

Sympathetic Nervous System Changes Based on Salivary Amylase after Animal-Assisted Education: Comparison by Age among Nursery School Pupils

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ABSTRACT

Objective: This study measured the salivary amylase in nursery school pupils during interaction with dogs as a part of animal-assisted education (AAE). Based on changes in their sympathetic nervous system, the effect and significance of animals on infants in nursery schools was evaluated.

Design: This was a quantitative, quasi-experimental study.

Materials and Methods: Saliva was obtained before and after AAE using dogs for measuring salivary amylase. Participants were divided into three groups according to age (12–18 months old [youngest group], 19–23 months old [middle group] and 2 years old [oldest group]) and their salivary amylase before and after AAE were compared.

Results: Salivary amylase in the youngest group decreased after AAE, but increased in the other groups. A significant difference in the salivary amylase levels was observed in the middle group before and after AAE.

Discussions: The sympathetic nerve plays a role in increasing salivary amylase in the middle and oldest groups. Infants in the youngest group may receive comfort from dogs rather than obtaining a stimulus.

Conclusions: This study suggested the necessity of assessing the purpose and method of AAE according to the children's age and their developmental stages and the importance of the presence of animals in nursery schools.

KEY WORDS

animal-assisted education, sympathetic nerve, α -amylase, nursery school children, biomarker

INTRODUCTION

Kindergartens, nursery schools and certified childcare centres were regarded as infant educational centres in 2017. The kindergarten curriculum guidelines have described the effect of animals on children^{1,2)}. In particular, interacting with animals during early childhood can successfully cultivate a foundation for children's character growth³⁾. According to the Asian Society for Animal-assisted Education and Therapy, animal-assisted education (AAE) is defined as an intervention that enhances educational quality and children's willingness to study using animals as 'living education tools'. Education using animals aimed at educational support has been implemented in Japanese schools⁴⁻⁶⁾.

Salivary amylase, a digestive enzyme, is a marker of stress and reflects changes in the enzyme activity⁶⁾. It correlates strongly with plasma norepinephrine concentrations and is used as a marker of the sympathetic nerve when assessing stress levels. Moreover, the salivary amylase levels change when the sympathetic nerve is stimulated through nervous actions⁷⁻¹⁰⁾.

PURPOSE

Many nursery schools raise several animals. However, few studies have evaluated the effect of animals on nursery school pupils. Furthermore, early childhood is the developmental stage for language acquisition. Thus, assessing the mental and stress status of infants based on their communication skills is difficult. This study measured salivary amylase when children interacted with animals in a nursery school as part of AAE. Furthermore, the effect of animals on the children and the importance of animal presence in nursery schools was evaluated based on the changes in their sympathetic nervous system.

MATERIALS AND METHODS

Study and Setting

This was a quantitative, quasi-experimental study, which included 24 children in a nursery school (1 and 2 years old) who were not afraid of dogs. Their saliva was collected after obtaining approval from their

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Table 1: Mean salivary amylase levels and difference in salivary amylase levels and standard deviation before and after AAE

	Mean	SD
Youngest group - before AAE	15.04	10.78
Youngest group - after AAE	14.96	12.31
Middle group - before AAE	5.07	4.47
Middle group - after AAE	6.87	5.28
Oldest group - before AAE	9.12	7.38
Oldest group - after AAE	10.6	9.84
Youngest group - Difference before and after	-0.7	12.82
Middle group - Difference before and after	2.07	6.57
Oldest group - Difference before and after	1.48	13.6

parents. The survey was conducted at one nursery school between January 2020 and June 2020.

Survey

Saliva was collected before and after AAE using dogs, and the salivary amylase levels were measured to observe changes in the sympathetic nervous system. In the classroom where AAE was performed, playing equipment, toys and notices were removed so that the children could focus on interacting with the dogs. Salivary amylase levels were measured using an enzyme analyse device, the salivary amylase monitor (Nipro Corporation, Japan). Children (≤ 6 children) interacted with animals for 10 min once a week under the surveillance of teachers and animal handlers. For safety measures, trained therapy dogs who follow the handler's instructions were selected. The dogs used included a male golden retriever and a female toy poodle.

Statistical Analysis

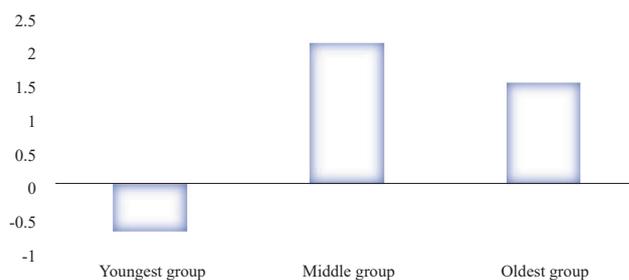
The early infancy period (1–2 years old) is a developmental stage, and children's development differs remarkably in several areas. Therefore, the children were divided into three groups: 12–18 months old (youngest group), 19–23 months old (middle group) and 2 years old (oldest group) groups. Moreover, their salivary amylase levels were compared before and after AAE. The obtained data were statistically analysed using the Statistical Package for the Social Sciences, version 26 (IBM, Armonk, NY, USA). The mean value and standard deviation were calculated, and non-parametric tests were performed.

Ethical Considerations

A researcher explained the details of the survey to the parents individually and requested them to involve their pupils in the study. In addition, the researcher explained that (1) participation in the survey was based on their free will and that they could refuse to participate at any time; (2) they would not suffer any disadvantages even if they did not agree to participate in the study; (3) personal information would be protected; (4) the obtained results would not be used for any purposes other than the survey and (5) the results of the survey might be published or presented at scientific congresses. The above points were provided in both oral and written forms to the children's parents, who then provided informed consent. The study was approved by the Institutional Review Board of Japan University Health Sciences (0202-2).

RESULTS

This study included 24 children in the survey. However, those who were unable to continuously participate in AAE and those whose saliva was not collected before and after AAE were excluded. Consequently, 15 children (5 children each in all the three groups) were included in the study. Statistical analyses were performed on the aforementioned three groups. First, we calculated the mean salivary amylase level, the mean difference in salivary amylase levels before and after AAE and standard deviation (Table 1).

**Figure 1: Mean difference in salivary amylase levels before and after AAE**

The mean value and standard deviation for salivary amylase levels were similar in the youngest group before and after AAE. However, their salivary amylase value decreased after AAE. The salivary amylase levels of the other two groups increased after AAE. The salivary amylase value decreased only in the youngest group after AAE. Moreover, the difference in this value before and after AAE was highest in the middle group (Figure 1).

Differences in the salivary amylase levels in each group before and after AAE were analysed using non-parametric tests (Wilcoxon). Consequently, no significant difference was noted.

DISCUSSION

The sympathetic nerve is speculated to be involved in increasing the salivary amylase levels in the middle and oldest groups. Children's feelings were stimulated through interaction with animals. In contrast, the salivary amylase levels decreased in the youngest group, indicating that this group may experience stress relief and comfort from dogs rather than experiencing a stimulus. This suggests that the purpose and implementation method of AAE should be evaluated according to children's age and developmental stage. The kindergarten curriculum guidelines state that it is required to provide appropriate instructions according to infants' developmental stage, while taking their growth into consideration²⁽¹¹⁾. Furthermore, several types of childcare methods and forms are employed in nursery schools¹²⁾. Appropriate instruction according to children's age or developmental stage is required because it may affect children's development. Therefore, AAE should be performed after careful discussion on its effects on children's growth.

A systemic review conducted by Purewal *et al.* (2017) showed that pet ownership is associated with emotional health benefit, particularly for self-esteem and loneliness¹³⁾. According to Zenkoku Pet Kyoukai, the number of pet owners in 20–40 age group, including first-time owners, is fewer than that of pet owners in other age groups¹⁴⁾. In particular, interacting with animals in nursery schools provides health benefits to children who have no experience of pet ownership at home. Furthermore, AAE, which is a planned educational intervention, may stimulate and comfort children, resulting in successfully cultivating a foundation for their character. Taken together, the results of this study suggest the importance of the presence of animals in nursery schools.

CONCLUSIONS

The levels of salivary amylase increased in the middle and oldest groups. Moreover, the sympathetic nerve may be involved in this elevation owing to stimulation of children's feelings in these groups by AAE. AAE may be associated with stress relief and comfort in the youngest group. These data suggest that the purpose and implementation method of AAE should be evaluated according to children's age and developmental stage. In addition, AAE, a planned educational intervention, may provide health benefits, stimulation and comfort to children, suggesting the importance of the presence of animals in nursery schools.

This was an initial stage study with a small sample size, which may be the reason for not observing any statistically significant differences. However, distinctive and interesting results indicated that the presence of animals in nursery schools may be important.

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