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Research Results
Резултати от научни изследвания

A WELLNESS TOOL TO PERFORM HEALTHY LIFESTYLE PRACTICES IN THE BULGARIAN SCHOOL SYSTEM

Assoc. Prof. Irina Nesheva, PhD
National Sports Academy "Vassil Levski"

Abstract. The number of children with diabetes is growing alarmingly. The age limit of patients has also decreased significantly. This material presents recreational physical activity through cheerleading. *Methods:* The research aims to attract the attention of educators (current and future) to the essence of the functional effects of cheerleading practice. The diagnostic of the functional indicators were with the asset of an innovative tool for diagnosing functional changes, providing a personal QR code on the effects of cheerleading practice. *Results:* The specific changes in dynamics inside the indicators that register the metabolic age, were studied. This detailed diagnosis is to develop wellness tools in Bulgarian schools as health prevention of childhood diabetes. *Conclusions:* According to the results of our study, functional indicator changes are related to the effectiveness of cheerleading programs. In order to diagnose functional changes, intelligent (smart) tools have been used to ensure high objectivity and personalisation of the data.

Keywords: Health prevention; cheerleading practice; smart tool; diagnostics of functional indexes; childhood diabetes

Introduction

Today, diabetes is one of the most common diseases in the world. There are 347 million people who diagnose with this disease. A new case of diabetes is diagnosed every 10 seconds, and one person dies from the disease (Dimitrova 2018). Each year, 7 million people hear the diagnosis for the first time, 70,000 of who are children (Ilinova et al. 2018; Dimitrova et al. 2018). According to the World Health Organisation[1] (2016), more than 500 million people will be affected by diabetes by 2030. In Bulgaria, according to statistics, about 500,000 people suffer from this disease. However, 40% of people do not know they have diabetes (Levterova et al. 2018; Dimitrova 2018a). The number of children suffering from diabetes is increasing alarmingly. The age limit of those affected has also dropped significantly (Levterova et al. 2018; Dimitrova 2019; Polimenov 2019). Increasingly, diabetes is detected in children under the age of 1 year. Researchers

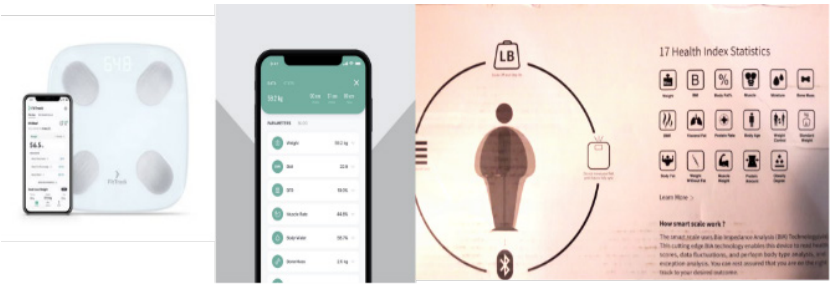
warn of the main risk factors for the development of diabetes mellitus (Levterova et al. 2018; Tomova 2021). The established fundamental indicators are overweight, immobility, poor vitamin balance or 30% heredity (Polimenov 2018; Ignatov et al. 2021; Ignatov et al. 2022; Polimenov 2022). The way of life is also crucial – nutrition, reduced physical activity, and stress in everyday life (Dimitrova 2018b; Ilinova et al. 2019;). Measures related to a healthy diet and lifestyle are effective in preventing or delaying diabetes (GWI 2021; Veselinov 2021; Ignatov et al. 2020). The health benefits of eating a diet rich in fresh fruits, vegetables, and legumes (beans, lentils, peas and others) have long been recognised and support the anti-stress capacity of the body (Angelcheva et al. 2019). Many studies prove that the nutrients in fruits and vegetables, such as fibre, folates, antioxidants, vitamins, and potassium, are related to the prevention of diabetes and cardiovascular diseases (Popivanova 2006; Nesheva 2016; Ignatov et al. 2021). In the prevention of diabetes, a balanced diet, recreational physical activity (at least 30 min. daily) and the regular intake of 30 ml of water per kilogram of weight per day occupy a central place (Trendafolov et al. 2013; Dimitrova et al. 2021). Leading specialists advise students to practice motor activity 3 – 4 times a week (Aciego et al. 2012; Minkovska 2017). Not to use energy and carbonated drinks, not to have pasta and sweets for breakfast, but with fruits, vegetables, nuts and dairy products (Dimitrova et al. 2021). Experts say that in children, diabetes manifests itself clearly and is easily recognised, while an adult can live with the disease for years without realizing it. The research aims to attract the attention of students and reveal the essence of cheerleading as a practice of extracurricular activity in Bulgarian schools. The number of children with diabetes is growing alarmingly. The age limit of patients has also decreased significantly. The large public knows that in the treatment, the conventional medicine prescribes the active application of recreational motor activities. This material presents the effects of the recreational Majorettes' program activity through cheerleading as an interactive health prevention for children with diabetes.

Methods

The purpose of this research is to draw the attention of educators, both current and future, to the functional benefits of cheerleading practice.

Measuring instruments

The diagnostic of the functional indicators were with the asset of an intelligent (smart) tool (Fit Track) for diagnosing functional changes, providing a personal QR code and hearth rate on the cheerleading practice effects (Scheme 1). This version of the smart tool expands the range of measured indicators by registering and presenting a comparative analysis of changes in body mass index and other physiological indicators.



Scheme 1. Dara Smart Scale (Fit Track) diagnosing asset – functionality

Subject

We recruited 121 students and schoolchildren, including the official cheerleading team of the NSA "V. Levski", for the study. The average age of participants was 18.2 years, with 87% being female and 13% male. The group had varying levels of technical training and motor ability. The study was conducted during the 2021 – 2022 academic year. The objective was to monitor the changes in body mass indicators before and after participating in Majorettes' practice.

Procedures

Anthropometric Measures: The height was measured to the nearest tenth of a centimetre (cm) on the first and last day of testing. Body mass was measured to the nearest tenth of a kilogram (kg) on the first and last day of testing using a Dara Smart Scale (Fit Track) diagnostic device.

Ethical statement

The study was harmonised with the last Bulgarian "Ethics in science" requirements by the National Centre for information and documentation (NCID, 2022). All participants provided written informed consent before participating in this study, and the study adhered to the ethical standards per the parents' agreement.

Statistical analysis

The data analysis was conducted using SPSS version 25. The descriptive statistics of the participant information were presented as the mean and standard deviation. A two-way repeated measure was performed to assess the impact of Majorettes' practice on heart rate (HR) during lessons (before and after). The data were analysed using a descriptive analysis of 19 indicators. The conclusions were drawn at a significance level of <95% (α>.05). A comparison was made between the indicators using independent samples analysis.

Results

The research focused on analysing the changes in specific indicators (visceral fat index, fat mass, body fat percentage, protein norm, muscle mass, basal metabolism) which reflect the metabolic age.

Table 1. Registered indicators for the comparative analysis between the studied two majorettes' contingents

Indicators	Abreviation	Function
Index visceral fats	(VAI), (WC), (BMI), (TG), (HDL)	Visceral obesity is a gender-specific mathematical index based on waist circumference body mass index triglyceride levels and cholesterol, indirectly expressing the function of visceral adipose tissue and insulin sensitivity.
Fat mass	(FM)	The fat mass index is calculated by dividing the weight of fat in kilograms by your height in meters squared.
Bbody fat rate	BFR (%)	The referent average for adults: woman should maintain a BFR of 25-31% and men should maintain a BFR of 18-24%.
Protein rate	PR (%)	The reference daily intake (RDI) for protein is 46 grams for women and 56 grams for men.
Metabolic Age	MA (years)	Is different of the biological years
Body water percent	BWP (%)	The majority of the human body is water, with an average of about 60%. The amount of water in the body changes slightly with age, gender and hydration levels. While the average percentage of water in a person's body is about 60%, the percentage can range from approximately 55-75%.
Basal metabolic rate	(BMR –Kcal)	Basic metabolism is the number of calories burned while the body performs a basic (basic) life support function. It is also commonly referred to as the resting metabolic rate (RMR), which represents calories burned.
Percentage of muscle mass	PMM(%)	The reference range for muscle mass is: 20-39 years: 75-89% for men, 63-75.5% for women; 40-59 years: 73-86% for men, 62-73.5% for women; age 60-79 years: 70-84% for men, 60-72.5% for women.
Body mass index	BMI	Body mass index is the weight of a person in kilograms divided by the square of the height in meters. High level may indicate high body fat. BMI checks for weight categories that can lead to health problems, but does not diagnose individual obesity or health.
Obesty level	OL (%)	If the BMI is less than 18.5, it falls under the underweight range. If the BMI is from 18.5 to <25, it falls within the healthy weight range. If the BMI is from 25.0 to <30, it falls into the overweight range. If the BMI is 30.0 or higher, it falls into the obesity range.
Weight withaut fat	WWF (kg)	Weight without adipose tissue
Muscle Mass	MM (kg)	Muscle mass weight

This in-depth diagnosis is aimed at creating wellness tools in Bulgarian schools for the prevention of childhood diabetes. The data from the participants in the study sample, as described in Table 1, were collected using the Smart System for the

analysis of anthropometric and morphological indicators. The values are low and correspond to the limits of the normal distribution according to the theoretically determined statistical values. This applies to all 17 indicators except for adipose tissue mass (No. 5) and control weight (No. 18).

Table 2. Students target majorettes group.
1. First functional indicators study with variation analysis

Indicators	X	S	Var	Ex	As	Max	Min	R
Index visceral fats	1,0	0,00	0%	-	-	1,00	1,00	0,00
Fat mass (kg)	5,71	3,82	67%	-0,41	0,93	13,60	2,10	11,50
% BFR - (body fat rate)	16,68	3,96	24%	-1,23	0,37	23,40	11,10	12,30
% - Protein rate	16,14	0,94	6%	-1,33	-0,41	17,50	14,60	2,90
Bone Mass (kg)	2,53	0,23	9%	-0,85	-0,62	2,80	2,10	0,70
Metabolic Age (years)	17,38	1,36	8%	-1,55	-0,12	19,00	15,00	4,00
Basal metabolic rate (BMR) (Kcal)	1270,94	76,66	6%	-0,83	-0,49	1384,00	1130,00	254,00
% - Obesity level	19,41	3,46	18%	-1,28	0,31	25,20	15,10	10,10
Weight without fat (kg)	43,74	2,38	5%	-0,99	-0,29	47,60	39,60	8,00
Muscle Mass (kg)	22,64	2,93	13%	-1,26	-0,04	27,20	18,10	9,10
% - Percentage of muscle mass	41,89	1,97	5%	-1,31	-0,36	44,30	39,00	5,30
BMI (kg м²)	8,24	2,76	33%	-0,51	0,93	13,70	5,60	8,10
% - Body water percent	59,4	4,62	8%	4,77	-1,84	64,60	45,10	19,50
Physical evaluation	5,63	0,70	12%	1,70	-1,73	6,00	4,00	2,00
Comparative analysis with independent samples of the variation indicators of the two majorettes groups								
t	0,0	-0,5	0,8	-2,0	0,4	-0,1	0,1	-0,7
Pt [%]	1,1	38,3	59,2	94,8	30,4	9,1	9,0	48,3

Table 3 displays the various indicators of the participants from the school group taking part in the FIT TRACK program (2). For this group, there was only one exception to the normal distribution, which was control weight (No. 18).

Table 3. Students target majorettes group.
2. First functional indicators study with variation analysis

Indicators	X	S	Var	Ex	As	Max	Min	R
1.Age	15,5	0,33	2%	4,90	-2,51	21,00	20,00	1,00
2.Height(cm)	155	6,06	4%	1,22	1,23	165,00	145,00	20,00
3.Weight (kg)	55,5	4,95	9%	-1,73	0,08	60,30	46,20	14,10
4. Index visceral fats	1,0	0,00	0%	-	-	1,00	1,00	0,00
5. Fat mass (kg)	2,4	0,28	12%	2,59	-1,14	2,80	1,60	1,20
6. % BFR - (body fat rate)	23,6	5,85	25%	-0,76	0,01	32,80	13,40	19,40

7. % - Protein rate	15,9	1,57	10%	-1,08	-0,05	18,40	13,50	4,90
8. Bone Mass (kg)	2,4	0,31	13%	1,70	-0,42	3,00	1,60	1,40
9. Metabolic Age (years)	18,4	1,54	8%	-0,39	-0,60	20,00	15,00	5,00
10. Basal metabolic rate (BMR) (Kcal)	1285,3	140,88	11%	1,47	-0,43	1569,00	990,00	579,00
11. % - Obesity level	21,2	2,76	13%	1,67	-1,00	25,40	15,00	10,40
12. Standard weight (kg)	59,3	4,19	7%	1,17	1,04	70,00	54,00	16,00
13. Weight without fat (kg)	13,7	4,59	34%	-0,41	0,26	22,90	5,50	17,40
14. Muscle Mass (kg)	44,0	5,69	13%	0,56	0,05	56,70	32,70	24,00
15. % - Percentage of muscle mass	56,1	4,46	8%	-0,97	-0,07	63,70	49,20	14,50
16. BMI (kg м²)	20,6	2,13	10%	0,83	-1,02	23,10	15,80	7,30
17. % - Body water percent	39,9	4,87	-415%	0,79	-0,96	50,50	30,50	20,00
18. Weight control (kg)	-1,4	5,84	-415%	0,79	-0,96	6,20	-15,20	21,40
19. Physical evaluation	3,5	0,87	25%	-0,44	0,01	5,00	2,00	3,00
Comparative analysis with independent samples of the variation indicators of the two majorettes groups								
t	0,0	-0,5	0,8	-2,0	0,4	-0,1	0,1	-0,7
Pt [%]	1,1	38,3	59,2	94,8	30,4	9,1	9,0	48,3

The research results show that there are greater variations in the indicators for the participants from the school group compared to the representative cheerleading team of the NSA "V. Levski". This is likely due to the higher level of training of the university team. A comparative analysis of the indicators was performed for the two groups and no significant differences were found. The absence of significant differences does not provide statistical evidence for the presence of differences between the two groups. The results of the research are also not limited to random statistical errors inherent in scientific experiments. Comparison of the data from the maximum and minimum values of the research samples shows that there is a greater change in the participants from the school group compared to the results of the representative cheerleading team of the NSA "V. Levski". This is also confirmed by the higher value of the span (R).

Table 4. Students target majorettes group.
1. Second functional indicators study with variation analysis

Indicators	**X1**	**X2**	**d**	**d%**	**t**	**Pt**
1.Age	20,9	20,9	0,0	0,000	0,00	0,0
2.Height(cm)	166,8	166,8	0,0	0,000	0,00	0,0
3.Weight (kg)	53,054	53,1	0,0	0,024	0,05	4,0
4. Index visceral fats	1,0	1,0	0,0	0,000	0,00	0
5. Fat mass (kg)	3,3	8,2	-4,9	-148,9	-2,56	96,2
6. % BFR - (body fat rate)	16,6	16,8	-0,2	-0,904	-0,50	37,0

7. % - Protein rate	16,1	16,2	-0,1	-0,622	-0,60	43,0
8. Bone Mass (kg)	2,5	2,5	0,0	0,000	0,00	0,0
9. Metabolic Age (years)	17,4	17,4	0,0	0,000	0,00	0,0
10. Basal metabolic rate (BMR) (Kcal)	1277	1264	12,9	1,008	3,14	98,4
11. % - Obesity level	19,4	19,4	0,0	0,000	0,00	0,0
12. Standard weight (kg)	62,4	62,4	0,0	0,000	0,00	0,0
13. Weight without fat (kg)	43,5	43,9	-0,4	-0,919	-0,60	43,5
14. Muscle Mass (kg)	22,7	22,6	0,2	0,715	1,63	85,2
15. % - Percentage of muscle mass	41,9	41,9	0,0	0,000	0,00	0,0
16. BMI (kg м²)	8,2	8,2	0,0	0,000	0,00	0,0
17. % - Body water percent	58,6	60,3	-1,7	-2,904	-1,09	68,7
18. Weight control (kg)	-9,2	-9,1	-0,1	1,083	-0,44	32,4
19. Physical evaluation	5,6	5,6	0,0	0,000	0,00	0,0

Tables 3 and 4 include measures that will not change because of the short time between entry and exit measurement: bone mass index, height, and body score. In contrast weight, subcutaneous fat and protein content level were statistically significant.

The results suggest that the motor activity level was not intense enough for the participants from the representative cheerleading team of the National Sports Academy "V. Levski". On the other hand, the author's program was found to be satisfactory for the school group participants. The significant values for adipose tissue mass and daily caloric balance suggest a potential influence on the results. The caloric intake is important in this analysis as it affects the basal metabolic rate, which in turn affects the burning of fat.

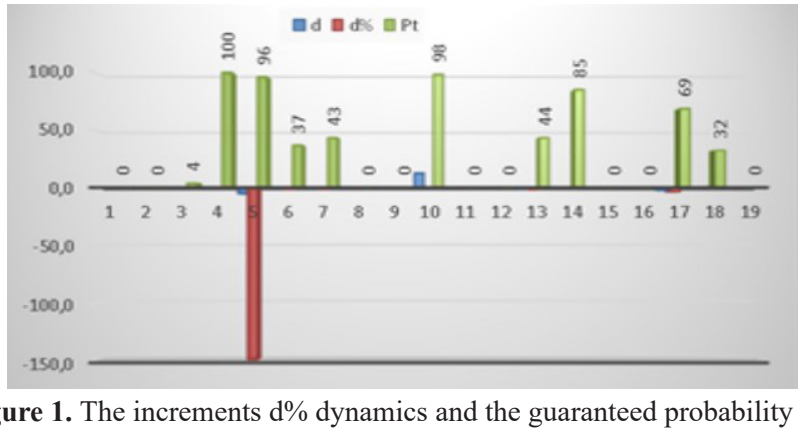


Figure 1. The increments d% dynamics and the guaranteed probability (Pt) for participants from the representative cheerleading team of the National Sports Academy "V. Levski"

Summarising, the research findings suggest that the cheerleading practice had a positive impact on the functional indicators of the school group participants. However, the motor activity of the participants from the representative cheerleading team of the National Sports Academy "V. Levski" was found to not be intensive enough and needs an upgrade.

Figure 1 displays the dynamics of the increments, d%, and the guaranteed probability (Pt) of the participants. Table 3 shows the 10 significant indicators, with a guaranteed probability that exceeds the 95% limit. The results of this research provide evidence for the importance of incorporating cheerleading practice in school programs as a tool for promoting health and wellness in the Bulgarian school system.

Table 5. Students target majorettes group.
2. Second functional indicators study with variation analysis

Indicators	X1	X2	d	d%	t	Pt
1.Age	15,5	15,5	0,0	0,000	0,00	0,0
2.Height(cm)	155	155	0,0	0,000	0,00	0,0
3.Weight (kg)	57,8	57,3	0,046	0,80	3,57	99,1
4. Index visceral fats	1,0	1,0	0,0	0,000	0,00	0
5. Fat mass (kg)	2,4	2,3	0,08	3,13	2,05	92,0
6. % BFR - (body fat rate)	28,1	19,0	-9,09	-47,77	-9,46	83,0
7. % - Protein rate	14,5	17,2	2,74	15,88	13,06	100,0
8. Bone Mass (kg)	2,4	2,39	0,01	0,53	0,19	14,3
9. Metabolic Age (years)	18,5	18,3	-0,25	-1,37	1,53	83,0
10. Basal metabolic rate (BMR) (Kcal)	1259,9	1310,8	50.88	3,88	6,45	100,0
11. % - Obesity level	21,2	21,2	0,0	0,000	0,00	0,0
12. Standard weight (kg)	60,8	57,9	2,89	4,75	11,77	100,0
13. Weight without fat (kg)	10,9	16,5	-5,56	-50,74	-10,94	100,0
14. Muscle Mass (kg)	41,2	46,9	5,75	12,26	11,24	100,0
15. % - Percentage of muscle mass	52,5	59,6	7,13	11.95	12,93	100,0
16. BMI (kg м²)	20,6	20,7	-0,055	-0,24	-0,54	39,4
17. % - Body water percent	38,0	41,9	3,98	9,48	5,66	99,9
18. Weight control (kg)	-2,8	0,0	-2,76	99,10	-6,60	100,0
19. Physical evaluation	3,5	3,5	0,0	0,000	0,00	0,0

The level of protein content, daily caloric balance, standard weight, fat-free weight, muscle mass weight, muscle mass percentage and control weight was affected by the intensity of the cheerleading program. It is characterized by a mixed workout (aerobic-anaerobic), with each of the exercises having a focus on one or the other component.

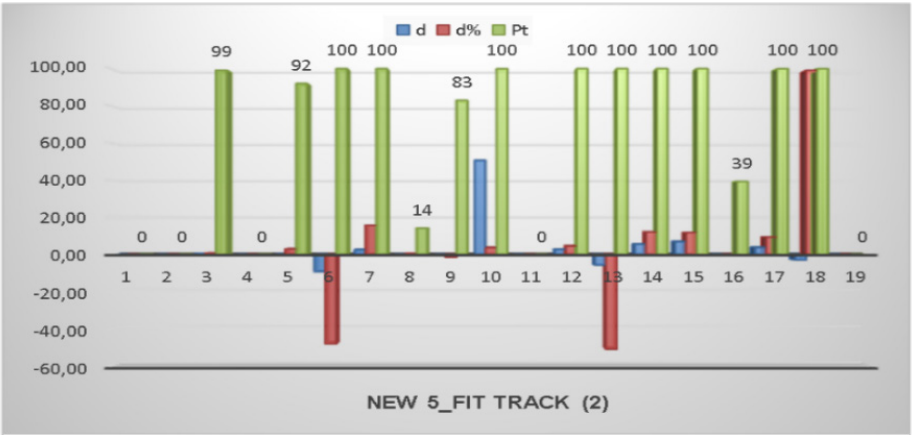


Figure 2. The dynamics of the d% increments and the guaranteed probability (Pt)

Figure 2 illustrates the dynamics of d% increments and guaranteed probability (Pt) for participants from the school representative cheerleading team. To further analyse the data, a correlation matrix was created based on established correlation coefficients. This allowed us to identify which indicators were significantly present in the correlation analysis, such as weight (r = 0.873) or subcutaneous adipose tissue (r = 0.968) which affects metabolic age (r = 0.864). The level of daily caloric balance (r = 0.884) is strongly correlated with the level of obesity (r = 0.973). Muscle mass weight (r = 0.999) is inversely related to control weight (r = -0.828), percentage of water in the body (r = -0.873), and high levels of protein in the daily diet.

Discussion

This study aimed to examine the impact of majorette practice as a wellness recreational activity on youth diabetes. The focus was on the effects of regular training, which took place 2-3 times per week for 4 months (137.81 ± 39.20 days). Despite the lack of research on the effects of leisure activities on a large sample of participants from diverse sports groups, this study fills the gap by offering a comparative analysis of the effects of a specific technique on the body in both amateur and actively training individuals. A comparison of changes in body mass index between active athletes and amateurs was also presented, adding to the uniqueness of the study. This study uses a smart tool for analysing the dynamics of functional indicators for diagnosis, with real-time data acquisition on the researcher's phone or computer. Building upon previous research, this study emphasizes the need for implementing wellness tools for health prevention in Bulgarian schools. The study demonstrates the positive effects of the majorette recreational program through

cheerleading as an interactive health prevention measure for children with diabetes.

Conclusions

In this study, the trend of physiological indicator changes caused by cheerleading programs was analysed. The use of smart diagnostic tools, including QR codes for individual registration, ensured objective and personalized data collection. The intensity of physical activity in majorettes practice, including a mix of aerobic and anaerobic exercise, should be tailored to the wellness program and the participants' technical abilities. Better-prepared individuals, such as team members of the National Sports Academy, need higher physical demands to reach competitive goals. School group participants found the author's program to be more than satisfactory in terms of intensity. The cheerleading practice in Bulgarian schools is one of the most effective tools for preventing childhood diabetes.

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Declarations of informed consent have been obtained for the publication of the surveyed data.

NOTES

1. www.who.int: The WHO Report is related to a study in The Lancet, in which researchers evaluated 751 studies with almost 4.4 million participants and data from 146 countries.

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✉ **Dr. Irina Nesheva, Assoc. Prof.**
ORCID iD: 0000-0002-0436-6398
Department of Gymnastics
National Sports Academy "Vassil Levski"
21, Acad. Stefan Mladenov St.
1700 Sofia, Bulgaria
E-mail: iranesheva2005@abv.bg