

## Introduction

The dietary habits among early childhood are the foundation of their future dietary habits. They need to acquire appropriate habits from this period. Currently, there are various issues in the dietary habits of preschoolers, such as insufficient vegetable intake. Nutrition education is necessary to parents who provide meals to young children at home. In recent years, the environment surrounding child-rearing has changed, such as the increase in the number of dual-earner households and the availability of information on child-rearing and dietary habits. It is necessary to respond to these changes. Therefore, the following four studies were conducted with the aim of proposing nutrition education for the provision of healthy meals by mothers with preschoolers.

### Study1. Relationship between maternal healthy eating literacy and healthy meal provision in families

In recent years, the isolation of childcare and the widespread use of smartphones have accelerated, and each person involved in childcare needs to be able to obtain, understand, evaluate, and use appropriate information. The objective of study 1 was to examine the effects of maternal healthy eating literacy (HEL) on healthy meal provision. We conducted an online cross-sectional survey with 1,899 mothers of preschoolers in December 2018. This study suggests that maternal HEL is associated with healthy meal provision regardless of the degree of eating out/consuming convenience food.

### Study2. Characteristics of dinner among preschoolers by vegetable intake

The objective of this study was to compare the characteristics of dinner among preschoolers based on vegetable intake, as part of efforts to promote the intake of vegetables among them. From March to May 2019, 121 preschoolers aged 4–6 participated in a five-day dietary record survey using photographs. The high intake group consumed five types of vegetables and at least one side dish per dinner, and raw vegetables, vegetable soups, and simmered vegetables frequently

### Study3. Examining the usability of the reflet to increase the amount and the frequency of vegetable dish provision by parents with preschoolers

We produced a reflet to increase the amount and the frequency of vegetable dish provision by parents with preschoolers based on the results obtained in Study1 and Study2. The objective of study 3 was to evaluate the usability of this reflet. In June 2021, the leaflet was distributed to 69 parents

with preschoolers attending one preschool in Tokyo, and a questionnaire survey about the leaflet was conducted. Forty-two parents responded, and almost all of them answered that they understood the contents of the questionnaire, and about 60% of them answered that they learned something new from the leaflet. In addition, many parents had not yet practiced the recommendations, such as "including five kinds of vegetables in a meal" and "making meal prep with vegetable," and this led to the provision of new knowledge. Even among the parents who have not yet practiced the leaflet, many parents answered that they would like to practice it, and it is expected that the leaflet will lead to an increase in the amount and frequency of vegetable dishes provided by parents to their children, indicating the usability of the leaflet.

#### Study4. Strategies used by mothers to prepare homemade meals under time constraints and vegetable dishes provision

With the increase in the number of dual-earner families, it is difficult to spend enough time each day preparing meals for the family. In daily life, those who are in charge of meal preparation are considered to use strategies to prepare homemade meals under time constraints. The objective of study 4 was to examine the strategies that lead to vegetable dish provision by mothers with preschoolers.

##### Study4-1. Development of a homemade meal strategies questionnaire and its association with vegetable dish provision

In October 2021, we conducted an online, cross-sectional survey of 400 mothers with preschoolers. Homemade meal strategies questionnaire comprising four subscales ("planned menu planning and shopping," "use convenience foods," and "meal prep") was developed. The frequency of vegetable dish provision more than seven times a week was associated with high level of "meal prep", and low level of "use convenience foods."

##### Study4-2. Frequency of vegetable dish provision by maternal type of meal preparation

Study4-2 was conducted based on the hypothesis that even if mothers "use convenience foods," they provide vegetable dishes frequently when they combine with "meal prep." The purpose of this study was to examine the vegetable dish provision of maternal type of meal preparation by combining the two subscales obtained in Study 4-1, "use convenience foods" and "meal prep." Even after adjusting for demographic characteristics, "both use convenience foods and meal prep" type had higher percentage of those who provided vegetable dishes more than 7 times a week than "only use convenience foods" type.

## Conclusions

In this study, we showed the characteristics of dinner of preschoolers who eat enough vegetable, the maternal preparing meal strategies that lead to provision of vegetable dishes more frequently, and the maternal healthy eating literacy as a facilitating factor for providing healthy meals. Furthermore, we prepared a leaflet aimed at increasing the amount and frequency of vegetable dish provision and showed its usability. In the future, it will be necessary to propose nutrition education that responds to changes in the environment surrounding child-rearing.