

## SPORTS INJURIES PREVENTION DUE TO ISOMETRIC EXERCISES

*This article considers the research of effect of isometric exercises done on the gym machine "Suhozhil" designed to reduce risk of injuries in sportsmen-weightlifters (kettlebell lifters). 32 sportsmen of various qualifications aged 18-36 took part in the research. The efficiency of the program has been tested in the pedagogical experiment based on the results of power exercises. The research showed growth of results of sportsmen-weightlifters in the majority of power exercises, which proves high effectiveness of workouts on this gym machine designed to prevent sports injuries.*

**Key words:** *isometric exercises, gym machine "Suhozhil", weightlifters (kettlebell lifters), injury prevention.*

**Description of the problem.** Current intensive tournament activity in kettlebell lifting sport and growth of competition require higher sport performance and, as consequence, workouts to be more intensive and loads to be competitive. Today, results of the best kettlebell lifters in the exercise "jerk" of two kettlebells reach 150-170 liftings. The load accumulated during only one tournament exercise by high class sportsmen doing exercises with kettlebells makes 300 tons and over [6,7]. Under such conditions, probability of overstrain of musculoskeletal system of the kettlebell lifters rises and might lead to injuries [2, 8]. However, reaching the higher goals goes hand in hand with the main task to protect and strengthen health of an athlete.

Along with rational methods of doing exercises, strength workout of a kettlebell lifter occupies one of the most important places in preventing injuries at all stages of training from year to year. High level of muscles and tendons strength development ensures high results in kettlebell lifting.

To develop strength qualities and strengthen tendons, traditional dynamic exercises are combined with isometric exercises, during which muscles tension is not accompanied with muscles contraction [3,10]. Muraveynik M.S. (Chernihiv) has developed and patented designer gym machine called "Suhozhil" and methods of isometric exercises to develop and strengthen all body muscles and tendons [5]. Efficiency of the gym machine in preventing sports injuries was tested on the group of kettlebell lifters of the Korolyov Zhytomyr Military Institute.

**Overview of recent researches and publications** [1,2,6] showed that a spine is the most fragile and at the same the most critical organ of the human body. Among main functions provided by the spine are: protection of internal organs and support to entire body; as an axis for all levers of joints and muscles to ensure movement; support of vertical position and balance of the body. Every function is performed due to complicated interaction of structural elements of the spine, ligaments and joints machine, discs and muscles. As the spine is tightly connected with the spinal cord and its structures, its pathology may cause various complications.

In the general structure of diseases, spine diseases occupy one of the leading positions. According to data provided by different authors, 50% to 80% of population of socially active age (29-60) suffer from pains in one or other part of the spine. Over 1/3 of the population in Ukraine have osteoporosis, scoliosis, and other diseases [6,8]. Every year, the number of patients is growing, and x-ray and clinical signs are registered in 12-15 y.o. children. Often the problems with the spine are found in older people who have sedentary lifestyle and, on the contrary, in those who have significant physical loads. The latter category includes sportsmen. The kettlebell lifters belong here as well. Like in other cases, in kettlebell lifting, an issue of healthy spine is an urgent issue.

Based on the results of the previous researches [6,7], it was found that over 60% of interviewed kettlebell lifters reported having period pains in the spine (more often in lumbar spine and lower thoracic part). Major part of those who mentioned pains (over 50%) were beginners and

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athletes of certain category who tried to reach high goals within the shortest possible time increasing loads while being not sufficiently physically and technically fit. The kettlebell lifters of high class (masters, masters of international class, honoured masters) with 5 year and over of experience in kettlebell lifting make high percentage (over 30%). It shows accumulative effect of the spine injuries. About 30% of interviewed kettlebell lifters were forced to stop trainings and seek neurological help.

The causes of injuries in kettlebell lifting have also been determined. Among them are: insufficient warm-up, irrational techniques in doing exercises; regular excessive physical strain, excessive workouts and exhaustion; pursuit of results and workouts with huge physical effort without sufficient physical fitness; insufficient level of back and abdominal muscles development (weak muscle corset). Among other causes are: considerably long life in sports (injuries occur as an accumulative result of numerous trainings); congenital spine anomalies; poor flexibility of the spine and joints mobility; hypothermia; bad habits (alcohol, smoking); infection; insufficient and poor nutrition; sport regime violation (insufficient rest (night sleep) and recovery); psychogenetic injury.

**The objective of the work.** To study effectiveness of isometric exercises done on the gym machine “Suhozhil” for preventing sports injuries in kettlebell lifters.

**Research methods.** Overview of literature, pedagogical observations, testing, interviewing, pedagogical experiment, and methods of mathematical statistics.

**Organization of the research.** To study effectiveness of isometric exercises done on the gym machine “Suhozhil” for preventing sports injuries in sportsmen - kettlebell lifters, we have carried the pedagogical experiment on the group of kettlebell lifters of the Korolyov Zhytomyr Military Institute. Duration of the experiment was 12 months. 32 sportsmen of various qualifications aged 18-36 took part in the research. The athletes did proposed complex of exercises on the gym machine on the days when no workouts in kettlebell lifting were scheduled, 3 times a week in one day for 10-15 minutes. At the beginning and closer to the end of the experiment control workouts were arranged to test weight-lifting exercises. From time to time, at the beginning and at the end of each workouts the values of heart rate and blood pressure were registered. During research accuracy of difference in performance of athletes at the beginning and at the end of the experiment was defined using Student’s criteria as well as the amount of change in power results expressed in percents.

**Discussion of research results.** Overview of literature showed that a big number of gym machines exist and respectively many exercises have been developed to work muscles and tendons. First pieces of information about isometric exercises and their impact on strength ability of a person can be found in the works by outstanding circus athlete Oleksandr Zass, who was very popular in the early XX century [3,10]. His system is based on doing exercises for various groups of muscles by stretching iron chains of various lengths. In his works [9], N.B. Sotsky presented designer’s gym machine “Bizon-1 M” that was unique in its construction, with the only drawback being its narrow focus at working muscles and tendons of hands and shoulder girdle only. The gym machine “Bizon-2” was similar to “Bizon-1 M” and was also designed by N.B. Sotsky [4,9]. Majority of exercises that can be done on the gym machine “Bizon-2” are

aimed at working muscles of hands, at the same time all other groups of muscles are not engaged. We know other gym machines of the Center of power kinesitherapy, but they make it possible to strain muscles and tendons only at certain angles, at the same time they are quite voluminous and take a lot of space [4]. IGRIP Portable Isometric Gym machine and Powerspin made in the USA are also classified as isometric gym machines. The exercises to be practiced on the first one require squeezing or stretching its handles by hands, and on the second one a ball should be spinned in the ring-runnel that allows training not only muscles of tendons of hands, but also those of the upper part of the body [4.] The drawback of these gym machines is their low effectiveness for strengthening muscles of legs and back.

Unlike other gym machines, the designer's gym machine "Suhozhil" is designed to do vast range of exercises to buildup muscles and tendons of the whole body [4,5]. The gym machine is composed of two pillars placed vertically at a certain distance one from the other that is equal to the average wide of shoulders of a person. The pillars have holes of the same diameter. The pillars are connected by three plaques (at the level of knees, elbows, and head) with the holes similar to the holes in the pillars. Cylinders that have to be squeezed or stretched according to the designer's workout methods are inserted into the holes in turn. Due to such construction cylinders may be placed at a required level and in a position that allows ensuring application of isometric load to different groups of tendons and muscles of the whole human body in turn. The gym machine is made of natural wood, occupies small space, may be installed in a gym as well as in residential premises, safe and simple in operation.

Main points of workout methods on this gym machine are: number of exercises – 8-10, number of circles in each exercise – 2-3; duration of each exercise – 45- sec; rest between the circles and exercises – 5-10 sec (2 inhales-exhales); efforts applied to perform the exercise – 20-30% (of nominal 100%); all exercises are performed as you exhale. In 3 months of regular training

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duration of exercises was increased up to 5-6 sec; efforts – up to 50% and 2-3 exercises were replaced with new ones [4,5].

Main advantages of the gym machine "Suhozhil" are : it provides opportunity to do exercises for strengthening muscles and tendons of the whole body; requires minimum time for workout (duration of the training – 10-15 minutes that makes all together 30-40 minutes per week); minimal strain on the body (heart rate meets initial values); possibility to install the gym machine in any premises; broad age range of those who can use it; number of exercises that can be done on it is limitless.

Having made post experimental analysis of values of parameters researched shown by the athletes, we have established that all power exercises resulted in growth of the results (table 1). But if exercises with a rod and gymnastic equipment showed no distinct difference in the results at the end of the test and their initial values ( $P > 0,05$ ), then in keeping the body in a horizontal position and hand dynamometrics the values showed evident improvement during the experiment ( $P < 0,05 - 0,001$ ). So, in squat with the rod on shoulders the average result of the kettlebell lifters grew by 3,92 kg (3,6%), in deadlift – by 4,12 kg (3,4%), in bench press – by 4,57 kg (4,9%), in pull-up on a horizontal bar – 2,6 times (4,9%) (table 1).

**Dynamics of power values of kettlebell lifters doing isometric exercises on the gym machine “Suhozhil” during the experiment (n-32, X±m).**

№	Values studied	Before experiment	After experiment	Difference %	Accuracy of difference
1.	Squat with the rod per 1 time, kg	106,30±3,54	110,22±3,23	3,6	t=0,82
2.	Deadlift per 1 time, kg	118,48±2,05	122,61±1,96	3,4	t=1,46
3.	Bench press per 1 time, kg	87,39±2,14	91,96±2,07	4,9	t=1,53
4.	Pull-up on a horizontal bar	18,91±0,56	20,04±0,54	5,6	t=1,45
5.	Extensions and curls of hands on parallel bars, times	35,61±1,78	37,91±1,89	6,1	t=0,89
6.	Lifting into sitting position	49,6±0,91	52,2±1,06	4,9	t=1,86
7.	Keeping the body in a horizontal position	252,6±24,5	348,3±27,6	27,4	t=2,59
8.	Stronger hand dynamometrics	43,61±1,29	50,48±1,09	13,6	t=4,03

The most impressive positive changes have been reached in values of power of muscles and tendons of back and hand. In keeping the body in a horizontal position the results increased by 97,5 c (27,4%), and in values of had dynamometric of the strongest hand the results improved by 6,87 kg (13,6%).

It is important to note that selective registration of the values of heart rate and blood pressure of kettlebell lifters before and after the exercises on the gym machine showed practically no raise in values of the parameters of cardiovascular system under control: fluctuation makes 2-5%. It is explained by the fact that any strain during exercises was done at exhaling.

It should be also noted that over 90% of interviewed kettlebell lifters that participated in the research stated that they felt increase of forces in their muscles and tendons and confirmed decrease (or complete absence) of pain in the vertebral column and joints during training on the gym machine. Thus, analysis of changes in values of strength ability as well as survey of the sportsmen confirm effectiveness of isometric exercises done on the gym machine “Suhozhil” for preventing injuries in kettlebell lifters.

**Conclusions.** 1. It has been established that as a result of exercises on the gym machine “Suhozhil” kettlebell lifters reached improved strength ability in squats with the rod by 3,92 kg, in deadlift – by 4,12 kg, in bench press – by 4,57 kg, in pull-up – 1,13 times, in exercise on parallel bars – 2,3 times ( $P>0,05$ ), in hanging – by 20,18 sec, in stronger hand dynamometric – by 6,87 kg, of left hand – by 5,74 kg ( $P<0,001$ ).

2. It has been stated that the designed gym machine and the designer workout methods are an effective way of preventing sport injuries in sportsmen – kettlebell lifters.

**The prospects of further research** is to study impact of exercises on the gym machine “Suhozhil” on improving mobile activity and strengthening body of older persons and acceleration of rehabilitation of athletes after injuries.