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Comparing the Efficacy of Dual Task Training, Strength Training and Aerobic Exercises on Higher Mental Functions in Geriatric Population

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Abstract: ***Background and purpose**: Higher mental functions are one of the important determinants of well-being in elderly. The purpose of this study was to investigate the effect of dual task training, strength training and Aerobictraining, on higher mental functions in geriatric population. And also to compare which was the most effective training among the three. **Methods**: Sixty elderly, aged 65-85 years, were randomly assigned into three groups: Aerobic Training (AT), Strength Training (ST), Dual Task Training Group (DT). Mini Mental Status Examination & Montreal Cognitive Assessment were recorded for all participants and the data was recorded before and after nine weeks of training. Training involved three sessions per week. **Result**: The results suggested that, at post training, the mean MMSE score of DT group was found significantly (p<0.05 or p<0.01) different and higher as compared to both AT(p=0.001) and ST (p=0.029), as well as the post test scores of MoCA of both ST (p=0.034) and DT (p<0.001) was found significantly (p<0.05 or p<0.001) different and higher as compared to AT. **Conclusion**: Study found all the three training (Aerobic, Strength and Dual task) effective in the management of cognition in elderly, but Dual task training was found to be more effective than both Aerobic and Strength training.***

Keywords: Cognition, Aerobic training, Strength training, Dual task training.

1. Introduction

The geriatric population often arbitrarily defines as the group of individuals sixty five years and older. Aging (growing old) is a natural phenomenon characterized by the loss of neurons and decrement in neurotransmitter release and physiological function. This may also be explained as the gradual decline of the central nervous system which includes deterioration of cognitive function such as memory, attention, reaction time and speed of information processing. Higher mental functions include orientation, attention, memory, communication and executive functions. Cognition refers to the processing of information about the environment that is received through senses. Other measures of higher mental function such as intellect and perception evidence decline [11] and behavior slows as demonstrated by prolonged reaction times[11], reduced brain wave (EEG) frequency [38], increased latency of event related potentials [6,17] and slower nerve conduction velocities.[16]

It has been suggested that decrements in mental and electrophysiological functioning of older individuals may, in part, result from the brain being mildly hypoxic[22,35] . There are two factors which contribute to reduced cerebral oxygenation in old age and thus may adversely affect brain function: the increasing presence of atherosclerosis[8,36] and an inability to efficiently transport and utilize oxygen resulting from physically inactive life-styles[15]. The latter can be improved by aerobic exercise[10] and there is growing evidence suggesting that the rate of decline of physical and cognitive abilities is governed by physical conditioning level as well as by age [9,10,18,21]. The association between physical fitness and cognitive health is as intuitive as ''*menssana in corporesano*.'' Over time, this Latin phrase has come to mean that only a healthy body can produce or sustain a healthy mind. Today, this relationship receives much more attention as our aging population places a high priority on preserving cognitive acuity into our golden years. In fact, numerous observational studies have demonstrated that people who are fit perform better on cognitive tests, and people who are active suffer less cognitive decline as they grow older[5,25]. For example, response times of older men who had maintained an active participation in physical activities such as racquet sports and running were significantly faster than those of age-matched sedentary men and little different from response times of much younger sedentary subjects[47,50]. Also, highly fit older individuals scored higher on tests of fluid intelligence than did less fit subjects[19,53,40] .

Aging is associated with considerable decline in a wide spectrum of cognitive abilities and gradual decline of central nervous system . These decline particularly when they escalate to dementia, can have dramatic inpact on the independence, safety, activities of daily living and overall quality of life of elderly. Exercise produces physiological changes in the elderly, but research has not consistently documented the physiological benefits of exercise for the elderly [55].

Although cross-sectional studies have suggested that physical activity is associated with attenuation of age related cognitive declines, longitudinal researches has produced mixed result, some studies have reported no cognitive changes following exercise, few significant on mood as a result of aerobic training in the elderly have been reported.
Cognitive function refers to a person's ability to process thoughts. Cognitionprimarily refers to things like memory, the ability to learn new information, speech, and reading comprehension. In most healthy individuals the brain is capable of learning new skills in each of these areas, especially in early childhood, and of developing personal

and individual thoughts about the world. Factors such as aging and disease may affect cognitive function over time, resulting in issues like memory loss and trouble thinking of the right words while speaking or writing.

Humans are generally equipped with a capacity for cognitive function at birth, meaning that each person is capable of learning or remembering a certain amount of information. This is generally measured using tests like the intelligence quotient (IQ) test, although these can be inaccurate at fully measuring a person's cognitive abilities. Infanthood and early childhood are the periods of time when most people are best able to absorb and use new information, with most children learning new words, concepts, and ways to express oneself on a weekly or even daily basis. Capacity to learn slows down little by little as one gets older, but overall cognitive function should not deplete on a large scale in healthy individuals.

The results of intervention studies evaluating the connection between exercise and cognitive functioning, however, are less consistent, and not every study has generated positive results[29,39,24]. Some more studies support the above statement showing less consistency in cognitive functioning [7,41,42,46,48]. The mixed results of clinical trials of exercise are only natural, however, given the variety of exercise regimes, the methods employed to measure fitness and exercise intensity, and the different measures that have been used to assess cognition. Yet in a recent article[32] showed in a randomized study that individuals with moderate cognitive impairment can increase some aspects of cognition with increased physical activity.

Many cognitive tools were used for the evaluation of cognition in different studies such as Short Mental Status Examination (SMSE), Boston Naming used in the study conducted by Nisser Umar et ol showing association of leisure time physical activity with cognition in the person aged 60 years and over by using Third National Health And Nutrition Examination Survey (NHANES-III) to assess cognitive functions typically affected in dementi[32].

Another study used Stroop And Spatial Working Memory (SPWM) task and MRI to know the executive control by prefrontal cortex[32] and a study took Adaptive Stroop Task to assess cognitive function [49,45]. Clinical scales of Wechsler (1969) for memory, cognition, attention, well being gives base line to the studies[12].

We have taken mini mental status examination (MMSE)[23,26,54] and Montreal Cognitive assessment MoCA [37] as our evaluation tool which took 10 minutes to administer and Covers 8 cognitive domains -:Visuospatial / Executive, Naming, Memory, Language, Abstraction, Delayed Recall, Orientation .The reliability and validity of MMSE is -: reliability (alpha = 0.84–0.99) and validity (r = 0.90). and reliability and validity of MoCA is -: reliability (alpha = 0.83) and validity (r = 0.92)

Important questions remain unresolved. Is any degree of exercise sufficient to improve cognitive performance, or is the effect dose-related, as noted by Barnes et al. If there is an exercise effect on cognition, is it a general effect, demonstrable across all cognitive domains, or is it concentrated on particular functions? For example, several authors [5,13,14,27,49] have reported that high levels of aerobic exercise tended to affect performance on tests of attention and executive function. If this is true, how does increasing the frequency of aerobic exercise impact various aspects of cognition.

The purpose of this investigation was to address the effect in Aerobic training, strength training and dual task training programme on cognition and to compare which was the most effective training.

2. Methods

The total of 120 subjects from geriatric population were approached for the study, out of which 80 gave their consent. Both males and females were included in the study. In 80 subjects 20 were excluded from the study due to some disability or disorder then the total of 60 subjects were taken from the community of Ghaziabad who were included in the study evaluated according to the inclusion criteria. Evaluation was done under the consideration of various factors such as age (65-80 years), Senior Fitness Test which has seven assessments for functional fitness. Depression assessment using Geriatric Depression Scale. Evaluation Performa to assess for any major orthopedic, cardiovascular condition as well as to evaluate visual impairments like cataract and diplopia which can inhibit participation. After completion of the selection procedure by using specific scales, all the subjects were assigned to 3 groups using random sampling in 3 groups and in each group, 20 subjects were taken, then the subjects were assessed on Mini Mental Status Examinationand Montreal Cognitive Assessment prior to the intervention, then intervention was given as per group for 9 weeks and subjects were again assessed for post intervention scores on the same scales.

Instrumentation and Tools Used

Stationary Cycle, Weighted belt, Dumbell (0.5−1.5 kg), Stop watch, Paper , Pen, Digit symbol test copy, Colored XXX sets, Chair, Mat, Weighing machine, Height meter, Inch tape, Walk way for 6 min walk test.

Procedure

Design of the Study**:** Pre and post Experimental Design
Outcome Measures**:** Mini Mental Status Examination**,** Montreal Cognitive Assessment

I Group**:** AEROBIC TRAINING (AT): (9 weeks)**,** 5 minutes of warm up activities (lower body stretches and marching in place at a causal pace). 10- 30 minutes of moderate intensity cycling on a stationary cycle (moderate intensity defined as 60% -65% of maximum heart rate, MHR= 220 – age). 10 minutes of cool down activities (slowing cycling and stretches).

II Group**:** STRENGTH TRAINING (ST): (9 weeks), First week one set and second week onward three sets .Each set consist of 12 repetitions of seven exercise.Hip extension, Knee flexion, Seated lower leg lift, Chair squat, Arm raise, Biceps curl , and Abdominal Crunch.

III Group: DUAL TASK TRAINING (DT): (9 weeks), Stroop Test (number in 45 s) , Color XXX, Color Word, Digit Symbol Test :Copy (seconds to complete), Substitution (number in 90 s) .

3. Statistical Analysis

The data were summarized as Mean ± SD. The age of three independent training groups (Group I: Aerobic, Group II: Strength and Group III: Dual task) were compared by one way analysis of variance (ANOVA) and the significance of mean difference between the groups was done by Student Newman-Keuls post hoc test while proportion of genders were compared by chi-square (χ^2) test. The effect of three independent training groups on outcome measures (MMSE and MoCA) over the periods (pre training: 0 wk and end of the training: 9 wk) were compared together by repeated measures analysis of variance (RM ANOVA) using general linear models (GLM) and the significance of mean difference within and between the groups was done by Student Newman-Keuls test after ascertaining normality by Shapiro-Wilk (W) test and homogeneity of variances by Levene's (F) test. A two-sided (α=2) p<0.05 was considered statistically significant. All analyses were performed on STATISTICA software (version 6.0) while graphs were made on MS EXCEL (Windows version 97-2003).

4. Result

To find out the effect of Aerobic, Strength and Dual task training on cognition (MMSE and MoCA) in elderly, 60 age (65-80 yrs) and sex (males=51 and females=9) matched subjects were randomized equally and trained either with Aerobic (Group I) or Strength (Group II) or Dual task (Group III). The comparative evaluation of demographic characteristics (gender, age, weight and height) and outcome measure (MMSE and MoCA) scores of three groups were presented in the following section A and B, respectively.

A. Demographic Characteristics

1) Gender

The frequency distribution of genders of three training groups were summarized in Table 1 and also shown graphically in Fig. 1. There were total 60 subjects (males=51 and females=9) in three groups, 20 in each group (males=17 and females=3). In all three groups, the frequency (number or % age) of males (85.0%) was higher than females (15.0%). Comparing the gender proportions (M/F) of three groups, χ^2 test revealed similar (p>0.05) number of males and females in three groups (M/F: 17/3 vs. 17/3 vs. 17/3, χ^2=0.00; p=1.000). In other words, subjects of three groups were gender matched and therefore, gender may not influence the training outcome measures (MMSE and MoCA).

2) Age

The age of three training groups were summarized in Table 2 The age of all three Aerobic, Strength and Dual task training groups ranged from 65-70 yrs with mean (± SD) 67.00 ± 1.41 yrs, 66.90 ± 1.41 yrs and 66.95 ± 1.43 yrs, respectively. The mean age of Aerobic group was the highest followed by Dual task and Strength group the least. Comparing the mean age of three groups, ANOVA revealed similar (p>0.05) age among the groups (F=0.02, p=0.975).

3) Weight

The weight of three training groups were summarized in Table 3 .The weight of Aerobic, Strength and Dual task training groups ranged from 60-75 kg, 60-74 kg and 60-75 kg, respectively with mean (± SD) 68.76 ± 3.87 kg, 68.06 ± 4.33 kg and 69.54 ± 4.66 kg, respectively. The mean weight of Dual task group was slightly higher than both Aerobic and Strength groups. Comparing the mean weight of three groups, ANOVA revealed similar (p>0.05) weight among the groups (F=0.59, p=0.558).

4) Height

The height of three training groups were summarized in Table 4 and also shown graphically in Fig. 4. The height of Aerobic, Strength and Dual task training groups ranged from 150-178 cm, 150-178 cm and 150-177 cm, respectively with mean (± SD) 168.87 ± 8.24 cm, 169.21 ± 8.43 cm and 168.98 ± 8.10 cm, respectively. The mean height of Strength group was slightly higher than both Aerobic and Dual task groups. Comparing the mean height of three groups, ANOVA revealed similar (p>0.05) height among the groups (F=0.01, p=0.991). In other words, subjects of three groups were also height matched and therefore, height may also not influence the training outcome measures (MMSE and MoCA).

B. Outcome Measures

1) Mini Mental Status Examination

The pre (0 wk) and post training (9 wk) Mini Mental Status Examination (MMSE) scores of three groups were summarized in Table 5 and showed that the mean MMSE scores in all three groups increases (improves) after the training and the increase was (improvement) was evident highest in Dual task followed by Strength and Aerobic, the least.

For each group, comparing the mean MMSE scores within the groups (between periods) (Table 6), the MMSE score in both Strength and Dual task groups increase (improves) significantly (p<0.001) at 9 wk (post training) as compared to 0 wk (pre training). However, the mean MMSE score in Aerobic group did not improved or changed significantly (p>0.05) at post training (9 wk) as compared to pre training (0 wk) i.e. found to be statistically the same (p=0.222). These comparisons concluded that the Strength and Dual task training are effective for improving the mental status (cognition) in elderly.

Similarly, for each period, comparing the mean MMSE scores between the groups (Table 7), the MMSE scores did not differed (p>0.05) between the three groups at 0 wk i.e. found to be statistically the same. In other words, MMSE scores were comparable between three groups. However, at post training, the mean MMSE score of Dual task group was found significantly (p<0.05 or p<0.01) different and higher (improve) as compared to both Aerobic group (p=0.001) and Strength group (p=0.029) while did not differed (p>0.05) between Aerobic group and Strength group (p=0.143).Further, comparing the net improvement in mental status (mean increase in MMSE scores from pre to post) of three groups (Table 5), ANOVA revealed significantly (p<0.001) different and higher improvement in mental status (cognition) of Strength group (0.25 ± 0.44 vs. 1.05 ± 0.83, p<0.001) and Dual task group (0.25 ± 0.44 vs. 1.15 ± 0.67, p<0.001) as compared to Aerobic group. However, the improvement in mental status did not differed (p>0.05) between Strength group and Dual task group i.e. found to be statistically the same (1.05 ± 0.83 vs. 1.15 ± 0.67, p=0.637).

Furthermore, at final evaluation (i.e. at the end of the training), the mental status in elderly those who received the Dual task training (4.24%) improved by 3.29% and 0.28% more as compared to those who received the Aerobic training (0.96%) and Strength training (3.96%), respectively (Table 5). The comparison concluded that for improving mental status in elderly, Strength training and dual task training is equally and significantly more effective than Aerobic training.

2) Montreal Cognitive Assessment

The pre (0 wk) and post training (9 wk) Montreal Cognitive Assessment (MoCA) scores of three groups were summarized in Table 8 and showed that the mean MoCA scores in all three groups increases (improves) after the training and the increase was (improvement) was evident highest in Dual task followed by Strength and Aerobic, the least.

For each group, comparing the mean MoCA scores within the groups (between periods) (Table 9), the MoCA score in both Strength (p=0.002) and Dual task (p<0.001) groups increase (improves) significantly (p<0.01 or p<0.001) at 9 wk (post training) as compared to 0 wk (pre training). However, the mean MoCA score in Aerobic group did not improved or changed significantly (p>0.05) at post training (9 wk) as compared to pre training (0 wk) i.e. found to be statistically the same (p=0.440). These comparisons concluded that the Strength and Dual task training are effective for improving the cognition in elderly.

Similarly, for each period, comparing the mean MoCA scores between the groups (Table), the MoCA scores did not differed (p>0.05) between the three groups at 0 wk i.e. found to be statistically the same. In other words, MoCA scores were comparable between three groups. However, at post training, the mean MoCA scores of both Strength group (p=0.034) and Dual task group (p<0.001) was found significantly (p<0.05 or p<0.001) different and higher (improve) as compared to Aerobic group. Further, the mean MoCA scores of Dual task group (p=0.034) was also found significantly (p<0.001) different and higher (improve) as compared to Strength group. These comparisons concluded that dual task training and Strength training are effective for improving cognition in elderly.

Further, comparing the net improvement in cognition (mean increase in MoCA scores from pre to post) of three groups (Table 8), ANOVA also revealed significantly (p<0.001) different and higher improvement in cognition of Dual task group as compared to both Aerobic group (0.25 ± 0.44 vs. 2.60 ± 0.99, p<0.001) and Strength group (0.60 ± 0.68 vs. 2.60 ± 0.99, p<0.001). However, the improvement in cognition did not differed (p>0.05) between Aerobic group and Strength group i.e. found to be statistically the same (0.25 ± 0.44 vs. 0.60 ± 0.68, p=0.141).

Furthermore, at final evaluation (i.e. at the end of the training), the cognition in elderly those who received the Dual task training (9.03%) improved by 8.08% and 6.79% more as compared to those who received the Aerobic training (0.95%) and Strength training (2.23%), respectively (Table 8). The comparison concluded that for improving mental status in elderly, dual task training is significantly more effective than both Aerobic training and Strength training.

5. Discussion

The study compares the effect of Aerobic, Strength and Dual Task training on the cognition in elderly living in the community. For each period, Table (7) showing comparative mean MMSE scores between the groups which represent that at post training, the mean MMSE score of Dual task group was found significantly) different and higher (improve) as compared to both Aerobic group and Strength group while did not differed) between Aerobic group and Strength group. These comparisons concluded that for improving mental status (cognition) in elderly, dual task training is more effective than both Aerobic training and Strength training.

Table (5) showing net improvement in MMSE of three groups. Whereas result from bar graphs (8.10) showing comparative mean MoCA scores between the groups, Further, represents the net improvement in cognition (mean increase in MoCA scores from pre to post) of three groups (Table 8.), ANOVA also revealed significantlydifferent and higher improvement in cognition of Dual task group as compared to both Aerobic group and Strength group. However, the improvement in cognition did not differed between Aerobic group and Strength group i.e. found to be statistically the same. Table (10) showing net improvement in cognition in MoCA of three groups.

M K. Jedrziewski et al in 2010, the results of their study add to the growing body of evidence in support of exercise as a potential intervention to decrease the risk of aging-related cognitive impairment. Intriguingly, The strength of this association may be due to additive effects from socialization and cognitive stimulation. In other words, they speculate that those who pursued a greater variety of physical activities were more engaged, through their greater array of exercises, both cognitively and socially. Their diversity of physical activities may have connected them to more people and provided additional cognitive stimulation.

Alexandre et al., 2009 in his review of Physical activity and cognition in the elderly says that physical activity is beneficial to cognitive health. Aerobic activity benefits cognitive function in elderly person with no known cognitive impairment. He also mention that the effects of aerobic exercise on cognition were shown to enhanced by combining it with strength training.

Steven Masley et al, 2009 in his research on aerobic exercise enhances cognitive flexibility shows the association with enhanced cognitive performance, in particular cognitive flexibility is a measure of executive function] .

Fang Yu et al, 2009, had studied over the facilitating aerobic exercises training in older adults with Alzheimer's Disease, he had focus there is lack adequate description of their aerobic exercise training programs and there clinical applicability with no clinical practice guideline for aerobic training in older adults with Alzheimer's Disease. He had concluded that engaging older adults with Alzheimer's disease in aerobic exercise is important, because aerobic exercise training improves physical functioning and has the potential to alleviate Alzheimer's disease symptoms. The aerobic exercise protocol we developed for older adults with mild to moderate Alzheimer's Disease appears in early pilot testing to be safe, feasible, and easy to implement

Ozkaya et al., 2005 in his study says that the Strength Training have a facilitating effects on early information processing and cognition of elderly and there is no difference in the functional fitness test between strength and endurance training. They concluded after strength training, neurobiological changes such as cerebral blood flow, neurotransmitter functioning, or increased cell complexity, might occur in different brain regions and contribute to Central Nervous System integrity.

Nebes et al., 2000 the researcher mentioned that in a Dual Task Training, both normal old subjects and the depressed geriatric patient showed a dual task decrement, in the accuracy on a cognitive task decline.

In the year F. Kramer et al 1999 , studied over a period of six month one twenty four sedentary adults, 60 to 75 years old, who were randomly assigned to either aerobic (walking) or anaerobic (stretching and toning) exercise. We found that those who received aerobic training showed substantial improvements in performance on tasks requiring executive control compared with an aerobically trained subjects.

A great deal of research has gone into pursuing the question of whether cognitive decline can be reversed or delayed through cognitive training. This research has established that older adults can improve cognitive abilities with training protocols targeting memory, reasoning, and speed of processing, among other cognitive domains.

Robert et al, 1983 in his study over Aerobic exercise training and improved neuropsychological function of older individual concluded that the test performance of the aerobically trained subjects improved more than the performance of exercise control group.

6. Clinical Implications

The result of study suggest that the intervention used in this study can help in the various domains of higher mental functions and cognition such as memory, reasoning, and speed of processing, among other cognitive domains to enhance or sustain cognitive abilities at healthy levels for longer portions of the life span in the hope that everyday functioning will benefit also to improvements in everyday abilities, including efficient performance of instrumental activities of daily living and safer driving performance.

7. Future Researches

Further study can be conducted on young population as this study was conducted on elderly (65-80 yrs). There is also need to investigate the effect on gender basis. The effect on the basis of activity level and differences between dominant and non-dominant body segments also needed. The findings of this study may be validated on large sample with more duration and longer follow up.

Limitation of Study

The study had many limitations like- Sample size was small. Many subjects had to be excluded from the study due to lack of education. No control on medication of the subjects.

8. Conclusion

Study found all the three training (Aerobic, Strength and Dual task) effective in the management of higher mental function in geriatric population. Dual task training was found to be more effective than both Aerobic and Strength training. The MMSE scores (mental status) improved by 3.29% and 0.28 % more in elderly those who received the Dual task than those who received the Aerobic and Strength training, respectively while MoCA scores (cognition) by 8.08% and 6.79%, respectively. This study concluded that Dual task training may be an effective therapeutic maneuver for improving higher mental function in geriatric population.

Conflict of Interest

he authors have no conflict of interest.

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Tables

Table 1: Frequency distribution of genders of three groups

Gender	Aerobic (n=20)	Strength (n=20)	Dual task (n=20)	χ^2 value (DF=2)	p value
Males	17 (85.0%)	17 (85.0%)	17 (85.0%)	0.00	1.000
Females	3 (15.0%)	3 (15.0%)	3 (15.0%)		

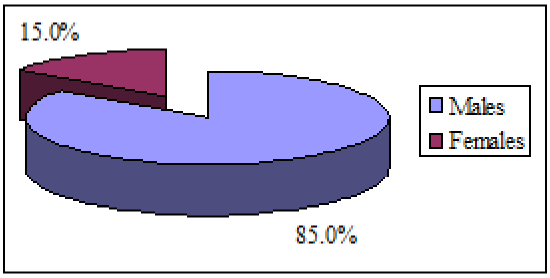

Figure 1: Pie chart showing frequency distribution of genders of three groups

Table 2: Age summary (Mean ± SD) of three groups

Aerobic (n=20)	Strength (n=20)	Dual task (n=20)	ANOVA F (2, 57DF)	p value
67.00 ± 1.41 (65-70)	66.90 ± 1.41 (65-70)	66.95 ± 1.43 (65-70)	0.02	0.975

Table 3: Weight summary (Mean ± SD) of three groups

Aerobic (n=20)	Strength (n=20)	Dual task (n=20)	ANOVA F (2, 57DF)	p value
68.76 ± 3.87 (60-75)	68.06 ± 4.33 (60-74)	69.54 ± 4.66 (60-75)	0.59	0.558

Table 4: Height summary (Mean ± SD) of three groups

Aerobic (n=20)	Strength (n=20)	Dual task (n=20)	ANOVA F (2, 57DF)	p value
168.87 ± 8.24 (150-178)	169.21 ± 8.43 (150-178)	168.98 ± 8.10 (150-177)	0.01	0.991

Numbers in parenthesis represents the range (min-max)

Table 5: Pre and post training MMSE scores (Mean ± SD, n=10) of three groups

Training groups	Pre training (0 wk)	Post training (9 wk)	Mean improvement (Post-Pre)	% improvement
Aerobic	25.85 ± 0.81 (25-28)	26.10 ± 0.72 (25-28)	0.25 ± 0.44 (0-1)	0.96%
Strength	25.45 ± 0.83 (24-27)	26.50 ± 0.69 (25-28)	1.05 ± 0.83 (0-3)	3.96%
Dual task	25.95 ± 0.76 (25-27)	27.10 ± 1.21 (25-30)	1.15 ± 0.67 (0-3)	4.24%

Table 6: For each group, comparison (p value) of mean MMSE scores within the groups (between periods) by repeated measures ANOVA followed by Newman-Keuls test

Training groups	Comparisons (Pre vs. Post)
Aerobic	0.222
Strength	p<0.001
Dual task	p<0.001

Table 7: For each training period, comparison (p value) of mean MMSE scores between the groups (within periods) by repeated measures ANOVA followed by Newman-Keuls test

Comparisons	Pre treatment (0 wk)	Post treatment (9 wk)
Aerobic vs. Strength	0.143	0.143
" vs. Dual task	0.712	0.001
Strength vs. Dual task	0.160	0.029

Table 8: Pre and post training MoCA scores (Mean ± SD, n=10) of three groups

Training groups	Pre training (0 wk)	Post training (9 wk)	Mean improvement (Post-Pre)	% improvement
Aerobic	26.15 ± 0.37 (26-27)	26.40 ± 0.50 (26-27)	0.25 ± 0.44 (0-1)	0.95%
Strength	26.25 ± 0.44 (26-27)	26.85 ± 0.88 (26-29)	0.60 ± 0.68 (0-2)	2.23%
Dual task	26.20 ± 0.41 (26-27)	28.80 ± 1.06 (27-30)	2.60 ± 0.99 (1-4)	9.03%

Table 9: For each group, comparison (p value) of mean MoCA scores within the groups (between periods) by repeated measures ANOVA followed by Newman-Keuls test

Training groups	Comparisons (Pre vs. Post)
Aerobic	0.440
Strength	0.002
Dual task	p<0.001

Table 10: For each training period, comparison (p value) of mean MoCA scores between the groups (within periods) by repeated measures ANOVA followed by Newman-Keuls test

Comparisons	Pre treatment (0 wk)	Post treatment (9 wk)
Aerobic vs. Strength	0.882	0.034
" vs. Dual task	0.812	p<0.001
Strength vs. Dual task	0.812	p<0.001