

IMPROVED BRAIN FUNCTION FROM MEDITATION FOLLOWING AN AWARENESS TRAINING PROGRAMME IN SPIRITUAL MEDICINE (ATPiSM)M. M. Jain¹, Nishtha Khatri², Pravin Jamadar³**HOW TO CITE THIS ARTICLE**

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ABSTRACT: INTRODUCTION: The relevance of spiritual practices in health and diseases is well recognized but its application in health care management is lacking. There are many factors responsible for present state of affairs. Firstly, spirituality is dismissed as superstitions, blind faith or worst as quackery resulting in to its poor coverage in modern medical curriculum. Secondly, there is lack of information on evidence based spiritual practices that separate them from superfluous rituals, earlier circumstantial needs, beliefs or extremist concepts. Thirdly, spiritual medicine does not constitute part of medical curriculum so few students, if at all, may take up this as career option. Lastly, research in spiritual medicine requires a well-equipped laboratory, high tech instruments and a team of expert scientists to generate credible data. All these require extra budgetary provision to an already constrained economy. Interestingly, current technological advances and hard core research at some of the premiere institutes of mind-body-medicine abroad have shown remarkable health benefits from a host of spiritual practices. Unfortunately, not only common man, but even health care professionals seem to be ignorant about these developments and hence remain skeptical about spirituality related discussions or deliberations. There is need to create awareness among common people and health care professionals regarding anticipated health benefits from spiritual practices as evident from scientific data. Such attempt may encourage people to participation in spirituality related activities with zeal and enthusiasm. The present study is aimed to verify this fact. For this purpose, we have prepared a training module based on available scientific evidence on mind-body-medicine. The said information is compiled in the form of Power Point Presentation (ppt) and termed as ATPiSM, an abbreviated form of "Awareness Training Programme in Spiritual Medicine".

MATERIAL & METHODS: STUDY SUBJECTS: 40 medical students of either sex between the ages of 18 to 21 years studying in MBBS at the institute constituted study population. After explaining purpose of the study and getting their consent, all the volunteers underwent a battery of tests for psycho-motor, cognitive and psycho-social functions. All volunteers were instructed regarding meditation practice by an expert. They were asked to meditate daily for about 15 minutes in the morning and as well as in the evening for two months. Subsequently, volunteers were divided in to two groups of 20 each by random allocation as treatment (T) and control (C) groups. The treatment group also received additional information on spiritual medicine in the form ATPiSM at the start of the study. At the end of two months, all the test parameters were repeated for both the groups. Observations were recorded and results were analyzed.

RESULTS: Compliance for meditation: Test group compliance for meditation was found to be in the range of 83 to 90% while control group compliance ranged between 48 to 90%. There was significant difference between pre and post interventional scores among test volunteers for psychomotor tests viz Visual reaction time (VRT, $p < .002$), stopwatch-VRT (S-VRT, $p < .005$) and Critical Flicker Fusion (CFF, < 0.007). Significant differences were also noted between pre and post intervention scores among study volunteers in cognitive function tests. Computer based Memory Test (CMT, $p < .001$), Digit Cancellation Test (DCT,

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p<.002) and Letter Substitution Test (LST, p<0.05). There was significant improvement in psychosocial behavior for all three categories as evident from higher scores post intervention in Cognitive Failure (p<.005), Anxiety Level (p<.05) and Self Esteem (p<.006). Control group also showed significant difference between pre and post score for CCF (p<.05), Cognitive Failure (p<.05) and Self Esteem (p<.01). **CONCLUSIONS:** ATPiSM act like a catalyst for meditation induced positive effects on mental functions. There were remarkable improvements from meditation in psychomotor, Cognitive and social functions among volunteers who were exposed to training module but not among the control subjects. This module may be tried for future research in spiritual medicine with advanced evaluation parameters including Physiological, Social, Psychological, hormonal, biochemical and neuro-imaging techniques.

KEYWORDS: Religion & Science Spiritual therapies Religion-Health & Science Complementary Therapies.

INTRODUCTION: The relevance of spiritual medicine in health and diseases is well recognized but its application in health care management, particularly in India and probably all around the world is lacking. Recently, our Honorable Prime Minister, Shri Narendra Modi, in his inaugural speech on the occasion of 42nd convocation ceremony at AIIMS (All India Institute of Medical Sciences) at Delhi said that 'Body Aura' is one of the ancient Indian techniques to assess health status of an individual and to diagnose a disease much earlier than it could be detected by modern means. He further elaborated on the subject asking young doctors to engage themselves in research in this field which has great potential in diagnosis and treatment of diseases. As a matter of fact, the message from our PM was to signify deep rooted philosophy of ancient times in management of health and diseases. Body aura is a reality today and it can be mapped by a technique called kilirin photography.⁽¹⁾ Dr. Munawwar Husain has demonstrated changing pattern of body aura under influence of rose flower extract (inhalational route) consistently in all volunteers which was further correlated with subjective well-being.⁽²⁾ It is increasingly realized that ancient spiritual practices were truly health practices meant for good health. These were vehemently pursued through religious rituals and customs to lead a healthy life free from even obscured disorders like anxiety, depression, low self-esteem and so on. The concept is well described in a book written by Harold G Koenig & Harvey J Cohen.⁽³⁾

In fact, all religions - Hinduism, Buddhism, Jainism, Sikhism, Christianity or Islam- advocate such practices for welfare of their followers. These included worshipping God, chanting mantras, Meditation, yogic postures, religious gatherings, annual pilgrimage, periodic fasting, feeding animals, keeping pets, protection of environment, preserving natural resources, donations, charity, love and compassion for all living being and astute discipline in words, deeds and actions. These activities were pursued through a set of rituals collectively called spiritual practices. Probably, faith, fear (Of God), conviction or self-interests make people accept a dictate or law and all these were underlying in the unique ancient philosophy of religion. With passage of time, many religious practices, superfluous rituals, earlier circumstantial needs, beliefs and extremist concepts got mixed with core spiritual matters leading to a short of disintegration and disbelief in ancient wisdom. Lack of scientific data further compounded problems of distinguishing between truly healthy practices from simply rituals and customs. Interestingly, advances in laboratory science and imaging techniques have broaden our vision by exploring anatomical, physiological and biochemical basis of positive health from spiritual practices. There are numerous papers describing "how" and "why" spiritual practices are essentially health related.^(4,5,6,7,8,9,10,11)

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Unfortunately, not only common man, but even health care professionals seem to be ignorant about these developments and hence remain skeptical about spirituality related discussions or deliberations. There is need to create awareness among common people and health care professionals regarding anticipated health benefits from spiritual practices as evident from scientific data which, we believe, may encourage people to engage in spirituality related activities with zeal and enthusiasm. The present study is aimed to test this hypothesis. For this purpose, we have prepared a training module based on available scientific evidence on mind-body-medicine. The said information is compiled in the form of Power Point Presentation and termed as ATPiSM, an abbreviated form of "Awareness Training Programme in Spiritual Medicine".

MATERIAL AND METHODS: Study Design: The study was an open label, parallel group, two arms, interventional study comprising of two groups of medical students, identical in all respects except the fact that test group was exposed to ATPiSM. The study was undertaken at Department of Pharmacology, Grant Government Medical College, Mumbai, INDIA. The study was approved by Institutional Ethics Committee.

Study Subjects: Medical students of either sex between the ages of 18 to 21 years who were studying in MBBS at the institute constituted study population. They were evaluated for their eligibility by inclusion and exclusion criteria (Annexure I). A total of 40 subjects were selected for the purpose of study.

PROCEDURE: All the volunteers were called at the study Centre on a particular day and time by the Principle Investigator (PI). After explaining them the purpose of the study, their consent was obtained. All volunteers underwent clinical examination by the study physician and detailed were entered in CRF. Subsequently, volunteers were asked to come to study Centre in a group of 4-5 at a time for base line measurements for various test parameters (Annexure II) and filling of questionnaire (Annexure III). All the tests were performed by an independent investigator (PJ) to avoid subjective variability in measurements. All the volunteers together had a session on meditation conducted by an expert, to be practiced twice a day for 15 minutes in the morning and evening during the entire period of study. Subsequently, volunteers were divided randomly in to two groups of 20 each as control and test group respectively. The test group received intervention, ATPiSM, in the form of a power point presentation which constituted training intervention for study participants. Control group did not receive any such training. The two groups were asked not to interact with each other regarding power point contents till the end of the study. All the volunteers were given a paper sheet to record their compliance for meditation on daily basis. The volunteers were again called at the end of two months for post-intervention measurements of all the study parameters by same investigator. Compliance sheet was also collected from them at this time. The results of test and control groups were compared using standard statistical tests within and in-between groups before and after intervention for level of significance.

STATISTICAL ANALYSIS: Paired 't' test was used to compare two paired groups and unpaired 't' test was used for comparison of two unpaired groups. Repeated measure ANOVA was applied for comparison of three or more variables in matched groups and one way ANOVA was used for unmatched groups. Level of significance was set at $p < 0.05$.

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RESULTS: The two groups were found to be identical in respect of age, sex, intelligence and were in good health (Table I). Thus any difference in pre and post scores within the test group or with control group is mainly attributed to intervention. At the outset, the overall results showed significant improvement in brain functions between pre and post test scores among study volunteers. No significant differences in majority of brain function parameters were observed between pre and post test scores in control subjects. Also, there was greater compliance for meditation practice in interventional group as compared to control group (Table II).

Psychomotor Functions: There was statistically significant difference between pre and post scores in VRT (0.63 ± 0.04 Vs 0.59 ± 0.04 , $p < .002$), S-VRT (5.27 ± 0.12 Vs 5.21 ± 0.1 , $p < .005$) and CFF test (35.95 ± 3.06 Vs 37.64 ± 3.24 , $p < .007$) but not for CRT among test group. In control group none of the above cognitive or psychomotor functions showed statistically significant difference except for the CFF (35.63 ± 2.57 Vs 34.63 ± 2.36 , 0.002).

Cognitive Functions: There was statistically significant difference between pre and post scores for CMT (491.75 ± 84.21 Vs 525.71 ± 81.69 , $p < .001$), DCT (0.93 ± 0.18 Vs 0.86 ± 0.15 , $p < .002$) and LST (1.64 ± 0.26 Vs 1.52 ± 0.24 , $p < .001$) among study group.

Psychosocial Behavior: There was significant improvement in psychosocial behavior among test volunteers as a result of intervention. The cognitive failure score improved from 89.75 ± 13.15 to 94.55 ± 12.60 , ($p < .005$), Anxiety level score improved from 61.45 ± 6.90 to 63.95 ± 7.17 ($p < .042$) and Self-esteem scores improved from 77.95 ± 10.94 to 82.25 ± 10.61 ($p < .006$). No significant difference was observed between pre and post scores in control subjects except for CCF ($p < .05$), Cognitive Failure ($p < .05$) and Self Esteem ($p < .01$).

Characteristics	Test Group (n=20)	Control Group (n=20)
Age (mean±SD)	20.6±0.50	20.2±0.40
Sex (n) M/F	11	7
	9	13
Educational Status	II MBBS	II MBBS
Pulse	77±9.4	74.8±11.43
B.P. Systolic (mean± SD)	120±5.95	116.9±6.17
Diastolic (mean±SD)	79.3±6.75	77.5±7.22
RR/min (mean±SD)	17.8±1.41	18.0±1.19

Table 1: Demographic data and vital clinical signs of study volunteers

(VRT – Visual Reaction Time, CRT – Choice Reaction Time, S-VRT – Stopwatch VRT, CFF – Critical Flicker Fusion, CMT – Computer based Memory Test, DCT – Digit Cancellation Test, LST – Letter substitution Test)

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Tests	Treatment Group (T)		Control Group (C)		P value		
	Pre Interv. Scores	Post Interv. Scores	Pre Interv. Scores	Post Interv. Scores	Pre Vs Post (T)	Pre Vs Post (C)	Post T Vs C
Psychomotor Tests							
VRT	0.63± 0.04	0.59± 0.04	0.62± 0.07	0.60± 0.06	0.002	0.21	0.53
CRT	0.32± 0.03	0.30 ±0.03	0.31± 0.04	0.30± 0.03	0.059	0.71	1.0
S-VRT	5.27± 0.12	5.21± 0.10	5.28± 0.17	5.22± 0.07	0.005	0.063	0.71
CFF	35.9± 3.0	37.6 ± 3.24	35.6± 2.57	34.3± 2.36	0.007	0.14	0.002
Cognitive Tests							
CMT	492± 84	525± 82	503± 63	494 ±69	0.001	0.39	0.19
DCT	0.93± 0.18	0.86± 0.15	0.83± 0.14	0.83± 0.17	0.002	0.88	0.55
LST	1.64± 0.26	1.52± 0.24	1.51± 0.27	1.55± 0.31	0.001	0.40	0.65
Questionnaires							
Cognitive Failure	89.7± 13.15	94.55± 12.6	86.5± 9.77	88± 7.98	0.005	0.19	0.05
Anxiety Level	61.45± 6.9	63.95± 7.17	60.9± 4.29	60.8± 2.68	0.042	0.92	0.07
Self Esteem	78± 10.9	82.2± 10.6	75.4± 10.1	75± 9.7	0.006	0.72	0.01

Table 2: Showing Pre and Post Interventional scores of different Test Parameters in Treatment and Control Group (mean + SD) and p-value

DISCUSSION: Brain is a mystery for scientists since ages and to predict its behavior in response to certain interventions are most difficult, if not impossible. Many attempts have been made to improve cognitive functions of the brain of a growing child or to delay age related functional deterioration in elderly people. Use of drugs for this purpose met with negligible success. However, engagement in mathematical tasks and literature at an early age has been shown to improve cognitive and behavioral pattern of a growing child.^(12,13)

Recently, it is found that spiritual practices of ancient times were remarkably beneficial and practicable in sustaining mental and physical functions for over a long period of time. As quoted by Moffitt et al, "Policy makers are considering large-scale programme aimed at self-control to improve citizen health and wealth and reduce crime. Experimental and economic studies suggest such programme could reap benefits. Yet, is self-control important for the health, wealth and public safety

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of the population. Following a cohort of 1000 children from birth to the age of thirty two years, we show that childhood self-control predicts physical health, substance dependence, personal finance and criminal offending outcome following a gradient of self-control. Effects of children's self-control could be disentangled from their intelligence and social class from mistakes they made as adolescents. In another cohort of 500 sibling-pairs, the siblings with lower self-control had poorer out-comes, despite shared background. Interventions addressing self-control might reduce panoply of societal cost, save tax-payers money and promote prosperity".⁽¹⁴⁾

In fact, religious rituals and customs are designed to exercise self-control of highest magnitude without much conscious efforts. Moreover, there is growing evidence of health benefits from a host of spiritual practices which have been proved by modern scientific methods at cellular and molecular level. Meditation is one of the universally accepted and well documented spiritual interventions for physical as well as mental wellbeing. However, spirituality induced improvement is subtle in nature and may not be equivocal⁽¹⁵⁾ in all the study participants thereby creating doubts about its relevance in clinical practice. An article by Bethany Eanes in this context is very relevant.⁽¹⁶⁾ Interestingly, with the advent of science and technology, it is now possible to substantiate the health benefits from spirituality by scientific methods. Alternatively, even when sufficient scientific evidence does exist, unawareness about it among health care professionals and health care consumers deprive them of its applicability. It is believed that, rather than preaching, if spirituality related benefits are explained in terms of scientific evidence, it might be more acceptable by the modern society and may improve their indulgence in spiritual practices. ATPiSM is designed to serve this purpose. Many studies have shown that formal training in spiritual practices has desirable impact on outcome.^(17,18,19,20,21) In our study we found significant improvements in most of the parameters of brain functions among test subjects as compared to control subjects. This was mainly as a result of intervention in the form of ATPiSM. The various factors responsible for the observed benefits may include (1) Awareness about evidence based spirituality related health benefits led to better compliance for meditation (2) A sense of deeper involvement in meditative practice after understanding underlying mechanism/s responsible for positive health (3) Unconsciously remained in meditative state throughout the day even when non-meditating and (4) Use of computer based objective parameters with fine precision could detect minor differences unlikely to be detected by traditional means. Spirituality related health benefits have been extensively reported by many investigators. Our study differs from earlier reported studies in the sense that most of those studies have been done in patients who were suffering from incurable chronic diseases and therefore were already in poor health.^(22,23,24)

Such population displays a lot of psychological component responsible for their wellbeing besides actual benefits from any intervention. Our study subjects included healthy medical students who were already, at least apparently, enjoyed good physical and mental health and had an above average IQ. Influencing mental functions of such study population within a short span of two months by meditation is rather difficult. Probably, it was due to awareness training programme on spiritual medicine that has resulted in to detectable improvement in brain functions. We have used simple but sensitive parameters to assess the mental abilities. There are many advanced techniques used by various investigators to demonstrate anatomical and physiological alterations in some of the strategic areas of the brain as a result of spiritual practices. However, these require expensive instruments, well equipped infrastructure and state of the art laboratory facilities besides a team of qualified and experienced persons to interpret and analyze the results. Nevertheless, our results

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correlate well with finding of other investigators who have used advanced techniques for evaluation, indicating that these simple, easy-to-do study parameters also have reasonable predictive values.

We have evaluated effects of meditation, a well-established spiritual practice, on various brain functions. There are many spiritual practices which have direct or indirect influence on human health. A comprehensive scientific approach to establish their worthiness in human health and diseases is need of the hour to control and contain the ever expanding menace of NCDs.⁽²⁵⁾

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Annexure 1: Inclusion- Exclusion Criteria:

Inclusion Criteria:

- Healthy male or female volunteers between ages of 18 and 21 years.
- No significant clinical H/O physical or mental illness.
- No H/O following any special type of spiritual practices.
- Ready to give consent freely and willingly.
- Ready to follow all study related procedures.

Exclusion Criteria:

- Unwilling to give consent.
- Known case of CNS or psychiatry disorders.
- Habitual smokers, alcoholic or drug addict.
- Taking any concomitant medication.
- Any gross distracting events like examinations, marriage within two months from the date of enrollment for the study.

Annexure II - Study Parameters:

Psychomotor Tests:

- Visual Reaction Time (VRT): (en) 10 (Global Limited; chube.zendesk.com).
- Stop-watch VRT: In-house developed test.
- Choice Reaction Time: Freedom Apps; branon.co.uk.
- Critical flicker fusion: A portable standardized CFF device was used.

Cognitive Tests:

- Computer based memory test: LG; weibo.com.
- Digit cancellation.
- Letter substitution.

Questionnaire based psychosocial evaluation:

Annexure III- Questionnaire: Cognitive Failure Questionnaire (Modified after Broadbent, Cooper, FitzGerald & Parkers, 1982).

The following questions are about minor mistakes, which everyone makes from time to time, but some of which happens more often than others. We want to know how often these things have happened to you in the past 2 months. Please tick the appropriate square. A-Very often, B-Quite often, C-Occasionally, D-Very rarely, E-Never.

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No.	Statement	A	B	C	D	E
1	Do you read something and find you haven't been thinking about it and must read again?					
2	Do you find you forget why you went from one part of the house to the other? Do you find you forget why you went from one part of the house to the other?					
3	Do you fail to notice signpost on the road?					
4	Do you find you confuse right and left when giving direction?					
5	Do you collide with the people?					
6	Do you find you forget whether you have turned a light or the gas or locked the door?					
7	Do you fail to listen to people's name when you are meeting them?					
8	Do you say something and realizing afterwards that it might be taken as insulting?					
9	Do you fail to hear people speaking to you when you are doing something else?					
10	Do you lose your temper and regret it?					
11	Do you leave important letters unanswered for days?					
12	Do you find you forget which way to turn on the road you know well but rarely use?					
13	Do you fail to see what you want in a super market even though it is very much there?					
14	Do you find yourself suddenly wondering whether you have used the word correctly?					
15	Do you have trouble making up your mind?					
16	Do you forget appointments					
17	Do you forget where you put something like a newspaper or a book?					
18	Do you find you accidentally throw away things you want and keep what you meant to throw away?					
19	Do you day dream when you ought to be listening to something					
20	Do you find you forget people's name?					
21	Do you start doing one thing at home and get distracted doing something else unintentionally?					
22	Do you find you can't quite remember something although it's "on the tip of your tongue"?					
23	Do you find you forget what you came to the shop to buy?					
24	Do you drop things?					
25	Do you find you can't think of anything to say?					

Medical Anxiety Scale Rating (MARS): (Modified after Heinssen, Glass & Knight, 1987).

For each statement, decide whether you Strongly Agree (SA), Agree (A), Neutral (N), Disagree (D), Strongly Disagree (SD). In the box to the right of each statement, put a tick mark that describe your level of agreement or disagreement.

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No.	Statement	SA	A	N	D	SD
1	I feel insecure about my ability to interact with patients					
2	I look forward to discuss my difficulties with the teachers					
3	I do not think I would be able to learn surgical skills					
4	The challenge of diagnosis in medicine is exciting					
5	I am confident that I can treat most of the patients					
6	Anyone can learn minor surgical procedures if they are patient and motivated					
7	Learning medicine is like learning any new skill, the more you practice, the better you become					
8	The burden of medical subjects is too much to pass university examinations easily					
9	A lot depends on the examiners and examination centre in overall success of a candidate					
10	I feel that I will not be able to keep with the advances happening in the medical field					
11	I dislike to discuss my performance in the exam once it is over					
12	I feel apprehensive in taking feedback from the patients about the treatment					
13	I have difficulty in understanding the practical aspects of learning					
14	It scares me to think that I could cause serious harm to the patients by wrong diagnosis or treatment					
15	I hesitate to investigate the patients for fear of diagnosing something that cannot be treated					
16	You have to be genius to become a specialist in medical science					
17	If given opportunity, I would like to treat some of the patients myself at UG level					

Current Thought Scale: A measure of state of self-esteem (Modified after Heartherton & Polivy, 1991).

This is questionnaire designed to measure what you are at this moment. There is, of course, no right or wrong answer for any statement. The best answer is what you feel is true of yourself at this moment. Be sure to answer all the items, even if you are not certain of the best answer. Again, answer these questions as they are true for you right now as compare to your other colleagues. A-Not at all, B-a bit, C-Somewhat, D-Very much, E-Extremely.

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No.	Statement	A	B	C	D	E
1	I feel confident about my abilities					
2	I am worried about whether I am regarded as success or failure					
3	I feel satisfied with the way my body looks right now					
4	I feel frustrated or rattled about my performance					
5	I feel that I am having trouble understanding things that I read					
6	I feel that others respect and admire me					
7	I am dissatisfied with my weight					
8	I feel self-conscious					
9	I feel as smart as others					
10	I feel displeased with myself					
11	I feel good about myself					
12	I am pleased with my appearance right now					
13	I am worried about what other people think of me					
14	I feel confident that I understand things					
15	I feel inferior to others at this moment					
16	I feel I look unattractive					
17	I feel concerned about the impression I am making					
18	I feel that I have less scholastic ability right now than others					
19	I feel like I am not doing well					
20	I am worried about looking foolish					
21	Others are partly responsible for my Failures					

A pre-designed scoring system was used for Digit Cancellation, Letter substitution and all psycho-social questions for the purpose of statistical analysis. Direct reading was used for remaining tests

AUTHORS:

1. M. M. Jain
2. Nishtha Khatri
3. Pravin Jamadar

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Pharmacology, Grant Government Medical College & Sri J. J. Group of Hospitals, Mumbai, India.
2. 3rd Year Medical Student, Grant Government Medical College & Sri J. J. Group of Hospitals, Mumbai, India.

FINANCIAL OR OTHER**COMPETING INTERESTS:** None

3. Senior Resident, Department of Pharmacology, Grant Government Medical College & Sri J. J. Group of Hospitals, Mumbai, India.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. M. M. Jain,
Associate Professor,
Department of Pharmacology,
Grant Government Medical College &
Sri J. J. Group of Hospitals, Mumbai, India.
E-mail: mangalmjain@gmail.com

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