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HURDLE RACE IN EARLY EDUCATION – 10 WEEKS OF ARTS AND PHYSICAL ACTIVITIES

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Abstract

Research objectives. Hurdling (in sport = hurdle run, in schools = run through obstacles) is an interesting and really natural activity. Hurdle run is a test of speed (hurdle run is a sprint run), strength (hurdle clearance = hurdle "jumps"), coordination (rhythm, balance), flexibility and a lot of mental (courage). Methodology. In this experiment participated 33 girls from Polish primary school aged 12 years. In order to choose the adequate equipment for teaching hurdle run we settled on banana cardboard boxes (50x40x24cm). Within the period of 10 weeks we organized physical education lessons (2 times a week, 25 minutes were devoted to "hurdle lesson"). Before and after the 10 weeks hurdle preparation period we assessed: motor preparation (acceleration/30 m run, speed/60 m run, speed endurance/180 m run, explosive strength (standing triple jump an medicine ball throw) and special-hurdle

abilities (time of 60 m hurdle run, number of steps between hurdles and "technique indicator"). Findings and research outcomes. Ten weeks of "hurdle training" increase time of speed run (60 m - p≤ 0, 01) and hurdle run (p≤0, 05). There were statistical significant differences between the number of stride "pattern" (p≤0, 01), too. Ten weeks of hurdle "training" didn't change the level of rest of general and special tests. The analysis of correlation shows that hurdle race is a speed and strength athletic event. Practical application. Hurdle race (on initiation/school level) could be an interesting and creative form of physical education. The obstacle sprint run could be a reliable test of physical abilities.

Keywords

Hurdle Run, Athletics, Arts, Physical Education, Children

1. Introduction - Literature Review

Hurdling (= run through obstacles) is a wonderful and really natural activity both in sport and physical education. Sprint hurdle run is an interesting school physical activity, combining speed, courage and grace (Iskra et al., 2008). Hurdle runs are a specific motor (speed + strength + special endurance) and coordinative (technique) track and field event. Hurdling can also be the first stage of preparations for the new, more extreme sports, such as parkour or steeplechase (Schlachter, 2014). Hurdling is arguably the most technically difficult and demanding of all track & field events for young athletes. The hurdles must be cleared by sprint running over them and not jumping (Boxhall, 2004). Teaching hurdle runs in a group of young children we used various kind of methods (Deister & Müller, 2013).

Hurdling is also a complex track and field event. The final result in sprint hurdle races (50-110 m) is determined by (among others) body build, motor preparation and the hurdle clearance technique (Cowburn, 2006; Iskra, 2007; McFarlane, 2000; Thompson, 1991).

Studies on the effects of various parameters (anthropometric, motor, technical) on hurdle performance constitute a major part of the literature (Iskra, 2012; Iskra & Mynarski, 2000). The research conducted in groups of the best hurdlers (including the Polish ones), demonstrated that the results in the typical for hurdlers running tests and laboratory tests, adapted to the specific nature of the effort are of essential importance (Iskra, Gasilewski, Hyjek & Walaszczyk, 2013; Iskra, Zając & Waśkiewicz, 2006). The research carried out among untrained young people shows that running through low obstacles can be an excellent form of motor skills (speed, dynamic strength of lower limbs/jumping abilities), motor

coordination (rhythm, response time, space orientation) and psychical traits (courage, determination) development (Iskra et al., 2008).

And finally - hurdle run could be a test of speed (hurdle run is a sprint run), strength (hurdle clearance = hurdle "jumps"), coordination (rhythm, balance), flexibility and a lot of mental traits (Iskra & Mynarski, 2000). In last Otsuka's studies ,,hurdle running requires coordinating multiple sprint running and jumping movements" (Otsuka et. al., 2015).

1.1 Art, Knowledge and Hurdle Race

Hurdling (under school conditions – races over low obstacles) is a comprehensive condition and coordination athletic event.

In kindergarten and school physical education (even children from 3 years of age on) racing over low obstacles is an excellent form of motor activity. Using the integrated teaching, different goals can be carried out and combined (Iskra, 2007).

In hurdle race teaching, the children can paint these clubs or tape them over in the patterns of their own choice: cardboard sheets with distinctive drawings (e.g. featuring animals, flowers, cartoon characters, athletes, etc.). They can also contain information from a specific field of knowledge (e.g. concerning geography or history of Mauritius / Poland, sports results, etc.). The runners who were defeated in the race may learn some new and interesting things.

Each of the obstacles can have an individual character - the subject of such a ,,hurdle work of art" and the technique of its preparation depends both on teachers and pupils. Here are a few examples: technology - drawing with crayons, subject - ,,Your country"; technique - painting, subjects - ,,you and your family"; technique - gluing over, subject - ,,National flag"; technique - gluing over with newspapers, subject - ,,Weird news"; technique - gluing over with colorful magazines; subject - ,,Your world of sport", ,,Your world of fashion", ,,Your world of film" (Iskra, 2010).

An obstacle of individual character has a different dimension - it links physical effort with creative act. The use of vertical and horizontal barriers is associated with the opportunity to create spatial objects, using boxes of different sizes (from matchboxes to TV-sets cardboard boxes). Apart from earlier comments on the techniques and themes of , individualization of cardboard boxes", one should add at this stage an opportunity to create a set of blocks (cardboard boxes) in the space used for hurdle races. The layout of boxes can vary, depending on the degree of sportsmanship of children and teenagers, the aims of training sessions and the number of cardboard boxes (Iskra, 2007, 2010; Wensor, 2011).

1.2 Aim

The aim of the study was to analyze the changes in results of sprint races through obstacles (cardboard boxes) and selected motor tests after a 10-week, hurdling classes/lessons". Additionally, it was examined whether there is a relationship between the results of runs through low obstacles and other physical fitness tests.

2. Methodology

2.1 Material

In the research participated girls from Polish Primary School aged 12 years – Polish 6th grade (n=33, body height: 155.9±6.37cm, body weight: 47.0±6.74kg).

2.2 Methods

For 10 weeks (2x 20 min, during physical education classes), the girls executed the exercise program focused on the "hurdle" race.

The "hurdles" were made in the of art education classes, using standard banana cardboard boxes with dimensions of 50/40/24cm. Each of the girls made her own ,,hurdle", decorating it in any way (drawing, painting, wrapping, etc.)

The curriculum was developed based on earlier publications and adapted to the level of exercising persons (see Protocol).

Before and after the series of special (hurdles) activities, the following tests were carried out:

- Hurdle race over the distance of 60m, including timing (running time) and spatial (number of steps between the hurdles) parameters. The distance between the hurdles was 6.20 m (4x body height), the number of hurdles – 5, approach/distance between the starting line and the first hurdle – 12m, distance between the last hurdle and the finish line – 17m. Detailed rules were presented in the study by Iskra (2001).
- Motor skills tests: 30m run (acceleration), 60m run (speed), 180m run (speed endurance), standing triple jump and vertical jump (explosive strength) and ,,sit and reach test" (flexibility).

Additionally, we assess special indicators of hurdle technique - number of strides between hurdles (so-called "stride pattern" or "stride rhythm") and "technique indicator - TI (= time of 60m hurdle run – time of 60m sprint run). In details - see Iskra et al., 2013.

In the assessment of differences before and after the training, an ANOVA analysis was used. In search for the relationship between the time and "rhythm" of the hurdle run, body build and fitness level, the Pearson correlation analysis was used.

2.3 Protocol

The hurdle run teaching process included 10 weeks of physical education lessons based on the principles of "athletic training" of children and youth. We used our own proposals for activities (Iskra, 2007, 2010; Iskra et al., 2008) and patterns taken from the literature (Cowburn, 2006; Schlacher, 2014; Thompson, 1991).

Ten weeks of exercises in the field of hurdle sprint race is a sufficient period to evaluate the ,,post-training" effects (Amara et al., 2015).

The exemplary classes consisted of four parts: warm-up with hurdles, walking over hurdles, running over hurdles (regular spaces between the obstacles) and running over cardboard boxes (irregular spaces).

The detailed scheme of exercises was described in Table 1.

Table 1: *Hurdle Teaching Protocol*

Weeks	Stage of teaching	Exercises
1	Test (1)	Run over 40 m with 5 hurdles
2-3	Stage1. General motor preparation	Sprint runs Horizontal jumps
3-9	Stage 2. Stretching	Static and dynamic flexibility ,,Hurdle" sitting Marches through obstacles
3-6	Stage 3. Runs over points and lines ,,obstacles"	Runs over ,,points" (sand bags), ,,lines" (gymnastic sticks) and zone (bike tires) obstacles (more see in text)
5-7	Stage 4. Runs over areas (zones) obstacles	Runs over mattress and between lines
6-10	Stages 5. Runs over ,,imitation" of hurdles	Runs over cardboard (cartoon) boxes lying in various position (horizontal or vertical)
9-10	Stages 6. Runs over various types of professional hurdles	Only trial (children's hurdles)
10	Test (2)	See point 1.

The individual stages include specific exercise groups. For example, stage 3 is shown below:

Stage 3 - runs over point's and line's „obstacles"

The type of obstacles in hurdling teaching:

- Point - ,,ringo" rings, sand bags, rolled sashes
- Line - boards, sashes, gymnastic sticks, sticks
- Zone - mattresses, ,,hula hoop" rings, bike tires, drown zones
- Vertical - cones, tires, cardboard boxes
- Vertical- zone various layout of cardboard boxes
- Hurdles - sponges, foamed polystyrene, mattress, specially constructed hurdles, standard hurdles (Iskra, 2010).

Remarks:

- „hurdles" for preschool and first grade school children – points and lines,
- distance between „flat" hurdles – 3-4 m in preschools, 4-6 m in schools and 6-8 m in physical education high schools.

For the test execution, banana cardboard boxes were used (Madler & Katzenbogner, 1990; Pliva, 1995). The cardboard boxes met all the criteria of athletic equipment used in school: safety, availability, possibility of using (light-weight, not making noise, not devastating walls), realization of motor requirements of this event (hurdle race is a sprint race) and realization of technical requirements of the event (the movement of trail and lead legs) (Iskra & Walaszczyk, 2011).

3. Results

Within the hurdle run parameters, there were changes in the running time (9.76±1.49 v 9.24±1.03 s) and the number of steps between hurdles (15.52±3.11 14.40±2.06 v steps). The statistical analysis did not show any before- and post-training differences concerning the first parameter ($p \geq 0.05$), but significant differences occurred in the "rhythm" of steps ($p \leq 0.05$).

The changes in results in some selected fitness tests after the 10-week hurdling classes (cardboard boxes) concerned mainly the sprint race over the distance of 60 m (9.76 ± 0.94 v 9.24 ± 0.67 s; $p \leq 0.01$) - Table 2.

Table 2: *The details of sprint-hurdle race (n=33)*

Parameter	Teaching	$\bar{x}$	SD	min-max	ANOVA
1. 60 m hurdle run (s)	Before	12,87	1,49	9,35-15,59	N.S.
	After	12,36	1,04	9,61-14.99	
2. Number of hurdle steps (no.)	Before	15,52	3,11	12-20	0,05
	After	14,20	2,06	12-20	
3. Technical indicator/TI (s)	Before	3,11	1,30	1,47-5,47	N.S.
	After	3,12	0,94	1,24-4,45	

TI = time of 60 m H run – time of 60 m (flat) run

In view of the progress in results of sprint races (with and without hurdles) no TI changes that would give the evidence of significant changes in the run technique were observed.

After 10 weeks of classes with the use of hurdles, there were no changes in speed and running endurance (30/60/180 m run), strength of the lower limbs (triple and vertical jump), and in mobility of joints („sit and reach"). Significant differences concerned the results of 60 m run - the traditional running distance in Polish schools (9.76 v. 9.24 s; $p \leq 0.01$) - Table 3.

Table 3: *Results of motor abilities (n=33)*

Test/unit of measure	Teaching	$\bar{x}$	SD	min-max	ANOVA
1. 30 m sprint acceleration (s)	Before	4,86	0,40	4,22-5,66	N.S.
	After	4,81	0,44	4,00-5,58	
2. 60 m sprint run (s)	Before	9,76	0,94	8,37-11,88	0,01
	After	9,24	0,67	7,88-10,49	
3. 180 m endurance/sprint run (s)	Before	32,62	2,53	27,14-37,11	N.S.
	After	32,81	3,05	27,60-39,37	
4. Standing triple jump (m)	Before	5,21	0,56	4,40-7,00	N.S.
	After	5,33	0,73	4,50-7,43	
5. Vertical jump (cm)	Before	33,52	6,90	24-57	N.S.
	After	34,42	6,60	24-51	
6. „Sit and reach" (cm + 20 cm)	Before	29,13	4,69	20-37	N.S.
	After	29,52	5,31	19-42	

In searching for the relationship between the hurdle running time and fitness parameters, running technique and body build, the Pearson correlation analysis was used. The largest correlation concerned the running skills (30-180 m), the rhythm of steps and horizontal jumps ($p \leq 0.01$). Flexibility, vertical jumps, hurdling technique and body height have less impact on the time of hurdle run ($p \leq 0.05$). The body weight in the group of 12-year-old girls does not affect the results in the hurdle sprint race (Table 4).

Table 4: *Correlation between the time of hurdle races and somatic/motor parameters*

Parameter	Ability	Correlation coefficient	P
30 m run	Acceleration	0,83	0,01
60 m run	Speed	0,75	0,01
180 m run	Speed endurance	0,82	0,01
Standing Triple jump	Dynamic strength	-0,63	0,01
Vertical jump	Dynamic strength	-0,37	0,05
„Sit and reach”	Flexibility	-0,35	0,05
Technical indicator	Technique	0,46	0,05
Strides (number)	Hurdler’s rhythm	0,54	0,01
Body height	Body build	-0,31	0,05
Body weight	Body build	-0,02	-

4. Discussion

Hurdle runs are not only an interesting track and field event, but also an excellent way of comprehensive physical activity both in other sports and in physical education at school (Alricsson, Harms-Ringodahl & Werner, 2001; Bortoli, Spagolla & Robazza, 2001). The analysis of hurdle run in groups of untrained youth can also be used for evaluation of motor and coordination skills. (Chanon, 1991).

The pioneer study in the field of hurdle run analysis in untrained children was the publication of Herm & Gerrold (1980), in which a way of clearing the hurdles (left and right lead leg) by 10-year-old students was taken into account. The observations made by physical education teachers and analysis of research results show that running through low obstacles is the appropriate form of physical activity of the youngest (even 3-year-old) children (Bortoli et al. 2001; Ikeda & Aoyagi, 2008; Iskra & Walaszczyk, 2011). The research also proved that

the tests in running through obstacles have a high reliability (Alricsson et al., 2001) and a close connection with the results of other motor and coordination tests (Bortoli et al., 2001).

The basic problem in making use of hurdle runs in fitness evaluation is the selection of the right equipment that meets the criteria of safety and relevancy (Iskra, 2007, Iskra & Walaszczyk, 2011). The use of banana cardboard boxes for learning hurdles by children and young people is the idea of Medler & Katzenbogner (1990); it was subsequently continued by Pliva (1995) and the authors of this study (Iskra et al., 2008).

Physical education lessons, and later on sports training, can be of diverse nature. The experience of the authors (Professor Janusz Iskra has been for 15 years the coach of Polish Athletic Team; best athlete: European champion in 400m hurdles run – Pawel Januszewski) and numerous literature references make it possible to separate the most important groups of exercises.

The nearly 3-month period of hurdling lessons, carried out using the cardboard "hurdles" did not directly affect the running time, but its structure (= the number of steps performed between the hurdles). The so-called "stride rhythm" is one of the most important hurdle run components, especially over distances of 150-400m (Iskra, 2012).

The results of fitness analysis (including speed, endurance, strength and mobility in the joints) in the context of hurdle training were analyzed by many authors (Alricsson et al., 2001; Bujak, Smajlovic, Likic & Omerowic, 2014; Ikeda & Aogagi; 2008; Iskra & Mynarski, 2000; Iskra et al., 2006; Otsuka, Ito M. & Ito A., 2010). The research carried out in the group of Polish girls showed that the "training" using hurdles can be an effective means to improve the running speed. As shown by previous studies (Giroud & Debu, 2004; Iskra & Mynarski, 2000), the hurdle running speed and the sprint running time in groups of untrained children show a high correlation.

After 10 weeks of special training there was an improvement in the 60 m hurdle running time and statistically significant improvement in 60 meters sprint race time ($p \leq 0.05$). This fact shows that the improvement in speed during the hurdle run requires more time compared to the flat run.

As studies of other authors (Bujak et al., 2014; Iskra & Mynarski, 2000) show, the body build is not the most important factor determining the time of hurdle sprint race in groups of untrained youth. Otsuka (2013) claimed that hurdle running record is related to physical characteristics including height and muscle strength. The results of analyzes are

significant in interpreting the results, since at the age of 12 years not physical fitness but body build can determine the test outcome.

Therefore, hurdles can be used as a universal motor skills test.

This is confirmed by correlation analysis of hurdle running time with the results of other tests. The running skills (times of 30-180 m runs), horizontal jumping and the ability to maintain the rhythm of the steps showed a high ($p \leq 0.01$) relationship with time of running through cardboard boxes. The correlation between the hurdling sports level, body build parameters, running technique and flexibility was lower ($p \leq 0.05$).

Accordingly, hurdles can be seen as an attractive form of a comprehensive assessment of physical fitness of untrained girls.

5. Conclusions

- Classes using hurdles can be an excellent way of preparation for sprint racing. For the little ones, the classic hurdles can be replaced with cardboard boxes.
- Changes in hurdle running times require much more time than sprints. This is important in the planning and implementation of training activities.
- Hurdling is a speed and strength event, in which the sprint preparation and horizontal jumping abilities are of crucial importance.
- Body build in groups of untrained girls does not matter in terms of hurdling. Therefore, hurdle run can be an excellent tool to evaluate the fitness, regardless of the rate of maturation of school-age girls.

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