

# Relationship between rhythm of juggling, personal tempo and effect of healing

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## Abstract

Reducing stress is important for maintaining healthy life. Anxiety disorder, major depression and psychosomatic disorder are representative disease by stress. Nakahara suggested that juggling therapy is effective for the treatment of anxiety disorders (Nakahara, 2006). We aim to investigate healing effect and factor of doing juggling to make use of it for getting relief from stress for people of today. In the first experiment, by adopting psychological tests, we examined the healing effect of juggling. We found that subjects' mood have brightened a bit after the exercise of doing juggling. We consider that rhythm of doing juggling and personal tempo of subjects may influence their mood. The personal tempo is a proper rhythm for the person who felts comfortable. Ichikawa suggested that a cause of the stress was brought by acting with out of the rhythm from one's personal tempo. In the second experiment, we examined a relationship between rhythm of the juggling and personal tempo (Ichikawa,2008). We also investigated a difference in the change of the mood under the exercise of the juggling. Especially, we focused on the relationship between rhythm of juggling, personal tempo, and effect of healing induced by doing juggling.

**Key words:** juggling, healing, Personal temp, Salivary Amylase

## Introduction

Nakahara reported on Juggling therapy for the treatment of anxiety disorders (Nakahara, 2006). They found that “Subjects (n=17) were treated with standard psychotherapy, medication and counseling for 6 months. For the last 3 months of treatment, subjects were randomized into either a non-juggling group or a juggling therapy group. The therapeutic effect was evaluated using scores of psychological testing (STAI: State-Trait Anxiety Inventory, POMS: Profile of Mood States) and of ADL (Activities of Daily Living) collected. After 6 months, an analysis of variance revealed that score on the state anxiety, trait anxiety subscales of STAI and tension-anxiety (T-A) score of POMS were significantly lower in the juggling-group than in the non-juggling group. Depression, anger-hostility scores of POMS were improved more than non-jugglers (Nakahara, 2006).”

For maintaining healthy life, it is important to reduce stress in daily life and not to build up it. An ideal way of reducing stress for people of today is a thing that anyone can do it easily without depending on age or sex. In this study, we focus on doing juggling by use of beanbags that is effective for the treatment of anxiety disorders. We also investigate an effect of healing induced by doing juggling.

## Purpose

The main aim of this study is to investigate healing effect and factor of juggling by focusing on the personal tempo to make use of doing juggling for getting relief from stress for people of today. We try to investigate the relationship between rhythm of juggling, personal tempo, and effect of healing induced by doing juggling through comparison of previous experiments and new three experiments in this study. The personal tempo is a proper rhythm for the person who felts comfortable. Ichikawa suggested that a cause of the stress was brought by acting with out of the rhythm from one's personal tempo (Ichikawa, 2008). In addition, we also investigate the relationship between psychological index measured by a face scale having seven levels and physiological index measured by using a stress checker of Salivary Alpha-Amylase to evaluate subjects' mood.

## Previous Experiment

In 2008, one of our authors investigated the effect of healing induced by doing juggling with three types of beanbag (Morikami, 2008). The three types were standard beanbag (weight: 40g), bell beanbag (A beanbag with a bell) and big beanbag (weight: 80g). 24 subjects (12 male and 12 female) were randomized into three groups. They had been instructed to play beanbag (doing juggling) with both hands during their free time

within three weeks. The subjects' mood after doing juggling was evaluated by the score of psychological testing (STAI: State-Trait Anxiety Inventory, POMS: Profile of Mood States) and by a face scale with seven different expressions reflecting personal mood. The face scale was produced originally by referencing the previous face scales (Shibata, 2004). We made a refinement on the face scale to choose it more easily (Fig.1).

After three weeks, the score of face scale became significantly higher by doing juggling than before it ( $p < 0.05$ ) (Fig2). Score of POMS and STAI were inconsistent, but half the subjects' activity score on the vigor subscale of POMS was higher than the score in three weeks ago. There was no variance between three groups. These findings suggest that subject's mood changes to more cheerful after doing juggling.

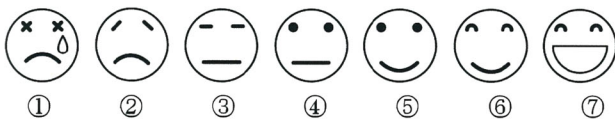


Fig1. Seven grade evaluation face scale.

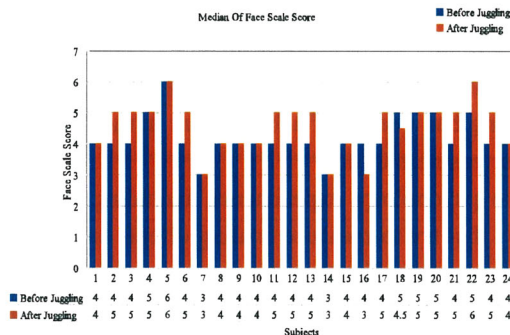


Fig2. Median of face scales for respective subjects.

### Experiment

We carried out three new experiments (Experiment1, 2, and 3) with the same subjects in this study. In the first experiment, we investigated the relationship between the mood and the personal tempo after doing juggling. That is, we tried to confirm the reproducibility of the mood change after doing juggling in the previous experiment. We also focused on the effect of personal tempo on the mood. In the second experiment, we introduced the stress measure using Salivary Alpha-Amylase monitor as a quantitative physiological index. The quantitative index is expected to bring different aspect of information compared to the qualitative index of the face scale. By comparing these scores, we tried to discuss relevance of these indices to evaluate the healing effect of doing juggling. The third experiments aimed to clarify the

relationship between the personal tempo and the effect of doing juggling.

### Methods

All three experiments were carried out in the time span from 3:00 p.m. to 6:00 p.m. Subjects in these experiments were 6 males and 6 females who were in good health. First, subjects were obliged to take off their watches and/or mobile telephone that could measure before starting the experiments. Next, subjects measured their heartbeat and personal tempo before and after the experiments. The personal tempo was produced by tapping the keyboard with subjects' forefinger of their dominant hand during one minute. Without telling the results of tapping, the personal tempo was produced by three times. After finishing all processes, we asked objects several questions and impression of the experiments.

In first experiment, after subjects choose their mood from seven face scales, they played juggling during two minutes and thirty second. After doing juggling, subjects choose their mood from seven face scales again. In second experiment, a process was added to measure stress using Salivary Alpha-Amylase after choosing a face scale. In the third experiments, the procedures were almost similar to the second experiment excepting that subjects were obliged to play juggling with their own tempo, which was estimated as the mean value of the personal tempo produced in the early stage of the experiment. A metronome was displayed on a monitor of personal computer with sounds to instruct their personal tempo.

### Results

The face scales' score of median values after playing juggling was higher compared to the value before the juggling. In the first experiment the value changed from 4 to 4.5, and in the third experiment it changed from 4.5 to 5 (see Fig.3). Figure 4 summarized the changes of mean values of the face scale between before and after doing juggling for the respective subjects. In the first experiment (blue bar), there were three positive subjects who choose higher score than before doing juggling. In reverse, two negative subjects choose lower score. In the same manner, there are four positive subjects and no negative subjects in the second experiment (orange bar). There are four positive subjects and three negative subjects in the third experiment (green bar). Results of the second experiment were recorded the best score; however, there was no significant difference between

three experiments statistically. Figure 5 showed the changes of the averaged values of personal tempo between before and after the experiments. The personal tempo was produced three times per subject in each experiment (the first experiment: blue bar, the second experiment: orange bar, and the third experiment: green bar). There were some differences among individual, however, the personal tempo changed apparently after doing juggling. Significant difference was accepted by the change of the personal tempo using measurement of non-parametric randomization: (Experiment 1:  $2P=0.0039$ ,  $p<.05$ , Experiment 2:  $2P=0.0049$ ,  $p<.05$ , Experiment 3:  $2P=0.0044$ ,  $p<.05$ ).

In the third experiment, we investigated the change of mood and stress due to difference of juggling tempo (see Fig. 6 and Fig. 7). In the second experiment, subject played juggling without any restriction of the tempo. In contrast, in Experiment 3, they were obliged to keep their own personal tempo. Note that Salivary Alpha-Amylases' quantities were different among individuals and also different day by day. For subjects 2, 5, 7, 9, and 10, the value of Salivary Alpha-Amylase decreased, and for subject 4, 8, and 12 the value increased in both experiments. Other subjects (1, 3, 6, and 11) showed a different tendency; smaller change in the second experiment and larger change in the third experiment. The scores of face scale were compared with the observed values of Salivary Alpha-Amylase. In spite of the small change in face scale, subjects who recorded large change of Salivary Alpha-Amylase were subjects 6 and 9 in the second experiment and subject 8 in the third experiment. Subjects 4 and 12 in the third experiments seemed to feel stress in the value of Salivary Alpha-Amylase, even though the scores of face scale were high. Subjects 5, 7 and 10 recorded reverse results compared to the subjects 4 and 12.

Finally, we tried to check how personal tempo influenced on the healing effect, which induced by playing beanbags, by comparing to the measured value of Salivary Alpha-Amylase (see Fig.8 and 9). In the third experiment, subjects were obliged to play beanbag with their personal tempo. Subjects 1, 4, 9, and 12 showed higher tempo compared to that in the second experiment. They also scored larger change in the Salivary Alpha-Amylase test.

### Concluding Remarks

Score of face scale showed no significant difference among three experiments. However, subjects' moods tend to change into cheerful condition after playing

beanbags. The personal tempos also have the change after the juggling. It can be considered that producing the rhythm of juggling influences acquisition of the personal tempo, and change of the moods can be influenced by changing the personal tempo.

There are many individual variations in the change of face scales' score and that of Salivary Alpha-Amylase score. We can not confirm any systematic tendency between them. However, it seems true that there exist two types of subjects who are sensitive or not sensitive to the change of rhythms in juggling, because some subjects change their moods in face scale and their personal tempo in juggling. For some subjects, it is not easy to play juggling under the obliged condition of tempo controlled by metronome in the third experiment. For the other subjects, the given tempo can be comfortable rhythm to play juggling. These discrepancies of respective perceptions may bring the individual variation in the scores of face scale and Salivary Alpha-Amylase test. From the impression hearing after the experiments, some subjects have felt that it is easy to play juggling with the metronome. However, some subjects are not. This discrepancy can be caused by the perceived feeling and/or stress of the respective subjects. It is not the direct effect of doing juggling but a sense of achievement in the difficult task and/or easiness to do.

In the psychology experiments, including the present study, that try to measure healing effects and the stress, it cannot contradict that the experimental environment and the measurement itself may influence to the psychological condition and feelings of subjects. We have to control the stress conditions before the experiments.



Fig3. Effect of playing beanbags on the face scales score. Mean values of the face scale are compared between before and after the juggling.

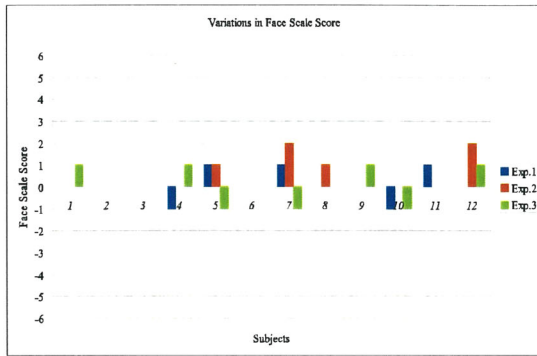


Fig4. Comparison of face scale change among Experiment 1, 2 and 3.

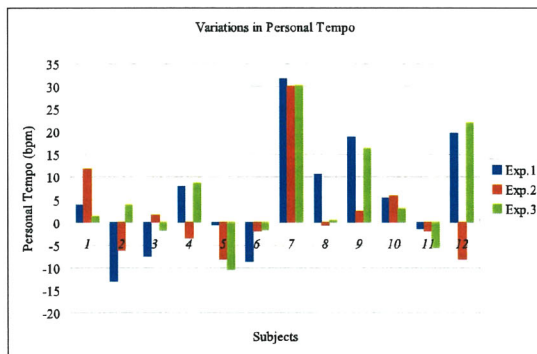


Fig5. Comparison of changes in personal tempo among Experiment 1, 2 and 3.

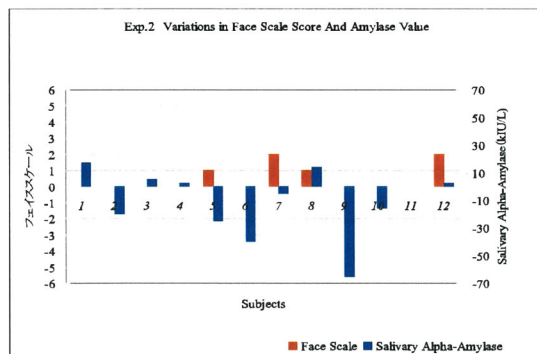


Fig6. Comparison of changes of face scale score with that of Salivary Alpha-Amylase test in Experiment 3.

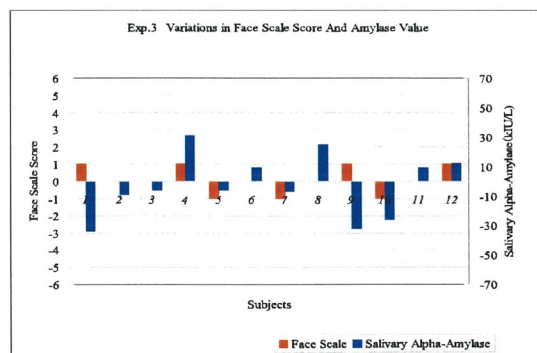


Fig7. Compare variations in face scale score with

Salivary Alpha-Amylase in Experiment 3

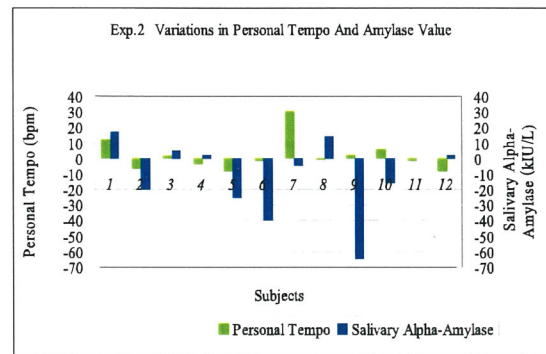


Fig8. Compare variations in personal tempo with Salivary Alpha-Amylase in Experiment 2.

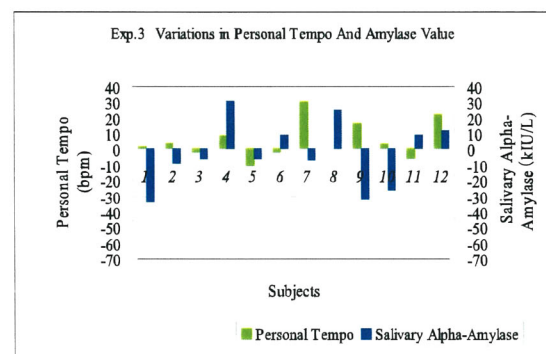


Fig9. Compare variations in personal tempo with Salivary Alpha-Amylase in Experiment 3.

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