

## The psycho nourishing effect of dance and musical training: a population based evaluation

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### ABSTRACT

**Introduction:** In the twenty first century, mental health hazards are growing by leaps and bounds. Worldwide reports based on several empirical data poses a serious threat for near future. Memory skill and emotional management are central to many neurocognitive and neuro psychiatric illness. Music and dance, the ancients of performing arts, have long been identified as mind relaxant and mind-body coordinator. Efforts are regularly made to include these performing art forms in non-invasive therapeutics. Most of the data are based on clinical patients and few on healthy subjects. But whether learning these art forms for a long time give any benefit in daily life is still not very apparent from experimental data. Thus, the present study aimed to investigate the impact of long-term training in this field on working memory impairment (WMI) and emotional regulation (ER).

**Methodology:** Individuals were recruited based on their soulful agreement to participate in the study. WMI and ER were assessed using validated questionnaires for each participant. Anonymized data obtained from participants were further analysed using suitable statistical methods.

**Results:** Finding from analysed outputs suggested a beneficial impact of long-term training in music and dance; WMI was significantly lower in the trained individuals ( $P < 0.05$ ). Significant difference in ER ( $P < 0.05$ ) was also evident, especially among the young aspirants.

**Conclusion:** Long term training in music and dance can be a potentially preventive as well as therapeutic intervention from stress, dementia, and other sort of mental illness.

**Keywords:** Music and Dance; Working memory impairment; Emotional Regulation.

**Abbreviations:** Cognitive functions (CF), Working Memory Impairment (WMI), Emotional regulation (ER).

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### INTRODUCTION

Dance and music are the rhythm based performing arts evoking oscillatory changes in the brain [1]. These art forms involve higher executive functions [2], necessitating co-ordination of different cognitive processes like different forms of memory, attention, thinking, presence of mind and flexibility [3]. Creativity at an older age stimulates mind rejuvenation, implying its potential for geriatric therapy [4]. Indian classical music (ICM) has an immense importance in nurturing a healthy mind [5]. Randomized trials were suggested for in depth investigation of effectivity of such therapies [6]. It is expected that continuous training in the field of dance and music should also have some positive role in developing individual's thought, perception, and memory skills.

Series of epidemiological research indicates a higher vulnerability of women population across the world to suffer from mood disorders [7-9], anxiety [10] and dementia [11]. In India, survey reports suggested a good number of women suffering from common mental disorders, which often remain unaddressed and may lead

to increased public health burden [12-15]. Moreover, sustained fear and low affect are also correlated to cognitive impairment in their later life [16].

Memory deficit and uncontrolled emotional surge have been discussed much in terms of mental health problems. Memory impairment is well evidenced in patients with dementia [17], anxiety and depression [18]. Emotional regulation is proposed to be related to working memory under a special nomenclature “Affective working memory” [19]. Cognitive reappraisal which can be defined as a way to reassess the importance of a stressor and related consequence by oneself, also depends on presence of mind and in turn related to working memory. Inappropriate emotional response can elicit different spectrum of psychosocial issues. Hence, developing non-invasive strategies to upskill working memory and emotional regulation is a timely act in the present era. On the backdrop of these given facts, an exploratory study was conducted in West Bengal, India, to understand and appreciate the role of continuous cultural training in the field of music and dance in ameliorating memory deficit and emotional crunch in women.

## METHODOLOGY

### Study participants

One hundred twenty healthy female individuals from the state of Bengal were requested for voluntary participation. Participants were requested to provide their educational qualification, occupation, socio economic status. Year of musical training, achievement, frequency of stage performance, were all recorded for the individuals who were involved in the field of music and dance. Each individual was given a study identification number, so that data analysis, interpretation and representation could be done in anonymous way. All participants were clearly informed about the mission of the study. Informed written consent was obtained from each adult participant and informed written parental consent was taken for each minor participant.

### Selected traits

Validated self-assessing questionnaires were filled up by the participants for working memory impairment (WMI-Full) [20], emotional regulation (ER) [21]. Based on literature, WM-Full and ER were sub classified further. WMI-Full was categorised into attention domain deficit (WMI-AD), storage domain deficit (WMI-SD) and executive domain deficit (WMI-ED). ER was sub sectioned to cognitive reappraisal facet (CRF) and expressive suppression facets (ESF).

### Statistical analysis

All the statistical analysis was performed using online portals of graph pad prism (<https://www.graphpad.com/quickcalcs/>) and social science statistics (<https://www.socscistatistics.com/tests/>).

## RESULTS

**Table 1: Detail of participants**

Group	Training status	No of individuals
C	None	40
E1	Attained & continued	35
E2	Attained but discontinued	16
<b>Subgroups</b>		
CA	Below 18	7
CB	18 & Above	33
E1A	Below 18	11
E1B	18 & Above	24
E2	Only 18 & Above	16

Out of one hundred twenty participants, complete information could be obtained from ninety one individuals (detailed in Table1). Thirty-five of them attended prolonged cultural training and continued so far (Group E1), sixteen individuals reported their preliminary training during teenage but discontinued later (Group E2), forty individuals never received such training (Group C). Mean age for E1 group was 26.59 ( $\pm 12.70$ ) and for Group C was 26.13 ( $\pm 7.93$ ). Most of them were employed while only eleven females were homemakers. Participants below twenty five years of age were all students. Eighteen years was chosen as a cut off to pursue stratified analysis across the groups. In the stratified system, E1 group had 11 individuals in first group (below 18 years: E1A) and 24 individuals in second group (18 years and above: E1B) while C group had twenty individuals in each group (below 18 years: CA and 18 years and above: CB). E2 group only consisted of 16 individuals aged above 18 years (age 33.06  $\pm 6.45$ ).

At the beginning of analysis, the questionnaires were tested for its goodness of fit in the population. The values of Cronbach alpha, an assured measurement of internal consistency were obtained for both the scales. The values for each questionnaire (WM-Full=0.87 and ER= 0.70) being satisfactorily higher indicated a good reliability of the scores for the present group of populations.

**Table 2: Comparison of means of trait scores**

Group	Mean $\pm$ Std Dev						
	WM-Full	WM-AD	WM-SD	WM-ED	ER	CRF	ESF
C	29.09 $\pm$ 11.31	10.88 $\pm$ 4.82	8.55 $\pm$ 4.52	9.66 $\pm$ 5.26	15.95 $\pm$ 5.06	9.51 $\pm$ 4.01	6.44 $\pm$ 2.93
E1	20.01 $\pm$ 11.78	8.14 $\pm$ 4.75	5.61 $\pm$ 4.04	6.27 $\pm$ 4.32	17.59 $\pm$ 5.48	11.42 $\pm$ 3.31	6.17 $\pm$ 3.48
E2	23.69 $\pm$ 13.23	9.0 $\pm$ 5.32	7.44 $\pm$ 5.02	7.25 $\pm$ 4.55	16.17 $\pm$ 4.70	9.41 $\pm$ 3.56	6.75 $\pm$ 2.05
Subgroups	Mean $\pm$ Std Dev						
	WM-Full	WM-AD	WM-SD	WM-ED	ER	CRF	ESF
CA	27.43 $\pm$ 6.71	11.71 $\pm$ 3.04	7.0 $\pm$ 2.31	8.71 $\pm$ 3.95	13.71 $\pm$ 2.06	6.14 $\pm$ 1.46	7.57 $\pm$ 1.51
E1A	21.36 $\pm$ 12.99	8.72 $\pm$ 5.33	5.55 $\pm$ 4.0	7.09 $\pm$ 4.76	19.78 $\pm$ 5.70	13.0 $\pm$ 3.08	6.78 $\pm$ 3.60
CB	29.44 $\pm$ 12.11	10.70 $\pm$ 5.13	8.88 $\pm$ 4.85	9.86 $\pm$ 5.52	16.44 $\pm$ 5.40	10.25 $\pm$ 4.02	6.19 $\pm$ 3.12
E1B	19.40 $\pm$ 11.42	7.88 $\pm$ 4.55	5.64 $\pm$ 4.14	5.90 $\pm$ 4.15	16.77 $\pm$ 5.28	10.83 $\pm$ 3.25	5.94 $\pm$ 3.49
E2	23.69 $\pm$ 13.23	9.0 $\pm$ 5.32	7.44 $\pm$ 5.02	7.25 $\pm$ 4.55	16.77 $\pm$ 4.70	9.41 $\pm$ 3.56	6.75 $\pm$ 2.05

Note: Significant differences ( $P < 0.05$ ) are highlighted

**Table 3: Correlation analysis between trait scores and age**

Traits	Pearson correlation coefficient (r)			
	Total	Group C	Group E1	Group E2
WM-Full	-0.06	0.008	-0.14	-0.005
WM-AD	-0.13	-0.14	-0.18	-0.002
WM-SD	0.09	0.12	0.06	0.1
WM-ED	-0.1	0.04	-0.23	-0.13
ER	-0.20	-0.22	-0.23	-0.05
CRF	-0.17	-0.03	-0.3	-0.08
ESF	-0.13	-0.33*	-0.08	0.03

Note: Significant differences ( $P < 0.05$ ) are highlighted

Unpaired two tailed T test revealed statistically significant difference between the groups. Individuals of group C had elevated working memory impairment (WMI) in all domains than the individuals in group E1, as evident from higher mean scores in WM-Full in group C (Table 2). More interestingly individuals aged 18 years or above (that is B) showed stronger difference ( $0.05 < P < 0.001$ ) in each sub domain of WMI (WMI-AD, WMI-SD, WMI-ED) (Table 2). However, mean trait score of E2 failed to produce any significant difference in comparison to C or E1. Correlation analysis between age and WMI, also revealed lesser positive association in E1 group (especially in WM-ED) (Table 3) meaning, their slower decay of memory skills with age, but the observation failed to produce the desired level of significance ( $P < 0.05$ ).

Better emotional control was noticed in younger individuals of group E1 (E1A) than their age matched control group (CA), but no difference was observed in the respective elderly groups (E1B vs CB) (Table 2).

Further analysis on sub domains of ER showed that CRF was more in the trained group (E1), largely because of higher score in younger trainee (E1A). Analysis on E2 failed to produce any significant difference. Correlation analysis showed significant negative correlation ( $P= 0.04$ ) between age-ESF in training naïve individuals (Group C) and a weak trend ( $P= 0.09$ ) between age-CSF in trained group (Group E1) (Table3).

## DISCUSSION

Maintaining a healthy life is a constant effort. The sharp increase of mental disorders and dementia in India threatens the present society for indefinite future. In 2018, a survey found that the number of dementia sufferers was going to be doubled by 2030 and tripled by 2050 [22]. The average lifetime morbidity of mental illness was 13.9% and suicidal risk was 6.4 in a National Mental Health survey among twelve states of India, [23]. Meta-analysis identified a prevalence rate of mental illness to be 58.2/1000 in Indian population [24]. According to World Health Organization, economic loss in mental health issues has been assessed to be trillion dollars between 2012-2030. Thus preventive measures are demanded badly!

However, in spite of advancement of medical science, treatments are nothing more than symptomatic improvement and delay in disease progression. Contemporary approaches through meditation [25], yoga [26], cultural therapy [27], cognitive behavioural training [28] show some promising window for future. The present study calls for inclusion of “Dance and musical training” in that list of contemporary non-invasive strategies.

Dance and music are multisensory performing arts involving higher order cognitive processes [29-30]. Research on the effect of music and movement identified that pairing these two is a natural process which enhances perception of emotion [31]. A study investigating effects of interpersonal memory suggested greater recall and associated memory when similar music was repeated for dancing [32]. Another study comparing memory skills of musicians to that of non-musicians showed higher beta mediated efficiency in the musicians [33]. Thus, our observation of significantly lower working memory impairment in the culturally trained group than its training naïve counterpart gives a direct population-based evidence to the literature pool. Probably, the constant rehearsal and execution of learnt episodes during a training session charge up a nonconventional way of memory formation and thus the trainees unknowingly exercise a better memorization technique in a joyful creative environment leading to lesser inefficient memory recall. Hopefully this observation would further acknowledge dance and musical training as a potential field of rehabilitation research for dementia and other memory related disorders in near future.

Emotion also influences working memory; it is related to anxiety associated negative resistive behaviour [34]. A good control on emotional bursts should also help in shaping oneself in life. Emotional regulation being a multifactorial trait, can be addressed through different strategies. In the present study, cognitive reappraisal facet (CRF) and expressive suppression facet (ESF) were tested as its subdomains. CRF helps a person to modulate the emotional understanding by changing the way one interprets the situation. Suppression of expression (ESF) can restrict venting out of individual’s emotion through behavioral manifestation [21]. While cognitive appraisal was earlier found to improve stress management [35], habitual suppression of emotion was declared to have adverse effects [36]. Increased suppression in older depressed women was reported too [15]. In the present study, younger ones from trained group had a better cognitive reappraisal that can help them in easy coping and making efficient survival strategies.

Interestingly suppression of emotion (ESF) was found to decrease with age. Earlier study on age related emotional changes revealed higher positive feeling in older individuals [37]. With age, people gather more experience, which is a vital factor in eliciting emotional response. Thus, with age and experience, perhaps, individuals get a better grip on one’s way of thinking and thus are quiet bold to express themselves, while the younger may lack enough confidence to express their emotion. However, emotional regulation and its underlying constructs are very much complex interlinking many of factors together [38], thus how suppressive emotion may get reduced with age need a further in-depth study. But above all, our observation of better CRF in the culturally trained individuals undoubtedly promote an efficient complementary neuro-nourishing role of music and dance training.

Overtly stress induce a supra cortisol surge in body causing memory impairment and neuro degeneration in later life [39]. It can also lead to anxiety and depression [35]. During this ongoing phase of Covid19

pandemic, people are suffering from stress, anxiety, depression, and other forms of dysphoria, which are being observed more frequently in females [40]. Prolonged home confinement, lack of exercise and getting used to the new normal have also increased boredom, frustration, and helplessness. In order to cope with the ongoing uncertain threat, people are adopting new hobbies, giving soulful effort in learning new skills. They are also nurturing creativity through music dance recitation story writing etc. So, outcome of this study demands much attention for its relevance in the present pandemic too.

## CONCLUSIONS

The study is exclusive in a way that it was a kind of double-blind test where neither the volunteers nor the researchers planned for the study before the training started. So “learning” was spontaneous in true sense. Participants were not influenced by researchers as well. Therefore, outcomes were unbiased too. Primary limitation of the study was its low sample size and limited number of analyzed traits. However, it is probably a first-time documentation of its kind from the region of West Bengal, to project the beneficial impact of prolonged dancing and musical training on cognitive health and personality among apparently healthy women. Successful replication of this study in larger cohort involving more neuro-psychological parameters would further warrant these long-term benefits of dance and musical training in aiding memory skills, emotional control, and overall wellbeing.

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