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Effect of Taking Chicken Essence on Cognitive Functioning of Normal Stressed Human Volunteers

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ABSTRACT

Objective: This study evaluates the effect of a commercial brand of chicken essence (BEC) on the various parameters related to stress and cognition of human volunteers. BEC is produced by a hot-water extraction process from chicken meat under high pressure conditions. It contains concentrated amounts of proteins, amino acids and peptides such as carnosine compared to homemade traditional chicken soup. Due to the unique extraction process, it has been postulated that readily absorbed amino acids and bioactive peptides are present in BEC. **Methods:** In this study, we evaluated the effect of BEC in comparison with a placebo on a group of distressed medical students. Students were randomly divided into two groups and given either BEC or a placebo drink daily for two weeks. Before and after the two weeks, the students were given a series of tests to assess their level of cognitive functioning and perceived stress level while being monitored for EEG recording. The combination of these tests, namely Digit span, Arithmetic and Letter-number sequencing, generally assessed the student's attention and working memory. **Results:** The working memory performance of students who ingested essence of chicken was found to be significantly better than those who consumed placebo when data comparing baseline and after two weeks consumption were compared. **Conclusion**: This study seems to suggest that essence of chicken has positive effects on the subjects' cognitive functions.

Keywords: **Essence of chicken, cognitive functioning, attention, working memory, EEG**

INTRODUCTION

Stress is a common phenomenon experienced by every individual. Whilst high levels of stress is often associated with psychological problems, an optimum degree of stress is deemed to be functional in our life. For instance, stress can be functional in motivating students to prepare for examination but excessive level of stress leads to poor performance. Nonetheless, stress can also be protective in preparations to react against challenging situations and danger.

Essence of chicken has been shown to have positive effect on recovery from fatigue caused by mental workload.[1] Naiphinich *et al.*[2] reported that normal subjects, when given chicken essence, showed positive changes on EEG (electro-encephalogram) of the brain. There were increased alpha waves among those who ingested chicken essence during

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both eye-closed and eye-opened periods. The beta waves were also noted to be increased during eye-opened periods without any significant changes in the delta and theta waves. These changes signify an increase in mental relaxation, which could be inferred to mean better concentration and organisation of thinking processes. The changes in beta wave also signify increased alertness and arousal state. However, the subjects were not tested specifically on these psychological parameters. We have also shown that persons with pathological anxiety can experience significant improvements not only in their anxiety levels but also their systolic blood pressure and pulse rate when given a commercial brand of chicken essence (BEC) in combination with psychotherapy.[3]

Another study was undertaken to show the action of BEC on normal but highly stressed individuals. It showed positive results on normal individuals with only high state anxiety. [4] The EEG changes noted by Naiphinich *et al.*[2] were further assessed by specific psychological and cognitive tests to assess attention, memory, alertness and actual subjective and objective anxiety parameters by that study. The effect of BEC on recovery from mental workload fatigue as shown by Nagai *et al.* [1] was also further assessed in the study.

The present study was interested in determining the effectiveness of consuming BEC on human cognitive functioning, specifically the working memory component and perceived stress level. A group of stressed normal subjects selected was involved in this double-blind, placebo controlled study where either BEC or a placebo was administered to assess the various parameters. During the administration of these tests, the individual's EEG reading was also recorded.

MATERIALS AND METHODS

Subjects

Male and female fourth year medical students posted to the Psychiatry Unit of University Putra Malaysia for the academic year 2005/2006 were recruited for the study. Most of the subjects had not taken essence of chicken previously. Those who had taken reported that they had taken it more than 10 years ago and indicated that they have no significant recollections of it in any form.

Test Samples

A commercial brand of chicken essence (BEC) and the placebo made up of milk protein (casein), as a comparison test sample were prepared and supplied by a private company.

Study Design

A randomised, double-blind, placebo controlled study design was used to evaluate the effect of BEC on stress and cognition in normal subjects. The subjects were randomly divided into two groups, namely, the placebo group (Group P) and the essence of chicken-treated group (Group BEC). The subjects in Group P and Group BEC were given 70ml of placebo (milk protein) and BEC respectively to consume every morning for two weeks. The

subjects and Investigator 1 who conducted the tests were blinded to the samples provided. Meanwhile Investigator 2 maintained a record of all the samples. This arrangement helped to minimise investigator personal bias as well as bias among the subjects in relation to potential taste differences between the two test samples.

Tests

The subjects were administered a battery of subtests extracted from the Wechsler Adult Intelligence Scale-3rd version (WAIS-III) at the beginning of the study and after two weeks of test sample administration. These subtests assess an individual's level of cognitive functioning specifically Working Memory. The test, namely, the Digit span, Arithmetic and Letter-number sequencing were administered to the students while they were connected to the EEG monitor. Measurements of alpha, beta, para-sympathetic and sympathetic activities were taken. All the tests were administered individually by the blind investigators with the assistance of a research officer.

Measurements

Working Memory denotes an individual's information-processing capacity. Viewed as an 'active' form of short-term memory, working memory has been suggested by recent literature as a key component of learning.[5,6] Short-term memory, also viewed as 'passive' form of memory, traditionally refers to the passive storage of information while that information either becomes encoded into long-term memory or is forgotten. On the other hand, working memory as assessed in this study serves as more than a temporary storage space for incoming information. Rather it is where calculations and manipulations of information occur. Furthermore, as Baddeley and Hitch[7] point out, this component stores the products or output of these calculations and transformations in addition to the original information.

The Wechsler Adult Intelligence Scales 3rd Version (WAIS-III)[8] has been widely used in assessing human intelligence in a comprehensive manner. The WAIS-III, comprising 11 subtests, assesses four main domains of cognitive functioning namely Verbal Comprehension, Perceptual Organisation, Processing Speed and Working Memory. The combination of the subtests, namely, Digit Span, Arithmetic and Letter-Number Sequencing form the Working Memory Index used in this study.

Digit Span

The Digit Span consists of two parts, that is, Digits Forward and Digits Backwards. Also know as 'auditory vocal sequencing memory', it requires the subject to recall and repeat auditory information in the proper sequence. While the Digits Forward is a simpler, straight forward task requiring rote memory, Digits Backward is relatively more complex. The examinee must usually hold the memory longer and also transform it before making a re-statement. Thus, a good performance on Digits Backward is likely to reflect a person who is flexible, able to concentrate, and tolerant to stress.

Letter-Number Sequencing

Letter-Number Sequencing requires the subject to attend to a series of letters and numbers that have been read to him or her, hold them in memory, manipulate them into a new order, and repeat the sequence.

Arithmetic

Arithmetic requires focused concentration as well as basic mathematical skills and an ability to apply these skills. The skills required to complete this test are usually acquired by the time a person finishes secondary school; therefore, low scores are more likely to be the result of poor concentration. Arithmetic is likely to be more challenging and stressful as the test scores are based on timed responses. Thus, persons who are susceptible to the adverse effects of anxiety are likely to be adversely affected.

In summary, for the purpose of the present study, the above mentioned tests were used to measure the differences of students' level of Working Memory functioning before and after consuming chicken essence for two weeks.

Perceived Stress Scale (PSS)

The Perceived Stress Scale (PSS)[9] is a measure of the degree to which situations in one's life are appraised as stressful. Items were designed to tap how unpredictable, uncontrollable, and overloaded respondents find their lives. These three issues repeatedly have been found to be central components of the experience of stress. This scale also includes a number of direct queries about current levels of experienced stress. In this study a 10-item version (PSS10) was used. Its scores are obtained by reversing the scores on the four positive items (Items Nos. 4, 5, 7 and 8) and subsequently summing across all 10 items. The PSS is not a diagnostic instrument; therefore cut-offs were not used in its interpretation. Rather, it was used to compare between people in the sample. It was administered at the beginning and on completion of the entire 2-week procedure of this study.

Study Procedure

The Research Assistant contacted the subjects and made appointments for the study session. When a subject arrived, he or she would be asked to sit down and relax for about five minutes before the actual study took place. The subjects are then informed of this study and that their participation was voluntary in nature, which was followed by handing them the Consent Form. Subsequently subjects were requested to fill in the Perceived Stress Scale. Their blood pressure and pulse rate were also recorded; the Research Assistant would then brief them on the study process. Electrode patches were then applied to facilitate EEG monitoring. The baseline measure of EEG was taken while the subject was in a relaxed state. The first 5 minutes of ECG reading was taken while the subjects had their eyes opened while the next 5 minutes of EEG reading was taken while the subjects had their eyes closed (pre-intake).

The subjects were then administered the three subtests to assess Working Memory, beginning with Digit Span followed by Arithmetic and finally Letter-Number Sequencing.

Table 1. The whole study procedures and time duration involved

Pre-intake	2 weeks	Post-intake
1. Baseline EEG readings Eyes opened– 5 minutes Eyes closed– 5 minutes	The ingestion of 70 ml of BEC/placebo daily for 2 weeks	1. Baseline EEG readings Eyes opened– 5 minutes Eyes closed– 5 minutes
2. Administration of subtests		2. Administration of subtests
3. Post-test EEG readings Eyes opened– 5 minutes Eyes closed– 5 minutes		3. Post-test EEG readings Eyes opened– 5 minutes Eyes closed– 5 minutes

When the administration of these subtests was completed, the EEG readings as conducted before, were repeated on the subjects in precisely the same manner. The subjects were then reminded to come back to the research room to get the test samples daily for two weeks. After two weeks, the subjects were administered the same procedures again (post-intake). These procedures are summarised in Table 1. In this study, the students were taught to relax while the Research Assistant administered the tests. These tests are believed to create a degree of stress on the students as they are asked to solve a few mental tasks. It is hypothesised that the students can perform their best at the optimum level of stress. In other words, in the face of stress, the students should be alert and should be able to keep calm in order to keep their concentration and attention working effectively on the given mental tasks.

Data Analysis

Statistical package for Social Science (SPSS) Version 13 was used to analyse the data collected in this study. The results of all the tests from these two groups were tabulated to calculate the changes between baseline and post-experiment scores. All values are expressed as mean ± standard error of mean (s.e.m). In order to detect any significant differences between the two groups in terms of the change in scores, *t*-test analyses was carried out. For all comparisons, the probability level of $p<0.05$ was considered as statistically significant.

RESULTS

Sample Characteristics

Four groups of students consisting of a total of 102 students were recruited for this study. Nonetheless, for the purpose of analyses, the data gathered from Group 1 (25 students) will not be included due to technical errors during study administration. As such, a total of 69 students comprising 27 male and 42 female students completed the study. The distribution of sample according to gender, posting group and ethnic group is summarised in Table 2. All the students were homogeneous in terms of age; their ages ranged from 22-24 with a mean of 23. As shown in Table 2, there are no significant differences between the number of

Table 2. Sample characteristics

Sample	BEC N (%)	Placebo N (%)	Total N (%)	Chi-square value
Gender				
Male	13 (19%)	14 (20%)	27 (39%)	
Female	25 (36%)	17 (25%)	42 (61%)	
Total	38 (55%)	31 (45%)	69 (100%)	3.26ns
Posting Group				
2	11 (16%)	11 (16%)	22 (32%)	
3	14 (20%)	9 (13%)	23 (33%)	
4	13 (19%)	11 (16%)	24 (35%)	
Total	38 (55%)	31 (45%)	69 (100%)	0.087ns
Ethnic group				
Malay	19 (28%)	23 (33%)	42 (61%)	
Chinese	18 (26%)	8 (12%)	26 (38%)	
Others	1 (1%)	0	1 (1%)	37.1***
Total	38 (55%)	31 (45%)	69 (100%)	

***p<0.001

students who consumed placebo and BEC with respect to gender and group posting. Although there was significant difference with regard to ethnic groups, ethnic distribution in this study conformed to the students' general ethnic distribution in their batch. Furthermore, as ethnicity is not the factor under study, it should be ignored. None of the students reported any adverse side effects after consuming either the BEC or placebo.

Working Memory

Overall, the subjects in the BEC group verbally reported that they were more focused in their studies and calm after the ingestion of BEC in comparison to their counterparts who consumed placebo. However, objective measurements of the test scores did not fully support the subjects' statements. In order to compare the differences between the placebo and BEC groups, all measurements were subjected to independent-sample *t*-tests. In particular, the data from pre-intake was compared with the post-intake from both groups. Table 3 presents the results of these analyses. Significant difference of cognitive performance between the BEC and placebo was found only in the Letter-Number Sequencing subtests.

Apart from comparing the data between the two groups, comparative analyses of students' performance between the baseline and after 2 weeks (within group) were also performed using paired-sample *t*-tests. As indicated in Table 4, the students in BEC group showed significant improvements in all tests measuring Working Memory after 2 weeks' of BEC consumption. Meanwhile Table 5 which presents the results of Working Memory performance after two weeks ingestion of test samples in the placebo group shows no significant improvements in all tests administered except for the Digits Forward test. Figures 1, 2 and 3 further illustrate the results tabulated in Table 3, 4 and 5.

Table 3. Results of subtests measuring Working Memory (BEC vs placebo)

Tests	Groups		*t*-value
	BEC (n=38)	Placebo(n=31)	
	Mean (s.e.m)		
Digits Forward (Pre)	10.71 (.37)	10.68 (.36)	.06 (ns)
Digits Forward (Post)	11.26 (3.27)	11.45 (.39)	.35 (ns)
Digits Backward (Pre)	7.47(.37)	8.16 (.39)	1.23(ns)
Digits Backward (Post)	8.39 (.36)	8.61 (.36)	.42(ns)
Arithmetic (Pre)	13.74 (.67)	15.32 (.71)	1.62 (ns)
Arithmetic (Post)	14.89 (.64)	15.74 (.84)	.81 (ns)
Letter- Number Sequencing (Pre)	12.42 (.48)	11.90 (.53)	.72 (ns)
Letter-Number Sequencing (Post)	13.55(.41)	12.10 (.44)	2.4*

* significant p<0.05, ns – not significant

Table 4. Results on Working Memory performance (Pre vs Post) – BEC group

Tests	Pre	Post	*t*-value
	Mean (s.e.m)		
Digits Forward	10.71 (.37)	11.26 (.37)	2.24*
Digits Backward	7.47 (.37)	8.39 (.36)	2.79**
Arithmetics	13.74 (.67)	14.89 (.64)	2.61*
Letter- Number Sequencing	12.49 (.48)	13.55 (.41)	3.9***

* significant p<0.05*, p<0.01, p<0.001***

Table 5. Results on Working Memory performance (pre vs post) – placebo group

Tests	Pre	Post	*t*-value
	Mean (s.e.m)		
Digits Forward	10.68(.36)	11.45 (.39)	2.44*
Digits Backward	8.16 (.39)	8.61 (.37)	1.4(ns)
Arithmetics	15.32(.71)	15.74 (.84)	.97(ns)
Letter- Number Sequencing	11.90 (.54)	12.10 (.44)	.58(ns)

*p <0.05, **p<0.005**, ns-not significant

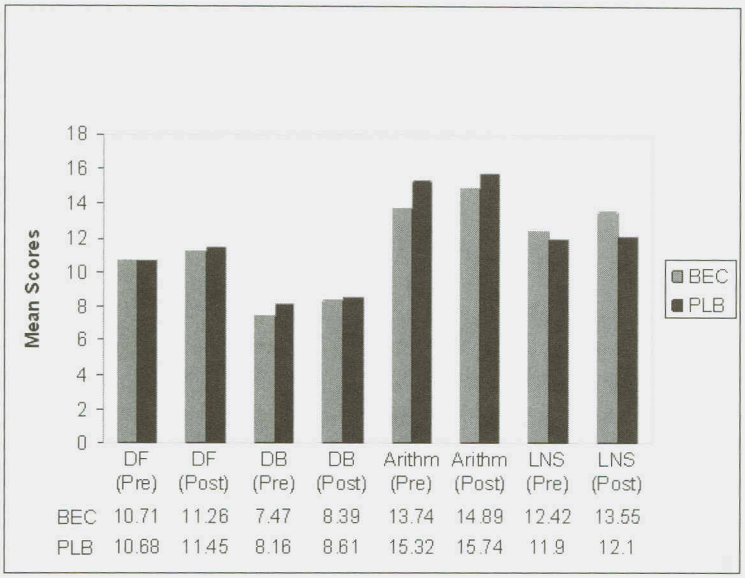

Figure 1. Results of Working Memory subtests(BES vs placebo)

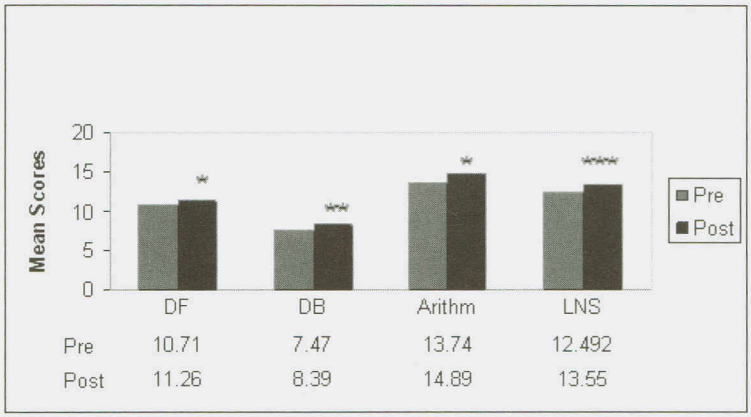

Figure 2. Results of Working Memory subtests (pre and post) - BEC

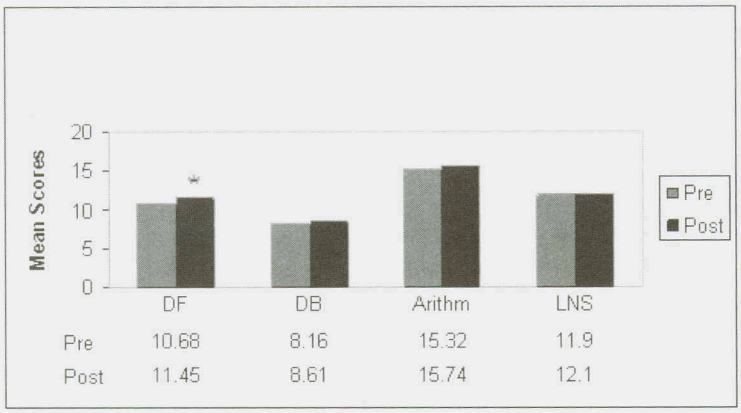

Figure 3. Results of Working Memory subtests(pre and post)- placebo

Perceived Stress Scale

With regard to perceived stress level, pre-and post-data were compared between the groups. Table 6 shows that none of the items in this scale were significantly different between the groups except for item in relation to the students' ability to control irritation; the BEC group showed relatively more ability to control irritation compared to the placebo group. Paired-sample tests were also conducted to determine within group baseline and post-ingestion of test samples. No significant differences were found in baseline and post data within groups in both BEC and placebo groups.

In relation to the physiological readings, no significant differences were found between the two groups (Table 7).

DISCUSSION

There was a significant difference between the cognitive performance of the BEC and placebo in the Letter-Number Sequencing test. As mentioned earlier, a better performance on this test suggests that the BEC group showed better ability in sequencing as well as a higher level of attention and concentration. This finding confirms the earlier finding of Azhar *et al.*[4]. The other tests showed similar trends although the results were not statistically significant.

Nonetheless, when data was further analysed to compare within group baseline and post-data, the BEC group showed significant improvements in all tests. However, the placebo showed an improvement only in Digits Forward test. Digits Forward, compared to other tests in Working Memory domain, is a simpler, straight forward task. On the other hand, Digits Backward, Arithmetic and Letter-Number Sequencing require a high level of focus and alertness, freedom from distractibility and capacity for attention and concentration. The significant differences between baseline and post-scores within BEC group suggests that they were relatively unaffected by stress and anxiety during the test administration.

Table 6. Results of the perceived stress score

Items	Mean (s.e.m)		*t*-value
	BEC (n=38)	Placebo(n=31)	
Upset because something unexpected			
Pre	1.79 (.94)	1.71 (.64)	.40 (ns)
Post	1.63 (.54)	1.58 (.72)	.33 (ns)
Unable to control important things in life			
Pre	1.55 (.86)	1.32 (.91)	1.07 (ns)
Post	1.66 (.71)	1.52 (.77)	.80 (ns)
Nervous and "stressed"			
Pre	2.03 (.67)	2.10 (.91)	.37 (ns)
Post	1.89 (.69)	1.84 (.69)	.33 (ns)
Confident of handling personal problems			
Pre	2.66 (.58)	2.71 (.70)	.34 (ns)
Post	2.66 (.71)	2.45 (.72)	1.2 (ns)
Things going your way			
Pre	2.29 (.70)	2.23 (.96)	.32 (ns)
Post	2.53 (.60)	2.42 (.67)	.68 (ns)
Couldn't cope with all things to be done			
Pre	1.76 (.88)	1.81 (.83)	.21 (ns)
Post	1.47 (.73)	1.58 (.81)	.57 (ns)
Able to control irritation			
Pre	2.61 (.76)	2.45 (.68)	.89 (ns)
Post	2.84 (.64)	2.42 (.72)	2.59*
Top of things			
Pre	1.74 (.80)	1.90 (.80)	.87 (ns)
Post	1.95 (.66)	1.84 (.74)	.65 (ns)
Angered by things outside one's control			
Pre	1.76 (.68)	1.87 (.81)	.61 (ns) Post
1.89 (.80)	1.68 (.83)	1.1 (ns)	
Can't overcome difficulties			
Pre	1.47 (.68)	1.58 (.67)	.65 (ns)
Post	1.26 (.76)	1.35 (.61)	.54 (ns)

Table 7. Results of physiological measurements

Measurements	Groups		*t*-value
	BEC (n=38)	Placebo(n=31)	
	Mean (s.e.m)		
Weight			
Pre	56.26 (1.96)	59 (2.43)	.75 (ns)
Post	55.88 (1.93)	59.6 (2.4)	.85 (ns)
Pulse Rate			
Pre	80.63 (1.47)	77.52 (1.79)	1.54 (ns)
Post	79.84 (1.37)	76.32 (1.24)	1.87 (ns)

ns - not significant

This finding supports the results shown in previous studies [4] that the BEC, probably acted via some mechanism, perhaps the neurotransmitter pathways, most likely the serotonergic which is able to inhibit some level of anxiety and stress thus facilitating optimal performance in human beings. The non-significant differences in the placebo group's performance suggests no significant improvement in their level of focus, attention and concentration. It must be noted that this current study employed far more difficult tests than the earlier one [4] in 2003. The tests are part of a standard memory test accepted internationally, that is, the WAIS III and WMS III, [8] as such the results in this study are more reliable and valid. Should be accepted.

The non-significant results both between placebo and BEC groups on the Perceived Stress Scale as well as in within group baseline and post-ingestion of test samples may indicate perceptions of a situational stressful environment as the students were all at the end of the posting and were soon going to sit for their end-of- posting at about that time. However, the greater control of irritation as significantly shown by the BEC group does indicate that even under such a stressful condition, BEC does have the potential to reduce stress probably through the serotonergic action as well.

There were no significant differences in the blood pressure readings as well as pulse rate readings of both groups of subjects. This is expected as the subjects were all normal subjects. The fact that BEC did not cause negative results in the physiological readings is a significant positive finding as it indicates BEC is very safe. The positive results of improving systolic blood pressure and pulse rate of diseased anxious subjects has been shown in an earlier study[3] amongst anxious subjects.

CONCLUSIONS

The significant improvement in all cognitive performance tests in the BEC group compared within group baseline and post-two weeks ingestion data as opposed to placebo group (only Digits Forward was significant) suggests that BEC has significant positive effects on subjects' cognitive functions.

This study originally purported to assess EEG reading to measure anxiety or stress level objectively amongst the participants. This limits the types of test that can be used to assess cognitive functioning as the EEG machine was extremely sensitive to even the slightest movement of the participants. Anecdotically, students in the BEC group subjectively reported feeling more alert and focused than their counterparts in the placebo group. One has to bear in mind that,for every posting, the post-test sessions were done approximately a week before the end of the posting. The students were generally anxious during these times and it could be one of the confounding factors in this study.

Further studies should be carried out to clarify these results in a more objective manner. Computerised tests measuring different aspects of cognitive functioning should be considered in future studies to reduce examiner bias. Caution should be exercised in generalising the results to the general population. The sample needs to be enlarge and the study methodology needs to be refined in order to reduce factors that may confound study results.

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