

Effects of Soup Intake for Fourteen Days on the Mood and the Difference in Cortisol of Awakening and Evening in the Clerical Employees: An Effectiveness Study Trial

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Abstract

In this study, an investigation based on an effectiveness study trial without special limitations was carried out regarding how 14 days' continuous soup intake would change the mood of the participants and their salivary cortisol levels between awakening and evening. The participants consisted of 16 healthy workers who agreed to participate in the experiment. The participants led their normal daily lives without consuming soup for the first 14 days (controlled condition), and then consumed their chosen soup once a day, at approximately 3 p.m., for the next 14 days (soup condition). Their salivary cortisol levels were measured when they woke up in the morning (awakening) and at 5 p.m. on the last day of each condition, while their mood was evaluated by questionnaire at 5 p.m. every day. The irritation-anger score of the soup condition was significantly lower than that of the controlled condition, and the difference in the salivary cortisol level between awakening and evening in the soup condition was significantly higher compared with the controlled condition. As a result, this study suggests that continuous soup intake under conditions of free choice in the afternoon at the workplace may be effective in relieving stress of worker's body and mind.

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Keywords

Soup, Effectiveness Study Trial, Salivary Cortisol Level, Mood

1. Introduction

Soup is a general term for liquid food made from meat, seafood and vegetable stock, and it has been empirically known that consuming warm savory soup on a regular basis in daily lives calms the mood and elicits a sense of relief (Midoh, 2011).

As a result of an experimental study that investigated the psychological change caused by chicken extract, it was reported that the tension-anxiety scale of POMS declined due to chicken soup intake for two weeks (Midoh & Noguchi, 2009). It was also reported that a sense of relief rose soon after consuming corn soup, which was sold at a store (Nagai et al., 2012). These above reports indicated that the soup intake caused some psychological changes, but no investigation on the effects of continuous soup intake in daily lives had been carried out with using any biomarkers to measure those psychobiological changes.

A wide variety of major biomarkers including blood pressure and heart rate have been put into use. However, in recent years, cortisol, which is contained in saliva and easily sampled with reducing participants' burdens, is attracting more attention as a biomarker. Generally, cortisol has a circadian rhythm with high levels after awakening and a decline in levels during the day (Hajat et al., 2010). It has been also reported that individuals with a strong self-awareness of chronic stress or work stress show flatter rhythms regarding the difference in their cortisol levels between morning and evening compared with healthy individuals (Miller et al., 2007; Liao et al., 2013). Furthermore, it has been reported that the difference becomes more prominent due to an improvement in health conditions by a cognitive behavior therapy (Holland et al., 2011).

The previous studies, which attempt to investigate effects of soup intake on the body and mind, have only been carried out with a specific soup, and there are no studies that allowed the participants have selected a type of soup on their preferences. Many studies which investigated foods intake on psychobiological effects were based on efficacy studies which conducted investigations under the optimum condition with the strict experiment control. However, recently, the importance of effectiveness studies which conducts investigations under the conditions similar to those of the subjects' actual daily lives and attempts to verify the effects, has been pointed out, (Singal et al., 2014). Effectiveness studies trials are performed to evaluate foods and drugs of which has been already assured these effects with efficacy studies, on the participants' daily lives, as well.

In this study, based on an effectiveness study trial, we investigated the mood which 14 days' continuous soup intake would cause on the subjects, along with the difference in the amounts of their cortisol secretion between awakening and evening. The participants were asked to freely select the type of soup depending on their daily mood and preference, so that their situations would be similar to those of their daily lives.

2. Methods

2.1. Participants

The participants consisted of 16 healthy office workers (male: 4; female: 12; 34.0 ± 3.1 years old) who were recruited from Shigakukan university staffs. All subjects were working at the same work place (mostly desk work) five days a week (days off on Saturdays and Sundays). All subjects had no past history of serious diseases and that they were not taking any specific medication. Prior to the study, all subjects provided written informed consent and participated in the study upon agreement in writing. This study was carried out upon obtaining approval from the ethics committee of Kurume university following the submission of a protocol.

2.2. Procedures (Figure 1)

A 28-days evaluation was carried out regarding the daily life of the participants (at work on weekdays and at home on weekends). Except they refrained from consuming instant soup, the participants were able to have their daily lives as usual for the first 14 days (controlled condition). During the subsequent 14 days, the participants were asked to consume a cup of soup at approximately 3 p.m. every day, but otherwise they weren't imposed

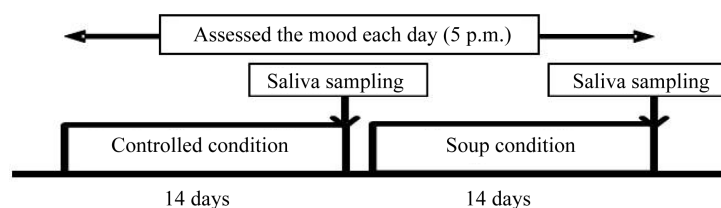


Figure 1. Experimental protocol.

any limitations on their daily lives as same as the controlled condition (soup condition). Saliva was collected from participants on awakening and at 5 p.m. on day 14 (last day of the controlled condition) and day 28 (last day of the soup condition). Saliva was collected by inserting cotton-like resin inside the mouth for 3 minutes and adhering saliva to it. After sampling, a sponge was placed in a spitz (Salisoft, Sarstedt, Inc., Germany) and centrifuged at 1500 rpm for 5 minutes (KR-180B, Kubota corp. Japan) to obtain clear saliva, as the assay sample. Further, the assay samples were stored at -80°C until analysis.

2.3. Soup

All participants were provided with 12 types of commercially available instant soups (Knorr® cup soup, Ajinomoto Co., Inc. Tokyo, Japan) prior to the study. The types of soups were as follows: “corn cream soup”, “corn cream soup with grains of corn”, “cream soup”, “mushroom”, “pumpkin”, “potatoes”, “spinach”, “vegetables and bacon”, “cream onion”, “spicy consommé”, “onion consommé” and “chicken consommé”. During the soup condition, the subjects were able to select a type of soup on their preference every day. They dissolved instant soup powder into 150 ml hot water and consumed it at approximately 3 p.m. In the controlled condition, the subjects were asked to refrain from consuming samples or any other soups similar to it.

2.4. Mood

With reference to [Steptoe and Wardle \(2005\)](#), we evaluated each item of “fatigue”, “happiness”, “irritation-anger” and “stress” by the five point scales from “none” (1) to “very high” (5). The participants reviewed their moods of each day at approximately 5 p.m. and gave their own evaluations. Holidays and weekends were excluded from the data because each subject lived their lives away from work. The moods were calculated the average score from the day 8 to the day 14 as for the controlled condition, and the average score from the day 22 to the day 28 as for the soup condition.

2.5. Cortisol

The level of salivary cortisol secretion was measured using a saliva cortisol kit (Salimetrics Inc., Carlsbad, USA) according to the attached protocol. The level of cortisol secretion at awakening and 5 p.m. was measured, and the difference between awakening and 5 p.m. was acquired. To avoid any influences of the menstrual cycle on the cortisol level, each participant was checked for the phase of their menstrual cycle.

2.6. Statistical Analysis

SPSS18.0J (IBM SPSS, Japan) was used for data analysis. A paired T-test was used to evaluate the mood and the difference in the salivary cortisol level between awakening and evening. Regarding the results of statistical analysis, a risk ratio of 5% or less was determined as a significant difference. The data are presented as the average \pm standard deviation.

3. Results

3.1. Mood

Table 1 shows the change in mood. The irritation-anger score of the soup condition was significantly lower than the controlled condition ($t(15) = 2.2, p < 0.05$). No significant difference was observed regarding fatigue, happiness and stress.

Table 1. Difference in the mood for the controlled condition and the soup condition. * $p < 0.05$ (vs. controlled condition).

	Controlled condition		Soup condition		<i>t</i> -value
	Mean	SD	Mean	SD	
Fatigue	3.4	0.5	3.2	0.8	1.7
Happiness	2.7	0.3	3.0	0.6	1.4
Irritation-anger	2.6	0.5	2.3	0.5	2.2*
Stress	3.0	0.5	2.7	0.5	1.7

3.2. Difference in the Salivary Cortisol Level between Awakening and Evening

Figure 2 shows the salivary cortisol level at awakening and evening. The salivary cortisol level in the evening significantly declined in the controlled condition ($t(15) = 6.3, p < 0.05$) and the soup condition ($t(15) = 7.1, p < 0.05$) compared with that at the awakening. The difference in the salivary cortisol level between awakening and evening in the soup condition was significantly higher compared with the controlled condition ($t(15) = -2.1, p < 0.05$) (Figure 3).

4. Discussion

Our effectiveness study trial was evaluated for the effect of continuous soup intake on the workers' mood at their workplace, and on the difference in their salivary cortisol levels between awakening and evening. As a result, the irritation-anger score in the soup condition was lower than that in the controlled condition, and a significant difference in their salivary cortisol levels between awakening and evening was also observed in the soup condition.

From the feelings of "irritation" and "anger" are included in negative emotions (Terasaki et al., 1992), it was suggested that the decline in the irritation-anger score in the soup condition reflected alleviation of the subjects' negative mood. Moreover it has been reported that consuming a specific type of soup would cause psychological changes such as the easing of the negative mood, etc. (Ishizaki et al., 2005; Midoh & Noguchi, 2009; Nagai et al., 2010). Our investigations suggested that continuous soup intake at a workplace has eased the work-related negative mood.

The difference in the levels of salivary cortisol secretion between awakening and evening associates with improvements in health conditions (Holland et al., 2011) and the buffering of chronic stress (Miller et al., 2007). Our investigations suggested that continuous soup intake not only alleviated the subjective negative mood, but also generated a great difference in the amounts of cortisol secretion between awakening and evening.

In this study, the participants freely selected a soup from 12 types depending on their mood of the day. It has been reported that the state of uneasiness related to food choices and food intake (Yannakoulia et al., 2008) and that taste recognition changed by experimentally imposing mental or physical stress (Nakagawa & Inui, 1997). It is also considered that the mood, as well as the mental and physical condition, affected taste (Karita et al., 2012) and the choice of food (Christensen & Brooks, 2006). Furthermore, Tatano et al. (2007) reported that the university students' selection of a lunch menu was strongly related to their mood of the day and preferences. These reports, taken together with our investigations, may be effective to lead to positive effects under the conditions allowing the subjects to freely make selections.

A drawback in an effectiveness study trial is mentioned; that is, it has difficulties in showing the validity because the condition is not as strictly controlled as in an efficacy study (Singal et al., 2014). However, the result of our study, which was carried out based on an effectiveness study trial under the condition assumed to reflect daily lives, suggests that continuous soup intake in the afternoon at a workplace may be effective in relieving stress of a worker's.

Finally the limitations of our study should be mentioned. First, our study was carried out by relying on an open study trial. In the future, a cross-over trial should be put into practice to investigate more detailed effects of the soup intake. Secondly, in our study, which was based on an effectiveness study trial, many participants consumed soup during their break in the afternoon; therefore it cannot be denied that secondary effects were produced by having a lively conversation with others and promoting communications. Furthermore, as our study was carried out under the conditions similar to those of the participants' daily lives, no consideration was given

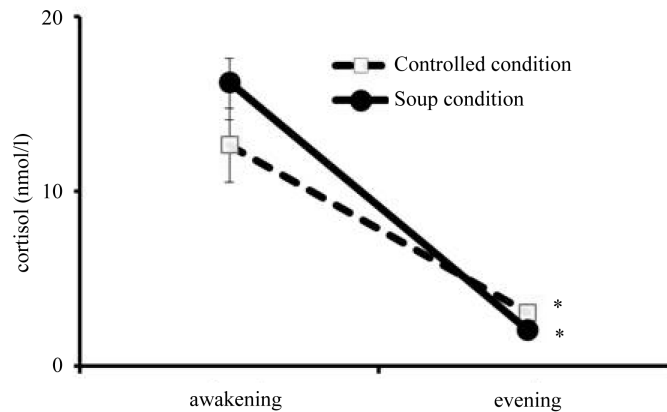


Figure 2. Comparisons of the diurnal slope of salivary cortisol level between the controlled condition and the soup condition. * $p < 0.05$ (vs. awakening).

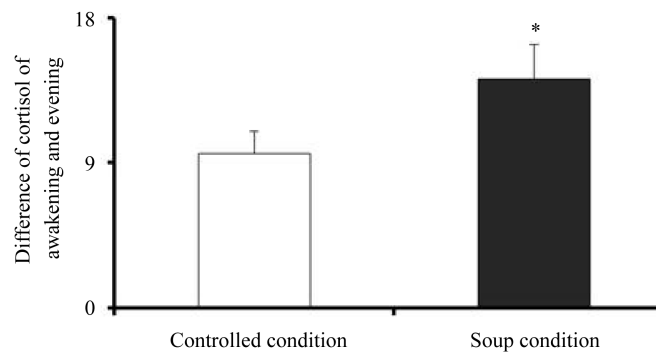


Figure 3. Difference in the salivary cortisol level between the awakening and the evening in “the controlled condition”, and that in “the soup condition”. * $p < 0.05$ (vs. control condition).

to the change of their mood and that of their cortisol levels which might be caused by poor physical conditions or by being confronted with unexpected events. A systematic evaluation by questionnaire has not been made on this point. However it could be assured from the subjects’ “introspection reports” that there have not been such unexpected events which might affect the result.

5. Conclusion

This study is carried out based on an effectiveness study trial under the condition assumed to reflect daily lives. The results of this study suggest that continuous soup intake in the afternoon at a workplace may be effective in relieving stress of a worker’s body and mind.

Conflict of Interest

The study was funded by Knorr Foods Co., Ltd., KT, TI and NM are employees of Knorr Foods Co., Ltd.,

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