

## Relationships Between Infant Birth Weight and Maternal Mastication Ability, Caloric Intake and Prepregnancy Body Mass Index of Women with Posterior Tooth Loss

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### Abstract

**Objective:** To analyze the relationships between infant birth weight and maternal mastication ability, caloric intake, and body mass index (BMI) of women with posterior tooth loss. **Material and Methods:** A cross-sectional study was conducted in 52 females aged 20–35 years who gave birth recently and had one or more unreplaced missing posterior teeth. The number and locations of the missing teeth were grouped on the basis of the Eichner Index. Prepregnancy BMI, caloric intake, and subjective mastication ability were recorded. **Results:** A significant difference was observed in the mean infant birth weights between the subjects with good and poor mastication in Eichner A2 ( $p < 0.001$ ), B1 ( $p = 0.039$ ), and B2 groups ( $p = 0.039$ ), that mean infant birth weight was lower in the group of women with poor mastication. The Pearson correlation test revealed a significant relationship between maternal caloric intake and infant birth weight ( $p < 0.001$ ). Mean infant birth weights differed between BMI categories, i.e., underweight, normal and overweight women subjects ( $2.59 \pm 0.18$  Kg,  $2.99 \pm 0.15$  Kg,  $3.58 \pm 0.30$  Kg) ( $p < 0.001$ ). The Kruskal-Wallis test revealed significant differences between the prepregnancy BMIs of pregnant women with posterior tooth loss and infant birth weights ( $p < 0.001$ ). **Conclusion:** We found that decreased subjective mastication ability in pregnant women who lost posterior teeth was associated with decreased infant birth weight, whereas higher mean caloric intake and higher prepregnancy BMI in pregnant mothers who lost posterior teeth were associated with increased infant birth weight.

**Keywords:** Mastication; Energy Intake; Body Mass Index; Birth Weight.

## Introduction

Missing teeth that are not replaced might have adverse anatomical and physiological effects on the oral cavity. One of the physiological aspects of tooth loss is functional impairment, such as disruption of mastication ability [1,2]. The process of mastication is influenced by the ability to crush food mostly by using the posterior teeth. Therefore, posterior tooth loss can lead to decreased masticatory ability [1,3]. This might cause a reduced ability to break down food into smaller particles that facilitate ingestion, which may result in selective food choices among individuals, such as avoiding hard and fibrous foods. This condition might cause nutritional deficiency and affect the general health of the population [4,5].

Expectant mothers need a balanced caloric intake for fetal growth. During pregnancy, a mother should be able to achieve and maintain a healthy weight by consuming appropriate food portions and monitoring the eating frequency [5]. The recommended daily intake for females is 2250 kcal for those aged 19–29 years and 2150 kcal for those aged 30–49 years [6]. In pregnant women, the recommended daily intake is 300 kcal more than the non-pregnant women [6]. Macronutrients required for a pregnant woman include carbohydrates, fiber, protein, and water. Micronutrients include vitamins and a variety of minerals, such as calcium, phosphorus, and iron. In addition, the recommended diet for pregnant women is to eat nutritious food by regulating the food intake to small but frequent (5–6 times a day) portions to prevent indigestion. Impaired nutritional status of pregnant women has a direct effect on the fetus, such as on infant birth weight [7–10].

Infant birth weight is one predictor of infant growth and survival [8,10]. In addition, to maternal nutrition, several factors affect the infant birth weight: sex, genetics, race, placental state, maternal age, parity, height, weight before pregnancy and weight gain, socioeconomic status, infection, physical, health services, maternal nutrition, and smoking or alcohol consumption [8–18].

Previous studies have confirmed the relationship between the diet of a pregnant woman and infant birth weight [9,10,12]. Previous research has also examined the type of food that is important for pregnant women, such as protein, folic acid, vitamin B12, and other nutrients [7–9]. Furthermore, loss of a posterior tooth that is not subsequently treated might disrupt mastication ability and caloric intake [19–21]; however, no studies are available on mastication ability in pregnant women who lost posterior teeth and how this condition relates to infant birth weight. Therefore, this study aimed to analyze the relationships between infant birth weight and mastication ability, caloric intake and prepregnancy BMI of women with missing posterior teeth.

## Material and Methods

### Study Design and Sample

This cross-sectional study was conducted in the Community Health Center (Puskesmas) Beji, Depok, West Java, Indonesia. The inclusion criteria were mothers with recent nonpremature labor, aged 20–35 years, who had one or more missing posterior teeth that had not been replaced, had a Mother and Infant Health (MIH) record book and were nonsmokers. The exclusion criteria were

subjects who are not willing to fill the approval letter, alcohol consumption, drug abuse, smoke and gestational diabetes.

#### Data Collection

The number and locations of missing teeth were recorded. The Eichner classification was used to classify the partial edentulism [13]. Infant birth weight, maternal prepregnancy body mass index (BMI) were collected from the MIH record book, and the subjects answered a subjective questionnaire on mastication ability. The BMI scores were categorized as underweight (score <18.5), normal (score = 18.5–25), and overweight (score >25). The subjective mastication ability was assessed by using the total score of the mastication questionnaire. The subjective mastication ability was considered poor if the total score was <12 and considered good if the total score was 12–16 [19]. The participants filled the questionnaire based on their memory.

Caloric intake was calculated by using the values obtained from the Semi-quantitative Food Frequency Questionnaire (FFQ) [22]. The result of the FFQ was in the form of total calories (kcal). The Semi-quantitative FFQ comprised questions on food, eating frequency, and portions [22,23].

#### Data Analysis

The collected data were analyzed by using IBM SPSS Statistics for Windows Software, version 22 (IBM Corp., Armonk, NY, USA). The unpaired independent t-test, Pearson test, and Kruskal-Wallis test were used to analyze the variables with a p-value <0.05. Kruskal Wallis was chosen as a non-parametric test because it has abnormal distribution data (<0.05).

#### Ethical Aspects

This study was approved by the Ethical Committee of the Faculty of Dentistry, Universitas Indonesia (No.44/Ethical Approval/FKGUI/VII/2017). All subjects gave written consent for participating in this study.

#### Results

Fifty-two subjects participated in the study. On the basis of the Eichner classification, the subjects were classified as Eichner group A2 (39/75%), A3 (7/13.5%), B1 (4/7.6%), and B2 (2/3.8%). The mean and standard deviation caloric intake of the mother was  $2890 \pm 5.23$  kcal. The mean infant birth weight was  $3124 \pm 0.42$  g. A significant difference was observed in the infant birth weight between different subjective mastication abilities of each Eichner group (Table 1), with Eichner A2 as the lower values.

The Pearson correlation test was used to analyze the relationship between caloric intake and infant birth weight due to normal data distribution. The results revealed that mean caloric intake was significantly associated with infant birth weight ( $p < 0.001$ ).

The results revealing the relationship between maternal prepregnancy BMI categories and the birth weight of infants are presented in Table 2. There were almost equal numbers of normal and overweight subjects. The results indicated that there were significant differences between each category of BMI ( $p < 0.001$ ).

**Table 1. Relationship between mastication ability and infant birth weight.**

Variables	Infant Birth Weight			p-value
	N	Min-Max	Mean $\pm$ SD	
Eichner A2				
Good	25	2.80–4.30	3.33 $\pm$ 0.36	<0.001*
Poor	14	2.30–3.50	2.88 $\pm$ 0.31	
Eichner A3				
Good	0	-	-	-
Poor	7	2.30–3.80	2.89 $\pm$ 0.50	
Eichner B1				
Good	1	-	3.90 $\pm$ 0.00	0.039*
Poor	3	2.90–3.20	3.03 $\pm$ 0.15	
Eichner B2				
Good	0	-	-	0.039**
Poor	2	2.70–3.05	2.88 $\pm$ 0.25	

\*Independent t-test;  $p < 0.05$ ; \*\*One sample t-test;  $p < 0.05$ .

**Table 2. Relationship between maternal prepregnancy BMI and infant birth weight.**

BMI	Infant Birth Weight			p-value
	N	Min-Max	Mean $\pm$ SD	
Underweight	9	2.30–2.80	2.59 $\pm$ 0.18	<0.001*
Normal	26	2.80–3.20	2.99 $\pm$ 0.15	
Overweight	18	3.50–4.30	3.58 $\pm$ 0.30	

\*Kruskal-Wallis test;  $p < 0.05$ .

## Discussion

Tooth loss can be caused by various diseases, such as caries, periodontal disease, trauma, and disorders that include hypoplasia, attrition, and cysts. Predisposing factors, such as sociodemography, attitudes, and lifestyle play a vital role in tooth loss [1-4]. Tooth loss can result in functional limitations, such as disruption of mastication that can lead to dietary changes [1,3,19]. Mastication is the process of pulverizing food for ingestion and digestion. The factors affecting mastication performance include tooth loss and posterior dental restoration, occlusal forces, sensory activity, salivary flow, and oral motor function [1,4,24-27]. In addition to these factors, the quantity and duration of chewing may also affect the process of mastication. This was reported by a study that found that prolonged chewing time in the mouth increases the destruction of food, especially hard food [28]. The process of mastication is influenced by the ability to break down food, which is mostly done by teeth. The occlusal contact of the remaining posterior teeth is the key to predicting the ability of mastication [19-21,28].

The Eichner index classifies tooth loss on the basis of the number of posterior tooth contacts [5,19,20,28]. In a study investigating the relationship between the number of teeth in contact

suggests that retaining the majority of the teeth may have a significant effect in maintaining the function of the oral cavity [20,28]. Reduced ability of mastication may lead to the formation of larger boluses during swallowing and hence might disturb the digestive system [1,3,5]. In addition, avoiding certain types of food, such as hard food, might affect general health due to its impact on nutritional and immune status [1,5,19,20,28].

A significant association of subjective mastication ability with infant birth weight from each Eichner group was found. In pregnant women, posterior tooth loss might affect the caloric intake and consequently infant birth weight [5,19]. In this study, subjective mastication was assessed by using a questionnaire. Even though the subjects presented with two to four supporting zones, subjective mastication ability could be assessed as good or poor and was related to infant birth weight.

Similar to mastication ability, maternal caloric intake during pregnancy also was significantly associated with the infant birth weight. The quantity, frequency, and types of food consumed will affect the fetus. One study found that if during pregnancy the mother experiences iron, folic acid, and vitamin B12 or D deficiencies, the fetus had a high-risk of premature birth, brain function disability, and low birth weight [7-11,17].

We also found that maternal prepregnancy BMI was significantly associated with infant birth weight. This finding is in accordance with other studies that reported the importance of BMI for infant birth weight [9,15]; however, in this study, the increase in BMI during pregnancy was not considered. This increase in BMI during pregnancy as well as the types of food consumed should be considered in future studies, because it is known that subjects with several missing teeth should avoid fibrous and hard food.

The limitation of this study is no consideration given to the different types of food. At the same time, it is important not just to consider the total caloric intake but also the different kinds of food. Furthermore, data on this study was collected based on the subject's memories.

## Conclusion

We found that decreased subjective mastication ability in pregnant women who lost posterior teeth was associated with decreased infant birth weight, higher mean caloric intake was associated with increased infant birth weight, and higher prepregnancy BMI in pregnant mothers who lost posterior tooth was associated with increased infant birth weight.

**Authors' Contributions:** ISBT designed the study, performed the data collection, the data analysis and interpretation, wrote the manuscript and reviewed the manuscript. NA designed the study and reviewed the manuscript. HK designed the study, performed the data analysis and interpretation and reviewed the manuscript. FG designed the study, performed the data analysis and interpretation and reviewed the manuscript. All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.

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