MONITORING OF DEPENDENCE OF MUSCLE STRENGTH LEVEL ON EXECUTION OF GYMNASTIC EXERCISE FORM IN SCHOOL PHYSICAL EDUCATION

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Abstract

The study deals with gymnastics in school physical education. It is important that pupils are sufficiently physically equipped for correct execution of the exercise forms. The main goal was to monitor the dependence of the level of muscle strength (of indicators of strength abilities in this case) on the execution of the exercise form called upswing. Pupils of the eight-year Liberec grammar school participated in the tests. It was a study for which two motor tests were chosen. The results show that the dependence of strength abilities on the execution of the exercise form exists. The strength abilities of the arms and shoulder girdle and the strength of lumbar, hip, thigh and abdominal muscles are determining for the execution of upswing; they are substituted by take-off in most cases.

Keywords: exercise form, strength abilities, muscle strength, motor tests

Introduction

Additionally to direct integration of gymnastics into lessons, variuos gymnastic exercises are included in other sports as well. Although vast majority of exercise forms is based on natural human activities, a lot of children do not have sufficient physical dispositions for their execution because of current lifestyle. That is why they do not manage some motor skills and exercises at all, or they perform them incorrectly, sometimes even risking damage to their health. For correct execution of the exercise forms, it is indispensable for the pupils to have sufficient power equipment because that ability conditions the execution of the exercise form (Arkaev-Suchilin, 2004).

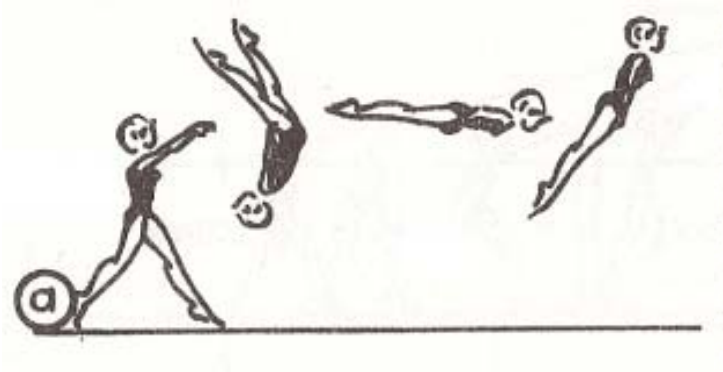
As our professional literature significantly lacks published recent studies from the area of gymnastics on the level of strength abilities and their influence on the execution of exercise forms, we decided to perform our research. The upswing on the horizontal bar is commonly described as control exercise form in outputs of ŠVP in the gymnastics curriculum of elementary schools.

The main goal of the research was to monitor the dependence of the level of muscle strength (of indicators of strength abilities in this case) on the execution of the exercise form called upswing.

1 Research Methodology

The study was performed in the eight-year Grammar School and Secondary Teachers College in Liberec during lessons of physical education. The tests took place at the end of March 2010. 49 girls and 46 boys from the first to the fourth years participated in. At the beginning

of the study, the pupils were invited to approach the horizontal bar and show the upswing one after the other.



Picture 1 Upswing on horizontal bar

The results were recorded in a two-degree assessment scale (performed-1, not performed-0) into a chart.

Subsequently two motor tests were chosen to test the monitored strength abilities of the selected muscle groups that condition the performing of the upswing: staying power in pull-up (static endurance strength of upper extremities and shoulder girdle) and sit-ups per 1 minute (dynamic strength of lumbar, hip, thigh and abdominal muscles) (Měkota, Blahuš, 1983).

The acquired values were compared to Neuman values (2003) and processed by basic statistic method.

2 Results and Discussion

The chart shows the results achieved in the first year's girls and boys in both tests performed. 12 girls and 14 boys participated in the tests.

Chart 1 First year grammar school/boys – girls

Girls	1	2	3	4	5	6	7	8	9	10	11	12			$\bar{x}$	s
Sit-up per 1 min.																
	49	42	40	25	39	52	35	40	39	46	40	40			40,58	6,54
Staying power in pull-up (s)																
	27	14	7	4	5	13	4	6	13	16	15	11			11,25	6,38
Upswing																
	1	1	1	0	0	1	1	1	1	1	1	1				
Boys	1	2	3	4	5	6	7	8	9	10	11	12	13	14	$\bar{x}$	s
Sit-up per 1 min.																
	42	38	46	29	42	32	53	30	37	33	39	39	39	36	38,21	6,18
Staying power in pull-up (s)																
	20	7	8	5	2	0	12	1	2	12	0	12	5	2	6,29	5,7
Upswing																
	1	0	1	0	0	0	1	0	0	0	0	1	0	0		

To evaluate the results in the sit-up per 1 minute test, we used comparison to Unifit test as presented by Neuman (2003). Below-average value under 29 cycles performed, average value

of 30-38 cycles and above-average value of 29 and more cycles is stated for 12 year old girls. The below-average value for 12 year old boys is set at 30 cycles, average value at 31-40 cycles and above-average at 41 and more cycles. According to NCYFS (National Children and Youth Fitness Study) (Neuman, 2003), weak performance for 11/12 year old girls is 25 percentiles, 26/28 cycles, average performance 50 percentiles and 32/33 cycles, above-average performance 75 percentiles and 37/40 cycles, excellent performance 90 percentiles a 42/46 cycles.

Weak performance for 11/12 year old boys is 25 percentiles and 30/32 cycles, average performance 50 percentiles and 36/38 cycles, above-average performance 75 percentiles and 41/44 cycles, excellent performance 90 percentiles a 48/50 cycles. When comparing the results achieved by girls to standard values, we can see that their performance is evaluated as above-average, while for boys as average. The girls who had performed 39 and more cycles performed the upswing as well. The boys achieved the same values. To perform the upswing on the horizontal bar, the pupils of the first year of the above stated school needed to perform 39 repetitions of sit-ups per minute.

In the second test, staying power in pull-up, we based our evaluation on Neuman (2003). 11/12 year old girls who had stayed in the prescribed position 4,5/5,7 seconds achieved below-average performance, 6,5-12/10,5 seconds equalled to average performance and 16/17,4 seconds and more to above-average performance. In the group of boys, below-average performance was achieved by pupils staying 10,8/12,7 seconds, average performance at staying 14-20/15,1-21,6 seconds and above-average at staying 24,6/26,2 seconds.

Girls, as compared to the standards described, oscillated at the level of average performance, while boys were deep under the limit of above-average performance. Their average performance (6,29 seconds) corresponded to below-average performance of 7 year old pupils. The girls had enough with staying 4 seconds in pull-up to perform the upswing, while boys needed twice as much, 8 seconds.

The following chart includes the performance achieved by girls and boys from second year of grammar school.

11 girls and 7 boys participated in the tests.

Chart 2 Second year grammar school/girl - boys

Girls	1	2	3	4	5	6	7	8	9	10	11	$\bar{x}$	s
Sit-up per 1 min.													
	30	21	23	32	38	39	36	26	34	38	35	32	5,97
Staying power in pull up (s)													
	26	0	0	10	17	2	7	15	7	5	25	10,36	8,84
Upswing													
	1	0	0	0	0	0	0	0	1	1	1		
Boys	1	2	3	4	5	6	7					$\bar{x}$	s
Sit-up per 1 min.													
	32	51	51	23	43	32	41					39	9,72
Staing power in pull up (s)													
	11	31	25	0	13	0	12					13,14	10,76
Upswing													
	0	1	1	0	1	0	0						

We compared the results achieved in the test of sit-up per 1 minute to the NCYFS I-II standards (Neuman, 2003). Weak performance for 13 year old girls is 25 percentiles and 27

cycles, average performance is 50 percentiles and 33 cycles, above-average performance is 75 percentiles and 40 cycles, and excellent performance is 90 percentiles and 46 cycles. Weak performance for 13 year old boys is 25 percentiles and 32 cycles, average performance 50 percentiles and 40 cycles, above-average performance 75 percentiles and 46 cycles, excellent performance 90 percentiles a 52 cycles. When comparing the performances achieved by the girls and boys to the above stated standards, we can see that their performance oscillates at the upper level of weak performances. Girls who had performed at least 30 cycles and boys who had performed 43 cycles of sit-ups performed the upswing. The level of strength of lumbar, hip, thigh and abdominal muscles of girls dropped while that of boys rose slightly up.

We compared the values achieved in the test of staying power in pull-up to Neuman (2003) standards again. 13 year old girls who had stayed in the prescribed position 5,8 seconds achieved below-average performance, 7,7-13,4 seconds equalled to average performance and 17,9 seconds and more to above-average performance. In the group of boys, below-average performance was achieved by pupils staying 12,8 seconds, average performance at staying 15,8-22,8 seconds and above-average performance at staying 27 and more seconds.

Both girls and boys, as compared to the standards described, oscillated at the level of below-average performance. The girls had enough with staying at least 5 seconds in pull-up to perform the upswing, while boys needed 13 seconds. The value of level of static strength of arms dropped slightly in girls, while they rose twice in boys.

12 girls and 13 boys of third year of grammar school participated in the tests.

Chart 3 Third year grammar school /girls - boys

Girls	1	2	3	4	5	6	7	8	9	10	11	12		$\bar{x}$	s
Sit-up per 1 min.															
	40	30	41	31	22	28	35	30	30	35	25	25		31	5,61
Staying power in pull up (s)															
	8	6	12	5	9	0	4	3	0	7	10	6		5,83	3,56
Upswing															
	1	1	1	1	0	0	0	0	0	0	0	0			
Boys	1	2	3	4	5	6	7	8	9	10	11	12	13	$\bar{x}$	s
Sit-up per 1 min.															
	31	36	53	35	40	46	42	31	39	50	38	40	45	41,23	12,4
Staying power in pull up (s)															
	11	38	16	12	16	21	29	3	7	29	15	24	38	19,92	9,72
Upswing															
	0	1	1	0	1	1	1	0	0	1	0	1	1		

For the test of sit-up per 1 minute we performed comparison to the NCYFS I-II standards (Neuman, 2003). They state weak performance for 14 year old girls as 25 percentiles at 29 cycles, average performance as 50 percentiles at 35 cycles, above-average performance as 75 percentiles at 41 cycles and excellent performance as 90 percentiles at 47 cycles. Weak performance for 14 year old boys is 25 percentiles and 35 cycles, average performance 50 percentiles and 41 cycles, above-average performance 75 percentiles and 47 cycles, excellent performance 90 percentiles a 52 cycles. We can evaluate the girls' performance in the tests as weak to average and the boys' performance as average. The girls who had performed 30 and more repeating cycles performed the upswing as well. Boys needed at least 36 cycles to perform the upswing. The values achieved in the test of girls are lower than in the second year while the ones of boys rise up..

Test of staying power in pull-up (Neuman, 2003). 14 year old girls who had stayed in the prescribed position 4,0 seconds achieved below-average performance, 6,4-10,9 seconds equalled to average performance and 15,3 seconds and more to above-average performance. In the group of boys, below-average performance was achieved by pupils staying 13 s, average performance at staying 18-26 s and above-average performance at staying 32,5 s.

Girls, as compared to the standards described, oscillated under the level of average performance, while boys were at the level of average performance. The girls had enough with staying 5 seconds in pull-up to perform the upswing, while boys needed 16 seconds. Girls achieve almost twice as low values as in the second year in this test, while the boys' values rise up.

12 girls and 14 boys participated in the tests in the fourth year of grammar school.

Chart 4 Fourth year of grammar school/girls – boys

Girls	1	2	3	4	5	6	7	8	9	10	11	12	13	14	$\bar{x}$	s
Sit-up per 1 min.																
	41	27	48	34	41	49	27	37	29	24	42	58	31	38	37,57	9,40
Staying power in pull up (s)																
	18	8	51	22	0	5	0	16	0	0	3	12	9	17	11,5	13,16
Upswing																
	1	1	1	1	0	0	0	1	0	0	0	1	1	1		
Boys	1	2	3	4	5	6	7	8	9	10	11	12			$\bar{x}$	s
Sit-up per 1 min.																
	29	37	53	37	37	40	41	39	41	34	53	43			40,33	6,66
Staying power in pull up (s)																
	0	37	39	33	55	30	30	30	30	33	19	58			32,83	14,38
Upswing																
	0	1	1	1	1	1	1	1	1	0	1	1				

The values for 15 year old girls in the test of sit-ups per 1 minute according to the Unifit test (Neuman 2003) are as follows - below-average performance under 31 cycles, average performance 32-41 cycles and above-average performance 42 and more cycles, and for boys – below-average performance under 38 cycles, average performance 39-47 cycles and above-average performance 48 and more cycles. According to NCYFS I-II, weak performance for 15 year old girls equals to 30 cycles, average performance to 35 cycles, above-average performance to 40 cycles and excellent performance to 45 cycles. Weak performance for 15 year old boys equals to 36 cycles, average performance to 42 cycles, above-average performance to 48 cycles and excellent performance to 53 repeating cycles.

Both girls and boys of the fourth year, as compared to both tests, achieved average performance; the girls' values had risen as compared to the third year. The rising trend of boys continued. Girls who had performed at least 27 cycles and boys who had performed 37 cycles of sit-ups performed the upswing.

We compared the values of the test of staying power in pull-up (Neuman, 2003) to the performance achieved. The standards for fifteen year old girls state: staying power of 3,5 seconds – below-average performance; 6-10,1 seconds – average performance and 13,3 seconds and more – above-average performance. For boys: they achieved below-average performance at staying 13,0 seconds, average performance at staying 23-31 seconds and above-average performance at staying 37,5 and more seconds.

Both girls and boys, as compared to the standards described, oscillated above the upper level of average performance. The girls had enough with staying at least 8 seconds in pull-up to

perform the upswing, while boys needed 30 seconds. The average value of staying power of girls and boys had risen almost twice as compared to the performance in the third year.

When comparing the total results achieved by girls, we can state that the performance in the first test of sit-up per 1 minute was dropping from the first to the third year and rose in the fourth year. In the test of staying power in pull-up the performance was dropping from the first to the third year and rose in the fourth year.

In boys, the performance in the test of sit-ups was rising from the first to the third year and dropped in the fourth year. The performance in the test of staying power in pull-up was rising from the first to the fourth year.

To perform the gymnastic exercise form of upswing, the girls needed at least 35, 30, 30 and 27 repetitions of sit-ups and at least 4, 5, 5 and 8 seconds of staying in pull-up in the respective years of grammar school.

The boys needed at least 39, 43, 36 and 37 repetitions of sit-ups and at least 8, 13, 16 and 30 seconds of staying in pull-up to perform the upswing in the respective years of grammar school.

The results show that to perform the upswing, girls need to perform at least 30 and boys 48 repetitions of sit-ups per 1 minute. The results in the test of staying power in pull up are different; they are often substituted by take-off of the lower extremities.

Conclusion

The results show that the dependence of the monitored strength abilities of selected muscle groups on the execution of the exercise form exists. Also motivation to performance plays a certain role that can distort the results of the measurement. Nevertheless, we can state that the condition for performance of the upswing is the static staying power of upper extremities and the shoulder girdle and that the dynamic strength of lumbar, hip, thigh and abdominal muscles is often substituted by take-off.

It can be stated in conclusion that the strength abilities of pupils must be constantly developed so that they are able to perform new exercise forms, thus meeting the requirements imposed on them by the curricula of school physical education.

Literature

[1] ARKAEV, L.J., SUCHILIN, N.G,: Kak gativiť chempionov. Moskva: *Fizkuľtura i sport*, 2004.

[2] MĚKOTA, K. , BLAHUŠ, P.: *Motorické testy v tělesné výchově*. 1. vyd. Praha: SPN. 1983.

[3] NEUMAN, J. :*Cvičení a testy obratnosti, vytrvalosti a síly*. 1. vyd. Praha: Portál, 2003. 160 s. ISBN 80-7178-730-2.

[4] OTTO, P., SVATOŇ, V. a kol.*: Didaktika gymnastika ve školní tělesné výchově*. Univerzita Karlova v Praze: SPN, 1983.

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SLEDOVÁNÍ ZÁVISLOSTI VELIKOSTI SVALOVÉ SÍLY NA PROVEDENÍ GYMNASTICKÉHO CVIČEBNÍHO TVARU VE ŠKOLNÍ TĚLESNÉ VÝCHOVĚ

Studie se zabývá gymnastikou ve školní tělesné výchově. Pro správné provedení cvičebních tvarů je důležité, aby žáci byli, dostatečně fyzicky vybaveni. Hlavním cílem práce bylo sledování závislosti velikosti svalové síly (v tomto případě indikátorů silových schopností) na provedení cvičebního tvaru-výmyku. Testování se zúčastnili žáci osmiletého libereckého gymnázia. Jednalo se o studii, pro kterou byly vybrány dva motorické testy. Z výsledků vyplývá, že existuje závislost silových schopností na provedení cvičebního tvaru. Podmiňující pro provedení výmyku jsou silové schopnosti paží a pletence ramenního a síla bederních, kyčelních, stehenních a břišních svalů, bývá ve většině případů nahrazena odrazem.

DIE ABHÄNGIGKEIT DER GRÖSSE DER MUSKELSTÄRKE AUF DIE AUSFÜHRUNG DER GYMNASTIKTURNFIGUR IM SCHULISCHEN SPORTUNTERRICHT

Die Studie befasst sich mit der Gymnastik im schulischen Sportunterricht. Für die richtige Ausführung der Turnfiguren ist es wichtig, dass die Schüler physisch ausreichend ausgestattet sind. Hauptziel der Arbeit war es, die Abhängigkeit der Größe der Muskelstärke (in diesem Fall der Indikatoren der Kraftfähigkeit) auf die Ausführung der Turnfigur – Aufschwung zu verfolgen. Am Testen nahmen die Schüler des achtjährigen Gymnasiums in Liberec teil. Es handelte sich um eine Studie, für die zwei motorische Tests ausgesucht wurden. Aus den Ergebnissen geht hervor, dass die Durchführung der Turnfigur von Kraftfähigkeiten abhängig ist. Eine Bedingung für die Durchführung des Aufschwungs ist die Kräftefähigkeit der Arme und des Schultergürtels und die Stärke der Lenden-, Darmbein-, Schenkel- und Bauchmuskeln, die in den meisten Fällen durch ein Abstoßen ersetzt wird.

OBSERWACJA WPŁYWU WIELKOŚCI SIŁY MIĘŚNI NA WYKONANIE TRENINGOWEJ FIGURY GIMNASTYCZNEJ NA SZKOLNYCH LEKCJACH WYCHOWANIA FIZYCZNEGO

Opracowanie dotyczy gimnastyki podczas szkolnych zajęć wychowania fizycznego. W celu prawidłowego wykonania figur gimnastycznych ważne jest, aby uczniowie mieli odpowiednie predyspozycje fizyczne. Badania miały na celu obserwację wpływu siły mięśni (w tym przypadku wskaźników zdolności siłowych) na wykonanie figury gimnastycznej – wymyku. Badaniami objęto uczniów ośmioletniego libereckiego liceum ogólnokształcącego. Do przeprowadzenia badań wybrano dwa testy motoryczne. Wyniki wskazują, że istnieje zależność zdolności siłowych i wykonania figury gimnastycznej. Do wykonania wymyku ważne są zdolności siłowe ramion i splotu ramiennego, a siła mięśni biodrowych, lędźwiowych, udowych i brzusznych bywa w większości przypadków zastąpiona odbiciem.