

Original

## Using salivary amylase to measure stress caused by urinating in diapers

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### Abstract

This article focuses on using salivary amylase levels to objectively measure patient stress caused by urinating in diapers. The study included 16 female students from Meiji University of Integrative Medicine. Participants were 20-21 years old, in good health, and not menstruating. Participants adhered to study conditions and the final eligible number of participants was 15. Average salivary amylase levels before and after urination were 51.0 (SD±14.6) kIU/L and 38.1 (SD±12.3) kIU/L, respectively. Average salivary amylase when relaxed was 32.8 (SD±13.3) kIU/L. These results suggest that stress associated with urination in a diaper can be measured using salivary amylase levels. This result is more fully developed in evaluation of intervention. For people with communication difficulties, e. g., people with dementia or disuse syndrome, our findings could be applied to evaluation of stress associated with using diapers.

**Key words :** stress, amylase, urination with diaper

### 1. Introduction

Urinary incontinence in the elderly greatly impacts their quality of life (QOL), and many studies have been published regarding urinary incontinence in this population. For example, Tannenbaum et al. reported a relationship between urinary incontinence and geriatric self-efficacy (Tannenbaum, Brouillette et al. 2009), and Langford discussed the stress associated with urinary incontinence, showing that it has a significant impact on geriatric mental health.

The average lifespan in Japan is 78 years for men and 85 years for women, both of which are the longest in the world. Given the longer female life expectancy, women will require a longer period of care in their elderly years.

In Japan, many elderly people in nursing homes use diapers. In fact, many nursing home health-care workers recognize that use of diapers can be damaging to the self-esteem of elderly patients (Fujii et al. 2008). Sinha et al. referred to stress as an important outcome of urinary incontinence (Sinha, Blackwell et al. 2008), and showed the importance of evaluating urinary incontinence in the elderly.

While previous studies have used salivary cortisol or s-IgA to monitor stress levels (Taniguchi, Hirokawa et al. 2007; Kivlighan, DiPietro et al. 2008), these methods are time consuming and costly. Some studies have used salivary amylase to monitor stress (Nater, Rohleder et al. 2005; Ng, Koh et al. 2008; Davis and Granger 2009), but there have been no major studies on the use of amylase to measure stress associated with incontinence.

### 2. Hypothesis

We hypothesized that salivary amylase levels could be used to objectively measure patient stress from urinating while wearing a diaper.

### 3. Objective

The purpose of this study was to objectively measure stress while urinating in a diaper.

### 4. Methods

#### Participants

A total of 16 female students from Meiji

University of Integrative Medicine were enrolled in the study because data from women will be used in the future to develop stress reduction techniques for urinary continence.

**Trial place and health of participants**

Participants carried out the study in their homes when they were relaxed. They were healthy and not menstruating.

**Variables and measures**

We measured salivary amylase levels using a salivary amylase monitor (NIPRO, Japan, medical equipment report number: 27BIX00045000073), and compared levels in non-relaxed conditions. Amylase levels increase when a person feels stress. Participants collected saliva samples for measurement of salivary amylase levels.

**Number of measurements**

Each participant put on a diaper when they began to feel micturition. Each participant's stress level was measured before urination with a diaper and after urination using a salivary amylase monitor. Measurements were performed by first placing a chip in the sublingual space for one minute, then inserting the chip into the amylase monitor for about 2 minutes. A numerical value reflecting stress values appears on the monitor screen. Participants were instructed on how to take measurements, and were free to carry out the measurements at their place of preference (e. g., at home).

Data were compared to amylase levels in the relaxed state. Measurements were taken four times.

**Analysis**

Means and standard deviations of stress values were calculated, followed by data analysis with a distribution-free method (Wilcoxon signed-rank test: level of significance=0.01) using SPSS 14.0 software for Windows.

**Ethical considerations**

We ensured that the privacy and anonymity of participants were protected. This study was approved by the ethics committee at Meiji University of Integrative Medicine.

**5. Results**

Participants were 20-21 years old, in good health, and not menstruating. Participants adhered to study conditions and the final number of

eligible participants was 15. Average levels of salivary amylase before and after urination were 51.0 (SD±14.6) kIU/L and 38.1 (SD±12.3) kIU/L, respectively. For comparison, average amylase in the relaxed state was 32.8 (SD±13.3) kIU/L. The difference in amylase levels before and after urination with a diaper was statistically significant (p<0.01) (Table 1).

Table 1 Wilcoxon signed-rank test authorization of amylase stress value (nonparametric method)

| stree of level                        | Mean value of Amylas (±SD) | Wilcoxon signed-rank test |
|---------------------------------------|----------------------------|---------------------------|
| before urination with a diaper (n=14) | 51.0 (±14.6)               | **                        |
| after urination (n=15)                | 38.1 (±12.3)               |                           |
| relaxed conditions (n=15)             | 32.8 (±13.3)               |                           |

\*\* : p<0.01

**6. Discussion**

Stress level ranges were categorized as follows: 1) 0-30 kIU/L (no stress), 2) 31-45 kIU/L (mild stress), 3) 46-60 kIU/L (moderate stress), and 4) >61 kIU/L (high stress). Salivary amylase levels were lower when participants were relaxed than either before or after urination in a diaper, suggesting that urination caused stress. Participants felt significantly higher stress before urination in a diaper than after urination and in the relaxed state. This stress was caused by the limitation of urinating in a diaper. Therefore, when participants released the physiological pressure, their stress decreased significantly. Our findings suggest that stress caused by urination in diapers can be measured using salivary amylase levels. This result is more fully developed in evaluation of intervention. For people with communication difficulties, e. g., people with dementia or disuse syndrome, our findings could be applied to evaluation of stress associated with using diapers.

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**References**

Davis, E. P., D. A. Grange: Developmental differences in infant salivary alpha-amylase and cortisol responses to stress, *Psychoneuroendocrinology* 34 (6): 795-804, 2009.

- Kivlighan, K. T., J. A. DiPietro, et al: Diurnal rhythm of cortisol during late pregnancy: associations with maternal psychological well-being and fetal growth, *Psychoneuroendocrinology* 33(9): 1225-35, 2008.
- Nater, U. M., N. Rohleder, et al: Human salivary alpha-amylase reactivity in a psychosocial stress paradigm, *Int J Psychophysiol* 55(3): 333-42, 2005.
- Ng, V., D. Koh, et al: Salivary alpha amylase levels under conditions of extreme examination stress, *Psychol Rep* 103(2): 455-8, 2008.
- Sinha, D., A. Blackwell, et al: Outcome measures after TVT for mixed urinary incontinence, *Int Urogynecol J Pelvic Floor Dysfunct* 19(7): 927-31, 2008.
- Taniguchi, T., K. Hirokawa, et al: The immediate effects of 10-minute relaxation training on salivary immunoglobulin A (s-IgA) and mood state for Japanese female medical co-workers, *Acta Med Okayama* 61 (3): 139-45, 2007.
- Tannenbaum, C., J. Brouillette, et al: Responsiveness and clinical utility of the geriatric self-efficacy index for urinary incontinence, *J Am Geriatr Soc* 57(3): 470-5, 2009.
- Kimihito FUJII, Kenichi KOMAYA, et al: The present conditions of patients with stoma which was watched from QOL evaluation, *Proceedings of The research-society of Tokai for stoma rehabilitation*, 28(1): 42-46 (in Japanese), 2008.