on the success of breastfeeding. Knowledgeable and motivated mothers were with higher success in breastfeeding. Over 93% of infants with initial manifestations of allergy were fed with infant formula, and only 2.3% - exclusively breastfed. Babies of artificial feeding were more likely to have allergies than breastfed babies (Figure 1).

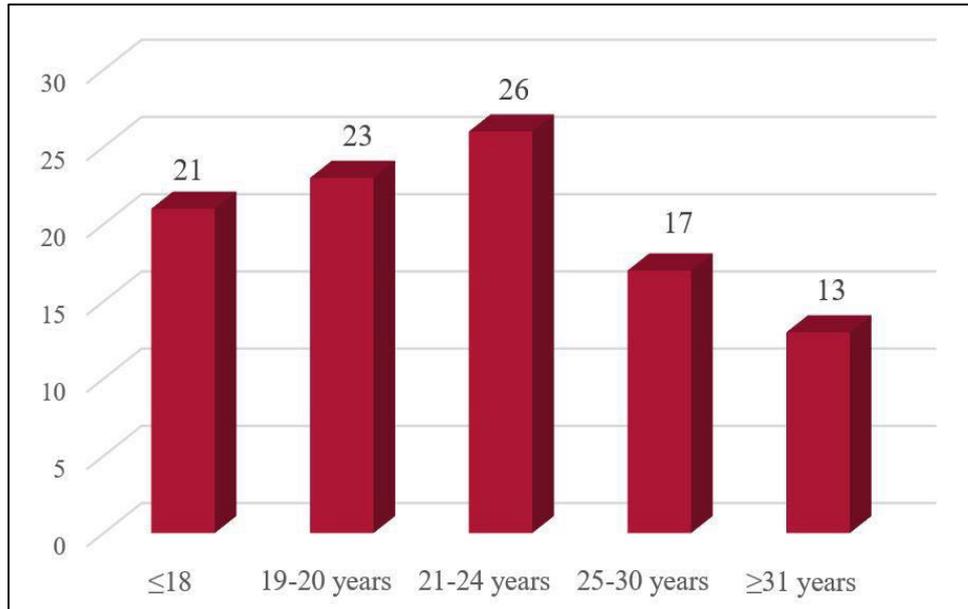
Figure 1. The prevalence of allergic disease in exclusively breastfed children with short (≤ 6 months) and prolonged breastfeeding duration



The mother's age caused affection to the duration of breastfeeding (Figure 2). Mothers aged 21-24 years breastfed their children for longer - 26%, followed by mothers aged 19-20 years. With the shortest duration of breastfeeding were mothers aged over 30 years old. The success of breastfeeding depended on the motivation of the mother, confident in her abilities and convinced that there are ways to deal with possible problems with breastfeeding. Higher educated mothers with positive previous breastfeeding experience, aged 21-24, breastfed their children longer. Early consumption of milk-formula increased

the risk of occurrence of allergies in the baby. We researched the most common reasons why women stopped breastfeeding. Most often the mother said “My milk was not enough to satisfy the baby.”- 42%; “My baby lost interest in breastfeeding and began to wean.”- 36%; “I used to get mastitis very frequently.”- 22%.

Figure 2. Connection Between Breastfeeding and Age of the Mother



We followed the most common clinical manifestations of Cow’s Milk Protein Allergy in infants. We found that isolated manifestations were rare. Most often in the first year of life we observed cutaneous-gastrointestinal form with unstable defecation, constipation, increased colic. The low values of hemoglobin and the anemic syndrome we founded in the studied children confirm the data from the literature for the separation of microscopic blood through feces in allergy, without obvious clinical manifestation of anemia. We founded the anemic syndrome during prophylactic monitoring of the blood test.

Breastfeeding provides the baby immunomodulatory, anti-inflammatory and nutritional components present in human breastmilk. Exclusive breastfeeding in the first six months of life is the factor with the greatest protective effect, followed by the duration of breastfeeding (1, 2). In recent years, there has been a trend to increase the duration of breastfeeding. This is due to the public’s awareness of the benefits of breastfeeding. Prolonged breastfeeding is associated with a reduced risk of eczema and allergic diseases in the first year of life. Children breastfed for more than six months are less likely to develop atopy and allergies (3, 5).

Conclusion:

Breastfeeding is the optimal method of infants feeding. It is of great public health importance and it must be encouraged and supported by Pediatricians, Family Physicians and Gynecologists. Exclusive breastfeeding and longer breastfeeding for more than 4 months are with a protective effect and reduce the risk of allergic diseases in children. Infants on artificial feeding are more likely to suffer from allergies than breastfed infants.

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Healthy nutrition of adolescents as a way to prevent heart health

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Abstract:

The study covers 919 students from 12 settlements in Bulgaria from 18 schools. The aim of the present work is to study and analyze the nutrition and eating habits of students aged 13-18 years. Documentary, sociological and statistical methods were used. The analysis of the data shows that unhealthy eating habits are acquired in childhood and adolescence. There is a relatively low consumption of fresh fruits and vegetables, milk, dairy products and high consumption of ready-made snacks, chips, confectionery, carbonated drinks. Close cooperation is needed between health professionals, teachers and parents in the fight against unhealthy eating habits, which will help reduce heart risk in the future.

Key words: nutrition, eating habits, students, heart health

Introduction:

Childhood is a period that is essential for creating an eating pattern that will reduce cardiovascular risk in the future. This is the period in which a healthy diet is nurtured and built, which determines the health, growth and development of children and influences eating habits and behavior in the following periods of life. [1, 2, 3]

Aim, materials and methods:

The aim of the present work is to study and analyze the nutrition and eating habits of students aged 13-18 years. The study is part of a research on the presence of cardiovascular risk factors among children and students. To collect the primary information are applied:

- Documentary method;
- Sociological method – a direct, individual, anonymous survey was conducted, on specially designed questionnaires among students aged 13 to 18 years;
- Statistical methods – descriptive statistics, variation analysis, statistical methods for dependencies, statistical methods for determining differences.

The statistical package SPSS (Statistical Package for the Social Sciences) version 19.0 is used for statistical processing of the results.

The subject of the study are the nutrition and eating habits of students. The object of the study are 919 students aged 13 to 18 from 12 settlements in Bulgaria and 18 schools.

Results and discussion:

The study involved 919 students aged 13 to 18 from different settlements in Bulgaria. Of these, 51.3% are girls and 48.7% are boys.

In the course of the study, we studied the nutrition and eating habits of students, such as the frequency of consumption of certain food groups. The data are tabulated in table 1.

Table 1. Frequency of consumption of certain food groups in students aged 13-18 years

Consumption of	Daily	Every other day	Once a week	2 times a week	3 times a week	Rarely – 1-2 times a month	Does not consume
Sausages and / or red meat	20.10%	14.9%	21.10%	13.10%	11.90%	5.20 %	13.70%
Ready-made snacks and sandwiches	34.40%	20.10%	13.80%	9.40%	9.00%	3.00%	10.30%
Chips and snacks	11.90%	8.90%	22.20%	7.50%	5.20%	12.70%	31.60%
French fries	10.90%	9.10%	30.30%	9.40%	6.70%	20.50%	13.10%
Fish and fish products	4.70%	3.80%	38.20 %	10.40%	5.70%	17.80%	19.50%
Ready-made sweets	34.50%	17.00%	20.00%	8.40%	7.40%	5.50%	7.20%
Carbonated drinks	26.30%	12.50%	12.60%	5.50%	6.10%	5.70%	31.30%
Milk and dairy products	51.10%	19.30%	10.20%	8.20%	9.00%	0.50%	1.70%
Fresh fruits	49.30%	23.60%	10.50%	6.50%	7.20%	1.30%	1.60%
Fresh vegetables	53.40%	20.70%	9.10%	5.90%	6.50%	1.00 %	3.40%
Cereals and / or potatoes	26.10%	23.00%	20.60%	13.80%	10.70%	2.00%	3.80%

The 12 recommendations for healthy eating for children aged 7 to 19 emphasize the provision of a varied diet, regular meals and compulsory breakfast, daily consumption of cereals and intake of wholegrained bread, milk and dairy products and fresh vegetables and fruits, intake of sufficient fluids, as well as compliance with hygiene rules when eating and preparing food. It is recommended to limit animal fats, fried foods, sugar and confectionery, consumption of carbonated beverages, reduce the use of salt and salty foods, abstain from alcohol, and maintain a healthy weight and daily physical activity. [4]

The analysis of the data obtained from the survey shows that only 50.0% of the respondents consume fresh fruits daily, only for 53.0% of them the vegetables are a preferred food in their menu every day and only for 51.0% milk and dairy products are present daily in their menu. Frequent consumption of foods rich in energy, fat and salt is found. For 20.0% of the respondents French fries are present in the menu every day or every other day, for another 35.0% such is the consumption of sausages and red meats. Approximately 55.0% of respondents consume ready-made snacks daily or every other day, and 20.0% - chips or snacks. 39.0% of the respondents drink carbonated drinks every day or every other day. Approximately 20.0% of the respondents do not consume fish at all, and another 18.0% - very rarely. Cereals and/or potatoes are consumed daily in 26.0% of cases and during the day in 23.0%.

The consumption of ready-made confectionery is extremely high, namely in 52.0% of the cases they are present in the students' menu daily or every other day. They are known to contain hydrogenated and partially hydrogenated fats, and there is scientific evidence linking their intake to an increased health risk of coronary heart disease due to an adverse effect on blood lipids and lipoproteins. [5]

The study found a statistically significant relationship between the frequency of consumption of most food groups and the place of residence of the respondents ($p < 0.05$). Exceptions are the consumption of fruits and cereals and potatoes, where no statistically significant dependence is found.

In order to find out what a food day is for students during school, we invited them to reproduce the food they ate the day before filling in the questionnaire.

The analysis of the data shows that there are negative trends in the nutrition of students and during school. Half of them eat ready-made pasta snacks, a quarter do not eat anything at school, and fruits,

milk and nuts are consumed by an extremely low proportion of respondents. A proven unhealthy eating pattern has been reported in a number of other studies. [6, 7, 8, 9, 10]

The reasons for the irrational eating pattern can be found in the free sale (in and around schools) of food and beverages that compromise healthy eating habits and students' free access to them. This is evidenced by the data from the study that some of the students indicated that they ate food from McDonald's, döner, cheeseburger and others. The reasons can also be found in the supply of unauthorized according to the Ordinance foods and beverages in the school shops and vending machines.

Conclusions:

1. Unhealthy eating habits are acquired in childhood and are maintained and/or deepened with age.
2. Only almost half of the surveyed respondents consume daily fresh fruits and vegetables, milk and dairy products.
3. Frequent consumption of unhealthy foods and beverages is established, namely ready-made snacks, chips, confectionery, carbonated drinks.

The widespread prevalence of cardiovascular morbidity, high incidence of overweight and obesity, necessitates the search for the causes of them in childhood and adolescence and taking timely preventive action to prevent the negative impact of risk factors and reduce morbidity in the future. Ensuring healthy eating and influencing this essential risk factor requires close cooperation between medical professionals working in schools, educators and parents. The cooperation will help to conduct regular targeted training of students on the benefits of healthy and rational nutrition and the risks of unhealthy eating, with an emphasis on future cardiovascular risk. The medical specialists also try to influence the observance of the sale and advertising of unauthorized persons according to the Ordinance for healthy eating of food and beverages and to inform the management of the schools and the respective control bodies in due time.

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Methodology of a kinesitherapy in patients after insertion of a coronary artery stent

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Abstract:

Purpose: Cardiovascular diseases are serious socio-economic diseases, widespread and affecting more and more people of working age. The purpose of the study was to investigate the effect of methodology of a kinesitherapy in patients after coronary artery stent insertion. **Material and Methods:** The study included 30 patients who underwent coronary artery stent insertion, divided into two groups (experimental and control) of 15 patients. In the experimental group we apply a methodology of kinesitherapy, including isometric and resistive exercises, and in the control group - standard cardio rehabilitation. **Results:** We reported an improvement in the studied indicators in both groups and this is more significant in the experimental group. **Conclusion:** The methodology applied by us, combining isometric and resistive exercises with elastic bands, is effective, easy to apply and supports the full return to an active lifestyle of those affected.

Keyword: kinesitherapy, coronary artery stent insertion, exercise, cardiovascular disease

Introduction:

Diseases of the cardiovascular system are common and cause high mortality worldwide [1]. They are preventable, but physical inactivity, nicotine abuse and poor eating practices are leading to an increase in prevalence in most countries [2]. Many randomized trials have shown that early cardio rehabilitation restores, prevents future vascular accidents, improves control of risk factors and quality of life in patients with cardiovascular disease, and reduces overall cardiovascular mortality [3, 4]. Lans et al. (2018) used resistive exercise in patients with chronic heart failure [5], and Oliveira-Dantas et al. (2020) apply resistive training in adult women with hypertension [6].

Purpose of the study. To investigate the effect of methodology a kinesitherapy in patients after coronary artery stent insertion.

Materials and methods:

The study was conducted in the Department of Physiotherapy and Rehabilitation at Blagoevgrad Hospital. Included were 30 men and women aged 46-83 years who underwent insertion of a coronary artery stent, divided into two groups of 15 participants depending on the applied kinesitherapy. The studies we applied to patients are: anthropometric measurements, 6-minute walk test (6MWT), Medical Outcomes Study 36 Items Short Form (SF-36).

The developed complexes last 25-30 minutes. They are applied five days a week for one month. In both groups we reduce the influence of risk factors. In the patients of the experimental group (EG) we apply specialized cardio rehabilitation, combining resistive exercises with elastic bands and isometry in the final position. For the resistive exercises we use a yellow rehabilitation rubber band and a yellow continuous rehabilitation rubber band. To the patients from the control group (CG), we apply standard cardio rehabilitation.

Data were analyzed by using Graph Pad Prism 3.0.

Results:

The mean age ($\bar{X} \pm SD$) of the participants in the EG was 56.8 ± 7.86 years, and those of the CG - 57.53 ± 9.83 years. The mean values of the body mass index in the EG were 28.55 ± 4.04 , and in the CG - 29.05 ± 2.52 . The values from the calculated waist / hip ratio in the EG were 0.84 ± 0.04 and in the CG - 0.87 ± 0.03 . The mean values of the measured waist-to-height ratio were 0.55 ± 0.05 for the EG and 0.57 ± 0.03 for the CG. The abdominal volume index in the EG was on mean 18.35 ± 3.81 , and in the CG - 19.35 ± 2.57 . High values of subcutaneous adipose tissue were observed in both groups. The distance traveled in the EG when performing at 6MWT was improved by 83.5 m, and in the CG by 78.5 m. The average points collected from the SF-36 questionnaire from the part for assessment of physical health in the EG was 43.0 ± 1.85 , and in the CG - 42.73 ± 1.71 . The assessment of the psychological aspect of the questionnaire in the EG averaged 57.07 ± 2.12 , and in the CG 56.93 ± 1.67 . We found no statistical differences between the medians of the two groups in the Mann Whitney test.

Discussion:

One of our tasks in the study is to control the risk factors in the studied groups. Megova et al. (2009) summarize that healthy lifestyle changes are important for the prevention and treatment of cardiovascular disease [7]. The circumference of the hips may reflect the effect of general obesity [8]. Barroso et al. (2017) found a prevalence of 70% of total obesity and 95% of abdominal obesity, according to abdominal circumference [9]. A study by Rashiti et al. (2017) show a significant correlation between the waist / hip ratio and coronary artery disease [10]. A meta-analysis by Tawfik (2018) found that the waist / height ratio was a significantly better predictor for hypertension and CVD [11]. According to Khosravian et al. (2020) the abdominal volume index has a good prognostic effect for detecting metabolic syndrome [12]. A number of authors point to the relationship between subcutaneous adipose tissue and the development of CVD. Therefore, we considered it appropriate to measure the subcutaneous adipose tissue. Dasari et al., 2020 identified 6MWT as a useful predictor of major adverse cardiovascular events [13].

Conclusions:

Population aging are leading to an increase in the incidence of cardiovascular disease. They are responsible for the high mortality rate both in our country and worldwide. The insertion of a coronary artery stent is a modern interventional procedure, thanks to which the disturbed coronary blood circulation is restored and the quality of life of the affected patients is improved. The methodology developed by us, combining isometric and resistive exercises with elastic bands, is effective, easy to apply and supports the full return to an active lifestyle of those affected.

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Effect of the application of a balance cushion in patients with low back pain

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Abstract:

Purpose. Low back pain is very common and is one of the most important musculoskeletal causes of limited activity and lack of work worldwide. The purpose of the study was to follow the effect of the application of exercises on a balance cushion in patients with low back pain. **Materials and Methods.** The study included 30 people with lumbar pain. We apply the following tests to patients: pain assessment, Schober test, lateral inclinations, Straight leg raise test, Neri's test and symptom of the button. The therapy consists of exercises on a balance cushion for a period of 1 month. **Results.** We observe an improvement in the indicators after the therapy **Conclusion.** The present study proved the effectiveness of the applied methodology, expressed in the treatment of pain symptoms and mobility in the lumbar spine in a shorter time.

Keyword: low back pain, balance cushion, therapy.

Introduction:

Low back pain is very common and is one of the most important musculoskeletal causes of limited activity and lack of work worldwide [1, 2]. Statistics show that 70-80% of people have had some low back pain at some point in their lives [3]. Konstandinu et al. (2016) point out that the causes of back pain can be single or multiple external injuries, osteoporosis, static overload, muscle strain, and stress [4]. Popova et al. (2017) indicate that lumbar disc herniation is 15 times more common than cervical hernia [5]. According to Călina et al. (2009) neglect of lumbosacral musculoskeletal algofunctional diseases can lead to vertebral or discogenic complications [6]. Therapy balls and wobble cushions offer the ability to practice dynamic sitting balance, core muscle strength, and postural control while offering added sensory stimulation through touch and movement [7].

The purpose of the study was to follow the effect of the application of exercises on a balance cushion in patients with low back pain.

Materials and methods:

The study was conducted in the Eighth Academic Building of SWU "Neofit Rilski", Blagoevgrad. The present study included 30 people with low back pain aged 22-53 years.

We applied the following tests to the patients: pain assessment using a visual-analog scale (VAS), Schober test, measurement of the lateral inclinations, Straight leg raise test, Neri test, symptom of the button.

Methodology of kinesitherapy.

We applied exercises on a balance cushion for a period of 1 month. The exercises are applied for 10 minutes several times a day. Subjects who are in a prolonged sitting position at work are advised to sit on a balance cushion. The exercises were visualized by us, and patients had to perform them independently at home and at work. Once a week we monitor the correct performance of the exercises and the condition of the patients by applying manipulative massage and processing of trigger points.

Statistical analysis:

We processed the statistically obtained results from the studied indicators using the statistical package Graph Pad Prism 3.0. We observed for statistical differences with the Wilcoxon signed rank test at $p < 0.05$.

Results:

The mean age of study participants was 34.8 ± 8.43 years. The degree of pain was assessed with the VAS. Before the therapy the mean degree was 6.43 ± 1.14 , and after it 0.37 ± 0.67 . Lumbar mobility was measured by the Schober test. The mean values ($\bar{X} \pm SD$) of it before treatment were 1.63 ± 0.50 cm, and then -3.06 ± 0.23 cm. We examined lateral mobility in the lumbar region by measuring lateral inclinations before and after treatment. The mean values of the measured tilt on the left are 56.72 ± 6.88 cm before therapy and 48.51 ± 1.66 cm after it, and on the right - 56.73 ± 7.29 cm (before treatment) and 48.61 ± 1.24 cm after it. To the participants in the study we apply the Straight leg raise test. The mean values of it before therapy are $46.20^\circ \pm 6.31$, and after it - $75.27^\circ \pm 3.67$. There are statistically significant differences at $p < 0.05$ according to the Wilcoxon test on the examined parameters before and after the performed treatment.

When applying the Neri test and the symptom of the button before the kinesitherapy, we found that 10 subjects had a positive Neri test and 19 had a positive symptom of the button. After applying the exercises on a balance cushion tracking indicators are negative.

Discussion:

Chronic low back pain is the second leading cause of disability worldwide as a major social and economic problem [8]. In Bulgaria, more than 4% of all those who sought medical help have low back pain [9]. When assessing the degree of pain using the visual-analog scale, we clearly see an improvement in the condition of patients after therapy with a balance cushion.

The mean value obtained at the end of the balance cushion therapy at Schober test is close to normal. Measurement of lateral inclinations shows a significant improvement in the condition of patients immediately after performing the exercises on a balance cushion. Sadler et al. (2017) found a reduction in lateral flexion ROM to be prospectively associated with the development of LBP [10]. According to Bretton (1999) pain occurring when the angle is between 30 and 60 degrees is a provocative sign of nerve root irritation [11]. By measuring the values from the Straight leg raise test, we digitally prove the effectiveness of our methodology with a balance cushion to affect low back pain.

The presence of the Neri test and the symptom of the button indicates neurological symptoms in the subjects. Their absence at the end of the study proves the effectiveness of influencing the neurological symptoms in the therapy with a balance cushion.

Conclusion:

Low back pain is a common problem after the population. In recent years, it has been observed that it is becoming more common among the younger population. In kinesitherapy practice, various conservative methods are used to influence the condition of those affected, as well as to improve their quality of life. The introduction of exercises on a balance cushion in patients with low back pain diversifies the means of conservative treatment used in kinesitherapy. The present study proved the effectiveness of the applied methodology in this type of contingent, expressed in the treatment of pain symptoms and mobility in the lumbar spine in a shorter time, as well as early return of those affected to their daily and professional duties.

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Application of corporate social responsibility in the implementation of business strategies of pharmaceutical companies in Bulgaria

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Abstract:

Corporate social responsibility has long been not simply a modern topic or an exception for the pharmaceutical companies. It has turned into a key concept as well as into a prerequisite for achieving long-term economic success. The successful functioning of the health system depends on the drug policy adopted by the countries which determines the strategic role of the pharmaceutical sector and its effective management based on good management practice. The paper aims at demonstrating the benefits from the introduction of programmes for corporate social responsibility (CSR) for the implementation of good business practices and effective leadership of the pharmaceutical companies in Bulgaria. The managers who participated in the study confirm that following the example of the large corporations worldwide, in our country, too, the majority of the companies recognise the positive effect from the introduction of initiatives of socially significant nature.

Key words: corporate social responsibility, pharmaceutical companies, strategies

Introduction:

Social responsibility is part of corporate culture, expecting the fulfillment of commitments undertaken voluntarily by the companies, in which the personal benefit and the private corporate interests are left behind and a new concept of corporate values is asserted [3, 5, 6]. During the recent years, corporate social responsibility has turned into a main business practice and has been included in the priority fields for development by the managements of the big pharmaceutical companies [2, 3]. There is an increase in the number of companies in Bulgaria that declare their commitment to the implementation of socially responsible practices. It is noteworthy that most of them submit annual social reports [1, 2].

Aim: To study the possibilities for the application of corporate social responsibility in a dynamic environment and attainment of good business practices in leading companies in Bulgaria.

Materials and methods:

The study methodology involves a mixed approach including quantitative and qualitative methods. The documentation method is applied for the analysis of the benefits from the implementation of CSR programmes for the achievement of good business practices of pharmaceutical companies by means of a literary review of scientific publications in medical journals on the studied issue. The sociological method was also used – a specially designed anonymous questionnaire was filled in by 168 medical representatives and an in-depth interview with 22 managers from 20 pharmaceutical companies, developing business in Bulgaria.

Results and discussion:

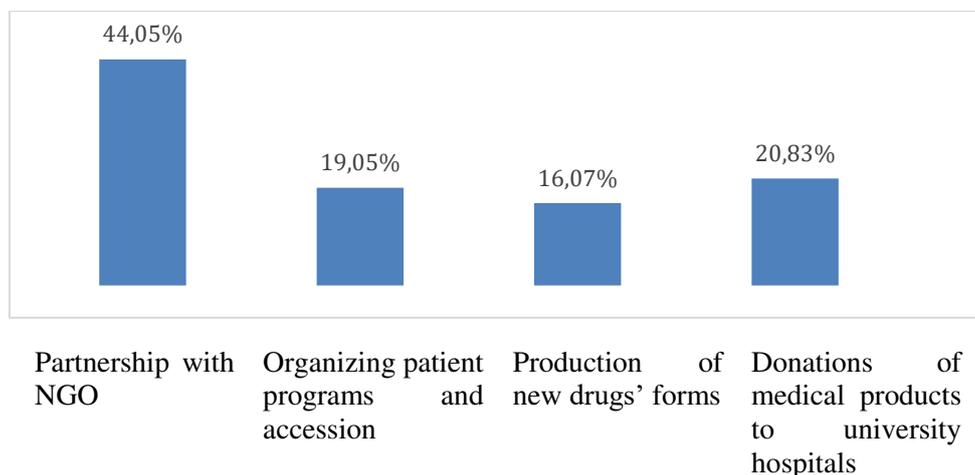
The pharmaceutical sector as one of the main world centres for pharmaceutical innovations guaranteeing the effectiveness of the healthcare systems, provokes our scientific interest and quest for rationalization of the management decisions in this field in accordance with the dynamic and competing environment of the pharmaceutical market.

According to the managers, a pharmaceutical company works well, when it achieves satisfaction of patients' needs and utilizes effectively its resources in order to improve the quality of the provided care. The team chooses the most suitable environment to present an effective service, ensuring the best or at least the same benefit for the patient as compared to other possibilities. The purpose is to utilize less resources, taking into consideration a great number of factors.

In their interviews, the managers of pharmaceutical companies become increasingly aware that the introduction of a powerful CSR programme is a basic element for the achievement of good business practices, effective leadership and organizational sustainability.

Responding to the questions about the implementation of company initiatives involving patient care, the medical representatives answer positively. This indicates the socially oriented policy of the pharmaceutical companies in Bulgaria. Most commonly, the preferred initiatives are related to partnerships with nongovernmental organisations (44.05%, n=74) and donations of drug products for university and municipal hospitals (20.83%, n=35). Less frequently, initiatives are organized aiming at the organization of patients' programmes and access to them (19.05%, n=35) as well as the production of new drug forms (16.07%, n=27) (Fig. 1).

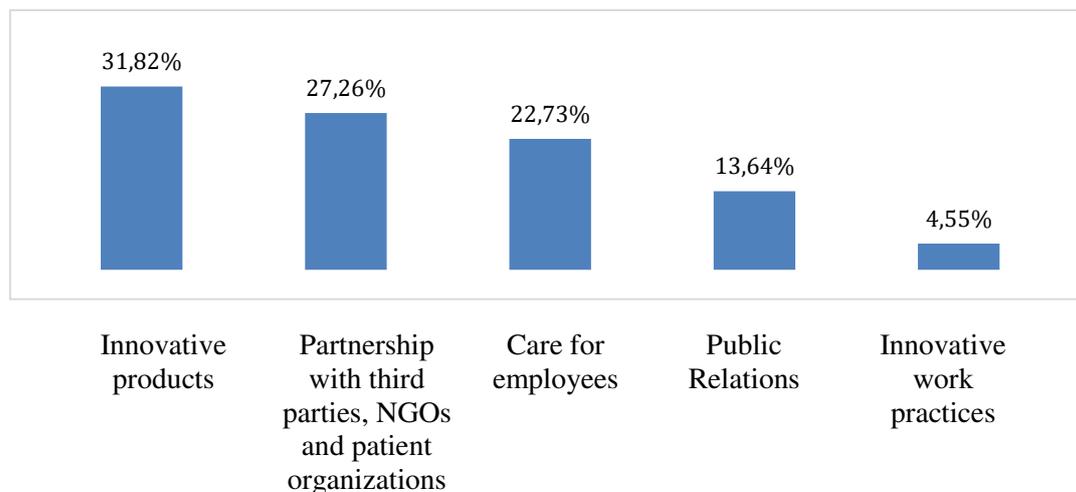
Figure 1. Pharmaceutical companies initiatives related to patients' care



By applying various initiatives, the pharmaceutical business contributes to the development of local communities. The implementation of CSR is not a single act, but a process in which the business demonstrates its attitude to society and contributes to its development. At the same time the company attains a better image and a better motivation for its teams.

Due to the increasing number of people with socially significant diseases, the need arises for innovative pharmaceutical practices and products to meet the consumers' demand and the increased expectations. Particular attention is paid to the future activities in the CSR strategy for continuous development aimed at the future success of the company. According to the respondents' opinion, the pharmaceutical companies focus their activities on the main CSR areas when creating innovative products (31.82%, n=7). As active members of the Bulgarian network of the UN Global Contract, the majority of the company managers share that they participate in a number of projects, linked in the field of partnerships with third persons, e.g. nongovernmental organisations (NGO) and patients' organisations (27.26%, n=6). The care for the employees and the social packages have approximately the same share (22.73%, n=5), followed by the public relations (13.64%, n=3) and innovative working practices (4.55%, n=1), targeted at various age groups (Fig. 2).

Figure 2. Distribution of activities from the main CSR fields implemented within the corporate strategies of the pharmaceutical companies



The corporate social responsibility in the pharmaceutical industry is aimed at building a partnership with nongovernmental organisations, the concern for the employees, ethical relations with the partners, innovative working practices and the environmental protection. Under these dynamic working conditions, including the pandemic situation with COVID-19, the corporate social responsibility is part of the social programmes launching for compassionate use of drugs and innovative therapeutical possibilities.

Conclusion:

The study confirmed that the process of the development of innovative pharmaceutical practices for CSR implementation is purposeful, well-structured and organized. The focus is placed on the seeking and providing desired changes which could offer a better and improved model for integrated health and pharmaceutical care, toward improvement of the quality of life of patients with socially significant diseases and last but not least, increased economic and financial stability of the pharmaceutical companies operating on the Bulgarian market.

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Healthcare specialist' retention during Covid-19 in Bulgaria

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Abstract:

Purpose: The aim of this study is to highlight the ways in which the healthcare personnel in Bulgaria can be retained during the unprecedented crisis in the healthcare sector. The shortage of qualified medical workers has a negative impact not only for the health of the population, but also on the standard of living and prosperity of each nation. The deficit is significantly exacerbated because of the COVID-19 pandemic.

Materials/Methods:

Analysis of empirical data, which is upgraded with correlation analysis. The study covers the period 2018-2022. Data is provided from the World Health Organization, International Council of Nurses, National Statistical Institute and University hospital "Saint Marina", Varna as the last one is taken as example in the present study.

Results and discussion:

Among motivational techniques adequate remuneration and opportunities for professional development stand out. They are crucial for healthcare personnel retention and have proved as highly effective during the COVID-19 pandemic.

Conclusions:

Based on the needs of the healthcare personnel and adapting to the current situation in Bulgaria, financial incentives are outlined as a reliable tool for retaining medical professionals. The example of the University Hospital "St. Marina" fully proves the relationship. The hospital manages to overcome the shortage of medical specialists through purposeful investments and human capital development, although the significant challenges that the healthcare sector is facing as a result of COVID-19 pandemic.

Key words: medical specialists; retention; healthcare; COVID-19;

Introduction:

Healthcare personnel shortage is a problem with global dimensions that leads to an inability for the healthcare systems to deliver high-quality health services to the population, limited access to healthcare and to a deterioration of health indicators. The deficit is strengthened due to demographic shifts in the countries, the increasing migration processes, economic trends, ongoing global pandemic of coronavirus disease (COVID-19), etc. According to the World Health Organization (WHO), by 2013 the shortage of healthcare workers worldwide amounted to 7.2 million and the deficit is projected to be 12.9 million by 2035 [6]. A few years later a new forecast of the WHO, indicate that 18 million healthcare personnel will be needed to fill the gap in 2030 [7]. The worldwide shortage of nurses by 2020 amounts to 27.8 million. In a study, conducted by the International Council of Nurses in March 2021, 20% of nurses reported intention of leaving the profession. Moreover, 13 million nurses will be needed to fill the gap caused by the aging of nurses and to replace those who want to leave the system in the coming years [1]. Bulgaria faces the same challenges as other countries – an aging population, an aging workforce in the healthcare sector, lack of attractiveness of the medical professions, especially

the profession “nurse”, uneven territorial distribution because of migration processes, etc. Those factors directly affect the provision of the Bulgarian healthcare system with healthcare personnel. Along with the COVID-19 crisis and the pressure on the healthcare system, the healthcare workers deficit reaches a critical point.

Background:

The total number of physicians in Bulgaria (4.2 per 1 000 population in 2019) is above the EU average of 3.9 [3]. Despite this fact, there is a lack of physicians in key specialties, such as anesthesiology and intensive care, pediatrics, psychiatry, infectious diseases, etc., which results in inefficiencies in the functioning of the healthcare system. Moreover, Bulgaria is one of the EU countries with the lowest densities of nurses 4.4 per 1 000 population, when EU average is 8.4 per 1 000 population [3]. Furthermore, overall life expectancy at birth in the country remains the lowest in the EU, survival rates for the most prevalent cancers are again among the lowest in the EU and the universal healthcare coverage remains inapplicable.

Taking Maslow’s theoretical statement of the hierarchy of needs as an example and applying it to the health sector, the incentives that could be applied to retain medical specialists can be identified. If it is assumed that physiological needs are satisfied, the next component of Maslow’s hierarchy is security [4]. The COVID-19 pandemic leads to high rates of infection and death, stress, burnout for healthcare workers. During the COVID-19 pandemic, meeting safety needs is extremely difficult. Quarantined/infected with COVID-19 healthcare personnel overwhelms the working schedule of other employees in hospitals. For example, the total amount of the staff in the University hospital “St. Marina” in Varna for 2020-2021 varies between 2019 and 2005 people. For the same period the number of quarantined/infected staff for 2020 is 367 people, for 2021 – 264 people, and only for January 2022 – 139 people. Their obligations should be divided among the other employees, which leads to extremely severe mental and physical stress, heavy workloads, emotional exhaustion, which may lead to medical errors, etc. Therefore, insecurity must be compensated by higher satisfaction of social needs, the need for respect and self-improvement.

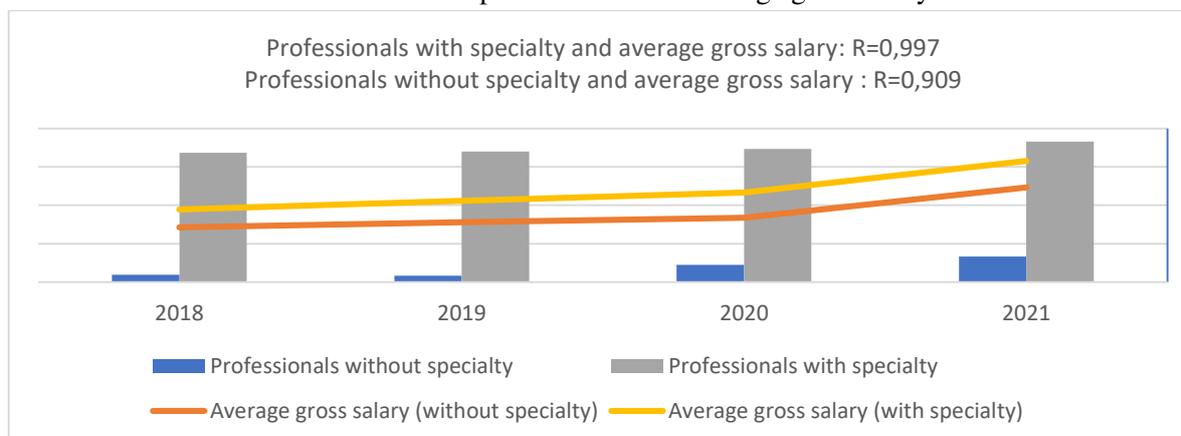
Attractive salaries play a key role in retaining healthcare professionals, although it is not the only determining factor. Despite healthcare sectors` insufficient funding, lack of reforms and ineffective policies, St. Marina Hospital managed to increase its revenues for the period 2018-2021 by nearly 40%. Moreover, the relative share of remuneration as a % of income for the same period increased by over 22%. The average gross salary of medical personnel in the hospital increased by over 70% in 2021, compared to 2018. According to data from National Statistical Institute (NSI) the average gross salary in the healthcare sector for December 2021 amounted to 1981 BGN [2]. The average gross salary of medical personnel in St. Marina Hospital for the same period is higher by over 40% than the national average. Evidence of effective personnel retention is the relatively constant number of employees for the period 2018-2021. In 2018 the total number is 2029 people, while in 2021 there are 2005 employees. Ongoing education, lifelong learning, investments in human capital and career development opportunities are key prerequisites for healthcare workers to remain practicing at the St. Marina Hospital. The number of doctors appointed without specialty in 2018 is 19 people, while in 2021 their number amounts to 66 people and an increase of 9% for 2021 compared to 2018 of doctors with an acquired specialty.

Results and discussion:

A correlation analysis is made to prove the strong impact of material and career development incentives to retain healthcare specialists. It aims to identify the direction of the relationship between number of professionals with and without specialty and average gross salary between 2018 and 2021. These

indicators are selected because they are directly related to the retention of employees. The statistical analysis was prepared based on data provided by St. Marina hospital.

Table 1. Correlation between number of professionals and average gross salary



According to the analysis a positive correlation is established:

- between the professionals with specialty and their average gross salary for the period from 2018 to 2021 $R=0,997108020567043$ – the higher the salaries, the more people are with specialty. Therefore, it could be expected that employees will be retained, and new personnel will be recruited.
- between the professionals without specialty and their average gross salary for the period between from 2018 to 2021 $R=0,909974544665405$ – in this case, the same trend is observed.

Future authors' studies will focus on a wider range of hospitals and a longer observation period in order to identify and to highlight the factors that have impact on retaining healthcare professionals.

Conclusion:

The unprecedented COVID-19 pandemic has impacted many aspects of people's lives, of which the lives of healthcare workers are one of the most impacted. Medical specialists are grappling with high level of stress, fear of being infected and infecting their families and its consequences on their own health, fatigue, and burnout amid the COVID-19 pandemic. The number of healthcare personnel needs to increase dramatically to meet the demand of the Bulgarian population. By providing competitive salaries and opportunities for career development the turnover intentions of the healthcare workers could be limited.

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Rehabilitation of patients after stroke and EMG changes in spastic hemiparetic gait, Wernicke-Mann type

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Introduction:

Human locomotion is a phenomenon of the most extraordinary complexity in which so great are the multitude of individual motions occurring simultaneously in the three planes of space (The Journal of Bone and Joint Surgery, 1953). Reduced peak knee flexion in the swing phase of gait, known as hemiparetic gait, Wernicke – Mann), is a common abnormality in patients with hemiparesis. Inappropriate activity of the rectus femoris muscle (RF), due to spasticity, has been widely reported as a cause of hemiparetic gait. Rehabilitation with BoNTA has been shown to be effective in patients with hemiparesis with lower limb spasticity (Tok et al.,2012; Dunne et al., 2012). EMG is a useful tool for the evaluation of abnormal patterns of muscle activation in patients with neurological disorders and EMG techniques may be used to evaluate the effects of BoNTA.

Spasticity of some muscles especially muscle rectus femoris is one of the main causes of Wernicke – Mann gait in patients with upper– motor neuron syndrome and leads to gait disabilities. Hemiplegic gait treatment with rehabilitation and BoNT A has been effective on clinically assessed spasticity as well as certain parameters of the gait cycle (knee flexion during the swing phase and gait velocity)

Hemiplegic gait, Wernicke-Mann type represents spastic pattern of hemiplegic leg, hip into extension, adduction and medial rotation, knee in extension, ankle in drop foot with ankle plantar flexion and inversion (equinovarus) which is present during both stance and swing phase. In order to clear the foot from the ground the hip and knee should flex but the spastic muscles won't allow, so the patients hikes hip and bring the affected leg by making a half circle i.e. circumducting the leg. Hence the gait is known as “Circumductory gait”

Wernicke-Mann gait is also characterized by a decrease in peak knee flexion during the swing phase of gait and is commonly observed in patients following stroke. One of the principle causes of the gait is spasticity of the rectus femoris muscle (RF). RF spasticity increases the knee extension moment in pre-swing and decreases knee flexion velocity at toe-off , both of which potentially decrease peak knee flexion in swing.

This study was designed to evaluate the need of rehabilitation of patients after stroke in order to improve their gait, range of motion and spasticity of muscle rectus femoris. It was designed to research if botulinum toxin type A injection on the spastic muscle of patients after stroke is effective. It aimed to determine clinical efficiency of BTX-A treatment on Wernicke - Mann gait and to provide more information on the physiopathology of this condition.

Purpose:

The aim of this study is to evaluate changes in the EMG signal (amplitude and frequency) of the knee extensor and flexor muscles as well as changes in knee and hip kinematics after rehabilitation and using BoNTA injections of spastic muscles in patients with hemiparetic gait Wernicke-Mann. Based on findings also in the literature it is hypothesized that spastic muscles activity would

decrease both in amplitude and frequency after rehabilitation with BoNTA injection, during the swing-phase of the gait cycle.

Methods:

Motion capture: provides joint angles, velocities and acceleration of the joints in 3D

Dynamic electromyography (EMG): provides muscle activation patterns recorded in motion

Clinical Examination of patients: Neurologic impairments (upper- and lower-limb motor function, muscle tone, sensitivity, range of motion, deep tendon reflexes) were assessed using the Stroke Impairment Assessment Set (SIAS). The Duncan - Ely test¹⁰ was also performed to specifically evaluate rectus femoris spasticity.

Results:

Rehabilitation of stroke patients walking with Wernicke – Mann gait is important medical and social problem. The aim of Rehabilitation is to improve gait velocity, to stride length and cadence with an increase of knee angular velocity of toe-off and maximal knee flexion in the swing phase. The main finding that is expected is that after BoNTA injection kinematic improvements will be associated with a decrease in EMG amplitude of RF, co-activation duration of spastic muscles in swing phase, and muscle activation frequency of RF during the entire gait cycle.

Discussion:

The present study shows the beneficial effects of BTX-A injection into the rectus femoris on stiff-knee gait in people with stroke. The treatment improved knee joint displacement, angular speed, and power. These improvements, and the decrease in the rectus femoris tone, decreased the vastus lateralis and biceps femoris activation time. Although it might have been preferable to perform a doubleblind randomized controlled trial to assess the effects of BTX-A, this would have been prohibitively expensive and long given the number of patients required and the cost of the motion analysis measurements.

Spasticity of the lower limbs is a major cause of disability in patients with chronic disorders of the pyramidal tract after stroke. Until now, no satisfactory treatment has been available. Medications seldom produce useful reductions in spasticity without side effects such as sedation and generalized weakness. Rectus femoris can be particularly resistant to drug treatment. Surgical procedures. Including section of nerve roots of the spinal cord and amputation of the femoral head, may be disfiguring, are not without risk, and spasticity can recur. Intrathecal infusion of baclofen by implanted pumps reduces spasticity, but this treatment requires close monitoring of the patient and the pump. There is a need of an easily administered treatment and rehabilitation that will control muscle spasm without producing generalized weakness or systemic effects, and injected botulinum-A toxin may meet these criteria.

Conclusion:

Rehabilitation and injecting BoNT A in spastic muscles in patients with hemiparesis after stroke seemed to delay the angle of peak spastic torque, whereas the voluntary force decreased and to improve social life of patients. In this study, after stroke patient selection, rehabilitation using BoNT A injection into the spastic muscle in hemiparetic gait type Wernicke - Mann led to improvements in impairments, functional aspects of gait, social life and discomfort

This study shows the beneficial effect of Rehabilitation and BTX-A in spastic muscles injection on Wernicke – Mann gait that was shown in patients with stroke. This study shows the importance of the rectus femoris in the physiopathology of hemiplegic gait. Future studies should also focus on the long-term benefits of BTX-A.

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Myrtenal effects on memory in experimental rats

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Abstract: Myrtenal belongs to low-molecular monoterpenes. There are no data in the literature, concerning its effects on the memory abilities of experimental animals. The aim of this study was to evaluate the potential effect of Myrtenal (M) on memory of laboratory rats. The substance was applied as intraperitoneal emulsion in male Wistar rats in single or repeated administration (40 mg/kg b.wt.) for 11 consecutive days. Changes in memory status of M-treated animals were evaluated in comparison to controls via Passive avoidance test and brain cholinergic transmission in cortex and hippocampus was biochemically studied. Our result showed that only single administration of monoterpene can improve memory performance of healthy animals. But multiple M administration affected cholinergic brain system, expressed as a significantly increased brain ACh levels. For the first time in our research Myrtenal's beneficial properties on memory capacity of intact rats after single administration were revealed.

Introduction: Myrtenal is a low-molecular monoterpene, present in essential oils of a number of plants like *Myrtus communis*, *Artemisia* spp., *Origanum majorana*, *Origanum vulgare*, *Glycyrrhiza glabra*, *Rozmarinus officinalis*, *Thymus* spp., *Salvia officinalis*, *Lavandula* spp., and in the royal clay (propolis). Myrtenal demonstrates *in vitro* anti-cholinesterase properties [2] and antioxidant action in carcinogenesis models [3]. Memory-stimulating properties of α -pinene in rodents, whose metabolite is Myrtenal, are also established [4]. But there are no data in the literature concerning *in vivo* effects of M on memory abilities of experimental animals.

Aim of this study was to evaluate the effects of Myrtenal on memory of laboratory rodents after single and repeated administration.

Materials and methods: The experiments were carried out on male Wistar rats (180 ÷ 220 g). Myrtenal was applied intraperitoneally as an emulsion in an established effective dose [5] for 11 consecutive days (40 mg/kg body weight). Memory performance of the experimental animals was evaluated via Passive avoidance test [6] on the 2nd, 24th and 48th hour after single and on the 12 day after its multiple administration. The brain acetylcholine esterase (AChE) activity [7] and concentration of acetylcholine (ACh) [8,9] in rodent were evaluated biochemically.

Results ad discussion:

1. *Effects of single and multiple Myrtenal administration on memory.* Results are shown on Figure 1.

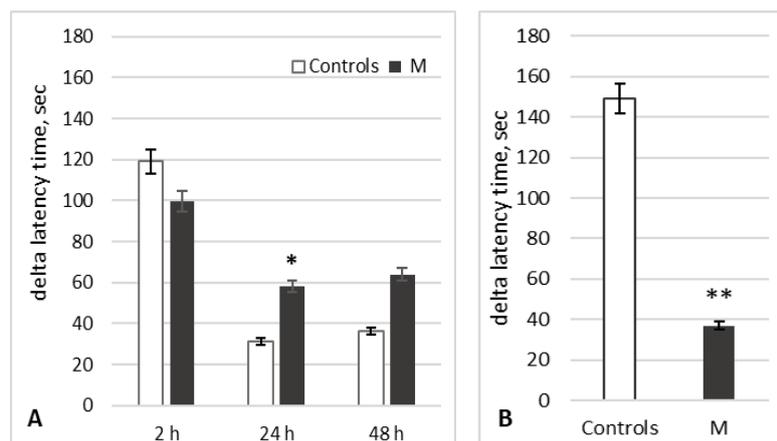


Fig. 1. Effects on memory capabilities in rats after single (A) and repeated (B) administration of Myrtenal – delta in latency time vs. initial training (IT) recording (sec); (*P < 0.05, **P < 0.01 vs. Controls)

Single Myrtenal administration significantly improved memory capacity of treated rats both on the 24th and on the 48th hour. M increased delta latency index compared to the controls. There was an 85.7 % increase (P < 0.05) on the 24th hour after first M administration and by 76.2 %, on the 48th hour after first M-administration (Fig. 1 A).

But multiple Myrtenal application impaired memory performance of healthy rats. Delta latency index, after 11 days treatment, was decreased by 75.2 % (P < 0.01) compared to Controls (Fig. 1 B). The substance did not improve memory capacity (long-term memory) which is in line with our previous studies established anxiolytic action of the molecule with hypomnesia properties observed [5].

2. Effects of Myrtenal on brain cholinergic transmission

AChE activity in two brain structures, connected with memory – cortex and hippocampus, as well as brain ACh content, were evaluated. Results are presented at Figure 2.

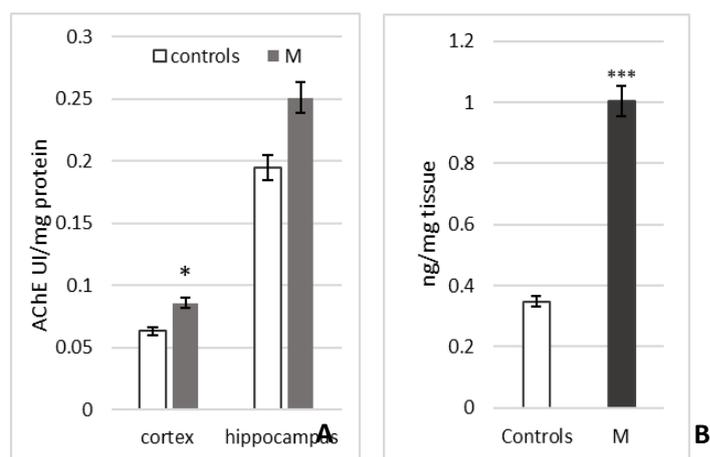


Figure 2. Effects on brain cholinergic transmission – AChE activity (A) and ACh content (B) after Myrtenal application; *P < 0.05, ***P < 0.001 Vs. Controls

Multiple Myrtenal administration increased AChE activity by 35.45% (P < 0.05) in cortex and by 28.91% in hippocampus respectively, as compare to the controls (Fig. 2 A).

These results can explain partially our data for impaired memory of M-treated rats in compare to controls. They confirmed also our initial hypothesis about AChE stimulating effect of Myrtenal after multiple administration established in healthy mice in our previous research [1]. On the other hand, our data did not confirm the anti-cholinesterase activity of Myrtenal, evaluated *in vitro* [2].

In the same time multiple Myrtenal administration increased ACh brain content 3-fold as compared to the Controls with level of significance $P < 0.001$ (Fig. 2 B). Acetylcholine is a mediator with a leading role in memory, as well as in neurodegenerative processes. Elevated ACh levels are associated with stimulation of activity and/or elevation of choline acetyltransferase (ChAT), an enzyme responsible for synthesis of ACh in neurons. We believe that high levels of ACh in combination with the lack of anti-cholinesterase properties of M could be due to ChAT influence as a possible mechanism for observed cholinergic enhancement effect.

Conclusions: For the first time effects of Myrtenal on memory status in laboratory rats was studied. The monoterpene Myrtenal improved significantly the short-term memory but had hipomnesic properties after multiple administration. These results were accompanied with lack of AChE inhibition activity *in vivo* and significantly elevated brain ACh levels. Established cholinergic enhancing effect of Myrtenal probably could be related to brain ChAT stimulation.

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