The 6th International Scientific Conference
EXERCISE FOR HEALTH AND REHABILITATION
The 2nd of December, 2020
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BOOK OF ABSTRACTS
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The aim of the conference is to bring together physiotherapists, occupational therapists, adapted physical activity specialists, sports medicine doctors, physical medicine and rehabilitation physicians, trainers and other specialists who are interested in the health promotion and rehabilitation modalities.

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Powerlifters lower body mobility and dynamic function: impact of foam rolling and neurodynamic mobilization

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Introduction. Powerlifting requires explicit functional properties such as mobility and dynamic function of all upper and lower body segments. Long and hard trainings can lead to restriction of these properties and athletes are forced to look for additional ways for improved recovery, injury-free state once accomplishing highest personal results. Nowadays, one of the most popular tool for recovery is foam rolling. Scientifically proven that it helps to activate sensomotoric functions, increases muscle flexibility, mobility [1]. However, neurodynamic mobilization is also been reported as efficient way for recovery. It helps to decrease mechanical nerve sensitivity and over time increases flexibility and can enhance muscle contraction force [2,3]. Research aim: to evaluate influence of foam rolling and neurodynamic mobilization for lower body mobility and dynamic function among powerlifters.

Research methods and organization. The study was approved by Research Ethics Committee (Nr. BEC-SR(M)-164). All participants signed the informed consent form before taking part in this study. Five females and nine male powerlifters aged 23 to 32, without any musculoskeletal injuries in the past 6 months, which have not allowed them to train for 2 weeks, never been diagnosed with any lower body limb pathologies, but have lower body joints range of motion restrictions, were enrolled to this study. The participants were divided into two groups: foam rolling group (FRG) (n=7) and neurodynamic mobilization (NMG) group (n=7). Leg length was measured with centimetre tape. For dynamic balance, mobility and movement symmetry Y Balance test (YBT) was used. Functional strength, power and neuromuscular control were evaluated by providing Single Leg Triple Hop (SLTH) test. Also pain sensation after each session was noted by using Visual Analog Scale (VAS). There were two different phases of interventions for both FRG and NMG groups, that lasted 4 weeks in total. Each phase within group lasted for 2 weeks. All the assessment tests were performed before and after each of the phase. NMG group participants for the first 2 weeks, 3 times a week, did neurodynamic mobilization exercises for femoral, sciatia and tibial nerves. Each exercise was supposed to be done for 5 sets for 1 minute. Later, for two weeks – same exercises, 3 sets for 1 minute were performed. FRG group for the first two weeks foam rolled quadriceps, hamstring and calf muscles both legs at the same time for 2 minutes. Later, for two weeks one leg at the time was foam for 1 minute. Exercise instructions were given before starting interventions. Data was analysed by using the program SPSS 26.0 and Microsoft Excel for Windows. Non-parametric dependent values were compared with Wilcoxon test, and two independent values were compared with non-parametric Mann-Whitney test. The results are presented as median (xme), minimum (xmin), maximum (xmax) value and mean (x̄) – xme (xmin – xmax; x̄). The difference was considered statistically significant when p < 0.05.

Results. In FRG group there were 2 females and 5 males and in NMG group consisted of 3 females and 4 males. There was no difference among groups. Single Leg Triple Hop right and left leg. There was significant increase in NMG after first (Z=-2.117; p = 0.034), second (Z=-2.366; p = 0.018), but not between interventions. Results in FRG statistically significantly increased after first (Z=-2.371; p = 0.008).
There was statistically significant increase in NMG after first (Z = -2.366; p = 0.018), second (Z = -2.371; p = 0.018), but not between interventions. Results in FRG statistically significantly increased after first (Z = -2.366; p = 0.018), second (Z = -2.366; p = 0.018), not between interventions. Y balance test right and left leg. In NMG statistically significant increase was found only after first (Z = -2.197; p = 0.028) intervention. Results in FRG have not changed after first, but statistically significantly increased after second (Z = -2.366; p = 0.018) without no difference between interventions. There was statistically significant increase in NMG after first (Z = -2.201; p = 0.028), second (Z = -2.197; p = 0.028) but not between interventions. Results in FRG have not changed after first, second but statistically significantly increased between interventions (Z = -2.375; p = 0.018). SAS for pain intensity: Pain sensation after each completed intervention exercises in NMG was always lower compared with FRG.

Conclusions. 1) Neurodynamic mobilization and foam rolling are effective in increasing powerlifters lower body neuromuscular control and muscle strength. 2) Both neurodynamic mobilization and foam rolling helps to increase dynamic balance and movement symmetry for powerlifters. 3) Pain sensation is significantly lower when performing neurodynamic mobilization compared to foam rolling.

References:

The risk of falls and fatigue changes in individuals with Multiple sclerosis using an integrated exercise program

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Introduction. About 50 to 80 percent of people with Multiple sclerosis (MS) experience balance and gait disorders, and 50 percent of them experience falls (1). Daily fatigue is associated with physical, cognitive, and psychosocial health, not only with the risk of falls, but it also limits patients’ daily activities (2, 3). It is important to find out whether an integrated physiotherapy program can correct the imbalance, reduce the risk of falls and fatigue. It is still unclear whether the effectiveness of a physiotherapy depends solely on the content of the program, or whether the time of day as well. The aim of this study was to evaluate the risk of falls and fatigue changes in individuals with MS using an integrated exercise program.

Research methods and organization. The study involved 16 females and 4 males aged 40 to 60 (52.35 ± 8.1) years, who belong to the Kaunas District Multiple Sclerosis Society. Participants were divided into two exposure groups and underwent the same integrated exercise program, which included stretching (10 min.), torso stabilization (20 min.), sensorimotor exercises (15 min.) and a dual-task method (15 min.). This program is based on the principle of the CoDuSe program: adding a dual task increases the postural sway and sensory disturbances evoke difficulties in balance control for
MS patients (4). Each group received 10 sessions every other day, 1 hour / day. The first group received physiotherapy in the morning and the second one – in the afternoon. At the beginning of the study, Timed Up and Go test was used for fall risk assessment (less than 10 s - no fall risk). For fatigue evaluation we used Multidimensional Fatigue Inventory Scale, which consist of 20-item scale designed to evaluate five aspects of fatigue: general fatigue, physical fatigue, motivation, activity, and mental fatigue (0 percent - no fatigue; 100 percent - high fatigue). At the end of the study, a re-evaluation was performed. Statistical analysis was performed using SPSS.21 program. Quantitative data are presented as median (Xme), minimum (Xmin), maximum value (Xmax) and arithmetic mean (X̄) – Xme (Xmin - Xmax; X̄). The Wilcoxon criterion was used to compare the two dependent samples, the Mann – Whitney – Wilcoxon test – two independent samples. Differences at p < 0.05 were considered statistically significant.

Results. The risk of falls after the application of the integrated physiotherapy program decreased in both groups (p <0.05). Before physiotherapy, the risk of falls in the first group was 17.98 (14.81 - 22.3; 18.1) seconds, and after physiotherapy - 12.7 (10.79 - 15, 93; 12.97) seconds. Before physiotherapy, the risk of collapse in the second group was assessed at 15.91 (12.32 - 22.39; 16.70) seconds, after - 15.22 (11.52 - 20.61; 15.3) seconds. Comparing the results of both groups after physiotherapy, it was found that the risk of falls of the first group after physiotherapy decreased more than the second (p <0.05), taking into account the changes in the results after the study (the first - 5.28, the second - 0.69 seconds). It was found that the total fatigue after the applied integrated physiotherapy program decreased only in the first group of subjects (p <0.05). Physical fatigue decreased in both the first and second study groups (p <0.05), but no differences in physical fatigue were found between the groups. After the applied complex physiotherapy program, increased physical activity (p <0.05) and motivation (p <0.05) of both groups were found. The incidence of mental fatigue was significantly reduced only in the first study group (p <0.05). Differences in these indicators between groups were not apparent.

Conclusions. Applying a complex physiotherapy exercise program to people with MS in the morning reduces the risk of falls more than applying it in the afternoon. General fatigue is reduced only by applying this program in the morning. Indicators of physical fatigue, physical activity and motivation do not depend on the application of physiotherapy at different times of the day.

References:
Young female football players’ functional movements: impact of balance exercises

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Introduction. In football balance is considered as most important technical skill needed for an athlete to perform. Players must acquire the ability to balance on a single leg during both static and dynamic situations during football activities [1]. Leg dominance can lead to lower limb strength asymmetry, muscle imbalances which can limit physical performance, reduce the intensity at which a player is able to work-out [2], and increase the injury risk (3). Imbalances between the dominant (D) and non-dominant (ND) leg may be a major contributing risk factor leading to injury (4). Research aim: To evaluate the effects of balance exercises during young football players functional movements and muscle performance of the dominant and non-dominant legs.

Research methods and organization. The study was approved by the Bioethics center (BEC-SR(M)-101). Consent forms were signed before taking part in the study. Either the participants or the appointed guardians of the minors signed consent on their behalf. The first study was conducted from March to June 2020 (it presents quarantine influence on players' results) and the second from June to August 2020 (presents the effect of balance exercises). Players who met the following selection criteria were included in the study: “Šiaulių sporto gimnazija” team players; age rank from 15 to 18 years; no less than 6 years of experience of playing football; participants had no injuries or other health restrictions during the previous 3 months before the enrolment to the study. Eighteen players of “Šiaulių sporto gimnazija” girls’ football team age 16.2±0.94 years participated. Functional Movement Screen test was used to evaluate the quality of movement. To evaluate static and dynamic balance the Flamingo test and dynamic Y balance test were used. To evaluate explosive power static and dynamic Vertical Jump was used. For sudden power Single Leg Triple Hop and 6-m hop for time tests were used. Leg dominance was determined with following question “which leg do you prefer to use when kicking?” Intervention started with warm-up (10 minutes) and balance exercises (20 minutes) and were provided to athletes from June to August. These balance exercises used weights and unstable platforms. In addition, a string jumping technique based on differential learning was used as warm-up. Balance exercises were performed after warm-up and prior to the main football training session. Duration of the balance exercises was twenty minutes triweekly. The data was analyzed using IBM SPSS Statistics (Ar-monk, NY: IBM Corp, USA), version 20. Non-parametric dependent values were compared with the Wilcoxon test. The difference was considered statistically significant when p < 0.05.

Results. Influence of quarantine: Flamingo test. Both leg ND (Z=-2.274; p = 0.023) and D (Z=-2.034; p = 0.042) had a significant decrease. Y balance test. Composite score of ND (Z=-2.201; p = 0.028) and D (Z=-2.591; p = 0.010) had significant decrease. FMS score decreased (Z=-1.977; p = 0.048). Vertical jump. ND leg static (Z=-3.202; p = 0.001) and dynamic (Z=-3.055; p=0.002) and D leg static (Z=-1.961; p=0.05) and dynamic (Z=-2.823; p=0.005) jumps height had a significant decrease. Single leg triple hop. D leg had a significant decrease (Z=-2.308; p = 0.021) while ND leg demonstrated no difference. 6-m hop for time. The jump time of the ND leg (Z=-2.535; p = 0.011) and D leg (Z=-2.939; p = 0.003) decreased significantly. The symmetry index did not change significantly in none of the one-legged jump tests. Intervention: post balance exercise program Y balance test. Composite score of ND (Z=-3.462; p = 0.001) and D (Z= -3.070; p = 0.002) had a significant increase. FMS score augmented (Z=-3.081; p=0.002). Flamingo test. A significant increase in static balance of ND (Z=-
3.238; p = 0.001) and D (Z=-3.456; p = 0.001) leg was present. Vertical jump. ND leg static (Z=-3.463; p=0.001) and dynamic (Z=-3.203; p=0.001) and D leg static (Z=-3.463; p=0.001) and dynamic (Z=-3.463; p=0.001) height of the vertical jump showed a significant increase. Single leg triple hop. The distance jumped with ND (Z=-2.485; p = 0.013) and D (Z=-2.964; p = 0.003) legs increased. The leg symmetry index was not demonstrating significant difference. 6-m hop for time. For both ND (Z=-3.072; p = 0.002) and D (Z=-3.402; p = 0.001) legs the time of leg hops increased. The leg symmetry index was not demonstrating statistical difference.

Conclusions. 1) The quality of functional movements decreased during quarantine and improved after two-month balance exercise program. 2) Static and dynamic balance decreased during quarantine once the opposite was true after balance exercises program 3) Both explosive and sudden power of dominant leg decreased during quarantine while both dominant and non-dominant leg improved after balance exercises program. 4) Quarantine and intervention has not affected neither leg asymmetry in single leg triple hop nor in 6-m. hop for time tests.

References:

The effect of closed and open kinetic chains exercises for trunk and lower extremities functional state in physically active adults

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Introduction. Over the past decade, the meanings of the functional state of trunk and lower extremities have been a widely discussed topic around the world. The aim is to find out how the neuromuscular control of trunk and lower extremities affect functionality, activity and biomechanics of the body of all people during physical activities (1). Properly selected physical exercises are an important aid in reducing the risk of injuries and have effect of motor control and movement to physically active individuals (2). Aim – to evaluate the effect of closed and open kinetic chains exercises for trunk and lower extremities functional state in physically active adults.

Research methods and organization. In this study participated 30 – 45 years old physically active adults (by World Health Organisation standarts). The study was completed successfully by 35 adults (group of closed kinetic chain exercises (CKCE) – 6 men and 12 women and group of open kinetic chain exercises (OKCE) – 6 men and 11 women). Age median of CKCE group was 38 (30 – 42; 37.5) years. Age median of OKCE group was 36 (30 – 44; 36.17) years. Thus, both groups were homogeneous by gender (p>0.05) and by age (p>0.05). The study was initiated and completed on 2019.12.01 – 2020.10.06 in “Eli physical therapy clinic”. The research was approved by the Lithuanian University of Health Science Bioethics Center. Selection criteria: engage in moderate – intensity for at least 150 minutes per week or 75 minutes of high – intensity physical activity; no clinically established lower limb and spinal pathologies; no clinically established cardiovascular system diseases and no
antihypertensive drugs use. Static endurance of trunk muscles was evaluated by Mc’Gill tests; static endurance of lower extremities and trunk muscles and neuromuscular sensory response were evaluated by unilateral hip bridge test; functional movement of the body was evaluated by functional movement screening (FMS) test. Participants in CKCE group did closed kinetic chain exercises with „Redcord mini“ equipment, meanwhile participants in OKCE group did open kinetic chain exercises with elastic resistance bands. For both groups each exercise program was applied 2 times a week, 10 weeks in all. One session took 60 minutes. Statistical analysis was performed using the “IBM SPSS Statistics 21” software package. Due to insufficient sample, the Wilcoxon criteria (Z) was applied to the two dependent samples. The nonparametric Man – Whitney Wilcoxon criteria (U) was applied to the two independent samples. The chi – square criteria (χ2) was applied to qualitative data analysis. The difference was considered statistically significant when p<0.05.

**Results.** FMS results showed statistically significant improvement in the CKCE group (Z=-2.203; p=0.028). In the OKCE group there was no statistically significant change (p>0.05). After comparing FMS results between both groups there was no difference neither before nor after the intervention (p>0.05). The endurance of trunk extensors (CKCE group (Z=-3.619; p<0.001), OKCE group (Z=-3.623; p<0.001)), flexors (CKCE group (Z=-3.682; p<0.001), OKCE group (Z=-3.008; p=0.003)), left side trunk muscles (both groups (Z=-3.681; p<0.001)), right side trunk muscles (both groups (Z=-3.681; p<0.001)) significantly improved in both groups. However, there were no differences in trunk endurance tests between the groups neither before nor after the intervention (p>0.05). Hip bridge endurance test for trunk and lower extremities showed significant improvement with both legs in the CKCE group (Z=-3.724; p<0.001), when in the OKCE group there was no significant improvement (p>0.05). Closed kinetic chain exercises improved trunk and lower extremities static muscle endurance more than open kinetic chain exercises (right leg (U=72.5; p=0.008), left leg (U=63.5; p=0.003)). After CKCE group assessment of neuromuscular sensory response with unilateral hip bridge test of trunk and both lower extremities after intervention there was significant increase in number of subjects, who had normal neuromuscular sensory response (right leg (χ2(1)=8.1; p=0.002), left leg (χ2(1)=6.75; p=0.006)). In OKCE group there was no difference in number of subjects with normal neuromuscular sensory response before and after the intervention with both legs (p>0.05). Closed kinetic chain exercises were more effective for normal neuromuscular sensory response activation than open kinetic chain exercises with both legs (right leg (χ2(1)=6.464; p=0.011), left leg (χ2(1)=4.825; p=0.028))

**Conclusions.** Both group exercises increased static endurance of trunk muscles for physically active adults. Closed kinetic chain exercises were more effective for performance of functional movement, static muscle endurance of trunk and lower extremities and neuromuscular sensory response than open kinetic chain exercises for physically active adults.

**References:**
The changes of young basketball players’ muscle strength and dynamic balance after specialised exercise program

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Introduction. Vertical jump height is a performance criterion integrated into scoring systems for many sports. Athletic performance can be improved by specifically training jumping ability (1). Good balance makes athletes prevent from injuries during playing basketball e.g. fracture, musculoskeletal disorder, and falls (2). There is a need for greater awareness of the importance of examination, including musculoskeletal screening and functional performance testing as part of a multidisciplinary approach to reducing the risk for future injuries (3). Aim of the study - to assess changes of young basketball players’ muscle strength and dynamic balance after specialised exercise program.

Research methods and organization. The study was approved by the Bioethics Center of Lithuanian University of Health Sciences. Consent forms were signed by participants and their legal guardians. The study included 14 basketball players. Participants age was 14.2 ± 1.6 years. All participants were attending basketball training 3 – 4 times per week at Kėdainiai Sports Center. Selection criteria for the study were: members of the same basketball team, attending basketball for at least 2 years; age 14 – 15 years; in six months period no trauma and no pain in the lower extremities. The dynamic balance of lower extremities was assessed with Modified Star Excursion Balance Test and lower extremities muscle strength (jump agility) - with Sargent test. Based on the results of the initial evaluation, specialised exercise program was developed, which the subjects had to perform 3 times per week for six weeks till the second evaluation. Participants performed exercise program on Mondays and Thursdays before their usual workouts. Program was performed for 40-45 minutes. Statistical data analysis was performed with SPSS (Statistical Package for Social Sciences) 22.0. Nonparametric Wilcoxon criteria was applied for two dependent samples. Quantitative data are presented as median (xme), minimum (xmin), maximum (xmax) value, and mean (x) - xme (xmin - xmax; x). Differences with p <0.05 were considered statistically significant.

Results. Dynamic balance. The combined result of the right leg during the first evaluation was 99.5 (89.5 - 111.2; 99.9) %, and the left leg - 99.6 (91–111.6; 99.7) %. After the exercise program, the right leg combined result was 100.1 (90.5–111.8; 100.2) %, and for the left leg - 99.8 (91–111.5; 101.1) %. After the specialised exercise program, the combined result of neither the right nor the left leg did not significantly change (right leg: Z = -0.126; p = 0.9; left leg: Z = -0.315; p = 0.75). The anterior reach difference between the right and left leg was 3 (0 - 15; 3.9) cm during the first evaluation, and 2.5 (0 - 10; 2.9) cm after the applied program. This change was statistically significant (Z = -2.047; p = 0.041) - the risk of lower extremities trauma has decreased. During the initial testing, posteromedial reach difference was 2.5 (0 - 8; 3.3) cm, and during the second evaluation - 3 (0 - 7; 2.8) cm. This change was not significant (Z = -0.954; p = 0.34). The posterolateral reach difference during the first assessment was 2 (0 - 9; 3) cm and after the exercise program - 2 (1 - 6; 2.6) cm. This change also was not significant (Z = -0.431; p = 0.667). Lower extremities’ muscle strength. The result of vertical jump test at the first evaluation was 49.8 (36.2 - 59.2; 48.2) cm. After the applied program, the result was 49.9 (38–62.3; 50) cm. A significant increase of the lower extremities’ muscle strength was observed after the exercise program (Z = -2.669; p = 0.008).

Conclusions. The lower extremities’ muscle strength and dynamic balance of young age basketball players after specialised exercise program improved.
Changes in respiratory system functional indicators, sleep quality and psychoemotional state of women attending Nirvana Fitness® classes

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Introduction. Stress has reached epidemic proportions worldwide. Therefore it is important to discover easy-to-use stress reduction interventions for the overall treatment and management of this global health problem (1), one of which is relaxation practices (2). An excellent relaxation tool is pursed – lips breathing (PLB) (3). Although PLB has been discussed for many years and the number of researches is growing (4), Nirvana Fitness® classes, which are based on this breathing technique, have not been studied in Lithuania or around the world so far. Research aim – to determine changes in respiratory function, sleep quality and psychoemotional state of women attending Nirvana Fitness® classes.

Research methods and organization. The research was conducted from October 2019 to May 2020. An evaluation was performed before the first Nirvana Fitness® class and after 8 months of classes. Classes were held for 45 minutes twice a week in small groups. 28 healthy, sedentary jobs working women met the selection criteria and 17 women completed the research. The age of the women was 52 (34 – 63; 51.12) years. Before and during the research all subjects worked a sedentary job and did not attend any other physical activity classes that taught correct breathing or performed breathing exercises. None of the women participating in the research were regularly smoking during and before the research. Sleep quality of the research subjects was evaluated using the Pittsburgh Sleep Quality Index (PSQI). If the PSQI value is greater than or equal to 5 during sleep quality assessment it indicates the presence of sleep disorders and poor sleep quality. The higher the PSQI value, the lower the quality of sleep (5). Psychoemotional state (distress, tendency to anxiety, tendency to depression and somatization) was evaluated using a Four – Dimensional Symptom Questionnaire (4DSQ). The functional state of the respiratory system was assessed by calculating the respiratory rate per 1 min, by measuring the forced vital capacity (FVC) (with Micro I spirometer), respiratory muscle strength, i.e. maximum inspiratory and expiratory pressure (with Micro Medical RPM pneumotonometer), chest excursion (with measuring tape). The analysis of the research data was performed by the means of mathematical statistical methods using IBM SPSS Statistics 22 software. Quantitative data of test results are described by median (xme), minimum value (xmin), maximum value (xmax) and arithmetic mean. The comparison of two dependent samples was performed by using the non-parametric Wilcoxon test. The difference was considered statistically significant when p < 0.05 (95 % statistical confidence level).

Results. The median PSQI of subjects at the beginning of the research was 4 (2 – 10; 5.29) and the PSQI value of 5 or greater had 47.1 % of women. The PSQI value of subjects after the Nirvana Fitness® classes significantly decreased to 3 (1 – 6; 3.12) and only 5.9 % of women had sleep disorder.
(Z = -3.096; p = 0.002). After evaluating the 4DSQ data, it was found that 88.24 % of women experienced distress at the beginning of the research of whom 17.65 % experienced an average degree of distress and 70.59 % – mild degree of distress. Their distress score was 8 (0 – 11; 6.59). At the end of the research 58.82 % of subjects experienced distress related symptoms, their distress score significantly decreased to 4 (0 – 8; 3.88) (Z = -3.064; p = 0.002), indicating that only mild distress was experienced. At the beginning of the research chest excursion of the subjects was 4 (1.8 – 9.1; 4.735) cm and at the end it was 5.5 (2.3 – 12.1; 5.976) cm, showing a statistically significant improvement (Z = -3.008; p = 0.003). At the beginning of the research the median respiratory rate of women was 18 (11 – 21; 16.94) bpm and it significantly decreased to 14 (11 – 20; 14.41) bpm at the end (Z = -3.171; p = 0.002). 15 out of 17 women had a positive result of decreased respiratory rate. The subjects FVC was 3.19 (2.19 – 4.9; 3.327) liters at the beginning and 3.07 (2.24 – 4.62; 3.24) liters at the end of the research. No statistically significant difference was observed (Z = -0.994; p = 0.32). During the first evaluation a maximum expiratory pressure of the women was 101 (55 – 83; 99.71) cm H2O and during the second evaluation – 120 (65 – 151; 114.06) cm H2O, which is a statistically significant improvement (Z = -1.989; p = 0.047). The maximum inspiratory pressure was 47 (9 – 95; 50.82) cm H2O at the beginning and 67 (42 – 109; 70.82) cm H2O at the end of the research. A statistically significant improvement was observed (Z = -3.552; p < 0.001).

Conclusions. After the application of Nirvana Fitness® classes an improvement of the sleep quality and reduced degree of distress and somatization of sedentary working women has been observed. Moreover an increment in respiratory muscle strength as well as respiratory rate and chest excursion has been observed, however, forced vital capacity did not change.

References:

Does local cryotherapy have additional benefit in recovery of patients after anterior cruciate ligament reconstruction?

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Introduction. Tear of anterior cruciate ligament accounts for more of 50% of all knee injuries (1). Anterior cruciate ligament reconstruction is considered as a gold standard after it's tear or trauma, especially for young persons and athletes (2). Returning to sports as soon as possible is the main goal of this operation (3). However it is necessary to pay attention to rehabilitation in postoperative period, which is essential for good treatment results. (2) Aim of the study. To measure and compare changes
of functional parameters by using local cryotherapy during physiotherapy for patients after anterior cruciate ligament reconstruction surgery.

**Research methods and organization.** The study was performed in Lithuania in AB „Eglės“ sanatorium. The examination involved 14 patients (10 males and 4 females) after anterior cruciate ligament reconstruction: 71% (n=10) of males and 29% (n=4) of females. Criteria of selection: 1. Age of the subjects – 20 – 45 years. 2. Subjects had been physically active for at least 5 years, at least 3 times a week. 3. Patients who have not previously experienced any knee injury or surgery. 4. Patients who have not experienced injuries of the other leg. 5. Patients who have not experienced concomitant knee injuries. Patients were randomly divided into two groups of 7 patients in each. The patients in first study group (5 (71%) males and 2 (29%) females) had standard physical therapy exercises. Average age of both study groups was similar: in first study group (x=31.43), in second study group (x=35). Patient in second study group (5 (71%) males and 2 (29%) females) had standard physiotherapy exercises including cryotherapy. Each patient underwent 20 physiotherapy procedures lasting 30 minutes and having 2 procedures a day. Methods of examination: 1. Pain Evaluation (numeric pain scale). 2. Anthropometric measurement: circumference of thigh and shin muscles and knee joint. 3. Dynamometry (.Jtech Dynamometer): thigh and shin flexors and extensors 4. Goniometry: range of motion of hip and knee joints 5. Stability measurement (computer equipment (TecnoBody ProKin 252). 6. „Lysholm" knee scoring scale: functional joint condition. Statistical methods used in the study: Wilcoxon signed-rank test used to compare two related samples, Mann-Whitney U test is used to compare differences between two independent groups. Differences at p<0.05 were considered statistically significant.

**Results.** The study showed, that in first examination group, statistical significant decrease was found in swelling of the knee joint, (Z=-2,070; p=0,038), statistical significant increase in muscle strength of flexors of the femur (Z=-2,371; p=0,018), extensors of the femur (Z=-2,366; p=0,018), flexors of tibia (Z=-2,366; p=0,018). Statistical significant increase was found in range of motion of knee flexion (Z=-2,366; p=0,018), static balance (Z=-2,366; p=0,018), dynamic balance (Z=-2,023; p=0,043), balance by standing on injured leg (Z=-2,366; p=0,018) and functional joint condition (Z=-2,371; p=0,018). In second examination group, statistical significant decrease was found in swelling of the knee joint, (Z=-2,121; p=0,034), statistical significant increase in muscle of flexors of the femur (Z=-2,371; p=0,018), extensors of the femur (Z=-2,388; p=0,017), flexors of tibia (Z=-2,366; p=0,018). Statistical significant increase was found in range of motion of knee flexion (Z=-2,366; p=0,018) and knee extension (Z=-2,070; p=0,038), static balance (Z=-2,366; p=0,018), dynamic balance (Z=-2,023; p=0,043), balance by standing on injured leg (Z=-2,366; p=0,018), functional joint condition (Z=-2,366; p=0,018). Measuring difference between groups, statistical significant difference was not found in knee circumference (U=21; p=0,710), muscle strength of flexors of the femur (U=23; p=0,902), muscle strength of extensors of the femur (U=20; p=0,620), muscle strength of flexors of tibia (U=21; p=0,710), range of motion of knee flexion (U=19; p=0,535), range of motion of knee extension (U=22; p=0,805), static balance (U=22; p=0,805), dynamic balance (U=18; p=0,456), balance by standing on injured leg (U=12; p=0,128), functional joint condition (U=16,5; p=0,318).

**Conclusions.** Standard physiotherapy plan and physiotherapy involving cryotherapy had the same effect in restoration of the knee function after anterior cruciate ligament reconstruction.

**References:**
Relationships between musculoskeletal system’s peculiarities and competition results in young age professional swimmers

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Introduction. Swimming is a human motor activity and has been associated with energy expenditure, which, depending on the type and intensity of exercise, resulted from various biochemical changes occurring in the human body. In professional swimmers musculoskeletal changes may also occur because of repetitive movement during swimming (1). There are many factors and relationships between anthropometric predispositions and musculoskeletal peculiarities that determine success in swimming at the championship level (2). The aim of this research - to evaluate relationships between musculoskeletal system’s peculiarities and competition results in professional swimmers.

Research methods and organization. The study was approved by the Lithuanian University of Health Sciences Bioethics Center. All participants signed consent forms. In this study participated 22 professional swimmers who were attending Kaunas swimming schools. Average participants’ age was 19.5 (±1.4) years. Twelve of them were women and ten of them - men. Selection criteria were: 18 years and older, swimmers more than 5 years, attends swimming trainings 5 or more times a week, participates in competitions and has a recorded competition result in 50 meters swimming pool in 100 meters freestyle. During this study shoulder girdle and back muscles’ strength was evaluated with Lafayette handheld dynamometer, dynamic stability of upper extremities was assessed with Y-balance test for upper extremities and also best 100 meters freestyle result in a 50 meters swimming pool during one year was recorded. Statistical data analysis was performed with SPSS (Statistical Package for Social Sciences) 23.0. Correlation was estimated using Spearman’s correlation coefficient (r). Correlation when |r| > 0.7 was considered strong, 0.3 < |r| ≤ 0.7 – medium strong and |r| ≤ 0.3 - weak. The correlation was considered significant when the significance level was p<0.05.

Results. Analyzing competition results and dynamic stability correlation of all participants, significant direct correlations were found: strong (r=0.72, p<0.001) with the dynamic stability of the right arm and medium strong with the left hand (r=0.64, p=0.001). Although in women group no significant correlation was found nor with the right arm dynamic stability (p=0.066) neither with the left arm (p=0.261). In men group also no significant correlation was found between competition results and dynamic stability of upper extremities: right arm (p=0.342), left arm (p=0.572). Analysis of competition results and different muscles groups strength correlation of all participants also revealed significant direct correlations: strong with latissimus dorsi muscle strength (r=0.73, p<0.001), strong with rhomboid muscle strength (r=0.72, p<0.001) and also strong with trapezius muscle (lower part) strength (r=0.82, p<0.001). In women group no significant correlations between competition results and back muscles strength were found. In men group only medium strong significant correlation was found between competition results and trapezius muscle (lower part) strength (r=0.59, p=0.042).
Conclusions. 1. The better dynamic stability of upper extremities is considered to be associated with better competition results in young age professional swimmers. 2. The bigger latissimus dorsi, trapezius lower part and rhomboid muscles strength is associated with better competition results in young age professional swimmers.

References:

Comparison of functional movements and dynamic stability of 14-15 years old football and basketball players

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Introduction. Football and basketball are the leading sports in the world, but the high level of interest in these sports is accompanied by numerous inseparable injuries [1,2]. Basketball players perform two to four times as many jumps than football players, while football players cover longer distances in matches. Representatives of both sports perform many complicated maneuvers, dives, accelerations and sudden stops, which lead to the abundance of injuries [3]. Research aim: to identify differences in functional movements and balance performance between football and basketball players.

Research methods and organization. The study was performed with the permission of the Bioethics Center Of Lithuanian University of Health Sciences No. BEC - SR (M) - 68 and with the consent of the subjects and parents between September 2019 and November 2020 at the Vilnius City Children's Football Academy and the Capital Basketball School Academy. A total of 44 participants (all of them were men) were tested in the study: basketball players (n = 22) aged 14.77 ± 0.53 years and BMI 21.45 ± 2.23 kg/m2, and football players (n = 22) aged 15.05 ± 0.99 years and BMI 20.73 ± 2.53 kg/m2. The age of the football players and basketball players did not have statistical difference (U=204; p = 0.27) as well as BMI (U=186; p = 0.34). The study consisted of a questionnaire, anthropometric data, modified „Y Balance test“ for upper and lower extremities and Functional Movement Screen test (FMS). In order to determine leg dominance, the football and basketball players were asked to specify which leg they use to kick a ball. Accordingly, arm dominance was determined by asking to specify the preferred hand to throw a ball. Statistical analysis was performed with IBM SPSS Statistics 22 and Microsoft Excel software. Data is presented as median (minimum value, maximum value, and mean). The Mann-Whitney U test was calculated to compare two independent samples, and for two dependent samples Wilcoxon test was used. Data is considered statistically significant at p <0.05.

Results. The composite lower extremities Y balance test score of the dominant leg of football players was 94.12 (86.59-103.33; 94.72) and of basketball players - 99.67 (88.32-116.85; 100.89), which differed significantly (U = 154.5; p = 0.04). Also, the lower extremities composite Y balance test score of the non-dominant leg of football players was 94.35 (86.23-101.85; 94.02) and 97.48 (86.67-123.22; 100.93) of basketball players, which differed significantly (U = 150; p = 0.03). The composite upper extremities Y balance test score of the dominant hand of football players was 110.98 (90.60-134.68; 111.32) and 134.49 (95.74-151.08; 127.53) of basketball players, which differed significantly (U = 115; p = 0.01). Also, the composite upper extremities Y balance test score of the non-dominant hand of
football players was 111.50 (95.73-136.04; 112.42) and 129.10 (87.77-156.69; 127.1) of basketball players, which differed significantly (U = 111; p = 0.01). The basketball players had higher score of the composite Y balance test score of upper and lower extremities, therefore better dynamic stability of upper and lower extremities and lower risk of non-contact trauma than football players. After evaluation of the results of the FMS tests, no significant differences were found: the deep squat test for football players was 2.00 (0.00-3.00; 1.95 ± 0.90) points and 2.00 (1.00-3.00; 1.82 ± 0.59) points for basketball players, (U = 117; p = 0.22), the push up test for football players was 2.00 (0.00-3.00; 1.86) points and 2.00 (1.00; 3.00; 1.95) points for basketball players, (U = 236; p = 0.88), the composite score of functional movements for football players was 14.00 (11.00; 18.00; 14.36) points and 14.00 (10.00; 18.00; 13.86) points for basketball players, (U = 212; p = 0.48). The majority of football and basketball players scored 14 or more points at composite functional movement test score, which means they had lower non contact trauma risk.

Conclusions. 1. The basketball players had higher score of the composite Y balance test score of upper and lower extremities, therefore better dynamic stability of upper and lower extremities and lower risk of non-contact trauma than football players.

References:

Does football players‘ musculoskeletal system‘s functional indicators change after the rolling exercise program application?

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Introduction. Football is a complex, demanding team game involving ever-changing movement patterns that require extremely good coordination and body control (1). As the population of football players grows rapidly, the number of injuries also keep increasing. Therefore, full attention must be paid to injury prevention for better results (2). Soft tissue dysfunction can be caused by many factors such as trauma, overload, muscle imbalance, and others that can contribute to the onset of trauma (3). Therefore, it is very important to include in the program exercises that help maintain the functional range of movements (4). The aim of the study - to evaluate the changes of football palyers‘ musculoskeletal system’s functional indicators after the rolling exercise program application.

Research methods and organization. The study was approved by the Bioethics Center of Lithuanian University of Health Sciences. All participants signed consent forms. The study involved 20 men, professionally playing football, aged 25 to 35 years. The subjects were playing football on average of 18.7 years. Research methods: 1) Questionnaire survey; 2) Anthropometric measurements: height, weight; 3) Assessment of body posture using visual assessment method (for frontal and sagittal planes), scoliometer (for horizontal plane) and plantography; 4) Assessment of lower extremities muscles strength using a handheld Lafayette dynamometer; 5) Assessment of functional movements using the Functional Movement Assessment Screen Test; 6) Flexibility assessment using Sit and reach

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The assessment was performed before and after the application of the exercise program, during which the subjects performed rolling exercises. The program’s duration was 10 minutes. It was applied for a month, twice a week, after training under the supervision of a physiotherapist. Statistical analysis was performed using IBM SPSS Statistics 21 software. The Wilcoxon test was used to compare the two dependent samples. Differences at p <0.05 were considered statistically significant.

**Results.** After the program application, an improvement in body posture was observed. A statistically significant difference was detected assessing posture by visual method (Z = -2.392; p = 0.017), Foot posture index (Z = -2.724; p = 0.006), evaluating thoracic spine rotation (Z = -2.859; p = 0.004) and lumbar spine rotation (Z = -2.428; p = 0.015). Also the increase in muscle strength was found. A statistically significant difference was obtained assessing hip flexors: non-dominant (Z = -2.809; p = 0.005), dominant (Z = -2.807; p = 0.005); hip extensors: non-dominant (Z = -2.807; p = 0.005), dominant (Z = -2.668; p = 0.008); adductors: non-dominant (Z = -2.666; p = 0.008), dominant (Z = -2.668; p = 0.008); abductors: non-dominant (Z = -2.810; p = 0.005), dominant (Z = -2.705; p = 0.007); hip internal rotators: non-dominant (Z = -2.668; p = 0.008), dominant (Z = -2.807; p = 0.005); hip external rotators: non-dominant (Z = -2.809; p = 0.005), dominant (Z =-812; p = 0.005); knee flexors: non-dominant (Z = -2.668; p = 0.008), dominant (Z = -2.807; p = 0.005); knee extensors: non-dominant (Z = -2.809; p = 0.005), dominant (Z = -2.805; p = 0.005); foot dorsiflexors: non-dominant (Z = -2.809; p = 0.005), dominant (Z = -2.812; p = 0.005), dominant (Z = -2.812; p = 0.005); foot plantarflexors strength: non-dominant (Z = -2.809; p = 0.005), dominant (Z = -2.812; p = 0.005) and foot plantarflexors strength: non-dominant (Z = -2.809; p = 0.005), dominant (Z = -2.812; p = 0.005). Flexibility also improved: a statistically significant difference was found in the evaluation of the Sit and reach test results (Z = -2.816; p = 0.005), the results of the Ober test of both legs: non-dominant (Z = -2.598; p = 0.009), dominant (Z = -2.810; p = 0.005), Ely's test results for both legs: non-dominant (Z = -2.844; p = 0.004), dorsal flexion of both legs: non-dominant (Z = -2.739; p = 0.006), dominant (Z = -2.585; p = 0.01). A statistically significant difference was detected assessing the quality of functional movements (Z = -2.714; p = 0.007).

**Conclusion.** The application of rolling exercise program improved the football players’ body posture in the sagittal, horizontal and frontal planes, lower extremities’ muscles strength, flexibility of hip, knee and foot and also functional movements performance.

**References:**

**Young men with and without lower back pain core muscle strength comparison**

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**Introduction.** Lower back pain is the biggest cause of the most years lived with disability in the world [1]. As a percentage 5 – 15 % of low back pain can be approved by a specific cause or diagnose while
85 – 95% of the cases are without a diagnose or the cause is unknown – this is called non-specified low back pain [2]. When evaluating the cause of lower back problems we often look at core musculature, their condition and function. In most cases the pain makes the negative impact on human’s movement function and muscle strength and aggravates daily life. The aim of this study is to compare core muscle strength in young men with and without lower back pain.

**Research methods and organization.** The permission of LUHS Bioethics center was received (2019 – 11 – 21, Nr. BEC – SR(M)103) to perform the investigation. 27 young males (20 – 30 years old) participated in this study. All of them were training in the same health center mostly 3 times per week, they all have not had any lower extremity and body muscle injuries in the past and current years, the ones who were feeling pain had this sensation for a few days until the test. Most participants were attending the health center three times per week and did not participate in any other sports activity. They were divided into two groups: 1. Experiencing non specific lower back pain (on the scale 1 – 4/10 NRS) (mean age = 25.16 ± 2.66 y/o; BMI = 23.59 ± 0.4 kg/m2). 2. Not experiencing lower back pain (mean age = 25 ± 3.16 y/o; BMI = 23.73 ± 0.5 kg/m2). Both groups age and BMI differences were not statistically significant (p = 0.905; Z = -0.15). In the research we investigated quadriceps and hamstring muscles isokinetic strength using Biodex Pro 4 machine, lumbar flexion, extension, lateral flexion isometric core muscle strength using Back – Check by Dr. Wolff machine. Without these methods questionnaire was made to evaluate age and pain sensation level. Anthropometric data was taken with weighing – machine and centimeter strip. Statistic analysis was made using IBM SPSS 22.0 software. Non – parametric data comparison was made using Mann – Whitney test. Data is provided (median ± standard deviation; BMI ± standard deviation). Statistical significance was accepted when p<0.05, tendency was observed when p≤0.15.

**Results.** Research results showed that there was a tendency of difference between groups in lumbar muscle (m. quadratus lumborum) strength of the left side (p = 0.15; Z = -1.44). Comparing lumbar muscle (m. quadratus lumborum) strength of the right side, no statistically significant difference was found (p = 0.59; Z = -1.87). Comparing m. erector spinae strength in both groups, no statistically significant difference was found (p = 0.72; Z = -0.39). Comparing m. rectus abdominis strength in both groups statistically significant tendency of difference was seen (p = 0.15; Z = -1.46). Comparing thigh quadriceps muscle strength in both groups there were no statistically significant difference on the left side (p = 0.94; Z = -0.73) and on the right side (p = 0.66; Z = -0.44). Comparing thigh hamstring muscle strength in both groups there were no statistically significant difference on the left side (p = 0.942; Z = -0.73) and on the right side (p = 0.66; Z = -0.44).

**Conclusions.** The investigation revealed tendency that young men who do not feel lower back pain have stronger lateral side lumbar muscles (m. quadratus lumborum) and frontal side (m. rectus abdominis) muscles than those who experience pain. Therefore we can state that core muscle strength is essential to avoid lower back pain and problems. Thigh quadriceps and hamstring muscle strength is not related with low back pain.

**References:**
Sport injuries in rugby and functional indicators of the musculoskeletal system

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Introduction. Rugby is a full-contact team sport that has a high risk of injuries which requires a functional movement support apparatus(1). Functional motion requires kinetic chain integration between stability and mobility. This coordination is important because technical sports tasks require a dynamic and static balance (2). The percentage of rugby injuries remains 3 times higher between contact sports (3) and > 60% of injuries occurs in contact (4). Physiological and biomechanical factors contribute to a holistic view which determines sports performance. Research aim – to identify prevalence of the sport injuries in rugby and the functional indicators of the musculoskeletal system.

Research methods and organization. The research was approved by Lithuanian University of Health Sciences Bioethics Centre No. BEC-SR (M)-162. The study involved high-skill rugby players (n = 50) from the Lithuanian national men's team (R-7, R-15). From 2017 to 2020 years 33 players were injured 17 players didn’t suffer an injury in rugby. The mean age of participants was 30.4 (± 4.6) years, mean height was 1.84 (± 0.05) cm, mean body weight was 97.7 (± 11.4) kg, and the mean BMI was 28.7 ± 3.2 kg/m². A one-time study was performed in the Lithuanian Rugby Federation during the Lithuanian men's rugby team preparation camp. Research methods: Australian Standardized Injury History Questionnaire; Functional movement screen (FMS); Static balance evaluation (Abili balance analysis); Dynamic balance evaluation (Y Balance Test); Vertical drop jump; Statistical analysis was performed using IBM SPSS Statistics 22.0 software. Mann-Whitney criteria U test was used to compare the two independent samples, and the Wilcoxon criteria was used to compare the dependent samples. Quantitative data are presented as median (xme), minimum (xmin), maximum (xmax) value and mean (x) – xme (xmin; xmax; x), and criterion value. Bivariate analysis was conducted using the Chi-squared test (x²) The significance and significance level of the criterion is provided in the results. Differences with p <0.05 were considered statistically significant.

Results. Most of the injuries consisted in rugby were ankle ligaments – 21.2%, ACL – 18.2%, shoulder tendons – 15.2%, other muscles and/or tendons ruptures – 15.2%, bone – 12.1%, clavicle dislocations – 9.1%, spinal cord injuries – 6.1%, knee meniscus – 3.0%, of all of the injuries. Most of the injuries occur in contact with another player - 54.5% of all episodes. The majority of players suffered new injuries 69.7%, during competition 63.6% and 78.8% didn’t use protective equipment. Lower right limb Y balance test results – 97.40(82.50 – 112.40; 99.44) points, left limb results – 99.70(83.30 – 115.80; 99.22) points. Results for the lower right limb of non-injury rugby players – 103,00(86.60 – 110.50; 101,58) points, lower left limb – 100,10(91,10 – 110,50; 100,31) points. No statistically significant difference was found between the groups (U= 226,50; p=0,269). Results of static balance in lower right limb of non-injury rugby players were – 1,40(0,40 – 6,60; 1,62) points, lower left limb - 1,50(0,30 – 5,40; 1,65) points. Results of lower right limb of experienced injury rugby players – 1,80(0,60 – 2,92; 1,60) points, left limb – 1,90(0,40 – 2,60; 1,56) points. No statistically significant difference was found between the players (U=239,50; p=0,40). Results of functional movements performed by rugby players who have suffered an injury – 14,0(9 – 20; 14,12) points, results of rugby players that did not suffered injury – 15,0(14 – 18; 15,5) points. I have investigated that non-injury group evaluation results of functional movements were better compared to rugby players that suffered from injury previously (Z=-1,98; p=0,048). The majority of non-traumatic players in the vertical jump scores were rated on average (52,9%), good (29,4%), bad (17,6%). Players who suffered from injury were evaluated on average (72,7%), others were evaluated bad (27,3%). The
results of the vertical jump and the injuries experienced are related, a moderate relationship was found (V=0.465; p=0.005).

**Conclusions.** Most injuries like ankle, knee, shoulders in rugby are experienced during the competition, in contact, without the using protective equipment. Non-injured rugby players group had better functional musculoskeletal performance than experienced ones. The better quality of performance of vertical jump and functional movement those who hadn’t suffered an injury compared to injured players group. The dynamic and static balance indicators weren’t related to the prevalence of injuries in rugby.

**References:**

**Correlation between the changes of lower extremity muscle strength, balance and biomechanics indicators at different seasonal periods in young basketball players**

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**Introduction.** According to the research, lower limb injuries are one of the most common among young basketball players and are twice as more common compared to the upper extremities (1). The situation occurs, supposedly because practices are mostly oriented to general physical training: increase of muscle strength and overall improvement of athleticism, while disregarding a balanced physical training together with exercises meant for injury prevention (2)(3). Aim of the research – to evaluate correlation between the change in lower extremity muscle strength, balance and biomechanics indicators at different seasonal periods in young basketball players.

**Research methods and organization.** The research was approved by Lithuanian University of Health Science Bioethics Center (No. BEC-SR(M)-98). The cohort of the study consisted of twelve systematically training young male basketball players, representing a team in Kaunas Basketball Amateur League, ages between 18 and 23, average body mass index - 24.8 kg/m2. The study was conducted in Lithuanian University of Health Sciences, in Department of Sports Medicine. Subjects had to fill out a questionnaire to find out if all the criteria is met: playing basketball for at least 5 years, feeling no acute pain during the study, and had not suffered any injuries in the past two months. The evaluation was performed twice: before and after the basketball season. The corrective exercise program was applied during the season to the usual training regimen – five exercises, two times a week. One-leg exercises were accentuated with extra weights or unstable planes as well as plyometric movements. Research methods: muscle strength of the lower extremities (hip flexors, extensors abductors and adductors, calf extensors and flexors, dorsal and plantar flexors) was assessed with „Lafayette Hand-Held Dynamometer“ apparatus. Dynamic balance indicators were assessed by the “Y
Balance Test”. Static balance indicators were assessed by “Abili Balance Analyzer”. Lower extremities biomechanics indicators were assessed by “Landing Error Scoring System (LESS)” test. Data analysis was performed using IBM SPSS 22.0 software. The Spearman criterion was applied to the correlation analysis. Correlation is considered to be very weak when $0<|r|\leq0.2$, weak when $0.2<|r|\leq0.4$, medium strength when $0.4<|r|\leq0.6$ strong when $0.6<|r|\leq0.8$ and very strong when correlation is $0.8<|r|\leq1$. Correlations when $p<0.05$ are statistically significant.

**Results.** Only statistically significant correlations are presented in the results. A statistically significant relationship was found between the change of “LESS” test results and the change of right hip adductors strength ($r=0.682; p=0.015$). A statistically significant relationship was found between the change in "Y Balance Test” (performed by the supporting left leg) results and the change in the strength of the hip flexors of the left leg ($r=0.587; p=0.045$). There was also a statistically significant relationship between the changes in “Y Balance Test” (supporting left leg) results and the change in right leg muscles strength extending the calf ($r=-0.727; p=0.007$).

**Conclusions.** The study showed, that applying corrective exercise to the normal training regimen for young basketball players, after the season the results are as followed: increasing the strength of the hip adductors of the right leg, the biomechanics of jumping improve; increasing the strength of the hip flexors of the left leg, the dynamic balance of the same leg deteriorates; increasing the strength of the calf extensors of the right leg, the dynamic balance of the left leg deteriorates.

**References:**


The relationship between core muscle endurance, range of motion, lower limb muscle strength, balance and daily physical activity in middle-aged individuals with lower back pain

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**Introduction.** Low back pain is one of the biggest public health problems. About 70-80 % of all adults experience at least one episode of low back pain at some point in their lives.(1) There are studies that found the lower limb muscles, lateral bending range of motion, core muscle endurance and balance may be related with low back pain. (2,3,4,5) In this research we involved several major components that can cause low back pain and tried to find relationship between them. These findings can help us to understand where we need to focus while treating these patients. The aim was to determine the relationship between core muscle endurance, range of motion, lower extremity muscle strength, balance and daily physical activity in individuals with low back pain.

**Research methods and organization.** To be eligible for inclusion in the trial, participants were required to have had nonspecific low back pain for at least 12 weeks, to rate the pain between 3 and 6 points based on the digital analog pain scale (moderate pain) and to be aged between 40 and 59 years. Exclusion criteria were clinical signs of radiculopathy, lumbar stenosis, previous spinal surgery and
central or peripheral nervous system disease. A total of 21 subjects with non-specific low back pain participated in the study (14 females (66.7 %) and 7 males (33.3 %). The median of the age of the participants was 50 (46 – 55; 50.4) years. Methodology of research: Core muscle endurance was evaluated by Kraus-Weber test for trunk flexors, McIntosh back muscle endurance test and McGill lateral core muscle endurance test. The range of motion of the core was evaluated using goniometry and modified Schober Test. Balance was evaluated using the Flamingo test. Oxford scale was used to evaluate daily physical activity. Statistical analysis was performed using IBM SPSS 21.0 software. The correlation was determined by calculating the Spearman correlation coefficient. Correlation relationship were determined according to the obtained values of correlation coefficient (r): r = 0 – 0.1 - no correlation; r = 0.1 - 0.39 - weak correlation; r = 0.4 - 0.69 medium correlation; r = 0.7 - 0.89 - strong correlation, r = 0.9 - 1 – very strong correlation. Statistically significant correlations were found when p < 0.05.

**Results.** The results showed that there was a statistically significant correlation between back muscle endurance and thigh extensor muscle strength on the left leg (r = 0.932 - very strong correlation, p < 0.001) and the right leg (r = 0.539 - medium correlation, p < 0.001). A statistically significant medium strength relationship was also observed between back muscle endurance and thigh flexor muscle strength on the left leg (r = 0.601, p < 0.001) and the right leg (r = 0.493, p < 0.05). Lateral core muscle endurance of the left side was correlated with the left thigh extensor muscle strength (r = 0.828 - strong correlation, p < 0.001), the left thigh abductor muscle strength (r = 0.532 - medium correlation, p < 0.005), and the left thigh flexor muscle strength (r = 0.470 – medium correlation, p < 0.005). There was a medium strength relationship between back muscle endurance and the Flamingo test on the left leg (r = -0.641, p < 0.001) and the right leg (r = -0.622, p < 0.001). Also, a medium strength correlation was between the left side lateral core muscle endurance and the Flamingo test on the left leg (r = -0.500, p < 0.05) and the right leg (r = -0.513, p < 0.05). Moreover, the right side of the lateral core muscle endurance was correlated with the Flamingo test on the left leg (r = -0.580 – medium correlation, p < 0.001) and the right leg (r = -0.658 – medium correlation, p < 0.001). There was a relationship between daily physical activity and back muscle endurance (r = 0.877 - strong correlation, p < 0.001), left side lateral core muscle endurance (r = 0.621 - medium correlation, p < 0.001) and the right side lateral core muscle endurance (r = 0.730 - strong correlation, p < 0.001). A statistically significant, medium strength relationship was found between the results of the daily physical activity and the Flamingo test on the left leg (r = -0.564, p < 0.001) and the right leg (r = -0.574, p < 0.001), and the core bending range of motion (r = 0.629, p < 0.001).

**Conclusions.** The study found that the lower the back muscle endurance, the weaker were tight extensor and flexor muscle strength in middle-aged individuals with low back pain. Moreover, the lower the back and the lateral core muscle endurance, the worse were the balance in middle-aged individuals with low back pain. The lower the daily physical activity, the lower were back and lateral muscle endurance, balance and bending rage of motion in middle-aged individuals with low back pain.

**References:**
The association between balance, coordination, mobility, reaction rate and cognitive function in patient after ischemic stroke

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Introduction. Ischemic stroke worldwide is one of the leading causes of morbidity, mortality and long-term disability (1). It is among the most common cerebrovascular diseases significant personal, social and economic losses and consequences (2). Focal neurological symptoms predominate during ischemic stroke based on ischemia localization, which leads to motor and cognitive impairment after ischemic stroke (3,4). The aim of the paper is to assess associations between balance, coordination, mobility, reaction rate and cognitive function in patient after ischemic stroke.

Research methods and organization. The research was carried out at the Hospital of Lithuanian University of Health Sciences, Neurorehabilitation section from 2020.08.01 to 2020.10.20. The study included 18 subjects (10 – female, 8 – male) 70.3 (±11.8) years following an ischemic stroke. The balance and coordination of the patients were assessed using multidirectional motorized platform (Chattanooga HUBER 360). The mobility was assessed with Rivermead mobility index (RMI) and multidirectional motorized platform (Chattanooga HUBER 360). The reaction rate was assessed through reaction meter and, finally we used Neurobehavioral Cognitive Status Examination (NCSE) to assess the cognitive function in general and cognitive function domains: consciousness, orientation, simple attention, language, constructional ability, memory, calculation skills, executive skills. Statistical analysis of the data and graphical representation of results was performed using IBM SPSS (Armonk, NY: IBM Corp, USA) 23.0 software. Correlation associations were determined by calculating Spearman’s Rank correlation coefficient. The association was determined according to the obtained values of correlation coefficient ($r$): $r=0-0.1$ - no correlation; $r=0.1-0.39$ - weak correlation; $r=0.4-0.69$ - medium correlation; $r=0.7-0.89$ - strong correlation; $r=0.9-1$ - very strong correlation. The differences with $p <0.05$ were considered statistically significant.

Results. Assessing association between balance and cognitive function (NCSE), was obtained correlation between stability coefficient of balance and orientation part of NCSE ($r=0.49; p=0.04$). Also found correlation between left foot movements lenght and calculation part of NCSE ($r=0.69; p=0.01$). The results showed correlation between left foot movements area and calculation part of NCSE ($r=0.50; p=0.04$). Also we found correlation between walking on the spot and executive skills part of NCSE ($r=0.50; p=0.04$). Assessing relationship between coordination and cognitive function (NSCE) was not obtained ($p<0.005$). Assessing relationship between mobility and cognitive function (NCSE) was obtained through correlation between RMI and orientation part of NSCE ($r=0.49; p=0.04$). Also was obtained correlation between mobility (multidirectional motorized platform) and language part of NSCE ($r=0.59; p=0.01$). Assessing relationship between reaction rate ant cognitive function in general (NSCE), was obtained statistically significant negative correlation between mistakes of reaction rate and executive skills part of NSCE ($r=-0.55; p=0.03$). Also we found correlation between mistakes of reaction rate and cognitive function in general (NSCE) ($r=-0.58; p=0.01$).
Conclusions. Association between balance, mobility, reaction rate and cognitive function was found. Advancement in balance and mobility improves cognitive function indices. Also, the better the mobility indices, the lower number of mistakes in estimating the reaction rate. However, significant associations were not found between coordination and cognitive function.

References:

The influence of sports injury prevention program on 7-10 years old female basketball players for functional movements quality balance and prevalence of sport injuries

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Introduction. It takes around 8-12 years of training for a player to reach elite level of performance[1]. Injuries and traumas can impact their results and most important – future in sports career and a lifetime[2;3]. Trauma prevention program is essential to reduce sports injuries risks[4]. Research aim: to evaluate sports injury prevention program effect on 7-10 years old female basketball players for functional movements quality balance and prevalence of sport injuries.

Research methods and organization. Research includes 44 female basketball players which was divided into three groups. I group 7-8 years old (n=12); II group 9-10 years old (n=18); III group was control group (n=14). Age was 7-10 years old. The research has lasted for one year (2019-2020). From LSMU Bioethics Center permission was obtained – BEC-SR(M)-244. Before the research from all the parents permission was received. Research groups had their training sessions with the same coach. Players had been playing basketball for over one year. All the players were tested before the sports injury prevention program. Functional movements were tested and evaluated using Functional Movement Screen (FMS). The Y balance test as used to assess dynamic balance of upper and lower extremities. Before the research players were asked to fill what traumas did they had and during research time all the injuries and missed games or workouts of athletes were registered. For control group there was no special training. Research groups had sports injury prevention programme before each training or game (15-20 minutes). The programme contains: Warm up; Main part: Static and dynamic exercises; and static muscle stretching exercises. In total there was 192 sessions, but some of the participants missed some sessions. Statistic analysis were calculated using IBM SPSS 22.0. Research samples for non-parametric criteria were applied to compare dependent and independent samples. The Wilkoxon test was applied for two dependent samples. The Kruskal-Wallis test was used to compare three independent samples. Quantitative data are presented as median (xme), minimum value (xmin), maximum value (xmax) and average ($\bar{x}$) – xme (xmin- xmax; $\bar{x}$). The Spearman criterion was applied to the correlation dependence. Correlation when $0 < | r | \leq 0.3$ was considered very weak,
0.3 ≤ |r| ≤ 0.5 weak, 0.5 ≤ |r| ≤ 0.7 moderate, 0.7 ≤ |r| ≤ 0.9 strong and 0.9 ≤ |r| ≤ 1 very strong. Differences at p<0.05 were considered statistically significant.

**Results.** After the injury prevention program were was statistically significantly lower number of injuries in both research groups compared to control group ($\chi^2=6.92; p=0.009$). After the research were was statistically significant increase in total FMS score in all the groups: I group before the research 17 (14; 19; 16,92) and after (18; 20; 19) ($Z=-3,114; p=0.002$). II group before the research 16 (14; 20; 16,39) and after 19 (17; 20; 18,67) ($Z=-3,677; p<0.001$). III group before the research 19 (16; 20; 18,36) and after 19 (16; 21; 19) ($Z=-3,06; p=0.002$). Comparing the results between the groups, no statistically significant difference was found at the end of the research ($H=1,08; p=0.582$). The difference between control and research groups in total Y balance test score in the left leg statistically were not significant. Before the injury program ($H=0,67; p=0.717$) and after ($H=3,09; p=0.213$). The difference between control and research groups in total Y balance test score in the right leg statistically were not significant. Before the injury program ($H=1,23; p=0.54$) and after ($H=4,42; p=0.11$). The difference between control and research groups in total Y balance test score in the right arm statistically were not significant. Before the injury program ($H=1,02; p=0.602$) and after ($H=5,135; p=0.077$). The difference between control and research groups in total Y balance test score in the left arm statistically were not significant. Before the injury program ($H=5,63; p=0.06$) and after ($H=3,86; p=0.145$).

**Conclusions.** 1. Sports injury prevention program did not had effect on the quality of functional movements and balance of 7-10 years old female basketball players. 2. Sports injury prevention program had reduced the prevalence of sports injury rates.

**Reference list:**
3. Lv B, Li S. Diagnosis study on sports injuries combined with medical imaging technology. Biomedical research. 2017; 118-124.

**Analysis of dynamic body stability, torso muscle strength and jump dynamics of Lithuanian ultimate frisbee players.**

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**Introduction.** Ultimate frisbee is a rapidly growing and popular sport in Lithuania. During 2019, the ultimate frisbee community grew by as much as 50%. Lithuania ultimate frisbee federation started to organize school tournaments, Lithuanian adult championships, also Lithuanian national team participates in international tournaments. Ultimate frisbee is a non-contact sport, but lower limb injuries are very common [1, 2,]. No research has been conducted on injuries in Lithuania ultimate frisbee. We investigated some of the movement characteristics, associated with lower limb injuries. Aim of the study: To compare body dynamic stability, torso muscle endurance and jump dynamics between healthy ultimate frisbee athletes and athletes with history of lower extremity injury.
Research methods and organization. The research was conducted at the sports team “Shooting Stars” training base from 01.06.2020 to 01.10.2020. Research was approved by Bioethics Center of Lithuanian University of Health Sciences (BEC-SR(M)-239). All players who attended training and agreed to participate in the study were divided into two groups accordint to the results of a questionnaire, which they filled out. A total of 47 athletes (male), participants of Lithuanian ultimate frisbee adult championships were included in the study: 22 have not experienced injury during last 6 months and 25 athletes suffered trauma of upper extremity (3 hip joint injuries, 11 knee joint injuries, 6 ankle joint injuries, 5 muscle injuries), but didn’t declare pain and participated in the competition. The age of the athletes was 18 - 35 years. The Y balance test for lower extremities was chosen for dynamic stability evaluation. Torso muscle endurance was assessed by a set of Kraus - Weber tests. Endurance of torso lateral muscles was assessed by lateral bridge test. The position of the lower extremities during vertical jump was assessed by drop jump tests. 30 cm high step was used during testing and a video camera from the phone. The jump technique was evaluated by landing error scoring system (LESS) questionnaire. Statistical analysis was performed with IBM SPSS Statistics 22 package. To test the assumption of normality was chosen Shapiro-Wilk test, all data was normally distributed. Student's t test was calculated to compare independent samples. The results were described by the mean ± standard deviation. Data differences between groups were considered statistically significant when the calculated significance level was lower than the selected significance level (p ≤ 0.05).

Results. The combined result of the Y-balance test of the left leg in group of not injured athletes was 111.48 ± 2.36, in the group of injured athletes - 107.09 ± 3.72, and differed significantly (t = -4.75; p = 0.001). The combined result of the Y-balance test or the right leg in the group of not injured athletes was 113.87± 2.31 cm, in the group of injured athletes - 109.40 ± 3.94 cm, and the difference was significant (t = -4.65; p = 0.001). The results of the Kraus - Weber abdominal endurance test: the abdominal muscle endurance of not injured athletes was 104.45 ± 18.86 s, of the injured athletes - 93.48 ± 27.30 s, significant difference was not found (t = -1,58; p = 0.121). The Kraus - Weber lower back endurance test of the group of not injured athletes - 112.64 ± 9.63 s, of the group of injured athletes - 104.36 ± 18.66 s. The results didn’t differ significantly (t = -1.87; p = 0.065). The lateral bridge test of the group of not injured athletes was 97.73 ± 16.24 s, of the group of injured athletes - 92.80 ± 18.09 s. The results didn’t differ significantly (t =-0.98; p = 0.334). The results of the drop jump test: in the group of not injured athletes, position of the varus/valgus during the first jump was - 0.46 ± 1.03 cm, of the injured athletes -2.08 ± 3.27 cm, the difference was significant (t = -2.22; p = 0.032). The results of the drop jump test in the group of not injured athletes, varus/valgus position during the maximum jump was -0.77 ± 1.27 cm, of the injured athletes -3.56 ± 3.92cm, the difference was significant (t=-3.19; p = 0.003). The result of the LESS questionnaire of the group of not injured athletes was 2.23 ± 2.14 points, of the group of injured athletes - 4.48 ± 2.50 points, the obtained difference was significant (t = 3.29; p = 0.002).

Conclusions. Ultimate frisbee players who suffered injury of lower extremity during past 6 months had significantly worse body dynamic balance scores than not injured players. Also, the position of the knees varus/valgus was significantly worse in the vertical jump landing for injured players than in not injured athletes. The position of the lower extremities of injured Ultimate frisbee players during a vertical jump landing showed significantly worse results compared to not injured Ultimate frisbee players which means injured Ultimate frisbee players are more likely to suffer repeated lower extremity injuries. Torso muscle endurance rates did not differ between groups.

Reference list:
The differential learning effect on lower limb function and gait in post-stroke patients

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Introduction. Lower limbs muscle weakness and neurological gait disorders are a major problem for many post-stroke patients as it results in an inability to perform daily activities (1, 2). The differential learning approach is characterized by: taking advantage of fluctuations that occur without movement repetitions and - the need of corrections during the primary acquisition process (3). The aim of differential learning is to support subject to find his/her individual context-dependent performance repertoire in order to perform a complex motor skill as successfully as possible (4). The aim: to assess the differential learning effect on lower limb function and gait in post-stroke patients.

Research methods and organization. Participants and methodology. Participants were recruited from Kaunas Hospital of Lithuanian University of Health Sciences and took part in the study during the period from 03/08/2019 to 16/10/2020. Participants signed informed consent and were involved in the study that was approved by the local bioethics center (No. BEC-SR(M)-182). The study included 26 subjects (age 73.77 ± 8.71 years) who suffered a stroke. Participants were randomly divided into two equal groups formed by 13 participants each. The first group was called a repetition-based group (RG) (age 73.69 ± 9.09 years) and the second was a differential learning-based group (DLG) (age 73.85 ± 8.67 years). Post-stroke patients in total had 10 individual physiotherapy sessions twice a day (30 and 35 minutes long). DLG and RG groups underwent a common exercise program consisting of muscle strengthening, mobility training, trunk control and balance developing exercises. The DLG group received additional differential learning approach exercises 3 times a week (6 sessions in total). RG group performed regular lower limb function and gait improving exercises 3 times a week (6 sessions in total). Before and after physiotherapy lower limb function was evaluated by the Fugl – Meyer Assessment Scale. For gait evaluation we used the Dynamic Gait Index. Statistical analysis was performed using SPSS 22.0 program. We used a non-parametric Wilcoxon test to compare two dependent samples and Mann–Whitney’s test to compare two independent samples. Data were presented as the median (me), the minimum value (min), the maximal value (max) and the mean – me (min-max; mean). We set the significance level at p < 0.05.

Results. Results of the lower limb function. Before therapy DLG group results were 25 (21-28; 24.69) points, after therapy they were 28 (24-31; 28.08) points. Thus, DLG group results revealed difference before and after therapy (Z=-3.28 p<0.001). Before therapy RG group results were 25 (21-27; 24.61) points, after therapy they were 27 (24-29; 26.92) points. Consequently RG group results also revealed a statistically significant difference (Z=-3.31; p<0.001). There was no statistically significant difference between the DLG and RG groups after therapy as well (U=55; p=0.14). Results of the gait assessment. Before therapy DLG group results were 17 (12-19; 15.92) points, after therapy they were
DLG group results revealed difference (Z=-3.27; p<0.001). Before therapy RG group results were 15 (12-18; 15.31) points, after therapy they were 17 (15-21; 17.46) points. Hence, there was also a statistically significant difference in the RG group (Z=-3.42; p<0.001). However, there was a statistically significant difference between the DLG and RG groups after therapy (U=44; p=0.04).

**Conclusions.** This study unraveled the differences among regular physiotherapy versus differential learning-based approach that proved to gain better post-stroke patients’ results in gait recovery, however, no difference was found on lower limb function.

**Reference list:**

**Comparative analysis of the use of food supplements by representatives of adult power sports and physically active persons exercising in the gyms of Klaipėda city**

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**Introduction.** Food supplements do not play a main role in the nutrition, food supplements are needed to ensure normal nutrition of athletes, to fill nutritional gaps and help achieve the goal more quickly [1]. The frequency and variety of nutrition supplements used by highly skilled athletes and physically active persons should vary, including individual body shape, training principle and physical capacity [2]. There are few studies in Lithuania that reflect the consumption of food supplements by persons of the power sports. Aim of the research: To determine the consumption of food supplements in the gyms of Klaipeda city by representatives of power sports and physically active persons.

**Research methods and organization.** The research was conducted in 2020 at "Alex gym" and "K1 Academy" gyms of Klaipeda city. The research was approved by Lithuanian University of Health Science Bioethics Center (BEC-SR(M)-97). In total 80 of adults participated in the research. Persons of the research were selected as athletes of power sports and physically active persons over 18 years old. Under the Sports Act [3], persons were divided into 2 groups, in the first group there were physically active persons who don’t participate in sports competitions, in the second group there were representatives of the power sport who participate in high-mastery competitions, weightlifting, wrestling, boxing. Persons of the research were divided into 28 physically active men, 12 physically active women; 23 men of the power sports and 17 women of the power sports. The exclusion criterion was age under 18 and older than 75 years. Data were collected using a survey. The survey consisted of 11 questions. The reliability of the survey was verified. Survey questions were provided with possible answers variants, to clarify the frequency and variety of food supplements used by athletes. MS Office software "Excel" and "SPSS" 26.0 were used for statistical analysis of data and calculation of results. The difference between the groups was assessed using the statistical method - $\chi^2$ test. The difference was considered statistically significant as p <0.05.
Results. Assessing the frequency of food supplements consumption by persons of power sports, it can be stated: 50% use food supplements for 8-10 months a year, 27.50% consumes 4-7 months a year, 12.50% consumed daily, 10% take 1-3 months a year. Assessing the frequency of consumption of food supplements among physically active persons, it can be stated: 67.50% take food supplements for 1-3 months a year, 30% consumes 4-7 months a year, 2.50% take 8-12 months a year. Representatives of power sports use food supplements more often than physically active persons ($\chi^2 = 39.298, p = 0.001$). Comparing the frequency of consumption of food supplements among men and women in power sports, it can be stated that 65.2% of men take food supplements for 8-12 months a year, 13% of men take food supplements for 4-7 months a year, 21.7% of men take daily supplements every day. Among women, 29.4% of food supplements were used for 8-12 months a year, 47.1% of women take food supplements for 4-7 months a year, 23.5% of women take food supplements for 1-3 months a year. Men in power sports take food supplements more often than women in power sports ($\chi^2 = 6.017, p = 0.01$). Assessing the type of food supplements used by athletes, it can be stated that the representatives of power sports use prohibited drugs in sports, belonging to group D more often 45% than physically active persons 5% ($\chi^2 = 17.067, p = 0.001$).

Conclusions. Athletes of power sports use food supplements more often than physically active persons. Men in power sports take food supplements more often than women. Representatives of power sports use prohibited drugs in sports more often than physically active persons.

Reference list:

Correlations of cervical spine functional status and cervical proprioception with the frequency and duration of mobile phone use in individuals with chronic neck pain

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Introduction. Chronic neck pain is the fourth leading cause of disability and years spent with functional disability worldwide (1). Some studies show that mobile phone usage is leading to an increased risk of neck functional impairments and chronic pain (2,3). However, there are little evidence about the relationship between impaired neck functional state and cervical proprioception based on excessive duration and frequency of mobile phone use (4). Research aim: to assess correlations between cervical spine functional state measures, cervical proprioception and the frequency and duration of mobile phone use in individuals with chronic neck pain.

Research methods and organization. The research was approved by Lithuanian University of Health Sciences Bioethics Center (BEC-SR(M)-250). All participants signed the informed consent form before taking part in this study. The study included 22 participants (10 males (45.5%) and 12 females (54.5%) who had chronic neck pain. The median of the age of the participants was 52.5 (34-61; 50.82) years. All of them felt neck pain for more than 3 months. The median of the pain intensity was 5.5 (3-6; 5.10) scores by Numeric Pain Rating Scale. Individuals diagnosed with other cervical spine
pathologies (disk herniation, radiculopathy, spinal stenosis, spondylolisthesis, osteoarthritis) were excluded. Neck pain intensity was measured using Numerical Pain Rating Scale (NPRS); active ranges of motion (AROM) of cervical spine assessed using goniometer; cervical muscle strength assessed using „Lafayette Instrument. Manual muscle tester” handheld dynamometer; cervical muscle strength endurance assessed using Deep Neck Flexor Endurance Test; cervical proprioception assessed using Cervical Joint Position Error Test (JPE). A questionnaire was used to collect information about the gender, age and the frequency and duration of mobile phone use. Data analysis was performed with IBM SPSS v 22.0 software package. The results are presented as median ($X_{\text{me}}$), minimum ($X_{\text{min}}$), maximum ($X_{\text{max}}$) and average ($X$) values – $X_{\text{me}}$ ( $X_{\text{min}}$-$X_{\text{max}}$). Correlation relationships were determined by calculating Spearman’s Rank correlation coefficient. Correlation relationships were determined according to the obtained values of correlation coefficient ($r$): $r=0$ – no correlation; $r=0.1$–$0.39$ – poor correlation; $r=0.4$–$0.69$ – moderate correlation; $r=0.7$–$0.89$ – strong correlation; $r=0.9$–$1$ – very strong correlation. The significance level $p<0.05$ was chosen.

**Results.** Considering the relation between participants age and duration of mobile phone use, negative moderate correlation between was found ($r=-0.471$; $p=0.01$) - the younger were participants, the greater time was spent using mobile phone. There was obtained statistically significant strong negative correlation between duration of mobile phone use and cervical extension AROM ($r=-0.790$; $p=0.03$) – the greater was time spent using mobile phone, the lower was cervical extension AROM. Also, there was obtained a strong negative correlation between duration of mobile phone use and cervical flexor muscles strength ($r=-0.736$; $p=0.01$) – the greater time was spent using mobile phone, the lower was cervical flexor muscles strength. Also was obtained strong negative correlation between cervical extension AROM and cervical JPE during neck extension ($r=-0.710$; $p=0.01$) – the lower was neck extension AROM, the greater was cervical proprioception impairment. Also was obtained strong negative relation between muscle endurance of cervical flexors and cervical JPE during neck extension ($r=-0.630$; $p=0.02$) – the lower was endurance of cervical flexors, the greater was cervical proprioception impairment. There was obtained moderate strength correlation between duration of mobile phone use and cervical JPE during neck extension ($r=0.652$; $p=0.01$). However, there were no significant correlations were found between strength and endurance of cervical flexors, AROM of cervical flexion, extension or rotation and frequency of mobile phone use ($p>0.05$).

**Conclusions.** The study has revealed that there were significant correlations between decreased active ranges of motion of cervical spine, strength and endurance of cervical flexor muscles measures and increased duration of mobile phone use in individuals with chronic neck pain. There was found a relationship between increased duration of mobile phone use and impaired cervical proprioception. However, there were no significant correlations were found between frequency of mobile phone use and other parameters.

**Reference list:**


Comparative analysis of functional movements and dynamic balance of bodybuilding and fitness representatives

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Introduction. Bodybuilding is a sport in which athletes use physical exercise and additional equipment to strengthen their health and build body muscles [1]. Fitness or otherwise light bodybuilding is one of the directions of bodybuilding [2]. As these two sports have become very popular in the world among people of all ages, it is becoming more relevant to people. There are many squats, lifts, pulls and other similar movements in this sport, which can result in various injuries. There is a lack of scientific information and research about it. Therefore, this topic is relevant and new compared to things like basketball. Research aim: to compare the functional movements and dynamic balance of bodybuilding and fitness sports.

Research methods and organization. The study was conducted in 2020 January-June in MB "Laimė sporte" sports club with the approval of the LSMU Bioethics Center. Data of 40 subjects (18-32 years old) were evaluated during the study. 19 of these individuals were engaged in bodybuilding and 21 in fitness. All participants were exercising for more than 6 months, and not having any health problems. The tests were Functional Movement System (FMS), Modified star excursion test of lower extremities and Flamingo balance test. All athletes were evaluated only once, and then, a comparative analysis was performed. Throughout the study, all athletes were evaluated and compared between the two groups, i.e. bodybuilders and fitness representatives. Mean and standard deviations (±) and confidence intervals (CIs) were calculated for the data expressed in the interval scale, and frequencies (units) were calculated for the data expressed in the nominal scale. To compare differences in outcomes between different study groups (by sport and gender), nonparametric Mann-Whitney U criteria were calculated (when the distribution of data differed significantly from the normal distribution and the results were compared between two groups (i.e., two independent samples)). The Chi-square (χ²) test was used to determine the significance of the differences in the results expressed on the rank and nominal scales. The Shapiro-Wolf test, which is suitable for small samples, was used to check the normality of the data. The significance level used was 95%. (i.e. p = 0.05). The obtained data were processed with SPSS version 20 package and Microsoft Office Excel 2010 program.

Results. For all tasks except stable torso pushup (U=173,500 p=0,326 p>0,05), fitness group scored higher than bodybuilders, and U tests showed that differences were significant (U=100,000 p=0,003 p<0,05; U=74,000 p=0,000<0,05; U=139,000 p=0,035 p<0,05; U=55,000 p=0,000<0,05; U=59,000 p=0,000<0,05; U=65,000 p=0,000<0,05). After calculating the U tests in FMS test results between men and women in bodybuilding group, significant differences were found in two tasks - male bodybuilders performed significantly better in the push up with stable torso task (U=13,000 p=0,018 p<0,05), female bodybuilders performed significantly better in lunge task (U=10,000 p=0,017 p<0,05). During mSEBT, for all directions of movement, bodybuilding subjects reached a length longer than fitness subjects. U tests showed that these differences were significant (U=89,500 p=0,003 p<0,05; U=114,500 p=0,021 p<0,05; U=106,500 p=0,011 p<0,05; U=93,500 p=0,004 p<0,05; U=105,000 p=0,010 p<0,05; U=88,500 p=0,003 p<0,05). These results were established by comparing bodybuilders group averages in three movements with both legs with fitness group averages. Comparing the results between the different sexes in the bodybuilding group, there was no significant difference, in the fitness group, men showed a statistically significant difference during the left leg movement to the side (U=1,000 p=0,032 p <0,05). Evaluating the results of flamingo test, standing on the right leg the
average number of falls in the bodybuilding group was 9.2±2.38 (PI:8.09;10.31), in the fitness group - 4.9±2.69(PI:3.94;6.16). Calculation of the U test showed that this difference was significant (U=37.00, p=0.000 <0.05). The results of standing on the left leg the average number of falls in the bodybuilding group was 10.95±2.26(CI:9.89;12.01), in the fitness group 5.05±2.04(CI: 4.10; 6.00). Calculation of the U test showed that this difference was significant (U=14.00, p=0.000<0.05).

Conclusions. Fitness group has better mobility and flexibility compared to bodybuilders, but they have better muscle strength and endurance. Bodybuilders had better coordination and mobility. However, fitness representatives had a better balance than bodybuilders as shown by the flamingo test.

Reference list:

The effect of two specialized physiotherapy exercise programs for individuals experiencing neck and shoulder pain

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Introduction. Introduction: In modern society, there has been a growing number of people who spend more and more time at the computer at work or in their free time. Often, chronic neck and shoulder pain in the workplace has socio-economic effects associated with reduced ability to work and reduced quality of life (2). According to Sihawong et al., Muscle balancing and endurance exercises are recommended to reduce chronic neck and shoulder pain (3). Research aim: To evaluate and compare the outcomes of two specialized physiotherapy exercise programs for individuals, who were experiencing neck and shoulder pain.

Research methods and organization. With the approval of the Lithuanian University of Health Sciences Bioethics commission (Nr. BEC-SR(M)-172) the research was performed in UAB „Kineziterapijos klinika“ from 2020-07-01 till 2020-10-10. 24 working-age participants (15 women and 9 men, aged 23 to 52 years) took part in the research, who experienced chronic neck and shoulder area pain, rated 1 to 6 points. Patients were randomly assigned to 2 groups of research of 12 subjects each. They were given one individual session each of 60 minutes. I group - patients were treated by stretching and positional relaxation exercises program with additional imagination exercises using „Dynamic alignment through imagery“ by Eric Franklin; II group were treated by the use of stretching and positional relaxation exercises program with additional deep neck muscle activation method with „Stabilizer“. The change in result was evaluated after the research by using neck disability index to describe functional independence; by using visual analogic scale VAS to describe pain intensity; by partly using the Hoeger scale to define head, neck and shoulder posture; by using GROC scale to evaluate patient's health condition; by using inclinometer to describe head, neck and shoulder area’s range of motion. Statistical analysis was performed by using „IBM SPSS Statistics 23.0“: Mann-Whitney test was used to compare independent samples, and Wilcoxon criteria was used for dependent samples. When p<0.05, the differences are considered statistically significant.

Results. In order to compare the results of change in functional independence between study groups I and II, statistically significant differences were observed: before the study (Z=-2.588; p=0.10), after the study (Z=-2.428; p=0.15). After comparing the results of change in pain intensity of both
researched groups, the evaluation results did not differ significantly between researched groups I and II: before (p>0.05) and after the study (p>0.05). In order to evaluate the results of change in posture between the two study groups, no statistically significant differences were observed: before (p>0.05) and after the study (p>0.05). With the aim of assessing the change in health condition between researched groups I and II, the results were monitored: before the study (p>0.05), after the study a statistically significant change was noticed (Z=-2.752; p=0.06). So as to compare the results of change in neck movement amplitudes before and after the study, no statistical differences were noticed between the two researched groups (p>0.05).

Conclusions. In order to evaluate and compare both used physiotherapy methodologies, we find similar effectiveness in health status, functional independence improvement. I group, that received additional imagination exercises, II group, which was treated with additional deep neck muscle activation with ‘Stabilizer’, their indicators were significantly progressed after the study. The results of change in pain intensity, posture, range of motion did not shift after the study in either of the researched groups.

Reference list:

The comparison and links of the quality of functional movements and dynamic stereotype of movement in bodybuilding

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Introduction. Functional movement screen (FMS) is used to evaluate functional movements and predict possible injury risk in different sports (1,2). Huge amount of bodybuilders training load demand perfect technique of dynamic stereotypes of basic sport movements such as squat. Concerning to athletes health and sport results the relations between these two types of movement may be crucially important and still have not enough research-based improvements. Elite athletes, which choose deliberate practice, differ from less accomplished ones (3). The aim of the research is to evaluate the quality of functional movements, the dynamic stereotype of the selected basic movement squat and the links between them in elite and amateur bodybuilders practice.

Research methods and organization. With the approval of the Lithuanian University of Health Science Bioethics center (No. BEC-SR(M)-197) the research was performed in sports clubs of Kaunas, Šiauliai, Marijampolė and Klaipėda with permissions of athletes, coaches and kind recommendations of Lithuanian Federation of Bodybuilding and Fitness from 2020-10-08 till 2020-11-10. The study involved 26 athletes. 1st group consisted of 11 professionals – 6 women and 5 men and 2nd group consisted of 15 amateurs – 8 women and 7 men. The functional movements of the athletes were analyzed by the FMS method, which is scored on an ordinal scale, with 4 possible scores ranging from 0 to 3. Evaluation of the squat as a basic movement was performed by each athlete of both groups. Bodybuilders had to perform 3 squats repetitions in each of regimes with different intensity of load,
i.e. without weight, with Olympic barbell and with a usual workout weight for this period. While squatting athletes were recorded in two planes – frontal and sagittal. There were used 10 squats quality criteria consisted of positions of the head, thoracic spine, trunk, hip, frontal plane knee alignment, tibial translation angle, position of the foot, descent, depth, and ascent. 1 point was given for compliance with each criterion, and 0 points were given for failure to meet the standard. Data analysis was performed using IBM SPSS 21.0 software. The research samples were small, therefore, non-parametric criteria were applied for the data analysis. The non-parametric Mann-Whitney U test was applied to compare two independent samples and the Friedman criterion was applied for the comparison for three dependent samples. Quantitative data are presented as median (xme), minimum (xmin) and maximum (xmax) value and mean (x̄) - xme (xmin-xmax; x̄). The Spearman correlation coefficient was calculated to evaluate the relationship between the two quantitative variables. Differences at p<0.05 were considered statistically significant.

**Results.** FMS results showed that amateur athletes scored 16(13-17; 15.87) points and professional athletes scored 19(16-20; 18.45) points. Amateur athletes scored 6(5-8; 6.27) points in squat performance without weight and professionals scored 8(7-10; 8.64) points. Athletes with Olympic barbell scored 6(5-8; 6.07) points and professionals 8(7-10; 8.64) points. With a usual workout weight amateurs scored 6(4-8; 5.93) points while professionals scored 9(7-10; 8.82) points. The comparison of the FMS results between amateur and professional revealed statistically significant differences (U=11.5; p<0.001). There were also statistically significant differences in weightless squat performance (U=6.5; p<0.05), squat with Olympic barbell performance (U=5; p<0.001), and squat with a usual workout weight performance (U=4; p<0.001). The comparison of the squatting performance of amateur athletes between squatting without weight, squatting with Olympic barbell and with a usual workout weight revealed a statistically significant difference (χ²(2)=7.6; p=0.022). Meanwhile, the comparison of the squatting performance of professional athletes between squatting without weight, squatting with Olympic barbell, and squatting with a usual workout weight disclosed no statistically significant difference (p=0.135). No correlations were found between the FMS results of amateur and the performance of weightless squats (p=0.221); likewise, the FMS results and the performance of squats with Olympic barbell (p=0.261) and the FMS results and squats with a usual workout weight (p=0.313) revealed no correlations. Similar results were obtained among professional athletes: no correlation was found between the FMS results and squatting without weight (p=0.853), squatting with Olympic barbell (p=0.853), and squatting with a usual workout weight (p=0.946).

**Conclusions.** The quality of functional movements, basic movement of squatting is better and performed more correctly by professionals. Amateurs perform basic movement of squatting differently depending on the magnitude of the external load, whereas professionals, regardless of the magnitude of the external load, perform squats with equal correctness. The FMS results between amateur and professionals has nothing to do with the basic dynamic stereotype of movement of squatting under different external loads.

**Reference list:**
Visual feedback therapy for stroke patients. Change in balance

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Introduction. Stroke is the third leading cause of death in terms of disease frequency and the main cause of severe disability with balance loss (1). Patients who suffered a stroke are unable to maintain a stable body position augmenting the fall risk (2, 3). The use of visual feedback therapy allows patients after stroke to better understand their body position and improve symmetry (2). Further visual feedback demonstrated to have extra motivation for patients after stroke with higher likelihood to perform various rehabilitation tasks on their own at home (4). Research aim was to evaluate balance changes after visual feedback therapy application for stroke patients.

Research methods and organization. The study was carried out at Neurology Department of the Hospital of Lithuanian University of Health Sciences (LSMU) Kauno klinikos. Study was approved by the local Bioethics center (No. BEC-SR(M)-179). Twenty-six patients were included in the study (age 63.1 ± 7.6 years) with diagnosis of stroke. Participants were randomly divided in two groups: the first group (visual feedback group – VFG) (age 63.5 ± 8.5 years) and second group (control group – CG) (age 62.8 ± 9.6 years). VFG participants performed Mirror visual feedback therapy protocol, while CG participants performed common exercise protocol consisting of balance exercises. Overall all subjects had 4 treatment procedures for 30 minutes. Balance before and after physiotherapy was assessed using Berg Balance Scale and Timed Up and Go test. Data analysis was performed using IBM SPSS 22.0 program. The non-parametric Mann–Whitney test was used to compare two independent samples. The non-parametric Wilcoxon test was used to compare two dependent samples. The results are presented as median (Xme), minimum (Xmin), maximum (Xmax), averages (x̄), values – Xme (Xmin-Xmax; x̄), the significance level was set at p < 0.05.

Results. Before visual feedback therapy balance results of VFG group were 39 (36-42; 39.23) points, after feedback therapy results were 43 (41-45; 43.07) points. Thus, VFG group results revealed a statistically significant difference before and after therapy (Z= -3.23; p<0.001). Before therapy CG group results were 38 (35-43; 38.76) points, after therapy were 41 (37-44; 41.15) points. Consequently, CG group results also revealed a statistically significant difference (Z= -3.25; p<0.01). Comparing VFG group with CG group revealed a difference (U=30.5; p<0.05). Results of the Timed Up and Go test. Before visual feedback therapy balance results of VFG group were 19.20 (12.41-30.34; 19.23) points, after feedback therapy results were 17.02 (10.21-28.22; 16.55) points. Thus, VFG group results revealed a statistically significant difference before and after therapy (Z= -4.46; p<0.001). Before therapy CG group balance results were 19.06 (11.36-32.47; 20.06) points, after therapy were 16.62 (9.43-30.44; 17.97) points. However, in CG group there were no statistically significant difference before and after therapy (Z= -3.15; p<0.48). Also, there was no statistically significant difference between the VFG group and CG group after therapy (U=73.00; p=0.55).

Conclusions. This study revealed that the application of visual feedback therapy in relatively short time significantly improved post-stroke patients’ balance. However, compared to common exercise protocol where was no difference among techniques showing both being equally relevant and applicable for improvement of the balance.

References:
Physiotherapy effect for functional impairment in individual with chronic low back pain

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Introduction. LBP is common health problem worldwide, especially among working – aged population. LBP has been found to be the most common cause of work-related disability [1]. Generally, since 1990 until 2015 the amount of disability caused by the LBP augmented by 54%. LBP is now the leading cause of disability worldwide. It is difficult to identify the cause of the pain, for the majority who suffers from LBP [2]. The purpose of this study was to broadly explore what individuals with LBP believe reduces their LBP.

Research methods and organization. Individuals experiencing LBP were invited to participate in this study by answering questions from an anonymous questionnaire. The criteria for inclusion in the study were: adults (18–65 years) experiencing lower back pain. One hundred twenty subjects participated in the study (36.6±13.3 years) and BMI was 25±5.2. Data was collected using a questionnaire covering a wide range of questions about LBP and LBP recurrences. The questionnaire was based on the Oswestry Disability, the Roland-Morris Disability, and the Health-Related Quality of Life Assessment SF-36 Questionnaires. In the questionnaire, subjects were asked about the pain duration and intensity in the morning, noon, evening, during position change or once exercising on a numeric rating scale (NRS). NRS is a horizontal line with an eleven point of numeric range from 0 to 10, 0 – no pain, 10 – the worst pain possible. Physical difficulty of work was divided into six categories from the first and the easiest "I don't work" to the most difficult "Very heavy: I often lift weights over 25kg and sometimes over 50kg". Statistical analysis was performed using IBM SPSS Statistics 23.0 for Windows and Microsoft Excel 2016 software packages. The position and scatter characteristics of the quantitative data of the obtained study results were calculated: means, standard deviations. Prior to data analysis, the Kolmogorov-Smirnov test was used to verify that the analyzed data was distributed according to the normal distribution because the sample of analyzed data was larger than 50. The significance level $\alpha = 0.05$ (95% confidence) was chosen to assess the reliability of the results. The Spearman correlation coefficient was used to calculate the linear relationship between the quantitative features. Differences with $p<0.05$ were considered statistically significant.

Results. Most of the respondents 39 (32.5%) indicated that their physical work difficulty is light, 33 (27.5%) stated that their work difficulty is moderate, 31 (25.8%) respondents indicated that their work is sedentary. LBP was felt for 12 weeks and longer by 82 (68.3%) subjects and 48.3% responded indicated the daily presence of pain. Subjects were asked about LBP recurrences the respondents answered that: 23 (19.2%) subjects recur weekly, 18 (15%) subjects recur monthly, 15 (12.5%) subjects feel sore constantly. In the question of what helps to reduce LBP the most, the subjects have
chosen several options. Of the 578 (120 respondents could choose several answers) responses, the answer with the most choices was stretching exercises 15.9%, 14.9% exercise, 11.2% massage, and 8.8% muscle strength exercises, 6.7% chose endurance training exercises. Subjects age showed inverse weak correlation with method to reduce LBP, i.e. “Rest” \((r=-0.187; p = 0.041)\) and showed direct weak correlations with “reduction of aggravating activity” \((r = 0.193; p = 0.034)\). Subject age showed none correlations with massage, stretching exercises, exercise, muscle strength training, endurance training, respectively \((p=0.374; p=0.732; p=0.143; p=0.59; p=0.465)\). Subject age showed none correlations with subjects perceived LBP time \((p = 0.116)\). Work difficulty showed direct weak correlations with massage and sleep \((r=0.181, p=0.049; r=0.223, p=0.015)\). Subjects the perceived LBP time showed a statistically significant, inverse weak correlations with method to reduce LBP i.e., sleep \((r=-0.205; p=0.025)\). Subjects LBP duration showed none correlations with methods reducing LBP, i.e., with massage, stretching exercises, exercise, muscle strength training, endurance training respectively, \((p=0.537; p=0.391; p=0.066; p=0.398; p=0.329)\).

**Conclusions.** The age of individuals does not influence the choice of physiotherapy methods for LBP relieving. As the age increases, the choice to reduce aggravating activity increases, and the choice of rest decreases, and conversely, younger people are more likely to choose rest as a means of reducing LBP. The harder the physical work of individuals, the more they choose massage and sleep, as pain relievers. There is no association between LBP duration and pain-relieving physiotherapy methods.

**References:**

**The effect of different physical therapy programs for knee function and pain in patients with patellofemoral pain syndrome**

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**Introduction.** Patellofemoral pain (PFP) is a very common complaint in general population, particularly in young adults and adolescent athletes who participate in jumping, cutting and pivoting sports(1) Patellofemoral pain affects physically active and sedentary individuals, accounting for 11-17% of knee pain presentations to general practice and 25-40% of all knee problems seen in sports injury clinic(2). Aim: To evaluate effect of different physical therapy programs for knee function and pain in patients with patellofemoral pain syndrome.

**Research methods and organization.** At this study participated physically active individuals who were between 20 – 45 years old. All subjects were informed about the research and signed the informed consent form. Ethical approval was obtained from Lithuanian University of Health Sciences Bioethics center (BEC – SR (M) – 227). The study was completed by 13 men, groups did not differ in age; physical activity or pain intensity. Subjects were randomly allocated in two groups: Eccentric load exercises group consisted of 6 subjects (age 22,5 ± 1,04) received exercise program based on eccentric exercises nine times per three weeks and Isometric load exercise group consisted of 7 subjects (age 22,1± 1,34) received exercise program based on isometric exercises and nine times per three weeks.
The study started and finished on 2020.07.02 – 2020.08.16 with Lithuanian University of Health Sciences basketball team. The selection criteria to be eligible for study: patellofemoral pain syndrome in one of the knees diagnosed by doctor; engage in moderate intensity for at least 150 minutes per week or 75 minutes of high – intensity physical activity; knee pain which lasts more than 6 weeks; pain when climbing down or up the stairs; pain is more than 5 and not bigger than 8 by Numeric Pain Scale; the age of participants from 20 to 45 years old who plays basketball. To evaluate knee pain was used Kujala knee; lower extremity function was measured by single leg hop test and Y balance anterior reach test and pain intensity measured by NPRS(numeric pain rating scale). Statistical analysis was performed using the “IBM SPSS Statistics 21” software package. Due to insufficient sample, the Wilcoxon criteria (Z) was applied to the two dependent samples. The nonparametric Mann – Whitney Wilcoxon criteria (U) was applied to the two independent samples. The quantitative results are presented as median (min; max). The difference was considered to be statistically significant when p<0.05.

**Results.** Kujala knee pain questionnaire score in eccentric exercise 83.38 (73 ; 92) and isometric exercise 87.71 (82 ; 93) groups had statistically significant improvement, which means pain decreased (eccentric exercise group) (Z=2.207; p=0.027);(isometric exercise group)( Z=-2.375; p=0.018), there was no statistically significant difference between the groups before (U=17.00; p=0.628) and after (U=13.00; p=0.295) intervention (p>0.05). The function of lower extremity while doing single leg hop test had statistically significant improvement in eccentric exercise 182.16 (161 ; 193) and isometric exercise 174.14 (160 ; 192) groups (eccentric exercise group) (Z=-2.264; p=0.024); (isometric exercise group) (Z=-2.388; p=0.017), there was no statistically significant difference between the groups before (U=11.00; p=0.181) and after (U=10.50 ; p=0.138) intervention (p>0.05) in affected lower limb. Measurements of Y balance anterior reach test had statistically significant improvement in eccentric exercise 70.33 (64 ; 75) and isometric exercise 66.28 (62 ; 73) groups (eccentric exercise group) (Z=-2.271; p=0.023) (isometric exercise group) (Z=-2.530; p=0.011), however there was no statistically significant difference in both groups before (U=10.00; p=0.138) and after (U=9.50; p=0.101) intervention (p>0.05).

**Conclusions.** Eccentric and isometric exercises had positive outcome for better knee function and lower knee pain intensity for patients with patellofemoral pain syndrome.

**References:**

**Joint hypermobility, the functional parameters of musculoskeletal system and balance assessment of gymnasts**

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**Introduction.** Rhythmic gymnastics is an Olympic sport in which athletes must have flexibility, movement coordination, and balance. The manifestation of these skills, and joint hypermobility can be very important in the pursuit of high sport results [1,2]. The specifics of this sport are tasking to the
body’s musculoskeletal system. Usually, rhythmic gymnasts are selected at the very early age and undergo high intensity training in childhood and adulthood. They usually end their careers early [4]. After the end of the career, the intensity and activity of the athletes goes down, the functionality of the musculoskeletal system slows down [5].

**Research methods and organization.** The 38 participants took part in the this study. They were divided into two groups. The first group consisted of female (n=19) gymnasts who were 19 to 23 years old (20.68±1.49 years). All gymnasts had previously taken part in national level competitions and had been professional athletes for 10.95±1.81 years. On average, they finished their career 4 years ago. The second group consisted of younger female (n=19) gymnasts who were between 11-14 years old (12.26±1.04). These respondents were actively practicing gymnastics during the time of the survey, and they had been taking part in national competitions for 7.37±1.83 years. It was a cross-sectional study. All participant joint hypermobility was tested using the Beighton score [3]. Their posture was evaluated by using SABIA’S scoliometer on the frontline (the axial spinal turn of the shoulders and hips) and by using the scoliometer on the horizontal plane (the asymmetry of the tendons of the chest and lumbar spine). The static endurance of the back, abdominal and lateral trunk muscles was tested using the McGill method with static body position until signs of pain or fatigue. The dynamic balance was tested using “Y” tests when participants had to perform multidirectional movements with each leg. Static balance - balance error system (BESS) while respondents performed six different tasks. Statistical analysis was performed using the IBM SPSS 22.0 software and Microsoft Excel program. Quantitative data is presented as arithmetical mean and standard deviation. Mann-Whitney (U) criterion was used to compare independent sample variables. Non-parametric Wilkoxon (Z) criterion was used for dependent samples. The symptoms of dependent samples were inspected using Chi-square ($\chi^2$) criteria. Data is considered statistically significant at $p <0.05$.

**Results.** In the retiree group joint hypermobility was found in 73.7% cases, while the younger group had 57.9% cases ($U=176; \ p=0.906$). The assessment of the dynamic balance of the right and left legs showed no difference in the retiree group ($Z=-0.563; \ p=0.573$), and in the younger group ($Z=-0.443; \ p=0.658$). The dynamic balance of the left leg ($U=174; \ p=0.863$) and right leg ($U=163; \ p=0.624$) was similar in both groups. To assess static balance, standing on one leg with the eyes closed on an unstable surface, younger gymnasts perform better ($\chi^2 (2)=9.905; \ p=0.007$), while standing position on an unstable surface when the feet are one behind the other, fewer mistakes were noticed in the younger group of gymnasts ($\chi^2 (1)=5.397; \ p=0.02$). In the rest of tests, both groups made a similar number of mistakes ($p>0.05$). Retired and younger gymnasts showed a small shoulder and hip asymmetry and it did not differ between the groups respectively $U=164.5; \ p=0.631$ and $U=156; \ p=0.371$. The posture of ex-gymnasts showed that shoulder asymmetry was bigger than hip asymmetry ($Z=-2.037; \ p=0.042$), which is a normal range. Similar results were seen from tests of younger gymnasts ($Z=-2.831; \ p=0.049$). No significant difference between the groups was found after posture in the horizontal plane: thoracic kyphosis ($U=162; \ p=0.584$) and lumbar lordosis ($U=142; \ p=0.252$). However lumbar lordosis was above normal in the younger group. The abdominal muscles showed more endurance than back muscles in the both groups: retiree ($Z=-3.068; \ p=0.002$), and younger group ($Z=-3.724; \ p=0.001$). Older participants had more back-muscle endurance ($U=79.5; \ p=0.002$). Active gymnasts had better endurance in the left side lateral trunk muscles compared to the retiree ($U=110; \ p=0.04$). In the younger group, both right side and left side lateral trunk static endurance was similar ($Z=-0.663; \ p=0.507$), meanwhile, in the retiree group, the left side muscles had more endurance than the right side ($Z=-2.046; \ p=0.041$).

**Conclusions.** Half of the retired and active gymnasts showed joint hypermobility. Dynamic balance, while performing difficult tasks was better in the active group, and static balance was similar. All
respondents showed bigger shoulder asymmetry than hip asymmetry. Active gymnasts had more expressed lumbar lordosis. Both groups showed more endurance in their abdominal muscles compared to their back muscles. Left and right side lateral trunk muscles showed more endurance in the group of younger gymnasts.

References:

Does age affect functional jump performance of young basketball players?

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Introduction. Basketball is characterized as a combination of masterful skills and high–intensity neuromuscular actions demanding game, which is distinguished by intermittent, changing functional movements and complexity of their technical performance [1,2]. Reported that basketball players performed 40–70 jumps and landings in the match [3]. During puberty, when the physical features of children are changing, assessment of neuromuscular asymmetry and biomechanics becomes a particularly important identification measure needed to predict potential risks of lower limb injury, as well as to ensure effective training [4]. Research aim. To evaluate functional jump performance of young basketball players and analyze it according to age.

Research methods and organization. This study was carried out June - September 2020 at „Vilniaus krepšinio mokykla“ and „Sostinės krepšinio mokykla“ basketball schools. The research was approved by Bioethics Center of Lithuania University of Health Science and the parents of all subjects of this study have signed off for their children to take part in this study. Forty two children, who attend trainings at one of these basketball schools, were included in this study. The average age of these children was 12.2±2.7 years, height was 1.62±0.20 m, body mass was 54.45±18.27 kg. The mean body mass index (BMI) was 20.19±2.38 kg/m2. Children were divided into 4 groups depending on their gender and age. First group included 9–10 years old girls (n=10) the mean height of this group was 1.45±0.06 m, mean body mass was 38.70±2.06 kg., second group – 14–15 years old girls (n=11) the mean height was 1.72±0.08 m, body mass 59.90±11.84 kg. Third group – 9–10 years old boys (n=10) the mean height was 1.42±0.07 m, body mass 39.00±6.53 kg and fourth group – 14–15 years old boys (n=11) the mean height was 1.85±0.06 m., body mass 77.36±9.42 kg. The anthropometric measurements were evaluated during the study and also children were being interviewed. The participants were evaluated using three functional jump tests: Single leg hop (SLH) test, Vertical Drop Jump (VDJ) test and Landing Error Scoring System (LESS) test. Statistical analysis was performed by IBM SPSS Statistics 22.0 and Microsoft Excel software. Quantitative data is presented as median, minimum, maximum value and mean. The Mann–Withney U test was calculated to compare two
independent samples. Bivariate analysis was conducted using the Chi–squared test ($\chi^2$). Differences with $p<0.05$ were considered statistically significant.

**Results.** Analyzing single leg hop test symmetry index results statistically significant difference was obtained only between different age girls groups and only when they performed triple hop jump ($U=15.0; p<0.05$) – older age girls performed better in this test. In $9$ – $10$ years old girls group the result was $90.5\%$ ($82.5$–$96.4; 90.2$), in $14$ – $15$ years old girls group $98.1\%$ ($62.1$–$99.8; 94.2$). The single leg hop symmetry index in both age groups of boys was similar. In $9$ – $10$ years old boys group vertical drop jump test results were: $10\%$ described as good, $50\%$ - average, $40\%$ - poor. In $14$ – $15$ years old girls group – $27.3\%$ were good, $54.5\%$ average and $18.2\%$ poor. No statistically significant difference was found in the results of girls from different age groups ($p=0.54$). Meanwhile, in $9$ – $10$ years old boys group vertical drop jump test results were: $10\%$ good, $40\%$ average, $50\%$ poor. In $14$ – $15$ years old boys group – $27.3\%$ were good, $45.5\%$ average and $18.2\%$ poor. No statistically significant difference was found comparing the results of boys from different age groups in the vertical drop jump test ($p=0.63$). No statistically significant results were obtained when analyzing LESS test results between different age girls groups. In $9$ – $10$ years old girls group the median was $9$ ($7$–$11; 9.10$) points, in $14$ – $15$ years old girls group - $7$ ($4$–$11; 7.45$) points, ($U=32.5; p=0.11$) and jumps were described as poor. Meanwhile in $9$ – $10$ years old boys group LESS results were $8$ ($5$–$9; 7.80$) points, described as poor, in $14$ – $15$ years old boys group - $6$ ($4$–$8; 6.18$) points, also described as poor. However, LESS test results between boys groups were statistically significant ($U=21.5; p=0.02$).

**Conclusions.** Older girls performed better in the single leg hop test, as well displayed better symmetry index results when performed triple hop jump, compared to the younger girls. There were no differences in results among boys of different age groups. There were no differences in biomechanics of vertical jump among girls and boys of different age groups. Boys from the older age group performed better in LESS test than the younger, while there was no difference between different group girls.

**References:**

**Knee function and the the degree of psychological confidence in physically active patients after anterior cruciate ligament reconstruction**

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**Introduction.** Anterior cruciate ligament injuries are one of the most common injuries of the knee, with an incidence of approximately $85$ per $100\,000$ in patients aged between $16$ and $39$ years [1]. Rates
of return to sport at 2 years after ACLR range from 41% to 83%, depending on age and competition level [2]. In addition, psychological factors and their impact on recovery, rehabilitation, and return to sport have received more attention in recent years [6]. Research aim – to assess functional outcomes of the knee and the degree of psychological confidence in patients 6 months after ACL reconstruction.

**Research methods and organization.** We have investigated 54 (24 women and 30 men) physically active patients after six months of ACL reconstruction. The average age of women was 23.25 ± 5.42 years, men - 24.97 ± 7.09 years. The patients were distributed into two groups: non – contact injury (I group, n=38 (17 women and 21 men)) and contact injury (II group, n=16 (7 women and 9 men)). Compare gender results between groups statistically significant difference was not found (p=1). The average age of first group was 22,63 ± 4,34 years, height – 182, 75 ± 12,31 cm, weight – 77,75 ± 17,37 kg and BMI – 22,99 ± 2,69. The average age of second group was 24,87 ± 7,05 years, height – 180,16 ± 10,95 cm, weight – 79,08 ± 12,83 kg and BMI – 24,3 ± 2,97. Compare these results between groups statistically significant difference was not found. Physical function was assessed by single – leg hop tests and the degree of psychological confidence was assessed by anterior cruciate ligament return to sport after injury scale (ACL – RSI). Data was presented as means ± standard deviation. The statistical analysis was performed using “IBM SPSS Statistics 22.0". The nonparametric Mann-Whitney test was used for comparison of two independent samples. To compare two dependent samples, the nonparametric Wilcoxon test was applied. The difference was considered statistically significant at p < 0.05.

**Results.** Patients in both groups had the similar knee function assessed by the single – leg hop tests. The psychological confidence was in the same level in non-contact injury (69,65 ± 19,92) and contact injury group (67,81 ± 22,81). Comparison of single – leg hop tests symmetry index between ACL – RSI questionnaire showed the statistically significant difference in the groups. In the first group single hop for distance symmetry index was (89,2 ± 8,49), crossover hop for distance – (91,0 ± 9,21), triple hop for distance – (91,24 ± 8,47), 6 – m timed hop – (94,47 ± 6,42) and the ACL – RSI questionnaire index was (69,65 ± 19,92) (p<0,001). In the second group single hop for distance symmetry index was (91,15 ± 8,84), crossover hop for distance – (85,59 ± 10,17), triple hop for distance (89,13 ± 7,97), 6 – m timed hop (91,97 ± 7,35) and the ACL – RSI questionnaire index was (67,81 ± 22,81) (p<0,001).

**Conclusions.** Type of the injury do not have influence on the function of the knee 6 months after ACL reconstruction. Knee function and the degree of psychological confidence is different 6 months after ACL reconstruction so athletes can have reinjury if they return to sport. We recommend do not return to sport because of poor functional outcome and lack of psychological readiness 6 months after ACL reconstruction. It is highly likely to have reinjury.

**References:**
The relationship between frailty syndrome, fall risk and quality of life in individuals with type 2 diabetes

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Introduction. Two conditions that can often occur at the same time in older people are type 2 diabetes and frailty syndrome. The prevalence of frailty syndrome in people over the age of 65 with type 2 diabetes is between 32% and 48% (1). Frailty syndrome is defined as a clinical geriatric condition in which an elderly person tends to be more vulnerable to both internal and external stressors due to dwindling reserves of age-related physiological systems. These stressors can lead to disability, falls, hospitalization, deteriorating quality of life or even death (2,3). The aim of the research was to evaluate the relationship between frailty syndrome, fall risk and quality of life in individuals with type 2 diabetes.

Research methods and organization. The research was carried out at the Hospital of Lithuanian University of Health Sciences Kaunas, geriatric section from 2020.09.09 to 2020.09.17. The study was approved by Lithuanian University of Health Sciences Bioethics center (BEC-SR(M)-184). Subjects were selected according to the following criteria: 65 years old and older with type 2 diabetes and a written consent to participate in the study. Individuals having cognitive impairment (MMSE <18 points), diabetic foot ulcers, uncontrolled heart disease and inability to move independently were not included. There were 22 subjects (14 females, 8 males) whose mean age was 69.27 (±3.601). Fall risk was assessed by using the “Timed Up and Go” test as well as the Morse Fall Scale (MFS). The balance of the subjects was assessed by using the Berg Balance Scale. Frailty syndrome was determined according to the Fried Frailty Criteria. If one or two of these criteria were found, a subject was considered as having a risk for frailty syndrome. Meanwhile, frailty syndrome was considered if at least three of the five criteria were confirmed in a subject. The SF-36 questionnaire was used to determine the quality of life in this research. Sociodemographic data was collected from the survey for more specific analysis. Statistical analysis was performed using IBM SPSS (Statistical Package for Social Sciences) 21.0 software. The correlations were determined by calculating the Spearman correlation coefficient. Correlations with p<0.05 were considered statistically significant.

Results. According to the study, 40.91% (n=9) of patients with type 2 diabetes were more at risk to have frailty syndrome (pre-fail phenotype), 45.5% (n=10) were identified with prevalence of frailty syndrome (frail phenotype) and 13.64 % (n=3) had none. A low risk of fall was present in 8 individuals (36.4%), high fall risk has been identified in 10 individuals (45.5%) and the remaining 4 subjects (18.2%) had no risk of falling. The results showed a statistically significant, moderate relationship between the duration of life with type 2 diabetes and the prevalence of frailty syndrome (r=0.515, p=0.024). According to the data, identified frailty risk, its prevalence and fall risk were all associated with a decreased quality of life (p<0.05). These results had significant negative correlations with all SF-36 subscale scores (p<0.05) – the greater the risk of frailty syndrome, its prevalence and a greater risk of falls – the lower quality of life in individuals with type 2 diabetes is expected. A statistically significant, moderate relationship was found between fall risk and frailty syndrome (r=0.698, p=0.001).

Conclusions. The research that included the elderly and older age group, has revealed that pre-fail and frail individuals who also had a risk of falling, were expected to have poorer quality of life. Moreover, the greater the risk of falling for individuals with type 2 diabetes, the greater the development of frailty syndrome.
 References:
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Effect of athletic taping and kinesiotaping on measurements of functional performance in basketball players with chronic inversion ankle sprains.

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Introduction. Chronic inversion ankle sprains are common in basketball players. Athletes will complete between 40-60 short sprints, over 40 jumps, and about 100 basketball-specific movements that involve direction changes during a game (1). These actions often place an athlete in the positions that increase the risk of injury (2,3). Different types of tape have been used in the prevention of sports injuries promoting support for the joints during movement (4). However, there is lack of evidence on the effect of taping on functional performance (5). Therefore, the aim of this study was to investigate the effects of athletic taping and kinesiotaping on measurements of functional performance in basketball players with chronic inversion ankle sprains.

Research methods and organization. In this study participated 18 – 30 years old amateur men basketball players. The study was successfully completed by 12 amateur basketball players. The study was initiated and completed on 2020.06.30 – 2020.11.01 in Kėdainiai Sports Center and LSMU basketball team „Medikas“. The inclusion criteria was having sustained recurrent ankle inversion sprains (at least three sprains) and having the diagnosis of FAI according to the Cumberland Ankle Instability Tool (CAIT). The maximum CAIT score is 30, a score ≤ 27 indicates functional ankle instability. While the exclusion criteria were 1) acute symptoms of a lower extremity injury, 2) history of ankle fracture, 3) ankle injury within three months of participation, 4) history of anterior cruciate ligament injury, 5) current participation in supervised physical rehabilitation, 6) any neurological deficit. Functional performance tests (Y-balance test [YBT], Single Leg Hop Test [HOP], flamingo balance test, Square hop test) were used to quantify static and dynamic balance, agility, strength and endurance. These tests were conducted three times at one week intervals using varied conditions: without tape, athletic tape, and kinesiotape. Statistical analysis was performed using the “IBM SPSS Statistics 22” software package. Due to insufficient sample, the Friedman criteria was applied to three or more dependent samples. Significance level of 0.05 was chosen to test the statistical hypotheses.

Results. The median combined result for the Y-balance test was highest in the without tape condition (96.4 points) followed by the kinesiotape condition (96.1 points) as compared to athletic tape condition (94.8 points). Statistically significant difference was found between the athletic tape and non-taped conditions (p=0.001) and between the athletic tape and kinesiotape conditions (p=0.01). In the flamingo test least attempted performance was measured in athletic tape condition (8 attempts) followed by non-taped condition (7.5 attempts) as compared to kinesiotape condition (7 attempts). Statistically significant difference was not found between any of these conditions (χ2(2)=4.439; p=0.11). In the single leg hop test the longest jump was measured in non-taped condition (176 centimeters) followed by kinesiotape condition (174 centimeters) as compared to athletic tape.
condition (170 centimeters). Statistically significant difference was found between the athletic tape and non-taped conditions (p=0.009) and was not found between kinesiotape and non-taped conditions (p=0.554) and also was not between athletic tape and kinesiotape conditions (p=0.307). In the square hop test the fastest jumps was measured in athletic tape condition (17.8 seconds) followed by non-taped tape condition (18.08 seconds) as compared to kinesiotape condition (18.4 seconds). Statistically significant difference was found between the athletic tape and kinesiotape (p=0.002) and was not found between athletic tape and non-taped conditions (p=0.124) and also was not between kinesiotape and non-tape conditions (p=0.459).

**Conclusions.** In this study, there were no significant differences among taping conditions for static balance measurement. Athletic taping caused a significant decrease in dynamic balance performance. Neither kinesiotape or athletic tape had a statistically significant effect on performance on the single leg hop and square hop tests.

**References:**

**The effect of strength training program on lower extremities functional capacity in male adolescent football players**

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**Introduction.** Football poses a relatively high risk of injury between professionals, amateurs and young players during training and matches [1]. In football, muscle and tendon lower limbs injuries dominate among all types of injuries [2]. To reduce the incidence of these injuries, scientists recommend applying strength exercises to the most vulnerable muscle groups [3,4]. Such exercises have been found to improve the functional capacity of the lower extremities and especially the strength indicators [5,6], but research with adolescent football players on this topic is still lacking. Research aim: to evaluate the effect of strength training program on lower extremities functional capacity in male adolescent football players.

**Research methods and organization.** In total, 36 male adolescent football players from the Baltic football academy and football academy “Žalgirietis” participated in the research. After agreement of bioethics and study participants, the study was conducted from June 2020 (preseason) till September 2020 (middle season). The subjects were randomly divided into two groups: intervention group consisted of 18 players (mean age - 15,39±0,5 years, BMI - 20,44±2 kg/m²) who performed strength training program and control group consisted of 18 players (mean age - 15,33±0,49 years, BMI - 20,26±2,13 kg/m²) who did not performed any given intervention. The strength training program
consisted of five exercises: Nordic hamstring curl, Copenhagen adduction exercise, reverse Nordic hamstring curl, bent and straight legs heel raises. The program was designed by recommendations of the literature and was performed for eight weeks. The exercises of the program were done two or three times a week, depending on the dosage. The study subjects were tested twice: at the start of the study before the program was applied and at the end of the study after the application. Lower extremities muscle strength was evaluated with a hand-held dynamometer (Lafayette Model-01165), muscle endurance with single leg squat (SLS) and single leg heel-rise (SLHR) tests, and dynamic balance with single leg hop for distance (SLHD) test. Statistical data analysis was performed using IBM SPSS Statistics 22.0 program. The quantitative results are presented as median (min-max; mean). The comparison of two independent samples was made with non-parametric Mann-Whitney test. The comparison of two dependent samples was performed with non-parametric Wilcoxon test. The difference was considered to be statistically significant when \( p<0.05 \).

**Results.** At the end of the study, no significant increase in maximal isometric strength in hip abduction, adduction, and knee extension and flexion movements was recorded in either the intervention or control group when assessing both limbs. The largest increase in maximal isometric strength in both groups was observed in the dominant leg knee extension motion. In the control group it has changed from 50.9 (34.9-64.6; 51.93) to 55 (37.7-74.6; 52.53) kilogram, and in the intervention group from 53.25 (45.4-66.2; 54.77) to 55.9 (41.7-69.9; 56.13) kilogram. After the program, the scores of SLS test in the intervention group increased in both limbs, but only in the dominant leg changes were statistically significant (\( Z=-2.122, p=0.034 \)). The maximal number of single leg squats increased from 10.5 (4-26; 11.25) to 18 (6-33; 17.13) repetitions. In the control group, results decreased or did not change after the second evaluation. At the end of the study, SLHR test results of the control group statistically significantly improved from 22 (16-31; 23.93) to 30 (19-39; 29) repetitions in the dominant leg (\( Z=-2.100, p=0.036 \)), and from 21 (12-30; 21.67) to 28 (21-40; 29.07) repetitions in the non-dominant leg (\( Z=-2.796, p=0.005 \)). In the intervention group the results of heel raises increased significantly from 24 (11-41; 24.27) to 27 (16-49; 29.73) repetitions only in the non-dominant leg (\( Z=-2.388, p=0.017 \)). After the study, a significant increase of SLHD test results was observed in the dominant leg of the control group (\( Z=-2.011, p=0.044 \)), and in the non-dominant leg of the intervention group (\( Z=-2.665, p=0.008 \)). It is worth noting that at the beginning of the study, the indicators of the non-dominant leg were statistically significantly lower in the intervention group (147 (122-172; 147.69)) compared to the control group (159 (124-177; 156.87)). Despite observed changes, the results of all tests and limbs did not varied between groups at the end of the study (\( p>0.05 \)).

**Conclusions.** The strength training program had not increased the maximal isometric strength in lower limbs. The results of single leg squat improved significantly only in the dominant leg, and the results of single leg heel-rise - in the non-dominant leg. The exercise program significantly improved single leg hop for distance results only in the non-dominant leg. However, the results of muscle endurance and dynamic balance tests did not differ significantly from the control group.

**References:**

Evaluation of functional capacity, functional movements and quality of life in young people of different physical fitness

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Introduction. It is generally accepted that physical activity beyond improving fitness and endurance levels plays a significant role in the promotion of physical and psychological health by reducing chronic diseases, mental disorders and decreasing all causes of mortality (1). Running is one of the most popular and accessible sport activities worldwide (2). Because of its easy accessibility, long distance running is practised by many people and along with the growing interest in disease prevention it continues to increase in popularity (3). Aim of the study. To compare the indicators of functional capacity, functional movements and quality of life of young people of different physical fitness.

Research methods and organization. The research took place in the Lithuanian University of Health Sciences, Medicine Academy, Department of Sports Medicine. The research was approved by the Lithuanian University of Health Science Bioethics Center (BEC-SR(M)-204) and started in 2020-06-25, and was finished in 2020-10-30. There was 30 participants in the study, 16 women and 14 men, 19-25 years old. Participants were required to run at least 2 kilometers once a month for the past year, also could not have any injuries in the past 12 months, other physical activities (such as stretching, warming up) depended on each participant individually. There were three groups: (1) people who actively participate in the running competitions (n=10), (2) people who exercise 2-3 or 4-6 times a week for at least 30 minutes (n=10), (3) people who exercise once a week or a month (n=10). In the study 3-minute plank test was used to determine functional capacity, FMS testing was used to evaluate functional movements, questionnaire SF-36 was used to assess energy and emotional levels. IBM SPSS Statistics 22.0 was used for statistical analysis. Data are provided as – median (minimum-maximum; mean). A nonparametric Kruskal-Wallis test was used.

Results. FMS testing showed that functional movements between group (1) 19 (14-21; 18.7), group (2) 18 (19-19; 17.6) and group (3) 13 (11-20; 13.7) differed depending on physical activity ($\chi^2(2) = 13.258; p = 0.001$). The same results are achieved between groups 1 and 2. Statistically significant difference was found between groups 1 and 3 ($p = 0.001$) and groups 2 and 3 ($p = 0.065$). SF-36 questionnaire showed that energy level between groups (1) 87.5 (56-95; 100), (2) 74 (56-82; 72.6) and (3) 50 (36-72; 51.6) the results differ depending on physical activity ($\chi^2 (2) = 16.837; p = 0.001$). The same results are achieved between groups 1 and 2, a statistically significant difference was found between groups 1 and 3 ($p = 0.001$) and groups 2 and 3 ($p = 0.005$). SF-36 questionnaire showed that emotional level between groups (1) 87 (65-95;84.5), (2) 82.5(65-95;80) and (3) 40 (15-85;44.5) the results differ depending on physical activity ($\chi^2(2)=18.328; p=0.001$). The same results are achieved between groups 1 and 2, a statistically significant difference was found between groups 1 and 3 ($p = 0.001$) and groups 2 and 3 ($p = 0.017$). Plank test showed that functional capacity between groups (1) 130(80-180;131.1) seconds, (2) 62.5(45-95;64.1) seconds and (3) 25.5(8-55;24.7) seconds. The results differ depending on physical activity ($\chi^2(2)=24.440; p=0.001$). A statistically significant differences
were found between groups 1 and 2 (p = 0.038), groups 2 and 3 (p = 0.001), groups 1 and 3 (p = 0.043).

Conclusions. The results of functional capacity were significantly better from the participants who actively participate in sports events or exercise 2-6 times a week. Also those who exercised only once a week or once a month found it more difficult to perform functional movements. Results showed that energy and emotional levels were better for participants who actively participated in sports competitions and exercised 2-6 times a week.

References:

Impact of individual constant workload and interval training on cardiovascular system indicators in patients after percutaneous transluminal angioplasty and stenting

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Introduction. Cardiovascular disease (CVD) is the main reason of the death in world-wide [1]. According to World Health Organization (WHO) 17.9 million of people dies every year. Researchers recommend aerobic exercise or high-intensity exercise to improve physical performance. Long-term physical training and physical activity reduces the risk of CVD, improves physical fitness. Aerobic exercise during cardiovascular rehabilitation reduces morbidity and mortality rate of CVD [2]. Research aim: To evaluate what effect do continuous and interval trainings impact on cardiovascular system of patients after percutaneous transluminal angioplasty and stenting during second rehabilitation stage.

Research methods and organization. There were 60 male patients participated after percutaneous transluminal angioplasty and stenting. Average age of the patients was 65.8± 3.6 years. Six minutes walking test (6MWT) was performed before the ergometry test. Hemodynamic reaction to physical exertion was determined during bicycle ergometry exercise. After the test, individual training program to patients was created and they there divided into two groups. Patients (n=30) in the first group received continuous aerobic training program, patients (n=30) in the second group received interval aerobic training program. The training duration was from 15 to 30 minutes, two times a day, 6 days a week and lasted for. After the research 6MWT and bicycle ergometry exercise was repeated. “IBM SPSS Statistics 22” software was used for statistical analysis. All data are presented as median, minimum, maximum values and average – Me (Xmin; Xmax; x̄). For comparison of two independent samples Student T test was used. For comparison of two dependent samples Paired Student T test was used and if assumption of normality was violated - non-parametric Wilcoxon test was used. Significance level was set at p <0.05.
Results. There is no significant difference of 6MWT exercise before the research (F=0.79; p=0.37) and after the research (F=0.15; p=0.69), though impact on 6MWT both within the constant and intermittent workloads patient groups was statistically significant (p<0.05). The hemodynamic response to before (F=1.42; p=0.23) and after (F=1.37; p=0.24) exercise in both training groups did not differ in terms of maximum heart rate (HR max), but the results of HR max in the study of interval training groups improved statistically significantly (p <0.05).

Conclusions. Individually prescribed constant and intermittent workload training had a positive impact on hemodynamics and physical capacity. However, which workout is more effective requires more research.

References:

The effects of different physiotherapy programs on the development of lower limb function in adolescent female volleyball players

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Introduction. Volleyball is a high-intensity sport that requires explosive force for movements in various directions.[1] In addition to players skills, the greater the strength is developed, the better the athletic performance.[2] Plyometric exercise programs are frequently used, but there are little evidence on the benefits for different components in functional abilities.[1] Resistance exercises are also effective in promoting muscle strength, and the combination of these two training modalities allows for the inclusion of even more effective blocks of training.[3] Research aim. To evaluate the effects of plyometric and combined plyometric-resistance exercises on the development of lower limb function in volleyball.

Research methods and organization. Prior to the study, permission from the Bioethics Center was obtained. The study was conducted from July 2020 till September 2020 in the training facilities of VšĮ “Tinklinio akademija” and VšĮ “Vilniaus tinklio mokymo centras” under the supervision of a physiotherapist. The study cohort consisted of 27 homogeneous subjects (27 girls) with the mean of age of 15.67±0.83 years, a mean height of 169.67±7.25 cm, a mean weight of 58.78±8.18 kg, and a mean BMI of 20.33±1.8 kg/m², p>0.05. All subjects were randomly divided into three groups: a control group (n=10) that didn’t participate in a specific exercise program and trained in a routine volleyball regimen, a first study group (n=7) that performed a specialized plyometric exercise program and a second study group (n=10) that trained according to the program of combined plyometric and resistance exercises. All study groups trained for 6 weeks, twice a week. Lafayette hand-held dynamometer was used to assess the strength of the hip flexors and extensors also the quadriceps and hamstring muscles. The main functional movements of the lower extremities were observed by performing a functional movement screening test. The assessment of explosive force was performed using a vertical jump test. Agility rates were assessed using a T-test. Statistical data analysis was performed using IBM SPSS 27.0 program. The research samples are small, therefore non-parametric criteria were applied for the data analysis. The non-parametric Kruskal-Wallis test was used for three
independent samples and non-parametric Wilcoxon test for two dependent samples. Quantitative data were presented as median (Xme), minimum (Xmin), maximum (Xmax) and mean (Xm) values - Xme (Xmin-Xmax;Xm). The significance level α=0.05 was used to test the statistical hypotheses. The difference was considered statistically significant when p<0.05.

**Results.** After analysis of the results of the study between the three groups, no statistically significant differences were found at the beginning and in end of the study p>0.05. In the control group, at the end of the study, there was a statistically significant increase in the strength of the non-dominant leg hip extensors (Z=-2.301; p=0.021) and the non-dominant leg quadriceps muscle (Z=-2.191; p=0.028), other tests did not significantly differ. At the beginning of the study for the control group, the muscle strength of the hip extensors of the non-dominant leg was 19.9 (15.9-24.4; 19.8) kg, in the end of the study - 21.45 (17.4-23.3; 21) kg. At the beginning of the study for the control group, the quadriceps muscle strength of the non-dominant leg was 41.8 (31.7-58.3; 41.87) kg, in the end of the study - 42.65 (25.2-45.5; 36.79) kg. In the first study group, at the end of the study, no statistically significant differences were found assessing muscle strength, lower limb functional movements, vertical jump and agility p> 0.05. In the second study group, at the end of the study, there was a statistically significant increase in the strength of the quadriceps muscle of the dominant leg (Z=-2.091; p=0.037) and the quadriceps muscle of the non-dominant leg (Z=-2.395; p=0.017), other tests did not significantly differ. At the beginning of the study for the second study group, the quadriceps muscle strength of the dominant leg was 35.1 (17.1-55.1; 36.41) kg, in the end of the study - 45.05 (31.56.3; 43.51) kg. At the beginning of the study for the second study group, the quadriceps muscle strength of the non-dominant leg was 37.1 (22.4-46; 35.88) kg, in the end of the study - 40.45 (33.4-57.3; 42.99) kg.

**Conclusions.** Girls who only participated in regular volleyball training statistically significantly improved non-dominant leg hip extensors and quadriceps muscles strength, while combined plyometric-resistance exercise training group significantly improved on both leg quadriceps muscles strength. Female volleyball players functional movement, vertical jump and agility test results did not statistically significantly differ after applying distinct physiotherapy program.

**References:**

**The psychophysiological changes in 18-years-old-schoolgirls practicing Shinrin-Yoku before and during Covid-19 pandemic**

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**Introduction.** Shinrin-Yoku could be defined as making contact with nature of forest and taking in the atmosphere: a process intended to improve mental and physical relaxation (1). Previous studies found positive emotions enhancement as well as reduction of reported modern-day “stress-state” and
“technostress” (2). Currently, the substantial stress could be induced not only by environment, technology but also because of COVID–19 pandemic (3). It is pivotal, that we do not ignore the psychological impact that the outbreak has. Specifically, psychophysiological ramifications could be long-lasting even after the pandemic has ended. Research aim: to reveal influence of Shinrin-Yoku and normal walking in town for 18-years-old-schoolgirls psychophysiological effects.

**Research methods and organization.** The study was approved by Bioethics Center (Nr. BEC-SR(M)-162). All participants signed the informed consent form before taking part in this study. Thirteen 18 years old (BMI = 19.54 ± 2.42 kg/m²) schoolgirls (12 of whom completed the study, 2 participants’ software data was partially included, overall, 10 students have fully completed), were enrolled as subjects. None reported a history of fibromyalgia, kidney diseases, all were non-smokers and had BMI lower than 35 kg/m². All of the subjects declared having an increased stress by perceived stress scale (PSS), initially more than 20 points. The study was accomplished in Tytuvėnai and it consisted of 2 phases. In phase 1 (before Covid-19 pandemic) and phase 2 (during Covid-19 pandemic) the enrolled participants number per phase was 6. Overall 12 girls walked for 7 days (daily in the afternoon) in town and forest for 30 min each. To measure the perception of participants’ stress, PSS was completed once-per-day after PA (physical activity). Before and after each walk arterial blood pressure (ABP): systolic (sABP), diastolic (dABP) was measured with the OMRON automatic ABP monitor M3. We used heart rate (HR) monitor Polar M430 to collect PA variables (4). We further used advanced Kubios heart rate variability (HRV) software (supports Polar input data) for analysis of HRV (5). Data analyzed with Kubios HRV: detrended fluctuation analysis (DFA) (short term fluctuations α₁ and long term fluctuations α₂). The data was analyzed using IBM SPSS Statistics (Armonk, NY: IBM Corp, USA), version 26. Statistical analyzes were conducted using analysis of non-parametric tests (Mann-Whitney and Wilcoxon). Significant level set at p < 0.05.

**Results.** Long term fluctuations in town (1.07 (0.91-1.87; 1.07)) and forest (0.98(0.85-1.14; 0.99) showed differences on day 5 (Z=-2.29, p=0.02). Analyzing mean values of PSS, stress level decreased through 7 days. On first-day experienced stress in group 1 was 24.5 (21-29; 24.75) and group 2 was 27.5 (22-34; 27.5) points while on day 7 group 1 values decreased to 19.5 (15-24; 19.5) and group 2 to 13 (6-25; 13.83) points. Statistically significant decrease of PSS between day 1 and day 7 was observed in group 1 (Z=-2.20, p=0.027) and group 2 (Z=-2.22, p=0.026). After forest walk, group 2 had higher sABP than group 1, respectively on day 3 (U=5.50, p=0.045), day 4 (U=5.50, p=0.045), day 5 (U=5.00, p=0.036), day 6 (U=5.50, p=0.045), day 7 (U=5.50, p=0.043). After walking in town, changes in sABP were observed in all 7 days except for day 6: day 1 (Z=-2.50, p=0.012), day 2 (Z=-2.40, p=0.016), day 3 (Z=-2.60, p=0.009), day 4 (Z=-2.51, p=0.012), day 5 (Z=-2.12, p=0.034), day 6 (Z=-1.51, p=0.13), day 7 (Z=-2.60, p=0.009). sABP increase was observed after the subjects walked in town. Analyzing the changes of sABP in forest before and after walk, decrease in sABP was observed on day 4 (Z=-1.89, p=0.05), day 5 (Z=-2.27, p=0.02) and day 7 (Z=-2.78, p=0.005). Analyzing dABP changes after walking in town, significant results were observed in following days: day 1 (Z=-2.04, p=0.041), day 2 (Z=-1.96, p=0.049), day 5 (Z=-2.63, p=0.008) and day 6 (Z=-2.75, p=0.006). Analyzing dABP changes after walking in forest, statistically significant decrease of dABP was observed on day 5 (Z=-2.94, p=0.003) and day 7 (Z=-2.81, p=0.005).

**Conclusions.** 1) Perceived stress of 18-years-old-schoolgirls decreased after 7-day Shinrin-Yoku intervention. 2) After town-walk on majority of the days’ participants’ systolic and diastolic blood pressure demonstrated augmentation. 3) Participants’ systolic blood pressure after walking in forest decreased in three days out of seven and diastolic blood pressure in two days out of seven.

References:


Effectiveness of electrical stimulation used in pair with physical exercises on upper limb function in patients after stroke

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Introduction. Stroke is one of the leading causes for disability and mortality in the world. According to the World Health Organization, stroke has been the second cause of death in the world for many years. [1] The consequences of this disease greatly impair functional independence and has a negative impact on the quality of life. Because of this, it is important to start rehabilitation as early as possible where physical therapy is the main component and by applying electrical stimulation greater and more effective recovery of the lost function can be expected. [2] The aim of this study is to evaluate the effectiveness of electrical stimulation used in pair with physical exercises on upper limb function in patients after stroke.

Research methods and organization. The study was carried out in the hospital of Lithuanian University of Health sciences “Kaunas Clinics”. The research was approved by Lithuanian University of Health Science Bioethics Center (BEC-SR(M)-157). 18 patients diagnosed with stroke participated in the study, 11 men and 7 women who were in the first phase of rehabilitation. First group consisted of 6 men and 3 women. Second group consisted of 5 men and 4 women. Assessment of gender confirmed homogeneity between groups (x²=0,234; p=0,629). Age of participants ranged from 59 to 73. Median age of first group was 64 (59 – 73; 10; 64,9) and 68 (59 – 73; 6; 67,7) in the second group. Assessment of age confirmed homogeneity between groups (U=28; p=0,268). Selection criteria: 1. Age of subjects 59 – 74; 2. Results of Oxford muscle strength evaluation 1-2 points; 3. No severe mental impairment according to mini mental state examination; 4. No contraindications to electrical stimulation. Participants were randomly assigned to groups of 9 patients per group. First study group had daily physical therapy based on physical exercises. Second study group had the same exercise program paired with electrical stimulation with parameters of 35Hz frequency, 150μs impulse duration and up to 65mA impulse amplitude during the exercises. Rehabilitation lasted for 5 days. Each patient underwent 5 procedures of 30 min. (excluding preparation and breaks) and were tested before rehabilitation and after. Methods of examination: 1. Oxford scale; 2. Fugl-Meyer upper limb examination; 3. Modified Ashworth scale; 4. Modified motor assessment (MAS) scale. Statistical analysis was done using “IBM SPSS Statistics 22”. Differences were considered statistically
significant at p<0.05. Statistical methods used in research: 1. Wilcoxon criteria; 2. Mann-Witney U test; 3. Chi-squared test.

**Results.** First patient group included in the study had a statistically significant improvement of upper limb movements by evaluating results of the modified motor assessment scale (Z=-2.675, p=0.007) and statistically significant improvement of upper limb function estimated by assessing Fugl-Meyer upper limb examination (Z=-2.666, p=0.008). Statistically significant improvement of wrist muscle strength was observed by comparing results of the Oxford scale: flexors - (Z=-2.585, p=0.01), extensors - (Z=-2.070, p=0.038). Second study group had a statistically significant improvement of upper limb movements by analyzing the results of modified motor assessment scale (Z=-2.536, p=0.011) and upper limb function based on Fugl-Meyer upper limb examination scores (Z=-2.673, p=0.008). Statistically significant improvement of wrist muscle strength was observed through measurements using the Oxford scale: flexors - (Z=-2.530, p=0.011), extensors - (Z=-2.46, p=0.014). Comparing results after rehabilitation between the study groups, no statistically significant difference was observed. Upper limb movement assessment difference with modified motor assessment scale was observed (U=34.5; p=0.605), evaluation of upper limb function using Fugl-Meyer upper limb examination was carried out (U=34.5; p=0.605). The Oxford muscle strength scale was used to determine the strength of wrist flexors (U=32; p=0.489) and extensors - (U=27; p=0.258).

**Conclusions.** Electrical stimulation, paired with physical exercise program, was not more effective on the recovery of the upper limb function in patients after stroke compared to physical exercise program without the use of additional methods.

**References:**

**Associations between posture, trunk and pelvic functional parameters in Latin American formation dancers**

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**Introduction.** Different dance styles consist of diverse movement patterns and paces, which alter the biomechanical and physiological demands, resulting in specific adaptations for each dance form [1]. It may induce a variety of physical problems including injury, poor posture, muscle imbalances and lumbar-pelvic region motor control disorders [2,3]. Pelvic region provides the link between trunk and legs by being connection point for core muscles and starting point of the thigh [4]. Hamstrings are also of great importance because their shortening changes the location of the lumbar-pelvic region and this affects posture [4,5]. Aim: to evaluate the associations between posture, trunk and pelvic functional parameters in Latin American formation dancers.

**Research methods and organization.** This study involved twenty-three non-professional Latin American formation female dancers. Participants were recruited from dance studio “Aistra šokiu” and took part in the study during the period of 08/01/2020 to 10/01/2020. The study was approved by the Lithuanian University of Health Sciences Bioethics Center (No. BEC-SR(M)-42). Inclusion criteria: age 20-40 years; dancing experience of at least 3 years and for at least twice a week; dancing non-professionally. Age of participants was 23 (20-33; 23.7) years. Participants had 8 (3-15; 8.53) years of
dancing experience. W.W.K. Hoeger visual scale was used for posture assessment. Six tests by H. Luomajoki were used for evaluating movement control of the lumbo-pelvic region. W.W.K. Hoeger and H. Luomajoki tests results are expressed in points. Trunk flexion was measured using modified Schober test, results are expressed in centimeters. Measurements of the muscle lengths were taken while performing the passive straight leg raise (PSLR) test and using goniometer and results are expressed in degrees. Data were analyzed using the program SPSS 22.0. The data are presented as median (xme), minimum (xmin), maximum (xmax) value and mean (xi) – xme (xmin - xmax; xi).

Qualitative data are presented as a percentage. Spearman’s coefficient (r) was used in order to assess the relationship between two nonparametric variables. A correlation coefficient of |r|<0.3 was considered weak, while 0.3 ≤ |r| ≤ 0.7 was considered moderate, and |r| > 0.7 was considered strong. The difference was considered statistically significant when p<0.05.

**Results.** According to W.W.K. Hoeger’s visual posture assessment scale, the dancers’ posture was 42 (34 - 48; 41,22) points. The posture of all subjects ranged from average to excellent. None of the subjects had a poor or very bad posture. The results for six tests by H. Luomajoki were 4 (1-6; 3.7) points. 39.13% of dancers could not perform more than half of the lumbar-pelvic movement control tests and only 4.35% of dancers could perform all six tests. Modified Schober test results were 6 (5-8.5; 6.43) cm. Only 39.13% of dancers reached the norm (7 cm). The passive straight leg raise result in right leg was 75 (55-105; 77.83) degrees, and in left leg 75 (60-100; 76.96) degrees. 82.61% of dancers reached the norm (70 degrees) with both legs. Moderately significant direct correlations were found: between posture and movement control of the lumbar-pelvic region (r=0,483; p=0,019); between posture and trunk flexion (r=0,456; p=0,029); between trunk flexion and movement control of the lumbo-pelvic region (r=0,655; p=0,001); between PSLR in left leg and trunk flexion (r=0,549; p=0,007); between posture and PSLR in right leg (r=0,596; p=0,003); between PSLR in right leg and movement control of the lumbar-pelvic region (r=0,485; p=0,019; between PSLR in left leg and movement control of the lumbar-pelvic region (r=0,646; p=0,001). There were direct strong significant correlations: between trunk flexion and PSLR in right leg (r=0,743; p<0,001); between posture and PSLR in left leg (r=0,714; p<0,001).

**Conclusions.** Almost half of Latin American dancers had good posture and none had a poor or very bad posture. More than a third of the dancers reached the trunk flexion norm and the same part of dancers could not perform more than half of the lumbar-pelvic movement control tests. Most Latin female dancers’ hamstrings were normal in length. There were direct moderate and strong relationships between posture, trunk flexion, lumbar-pelvic movement control, and hamstring length in a Latin American female dancers.

**References:**