

# “Gravitron” Assisted Pull-Up Machines in Strength Building as Part of Physical Education Class in the Senior Years of Secondary School

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**Abstract** — In order to meet the State Educational Standard for Secondary Schools in the Russian Federation, a comprehensive test investigating physical fitness in senior students was conducted. The sample consisted of male youth attending Astrakhan secondary schools. This test showcased that physical fitness in said students was underdeveloped. By using the weight machines, “Gravitron” assisted pull-up machine to be exact, the students were able to significantly improve their fitness and strength building capacities in order to prepare for the GTO pull-up tests on a horizontal bar. The research materials for the study were physical fitness test scores obtained from the secondary school students in Astrakhan (Russia) along with medical commission reports. In order to assess physical fitness in said sample, the students were asked to perform pull-ups on a horizontal bar. The calculations were computed using Statistica 10 analytics software package (USA) and its applications. The correlation analysis was performed applying the Pearson correlation coefficient. The PE curriculum for the experimental group introduced obligatory pull-ups on a horizontal bar. As a result, the strength building capacity of said students increased significantly over 6 months doing this exercise. The results of this study prove the effectiveness of using the “Gravitron” assisted pull-up machine (Russia) in PE classes in senior school which facilitates higher physical fitness scores when performing pull-ups on a horizontal bar.

**Keywords**—*physical education in schools; senior students; strength building; assisted pull-up machine.*

## I. INTRODUCTION

The State Educational Standard for Secondary Schools in the Russian Federation provides for a comprehensive physical training program, sports activities, and negative attitude towards any bad habits and addictions [2,3,4]. The methodology accounting for PE classes’ curriculum in schools is an intrinsic part of effective strength building [6]. The previous studies [1,7,8,9,10,12] emphasize the fact that the school and university students not only lack physical fitness

but also get sick more often. In their turn, the affected regulatory and self-adjusting mechanisms can cause pathological changes in the body [13, 15, 16, 17, 20, 21, 22, 23]. Sports activities [11, 14, 18, 19] and performing the check-up exercises which necessitate fulfilling the GTO tests (the all-Russian physical culture training program “Ready for Labor and Defence”) should be the focus of PE classes [5]. In this regard, the “Gravitron” assisted pull-up fitness machine (Russia) was tested in PE classes in senior school, its purpose being to help the students build strength.

## II. RESEARCH METHODOLOGY

The research material was the data obtained through the check-up strength testing conducted among the senior students (grades 10 and 11) in the secondary school №6, Astrakhan (Russia). The sample consisted of 29 male students who were not excused from participation in physical education for medical reasons. In order to assess physical fitness in said sample, students were asked to perform pull-ups on a horizontal bar. The mathematical calculations were enabled using Statistica 10 analytics software package (USA) and its applications. The correlation analysis was performed applying the Pearson correlation coefficient.

## III. RESULTS

To exemplify how the physical fitness can be assessed, a “pull-ups on a horizontal bar” test was carried out. The results thereof showcased that the majority of the male students in Astrakhan secondary schools had difficulties performing this check-up test. In course of the study, two sample groups were formed. Both were comprised of male students (10th and 11th school years) attending the secondary school №6, Astrakhan (Russia). All sample students had had their annual medical checkup and, being medically suitable, were allowed to participate in PE classes. The PE curriculum of the experimental group ( $n_1$  — 14) included pull-ups on the “Gravitron” assisted pull-up machine, whereas the control

group ( $n_2 = 15$ ) was not required to perform those exercises. The initial stage of the study did not display whether there were any major mean value differences between the control group and the experimental one, the mean value amounting to  $6,10 \pm 1,20$  repetitions. It should be however noted that this study did not include scores obtained from 2 students who were overweight and performed 0 pull-ups on the horizontal bar. Scores of two more students who had "Junior Athlete" ranks in gymnastics and boxing were excluded from the study as well. They did 22 and 18 repetitions, respectively. A set of strength-building exercises using the assisted pull-up "Gravitron" machine was adopted during the study:

- Parallel-grip pull-ups (3 sets of 8-10 repetitions);
- Neutral-grip chin-ups on a straight bar (3 sets of 10-12 repetitions);
- Behind-the-neck pull-ups on a curl bar (3 sets of 8-10 repetitions);
- Chin-ups on a curl bar (3 sets of 10-12 repetitions).

The recovery time between sets was determined individually — that was the time within which the heart rate dropped to 130 heartbeats per minute, being the 2nd minute of rest. Upon completing all the given repetitions, a counterweight could be attached if needed adding 5 kg each time.

When using the "Gravitron" assisted pull-up machine, special attention was paid to how the exercise was performed. Students were not approved of:

- tilting their pelvis forward;
- having an excessive curve in the spine when performing the final part of the exercise;
- performing the exercise in a rough, abrupt manner;
- showing muscle imbalance in arms;
- not fixing their hands on the bar (grips) properly.

While performing the exercise, the arm angle was controlled. The students learned using the lats and the subscapularis muscles.

Thereafter, the dynamic changes and their fluctuations throughout the school year were assessed. The fitness scores improved significantly in the middle of the second term (hence, after 7 months) and amounted to  $8.20 \pm 1.20$ ;  $p < 0.05$ ;  $r = 0.421$ . The best horizontal bar pull-up performance scores amounted to  $8.80 \pm 1.20$ ;  $p < 0.05$ ;  $r = 0.434$ , being the 9th month of doing this exercise. The results observed at the end of the school year indicated that the fitness scores had reached their plateau. The control group ( $n_2 = 15$ ) exhibited no significant improvements performing high bar pull-ups during the study.

#### IV. CONCLUSION

Thus, the results confirm that implementing of the "Gravitron" assisted pull-up machine show positive results when applied in PE class in secondary school. The said exercise machine is very flexible in terms of adjusting the

strength-building exercises to individual needs which is needed to meet personal health requirements. This aspect allowed not only to develop strength in students but as well to teach them proper and efficient exercise techniques. Hence, the exercises tested using the "Gravitron" assisted pull-up machine do arguably have a positive impact on strength building. At the same time, the ability to adjust the exercises to accommodate personal health requirements proves that the proposed method is reasonable and well-balanced.

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