Brain Activity Analysis on "Kana-Ami" Making Process

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Abstract. In this paper, the brain wave activity and saliva α-armylase for expert and non-expert was measured during five test of "Kana-ami" fatigue. Two experts were employed as expert and non-expert for comparison. The feature of subjects' working state and physical condition for each trial test was paid attention. It is found that expert was able to keep charging and concentrate working state even the body under the fatigue condition.

Keywords: Kana-ami · Brain wave · Saliva α-armylase · Expert · Non-expert

1 Introduction

"Kana-ami" is a classical traditional handicraft product of metal wire network in Japan as shown in Fig. 1. The history of Japanese "Kana-ami", the wire netting ware in Kyoto, goes back more than ten centuries. Used as kitchen utensils in Kyoto cuisine, these tools have been cherished by chefs in the city through the ages. However, "Kana-ami" handicraft technique has been declined in the development of social industrialization.

Additionally, on the one hand, traditional handcrafts are handed down mainly through oral teaching and extempore creation, making proceed of teacher-student relations, family relations and art education. On the other hand, a lot of traditional craftsman consider their work is monotonous and tedious even if very meaningful. It is very important to overcome the obstacles of focus on proceeding one thing for a long time.

However, it is very difficult for learner to keep concentrate the working state from master. Usually, the master only can pass the every essential to the prentice but the rest were on your own even with a long-term practice. Similarly, "Kana-ami" making process is a long and boring period. In order to make a good quality "Kana-ami" product, craftsman always keep the high concentration during the making process. However, long-term concentration is easier to make craftsman tired and affect the overall product beauty finally.

V.G. Duffy (Ed.): DHM 2015, Part I, LNCS 9184, pp. 212–219, 2015.
DOI: 10.1007/978-3-319-21073-5_22

Fig. 1. Japanese traditional handicraft of "Kana-ami"

In previous research, the expert's motion of the "Kana-ami" weaving process was clarified [1–3]. As the same time, the different "Kana-ami" hexagonal structure in vertical direction between expert and non-expert also was explained in the free fall experiment by high-speed camera [4, 5]. The results confirmed the superiority of the product made by expert. It was considered that expert could keep a reasonable tempo and interval-timing during long-term proceeding. Referred to previous study, the results of five continuous "Kana-ami" product making fatigue tests clarified that non-expert with 10 years experience is difficult to keep continuous a good working mental status with long-time making process.

In this study, cooperating with "Kanaami Tsuji" workshop, it is one of the few workshops to focus only on the "Kana-ami" production in Japan. Two craftsmen were employed as experts, called expert and non-expert, which have parent-child and Master-apprentice relationships. Expert is the excellent metal wire net designer of Kyoto in 2009 and 2010 with 46 years experience. Non-expert would be determining to continue the Japanese traditional handicraft technique, which has 10 years weaving experience.

The brain activity analysis was employed to evaluate subject's brain concentration condition during "Kana-ami" product making process. The brain wave analysis system was applied, the subjects was required to make five "Kana-ami" continuously. Both expert and non-expert's brain wave activity was recorded one by one. The five trials of expert and non-expert's α and β brain wave ratio were calculated to present the working state. The saliva α-armylase activities for each trial of expert and non-expert were measured and used for assessing their physical recovery and levels of fatigue.

In additionally, the result of expert's α and β brain wave were shown a steady ratio during the whole process of five trials "Kana-ami" making. However, the expert shown the large saliva α-armylase changing, which was considered that expert was physical fatigue easily because older characteristic. Therefore, expert can keep a good working condition under fatigue state.

And the purpose of this paper was through the evaluation and analysis of craftsman's brain activity difference during "Kana-ami" making process to found the relationship between expert key point of brain activity and their working state and finally provide a reference for the new scholars.

2 Experiment

2.1 Participants

In this study, the two masters with 46 years and 10 years wire netting technique experience were employed as participants, which called expert and non-expert. The expert and non-expert not only have parent child relationships but also have mentoring relationship. And both of them would be committed to heritage this Japanese handicraft technique of 'Kana-ami'.

2.2 Experimental Process

The subjects were required to make five "Kana-ami" products continuously. The brain wave activities of expert and non-expert were recorded by EEG system (electroencephalogram, MindSet; NeuroSky) as shown in Fig. 2. The saliva α-armylase activity also was measured by saliva α-armylase system (NIPRO) before the experiment and after the production for each product each as shown in Fig. 3.

Fig. 2. Brain wave activity system

Fig. 3. Saliva α-armylase activity

3 Results and Discussions

3.1 Analysis Result of α and β Brain Wave

Figures 4 and 5 showed brain wave α and β occupation ratio comparison between expert and non-expert during fiver continuous trial tests. It is worthwhile to find that expert's α and β ratio kept constant and similar value at the level of 30 % and 70 % respectively during five continuous trial tests. However, non-expert displayed irregular α and β ratio trial through all the trials with rise-fall trend from trial to trial. In order to investigate the change of brain wave activity of expert and non-expert along with increasing trial test number, average value of α wave for each trial were also calculated and plotted in Fig. 6. It demonstrated that expert could keep a stable mental condition with low relaxation (α) and high concentration (β) balance during continuous 5 trial weaving process. By contrast, non-expert's brain wave behavior was not stable, sometimes concentrated in work and sometimes relaxed without limit by significant increasing of α ratio, which was considered to be a key factor affected stability of final product's quality.

3.2 Saliva α-Armylase Activity Discussion

As well know that saliva α-armylase could be a kind of effective indicator of fatigue and stress condition Here, in Fig. 7 Saliva α-armylase of both expert and non-expert subjects were measured just after each product weaving trial, and five times of continuous saliva test data was plotted. In general, both expert and non-expert subjects showed increasing fatigue symptom change after continuous five trial tests.

It is obvious to note that expert's saliva value increased significantly along with increasing test trial with larger value than non-expert. And non-expert also displayed a linear increasing trend with prolonged trial test time. Due to expert's longer occupation experience, it was confused to find that expert's big fatigue change than non-expert. However, when we considered the factor of both two subjects' characteristic ages, expert was elder than non-expert with nearly 30 years. Referred to the research of relationship between saliva test and human characteristic, people with larger ages would easily generate a large amount of saliva α-armylase. Therefore, expert's physical

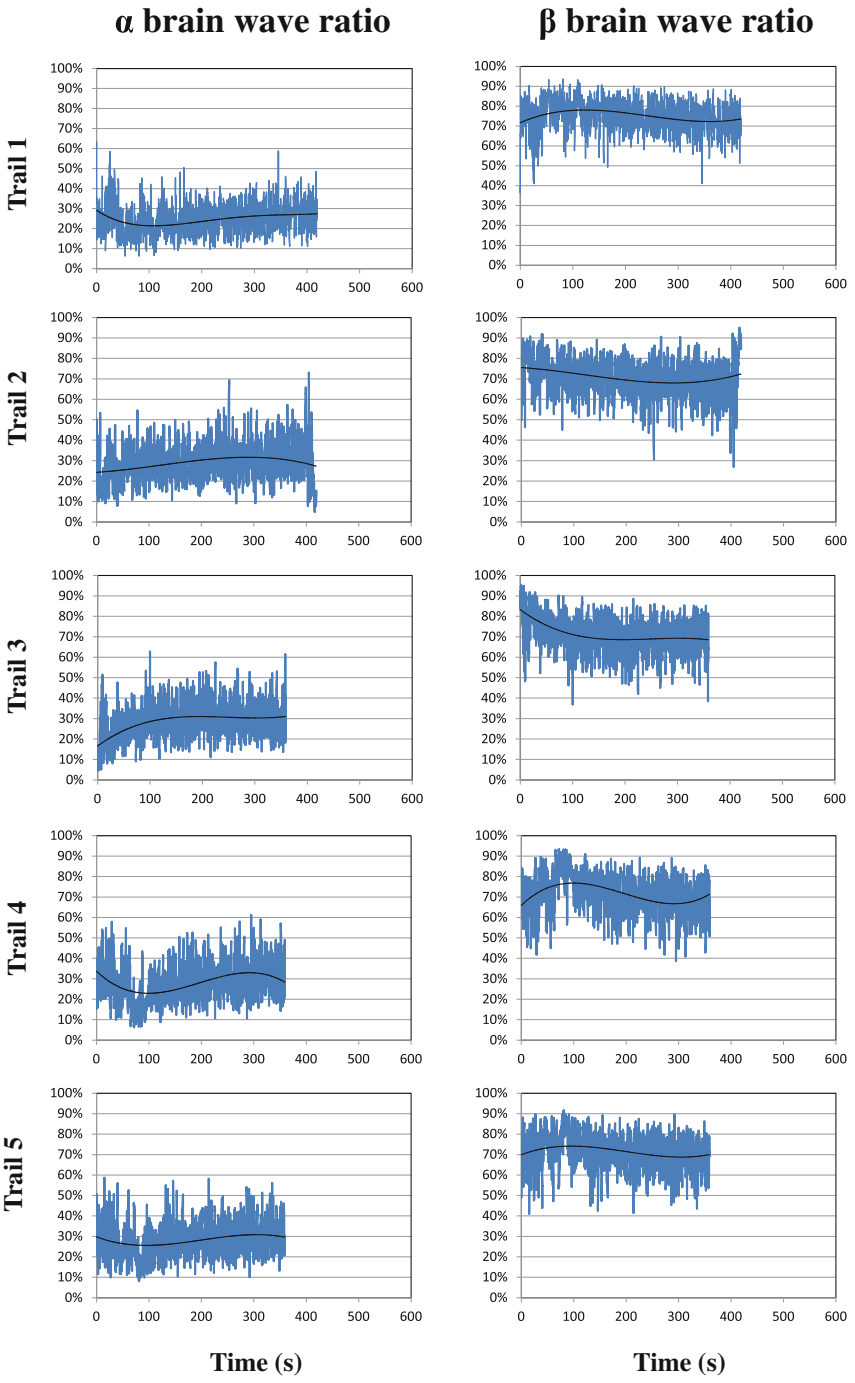

Fig. 4. Five trials α and β brain wave ratio of expert

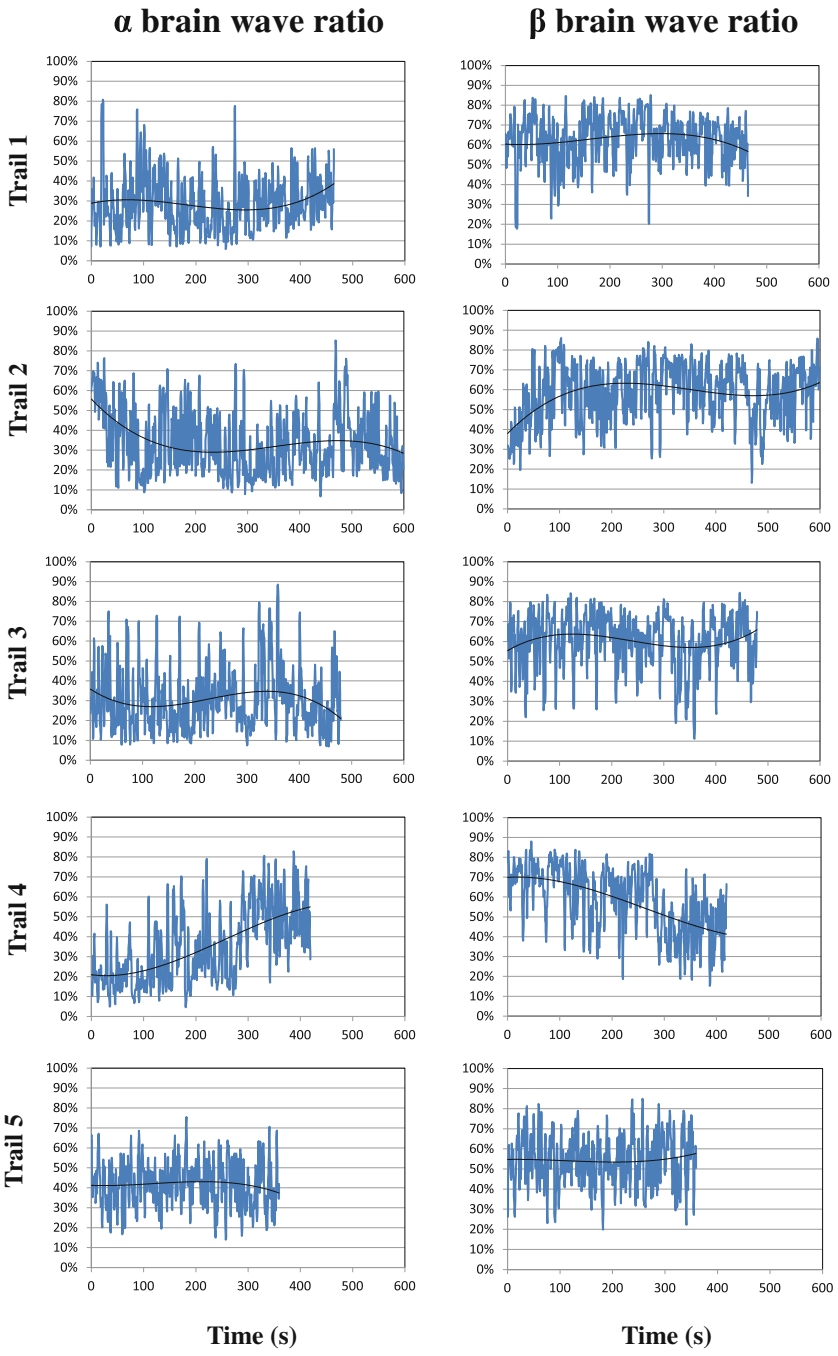

Fig. 5. Five trials α and β brain wave ratio of non-expert

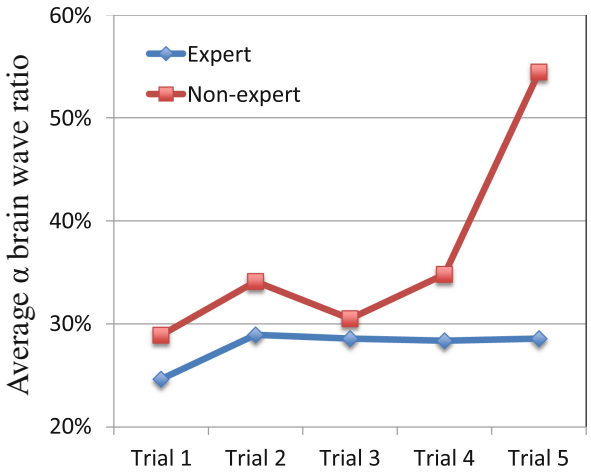

Fig. 6. The average α and β brain wave ratio of expert and non-expert

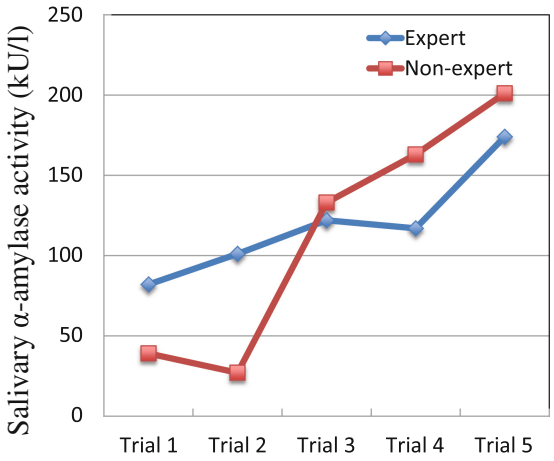

Fig. 7. The saliva α-armylase of expert and non-expert

fatigue symptom with larger saliva α-armylase value could be mainly explained as larger age factor but not caused by technical process.

4 Conclusions

In this research, brain wave analysis and saliva α-armylase activity measurement were conducted to investigate expert and non-expert's mental situation during continuous five trial of product weaving process. As a conclusion, both expert and non-expert presented the severer physical fatigue status during continuous test trial by trial.

Furthermore, expert's sharper increasing of saliva α-armylase in a wider range because of larger age factor was also clarified. However, the expert's brain wave showed a fairly steady ratio of α wave ratio and β wave ratio. Combined two tests results together, it could be demonstrate that expert was able to control his body fatigue and concentrate for long-term weaving process.

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