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Transformational Effects of the MBS Yoga Program on Treated Motor Status

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Original scientific paper

Abstract
The main objective of this research was to determine the effect of the "MBS Yoga" programme on quantitative changes in manifest dimensions of power (static and dynamic), balance and flexibility over a period of 3 months.
The research was conducted on a sample of 69 first and second year female students from the Faculty of Transportation and Traffic Sciences in the 18-22 year age group, who were selected at random. The sample consisted of two groups of female students, an experimental and a control group. The experimental group comprised 33 female students who implemented the recreational "MBS Yoga" programme during three months. The control group comprised 36 female students who were involved teaching a programme of physical education courses at the faculty. A sample of manifest variables consists of twelve tests, three for each of the motor abilities. In summing up the obtained t-test results, we can conclude that trimonthly implementation of the "MBS Yoga" programme led to anticipated statistically significant changes between the control and experimental groups for each particular variable and subsequently it can be conclude that all the set conditions of this research had been fully confirmed. Based on the t-test results for paired samples of each variable, and especially the results of discriminant analysis, it is clearly noticeable that the tri-monthly "MBS Yoga" programme leads to a statistically significant change for each motor variable in the experimental group between the initial and final verification.

Key words: **MBS (Movement Balance System), Yoga programme, transformational effects, flexibility, strength, balance**

Introduction

The author of this paper is also the author of the "MBS Yoga" programme, which is defined as a yoga style possessing a more dynamic character. It is thought that there are approximately 840,000 yoga exercises (Birkel DA, Edgren L.1998). The programme consists of yoga exercises providing the program with diversity, flexibility, balance and a mental focus on the body during the actual course. Though the entire programme is based on yoga exercises, it is complemented with Pilates techniques (visualization), dance aerobics (moderate intensity) and kinesitherapy (corrective exercises). A variety of props (large and small balls, weights, tyres, elastic bands ...) and a variety of methods, including motion correction, increasing load intensities, and motivation in class provide a greater thoroughness of impact on anthropological status and on training diversity. The "MBS Yoga" programme is largely based on yoga exercises, including breathing and relaxation techniques.

The World Health Organization (WHO) officially recognizes yoga as one of the scientifically verified health and prevention systems. Yoga is a combination of natural body movements called "Asanas" which when executed are harmonised with regular and controlled breathing. Using a variety of movement forms, the goal of this type of program is to cause a burden possessing an aerobic character at a moderate intensity (60-80% of the maximum heart rate per minute) using a variety of yoga exercises. The results of exercising at this load level is the development of basic endurance, development of the cardiovascular and respiratory systems, aerobic muscular endurance, aerobic capacity, reduction of subcutaneous adipose tissue and prevention of metabolic diseases (Andrijašević, 2010)

Implemented method

In this research, 69 first and second-year female students from the Faculty of Transport and Traffic Sciences in the age of 18-22 year were selected at random to participate. The sample comprised two groups of female students, an experimental and a control group. The experimental group comprised 33 female students who implemented the recreational "MBS Yoga" programme during a three-month period. The control group comprised 36 female students who were involved in teaching a programme of physical education courses at the faculty.

A sample of manifest variables consisted of twelve tests, three for each motor ability. The choice of motor skills (Metikoš et al. 1989) analyzed in this study was based on the realization that latent dimensions (strength, flexibility,

balance) are stimulated during targeted treatment using the "MBS Yoga" programme over a duration of 3 months.

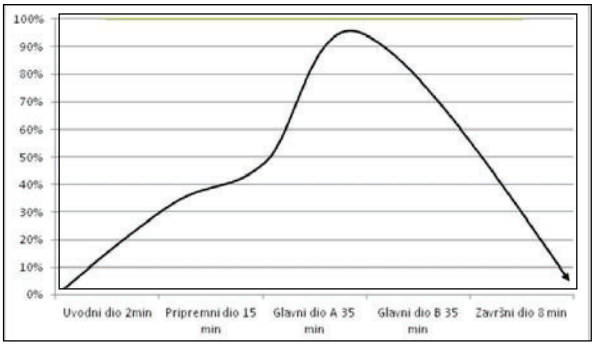
The variables selected for assessing motor abilities are described in the proposed validated series of tests used to assess motor skills (Metikoš et al. 1989) and accompanied by certain modifications. The variables are as follows: (1) Tests for assessing balance (Standing on one foot lengthwise on a balance bench with eyes open - R1; Standing on two feet lengthwise; Standing on two feet crosswise on the balance bench with eyes open - R3; (2) Tests for assessing dynamic forces: (1) Raising the upper body with weights - DSEL; half squats with weights - DSP; Bench press - DSBP (Mikić, B., 1999), (3) Tests for evaluating static power: (1) Horizontal endurance face down - SSHI; (2) Horizontal endurance face up - SSIZP; (3) Load endurance load in a half squat position - SSIP, and tests for assessing flexibility: (1) bench crunches - FPLL; (2) astride touch-toe - FPR, (3) twists with the stick - FI.

The subjects from the experimental group conducted the "MBS Yoga" programme for a period of three months, three times a week for 60 minutes. The implemented programme included the following elements: exercises for flexibility, strength, balance, coordination, relaxation, as well as breathing techniques and corrections. One hour of the "MBS Yoga" programme comprised preliminary, preparatory, primary and a final part providing an integral harmonious unit without pauses between parts, making it all the more dynamic. The introductory part of the class hour lasts up to 5 minutes, which includes a brief theoretical section on anatomy, physiology, biomechanics, nutrition and breathing, with various techniques for relaxation and movement correction.

The preparatory part of the hour (15 min) consists of general preparatory exercises based on large amplitude yoga exercises in the low intensity zone and corrective exercises. Based on the effects, the exercises were methodically sorted in the following sequence: relaxation exercises, breathing exercises, corrective exercises aimed at optimizing movement, including stretching exercises that aim to provide functional body movements (Hannaford, C., 2007). The main part of the hour covering a period of 35 min involved a continuous aerobic regimen. The main A part of the hour was performed in a standing position where movement of the lower extremities included walking, kneelift, hip extension, leg abduction, half squats, lunges, etc., while development of the upper body required performing large amplitude yoga exercises using props, water balls.

The main B part of the hour was performed in the sitting, prone and kneeling body position with exercises focusing on developing power (Braith, RW, JE Graves, SHLeggett, ML Pollock, 1993), flexibility and balance, and if necessary were supplemented with corrective movement exercises and exercises with the eyes closed (Kosinac, Z., 2009). The final part of the hour lasted up to 5 min, and included yoga exercises that focused on stretching the muscles and proper continuous breathing, with the goal of reducing heart rate and relaxing the entire body (Tran MD, Holly RG, Lashbrook J, Amsterdam EA, 2000).

Figure 1. The structure of the load intensity (using Borg's scale (Marković and Bradić, 2009) and temporal articulation of "MBS Yoga" treatment.



Subjects in the control group conducted the physical education curriculum for a period of three months, once a week for 2 hrs. The control group performed walking tours on Sljeme. It should be emphasized that walking speeds were not set for the programme subjects or for the rest periods while ascending to the destination.

Basic statistical parameters were calculated for all variables and the results were presented in tables and graphs; (1) in order to determine the significance of differences between the experimental and control groups, the t-test for independent samples was applied to each variable separately; (2) in order to determine the significance of differences between the initial and final verification in the experimental group, the t-test for paired samples was applied to each variable separately; (3) for the purpose of determining the statistical significance of changes in all observed variables together and determining which variables lead to a statistically significant difference between the experimental and control groups, discriminant analysis was applied (Milanovic, D., 1997).

Results and Discussion

Analysis of the obtained results, in particular using analysis of t-values and Sig. (2-tailed) statistical significance for each treated variable led us to observe that there is a statistically significant difference between the experimental and control groups (Table 1). By analyzing the results of t-test with respect to the variables that assess flexibility (Furjan-Mandic, G., Jurinec, J., Wolf-Cvitak, J. Kolar, M., 2003), we observed high statistical indicators of difference in the final measuring between the experimental and control groups. This is an indicator of a well-designed and target-oriented "MBS Yoga" programme, in particular specific yoga exercises that develop flexibility. Statistically significant differences in the area of strength and balance indicate that the "MBS Yoga" programme was created with the clear intention of increasing motor status on the treated areas. (Schell FJ, Allolio B, Schoneck OW., 2001).

Table 1. Testing the difference between arithmetic means and standard deviations of two different groups of subjects (t-test for independent samples

Variable	Levene's		t-test						
	F	*Sig.*	*t*	***df***	***Sig.***	*Mean Difference*	*Std. Error Difference*	*95% Con. Interval of the Difference*	
								Lower	*Upper*
FI2	.000	.989	-3.004	67	.004	-9.134	3.041	-15.203	-3.065
			2.988	64.242	.004	-9.134	3.057	-15.240	-3.028
FPR2	7.845	.007	1.940	67	.057	4.000	2.062	-.116	8.116
			1.978	58.995	.053	4.000	2.022	-.045	8.045
FPLL2	19.267	.000	6.004	67	.000	16.732	2.787	11.170	22.295
			6.157	53.724	.000	16.732	2.717	11.283	22.181
SSHI2	8.582	.005	7.159	67	.000	18.030	2.519	13.003	23.058
			7.287	60.705	.000	18.030	2.474	13.082	22.978
SSIP2	16.921	.000	5.647	67	.000	1.12828	.19979	.72950	1.52706
			5.472	41.661	.000	1.12828	.20619	.71208	1.54448
SSIZP2	8.915	.004	2.512	67	.014	.09823	.03910	.02018	.17628
			2.416	35.653	.021	.09823	.04066	.01575	.18072
DSBP2	9.598	.003	1.544	67	.127	.12275	.07949	-.03591	.28141
			1.529	60.861	.132	.12275	.08031	-.03784	.28334
DSEL2	14.763	.000	5.537	67	.000	1.13466	.18658	.71342	1.46727
			5.528	40.489	.000	1.13466	.18728	.70945	1.45633
DSTPT2	6.615	.003	1.713	67	.011	.08558	.02911	.01864	.16922
			1.683	34.421	.017	.08558	.03045	.01434	.16247
$R1_2$	3.797	.122	-2.743	67	.004	-1.125	.282	-1.788	-.561
			2.775	65.551	.003	-1.125	.276	-1.770	-.569
$R2_2$	2.768	.101	-2.938	67	.005	-1.114	.379	-1.870	-.357
			2.974	64.756	.004	-1.114	.375	-1.862	-.366
$R3_2$	3.995	.050	4.608	67	.000	-.01740	.00378	-.02494	-.00986
			4.687	61.379	.000	-.01740	.00371	-.02482	-.00998

With respect to flexibility, in Table 2 we see that the t-values of transformational effects stemming from the "MBS Yoga" programme for the control group was smaller. However, in terms of statistical significance values, we conclude that there was a change between the two measurements in the experimental group for all treated motor areas.

It should be noted that the largest t-value is attributed to the variable of "flexibility in astride touch-toe" (FPR), which amounts to 8.442 at a statistical significance level of 0.00. It is actually this variable that can rightly be called a variable representative of changes between the two flexibility measurements in the experimental group. Based on the t-values and Sig. - statistical significance shown in Table 2, we can conclude that, between the two measurements, there occurred significant changes in the experimental and in the control group. These changes in static strength are the result of desired outcome by the tri-monthly "MBS Yoga" recreational programme.

Analysis of the results presented in Table 2 based on t-values and statistical significance shows that for all pairs of variables statistically significant changes occur between the initial and final measurements. Higher t-values were observed for pairs of variables from the experimental group of subjects, whereas the groups in the pairs of variables that assess the level of repetitive forces experienced a statistically significance between the two measurements. On the basis of the results of t-values and statistical significance for the experimental group, we observe a difference in both sets of variables that define the balance of subjects. A negative sign shows the differences in changes between the initial and final measurements with a reduction of results meaning a better outcome in the test itself. Results in the control group show that the variable pair group $R1^2$ - $R1^1$ has no statistically significant difference ($t = 1.745$, $p = 0.09$) and this is actually the first variable pair (balance) whereby the t-test does not show statistically significant transformational changes.

Table 2. T-test statistical significant changes between initial and final measurements for both groups of subjects

Group			Paired Differences					t	df	Sig. (p)
			Mean	Std. D	Std. E	95% Confidence Lower	95% Confidence Upper			
Eks	Pair 1	FI2 - FI1	-8.758	6.746	1.174	-11.149	-6.366	-7.458	32	.000
	Pair 2	FPR2 - FPR1	6.636	4.526	.788	5.031	8.241	8.422	32	.000
	Pair 3	FPLL2 - FPLL1	12.758	9.956	1.733	9.227	16.288	7.361	32	.000
	Pair 4	SSHI2 - SSHI1	12.606	8.396	1.462	9.629	15.583	8.625	32	.000
	Pair 5	SSIP2 - SSIP1	.94667	.94197	.16398	.61266	1.28068	5.773	32	.000
	Pair 6	SSIZP2 - SSIZP1	.10212	.16140	.02810	.04489	.15935	3.635	32	.001
	Pair 7	DSBP2 - DSBP1	.27212	.26843	.04673	.17694	.36730	5.824	32	.000
	Pair 8	DSEL2 - DSEL1	.22394	.20591	.03584	.15093	.29695	6.248	32	.000
	Pair 9	DSTPT2 - DSTPT1	.24606	.28802	.05014	.14393	.34819	4.908	32	.000
	Pair 10	$R1_2$ - $R1_1$	-1.091	1.071	.186	-1.471	-.711	-5.850	32	.000
	Pair 11	$R2_2$ – $R2_1$	-.01485	.00906	.00158	-.01806	-.01164	-9.419	32	.000
	Pair 12	$R3_2$ – $R3_1$	-.01866	.00581	.00147	-.01628	-.01266	-7.718	32	.000
Kon	Pair 1	FI2 - FI1	1.722	3.453	.575	.554	2.890	2.993	35	.005
	Pair 2	FPR2 - FPR1	-2.750	4.136	.689	-4.149	-1.351	-3.989	35	.000
	Pair 3	FPLL2 - FPLL1	-6.500	7.493	1.249	-9.035	-3.965	-5.205	35	.000
	Pair 4	SSHI2 - SSHI1	-4.778	4.543	.757	-6.315	-3.241	-6.311	35	.000
	Pair 5	SSIP2 - SSIP1	-.30556	.32885	.05481	-.41682	-.19429	-5.575	35	.000
	Pair 6	SSIZP2 - SSIZP1	-.05806	.04622	.00770	-.07369	-.04242	-7.537	35	.000
	Pair 7	DSBP2 - DSBP1	-.08139	.11172	.01862	-.11919	-.04359	-4.371	35	.000
	Pair 8	DSEL2 - DSEL1	-.06083	.05789	.00965	-.08042	-.04125	-6.306	35	.000
	Pair 9	DSTPT2 - DSTPT1	-.21500	.24518	.04086	-.29796	-.13204	-5.262	35	.000
	Pair 10	$R1_2$ - $R1_1$	**.389**	**1.337**	**.223**	**-.063**	**.841**	**1.745**	**35**	**.090**
	Pair 11	$R2_2$ – $R2_1$	.00861	.00961	.00160	.00536	.01186	5.378	35	.000
	Pair 12	$R3_2$ – $R3_1$	.06673	.07245	.02392	.02168	.00343	2.241	35	.000

Based on the interpretation of obtained t-test results for paired samples which were applied to each variable separately, and for the purpose of testing the assumption that a change will occur between the two measurements, we can conclude that the tri-monthly "MBS Yoga" programme leads to statistically significant changes in the experimental group for each variable of analyzed motor space between the initial and final measurements. A much larger significance of change under the influence of targeted training was noted in the experimental group of subjects when compared to the control group.

Discriminant analysis was applied to determine the statistical significance of quantitative changes in all the observed variables, and to determine what variables lead to a statistically significant difference between the experimental and control group subjects.

The results of Barttlet's Chi-square test (Table 3) shows that the obtained discriminant function is significantly different between the groups in the final measurement with a canonical correlation of 0.806 and a statistical significance of $p = 0.00$. The Chi-square test confirmed a statistically significant difference between the experimental and control groups of subjects in the area of motor skills. The obtained discriminant function was used to determine which applied variable(s) led to significant differences between the experimental and control groups. Such data clearly displays the guidelines covering the influence of the "MBS Yoga" recreational programme on transformation of motor space for subjects. (Schell FJ, Allolio B, Schoneck OW, 2001). It was particularly important to accurately detect the size of the variables that best define the differences, in order to more precisely determine the segmentary orientation of the particular operators in the applied "MBS Yoga" programme (Mavrin, M., 2000).

Table 3. Chi-square test of the discriminant function

Eigenvalues				
Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	1.857[a]	100.0	100.0	**.806**
Wilks' Lambda				
Test of Function(s)	Wilks' Lambda	Chi-square	Df	Sig.
1	.350	64.556	11	**.000**

Table 4. Structure of the discriminant function

Variable	Function 1
FI	.308
FPR	-.048
FPLL	.512
SSHI	.342
SSIP	.334
SSIZP	.135
DSBP	-.155
R1	-.367
R2	-.313

The structure of a discriminant function (Table 4) indicates which variables mostly differentiate these two groups of subjects in the final measurement. In this case, it is the variable "bench crunches" (FPLL) with a correlation coefficient indicating a discriminant function of .512. This variable, In synergy with other variables, which determine the area of flexibility in the best possible manner, illustrates the primary impact of the "MBS Yoga" programme (Garfinkel M, Schumacher HR Jr., 2002). The variable FPLL, which has the greatest variability of defining the obtained discriminant function, provides insight into how the "MBS Yoga" programme mostly discriminates the level of transformational performance between the two groups of subjects with respect to developing flexibility.

This conclusion certainly justifies the programme's actual targeted orientation, selection of carrier and the frequency of these exercises in the applied trimonthly programme (AMJ, 2004). Besides these variables, the variables in the area of static (isometric) force also associated with large statistical values (SSIP - .334, SSHI - .342 and SSIZP - 135), largely define the discriminant function that distinguishes the experimental group from the control group in the final measurement. The data justifies the objectives of the programme, which was directed towards increasing activation of the stabilizer muscle by static contractions. žEndurance' exercises were well chosen because they produced transformational results that discriminate improvement in the motor status of subjects in the experimental group (Braith, RW, JE Graves, SHLeggett, ML Pollock, 1993). The rest of the explanation covering the discriminant function is assumed by variables that determine dynamic power and balance. (DSBP - .155, .367, and R 1-R 2 -. 313).

Interpretation and discussion of the results obtained by discriminant analysis of differences in the effects of the applied programme on groups of subjects lead to the following conclusions: a specifically targeted trimonthly "MBS Yoga" programme leads to a statistically significant change when comparing the experimental and control groups in all treated variables used for assessing the motor status of subjects.

Concluding

The concluding observations on the transformational effects of the applied programme and obtained differences between the two treated groups of subjects can be addressed in several ways: (1) One of the primary objectives of this research was to determine the differences between the experimental and control group of subjects. In order to analyze the difference between the groups a t-test (for independent samples) was applied. The statistical significance in differences between the experimental and control groups for all variables was proved, except for the variable "Bench press" (DSBP) which assesses repetitive muscle strength of the upper body through a movement called press.

The differences between the experimental and control group of subjects was due to the influence of different programs. The experimental group conducted the "MBS Yoga" programme that includes exercises specifically focused on the development of selected motor skills in the research (flexibility, strength and balance). The control group of subjects conducted the set physical education curriculum; (2) After analyzing t-test results for paired samples with respect to each of the variables individually, the following sub-conclusions can be drawn: there are between two measurements in all variables of the control and experimental groups, except for the variable "standing on one leg lengthwise on the balance bench with eyes open" (R1) in the control group of subjects, with the largest differences evident in the area of flexibility for the experimental group occurring because the "MBS Yoga" programme is based on yoga exercises (Raub JA, 2000),

(3) Statistical indicators of the positive effects on the changes in balance, especially in the variable "standing on one leg lengthwise on the balance bench with your eyes open," confirm one of the goals of the "MBS Yoga" programme, which is improving balance. Furthermore, this difference between the two groups is attributed to exercising during the programme with eyes closed, because the fact is that to maintain the body posture, a person uses information coming from the joints, skin, muscles and tendon mechanoreceptors, from the centre of gravity (located in the middle ear) and the visual system. By eliminating the information that comes to us from the outside world, we rely more on the information we have received earlier, from our motor patterns (Fitts, RH, McDonald, KS, Schluter, JM, 1991),

(5) results from Barttlet's Chi-square test and the results from canonical correlations prove that the obtained discriminant functions define quantitative changes between initial and final measurements in each experimental group for each tested motor space under the influence of the "MBS Yoga" programme. These results indicate that the experimental programme using targeted exercises produced positive transformational effects in the manifest

space of balance, strength (repetitive and static) and flexibility, and (6) the conducted "MBS Yoga" recreational programme has a positive effect on the transformation of the dimensions incorporating strength, balance and flexibility in the experimental group of subjects.

However, it is important to mention, however, the greatest contribution of this program demonstrated for flexibility due to the abundance of yoga, balance area because the program in certain parts of running with your eyes closed. The value obtained results in motor strength enables even better conception of the "MBS Yoga" (Maheshwarananda PS, 2000).

Larger differences between the groups were not obtained, and perhaps would be obtained had it been done on an older population, because young, healthy women naturally have a higher level of health.

Recreational programs can achieve the desired effects only if they meet the full criteria for a well-designed program, professional staff, individualized approach, insight into the initial state of the individual, and a sense of the needs of program participants.

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