RESEARCH ARTICLE

EFFECTS OF SALVIA OFFICINALIS L. (SAGE) ON COGNITIVE IMPAIRMENT IN SAUDI AGING PEOPLE

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ARTICLE INFO	ABSTRACT
	Background and Aim: Elderly people are susceptible to cognitive impairment making them a particularly vulnerable group. The number of older people had cognitive impairment and dementia is increasing worldwide. Salvia officinalis (Sage) is a plant in the family of Labiatae. It contains a large array of active compounds that may enhance cognitive activity and protect against neurodegenerative diseases. This study aimed to assess the effect of the orally received sage tea extract for 4 weeks on improving the cognitive performance in elderly people. **Methodology:** Cross-sectional intervention study was conducted, one hundred participants 47 males and 53 females (aged 60 and older) received of S. officinalis (tea bag contain 2.5g), participate were received 2 cup/day for 4 weeks. Cognitive performance measured was assessed by the change in The Mini Mental State Examination (MMSE) score before and after received sage tea. **Results:** The mean age to all participants was 70.16 ± 7.05. The cognitive performance was improve after received S. officinalis, there was a statistical significant difference ($p < 0.001$) for the MMSE score in both gander before and after one month of receiving sage with total score (22.57 and 25.25, respectively). **Conclusion:** Salvia officinalisis has potential health benefits; it improved cognitive performance for elderly participants. Further investigation is essential to help in elucidation the potential of this commonly ingested herb to enhance cognitive health and wellbeing.

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INTRODUCTION

As life expectancy has increased over the past few decades, a number of chronic diseases become more prevalent among older population (Landau *et al*., 2016). Older adults may experience changes in their abilities to name objects or with their visual, verbal and short-term memory- some of which may be considered a normal consequence of the ageing process) Ogunniyi *et al*., 2011). Dementia is a common chronic disease among older individuals. It characterized by loss of brain functions, which affects daily life in an alert person memory, thinking, language, judgment, and behavior (Pierce *et al*., 2015). The prevalence of Mild cognitive impairment (MCI) is about four-times greater than dementia, its prevalence of the populace over sixty five years in industrialized countries is about 10-25 % (Petersen *et al*., 2013). It is an etiologically heterogenous syndrome characterized *via* reminiscence overall performance below the age norm, in any other case unimpaired highbrow functioning, and well preserved activities of everyday living. A few MCI individuals will progress to Alzheimer's Disease (AD), or to some other dementias but some of them may additionally even get better. Mild cognitive impairment traits are declining and disturbance of cognition, minimal impairment of complex activities, capability to perform regular daily functions, and absence of dementia (Sanchez-Benavides *et al*., 2010). In usual MCI, memory impairment as well as cognitive decline is at a extra rate than anticipated for an individual's age and academic level without impairing each day activities (Verghese *et al*., 2006). The MCI is a transitional stage among regular state of brain and dementia (Jefferson *et al*., 2008). Sage (*Salvia officinalis L.*) is a common herb that can grow wildly or in cultivation. It has been long known for its broad medicinal properties (Lima *et al*., 2005). Sage tea has been traditionally used for the treatment of digestive and circulation disturbances, bronchitis, cough, asthma, angina, mouth and throat inflammations, depression, excessive sweating, skin diseases, and many other diseases (Walch *et al*., 2011). The majority of the phenolic acids in Salvia species are derivatives of caffeic acid (Kamatou *et al*., 2011). Also, carnosic acid and rosmarinic acid, which are present at high concentrations in the extract of sage plants, have shown strong antioxidant properties (Yurtseven *et al*., 2008). Therefore the present study was undertaken to assess the effect of the orally received sage tea extract for 4 weeks on improving the cognitive performance in elderly people.

Subjects and Methods

Participants and setting: The present study was designed as a cross-sectional intervention study. One hundred older adult

volunteers 53 female and 47 male age (60 years and older) participate in this study. This study was conducted in Jeddah, Saudi Arabia. It was carried out from January 2015 to February 2018.

Inclusion and exclusion criteria: The inclusion criteria include subjects aged 60 years and above, with no history of medical disorders, and they had mild to moderate score in MMSE. The exclusion criteria included subjects who had any history of epilepsy, anxiety, depression or psychiatric disorders, cardiovascular disease, kidney disease, liver disease and/or gastrointestinal diseases, or concurrent medically prescribed or over-the counter medications.

Plant: *Salvia officinalis* bags (each bag contains 2.5 g *S. officinalis* in powder form) were obtained from the Abazee, natural-foods stores, Jeddah, Saudi Arabia.

MATERIALS AND METHODS

***Salvia officinalis* extract preparation and interventions methods:** *Salvia officinalis* extract (tea bag 2.5 g). One cup of boiling water was added to one bag of *S. officinalis*, then cover and steep for 10 minutes and strain the tea to remove the bag (Rainer and Douglas, 2015), participate were received 2 cup/day.

language. The maximum score is 30. The MMSE takes only 5-10 minutes to administer and is therefore practical to use repeatedly and routinely. The MMSE questionnaire performed and the score interpreted according to (Pangman *et al.*, 2000).

Statistical analysis

All data were analyzed by using the SPSS version 22. The data were explored for their descriptive statistics. Differences were considered significant if p-value was < 0.05 (Snedecor and Cochron, 1989).

RESULTS

Relationship between MMSE and gander: Table (1) showed that women were 53% and man were 47%. The mean $\pm$ SD for age to all participants was 70.16$\pm$ 7.05. The results revealed that there was a significant relationship between gander and the score for orientation date questions before and after using sage. For the other exam questions score there were no significant relationship with gander ($p>0.05$). The average total score of MMSE for men was more than average score of women (23.00 $\pm$ 3.26 and 22.19 $\pm$ 3.31, respectively) (Table 2&3).

Relationship between MMSE and age groups: The results in Table (4&5) showed the relationship between age groups and

Table 1. Demographic characteristics of the participants

Gander	Frequency	%
Men	47	47
Women	53	53
Total	100	100
	Mean	SD
Age	70.16	7.05
Men Age	71.45	6.56
Women Age	68.87	6.60

Table 2. Relationship between MMSE and gander before receiving sage

Items of MMSE	Men	Women	t- test	P-value
Orientation date	3.53 ± 0.88	3.06 ± 1.01	2.49	0.01*
Orientation place	3.91 ± 0.88	3.58 ± 0.93	1.82	0.07
Registration	3.18 ± 0.25	2.98± 0.17	-1.01	0.29
Attention	2.83 ± 0.84	2.79 ± 1.03	0.19	0.84
Recall	2.30 ± 1.12	2.43 ± 1.28	- 0.56	0.57
Ordering	2.81 ± 0.39	2.64 ± 0.49	1.87	0.06
Drawing	0.64 ± 0.048	0.68 ± 0.047	- 0.43	0.67
Total score	23.00 ± 3.26	22.19 ± 3.31	1.23	0.22

Data are expressed as mean ± SD. * Statistical significant

Table 3. Relationship between MMSE and gander after one month of receiving sage

Items of MMSE	Men	Women	t-test	P-value
Orientation date	3.98 ± 0.74	3.62 ± 0.95	2.11	0.03*
Orientation place	4.19 ± 0.68	4.02 ± 0.84	1.11	0.27
Registration	4.98 ± 0.15	5.00 ± 0.34	-1.06	0.29
Attention	3.28 ± 0.77	3.19 ± 0.83	0.54	0.58
Recall	3.55 ± 1.14	3.58 ± 1.05	-0.15	0.88
Ordering	2.91 ± 0.28	2.89 ± 0.32	0.46	0.64
Drawing	0.64± 0.048	0.68 ± 0.047	-0.42	0.67
Total score	25.55± 3.15	24.98 ± 3.29	0.88	0.39

Data are expressed as mean ± SD. * Statistical significant

Cognitive assessment: The Mini Mental State Examination (MMSE) questionnaire is a tool that can be used to systematically and thoroughly assess mental status. It is an many questions measure that tests areas of cognitive function: orientation, registration, attention and calculation, recall, and

the score of MMSE. There was a significant relationship between age groups and the score for all questions before and after receiving sage, where the average score for age group (60-69) was more than average for the other age groups. For the total score there was a significant relationship with age group

and the score of MMSE (p< 0.05) before and after one month of receiving sage, except registration there was no significant relationship for age groups. For the total score there was a significant relationship with age group where (p< 0.05). Table (6) demonstrated the relationship between the score of MMSE before and after one month of receiving sage. There was a significant different in the score of all questions between before and after one month (p < 0.05), where the average score after one month were higher than before, expect registration questions. Regarding total score of MMSE, there was a significant difference (p< 0.001) for the total MMSE score before and after one month of receiving sage, where the average score after one month was (25.25), which was higher than before score (22.57), and this provide an evidence that receiving sage herb can improve the cognitive performance in elderly people.

there were gender differences in prevalence of cognitive impairment. While some had found that there was no gender differences (Busse *et al.*, 2003). Moreover, the obtained results agreed with DiCarlo *et al.* (2002) who reported that higher cognitive impairment prevalence were shown in women than men. Considering the age in our study there was a significant relationship between age groups and the score for all questions before and after receiving sage Our findings were similar to other studies in different countries: an exponential increase in dementia by age, higher estimates in women only in the oldest participants, and the total score of MMSE in men was higher than women (Ravaglia *et al.*, 2005).The superiority of MCI is calculable to be between 2-10 % amongst oldsters over 65 years aged (Petersen *et al.*, 2009 and Langa and Levine, 2014).

Table 4. Relationship between MMSE and age groups before receiving sage

Items of MMSE	Age groups			t- test	P-value
	60-69	70-79	>80		
Orientation date	3.96±0.84	3.43±0.87	2.57±0.98	24.43	0.00*
Orientation place	4.46±0.74	3.65±0.92	3.26±0.66	18.69	0.00*
Attention	3.61±0.68	2.76±0.93	2.23±0.65	25.01	0.00*
Registration	3.98±0.15	3.20±0.30	2.98±0.20	1.293	0.28
Recall	3.00±1.02	2.57±0.98	1.66±1.21	13.03	0.00*
Ordering	2.93±0.26	2.65±0.48	2.63±0.49	4.46	0.01*
Drawing	1.00±0.01	0.70±0.46	0.34±0.48	21.19	0.00*
Total score	25.96±1.92	22.76±2.63	19.66±1.78	66.08	0.00*

Data are expressed as mean ± SD. * Statistical significant

Table 5. Relationship between MMSE and age groups after one month of receiving sage

Items of MMSE	Age groups			t- test	P-value
	60-69	70-79	>80		
Orientation date	4.43 ± 0.57	3.92 ± 0.83	3.74±0.65	27.03	0.00*
Orientation place	4.61 ± 0.63	4.16 ± 0.68	3.63±0.69	16.72	0.00*
Attention	3.86 ± 0.36	3.24 ± 0.64	2.71±0.86	22.73	0.00*
Registration	5.00 ± 0.15	4.98 ± 0.30	4.72±0.20	1.293	0.28
Recall	4.07 ± 0.72	3.78 ± 0.85	2.94±1.23	11.61	0.00*
Ordering	2.96± 0.18	2.95 ± 0.23	2.80±0.41	3.12	0.06
Drawing	1.20 ± 0.00	0.80 ± 0.46	0.54±0.48	21.19	0.00*
Total score	27.89±1.66	25.78±2.44	22.57±2.89	38.66	0.00*

Data are expressed as mean ± SD. * Statistical significant

Table 6. The MMSE before and after one month of receiving sage

Items of MMSE	Duration		t- test	P-value
	Before	**After**		
Orientation date	3.29 ± 0.97	3.80 ± 0.87	-8.58	0.00*
Orientation place	3.75 ± 0.92	4.11 ± 0.77	-6.05	0.00*
Attention	2.81 ± 0.94	3.24 ± 0.80	-6.93	0.00*
Registration	3.08 ± 0.20	4.99 ± 0.10	1	0.32
Recall	2.37 ± 1.20	3.57 ± 1.08	-15.16	0.00*
Ordering	2.72 ± 0.30	2.90 ± 0.45	4.37	0.00*
Drawing	0.66± 0.16	0.66 ± 0.10	2.67	0.00*
Total score	22.59 ± 3.29	25.27 ± 3.22	-17.67	0.00*

Data are expressed as mean ± SD. * Statistical significant

DISCUSSION

Salvia plant and its constituents can influence several biological mechanisms associated with cognition performance. Several studies have confirmed that many salvia species have promising, cognitive-enhancing effects in human adults. In our study there was a significant relationship between gander and the score for orientation date questions before and receiving sage, where the average score of men was more than average score of women, except in recall questions. The total score of MMSE in men was higher than women. Our results were in the same line with **Scarmeas *et al.* (2006)** who demonstrated that

Epidemiological studies that report age gradient between men and women between 60 and 79 years of age, women showed a higher dementia risk at very old age as in other studies than men (Ott et al., 1998 and Miech et al., 2002). Our data illustrated that the age of the elderly with mild cognitive impermanent receiving S. officinalis extract experienced significant benefits in cognition after 4 weeks treatment. The clinical relevance of these findings was emphasized by the improvements the score of MMSE (orientation date, orientation place, attention, recall, ordering, drawing). To the best of our knowledge, there were few studies in the clinical trials of *S. officinalis* extract and its effect on cognitive impermanent.

There is increasing evidence to indicate the possible efficacy of *S. officinalis* and *Melissa officinalis* in the management of cognitive impermanent, that a 4-month treatment with hydroalcoholic extract of S. officinalis improved cognitive functions in patients with mild to moderate AD (Akhondzadeh *et al.*, 2003). Scholey *et al.* (2008) indicated the advantage for *S. officinalis* in the management of patients with cognitive impermanent. According to findings in our study there was a significant different in the score of all questions, expect registration score between before and after one month, where the average score in one month later higher than before. This provides evidence that receiving sage herb can improve the cognitive performance in elderly people this might be due to its active constituents. There is increasing evidence to suggest that S. *officinalis* has cognitive- and memory-enhancing effects. In animal studies, it has been shown that extract of S. *officinalis* increases memory retention of passive avoidance learning in rats (Eidi *et al.*, 2006). Our results were in agreement with Lu and Foo (2002) who confirmed that sage rich in polyphenol, phenolic acids and flavonoids compounds. These phenolic compounds consist of caffeic acid and its derivatives, rosmarinic acid, salvianolic acids, sagecoumarin, lithospermic acids and sagernic acid. The maximum widespread flavonoids consist of luteolin, apigenin, hispidulin, kaempferol and quercetin. Baranauskiene *et al.* (2011) reported that rosmarinic acid, carnosic acid and quercetin, discovered in several salvia species can inhibit Acetylcholine (Ache) activity which play a critical role in cognitive functions and behavior, such as interest, gaining knowledge and motivation, alterations in Ache signaling are concerned in the pathophysiology of multiple neurodegenerative disorders as AD. Baricevic *et al.* (2001) reported that *salvia* species and their constituents are powerful Ache inhibitors. An aqueous extract of *S. officinalis* diminished Ache in mice (Yadav and Mukundan, 2011 and Russo *et al.*, 2013). Clinical trials demonstrated that S. officinalis enhances cognitive performance both in healthy participants and patients with cognitive impairment or dementia (Miroddi *et al.*, 2014). Moss *et al.* (2010) reported that the aroma of S. officinalis essential oil could enhance prospective memory performance in healthy adults. To date, inhibitors of Ache are the leading therapeutics of AD and *S. officinalis* might be a promising source for developing therapeutic agents for this disease.

Conclusion

The results of this study indicate the efficacy of receiving *S. officinalis* in the management of mild to moderate cognitive impairments in elderly people. Thus may be attributed to the bioactive compounds in *S. officinalis* which contains a large array of active compounds that may enhance cognitive activity and protect against neurodegenerative disease in elderly subjects. Further investigation is essential to help in elucidation the potential of this commonly herb to enhance cognitive health and wellbeing.

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