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SHORT COMMUNICATION

IMMEDIATE EFFECT OF NOSTRIL BREATHING ON MEMORY PERFORMANCE

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Abstract : The self-control study on thirty normal subjects of both genders (mean age 25.83±3.41 years) were taken in a self control study group and were tested for three types of Nostril breathing practices and Breath Awareness (BA) effects. Namely verbal recall performance of numerical data such as Digit Span Forward (DSF) and Digit Span Backward (DSB) as well associate learning memory function using Wechsler Memory Scale. The interventions included Right Nostril Breathing (RNB), Left Nostril Breathing (LNB), Alternate Nostril Breathing (ANB) and Breathe Awareness for duration of 30 minutes daily, four consecutive days. The Repeated Measure ANOVA analysis revealed a significant increase in both DSF and DSB recall performance due to RNB at P<0.001 level and increased DSB score due to ANB at P<0.014 level with a non- significant increase due to LNB suggests that the RNB facilitates both DSF and DBF recall performance. However, the LNB effect on left hemisphere helps to restore the memory function of right hemisphere. This study concludes that the RNB enhances numerical data retrieval mostly as a result of left brain activation.

Key words : nostril breathing, breath awareness, wechsler memory scale, memory function

INTRODUCTION

The nasal cycle is phenomenon of alternate periodic breathe functions and its variations are characterized by the alternating patency of the nostrils for every two to eight hours (1). Studies of performance on hemispheres specific tasks related to unilateral forced nostril breathing support the idea of hemispheric activation contra lateral to the dominant nostril (2). This relation of nasal cycle performance with hemispheric activity on few mental functions is established based on previous reports suggests (3) that breathing through a particular nostril enhances spatial memory

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performance on school children (3), similarly another study indicated that immediate effect of right and left nostril breathing enhances verbal and spatial scores corresponding to the cerebral hemisphere contra lateral to the patent nostril (4). However, there are scanty reports upon effect of uni-nostril breathing on memory function which revealed that left nostril breathing enhanced the right hemisphere related specific task (5). Therefore, there has been no study in regard to the effect of uni-nostril and alternate nostril breathing on left hemisphere function during memory performance.

METHODS

The subjects of this study was carried out on DYEd (Diploma in Yoga Education) students of both genders selected from G.S. College of yoga and Cultural synthesis, Kaivalyadhama, Lonavla, Pune district includes 18 males and 12 female. This study was conducted on thirty students of both genders, whose ages ranged from 20 to 34 years (group mean±S.D., 25.83±3.41 years). The inclusion criteria include healthy students without any medical complications. The students having learning problem are excluded from the study. The gender differences are ruled out as both the genders are in the same age group and same class. The study was executed with duly obtained informed consent as per the research ethics rules. They were imparted three different types of nostril breathing such as Right Nostril Breathing (RNB), Left Nostril Breathing (LNB), Alternate Nostril Breathing (ANB and Breath Awareness (BA) in a randomized sequence manner was initially demonstrated and practiced for two weeks and later practiced for four consecutive days. They were tested for immediate effect of nostril breathing before and after 30 minutes of intervention on memory performance using Wechsler Memory Scale.

Memory tasks performance tested by Wechsler memory scale which has been standardized for Indian population. The components of WMS includes (i) digit span forward and ii) digit span backward, and (iii) Paired associate learning (easy and hard), with 10 items each. The digit span forward includes six pairs for the numerical items of easy task and four pairs for the numerical items of hard task. Each correct answer was scored as ‘1’. The sequence of recall of numerical items in digit span backward is in the reverse order unlike in digit span forward. The last test includes paired associate learning verbal task which comprises the presentation of ten pairs of unrelated words in three trials. After the completion of the three trials the investigator provides the first word in each pair and subsequently the subject has to supply the appropriate associating second word. Out of the ten pairs of associate learning items, the six pairs were semantically easier to remember (e.g., Paper-Pen) it is scored as 1 and if no relevant association exists it considered as hard task and is scored as 2. This was based on the conventional scoring for Wechsler memory scale (6 & 7).

There were four yogic aspect of nostril breathing practice sessions that will cover arbitrary number of breath cycles as per the capacity of the subject performing breathing cycles for total of 30 minutes duration. The four practices were (i) Right nostril yoga breathing or *surya anuloma viloma* which

involves alternate cycle of inhalation and exhalation exclusively through the right nostril while the left nostril is gently occluded, (ii) Left nostril yoga breathing or *chandra anuloma viloma* involves similar breath cycle through the left nostril breathing while the right nostril is gently occluded, (iii) Alternate nostril breathing or *anuloma viloma* involves inhalation through one nostril while other is occluded and vice-a versa for next breath cycle and (iv) Breath awareness, for which the subjects were instructed to keep a watch on the breath pattern while remained in normal state of breathing.

The data were analyzed applying Repeated Measure ANOVA test using statistical software package SPSS (version 10.0).

RESULTS

The results of the memory performance for the three interventions types of nostril breathings' and breath awareness are shown in the Table I.

The following results showed right nostril yoga breathing (*surya anuloma viloma*), there was an increase in Digit span forward and digit span backward ($P<0.001$) and alternate nostril breathing also showed significant increase in digit span backward task ($P<0.014$). Other practices did not show any significant change. Also there is significant change in between groups of LNB versus BA of digit span backward ($P<0.05$).

DISCUSSION

The memory is one of the ability of the brain to store and retrieve information of both verbal and non verbal nature. This retrieval process involves generation of a sequence of entities in the response set which corresponds to the entities of stimulus set. This decides the nature of recall function. For example recall of telephone numbers, etc. The left hemisphere (LH) lobe of cerebral cortex is the seat for recall of numerical, descriptive and analytical data. This involves temporal lobe to register and encode the incoming stimulus information in the parietal lobe for information storage. The display of recall would be a motor output such as the verbal recall involving speech motor pathways. This cortical aspect of retrieval function is also co-related with the regional cerebral circulation (8). Further, few studies reveal the relation between the

TABLE I: Effect of three yogic breathing and Breath awareness on immediate digit and associate memory performance.

Groups	*Digit span forward*		*Digit span backward*		*Associate learning*	
	Before	*After*	*Before*	*After*	*Before*	*After*
Right nostril	6.0±2.0	7.3±1.6	5.0±1.6	6.13±1.4**	12.7±4.5	12.63±3.8
Left nostril	6.46±2.1	7.03±1.7	5.26±2.3	5.7±1.9@	12.53±4.2	13.76±4.2
Alternate nostril breathing	6.6±1.8	6.86±1.8	5.0±2.2	5.8±1.8*	13.8±4.3	14.31±4.0
Breath Awareness	7.1±1.6	6.76±1.7	5.3±2.3	5.56±2.2	12.75±4.7	11.73±4.4

**P<0.001, Repeated measure ANOVA compared to before.
*P<0.014, Repeated measure ANOVA compared to before.
@P<0.05, Repeated measure ANOVA compared to after (between group).

breathing techniques such as uni-nostril (right and left nostril) and alternate nostril breathing on enhanced spatial memory performance, etc (2). However, the underlying mechanism of effectiveness of nostril breathing on recall function in Backward Digit Memory (BDM) test is still unclear. Therefore, findings of this study revealing the effectiveness of breathing techniques on two out of three components of Wechsler Memory Scale (WMS), such as recall of Digit Span Forward Memory (DFM), Digit Span Backward Memory (BDM) and associate memory, indicated a significant increase in both DFM and BDM memory performance upon right nostril breathing at P=0.001 level and relatively lesser digit backward memory (DFM) performance upon alternate nostril breathing at P=0.014 level. The possible mechanism behind the cerebral aspect of recall function based on the obtained differences in DFM and BDM scores could be interpreted as shift in direction and sequence of encoded response entities in particular response set, wherein, the sequence of stimulus entities of the response set in BDM is opposite to the stimulus set unlike DFM type of recall function.

This aspect of recall response may be well explained on the basis of the memory stack model of Digital Computer. The recall function in DFB would be proposed as the sequence of stimulus set arriving through sensory pathways which might be placed in the assigned neural space or “bin” would be similar to the memory stack model of retrieval mechanism of a digital memory (9). Here, the study proposes that the response set entities may distributed in a neural space or “*bin*” which could be the assigned neural space of memory stack. Therefore, the manner of information retrieved in the DFM recall function would be in the order of the first in- first out (FIFO) or last in- last out (LILO) recall sequence (9). Thus, the first element of stimulus would be retrieved earlier. The DFM type of recall function is common in any typical learning process. But the sequence order of recall mechanism in the DBM response set could be proposed as first in- last out (FILO) or last in- first out (LIFO) order of sequence (9) due to the “*swap*” function operation (10). This suggests that there exist two different unique LH neural mechanisms which initiates the DFM recall function and also triggers DBM recall function involving another kind of neural mechanism through Swap operation in generating DBM response set. Therefore, as a result of Swap function, the response of first stimulus will be assigned in the last segment of neural space or “*bin*” which could represent the neural space of memory stack. Thus, the response entities corresponding to the first stimulus entities would be retrieved at the fag end of the time window of recall function. Similarly, response entities of the corresponding lastly arrived stimulus will be retrieved at initial epoch of the time window of recall function. This suggests that the RNB induces swap function to generate specific sequence of response set entities in the reverse order of DBM recall function.

However, the results of the ANB which shows the specific reduction of Swapping effects of RNB on DBM performance may be inferred from the results of “t” significant value at $P<0.014$ level would clearly suggest that the short term of effect RNB on the low BDM performance in comparison to memory performance of RNB alone at

P<0.001 level could be due to the wash -out effect of LNB on LH as inferred from the both LNB alone and LNB of ANB intervention. Thus, the wash–out effect of uni-nostril LNB is to restore the function of RH through LH action. This prevent habituation component as confirmed from the no-significant changes followed by LNB on recall functions.

Therefore, this suggests that the transient effects of LNB alone or as alternate breathing would enhance refresh rate of LH through ipsi-lateral nostril breathing. This may enhance the contra- lateral RNB effect on LH efficiency in order to facilitate faster alterations in the underlying neural circuit of LH. Therefore the result of ipsi-lateral nostril breathing enables to perform the Swapping function. However, results of non significant changes in the associative learning response reflects non involvement of lateralization of hemisphere in long term memory (LTM) functions of the hippocampus. This is irrespective of any intervention. This suggests a wide spread non-specific cortical process and hence the breath awareness functions of the cortex as a whole may not strengthen the lateralization of cerebral hemispheres.

The study concludes that the right nostril breathing would facilitate better inherent digit backward and digit forward span memory performance of left hemisphere. However, alternate nostril breathing may only refresh the left hemispheric activity during recall function and the associative learning is not affected by any of such interventions.

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