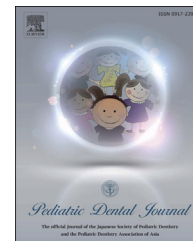


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Original Article

A primary study on feeding behaviors of autism model rat pups in the weaning period



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ABSTRACT

It is well known that children with autistic spectrum disorder possess various behavioral problems related to feeding, short attention span and maladaptation to surrounding environments. This study aimed to identify appropriate measures to address behavioral characteristics associated with eating and feeding in children with ASD by examining feeding behavior throughout the weaning period in rat pup models of autism.

Male Sprague–Dawley (SD) rats and healthy SD rats were nursed with their mothers until 14 days after birth. Then, the pups were divided into the following three groups and related in separate cages without their mothers: group A, two model rats; group B, a model rat and a control rat; and group C, two control rats. The number of meals ingested together and the number of body contact made with other rats at mealtime in each cage were counted from the 15th day to the 21st day. During this period, the body weight of each rat and the amount of food intake in each cage were also measured.

These were no remarkable differences in body weight gain between the model rats and control rats. In addition, the amount of food intake was not statistically different among the three groups. The number of body contacts made was not significantly different between group B and group C; however, the number of body contacts made was significantly lower in group A than in the other two groups.

These findings indicate that the rat pup models of autism displayed a feeding behavior similar to that of children with autism. These behavioral problems were improved by the inclusion of healthy rat pups in the same cage at the time of feeding.

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1. Introduction

Autism spectrum disorder (ASD) is a congenital condition associated with behavioral abnormalities in social relations, communication and motor activities. The onset of ASD is early

childhood [1–3]. It is a complex disorder that shows variable behavioral problems and other symptoms related to the lack of social interaction [4,5]. In addition, behavioral problems at mealtimes are reported as a significant issue of concern by parents, and a wide range of behavioral characteristics at mealtimes have been reported in studies on children with

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ASD [6–10]. According to previous studies, the prevalence of feeding and eating problems in children with ASD is estimated to be approximately 90% [7,8]. These studies showed that one of the problems at mealtimes is inappropriate behavior; in addition, escape and maladaptation to different situations were frequently observed among children with autism [6,11,12]. Treatment outcomes for these behavioral problems remain unclear despite the availability of some studies that conducted among children with ASD.

Some animal experiments have been conducted to study the characteristics of children with ASD [13–17]. In these experiments, rat models of autism were created through central nerve injury or medication to the mothers, and, subsequent social behavior and communication deficits were observed among the pups. The results of these experiments showed decreased or deficient social recognition and decreased aggression, which are characteristics similar to those children with ASD. Therefore these experimental rats are used widely as disease- models to elucidate the behavior characteristics and changes observed in children with ASD. However, behavioral characteristics associated with eating and feeding, which are often observed in children with ASD, have not been studied sufficiently. In particular, studies documenting these characteristics during weaning periods are extremely rare, and the observation of animal feeding behavior in order to elucidate behavioral problems associated with eating and feeding in children with ASD.

In this study, feeding behavior during the weaning period was examined in rat pup models of autism for the purpose of determining appropriate measures to address the behavioral problems associated with eating and feeding in children with ASD.

2. Materials and methods

The rat pup models of autism were prepared according to methods previously reported [18,19]. Sprague–Dawley rats

(Saitama Experimental Animals Supply Co., Ltd) of were orally administered 800 mg/kg of saline mixed sodium valproic acid on the 10th day of pregnancy. The rat pups thus born were used as models of autism (thereafter referred to as model rat). In addition, plain saline was orally administered to a different set of SD rats on the 10th day of pregnancy, and the pups thus born were used as control rats. Only male pups were used for this experiment. The model and control rat pups were bred separately by an ordinal method and kept with their mothers for 14 days after birth. The temperature and the humidity were maintained at 23 ° C and 50%, respectively. In addition, a 24-h light-dark cycle was followed (light period, 08:00 to 20:00; dark period, 20:00 to 08:00). On the 15th day, the model and control rats were divided into three groups and nursed without their mothers. Group A comprised two model rats, group B comprised one model rat and one control rat, and group C comprised two control rats. Each group was bred in separate cages until the 21st day, and the rats were fed pellet food and water ad libitum. A flow chart of this study is shown in Fig. 1. The body weight of each rat was measured once a day during the experimental period (at 08:00). The solid food and water intake in each cage was measured by a feeding and drinking monitor for rodents (FDM System MODEL FDM-ez 1, Neuroscience inc., Tokyo) [20,21]. Furthermore, the behavior of rats during food intake was obtained by recording their behavior for 2 h each during the light and dark periods using a digital video camera [22–24]. Although the feeding behavior of individual rats has been recorded and observed, few studies have observed feeding behaviors in rat models of autism. Therefore, the number of meals ingested together and the number of body contacts made during mealtime were documented from the video recordings of feeding. The definitions of these feeding behaviors are presented in Table 1. These experiments were repeated three times and the results were obtained for 6 rats in each group. The average number of meal ingested together every 1 h and the average number of body contacts made every 10 min during feeding were calculated, and compared

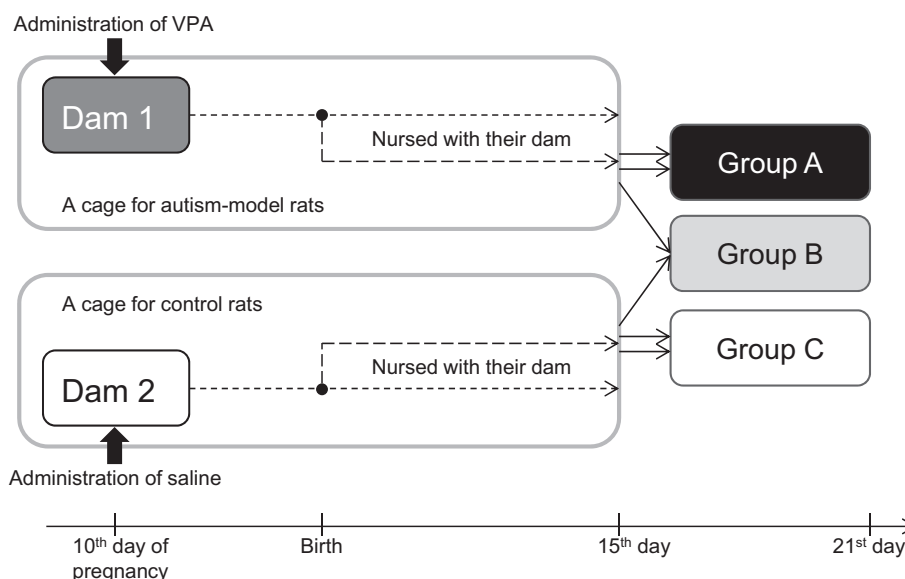


Fig. 1 – Overview flowchart of this experimental design.

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