FACTORS INFLUENCING CHANGES IN TWEEZER DEXTERITY SCORES FOLLOWING YOGA TRAINING

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Abstract: Yoga has already been shown to improve perceptual-motor skills, but the factors which influence its effects are not well defined. This study correlates age, gender, and motivation to learn yoga with the performance in a dexterity task following yoga. Tweezer dexterity was recorded in eighty subjects belonging to four groups. Two groups were given a month of yoga training. One group consisted of subjects who had volunteered to join for the training and the other group was deputed for the training as part of their job. The two remaining groups did not receive yoga training and were selected to match the respective groups receiving yoga, for age and sex, but not for their motivation to learn yoga. The test involved using a tweezer to place metal pins in evenly spaced holes in a metal plate within four minutes. Following yoga the scores of the volunteers who learnt yoga increased significantly, whereas there was no change in scores of deputed subjects and non-yoga groups. For reasons described in detail, factors such as age and gender did not appear to contribute to the difference in performance. Hence motivation to learn yoga appeared to influence the magnitude of increase.

Key words: Tweezer dexterity; yoga; motivation.

INTRODUCTION

The practice of yoga requires active participation of the subject. Hence the effect of factors such as the motivation to receive yoga training, as well as the subject's age and gender may be expected to influence the outcome. This is interesting to study as yoga training is increasingly being included as part of the routine program of various institutions ranging from schools (1) to jails (2), where subjects with different backgrounds and levels of interest in the program may participate.

The performance in perceptual-motor tasks requiring skill and attentiveness such as mirror star tracing (3) and hand steadiness (4, 5) was reported to improve following the practice of yoga. The present study compared scores in a dexterity task following yoga between two groups which differed with respect of their age, gender and motivation to learn yoga. Previous reports have shown that the performance in a peg moving task was stable between the third and fifth decade of life (6). Hence age differences may not be expected to contribute to baseline differences in performance in a motor task, though the correlation with performance after yoga has not been worked out. However gender does make a difference to dexterity, as a previous report (7) has shown that females have a higher baseline score on a dexterity task than males. The effect of gender on performance following yoga has also not been studied. Hence in the present study an attempt was made to understand the relative contribution of each of these factors (i.e., age, gender, and motivation to learn yoga) to the performance after yoga.

METHOD

Subjects

There were four groups having twenty subjects each. Two groups consisted of (i) volunteers for yoga training (group average age 23.1±4.4 years; 10 male and 10 female subjects) and (ii) those deputed from their work place for training in yoga (group average age 32.5±4.1 years; all male subjects). Both groups practised yoga for a month. The other two groups consisted of corresponding age and gender matched subjects who were not given yoga training. These two control or non-yoga groups were not matched for motivation with the yoga groups. However, they did not appear to be specially motivated to learn yoga, as none of them asked for yoga training

though the option of receiving training in yoga after the study was completed, was open to them.

Procedure

All four groups were assessed on a tweezer dexterity task detailed below, at the beginning and end of a month. The assessment was modelled on the O'Connor tweezer dexterity test (8). The apparatus was manufactured by Anand Agencies, Pune, India. Subjects were instructed to pick up cylindrical metal pins with a tweezer using the dominant hand and place them in holes in a metal plate, as quickly as possible. They were told when to begin the test and after 4 minutes were asked to stop. The number of pins placed was counted as the dexterity score. It was noted that all subjects were right hand dominant (for writing, throwing a ball, combing their hair etc.).

Data analysis

A two factor analysis of variance (ANOVA) was used to cheek for significant differences between the four groups, i.e., Factor A, and for difference between recordings on day 1 (before) and day 30 (after), i.e., Factor B. The Tukey test for the least significant difference between means was used for multiple comparisons.

A two factor analysis of variance (ANOVA) was used to test the gender effect, comparing the dexterity scores of three groups (Factor A), viz. the male volunteers (n=10), female volunteers (n=10) and the deputed subjects (all males, n=20). Their day 30 and day 1 data were compared (Factor B). Pairwise comparisons of the values of the three groups were made using the Student-Newman-Keuls method.

Yoga training

Both yoga groups (volunteers and deputed subjects) received 30 days training in asanas 90 min, pranayamas 60 min, kriyas 30 min, meditation 20 min, devotional sessions 60 min, guided relaxation 60 min and lectures on the theory and philosophy of yoga 60 min.

RESULTS

Two factor analysis of variance (ANOVA)

There was a significant difference between the four groups i.e., Factor A, $F=8.79$, $P<.001$. For Factor B (day 30 versus day 1), $F=10.41$, $P<.005$. The interaction between the factors (A x B) was also significant, $F=6.99$, $P<.001$.

Tukey test for multiple comparisons between means

There were significant differences between dexterity scores of the volunteers for yoga training, recorded on day 1 ($q = 7.5$, $P<.001$). The day 30 values of these subjects were significantly different (i) compared to the day 30 values of the deputed subjects ($q=5.0$, $P<.005$) and (ii) compared to the day 30 values of their matched, 'non-yoga' group ($q=5.0$, $P<.005$).

Group averages values + SEM are presented in Table 1.

Table 1: Tweezer dexterity scores in the four groups on day 1 and day 30. Values are group mean ± SEM.

	Day 1	*Day 30*
Volunteers	49.8 ± 2.3	65.4 ± 1.9*
Control	48.3 ± 1.9	48.1 ± 2.5
Deputed	49.6 ± 1.8	54.9 ± 2.2
Control	49.3 ± 2.3	47.6 ± 2.1

**P<0.001 (Tukey test) day 30 values compared with corresponding day 1.*

Separate two factor analysis of variance (ANOVA) specifically to study the gender effect

There was a statistically significant difference between the day 30 and day 1 values of the three groups (F=29.8, DF=1.74, P<.001). There was a marginally significant difference between the three groups, male volunteers (n=10), female volunteers (n=10) and deputed subjects (all males, n=20) [F=3.11, DF=2.74, P=.05]. All pairwise multiple comparisons by Student-Newman- Keuls method showed a significant (P<.05) difference between the day 30 values of deputed subjects compared to those of both male and female volunteers. The day 30 values of male and female volunteers were not significantly different. Both male and female volunteers showed significantly higher values on day 30 compared to their respective values on day 1.

Percentage changes and mean values are given in Table II.

TABLE II: Dexterity scores on day 30 after yoga of male volunteers, female volunteers and deputed subjects (all males). Values are group averages. The p value is for multiple comparisons, pairwise comparing Day 30 versus Day 1 of the respective group with Student-Newman-Keuls test.

Groups	Day 1	Day 30	% Change	P level
Male volunteers (n = 10)	48.1	66.3	37.8	<.05
Female volunteers (n = 10)	51.4	63.9	24.2	<.05
Deputed, all male (n = 20)	49.6	54.9	10.6	>.05 NS

DISCUSSION

The present study showed that one month of yoga training increased tweezer dexterity scores significantly in volunteers but not in deputed subjects. A retest effect could be ruled out as the groups who did not practice yoga showed no change.

Manual dexterity and the ability to perform rapid, fractionated movements depends on the presence of an opposable thumb (9) as well as on monosynaptic connections between the primary motor cortex and the ventral horn motor neurons in the cervical spinal cord (10). For example, in certain new-world primates where the corticospinal fibres end on neurons in Rexed's laminate of the intermediate zone, dexterity is markedly less.

Dexterous or skilled actions depend on the speed of gross movements of hand and arms, manual rhythm, and co-ordination of eye and finger control (11). The present study showed that the practice of yoga improved the performance in the tweezer dexterity task under assessment. An indirect correlation between high anxiety and poor performance in a motor task using a peg board was inferred by Stocker (12), who observed, a trend of least efficient motor performance correlated with high anxiety. Yoga practice for four to eight weeks has been shown to reduce symptoms and objective indicators of anxiety in patients with anxiety neurosis (13). Hence the anxiety-reducing effect of yoga may be responsible for the improvement in tweezer dexterity scores observed in the present study.

The difference in the response of the two groups who received yoga training could be related to three factors viz. (i) age, (ii) gender, and (iii) motivation.

The group average age of the volunteers for yoga training was 23.1 ± 4.4 years, whereas the average age of the deputed subjects was 32.5 ± 4.1 years. However there were four subjects who had exactly the same age in the two groups. The average percentage change among these four volunteers was 20.4%, whereas the four age matched, deputed subjects had an average percentage increase of 2.3%. Though there were only four age matched subjects among the two groups, these results suggest that the differences in age may not have contributed to the differences in performance between the two groups as the same trend was observed. Also, as described earlier, in a previous report the performance in a peg moving task was stable between the third and fifth decade of life (6). While the peg moving task was not same as the dexterity task used in the present study, the results of the peg moving study (6) may be extrapolated to support the conclusion that age differences were not responsible for the differences in performance between the volunteer and the deputed groups in the present study.

In the present study there was also no effect of gender on the dexterity scores after yoga, as the day 30 (after yoga) scores of the male and female volunteers were not significantly different. However the scores of both these groups were significantly higher than the day 30 scores of the deputed subjects, who were all males. These results suggest that gender differences did not influence the outcome.

The difference in motivation to learn yoga therefore remains the factor most likely to have influenced the performance of subjects in the dexterity task. It would have been preferable to have studied a non-yoga motivated group, but this was not possible in the present study. Further studies on groups receiving yoga training, in which motivation of each subject is rated and correlated with objective assessments, would help in understanding the contribution of this factor.

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