

Effect of Taking Chicken Essence on Stress and Cognition of Human Volunteers

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SUMMARY

Stress is a common phenomenon. Every individual experiences it. There are many ways of combating stress. Stress is necessary for preparation against challenging situations and danger. It is necessary to have stress before a test so that we are prepared. For instance, stress actually motivates students to prepare for examination but excessive stress can lead to poor performance. This study evaluates the effect of a commercial essence of chicken (CEC) on the various parameters related to stress and cognition of human volunteers. CEC is produced by a hot-water extraction process from chicken meat under high pressure condition. 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 CEC. In this experiment, we evaluated the effect of CEC in comparison with a placebo and carageenan on a group of stressed medical students before their examinations. Students were divided into three groups at random and given either CEC, placebo or a carageenan drink daily for two weeks. Before and after the two weeks, the students were given a series of tests to assess their mental and physical well-being as well as attention and memory. The tests were the general health questionnaire (GHQ), SF36, digit span, construction of figures, 3-min memory test, comprehension and mental arithmetic. The students who ingested essence of chicken fared significantly better than the other two groups of students. The ability of essence of chicken to control anxiety by distraction and promoting attention and memory is discussed.

INTRODUCTION

Essence of chicken has been shown to have a positive effect on recovery from fatigue caused by mental workload (Nagai, Harada & Nakagawa, 1996). At the *First International Neuroscience & Nutrition Symposium on Nutrition and the Promotion of Brain Development and Function*, Naiphinich, Naiphinich & Samporn (2000) reported that normal subjects, when given chicken essence, showed positive changes on EEG (Electroencephalogram) of the brain. There was an increase in alpha waves among those who ingested chicken essence during both eye-closed and eye-opened periods. The beta waves were also noted to increase 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 organization of thinking processes. The changes in beta waves 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 essence of chicken (CEC) in combination with psychotherapy (Azhar, Abdul Razak & Mohsin, 2001).

The current study was thus needed to show the action of CEC on normal but highly stressed individuals. If Azhar, Abdul Razak & Mohsin (2001) showed that it has a positive effect on anxious subjects (high trait and high state anxieties), then it should have even better results on normal individuals with only high state anxiety. The EEG changes noted by Naiphinich *et al.* (2000) can further be assessed by specific psychological and cognitive tests to assess attention, memory, alertness and actual subjective and objective anxiety parameters. The effect of CEC on recovery from mental workload fatigue as shown by Nagai *et al.* (1996) can also be further assessed in the current study.

With all these in mind, we selected a group of highly stressed normal subjects and carried out double blind, placebo controlled study administering CEC, placebo and carageenan drink and assessed the various parameters mentioned above.

METHODOLOGY

Subjects

Male and female fourth-year medical students posted to the psychiatry department of Universiti Sains Malaysia for the academic year 2000/2001 were selected for the study. All subjects had not previously taken essence of chicken.

Test samples

Commercial essence of chicken (CEC), placebo made up of water added to caramel, and a carageenan protein drink as a comparison test sample were prepared and supplied by a private company.

Experimental design

A randomized, double-blind, randomized, placebo controlled study design was used to evaluate the effect of CEC on stress and cognition in normal subjects. The subjects were randomly divided into 3 groups, the Placebo group (Group P), the essence of chicken-treated group (Group CEC), the carageenan C comparison group (Group C). There were 52 subjects in group P, 56 in group CEC, and 565 in group C who completed the study. The three groups were given 70ml of placebo (water added with caramel), CEC, carageenan drink respectively to consume every morning for two weeks. The subjects and Investigator 1 who conducted the tests were blind to the samples provided. Investigator 2 kept a record of all the samples with the help of a Research Officer. This helped to minimize bias among the subjects due to taste difference between the three test samples.

Measurements

The subjects took a battery of tests at the beginning of the study and after two weeks of test samples administration. All the tests were carried out concurrently on a group of subjects with Investigator 1 and subjects blind to the type of samples administered. The tests carried out were the General Health Questionnaire (GHQ), SF36 Health Status Survey, Digit span, Figure Construction, Three-minute Memory test, Comprehension, and Mental Arithmetic.

The GHQ (Goldberg & William, 1988) is a structured questionnaire validated in Malaysia (Maniam, 1996). It has become a commonly used instrument in multicentre, international clinical trials designed to detect non-psychotic psychiatric disorders. It helps to identify states of depression, anxiety and psychiatric morbidity. It has scores of up to 60 and any score above 4 is taken to mean a possible psychiatric morbidity. It takes 10 min to complete the GHQ.

SF36 Health Status Survey (Ware & Sherbourne, 1992) is an accepted scale consisting of 36 questions to measure the quality of life. It has been used in numerous studies to measure mainly the physical aspects of quality of life. It complements the psychological component of the GHQ. It takes about 30 min to complete the SF36.

The following five tests were applied to test for different aspects of memory (Bech, 1957). Digit Span test is a standard bedside test used to measure immediate memory. A series of numbers ranging from three digits to seven digits are shown. The subject is required to recall the digits as soon as after the digits are shown. A separate set of digits (ranging from three to seven digits) is then given but this time the subject must recall them in the reverse order.

Figures Construction tests are given as part of testing recent memory. Subjects are given a set of five figures to remember over one minute. The figures are then removed and the subjects are required to draw the figures based on their memory.

The Three Minute Memory test is a test to identify new learning ability. The subjects are given five unrelated objects to remember, after which they will be distracted for three minutes and then asked to recall the objects.

In the Mental Comprehension test, the subjects are given a paragraph from a newspaper clipping consisting of ten factual statements. They are given three minutes to read the text, after which the subjects are required to write the facts in the correct sequence.

The Mental Arithmetic test is a test of simple arithmetic problems. The subjects are required to solve each problem within one minute mentally without using pen or paper.

Data analysis

The results of all the tests from the 3 groups were tabulated to calculate the changes between baseline and post-experiment scores. All values are expressed as mean \pm standard error of mean (s.e.m). To detect any significant difference between the 3 groups in terms of the change in

scores, one-way ANOVA followed by Tukey's Multiple Comparison test were carried out. For all comparisons, the probability level of $p < 0.05$ was considered as statistically significant.

RESULTS

175 subjects were initially enrolled into the study. They comprised 105 female and 71 male students. All of them were within the 23 to 24 years range. All together, 164 students (93%) completed the study. Of the 12 dropouts (personal reasons, non-compliance), 5 were from the placebo group (P), 4 from the essence of chicken group (CEC) and 3 from the other protein group (C). Finally there were 52 students in group P, 56 students in group CEC, and 55 students in group C. No adverse effects were experienced by the students.

For the GHQ test, there was no significant difference among the three groups at the start of the experiment (P, 7.13; CEC, 7.34; C, 6.71, $p > 0.05$). (A, 7.135; B, 7.338; C, 6.709, $p > 0.05$). However, after two weeks of daily ingestion of the P, CEC, and C samples, the reduction in GHQ score of group CEC was significantly different from that of group P (5.41 v.s. 1.23, $p < 0.001$; Tukey's Test) and C (5.41 v.s. 1.87, $p < 0.01$; Tukey's Test). Group CEC showed the greatest improvement in terms of reduction in GHQ scores. See Table 1 for a summary of the results.

For SF36 test, there was no significant difference among the three groups at the start of the experiment (P, 96.54; CEC, 95.64; C, 97.36, $p > 0.05$). However, after two weeks of daily ingestion of the test samples, the increment in SF36 score of Group CEC was significantly different from Groups P (11.14 v.s. 4.85, $p < 0.01$; Tukey's Test) and C (11.14 v.s. 4.33, $p < 0.001$; Tukey's Test).

Table 1. Results of scores before and after 2 weeks ingestion of Placebo (P), Essence of Chicken (CEC) or Carageenan (C) by 3 groups of students

Tests	P			CEC			C		
	Before	After	Change	Before	After	Change	Before	After	Change
GHQ (s.e.m)	7.13 1.97	5.90 2.08	1.23 0.64	7.34 2.15	1.93 1.99	5.41‡ 0.69	6.71 0.71	4.84 0.59	1.87‡ 0.47
SF36 (s.e.m)	96.54 0.87	101.38 0.54	4.85 1.02	95.64 0.96	106.79 0.63	11.14‡ 1.62	97.36 1.13	101.69 0.86	4.33‡ 1.00
DS (s.e.m)	17.19 0.76	18.21 0.75	1.02 0.41	17.70 0.86	20.20 1.03	2.50‡ 0.50	17.45 0.42	18.22 0.38	0.76‡ 0.32
Construct (s.e.m)	4.08 0.35	4.50 0.27	0.42* 0.11	4.13 0.39	4.80 0.23	0.68* 0.14	4.09 0.12	4.49 0.08	0.40* 0.13
3-min test (s.e.m)	4.31 0.42	4.50 0.29	0.19 0.10	4.27 0.43	4.89 0.14	0.63‡ 0.12	4.33 0.11	4.55 0.08	0.22‡ 0.08
Compre. (s.e.m)	5.79 0.60	7.00 0.45	1.21 0.22	5.54 0.66	7.86 0.58	2.32‡ 0.25	5.47 0.17	6.96 0.17	1.49‡ 0.20

MAT	7.13	7.79	0.65	7.25	8.88	1.63‡	7.38	7.76	0.38†
(s.e.m)	0.54	0.40	0.17	0.60	0.41	0.28	0.20	0.17	0.23

All values are expressed as mean ± s.e.m

- ‡ There is a significant difference when comparing the changes in score between the 3 groups ($p < 0.05$ or less, $F_{2,160} \geq 5.12$; ANOVA). Group CEC is significantly different from Group P ($p < 0.05$ or less; Tukey's Multiple Comparison Test) and Group C ($p < 0.05$ or less; Tukey's Multiple Comparison Test).
- † No statistically significant difference is noted between Group C and Group P in term of changes in score ($p > 0.05$ or less; Tukey's Multiple Comparison Test).
- * Comparing the increments in score between the 3 groups, no statistically significant difference is noted between all 3 groups ($p = 0.21$, $F_{2,160} = 1.553$; ANOVA).

For Digit Span test, there was no significant difference among the three groups at the start of the experiment (P, 17.19; CEC, 17.70; C, 17.46, $p > 0.05$). However, after two weeks of daily ingestion of the test samples, there was a significant difference between Group CEC and Groups P ($p < 0.05$; Tukey's Test) and C ($p < 0.005$; Tukey's Test) in terms of improvement in Digit Span scores (CEC 2.5; P, 1.02; C, 0.76).

For Figure Construction test, there was no significant difference among the three groups at the start of the experiment (P, 4.08; CEC, 4.13; C, 4.10, $p > 0.05$). At the end of two weeks, the increment in score between the three groups was not statistically significant (CEC, 0.68; P, 0.42; C, 0.40) ($p = 0.21$, $F_{2,160} = 1.553$; ANOVA).

For the 3-minute memory test, there was no significant difference among the three groups at the start of the experiment (P, 4.31; CEC, 4.27; C, 4.33, $p > 0.05$). Comparing the three groups at the end of two weeks, the increment score of Group CEC was significantly different from Group P (0.63 v.s. 0.19, $p < 0.01$; Tukey's Test) and Group C (0.63 v.s. 0.22, $p < 0.05$; Tukey's Test).

For the comprehension test, there was no significant difference among the three groups at the start of the experiment (P, 5.79; CEC, 5.54; C, 5.47, $p > 0.05$). However, after two weeks of daily ingestion of the test samples A, B, and C, the increment in comprehension score of Group CEC was significantly different from Group P (2.32 v.s. 1.21, $p < 0.01$; Tukey's Test) and C (2.32 v.s. 1.49, $p < 0.05$; Tukey's Test).

For the mental arithmetic test, there was no significant difference among the three groups at the start of the experiment (P, 7.14; CEC, 7.25; C, 7.38, $p > 0.05$). However, after two weeks of daily ingestion of the test samples Group CEC and Group P ($p < 0.05$; Tukey's Test) and Group C ($p < 0.0001$; Tukey's Test) in terms of improvement in mental arithmetic scores (CEC 1.63; P, 0.65; C, 0.38).

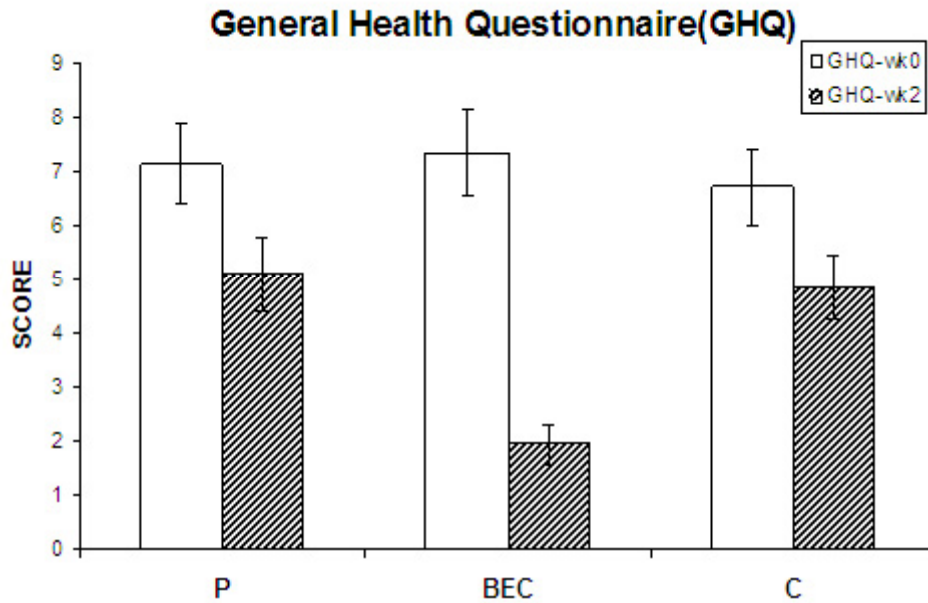


Figure 1. The General Health Questionnaire (GHQ) scores before and after 2 weeks of consuming placebo (P), essence of chicken (CEC) and carageenan (C). Score values are expressed as mean \pm sem.

There is a significant difference when comparing the reduction in score between the 3 groups ($p < 0.0001$, $F_{2,160} = 13.83$; ANOVA). Group CEC is significantly different from Group P ($p < 0.001$; Tukey's Multiple Comparison Test) and Group C ($p < 0.01$; Tukey's Multiple Comparison Test). No statistically significant difference is noted between Group C and Group P.

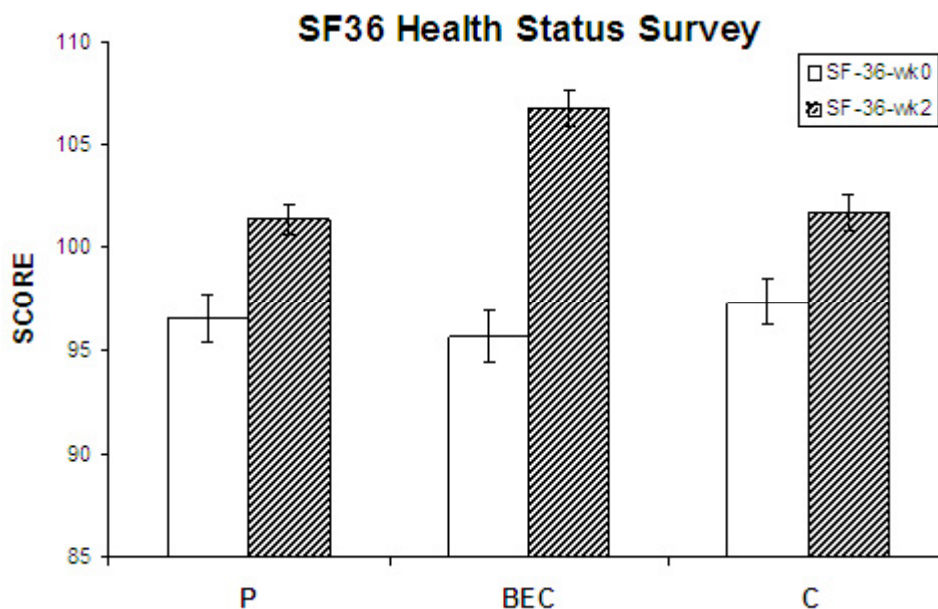


Figure 2. The SF36 Health Status Survey scores before and after 2 weeks of consuming placebo (P), essence of chicken (CEC) and carageenan (C). Score values are expressed as mean \pm sem.

There is a significant difference when comparing the increments in score between the 3 groups ($p = 0.0002$, $F_{2,160} = 9.17$; ANOVA). Group CEC is significantly different from Group P ($p < 0.01$; Tukey's Multiple Comparison Test) and Group C ($p < 0.001$; Tukey's Multiple Comparison Test).

Comparison Test). No statistically significant difference is noted between Group C and Group P.aa

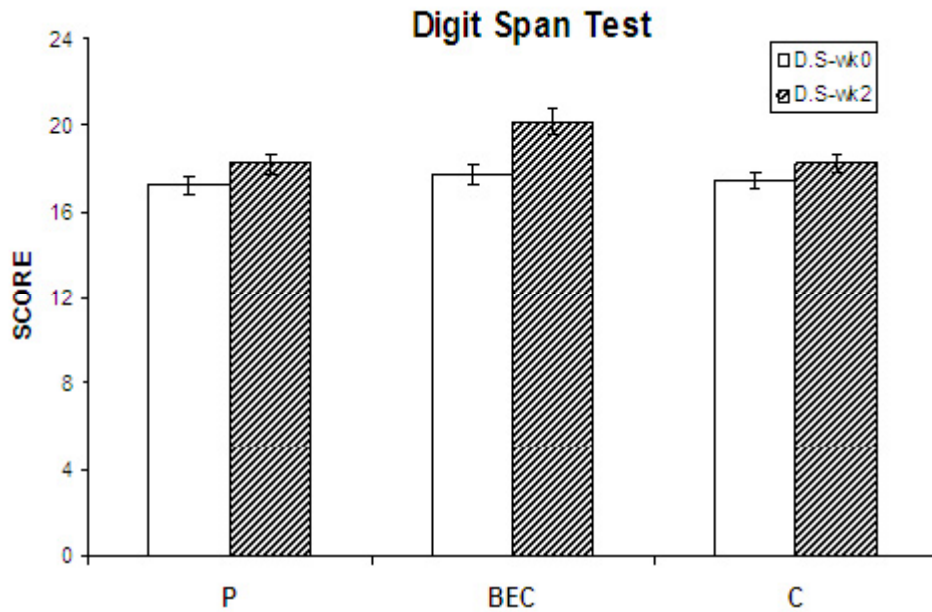


Figure 3. The Digit Span Test scores before and after 2 weeks of consuming placebo (P), essence of chicken (CEC) and carageenan (C). Score values are expressed as mean \pm sem. There is a significant difference when comparing the increments in score between the 3 groups ($p=0.007$, $F_{2,160}=5.12$; ANOVA). Group CEC is significantly different from Group P ($p < 0.05$; Tukey's Multiple Comparison Test) and Group C ($p < 0.005$; Tukey's Multiple Comparison Test). No statistically significant difference is noted between Group C and Group P.

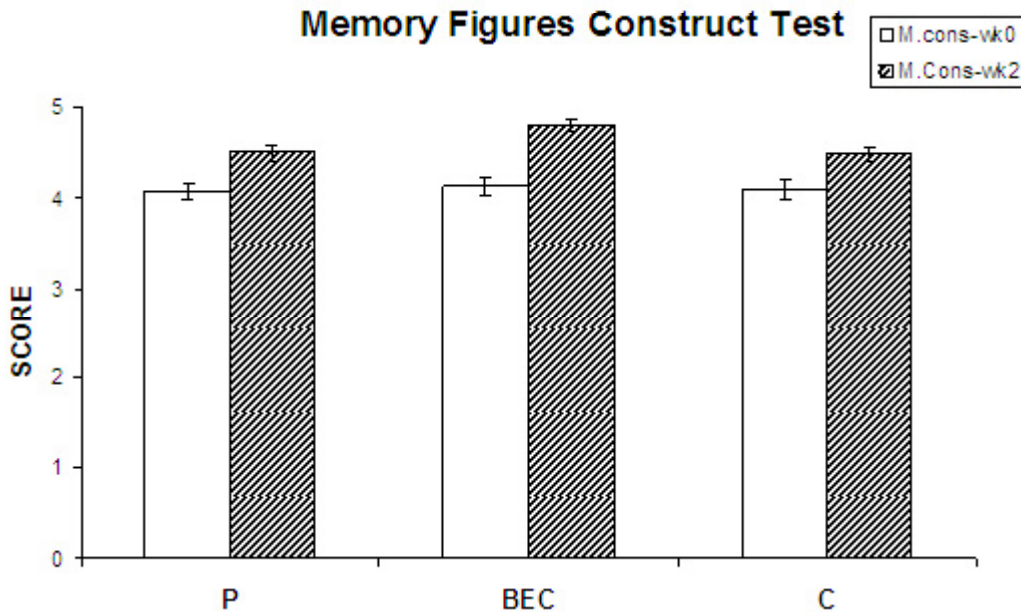


Figure 4. The Figure Construction Test scores before and after 2 weeks of consuming placebo (P), essence of chicken (CEC) and carageenan (C). Score values are expressed as mean \pm sem.

Comparing the increments in score between the 3 groups, no statistically significant difference is noted between all 3 groups ($p=0.21$, $F_{2,160}=1.553$; ANOVA).

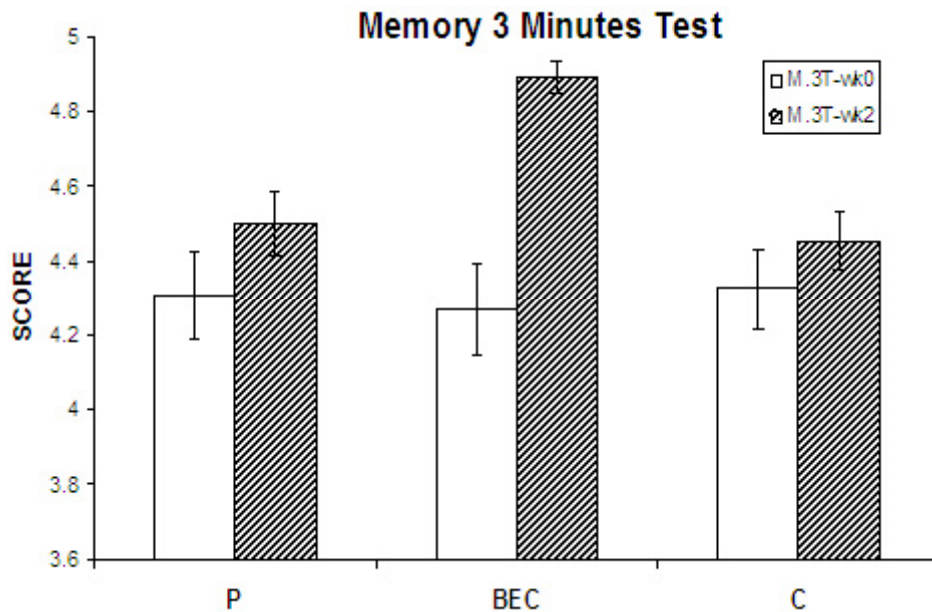


Figure 5. The 3-minute Memory Test scores before and after 2 weeks of consuming placebo (P), essence of chicken (CEC) and carageenan (C). Score values are expressed as mean \pm sem. There is a significant difference when comparing the increments in score between the 3 groups ($p=0.0035$, $F_{2,160}=5.86$; ANOVA). Group CEC is significantly different from Group P ($p < 0.01$; Tukey's Multiple Comparison Test) and Group C ($p < 0.05$; Tukey's Multiple Comparison Test). No statistically significant difference is noted between Group C and Group P.

DISCUSSION

The results indicate that the subjects taking essence of chicken performed significantly better than those taking either placebo or carageenan in all the tests except the Figure Construction test measures. This finding adds to the earlier findings that chicken essence could have beneficial effects on the cognitive functions of subjects. Perhaps through the serotonin system, it causes less anxiety and leads to increased alertness and better concentration, thus allowing the subjects to make fewer mistakes in the tests.

Perhaps there is a unique composition of amino acids or peptides in the essence of chicken that helps to increase mental focus and concentration while reducing anxiety concurrently as shown by Naiphinich *et al.* (2000). Essence of chicken contains concentrated amounts of proteins, amino acids and peptides such as carnosine, compared to homemade traditional chicken soup. Due to a unique extraction process, it has been postulated that readily absorbed amino acids and bioactive peptides are present in the commercial essence of chicken (CEC). Table 2 shows the nutritional composition of CEC.

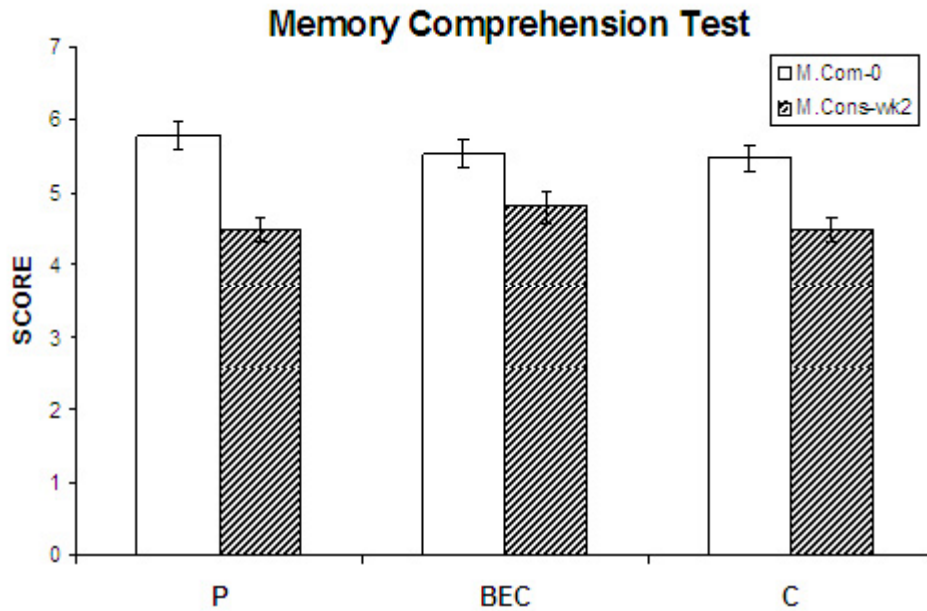


Figure 6. The Comprehension Test scores before and after 2 weeks of consuming placebo (P), essence of chicken (CEC) and carageenan (C). Score values are expressed as mean \pm sem. There is a significant difference when comparing the increments in score between the 3 groups ($p=0.0016$, $F_{2,160}=6.67$; ANOVA). Group CEC is significantly different from Group P ($p < 0.01$; Tukey's Multiple Comparison Test) and Group C ($p < 0.05$; Tukey's Multiple Comparison Test). No statistically significant difference is noted between Group C and Group P.

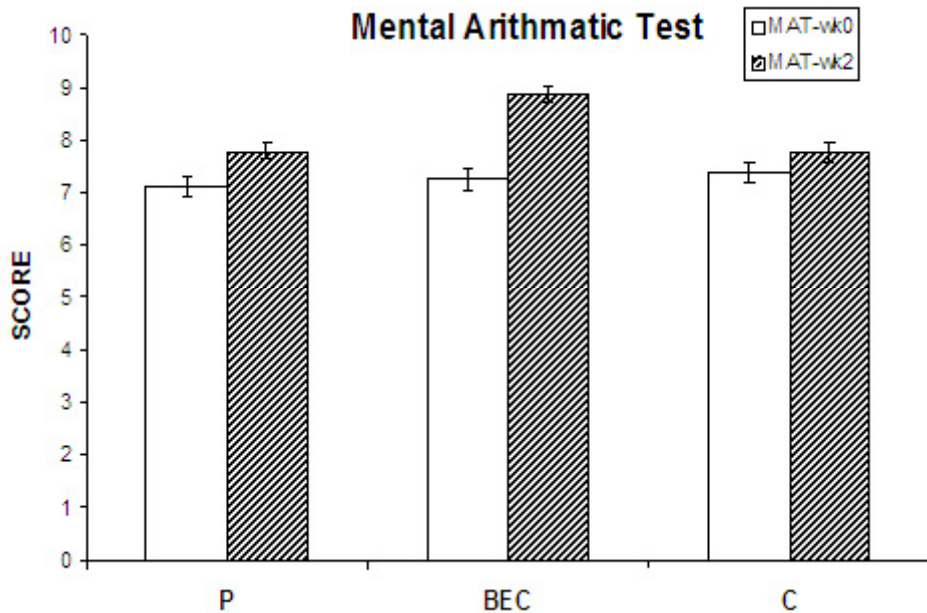


Figure 7. The Mental Arithmetic Test scores before and after 2 weeks of consuming placebo (P), essence of chicken (CEC) and carageenan (C). Score values are expressed as mean \pm sem. There is a significant difference when comparing the increments in score between the 3 groups ($p=0.0004$, $F_{2,160}=8.20$; ANOVA). Group CEC is significantly different from Group P ($p < 0.05$; Tukey's Multiple Comparison Test) and Group C ($p < 0.001$; Tukey's Multiple Comparison Test).

Comparison Test). No statistically significant difference is noted between Group C and Group P.

Table 2. Composition of commercial essence of chicken (data provided by manufacturer)

Ingredient	Amount
(mg/ml)	
Protein and peptide	83.0
Amino acid (free)	3.1
Hexose	0.8
Lipid	0.4
Mineral	(µg/ml)
Ca	26
Fe	1
Mg	32
Zn	2
K	1740
Na	550
Cl	1340
P	480
Cu	2
Mn	5
S	500
Se	0.05
Vitamin	(mg/kg)
Vitamin B2	1.0
Vitamin B6	0.37
Vitamin B12	0.002
Niacin	6.4
Folic acid	0.15
Vitamin C	15

A study in Singapore indicates that essence of chicken has the possibility of increasing the brain activity of 5-HT (Xu & Sim, 1997). This could mean that essence of chicken therefore has effects on sleep, mood elevation, analgesia, facilitation of motor output and regulation of circadian rhythm. Our findings seem to implicate the 5-HT system.

In this study, the randomized, double blind, placebo controlled design enhanced objectivity minimized bias due to investigators or volunteers. Different modalities of tests were conducted to investigate different psychological and cognitive aspects to ensure unbiased results. All the subjects were tested under the same conditions by the same interviewer to again avoid potential bias.

We believe the whole process could also be explained by the cognitive model of thinking. The cognitive model of anxiety proposes that dysfunctional patterns of thinking are involved in the maintenance of anxiety (Beck, 1976; Beck, Emery & Greenberg, 1985). These patterns of thinking are manifested, according to Beck, at the surface level as negative automatic thoughts in the stream of consciousness. Worry is normal and represents a natural mechanism to keep us

aware of our environment. It can get out of hand and become unnecessary and excessive. This is then called anxiety, our most common emotional problem. The Diagnostic and Statistical Manual of Mental Disorders (APA, 1994) emphasizes that worry is a psychic component in the diagnostic criteria for general anxiety disorder (GAD). Specific models of the function and maintenance of worry have recently emerged such as those of Borkovec and colleagues (Borkovec & Inz, 1990) and of Tallis & Eysenck as quoted in Eysenck (1992). These approaches have begun to view worry in terms of a more general cognitive-processing framework. The theory asserts that worry serves as an avoidance function by diverting attention from other forms of intrusive thought, which may be more closely associated with somatic activation (Borkovec, Shardick & Hopkins, 1991). However, it contributes significantly to the maintenance of anxiety. Worry is reinforced by its somatic-anxiety reducing effects and is therefore difficult to change. It may also maintain anxiety by preventing emotional information from being fully processed because fear structures are not completely accessed. In addition to cognitive avoidance, Borkovec *et al.* (1991) also propose that worry serves to anticipate threat and enhance avoidance of threat, which may be encountered in the future. Another group of researchers (Eysenck, 1992) propose that worry acts as an alarm by introducing threat material into consciousness. It also represents threat related thoughts into awareness, which serves to prompt the individual. Finally, worry allows the individual to anticipate future threats and therefore serves a preparatory function.

Several conclusions concerning the attention characteristics and correlates of worry have been drawn from a recent review (Wells, 1994). First, worry can be differentiated from other varieties of intrusive thought or obsessional thoughts. However, it is likely that all of these cognitive events rely on some attention. Whilst the continued processing of worry relies on attention, the initiation of worry may be involuntary and preceded by automatic processing, which issues a call for controlled processing involvement. Within an information-processing framework, worry is not only initiated by low-level automatic processing activities, it may be initiated by top-down influences of self-knowledge. This knowledge will guide and shape activities of the controlled processing system in which worry is executed. For example, some individuals may use worry as a coping strategy for reducing threats such as those believed to be associated with optimism. Moreover, the attentionally demanding nature of worry means that the process is capable of draining resources, which could be used for other types of intrusion. Thus, as Borkovec & Inz (1990) suggest, worry may contribute to cognitive-emotional avoidance in some subjects.

This aspect is used in psychological treatment of anxiety i.e. reduction or control of worry. In an earlier paper (Azhar *et al.*, 2001) essence of chicken was used in conjunction with psychotherapy and it probably acted via some mechanism, perhaps through certain neurotransmitter pathways, most likely the serotonergic, to reduce some level of anxiety and thus helped the subjects to be able to 'distract' from the anxiety and 'worry' and respond to the psychological treatment. In other words the cognitive emotional avoidance in these subjects may be reduced and thus respond better to psychotherapy because the demanding nature of worry means that the process is capable of draining resources which could be used for other types of intrusion and essence of chicken may serve its purpose here. What seems to be of positive value is that not only do the psychological and cognitive measures of anxiety show significant reduction but the actual readings of blood pressure and pulse rate also indicate a significant reduction. This could only happen if the subjects could be distracted from the anxiety state and follow strictly the

psychotherapy really well. Subjects taking essence of chicken showed significant improvements compared to the other experimental groups on the various parameters mentioned.

Similarly in this study, the subjects taking essence of chicken seem to benefit the most. The same explanation would probably be the answer i.e. the subjects responded to the action of the amino acid chains and peptides or the serotonin system enhancement or a combination of both. Such potential physiological modulation causes the subjects to be sufficiently relaxed to get distracted from worry and anxiety while at the same time focus and attend more to the tasks given. The small groups of tasks given in small groups to the subjects sequentially are almost similar to sitting for a school test. The environment is almost similar to a college examination with an examination hall supervised by an invigilator. If we expand this, it could perhaps have similar effects on students taking their examinations and that taking essence of chicken everyday for two weeks could bring about this change.

CONCLUSION

In conclusion, this preliminary trial on normal stressed human subjects seems to show that essence of chicken has beneficial effects in helping to reduce anxiety possibly through distraction, and thereby providing a higher possibility of mental focusing and attention to reduce mistakes. It needs to be shown how it would affect other types of subjects in larger groups such as school children in urban and rural settings with different nutritional status as well as other stimuli. It is important to note that we are not claiming that this substance can make people brilliant but for those who have been preparing for a test, this food product, which in essence is a functional food, can perhaps enhance their already good ability to reduce mistakes. It should be further tested in a bigger population. It must also be noted that the effects of the essence of chicken on the subjects were also significantly positive in reducing GHQ scores and increasing SF36 scores, which means it also provides increasing qualities of mental and physical health.

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