

## MOVEMENT COORDINATION: PECULIARITIES OF STRENGTH EFFORT ASSESSMENT IN GIRLS AGED 11-13

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### Abstract

**The purpose of the study** is to determine the peculiarities of strength effort assessment in girls aged 11-13.

**Materials and methods.** The study participants were girls aged 11 (n=25), 12 (n=27), 13 (n=18). The children and their parents were fully informed about all the features of the study and agreed to participate in the experiment. The paper used methods of scientific literature analysis, testing, methods of mathematical statistics. To determine the peculiarities of strength effort assessment, the study used a t-test for paired observations and a t-test for independent samples.

**Results.** The girls aged 11-13 demonstrate the best assessment of effort reproduction at 2/3 of maximum strength. There is no statistically significant age-related dynamics in strength effort assessment in girls aged 11-13. The correlation between the effort reproductions at 1/3, 1/2 and 2/3 of maximum strength is not statistically significant.

**Conclusions.** In the process of physical education of girls aged 11-13, special attention should be paid to the development of motor control ability as the component of coordination training of schoolchildren.

**Keywords:** movement coordination, strength effort, motor control, girls aged 11-13.

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### Introduction

The research papers by Khudolii and Marchenko (2007), Ivashchenko (2016) focused on the development of motor abilities in schoolchildren. The regularities of coordination abilities development were described in the papers by Farfel (2011), Ilin (2003), Liakh (2000). Movement coordination is one of the basic abilities that can be developed in school age (Balsevich, 2000; Serhiienko, Chekmarova & Khadzhynov, 2012; Ivashchenko, 2016).

Researchers found that the level of coordination abilities development influences the effectiveness of teaching motor actions (Khudolii, 2008; Ivashchenko, Khudolii, Iermakov, Lochbaum, Cieślícka, Zukow, Nosko & Yermakova, 2017).

The research findings obtained by Lopatiev, Ivashchenko, Khudolii, Pjanylo, Chernenko and Yermakova (2017), Ivashchenko, Khudolii, Iermakov and Prykhodko (2018) reveal the multifactorial structure of motor

abilities development in schoolchildren. In the structure of movement coordination, motor control ability plays a key role (Ilin, 2003; Khudolii & Ivashchenko, 2014; Ivashchenko, 2016). Muscular strength is the basis for demonstrating schoolchildren's motor abilities, and the ability to assess muscular effort is key to evaluating the spatial and temporal characteristics of movement (Serhiienko, Chekmarova & Khadzhynov, 2012; Ivashchenko, 2016). Farfel (2011) paid particular attention to the peculiarities of evaluating the spatial, temporal and strength characteristics of movement.

The planning of coordination abilities development requires the availability of informative pedagogic control indicators (Krutsevych, Vorobiov & Bezverkhnia, 2011; Bodnar & Andres, 2016; Ivashchenko & Kapkan, 2016) and knowledge of their development peculiarities (Liakh, 2000; Khudolii, 2008; Ivashchenko, 2016).

The analysis of scientific literature suggests the need for further research on the peculiarities of strength effort assessment.

The purpose of the study is to determine the peculiarities of strength effort assessment in girls aged 11-13.

## Materials and methods

*Study participants.* The study participants were girls aged 11 (n=25), 12 (n=27), 13 (n=18). The children and their parents were fully informed about all the features of the study and agreed to participate in the experiment.

*Study organization.* The paper used methods of scientific literature analysis, testing, methods of mathematical statistics.

*Testing procedure.* Strength effort assessment. Equipment: dynamometer, calculator. Testing: the right hand maximum strength was measured for each participant. After that, they were asked to perform the following effort that equals to:

1/3 of maximum strength;

1/2 of maximum strength;

2/3 of maximum strength.

The result in kg was recorded in the protocol. The error of the produced effort was calculated in percentage. To determine the maximum effort, the testees made two attempts. The best result was recorded. The dosed effort was performed once.

*Statistical analysis.* To determine the peculiarities of strength effort assessment, the study used a t-test

for paired observations and a t-test for independent samples.

## Results

Table 1 shows the results of the analysis of age-related dynamics of strength effort assessment in the girls aged 11-13. There is no statistically significant dynamics in strength effort assessment in the girls aged 11-13.

Tables 2-4 show the results of the comparison of error when assessing different efforts. The girls aged 11 demonstrate the best assessment of effort at 2/3 of maximum strength. The worst one – the effort at 1/3 of maximum strength ( $p=0.001$ ). There is a statistically significant correlation between the assessments of efforts at 1/3 and 2/3 of maximum strength ( $p=0.035$ ).

The girls aged 12 demonstrate the best assessment of effort at 2/3 of maximum strength, the worst one – the effort at 1/3 of maximum strength ( $p=0.001$ ). There is no statistically significant correlation between the assessments of different efforts ( $p>0.05$ ).

The girls aged 13 demonstrate the best assessment of effort at 2/3 of maximum strength, the worst one – the effort at 1/3 of maximum strength ( $p=0.001$ ). There

**Table 1.** Results of the analysis of age-related dynamics of strength effort assessment in the girls aged 11-13.

Test	Age	N	Mean	Std. Deviation	T	p
Hand maximum strength	11	25	29.48	8.28	.638	.526
	12	27	28.07	7.60	.571**	.571
	13	18	28.00	8.53	.031***	.976
Effort at 1/3 of hand maximum strength, %	11	25	34.63	16.07	.272	.787
	12	27	33.61	10.70	.887**	.380
	13	18	30.44	14.12	.856***	.397
Effort at 1/2 of hand maximum strength, %	11	25	21.19	8.39	-.165	.869
	12	27	21.62	10.30	-.721**	.475
	13	18	23.44	12.06	-.540***	.592
Effort at 2/3 of hand maximum strength, %	11	25	15.55	8.15	.106	.916
	12	27	15.32	7.44	-.227**	.821
	13	18	16.19	10.49	-.328***	.745

\*11-12 years; \*\*11-13 years; \*\*\*12-13 years

**Table 2.** Results of the analysis of peculiarities of strength effort assessment in the girls aged 11 (n=25)

Test	Mean	Std. Error Mean	Difference	T	p	
Pair 1	Effort at 1/3 of hand maximum strength, %	34.63	3.21	13.44	3.346	.003
	Effort at 1/2 of hand maximum strength, %	21.18	1.68			
Pair 2	Effort at 1/3 of hand maximum strength, %	34.63	3.21	19.08	6.524	.000
	Effort at 2/3 of hand maximum strength, %	15.55	1.63			
Pair 3	Effort at 1/2 of hand maximum strength, %	21.19	1.68	5.64	2.199	.038
	Effort at 2/3 of hand maximum strength, %	15.55	1.63			

**Table 3.** Results of the analysis of peculiarities of strength effort assessment in the girls aged 12 (n=27)

	Test	Mean	Std. Error Mean	Difference	T	P
Pair 1	Effort at 1/3 of hand maximum strength, %	33.61	2.06	11.98	4.088	.000
	Effort at 1/2 of hand maximum strength, %	21.62	1.98			
Pair 2	Effort at 1/3 of hand maximum strength, %	33.61	2.06	18.28	6.738	.000
	Effort at 2/3 of hand maximum strength, %	15.32	1.43			
Pair 3	Effort at 1/2 of hand maximum strength, %	21.62	1.98	6.30	2.812	.009
	Effort at 2/3 of hand maximum strength, %	15.32	1.43			

**Table 4.** Results of the analysis of peculiarities of strength effort assessment in the girls aged 13 (n=18)

	Test	Mean	Std. Error Mean	Difference	T	P
Pair 1	Effort at 1/3 of hand maximum strength, %	30.44	3.33	7.00	1.738	.1
	Effort at 1/2 of hand maximum strength, %	23.44	2.84			
Pair 2	Effort at 1/3 of hand maximum strength, %	30.44	3.33	14.24	4.087	.001
	Effort at 2/3 of hand maximum strength, %	16.19	2.47			
Pair 3	Effort at 1/2 of hand maximum strength, %	23.44	2.84	7.24	2.100	.051
	Effort at 2/3 of hand maximum strength, %	16.19	2.47			

is no statistically significant correlation between the assessments of different efforts ( $p > 0.05$ ).

## Discussion

The study assumed that schoolchildren had peculiarities in assessing efforts at 1/3, 1/2 and 2/3 of maximum strength. The study has found that there are no age-related changes in muscular effort assessment in the girls aged 11-13. This indicates that this age period is not sensitive to the development of the ability to assess strength effort. These results supplement the data of Balsevich (2000), Ilin (2003), Liakh (2000) on the sensitive periods of movement coordination development in children and adolescents, and the data of Nosko (2002), Nosko and Arkhypov (2014), Khudolii and Ivashchenko (2014) on motor function development in children and adolescents.

The girls aged 11-13 demonstrate the best assessment of effort at 2/3 of maximum strength. These results confirm the data obtained by Ivashchenko (2016), Liakh (2000) showing that children and adolescents best assess efforts at 2/3 of maximum strength.

These findings confirm the conclusion made by Farfel (2011) that the errors in the assessment of different modalities in motor control do not correlate with one another and require a special training for ages 11-13. The importance and practical significance of the results of research on kinesthetic sensitivity are highlighted in the papers by Li, Su, Fu and Pickett (2015), Brink and Jacobs (2011), Morash, Pensky, Alfaro, and McKerracher (2012).

## Conclusions

Girls aged 11-13 demonstrate the best assessment of effort at 2/3 of maximum strength. There is no statistically significant age-related dynamics in strength effort assessment in girls aged 11-13.

In the process of physical education of girls aged 11-13, special attention should be paid to the development of motor control ability, the correlation between the effort reproductions at 1/3, 1/2 and 2/3 of maximum strength is not statistically significant.

## Conflict of interest

The author declares no conflict of interests.

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## КООРДИНАЦІЯ РУХІВ: ОСОБЛИВОСТІ ОЦІНКИ СИЛОВИХ ЗУСИЛЬ У ДІВЧАТ 11-13 РОКІВ

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Реферат. Стаття: 5 с., 4 табл., 20 джерел.

**Мета дослідження** – визначити особливості оцінки силових зусиль у дівчат 11-13 років.

**Матеріал і методи.** У дослідженні прийняли участь дівчата 11 років (n=25), 12 років (n=27), 13 років (n=18). Діти та їхні батьки були інформовані про всі особливості дослідження і дали згоду на участь в експерименті. У роботі використані методи аналізу наукової літератури, тестування, методи

математичної статистики. Для визначення особливостей оцінки силових зусиль був використаний t-тест для парних спостережень і t-тест для незалежних виборок.

**Результати дослідження.** Дівчата 11-13 років найкраще оцінюють відтворення зусилля 2/3 від максимального. Статистично достовірної вікової динаміки в оцінці силових зусиль у дівчат 11-13

років не спостерігається. Взаємозв'язок між відтворенням зусилля 1/3, 1/2 та 2/3 від максимального статистично не достовірний.

**Висновки.** У процесі фізичного виховання дівчат 11–13 років необхідно акцентувати увагу на

формування здібності до управління рухами як компоненти координаційної підготовки школярів.

**Ключові слова:** координація рухів, силові зусилля, управління рухами, дівчата 11–13 років.

## КООРДИНАЦІЯ ДВИЖЕНІЙ: ОСОБЕННОСТИ ОЦЕНКИ СИЛОВЫХ УСИЛИЙ У ДЕВОЧЕК 11–13 ЛЕТ

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Реферат. Статья: 5 с., 4 табл., 20 источников.

**Цель исследования** – определить особенности оценки силовых усилий у девочек 11–13 лет.

**Материал и методы.** В исследовании приняли участие девочки 11 лет (n=25), 12 лет (n=27), 13 лет (n=18). Дети и их родители были осведомлены обо всех особенностях исследования и дали согласие на участие в эксперименте. В работе использованы методы анализа научной литературы, тестирование, методы математической статистики. Для определения особенностей оценки силовых усилий был использован t-тест для парных наблюдений и t-тест для независимых выборок.

**Результаты исследования.** Девочки 11–13 лет лучше оценивают воспроизведение усилия 2/3 от

максимального. Статистически достоверной возрастной динамики в оценке силовых усилий у девочек 11–13 лет не наблюдается. Взаимосвязь между воспроизведением усилия 1/3, 1/2 и 2/3 от максимального статистически не достоверна.

**Выводы.** В процессе физического воспитания девочек 11–13 лет необходимо акцентировать внимание на формирование способности к управлению движениями как компоненты координационной подготовки школьников.

**Ключевые слова:** координация движений, силовые усилия, управление движениями, девочки 11–13 лет.

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