

The effect of Ginseng and Nigella sativa on the psychomotor performance: Randomized clinical trial

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Date Submitted: 2.3.2010

Date Accepted: 15.7.2010

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Abstract

Background: Ginseng and nigella sativa produced different central effects separately but the combined effects not studied previously. **Aims:** This study aimed to show the separated and combined effects of Ginseng and Nigella sativa on the psychomotor performance. **Subjects and method:** 20 healthy volunteers (15 males + 5 females) enrolled in this study, they were medical college students, and their ages were 20 – 21 year with mean of 20.2 ± 0.41 . Each volunteer do the psychomotor performance before and after each selected agents. **Results:** The result showed ginseng produce significant improvement in all parameters of psychomotor performances, while the nigella improves only the choice reaction time and produces insignificant changes on other parameters. The combined action of ginseng and nigella produced significant improvement in all psychomotor performances parameters. **Conclusions:** From these results, we can conclude, that combined effect of ginseng and nigella sativa produced significant effects more than ginseng alone and removed the inhibitory action of nigella sativa, also nigella sativa modulate the stimulatory action of ginseng, regarding the choice reaction time which reflect the cognitive function improvement.

Key Words: CRT, CFFT, Cognition

INTRODUCTION

Psychomotor performance defined as the total regulations between the central and peripheral integration regarding the perception, decision and reaction for special movement response.^[1] The reaction for single stimulus called complex reaction time, also response to differentially two or more stimuli called choice reaction time.^[2] Psychomotor performance testing used to estimate the speed of cognitive processes.^[3] Therefore, many agents affecting the cognitive function can be assessed indirectly by psychomotor performance test. Nigella sativa and ginseng effects on psychomotor performance

test reflect their effects on cognitive and central processing function.

Nigella sativa have been subjected to a range of pharmacological investigations in recent years. These studies have showed a wide spectrum of activities such as antibacterial, antitumor, anti-inflammatory, analgesic and smooth muscle relaxant.^[4,5] Some of these activities have been predominantly attributed to the volatile and fixed oils. Thymoquinone, which is the main active component of N. sativa extract, has been shown to attenuate a variety of brain toxicities that are the consequence of oxygen free radical damage.^[6] Moreover; thymoquinone (TQ)

regarded as potential antiepileptic agent more potent than valproate.^[7]

Thymoquinone suppressed the nociceptive response in hot – plate, tail pinch test, acetic acid induced writhing test and early phase of formalin test and naloxone (1mg/kg) blocked thymoquinone induced antinociception, also thymoquinone inhibit histamine release from mast cell and inhibit cyclo-oxygenase and 5 – lipooxygenase and pathway of arachidonic acid metabolism in peripheral leukocytes.^[8]

Nigella and thymoquinone from crud fixed oil of *N. sativa* inhibit non-enzymatic peroxidation in ox brain phospholipid membrane.^[9]

Ginseng botanical preparations may be derived from any several species of genus panax. The active principle appears to be dozen or more triterpnoidsaponin glycoside called ginsenosides or panaxoside.^[10]

The root of the plant generally contain the highest concentrations of ginsenoside when it has matured for 4 – 6 years, the panaxginseg formulation be standardized to 7% ginsenosides.^[11]

An extensive literature exists on the potential pharmacologic effects of ginsenosides. Unfortunately, the studies differ widely in the species of panax used, the ginsenosides studies, the degree of purification applied to the extracts, the animal species studies, and the measurements used to evaluate the responses.

Some of the more commonly reported beneficial pharmacologic effects include modulation of immune

function, ergogenic and nootropic activity, antistress, analgesic, antiplatelet and vasoregulatory effects.^[12-15]

Ginseng is most often used to help improve physical and mental action, clinical trial of this action are small sample size and reported either an improvement in mental function and physical performances or no effects.^[16]

The German Commission E recommends 1 – 29/ dl of crud panax ginseng root which equivalent to 200 mg of standardized extract in some clinical trial.^[17]

Therefore, the aim of this study is to evaluate the separated and dual effects of ginseng and nigella sativa on psychomotor performances and to determine the locomotor and cognitive abilities indirectly.

MATERIALS AND METHODS

This study was carried out in Department of Pharmacology, College of Medicine, Al-mustansiriya University, Baghdad – Iraq, from October to December 2008. It is approved by scientific jury of Department of Pharmacology, and licensed by board of medical college.

The subjects of this study were medical college students. Twenty volunteers (15 males and 5 females) were accepted to enroll and complete this single blind randomized clinical study.

Each student is interviewed by researcher, and received verbal and written instruction of research protocol and the procedure of each test, see table one for characteristics of participants.

Table 1. The characteristics of the study.

Number		20
Gender	<i>Males</i>	15
	<i>Females</i>	5
Age (year)	<i>lower limit</i>	20
	<i>Upper limit</i>	21
Range		1
Mean ± SD		20.2 ± 0.41
Drugs		Ginseng, Nigella sativa (black seed) and ginseg with nigella (Ginsco)
Psychomotor testing		Leed's Battery test

Assessment of psychomotor performance by psychometric test by Leed's Battery psychomotor instrument, this instrument is assessed both sensory and motor performance via determination of total reaction time.

This test globally evaluated psychomotor performance. Test subject placed a finger on a panel and is required to

turn off one of six equidistant and randomly illuminated lights by pressing the correct button. Measurement is made of the time taken to recognize the stimulus (total reaction time) and the motor response velocity (choice reaction time).^[18]

The movement time (MRT) measured by subtraction choice reaction time from total reaction time.

TRT = MRT + RRT

MRT = TRT – RRT

Psychomotor performance test done before drug intake as control and then done after intake of 350 mg ginseng, 350 mg nigella sativa capsule and combined nigella sativa and ginseng (Ginsco capsule). The time before and after testing was 2 hours. The results are expressed as number, percentage, coefficient variation and mean ± SD. The data the data was analyzed by using Student's "t" test (two

Nigella sativa produced insignificant effects on TRT and MRT (P > 0.05), but reduced the RRT significantly from 375.50 ± 59.10 to 322.52 ± 21.11 (P < 0.05). Therefore; the nigella sativa seed improved only the RRT of the psychomotor performances, Table (4).

The combined effects of ginseng and nigella sativa produced significant reduction in all parameters of psychomotor performances. The TRT reduced from 526.80 ± 70.61 to 417.50 ± 66.14, (P < 0.05), Table (5).

The paired sample test for dual effect of ginseng and nigella sativa showed significant reduction in all parameters of psychomotor performances, Table (6).

Testing was 2 hours. The results were expressed as number, percentage, coefficient variation and mean ± SD. From these results we can show that ginseng alone

tailed paired), P value was < 0.05 as lowest limit significance.

RESULTS

Ginseng significantly reduces all the parameters of psychomotor performances (p < 0.05). The TRT reduced from 635.8±114.57 to 401.9±69.84, so ginseng improves the reaction time and psychomotor performances. Table 3 shows the effects of Ginseng on psychomotor performance.

produced more difference in TRT > 234 msec. But the combined effect produced only 109 msec. reduction in TRT.

The variability in the psychomotor performances tested shown in Table 2.

Table 2. Intra and inter-individual variation of psychometric test (Baseline data).

Variation	Psychomotor test
Intra-individual	7.3%
Inter-individual	14.3%

Table 3. Effects of Ginseng on psychomotor parameters.

Paramaters	Before Mean ± SD	After Mean ± SD	P value
CRT (mesc.)	635.8±114.57	401.9±69.84	< 0.05*
MRT (mesc.)	211.1±45.47	188.39±47.54	< 0.05*
RRT (mesc.)	424.60±69.1	213.51±22.3	< 0.05*

*Significant effects using paired t-test (P < 0.05).

Table 4. Effects of Nigella sativa on psychomotor parameters.

Parameters	Before Mean ± SD	After Mean ± SD	P value
CRT (mesc.)	590.9±81.21	511.30±91.78	> 0.05
MRT (mesc.)	215.4±22.11	188.79±70.67	> 0.05
RRT (mesc.)	375.50±59.10	322.51±21.11	< 0.05*

* Significant effects using paired t-test (P < 0.05).

Table 5. Combined effect of ginseng and Nigella sativa on psychomotor parameters.

Parameters	Before	After	P value
	Mean ± SD	Mean ± SD	
CRT (mesc.)	526.80±70.61	417.50±66.14	< 0.05*
MRT (mesc.)	164.2±10.56	155.38±14.81	< 0.05*
RRT (mesc.)	362.60±60.11	262.12±51.33	< 0.05*

* Significant effects using paired t-test (P < 0.05).

Table 6. Paired sample test for combined effects of ginseng and Nigella sativa.

Parameters	Paired differences				t value	P value	
	mean	S.D	S.E	95% confidence interval			
				lower			Upper
TRTB-TRTA	40.30	58.612	18.53	-1.628	82.22	2.174	< 0.05
CRTB-CRTA	41.30	70.57	22.31	-9.186	91.786	1.851	< 0.05
MRTB-MRTA	22.60	30.63	9.68	-0.685	44.515	2.333	< 0.05

TRTB = Total reaction time before. MRTA = Movement reaction time after.. CRTB = Choice reaction time before. CRTA = Choice reaction time after. MRTB = Movement reaction time before.

DISCUSSION

The result of this study demonstrated that ginseng produced significant improvement in all psychomotor performances parameters. While nigella sativa produced insignificant improvement in both total reaction time (CRT) and movement reaction time but produce significant reduction in choice reaction time, but combined effect of nigella and ginseng produced significant reduction in psychomotor performances values.

Arcelin and Brisswalter 1999, they reported 13.3% inter-individual variations and 7.2 – 25.2% intra-individual variations for assessment psychomotor performances, in our study the inter-individual and intraindividual variation were 14.3% and 7.3% respectively.

Psychomotor performances and cognitive functions deteriorated with aging.^[20] Aging factor is missed in this study because all subjects enrolled in this work are of equal young age.

Gender factor, influence the baseline data of psychomotor performances as well as cognitive function, therefore small sample size contributing for nonsignificant effects of gender, therefore the hormonal differences and factors are excluded in this study because estrogen fluctuation

affect the accuracy, attention resources and memory functions.^[21]

Ginseng has served as a tonic as well as an ingredient of folk medicine in countries of the Far East. It consists of two major components; Saponin and non-Saponin fraction, the major biological function mediated by saponin from which more than 30 different ginsenosides have been isolated and chemically identified.^[22,23] The ginsenoside regarded as neutropic by modulation of acetylcholine evoked secretion of catecholamine and cAMP phosphodiesterase activity.^[24] Ginseng significantly ameliorated learning deficit of rats with hippocampal lesion in a place learning test, impaired performances by scopolamine and ischemia-induced decrease in the passive avoidance task in rats.^[25,26] All these studies indicated that ginseng regarded as nootropic agent so improve the mental and psychomotor performances which are coincided with our result that showed, ginseng produce significant improvement in psychomotor performances parameters.

Add to this, ginseng regarded as anti-anxiety – adaptogen that normalize physical stress and mental consequences, therefore oxprenolol act as nootropic because it remove anxiety induced disorder in psychomotor performances.

[27] The adptogenic effects of ginseng are attributed to its action on the hypothalamic – pituitary – adrenal axis pathway, because ginsenoside exerted inhibitory effects on Ca^{+2} current in adrenal chromaffin cells.^[28]

Moreover; ginseng modulate the neurotransmission by increase the level of monoamine oxidase and acetylcholine transferase enzymes in rat brain, and increase level of serotonin, dopamine and other catecholamine^[29]. Also ginseng can block the behavioral sensitization induced by psychostimulants. Ginseng; also activated nitric oxide synthesis in hippocampus which is responsible for general memory and mental functions that mediated the long term potentiating.^[30; 31]

Nigella sativa produced diverse neuropharmacological action on cognitive and psychomotor performances, it does not produce any significant improvement in total reaction and movement reaction time, these our results supported by Jackson 1990 study which is showed that nigella produced decreasing in muscle tone and central depressant effects with anticonvulsant properties.

Recently; thymoquinone, α -Hederine and triterpenesaponin are the main isolated have potent activation of inotropic GABA- A receptor which mediate the anti-anxiety effects and decreasing in the muscle tone which also mediate various psychological and neurological disorders such as Alzheimer's disease.^[32]

Nigella sativa improve the choice reaction time significantly which reflect the processing time of cognitive function for decision deciding, this supported by Candelario – Jaliletal 2001 study which was showed cognitive enhancing effects of thymoquinone by enzymatic and non-enzymatic neuroprotection after forebrain ischemia and inhibition of lipid peroxidation and improve the cholinergic transmission at cerebral cortex and hippocampal region.

Acknowledgement:

Thanks to Drs. Ammar W. Ashor, Ali I. Al-Gareeb, and Hayder M. Khalil Al-Kuraishy for their help in this study.

Thymoquinone and thymohydroquinone activate β_2 -receptor lead to cognitive stimulation, because catecholamine activate β_2 leading to memory and cognitive enhancement.^[34]

Moreover; thymoquinone inhibit both cyclo-oxygenase and 5-lipoxygenase, so inhibit generation of reactive oxygen species derived from metabolism of arachidonic acid, so aspirin regarded as important treatment of Alzheimer's disease due to inhibition of free radical generation induced by cyclooxygenase.^[35]

Also, nigella sativa protect the neurons from excitotoxicity induced by glutamate and dopamine.^[36]

Dual effects of ginseng and nigella sativa on psychomotor performances reflect the counteraction and modulation of both agents. The excitatory effects of ginseng remove the inhibitory action of nigella sativa that is mediated by GABA receptor, also activation of adrenoceptors by thymoquinone augment the cognitive and nootropic effects of ginsenosides. Thus dual effects is more beneficial than one of them due to dual antioxidant of both ginseng and nigella sativa so produce more potent neuroprotection.

Our experimental result coinciding with most previous studies, but no available experimental data and reviewed articles concern the dual action of nigella and ginseng have been discussed.

Conclusions: Ginseng improves psychomotor performance and cognitive function and Nigella sativa only improve the mental processing function but Ginseng and nigella produce more pronounced effects on the psychomotor performance parameters. Moreover; combined effects masked the negative and depressant effects of nigella by ginseng.

Conflict of interest: none

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