

BRENBAL AS A FREE TIME ACTIVITY SUITABLE FOR AEROBIC FITNESS DEVELOPMENT FOR CHILDREN OF SCHOOL AGE

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Abstract

The main aim is to present the sports game Brenbal as an attractive game suitable for the development of aerobic fitness for children of school age within outdoor activities (PE, courses, residential outdoor schools, etc.). The research part of the project is dealing with the intensity of motion load using the Brenbal game. 76 probands 12-13 years of age have participated in measuring research realised at two elementary schools in Liberec. To implement the project monitors of the heart rate, Polar 800CX were used allowing individual setting up the zones of intensity. Zones 2-4 (60-89% HR_{max}) were tracked dominantly and the number of minutes spent in them. The measured section was a 45-minute teaching unit. During the implementation of the Brenbal game, the file of girls and boys achieved 25 min 36 sec (56% of the time) of 45 min in zones 2-4. During intersexual distribution, the boys file was more active with the time of 25 min 51 s (57.47% of the time) in zones 2-4. The girls file achieved time of 25 min 18 s (56.23% of the time) in zones 2-4. Based on the research, the attractive Brenbal game can be recommended ideally suited for the development of children's aerobic fitness.

Keywords

Brenbal; Load intensity; Teaching unit.

Introduction

Brenbal is a Swedish game (originally "brännball") which has a number of corresponding elements with softball and baseball. Unlike these games, Brenbal is a highly dynamic game and players are not eliminated. This difference is strongly motivational especially for less gifted players [7]. The game can be characterised by simple rules, quick training and as relatively financially undemanding. From the authors' experience, the game is considered to be very popular among all age groups and ideal to be used in a wide variety of outdoor programmes (summer courses, training camps, free-time programmes) but also during the physical education at school.

Results of many researches show that physical activity is not sufficient (so-called hypokinesia) and related to the decrease of aerobic fitness of even school age children [8, 6, 12, 11]. This state is adverse considering the overall functional body condition of children during the period of their growth and development. Dynamic activities of aerobic character with frequent changes of load intensity and game elements appear to be the most suitable type of motion load for children of school age [5] and that is why the sports games can help [7]. Games can contribute to cultivate the so-called healthy oriented fitness thanks to their diversity and attractiveness. From a series of investigation [1, 2], it is clear that if an activity

for children is attractive enough and satisfying, they pursue it regularly. For the above reasons, Brenbal is one of the options to increase the attractiveness of motion programmes.

From the physiological aspect, aerobic fitness is defined as an ability of cardio-vascular, respiratory and muscle system to transport, accept and use oxygen during a motion load [11]. Aerobic fitness is necessary in everyday life and is considered to be the key component of physical fitness and a healthy life style. Heart rate is the only functional characteristics related to the intensity of motion load which is measurable in terrain conditions without the need of expensive devices using only heart rate monitors, so-called sport testers [3, 4, 12].

In 45-minute teaching unit of physical education a clean exercise time lower than 14 minutes is considered to be insufficient. An averagely effective teaching unit is between 14-17 min. Satisfactory numbers are above 17 min and pure exercising time above 22 min is considered to be exceptionally effective [13].

Strong [10] indicates that beneficial healthy advantages can be reached even by cumulation of motion activity during the day. The aim of daily cumulation is minimally 60 min of developmentally appropriate, varied and entertaining activities of medium and higher intensity. The duration of one interval should not outreach 10 min [11].

From above mentioned reasons we consider as currently important to investigate possibilities of using the game Brenbal as an attractive non-traditional game for development of aerobic fitness of children of school age.

1 Aim of Work

The main aim is to present the sports game Brenbal as an attractive activity for the development of aerobic fitness of children of school age via measuring the intensity of motion load.

2 Methods

2.1 Characteristics of the Measured Unit

The research took place in the 7th grades of two elementary schools in Liberec. The investigation took place during teaching units of physical education. At both schools the physical education lessons were divided into groups of girls and boys. The investigation contained 76 girls and boys (34 girls, 42 boys).

2.2 Characteristics of Research Methods

For measuring the intensity of motion load during the realisation of Brenbal, heart rate monitors Polar 800CX were used. Measuring devices allow capturing heart rate beat by beat, recording the process of activity, settings of individual load zones and transfer measured data into a computer to subsequently evaluate them in Polar ProTrainer 5 software.

Individual settings of load zones (values of HR_{rest} and HR_{max} were determined) preceded the monitoring of heart rate during the Brenbal game. HR_{max} was determined using the endurance shuttle run with 20m distance (so-called Leger test with monitoring of heart rate).

Individual load zones (Z) are: Z5 – 90-100% HR_{max} , Z4 – 80-89% HR_{max} , Z3 – 70-79% HR_{max} , Z2 – 60-69% HR_{max} , Z1 – 50-59% HR_{max} , under the zones – 0-49% HR_{max} .

To determine the percentage of the time spent in the aerobic zone, the zone (60-90% HR_{max}) from 2. to 4. zone was established. The value of anaerobic threshold was determined at the borderline of 90% of HR_{max} .

A part of the entry testing was also measuring basic somatic characteristics: body height, body weight and BMI.

2.3 Characteristics of the Teaching Unit

During measuring, the uniform structure of the teaching unit of physical education was kept with the time donation of 45 min. The content was: warming, warm-up, practice, implementation of the actual game and the closing part. A suitable sequence of individual units of physical and psychological load was preserved [13].

- **Introductory part:** muster, salute, content and aim of the lesson (ca. 2 min).
- **Preparation part:** motion activity for warming (ca. 5 min), dynamic warm-up (ca. 6 min).
- **Main part:** practice of game activities of an individual (ca. 5 min), explanation of rules and game principles (ca. 4 min), illustration of a compact game (ca. 3 min), and actual implementation of the game – match (ca. 15 min).
- **Closing part:** stretching and relaxing exercises (ca. 4 min), muster and evaluation (ca. 1 min).

2.4 Characteristics of a Non-traditional Game

The research was oriented towards the Brenbal game. The game was chosen considering the long-term experience of researchers of the project, popularity of the game among students during many implementations, easy practice and the possibility of involving girls and boys together. A big contribution is an easy involvement of physically ungifted children. The chosen non-traditional game does not require any difficult and lengthy preparation neither from the students' side nor the teacher's side. A parameter of selection was also low financial demand (bat, tennis ball, cones).

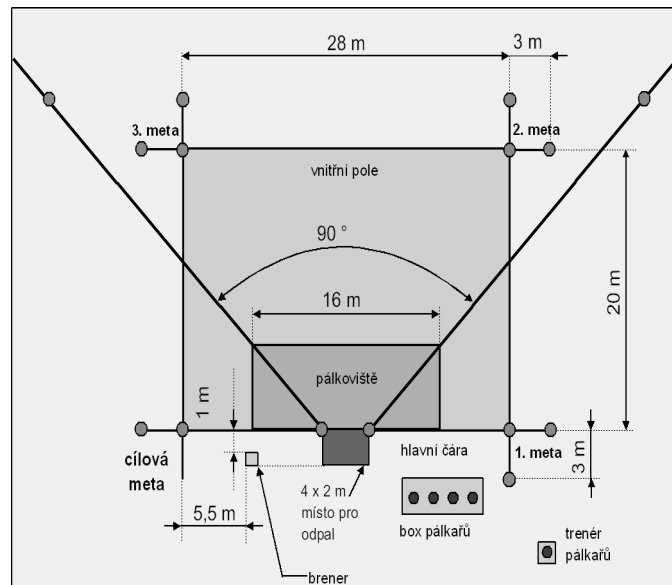
Adjusted rules of the game were expecting the time donation of the teaching unit (45 min). Ca. 15-minutes time space was reserved for the actual game implementation.

2.5 Adjusted Rules of Brenbal

Brenbal is a batting game involving 2 teams of players taking turns at the bat and the pitch. In contrast with softball or baseball, players are not eliminated. Even with the game's dynamics the intensity of motion load can be partly set individually by each individual.

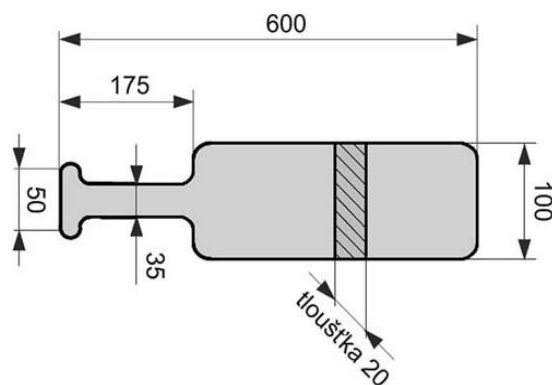
- **Number of players in a team:** standard is 11 players, it is possible to adjust the number of players according to the number of children in the class (6 players minimum).
- **Pitch:** standard is 30 x 50 m. For school children and beginners, it is ideal to adjust the measurements of the pitch (reduce). An indoor variant is possible too, depending on the limitations of the gym.
- **Brener base:** a space 1 x 1 m (for instance it is possible to use a gymnastics hoop) (see picture 1).
- **Space for hit:** at the main line between the “final base” and the base n. 1 (see Fig. 1).
- **Equipment:** tennis ball, brenbal bat (see Fig. 2), cones for marking the pitch.
- **Characteristics of the game:** two teams play (batsmen and pitchmen) with the aim of acquiring more points in total than the opposing team. The role of batsmen and pitchmen changes at halftime. In our research we used 2 x 7 min game time.

- **Batsmen task:** after self-pitch hit the ball aiming it into the sector and run around bases in the outer pitch, stepping on every single base.
- **Pitchmen task:** after the hit seize the ball as soon as possible and pass it to brener (“burner”) to prevent the batsmen from running around bases (“close game”).



Source: [7]

Fig. 1: Diagram of brenbal pitch



Source: [9]

Fig. 2: Measurements of brenbal bat

- **Batsmen:** hit the ball after the main referee instruction (from the box) in predetermined order. A batsman pitches the ball himself/herself and has an unlimited number of tries. After a successful hit, the batsman runs out and tries to step over the main line determining the final base with stepping on bases n. 1, 2 and 3. One or more players can stay on a base and they can outrun (overtake) each other. A batsman has to step on a base before the brener exclaims “Bren!”. Batsmen who are not staying on bases have to get back to the first base. Pitchmen gain points for every returned batsman.

- **Pitchmen:** arbitrarily placed inside inner and outer pitch. Players on the pitch can prevent batsmen from further progress using the only way, so-called “closing the game” (brener exclaims “Bren!” while having at least one leg on the base and the ball in hand).
- **Batsmen points:** after running around all of the three bases and reaching the final base with an interruption of the run at one of the bases due to stopped game batsmen gain 1 point. For running the full round (“homerun”) after a self-pitch without an interruption, batsmen gain 6 points.
- **Pitchmen points:** ball caught directly after a hit with one hand – 2 points. Ball caught directly after a hit with both hands – 1 point. For each player who did not reach a base or run off the base and was not able to return to the base before the exclamation “Bren!” (so-called “closed game”) – 1 point.

The full text of the rules can be found in publications: [9, 7].

3 Results and Discussion

The chapter presents results of somatic characteristics, results of heart rate values from the endurance shuttle run, time expression and percentage of the time spent in zones and final values of heart rate during the implementation of the non-traditional game.

3.1 Results of Somatic Characteristics

Results of somatic characteristics (see Table 1) point out the higher values of boys than girls of every measured parameter (body height, body weight and BMI).

Tab. 1: Basic somatic characteristics

	<i>n</i>	Body height (cm)		Body weight (kg)		BMI	
		\bar{x}	<i>s</i>	\bar{x}	<i>s</i>	\bar{x}	<i>s</i>
Girls and boys	76	158.29	8.46	50.36	10.53	19.95	2.95
Girls	34	158.00	7.15	48.97	10.13	19.57	3.17
Boys	42	159.38	9.72	51.58	10.73	20.19	2.69

Explanatory notes: *n* = number of children; \bar{x} = arithmetic mean; *s* = standard deviation; BMI = Body Mass Index = weight (kg) / height² (m).

Source: Own

3.2 Results of Endurance Shuttle Run

Results of values of HR_{max} (see Table 2) obtained using the 20 m endurance shuttle run (so-called Leger test with heart rate monitoring) were important for individual settings of load zones. Only values of HR_{rest} were measured during a separate teaching unit. The value of HR_{ant} was set by a line of 90 % of HR_{max} . The lowest values of HR_{rest} were reached by the unit of girls (73.8 ± 13.3 pulse.min⁻¹). The highest values of HR_{max} were reached by the unit of boys (197.6 ± 9.9 pulse.min⁻¹).

Tab. 2: Values of heart rate during the endurance shuttle run

	<i>n</i>	<i>HR_{rest}</i>		<i>HR_{max}</i>		<i>HR_̄</i>		<i>HR_{anp}</i>	
		\bar{x}	<i>s</i>	\bar{x}	<i>s</i>	\bar{x}	<i>s</i>	\bar{x}	<i>s</i>
Girls and boys	76	75.67	12.17	197.56	8.71	136.91	8.03	177.80	7.81
Girls	34	73.80	13.30	197.50	7.40	136.10	8.60	177.70	6.70
Boys	42	77.60	10.50	197.60	9.90	137.80	7.30	177.90	8.80

Explanatory notes: *n* = number of children; \bar{x} = arithmetic mean; *s* = standard deviation; *HR_{max}* = maximal heart rate; *HR_{rest}* = rest heart rate; *SF_̄* = average heart rate; *SF_{anp}* = heart rate on the level of anaerobic threshold (0.9 *SF_{max}*).

Source: Own

3.3 Time Spent in Individual Zones of Intensity

The time spent in individual zones of intensity during a teaching unit (45 min) indicates the high intensity of motion load using the Brenbal game (see Table 3). Recommended zone (60-89% *HR_{max}*) 2.-4. zone of intensity. The time spent in those zones for the file of girls and boys is 25 min 36 sec (56.91% of the time), for the file of girls 25 min 18 sec (56.23% of the time) and for the file of boys 25 min 51 sec (57.47% of the time). Very minimal differences can be seen between individual files. According to Vilímová [13] it is, from timing point of view, a very effective teaching unit (45 min) for all files.

Tab. 3: Time spent in individual zones (teaching unit of 45 min)

	<i>n</i>	GAME		
			BRENBAL	
			Time [%]	Time [min:s]
Girls and boys	76	Zone 0-1 [%]	18.48	8:16
		Zone 2-4 [%]	56.91	25:36
		Zone 5 [%]	24.97	11:04
Girls	34	Zone 0-1 [%]	10.84	4:53
		Zone 2-4 [%]	56.23	25:18
		Zone 5 [%]	32.93	14:49
Boys	42	Zone 0-1 [%]	24.67	11:06
		Zone 2-4 [%]	57.47	25:51
		Zone 5 [%]	17.87	8:03

Explanatory notes: *n* = number of children; Zone 0-1 (0-59% *HR_{max}*); Zone 2-4 (60-89%); Zone 5 (90-100%); Time [%] = percentage of the time in individual zones; Time [min:sec] = time in individual zones in minutes and seconds.

Source: Own

3.4 Values of Heart Rate during the Implementation of the Non-traditional Game

The resulting values of heart rate during the actual implementation of the Brenbal game (see Table 4) indicate the high intensity during the match part of the teaching unit. Match part was 2x7 min (2 min rest). The highest values of *HR_{max}* were reached by the file of girls during the match (194.32 pulse.min⁻¹).

Tab. 4: Values of heart rate during the implementation of the non-traditional game

BRENBAL											
Girls and boys (<i>n</i> = 76)	<i>HR_{min}</i>	\bar{x}	109.95	Girls (<i>n</i> = 34)	<i>HR_{min}</i>	\bar{x}	114.73	Boys (<i>n</i> = 42)	<i>HR_{min}</i>	\bar{x}	105.88
		<i>s</i>	19.43			<i>s</i>	18.12			<i>s</i>	19.60
	<i>HR_{max}</i>	\bar{x}	190.39	<i>HR_{max}</i>	\bar{x}	194.32	<i>HR_{max}</i>	\bar{x}	187.12		
		<i>s</i>	13.64		<i>s</i>	12.61		<i>s</i>	13.60		
<i>HR_{x̄}</i>	\bar{x}	152.63	<i>HR_{x̄}</i>	\bar{x}	159.18	<i>HR_{x̄}</i>	\bar{x}	147.44			
	<i>s</i>	17.48		<i>s</i>	14.39		<i>s</i>	17.90			

Explanatory notes: *n* = number of children; \bar{x} = arithmetic mean; *s* = standard deviation; *HR_{max}* = maximal heart rate; *HR_{min}* = minimal heart rate; *SF_{x̄}* = average heart rate.

Source: Own

Conclusion

The main aim is to present the sports game Brenbal as an attractive activity for the development of aerobic fitness for children of school age via measuring the intensity of motion load.

The research part of the project was dealing with the intensity of motion load during a teaching unit when playing the Brenbal game. The investigation contained 76 probands 12-13 years of age and was implemented at two elementary schools in Liberec. Heart rate monitors Polar 800XC were used for the implementation of the project. With their help, the values of *HR_{rest}* (the file of girls and boys 75.69±12.17 pulse.min⁻¹) and *HR_{max}* (the file of girls and boys 197.56±8.71 pulse.min⁻¹) were determined. Those details were crucial for individual settings of the zones of the intensity of the motion load. Zones 2-4 (60-89% *HR_{max}*) and the time spent in them were watched dominantly. Measured part was a 45-minute teaching unit. During the implementation of the Brenbal game, the file of girls and boys reached a value of 25 min 36 sec (56.91% of the time) in zones 2-4 from 45 min of overall time. During the intersexual distribution, the file of boys was more active with the time of 25 min 51 sec (57.47% of the time) in zones 2-4. The file of girls reached the time of 25 min 18 sec (56.23% of the time) in zones 2-4. Based on the research the Brenbal game can be recommended as ideally suitable for using in school physical education and in outdoor programmes given the positive development of aerobic fitness of children.

Acknowledgements

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BRENBAL JAKO VOLNOČASOVÁ AKTIVITA VHODNÁ PRO ROZVOJ AEROBNÍ ZDATNOSTI U DĚTÍ ŠKOLNÍHO VĚKU

Hlavním cílem je představení sportovní hry Brenbal jako atraktivní hry vhodné pro rozvoj aerobní zdatnosti u dětí školního věku v rámci outdoorových aktivit (TV, kurzy, školy v přírodě apod.). Výzkumná část projektu se zabývá intenzitou pohybového zatížení při využití hry Brenbal. Měření se zúčastnilo 76 probandů ve věku 12-13 let a bylo realizováno na dvou základních školách v Liberci. K realizaci projektu byly použity monitory srdeční frekvence typu Polar 800CX umožňující individuální nastavení zón intenzity. Dominantně byly sledovány zóny 2-4 (60-89 % SFmax) a počet minut v nich strávených. Měřeným úsekem byla 45minutová vyučovací jednotka. Soubor dívek a chlapců dosáhl při realizaci hry Brenbal hodnoty 25 min 36 s (56,91 % času) z 45 min v zónách 2-4. Při intersexuálním rozdělení byl soubor chlapců aktivnější, s časem 25 min 51 s (57,47 % času) v zónách 2-4. Soubor dívek dosáhl času 25 min 18 s (56,23 % času) v zónách 2-4. Na základě výzkumu lze doporučit atraktivní hru Brenbal jako ideální pro rozvoj aerobní zdatnosti dětí.

BRENBAL ALS GEEIGNETE FREIZEITAKTIVITÄT ZUR ENTFALTUNG AEROBISCHER TÜCHTIGKEIT BEI KINDERN IM SCHULALTER

Hauptziel dieses Beitrags ist die Vorstellung der Sportart Brenbal als eines attraktiven Spiels, welches sich zur Entfaltung der aerobischen Tüchtigkeit bei Kindern im Schulalter im Rahmen von Außenaktivitäten eignet (TV, Kurse, Schulen in der Natur u. Ä.). Der untersuchende Teil des Projektes befasst sich mit der Intensität der Bewegungsbelastung bei der Anwendung des Spiels Brenbal. An der Messung beteiligten sich 76 Probanden im Alter von 12 und 13 Jahren. Die Messung wurde an zwei Grundschulen in Liberec durchgeführt. Zur Realisierung des Projekts wurden Herzfrequenzmonitore des Typs Polar 800CX verwendet, auf welchen individuelle Intensitätszonen eingestellt werden können. Vor allem wurden die Zonen 2-4 (60-89 % SFmax) und die Anzahl der darin verbrachten Minuten beobachtet. Die gemessene Einheit bestand in einer 45-minütigen Unterrichtseinheit. Die Gruppe Mädchen und Jungen erreichte bei der Durchführung des Brenbal-Spiels Werte von 25 Min. 36. Sek. (56,91 % der Zeit) von 45 Min. in den Zonen 2-4. Bei intersexueller Aufteilung erwies sich die Jungengruppe als aktiver mit einer Zeit von 25 Min. 51 Sek. in den Zonen 2-4. Die Mädchengruppe erreicht eine Zeit von 25 Min. 18 Sek. (56,23 % der Zeit) in den Zonen 2-4. Auf Grundlage der Untersuchung kann man das attraktive Spiel Brenbal als ideal für die Entfaltung der aerobischen Tüchtigkeit der Kinder empfehlen.

BRENNBALL JAKO FORMA AKTYWNOŚCI ODPOWIEDNIA DLA ROZWOJU SPRAWNOŚCI AEROBOWEJ DZIECI W WIEKU SZKOLNYM

Głównym celem jest zaprezentowanie gry brenball jako atrakcyjnej gry plenerowej odpowiedniej dla rozwoju sprawności aerobowej dzieci w wieku szkolnym (TV, kursy, zielone szkoły itp.). Badawcza część projektu poświęcona jest intensywności obciążenia układu ruchu podczas gry brenball. Badaniami objęto 76 dzieci w wieku 12-13 lat uczęszczających do dwóch szkół podstawowych w Libercu. Do celów realizacji projektu wykorzystano monitory pracy serca typu Polar 800 CX umożliwiające indywidualne ustawienie stref intensywności. Przede wszystkim obserwowano strefy 2-4 (60-89 % SFmax) i czas pozostawania w danej strefie w minutach. Odcinkiem pomiarowym była 45minutowa jednostka zajęciowa. Grupa dziewcząt i chłopców grając w brenball osiągnęła wartość 25 min. 36 s (56,91 % czasu) z 45 minut spędzonych w strefach 2-4. Grupa chłopców była aktywniejsza, osiągając czas 25 min. 51 s (57,47 % czasu) w strefach 2-4. Grupa dziewcząt osiągnęła czas 25 min. 18 s (56,23 % czasu) w strefach 2-4. Na podstawie przeprowadzonych badań grę brenball można zalecić jako idealną dla rozwoju sprawności aerobowej dzieci.