

Full Length Research Paper

Enhanced memory processes under the influence of herbal drug Somina and its effect on brain serotonin

Aisha Azmat^{1*}, Muhammad Ahmed², Saida Haider³, Darakshan Jabeen Haleem³,
Navaid-ul- Zafar⁴ and Syed Iqbal Ahmad⁵

¹Department of Physiology, Faculty of Medicine, Umm-Al-Qura University Makkah, Saudi Arabia.

²Department of Pharmacology, Faculty of Pharmacy, Umm-Al-Qura University Makkah, Saudi Arabia.

³Department of Biochemistry, University of Karachi, Karachi 75270, Pakistan.

⁴Hamdard Laboratories (Waqf) Pakistan, Karachi, Pakistan.

⁵Dr. Hafiz Muhammad Ilyas Institute of Pharmacology and Herbal Sciences (Dr. HMIIPHS), Hamdard University, Karachi 74600, Pakistan.

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A progressive decline in memory with advancing age is an established fact. The purpose of the present study was to investigate the effects of Somina (herbal drug) on memory processes of rat. Somina (285 mg/kg-body weight) was administered orally in rats for 29 consecutive days. It is observed in the present study that Somina is responsible for the enhanced memory related behavior significantly in both male and female rats ($p < 0.025$ and $p < 0.0005$ respectively) measured by elevated plus maze activity. It is also observed that Somina increased the availability of tryptophan in brain and hence increases 5-hydroxytryptamine (Serotonin: 5HT). Therefore it is suggested that administration of somina strengthens all processes involved in memory and learned behavior.

Key words: Herbal medicine, tryptophan, serotonin, memory, elevated plus maze activity.

INTRODUCTION

The Unani system of medicine in which plants (whole or parts) are used as herbal drugs to cure various ailments, is quite prevalent and has potential for improving health and lowering the cost of treatment, and thus makes health care affordable for all. A lot of herbs are used still for treating various diseases; the reason behind this is that most of the people believe that they have less toxic effects and more synergic effects (Murtaza et al., 2012). Some previous studies had already reported the importance of herbs as medicine and their use in different ailments (Sima et al., 2012; Jinous and Fereshteh, 2012; Muhammad Alam et al., 2012). The literature on herbal medicine mentions several herbs exerting influence on brain function in general and memory in particular. It is assumed that some pharmacological formulation might

facilitate the neurotransmitters (such as Acetylcholine, Dopamine, Serotonin, Catecholamines etc.) presumed to play a vital role in the organization of memory. These herbal medicines have been prepared from a single herb as well as by mixing the ingredients of many herbs. One of such medicine is Somina, which is prepared by Hamdard Laboratories (Waqf), Pakistan. Somina is claimed to be a cephalic tonic having sedative, hypnotic and anxiolytic activities, and it improves memory. Somina is composed of five ingredients that belong to five different medicinal plants: *Sesamum indicum*, *Prunus amygdalus*, *Papaver somniferum*, *Lactuca scariola* and *Lagenaria vulgaris*.

S. indicum belongs to family Pedaliaceae. Amino acid composition of *S. indicum* suggests that it contain tryptophan (Morris, 2002). Levkovitz et al. (2003) reported that tryptophan had a beneficial effect on memory functions.

P. amygdalus belongs to family Rosaceae. It improves brain functions.

*Corresponding author. E-mail: aishaazmatkhan@hotmail.com.
Tel: 00966 025270000 ext. 4419.

P. somniferum belongs to family Papaveraceae, in minute doses it stimulates brain, heart and respiration. Its hypnotic and sedative property is helpful in relieving hysteria (Khan, 1997).

L. scariola (seed extracts) belongs to family Compositae/Asteraceae. It is useful against nervousness, palpitation having sedative and hypnotic activities (Khan, 1997).

L. vulgaris belongs to family Cucurbitaceae, it is cooling refrigerant, sedative used as a traditional brain tonic (Khan, 1997).

On the basis of aforementioned reported effects in literature regarding the individual constituents of Somina, this study was conducted to investigate the role of Somina in the organization of memory processes.

MATERIALS AND METHODS

Drug

Somina (herbal drug) that was used in the present study was obtained from Hamdard laboratories (Waqf) Pakistan in powdered form. The dose of Somina 285-mg/kg was prepared by dissolving its powder in distilled water for experimental use.

Animals

Sprague-Dawley rats of either sex weighing between 200 to 225 g were obtained from Dr. Hafiz Muhammad Ilyas Institute of Pharmacology and Herbal Sciences (Dr. HMIIPHS) and housed individually in separate cages for seven days prior to experimentation with free access to food and tap water *ad libitum*. Animals were divided into four groups of seven rats in each. Groups I and II served as female and male Control respectively, and Groups III and IV served as male and female treated respectively. Single dose of 285-mg/kg of somina (dissolved in distilled water) was administered orally in treated rats for 29 consecutive days. While the control group received equivalent volume of distilled water through the same route with oral feeding needle. Food intake was monitored weekly during the entire study. The experimental protocol was approved by the institutional ethics committee.

Elevated plus maze activity

This study was carried out by using the method described by Hozumi et al. (2003). In first training trial, a rat was placed at the end of one open arm facing away from the central platform, and the time it took for the rat to move from open arm to either of the closed arms (transfer latency) was recorded. With the aim to attain a low level of transfer latency, the exposure of animals on the elevated plus maze was repeated on the 2nd and 3rd day. All trials were performed at 24 h interval as described by Hozumi et al. (2003). The retention trial was measured at the end of entire study after the 3rd trial was finished, and the transfer latency time was recorded.

Estimation of 5HT and tryptophan

At the end of 29th day, all animals were sacrificed by decapitation and their brains were dissected out and stored at -70°C till analysis and their blood were collected, then plasma was separated by centrifugation. Concentrations of brain 5HT, its metabolite 5HIAA

(5-hydroxyindole acetic acid), and plasma and brain tryptophan were measured by using HPLC-EC as described earlier (Haider and Haleem, 2000).

Statistical analysis

Statistical analysis for elevated plus maze test was carried out by student's t-test. The criterion of significance was set at $P < 0.05$. All results are given as mean \pm standard deviation.

RESULTS

Influence of Somina on memory related behavior measured by elevated plus maze activity

The retention trial was measured on the last day after the 3rd training trial was finished, and the transfer latency was recorded. Results of this retention trial showed that the transfer latency time was significantly decreased in both male ($p < 0.025$) and female ($p < 0.0005$) rats treated with Somina when compared with their control rats (Figure 1).

Effect of Somina on 5HT and 5HIAA

The results presented in Figure 2 demonstrate that in male and female rats, brain 5HT levels were found to increase after Somina treatment as compared to their respective control and this increase was statistically significant ($P < 0.005$ and $P < 0.05$, respectively). Brain 5HIAA levels were also found to increase (Figure 3) after Somina treatment in both male and female rats as compared to their control. This increase was statistically significant in male rats ($P < 0.005$) while in female the increase was statistically non significant ($P > 0.05$) as shown in Figure 3.

Effect of Somina on tryptophan

After Somina treatment, plasma tryptophan level were found to decrease significantly in both male and female treated rats ($P < 0.05$) when compared with their control (Figure 4). However, Somina treatment increased the brain tryptophan level in both male and female treated rats non-significantly when compared with their respective controls (Figure 5).

Effect of Somina on food intake

At the end of study, the cumulative food intake of Somina treated rats was compared with their respective controls. The results showed that food intake was decreased (Figure 6) in both male and female rats by 18 and 36% as shown in Figure 6. The decrease in food intake is statistically significant ($P < 0.025$).

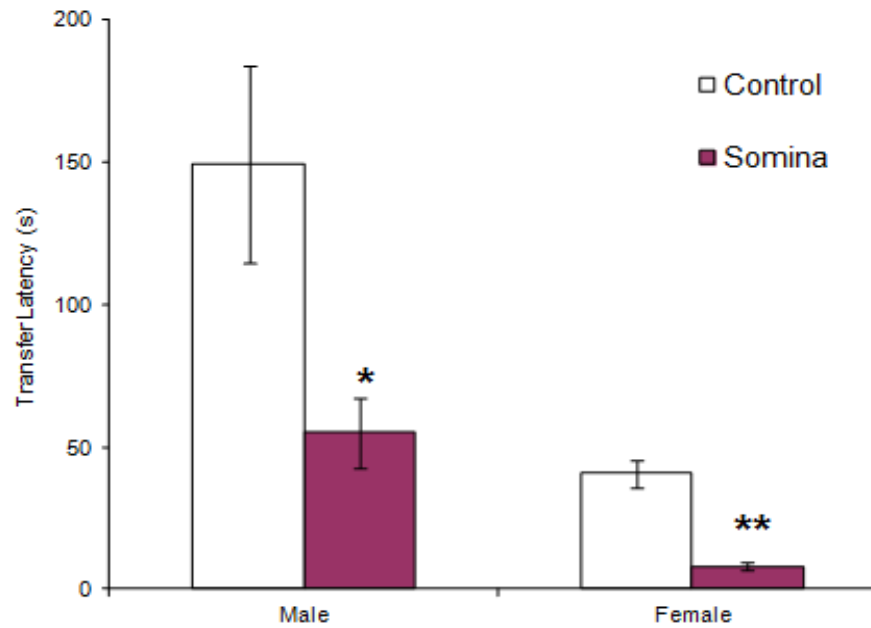


Figure 1. Effect on memory measured by elevated plus maze after Somina treatment. Values are mean \pm SD (n = 7). Significant difference by Students t-test. *P < 0.025, **P < 0.0005 from respective controls.

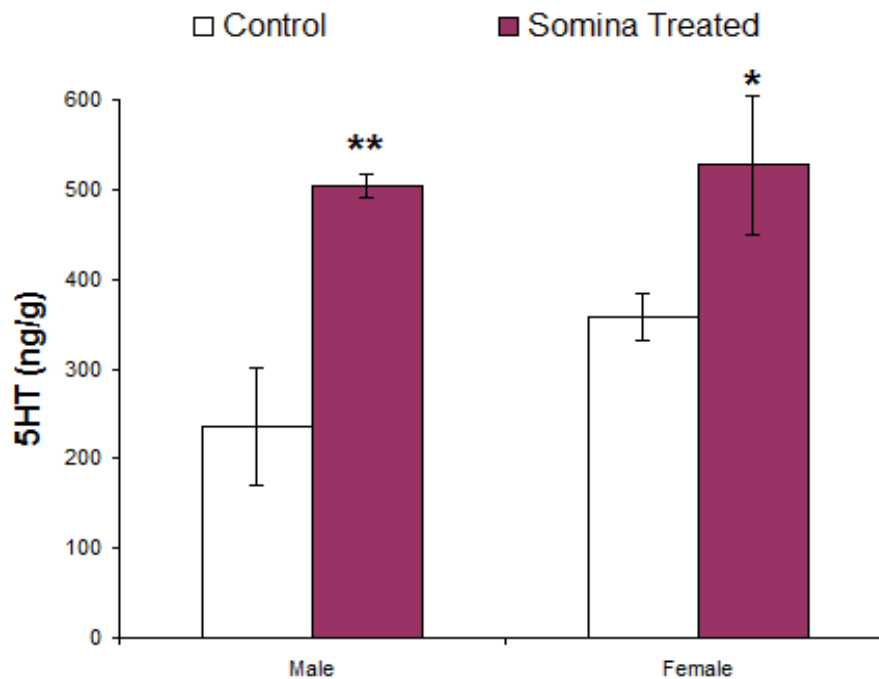


Figure 2. Effect of Somina on brain 5HT levels. Values are mean \pm SD (n = 7). Significant difference by Students t-test. *P < 0.05, **P < 0.005 from respective controls.

DISCUSSION

In the present study, Somina has been tested for its effects on memory. The results presented (Figure 1)

clearly shows that Somina has ability to increase the memory span and decrease the transfer latency time significantly (Figure 1) in both male and female rats. In our opinion, Somina enhances the amino acid tryptophan

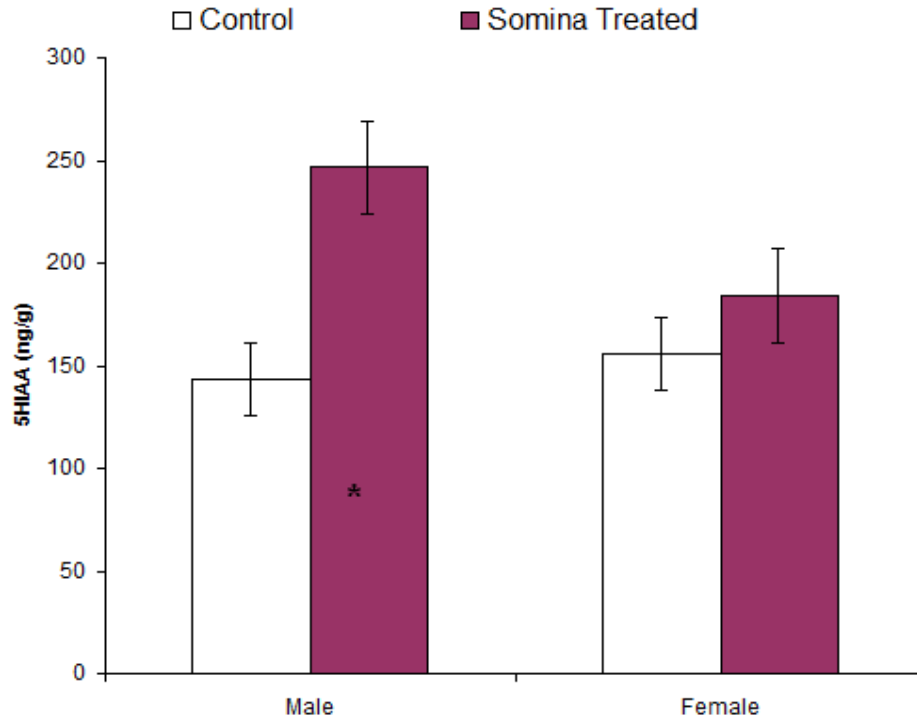


Figure 3. Effect of Somina on brain 5HIAA. Values are mean \pm SD (n = 7). Significant Difference by Students t-test. *P < 0.005 from respective controls.

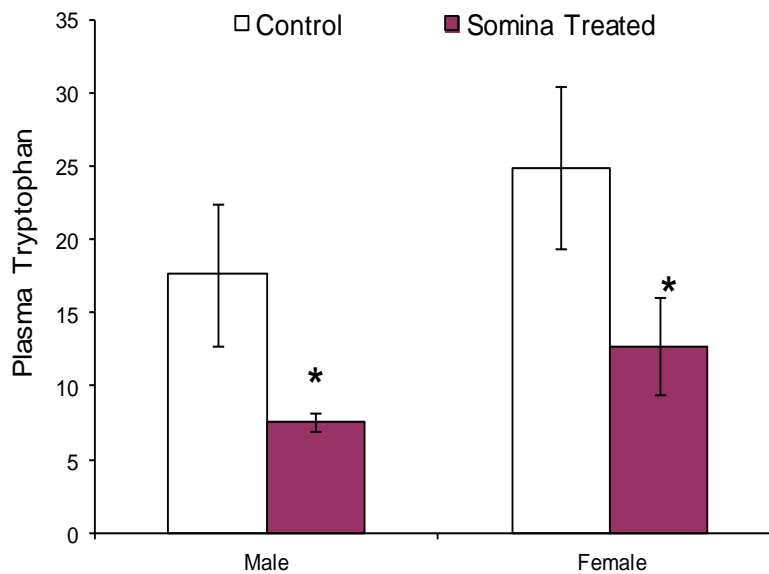


Figure 4. Effect of Somina on Plasma Tryptophan ($\mu\text{g/g}$). Values are mean \pm SD (n=7). Significant Difference by Students t-test. *P<0.05 from respective controls.

in brain because one of its constituent *S. indicum* contains tryptophan (Morris, 2002). Tryptophan is an essential amino acid (that is, it cannot be made by the

body but must be ingested). It is reported that tryptophan has a beneficial effect on memory functions (Levkovitz et al., 2003) because dietary tryptophan is converted into 5-

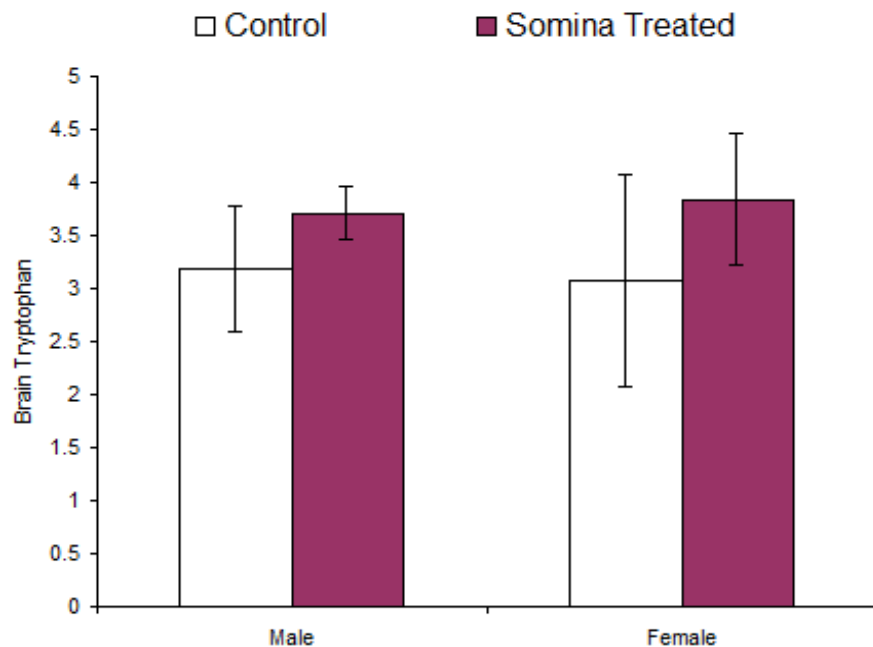


Figure 5. Effect of Somina on brain tryptophan ($\mu\text{g/g}$). Values are mean \pm SD ($n = 7$). Non-Significant difference by Students t-test.

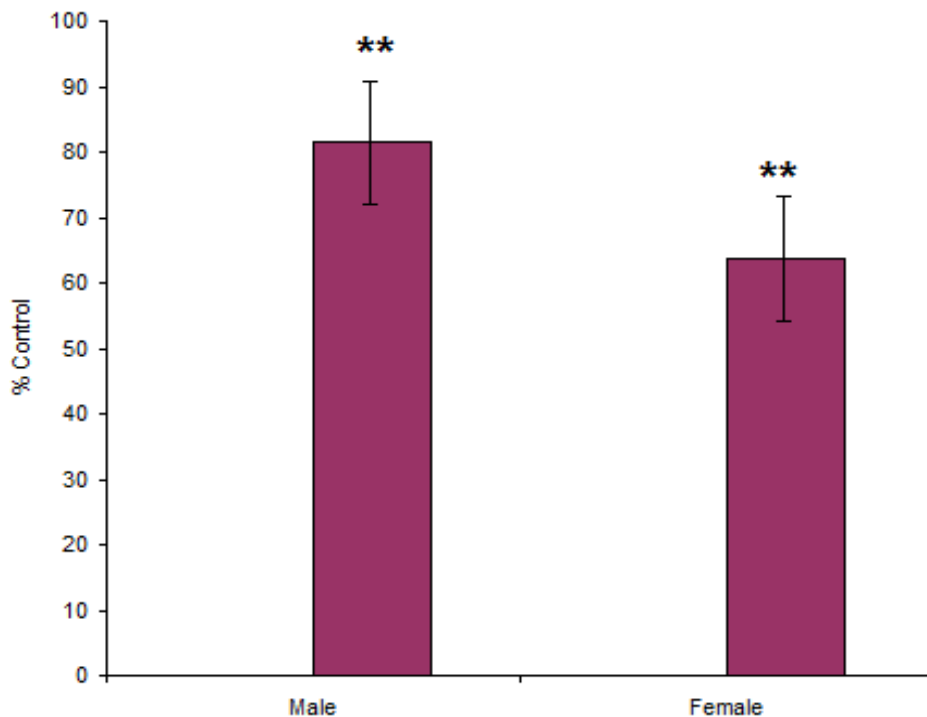


Figure 6. Effect of Somina on food intake. Values are mean \pm SD ($n = 7$). Significant difference by Students t-test. * $P < 0.025$ from respective controls.

hydroxytryptophan then 5-HT/Serotonin. 5 HT has been implicated in numerous behaviours including feeding, aggression, obsessive-compulsive disorder, sleep, mood,

and memory. It is also reported that the serotonergic system controls the time scale of evaluation (Doya, 2000). It is also observed in present results that brain

5HT were significantly increased in both male and female Somina treated rats (Figure 2) and brain tryptophan levels non-significantly (Figure 5). However, plasma total tryptophan levels were found to decrease significantly (Figure 4). Thus it may be suggested that Somina increases the transport of tryptophan via a change in the ratio of plasma tryptophan to the sum of the other large neutral amino acids (Trp-LNAA ratio) or by increasing the free fraction of tryptophan thus increases the cerebral availability of tryptophan (Figure 5). Therefore, this Somina induced increase in tryptophan availability in brain may increase brain 5HT synthesis (Figure 2). This increase in brain 5HT as suggested may be responsible for the increase in the memory span and decrease in the transfer latency time as reported by Riedel et al. (1999). In animals treated with Somina (Figure 6), a decrease in food intake was observed which might be related to an increase level of 5HT also observed in the present study (Figure 2). As it is reported, the increased levels of 5HT decrease the appetite and food intake (Abadie et al., 1993). Further, the increase in memory processes may also be due to the presence of other constituent of Somina, that is, *P. amygdalus*, *L. vulgaris* and *L. scariola* used as brain tonic in traditional medicine having sedative activity (Khan, 1997). Another ingredient of Somina *Papaver somniferum* stimulates brain (Khan, 1997). All the effects independently produced by various ingredients in Somina are producing a total beneficial effect on memory.

Conclusion

From the preceding discussion, it is concluded that Somina is a physiologically and pharmacologically active drug. Somina, the herbal formulation used in this study, improves memory functions by regulating tryptophan and 5HT levels in the brain. The present experiments in rats show that Somina decrease the transfer latency time while increasing memory span. Therefore, administration of Somina strengthens all the processes involved in memory and learned behavior.

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