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Physiological and psychological responses to a 12-week BodyBalance training programme

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Summary BodyBalance is a popular mind—body program practised at numerous leisure centres throughout the western world that makes many unsubstantiated claims as to the benefits of participation. This study examines physiological and psychological responses in adults, aged (mean ± S.D.) 43.9 ± 10.9 years, to a 12-week 'BodyBalance' exercise program. An exercise intervention group ($n = 17$) undertook three 1-h classes, each week for 12 consecutive weeks while the control group ($n = 17$) attended three 90-min 'health lectures'. ANCOVA demonstrated significant differences between the control and exercise groups in body mass, skinfold measures, total girth circumference from six sites, maximal isometric back strength, five measures of flexibility and state anxiety. Post-hoc tests on the experimental group data showed body fat decreased significantly by 1.10 ± 1.02% ($t = 4.44$; $P < 0.01$), girth by 4.40 ± 5.80 cm ($t = 3.13$; $P < 0.01$) and back strength increased by 17.12 ± 15.39 kgf ($t = -4.59$; $P < 0.01$). Flexibility was also significantly enhanced with performance of the modified sit-and-reach test increasing by 5.90 ± 2.56 cm ($t = -9.50$; $P < 0.01$), hip flexion by 9.84 ± 8.41° ($t = -4.82$; $P < 0.01$), hip extension by 7.65 ± 4.48° ($t = -7.04$; $P < 0.01$), hip abduction by 10.00 ± 4.91° ($t = -8.40$; $P < 0.01$) and lateral trunk flexion by 3.06 ± 5.72° ($t = -2.21$; $P < 0.05$). Finally, state-anxiety (STAI) was significantly reduced intra-class at weeks 1, 6 and 12 by 9.24 ± 9.46 ($t = 4.02$; $P < 0.01$), 6.59 ± 6.26 ($t = 4.34$; $P < 0.01$) and 7.18 ± 5.50 ($t = 5.38$; $P < 0.01$), respectively. The findings of this study suggest mind—body exercise programs like BodyBalance could significantly benefit state-anxiety as well as strength, flexibility, and anthropometry around the trunk.

Introduction

Mind—body exercise formats are becoming more prominent throughout the fields of health and fitness, irrespective of the volume of unsupported claims relating to their benefits.[1] They suggest the ability to enhance performance, improve general health or facilitate rehabilitation but without the research base currently available to conventional methods of exercise. This may be attributed to the difficulty of measuring certain 'holistic'

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or spiritual elements alongside a distinct lack of accessible research funding.[2] The shortfall of evidence, however, does not seem to influence the ever-expanding popularity of mind—body exercise within the leisure market. The types of holistic workouts currently fashionable include both traditional methods such as yoga and tai chi and those more recently developed such as Pilates, Feldenkrais and BodyBalance. The latter, 'BodyBalance', is simply the trade name of a 60-min pre-choreographed program formulated to represent a fusion of teachings from yoga, tai chi, Pilates and Feldenkrais.[3,4] To date, however, BodyBalance has not been the subject of any peer-reviewed, independent research. This study therefore seeks to investigate selected aspects of the program but will need to rely upon earlier research conducted into holistic practices that underlie its foundation.

The modality of yoga constitutes the greatest portion of the BodyBalance workout. Firstly, research into this discipline has suggested participation produces a positive influence upon blood pressure (BP) and heart rate (HR) in both hypertensive and normotensive subjects.[5,6] In addition, there is an indication that this workout may improve respiratory disorders in asthmatics and smokers as well as being of benefit to those diagnosed with no lung disease.[7,8] Next, investigations into yoga, tai chi, Pilates and Feldenkrais with respect to musculoskeletal disorders such as osteoarthritis and chronic low back pain have shown a reduction in pain intensity, functional disability and medicinal dosages.[9—11] This in turn would lead to improvements in an individual's health-related quality of life and self-efficacy of pain.[12—14] Participation in yoga, tai chi and Feldenkrais in association with psychological disorders, have also demonstrated reductions in anxiety and stress.[15,16] Consequent upon this are greater feelings of tranquillity, contentment and enhanced short-term mood states.[17—19] Finally, participation in all of these mind—body formats have been shown to influence the three components of fitness; namely flexibility, muscular strength and cardiovascular.[20—22] Since BodyBalance includes elements of the workouts discussed above, a reasonable assumption is that it would also reap similar benefits, thereby attaining results suggested in the BodyBalance literature, such as improved flexibility, mobility, posture, anxiety and muscle strength.

One matter to reflect upon when scrutinising the respective investigations supporting the foundations of BodyBalance are the inherent weaknesses that lie within their research design. One example often discovered in this field is the lack of appropriate, independent control groups whose absence would shed some doubt upon the resulting validity of the study.[8,23,24] There are also many studies in existence that display no significant changes following mind—body exercise intervention, particularly with variables such as flexibility, strength, body composition and BP.[13,23,25]

The principal objective of this longitudinal study was to investigate physiological and psychological responses derived from BodyBalance with particular reference to research from associated programs. It also aims to consider some of the claims made by its promoters.

Methods

Subjects

A selection of 40 healthy adults, 8 male and 32 female, participated in this study. Their mean age, height and weight were 43.89 ± 10.94 years, 166.42 ± 8.05 cm and 72.87 ± 14.88 kg, respectively. Exclusion criteria applied were as follows: (a) individuals who were participating in or had within the preceding three-month period participated in mind—body programs; (b) were not within a specified age band of 18—65 years; (c) had suffered from any medical conditions that would influence the integrity of the results or compromise safety during BodyBalance classes, such as disorders that could affect balance or pregnancy. Volunteers were randomly assigned to either a control lecture group ($n = 20$) or an exercise intervention group ($n = 20$). The method of assignment required names to be divided into two boxes based upon gender and then alternately allocated to each group via a blind draw; this resulted in four men and 16 women per group. Six of the subjects did not complete the study for the following reasons. One male from the control group and two males from the exercise group withdrew because of work commitments. One female from the control group ''... felt there was nothing to be gained ...'' and the other two females, one from each group, incurred an injury or illness that prevented them from participating. The physical characteristics of the remaining subjects ($n = 34$) are listed in Table 1. All subjects provided written informed consent before participating in the study, which had prior approval by the University Ethics Board. Informed consent included the rights of the subjects to withdraw from the study at any stage along with terms of the honorarium that provided control group subjects with an 8-week leisure centre workout-pass upon completion.

Table 1 Physical characteristics of participants and anthropometric measures (mean ± S.D.)

Parameter	Control group ($n=17$) (3 male, 14 female)		BodyBalance group ($n=17$) (2 male, 15 female)		
	Baseline	Post-treatment	Baseline	Post-treatment	$F_{(1,31)}$ value
Age (years)	40.8 ± 12.9	41.0 ± 12.9	43.8 ± 9.1	44.1 ± 9.0	0.666
Height (cm)	167.5 ± 8.2	167.6 ± 8.2	166.0 ± 8.3	165.8 ± 8.4	1.140
Body mass (kg)	75.0 ± 17.4	75.3 ± 16.8	71.5 ± 13.4	70.6 ± 12.1	8.258**
BMI	26.7 ± 5.4	26.8 ± 5.2	26.0 ± 4.6	25.7 ± 4.2	4.669*
Body fat (%)	31.5 ± 7.0	31.4 ± 7.1	34.0 ± 5.9	32.9 ± 5.2**	5.990*
Arm Girth (cm)	31.3 ± 4.7	31.4 ± 4.7	31.3 ± 3.9	31.1 ± 3.4	1.599
Chest girth (cm)	97.6 ± 10.5	97.4 ± 10.3	94.5 ± 7.3	94.0 ± 6.8	0.804
Waist girth (cm)	87.9 ± 16.1	88.7 ± 16.3	85.2 ± 10.7	82.7 ± 9.2**	18.718**
Hip girth (cm)	105.3 ± 10.4	105.5 ± 9.6	104.1 ± 8.2	103.2 ± 7.4*	8.558**
Thigh girth (cm)	61.0 ± 7.0	62.5 ± 9.0	59.7 ± 5.4	59.9 ± 5.0	1.212
Calf girth (cm)	38.7 ± 4.1	38.5 ± 4.0	37.9 ± 2.9	37.4 ± 2.9	3.802
Σ Girths (cm)	421.9 ± 49.0	423.0 ± 48.4	412.6 ± 35.3	408.2 ± 31.2**	13.814**

BMI, Body mass index; $*P<0.05$; $**P<0.01$.

Procedure

The timetable scheduled a battery of anthropometric, physiological and psychological evaluation tests immediately before a 12-week treatment period. The parameters included in the series were BP, pulmonary function, flexibility, back strength, aerobic power, height, body mass (BM), girth, body composition, state-anxiety and mood. Re-testing of participants successfully completing the intervention utilised the same assessment measures as baseline.

For 12 consecutive weeks, subjects attended either BodyBalance classes or general health lectures. There were three 60-min BodyBalance classes conducted in the college gymnasium each week led by a qualified BodyBalance instructor. The choreography employed, specifically formatted for BodyBalance 25 (Table 2), ensured that each class was the same in terms of its movement components. If a subject was unable to participate in a scheduled class, attendance at an alternative local leisure venue also using BodyBalance 25 assisted completion of their 36 classes ($n=18$ attended by BodyBalance group). From the BodyBalance group no subject missed more than four classes, resulting in 19 classes (3%) not undertaken within the group and an average individual attendance of 34.88 ± 1.50. Likewise, the control group attended three 90-min lunchtime discussion groups, one each month, formed around aspects of nutrition, health and exercise from which one subject missed two sessions and another a single session. These supervised lectures attempted to compensate for some positive benefits upon mood derived from social group stimulation and instructor attention without producing a training effect.[17]

Table 2 Breakdown of the BodyBalance workout

Track	Min	Objective	Main composition
1	4.40	Warm up	Tai Chi: Centering, breathing, mobility
2	6.20	Sun Salutations	Yoga poses: Mountain, down/up dog, cobra
3	6.30	Standing Strength	Yoga poses: Warrior, triangle
4	4.40	Balance	Yoga poses: Mountain, tree, star, eagle
5	4.30	Hip Openers	Yoga poses: Mountain, swan, half lotus, frog
6	4.40	Core—Abdominals	Yoga, Pilates/Feldenkrais: Boat pose, leg raise, curls
7	4.00	Core—Back	Yoga poses: Horse, crocodile, upper/lower locust, bow
8	4.35	Twists	Yoga: Mountain pose, standing balance twists, lunges
9	4.25	Forward Bends	Stretches including hamstring, adductor, oblique
10	5.20	Relaxation	
11	2.05	Meditation	

Measures

Anthropometry and body composition

Subjects were required to wear the same light clothing with bare feet for both testing sessions; the investigator taking the measurements was not blinded to group allocation. Height, mass and girth circumference at six standardised sites were recorded to the nearest 0.1 cm, 0.1 kg and 0.1 cm, respectively. The circumference at the chest, waist, hips, right thigh, right calf and upper portion of the right arm were measured twice in rotation using a Holtain anthropometric tape according to the landmarks detailed in Heyward.[26] The two readings for each anatomical site were then averaged following which the six site averages were added together to provide a single cumulative measure. The Durnin & Womersley equation[27] was used to establish skinfold to the nearest 0.1 mm on the right side of the body. Assessments were taken with Harpenden Skinfold callipers HSK-BI (British Indicators, West Sussex) at the biceps, triceps, suprailiac and subscapular sites.[26] A Holtain anthropometric tape helped to determine any necessary midpoints to assist accurate measurements. Skinfold readings were repeated twice in rotation and the data from each site averaged. The total mean skinfold sum was then entered into analysis software that predicted percentage body fat based upon the skinfold equation attributed to Siri.[27]

Blood pressure and lung capacity

BP assessment was performed after a 5-min seated rest interval. A second reading, taken 2 min later, allowed averages for diastolic and systolic measures to be calculated. A vitalograph-compact spirometer (Vitalograph Limited, United Kingdom) was used to determine forced vital capacity (FVC), inspiratory vital capacity (IVC), forced expiratory volume in the first second (FEV_1) and forced expiratory ratio between FEV_1 and FVC (FEV_1/FVC%). Three trials were conducted for each test and the 'best' result recorded for analysis.

Aerobic power

A 3-min step test was used to assess cardiovascular ability by following the protocol issued by the YMCA.[28] Following a demonstration and practice run covering aspects of technique and safety, the subject was required to step on and off a 12-in. high step platform. A metronome set to 96 bpm dictated the speed of movement and the subject was encouraged to perform continuously at one-step per beat. A stopwatch, started upon first foot placement on the platform, monitored the required time of 3-min. The researcher informed subjects as each minute elapsed and when the final 15 s remained. A Polar HR monitor (Polar Sport Tester, Finland) was attached around the chest; the mean HR over 3 min was recorded upon completion of the test.

Strength

The test to determine the isometric muscle strength of the back followed the protocol listed within the 'back dynamometer' manual (Takei & Company Limited, Tokyo). The measuring accuracy of the unit was given as ± 3 kgf in 150 kgf. The subjects were required to stand on the back dynamometer footplate, holding a bar attachment with a natural overhand grip. From a forward flexed starting position of 30°, they were then to return to upright stance without using any knee flexion, pulling the handle up gradually. The researcher demonstrated the move prior to testing and the subjects performed a practice trial to familiarise themselves with the equipment. The three trials conducted were interspersed with 1-min rest intervals and the mean value used for analysis.

Flexibility

The modified sit-and-reach test protocol[29] was used to assess trunk and hamstring flexibility. The subjects sat on the floor with their buttocks, shoulders and head in contact with a wall, both feet placed against the front surface of a 12 in. high sit-and-reach box and arms outstretched in front resting on the superior surface of the box. A yardstick was then set at the point where the subjects' fingertips ended and the objective was to slide the hands slowly along the top of the yardstick, holding them for two seconds at the furthest attainable point. The best of three trials was noted.

Trunk 'range of motion' (ROM) was assessed using a clinical goniometer accurate to $\pm 1°$ using the procedure outlined in Heyward.[26] All trials called for the pelvis to be held stationary, thus preventing unwanted rotation or tilting. The three tests to assess hip joint ROM (namely hip flexion, hip extension and hip abduction) required that the subjects commenced the test lying on a physiotherapy bench with the knees fully extended. The final test, to assess thoracic and lumbar lateral flexion, involved the subjects starting from an upright stance with arms hanging down alongside the body. All measures were repeated three times and the average used to provide four measures of flexibility.

Psychological assessments

All questionnaires used in this study followed the administration design advocated in their respective manual.[30–32] Firstly, the 12-item General Health

Questionnaire (GHQ) and the 20-item 'trait' aspect of the Stait-Trait Anxiety Inventory for Adults (STAI—Y2) were administered upon arrival at the first class and the final testing session. In addition, subjects had to complete the 20-item 'state' anxiety questionnaire (STAI—Y1) and the 24-item Profile of Mood States—Adolescents (POMS-A) immediately before and after three specified classes, one in each of weeks 1, 6 and 12. The GHQ-12 gauges general health and in particular aims to identify depressive and anxiety-related disorders within the 2-week period preceding its completion. It consists of questions such as ''Have you recently lost much sleep over worry?'' and lists responses from ''Not at all'' to ''Much more than usual''. It is scored on a simple Likert scale from 0 to 3. The STAI, extensively used to investigate anxiety within exercise-based research, is evaluated on a 4-point Likert-type format from 1 to 4.[33] The STAI Y-1 measures how the respondent feels ''... at this moment ...'' and is graded from ''Not at all'' to ''Very much so''. The STAI Y-2 obtains an indication of how the subject ''...generally feel[s]'' from ''Almost never'' to ''Almost always''. Included are statements such as ''I feel calm'' or ''I am happy''. Finally the POMS-A, again an instrument often used within exercise and anxiety literature, assesses the six subscales of tension, depression, anger, vigour, fatigue and confusion and encompasses four items within each subscale.[34] It again asks subjects to describe how they relate ''right now'' to feelings labelled ''Lively'' or ''Anxious'' and graded from ''Not at all'' to ''Extremely'' on a 5-point Likert scale of 0—4. The Total Mood Disturbance score (TMD) calculation weights vigour as a negative factor and deducts this value from the sum of the remaining five states.[31]

Statistical analysis

Baseline data was assessed for normality and outliers greater than ± 3S.D. were excluded. Post intervention data were analysed for group differences using ANCOVA on SPSS (version 11.5) software with the baseline measures as the covariate. All data were expressed as mean and standard deviation. Independent *t*-tests were used post hoc to examine any observed differences on the unadjusted data between the two groups at commencement of the study. Likewise, paired samples *t*-tests investigated significant differences between the preliminary and post-intervention results within each group. Statistical significance of the main effects was set at $P < 0.05$.

Results

The BodyBalance group and control group did not differ significantly at baseline for all anthropometric, physiological and psychological measures with two exceptions; these are forced expiratory ratio of FEV_1/FVC and the GHQ-12. Subsequent analysis of these factors found no statistically significant differences in the ensuing change over the 12-week intervention period. There were no significant changes in the control group between any of the baseline and the post-testing sessions.

Comparisons of anthropometric data are displayed in Table 1. Univariate ANCOVA revealed a significant effect of BodyBalance intervention on BM,

Table 3 Cardiorespiratory, strength and flexibility measures (mean ± S.D.)

Parameter	Control group ($n = 17$)		BodyBalance group ($n = 17$)		
	Baseline	Post treatment	Baseline	Post treatment	$F_{(1,31)}$ value
Mean IVC (l)	3.3 ± 0.9	3.2 ± 0.8	3.1 ± 0.5	3.2 ± 0.5	0.400
Mean FVC (l)	3.2 ± 0.8	3.3 ± 0.8	3.2 ± 0.5	3.1 ± 0.5	3.356
Mean FEV_1 (l)	2.9 ± 0.7	2.9 ± 0.7	2.8 ± 0.5	2.8 ± 0.5	0.662
FEV_1/FVC (%)	90.4 ± 7.9	88.2 ± 10.2	84.8 ± 6.2	85.1 ± 4.6	0.451
SBP (mm Hg)	125.4 ± 21.8	123.1 ± 21.9	114.4 ± 13.2	112.8 ± 11.7	0.409
DBP (mm Hg)	78.4 ± 11.7	77.3 ± 14.6	72.0 ± 9.9	73.6 ± 8.7	0.056
Resting HR (bpm)	75.7 ± 10.5	76.2 ± 10.5	70.7 ± 8.4	72.0 ± 11.2	0.064
Exercise HR (bpm)	144.3 ± 17.5	143.7 ± 19.1	137.4 ± 17.6	136.6 ± 17.5	0.032
Back Strength (kgf)	65.8 ± 29.7	67.8 ± 28.4	75.6 ± 35.9	92.7 ± 28.1**	15.474**
Sit and Reach (cm)	36.5 ± 8.2	36.1 ± 9.3	34.2 ± 6.6	40.1 ± 5.7**	39.940**
Hip flexion (°)	109.6 ± 13.3	110.3 ± 13.4	113.8 ± 10.6	123.7 ± 8.2**	21.190**
Hip extension (°)	10.5 ± 5.5	10.1 ± 5.6	10.7 ± 8.1	18.3 ± 8.5**	37.004**
Hip abduction (°)	33.0 ± 8.5	31.5 ± 6.9	29.7 ± 9.5	39.7 ± 9.3**	51.180**
Lateral flexion (°)	62.3 ± 7.4	60.5 ± 10.1	64.1 ± 9.4	67.1 ± 8.1*	6.341*

IVC, inspiratory vital capacity; FVC, forced vital capacity; FEV_1, forced expiratory volume in the first second; SBP, systolic blood pressure; DBP, diastolic blood pressure; HR, heart rate; *$P < 0.05$; **$P < 0.01$.

Body Mass Index (BMI) and skinfold complemented by changes of circumference measurements taken around the trunk region. Both waist and hip girth were significantly reduced along with the sum of the six sites for which girth was measured.

No significant changes were displayed in pulmonary or cardiovascular data (Table 3). This included a measure of aerobic power (exercise HR) as determined by the 3-min step test. However, significant group differences were shown for the changes in back strength and flexibility of muscles surrounding the 'core'. Maximal isometric strength of the lower back showed a relative increase in the BodyBalance group. Likewise, all five tests related to flexibility also increased. The sit-and-reach test and the 'ROM' resulting from hip flexion, extension and abduction and lateral flexion were all significantly enhanced.

The last area investigated in this study relates to psychological data obtained using specific questionnaires, namely the STAI-Y1, STAI-Y2, POMS and GHQ questionnaires (Table 4). First, there were no significant changes in trait anxiety (STAI-Y2) from baseline for either of the groups. State anxiety (STAI-Y1) however was influenced by participation in a BodyBalance workout with the results recorded between the commencement and completion of each of three specified classes in weeks 1, 6 and 12 displaying a significant reduction. Furthermore, ANCOVA demonstrated a highly significant difference in state anxiety over the duration of intervention between the two groups from classes 1 to 12; although post hoc *t*-tests showed neither the anxiety increase of the control group or the decrease of the exercise group were significant separately. Finally, ANCOVA also highlighted a

Table 4 Psychological Measures (mean ± S.D.)

Parameter	Control group ($n = 17$)		BodyBalance group ($n = 17$)		
	Pre-treatment	Post-treatment	Pre-treatment	Post-treatment	$F_{(1,30)}$ value
STAI—Y2	38.8 ± 8.6	35.9 ± 10.1	40.0 ± 9.6	37.7 ± 11.1	0.073
GHQ-12	9.3 ± 2.5	9.3 ± 3.0	13.9 ± 7.0	9.2 ± 6.7	1.054
STAI-Y1[a]	32.2 ± 7.7	35.3 ± 8.8	29.6 ± 10.0	26.9 ± 7.6	9.916**
STAI-Y1 week 1	33.6 ± 10.0	32.2 ± 7.7	38.8 ± 14.1	29.6 ± 10.0**	6.080*
STAI-Y1 week 6	31.4 ± 7.9	31.9 ± 7.7	32.7 ± 9.1	26.1 ± 7.8**	14.172**
STAI-Y1 week 12	36.0 ± 7.6	35.3 ± 8.8	34.1 ± 9.8	26.9 ± 7.6**	14.630**
POMS week 1					
Tension	2.0 ± 3.5	1.1 ± 2.0	3.4 ± 3.0	1.3 ± 2.8	0.932
Depression	1.7 ± 2.8	0.8 ± 1.3	3.2 ± 4.7	1.2 ± 2.8	0.011
Anger	1.2 ± 2.8	0.5 ± 1.1	3.0 ± 4.4	0.9 ± 2.5	0.127
Vigour	8.8 ± 3.2	8.9 ± 3.4	7.4 ± 3.0	7.4 ± 3.6	0.197
Fatigue	3.6 ± 3.5	3.0 ± 3.1	4.2 ± 3.8	4.8 ± 4.3	1.912
Confusion	2.1 ± 3.8	1.3 ± 1.8	3.2 ± 3.9	1.8 ± 2.9	0.006
POMS week 6					
Tension	1.6 ± 2.9	1.1 ± 1.5	1.2 ± 1.3	0.6 ± 1.3	1.000
Depression	1.1 ± 2.1	0.9 ± 1.7	1.1 ± 1.9	0.4 ± 1.2	2.269
Anger	0.6 ± 1.6	0.6 ± 1.5	1.2 ± 2.1	0.1 ± 0.3	3.716
Vigour	8.8 ± 3.5	8.6 ± 3.2	7.7 ± 3.6	7.9 ± 3.6	0.013
Fatigue	3.5 ± 3.0	4.4 ± 4.7	3.0 ± 2.1	2.4 ± 2.2	2.102
Confusion	1.6 ± 1.8	1.7 ± 2.3	1.4 ± 2.0	0.7 ± 1.5	3.421
POMS week 12					
Tension	1.7 ± 1.4	1.5 ± 2.0	1.9 ± 2.1	0.6 ± 1.2**	5.647*
Depression	1.7 ± 2.5	1.1 ± 1.8	1.7 ± 2.2	0.6 ± 1.2**	4.212*
Anger	1.2 ± 2.2	0.8 ± 1.5	1.1 ± 2.0	0.1 ± 0.3	4.989*
Vigour	9.0 ± 3.7	8.9 ± 3.9	8.9 ± 2.8	8.2 ± 3.1	0.461
Fatigue	2.9 ± 3.4	3.1 ± 4.2	3.2 ± 3.5	2.1 ± 1.9	3.084
Confusion	1.7 ± 2.1	1.4 ± 1.9	1.7 ± 2.2	0.9 ± 1.5	1.696
TMD week 1	41.9 ± 14.6	37.8 ± 7.8	49.7 ± 20.2	42.6 ± 15.5	0.101
TMD week 6	39.6 ± 10.9	40.2 ± 10.2	40.2 ± 9.5	36.2 ± 7.0	2.639
TMD week 12	40.2 ± 10.8	38.9 ± 10.6	40.7 ± 12.4	36.1 ± 7.0	2.830

STAI, State Trait Anxiety Inventory; GHQ-12, 12-item General Health and Quality of Life; POMS, profile of mood states; TMD, total mood disturbance. $^{*}P < 0.05$, $^{**}P < 0.01$.

[a] End of 1st class—end of last class.

significant relative reduction for the BodyBalance group in three factors on the POMS questionnaire —'tension', 'depression' and 'anger' — between the beginning and the end of the week 12 class.

Discussion

With an ever-increasing trend to encourage participation in holistic exercise, there is both the need and opportunity to develop research within this field. The purpose of the current study was to investigate changes in a variety of physiological and psychological measures for subjects partaking in 'BodyBalance' and determine any validity to the 'benefits' claimed. These are discussed in light of previous investigations into yoga, tai chi, Pilates and Feldenkrais.

The first physiological measure of interest is the highly significant reduction in BM that occurred over the course of the exercise intervention program. This added to the significant reductions in body fat, BMI and the sum of girths measured at six sites leads to the conclusion that weight loss accompanies an increase in lean BM. Particularly noticeable is that the sites that were significantly reduced — namely the waist and hips — would imply the main effect to be around the trunk region. Earlier investigations recording anthropometric measures have often produced differing results and suggestions have been made that change, or indeed the absence of change following mind—body intervention, may be influenced by frequency of classes, duration of intervention or modality of exercise.[23,35]

A number of earlier studies using yoga intervention that measured vital capacity along with inspiratory and expiratory pressures resulted in significant improvements in pulmonary measures.[7,8] This is unlike the findings of the current study where no significant changes were determined within such factors. In addition, there were no changes to systolic and diastolic blood pressure readings. Although one particular study conducted with tai chi over a 12-month period[25] supports these findings, a large proportion of other research based on yoga breathing and yoga exercise classes[5,6] produced a significant reduction in BP. The reason for this may be the percentage of breathing exercises and relaxation incorporated within the yoga workouts as opposed to that within BodyBalance or the form of tai chi undertaken. With respect to components of fitness, the American College of Sports Medicine guidelines for flexibility[28] recommended that participants should attempt to exercise on 'at least 3 days per week' with a 'major emphasis on [the] lower back and thigh area'. They suggest that lack of flexibility in specified areas may have connections to chronic low back pain. BodyBalance performed on three separate occasions during each week of the intervention period meets this criterion. This particular study supports the program's effectiveness to increase flexibility as tests for sit and reach, hip flexion, hip extension, hip abduction and lateral flexion all displayed significant improvements. However, an increase in flexibility is not always the outcome of holistic style exercise.[13] Another component of fitness is strength and, of particular interest to this study concerned with 'core' type training methods, is back strength. The back strength dynamometer, which measures maximal force generated by the lower back in 1-repetition maximum (1-RM), indicated a significant improvement in the strength of that muscle group. This reinforces the improvements in trunk strength additionally supported by abdominal strength gains ($P < 0.01$) found by Song et al.[13] in a tai chi study. No changes, however, were discovered in aerobic power, although improvements were found in a tai chi study that utilised the same 3-min step test as a measure.[20] One contributory factor to the outcome may have been the age group, as tai chi participants were older adults whereas the BodyBalance group had an average age of 44 years.

The last area under scrutiny covers psychological parameters and relates predominantly to state and trait anxiety as defined by the STAI-Y1 and STAI-Y2, respectively. The STAI-Y1 questionnaire assesses how a subject feels at a particular moment in time. The findings resulting from participation in a BodyBalance class showed a significant reduction in anxiety. This is in agreement with Berger and Owen,[17] who reported that Hatha Yoga produced significant short-term reductions in state anxiety following exercise, and Kerr et al.,[15] who showed state anxiety scores to decrease significantly over a single lesson of Feldenkrais. In addition, state anxiety over the duration of the intervention period also showed a statistically significant decrease in the experimental group in contrast to an increase in the control group. These longitudinal findings again support research by Kerr et al.,[15] who found state anxiety measured using the 20-item STAI improved significantly from baseline to the end of the 10-week intervention period. This is irrespective of the fact that Kerr gave no indication of a control group and that Feldenkrais, the mode of exercise used in that study, is considered a more sedentary exercise form than BodyBalance. Finally, the results of POMS in this study do not wholly support Kolt et al.[16] who assessed Feldenkrais participants for state anxiety on four occasions over 2 weeks using the 12-item

POMS-B1 questionnaire, ultimately reporting significantly lower scores. Kolt acknowledges that results may have been because subjects anticipated a change in anxiety. Following the large number of tests completed and the longer intervention period for the current study, this effect would be negligible, leaving results to show significance only in the tension, depression and anger components at week 12. It is possible that this, in turn, could be attributable to participant feelings connected to it being the final class of the series.

An acknowledged limitation of this study is the lack of investigator blinding. Author involvement in maintaining attendance and encourage adherence to the program meant, consequently, awareness of participant group affiliation during the final assessment. Future studies on mind—body exercise formats such as BodyBalance should control for this element.

Conclusion

The findings of the current study reinforce the concept behind mind—body exercise as a means of strengthening the core or central region of the body. Along with changes in flexibility, this could enhance posture, strengthen body tone and possibly lead to a reduction in associated ailments and conditions such as chronic back pain. This, in conjunction with the reduction in state anxiety, would support some of the claims presented by the company behind BodyBalance. There were, however, many cardiorespiratory and mood states that were not influenced even though changes had been apparent in its composite holistic disciplines. Additionally, research is also suggested to investigate parameters such as balance and posture that may arise following changes in core strength and flexibility.

Practical implications

- Mind-body exercise formats can be used to improve strength, flexibility and anthropometry around the trunk region.
- Body Balance and other similar programmes can help to reduce anxiety.
- The benefits derived from a mind-body programme will vary depending upon the type of exercise components emphasised within the workout.
- Not all mind-body programmes are effective in alleviating high blood pressure and respiratory disorders.

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