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Evaluation of Human Stress with Salivary Alpha-amylase

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Introduction

Recent drastic development on biochemical molecular detecting methods of human secretory substances reveals that the changes of the level of various human salivary substances can be closely related to the changes of human mental states. Those studies have originally started in the field of behavioral medicine, but nowadays its forms the new interdisciplinary scientific field frequently called as *Psychoneuroimmunology* and/or *Psychoneuroendocrinology* (e.g., Ader, 2001). However, those fields of studies are relatively immature and much more accumulation of systematic research would be needed.

We conducted a simple experiment focusing on the change of human salivary alpha-amylase during stressful mental workload. Alpha-amylase is a major human digestive enzyme and it is also thought to be a possible stress marker. Some researchers reported that the increase of concentration of Alpha-amylase within saliva by stressful task considered that reflects the enhancement of human autonomic nervous system (e.g., Yamaguchi, 2004).

Experiment

Four undergraduate students were required to conduct a simple and repetitive stressful task, which consisted of the 15 minutes of an arithmetic task and 9 minutes of break, repeatedly 4 times. Subjects' saliva was sampled during the task/break every 3 minutes and the alpha-amylase was detected by a dry chemical amylase-detecting device (COCORO MERTER, NIPRO Co., Japan). Heart rate is also recorded as a reference of an autonomous nervous system index.

Result and Discussion

As the result, the level of averaged alpha-amylase was significantly increased during the task and decreased by the break ($p < .01$, by paired *t*-test) (The typical data was shown in Figure 1), but no main effect of time by *ANOVA*.

On the other hand, the heart rate (HR) and its low frequency (LF) components also changed accompanying with the task/break schedule (Figure 2). Therefore, the alpha-amylase can be taken as one of the human mental

stress marker. The LF components, which can reflect the human cardio-vascular activity, clearly switched such as active/inactive in time series, while HR gradually decreased. It suggests the same controlling mechanism is underlying between the alpha-amylase activities and the autonomic nervous related circulatory system.

In addition, there are some experimental facts that human protein secretion can be mediated by higher mental process (including cognitive process) (e.g., Ader, 2001). Thus, far more research could bring useful knowledge to the field of cognitive science.

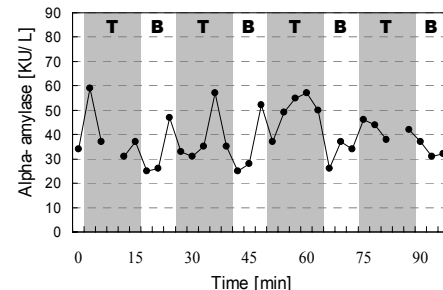


Figure 1: Change of the salivary alpha-amylase during the task ('T') and break ('B').

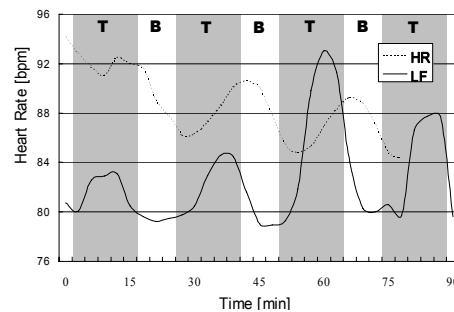


Figure 2: Change of HR and LF.

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