



Honey and Children: The Effect of Honey from *Apis cerana* Bees on Children' Nutritional Status in East Nusa Tenggara - Indonesia

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ABSTRACT

This study aims to examine the effect of honey from *Apis cerana* bee colonies on nutritional status in children aged two to five years old in the working area of Mok Community Health Center, Manggarai Regency, East Nusa Tenggara - Indonesia. The study was conducted in May - June 2018, with quasi-experiment design with pre and post test in one group. The sample in this study amounted to 35 children under five years old, with malnutritional status. Nutritional status is determined by the weight-for-age. The used honey was honey from the *A. cerana* bee colonies harvested in Manggarai Regency. Honey was consumed by children as much as 5 mL, twice a day, morning and evening, for 8 weeks. Nutritional status measurements were taken at 0 weeks, 4 weeks and 8 weeks before and after honey consumed regularly. Post-Hoc data analysis using the Wilcoxon Signed Rank Test. The results showed a significant increase in children's nutritional status at week 4 and week 8. The percentage of children with malnutritional status after being given honey *A. cerana* regularly for 4 weeks fell to 57% and good nutrition increased to 43%. Meanwhile, after 8 weeks of honey, the malnutritional status has decreased to 31%, and vice versa 69% of children have increased their nutritional status to good nutrition. The results of a comparative test of increasing nutritional status between 4 and 8 weeks showed that there was a significant difference between improving the nutritional status of children under five years old who consumed honey for 4 weeks and for 8 weeks. The research shows the length of time consumed *A. cerana* honey regularly in children aged two to five years old, will have a positive effect to the nutritional status from poor to good nutritional status.

Keywords: *Apis cerana*, honey, nutritional status, children

INTRODUCTION

The development of children under five years old is one part of the golden period of the stage of human development. For optimal growth and development of under five years old, the children must be in a well nourished nutritional status. Adequate nutrition, beginning in early stages of life, is crucial to ensure good physical and mental development as well as long-term health. Childhood underweight are an important public health problem, as these conditions tend to have a chronic condition that cause a wide range of future morbidity (Hasibuan et al., 2019)

However, there were many children under five years in Indonesia in malnutrition and severe malnutrition nutritional status. One area in Indonesia had children under five years with poor nutritional status was in the working area of the Public Health Center Mok, East Manggarai Regency, East Nusa Tenggara.

The limit for the category of nutritional status of children under five years according to the weight of the child achieved at a certain age (weight-for-age, WFA). WFA is one of the indices set by the World Health Organization (WHO, 2006). The nutritional status categories of children based on WFA are severe malnutrition, malnutrition well nourished or good nutrition, and overweight or over nutrition. The WFA index categorization uses the Z-score, which is the WFA deviation value from the normal WFA value according to WHO growth standards. Otherwise, the calculation of Z / WFA score used in this study was (WFA child - standard WFA) or standard deviation of standard WFA (Ministry of Health of the Republic of Indonesia, 2018).

Based on the 2017 Nutrition Status Monitoring Pocket Book (Ministry of Health of the Republic of Indonesia, 2018), the nutritional status of children under five (0 - 59 months) based on the WFA index, East Nusa Tenggara Province was 7.4% of children under five years old severe malnutrition, 20.9% malnutrition, and 71.1% good nutrition. The data from the East Nusa Tenggara Provincial Health Office (2017), the prevalence of malnutrition in East Manggarai in 2015 was 32% and in 2016 as many as 30%, and in 2017 as much as 37%. From these data it was found that the number of malnourished children under five years old in the working area of the Public Health Center Mok, there were 79 children (41%) of the total weighed as many as 195 children.

Honey is a natural sweet substance that is produced by honey bee colonies, from plant flower nectar or plant secretions, collected by worker bees, brought to the hive comb until it undergoes the process of becoming honey. Honey has very diverse characteristics and is usually consumed directly without further processing. Honey contains carbohydrates, proteins, amino acids and organic acids, minerals, vitamins, enzymes, aromatic substances, pigments, antioxidants, polyphenols, flavonoids, carotenoids (Kumar et al., 2010; Boussaid et al., 2018). Honey has many benefits and has been studied as effective in reducing the risk of heart disease, cancer, immune system deficiency, cataracts, and wound treatment, as well as having anti-inflammatory, anti-bacterial, antiviral, antibacterial, antihyperlipidemic, antidiabetic and anticancer (anti-cancer) activities. (Kumar et al., 2010; Raa, 2016; Boussaid et al., 2018), Honey antioxidants function as hepatoprotective and cardioprotective agents (Raa, 2016). However, there have not been many studies on the benefits of honey in improving nutritional status in neither infants nor toddlers (Bogdanov et al., 2008). Instead of honey is not recommended for children under 2 years.

In East Manggarai Regency, there were two types of honey were found in accordance with the types of honey bees. There were honey bees namely *Apis dorsata* and *Apis cerana*. Both types of bees have different comb hive characters. One of the unique characters of the honey produced by *A. cerana* colony, that it is often called the cave honey (madu gua – Indonesia) or ground honey because it comes from a beehive at the ground (Crane, 1999). Honey from *A. cerana* colony were very common in East Manggarai Regency. People usually harvest honey from bees' colonies near home. *Apis cerana*' honey from East Manggarai Regency were multifloral honey.

Based on that, the purpose of this study was to examine the effect of honey produced by *A. cerana* colonies in improving nutritional status in children aged two to five years old in the working area of the Public Health Center Mok, Manggarai Regency, East Nusa Tenggara - Indonesia.

MATERIALS AND METHODS

Respondents

The criteria for inclusion of respondents in this study were children between two and five years old and reported for having malnutrition according to WFA index, and the children lived in the working area of the working area of the Public Health Center Mok, Mbengan, Komba City, East Manggarai Regency, Flores Island, East Nusa Tenggara, Indonesia. From January to April 2018, out of 125 two – five years old children, there were 35 children (28%) suffering from malnutrition the criteria as samples or respondents in this study. Nutritional status measurement index referred to base on the Ministry of Health of the Republic of Indonesia (2018). The gender characteristics of respondents in this study were 60% girls and 40% boys.

Weighing

The child's weight was measured by the calibrated steel balance. Weighing was conducted before the honey treatment, after 4 weeks, and after 8 weeks after the treatment. After weighing, the nutritional status of the children was calculated and recorded.

Honey

The honey given to respondents was honey obtained from the *A. cerana* bee colonies around East Manggarai Regency (Fig. 1). Five mL of honey was given twice a day morning and evening to respondents for 8 weeks. All women who have children as respondents were provided monitoring sheets to ensure that every day, the respondent was given honey twice. The village midwives monitored, so that no respondent drops out of the research.



Fig. 1 *Apis cerana* ground beehive and harvesting honey from the ground beehive

Data Analysis

The analysis carried out in this study was the data normality test, then the Friedman Test to examine the effect of the nutritional status of children before the treatment, after 4 weeks, and after 8 weeks of honey treatment. Afterwards, Post-Hoc Wilcoxon Test was conducted to test differences in body weight between the time intervals of honey treatment.

For the further analysis, observation at the children's behavior and interview with the parents were conducted to obtain more understanding about the nutritional status changing process outside the public health center (Diekmann, 2010).

RESULTS AND DISCUSSION

Table 1 and Figure 2 shows the nutritional status of 35 2-5 years old children at week 0 or before consumed honey, 4 weeks and 8 weeks. After 4 weeks and 8 weeks of regular honey consumption, the nutritional status of children were measured again.

Table 1. Distribution of frequency and percentage of 2-5 years old children's nutritional status before and after 4 and 8 weeks honey consumption

Nutritional Status	Week 0		Week 4		Week 8	
	F	%	F	%	F	%
Malnutritional	35	100	20	57	11	31
Good nutritional	0	0	15	43	24	69
Total	35	100	35	100	35	100

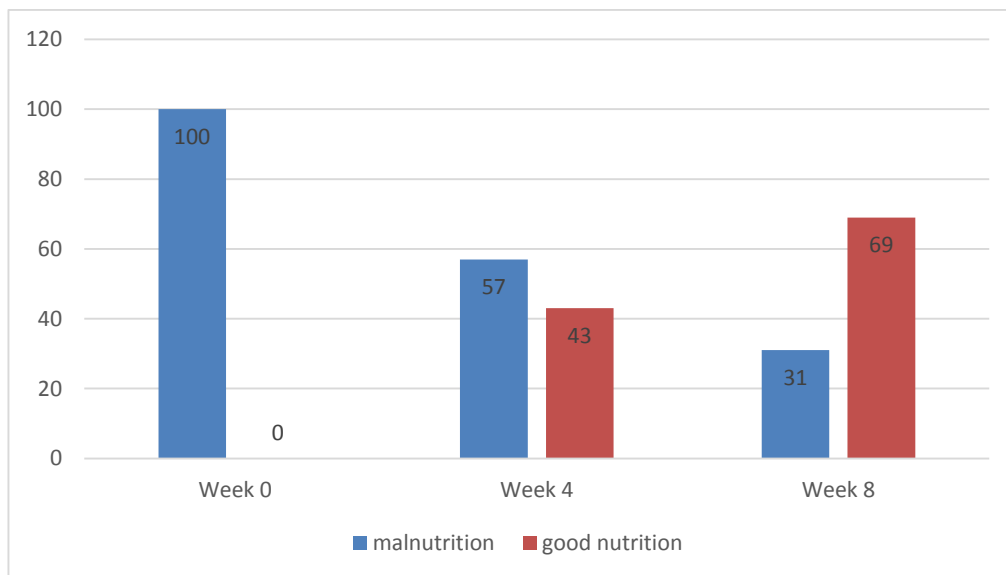


Fig. 2. Percentage of nutritional status of children two - five years before and after consumed honey for 4 and 8 weeks

From Table 1 and Figure 2, it could be seen that the percentage of 2-5 years old children who consumed honey regularly for 4 weeks has increased the status to good nutrition by 43% and reversely the status of malnutrition childhood had fallen to 57%. From Table 1 and Figure 2 it could be seen that after the childhood continued to consumed honey until week 8, the percentage of childhood in good nutritional status became 69% and the percentage of malnutrition fell to 31%.

Friedman's test results for the nutritional status of the children are shown in Table 2, which measuring children's weight at 0 weeks (before consumed honey), after 4 weeks and 8 weeks of honey treatment. The results showed a significant weight difference between the nutritional status of 0 weeks, 4 weeks, and 8 weeks (Figure 3).

Table 2. Friedman test results children weight in accordance with the nutritional status

Weighing Time	N	Mean (kg)	Median (kg)	Asymp. Sig.
Week 0		9.811	9.900	
Week 4	35	10.931	11.200	0.000
Week 8		11.203	11.300	

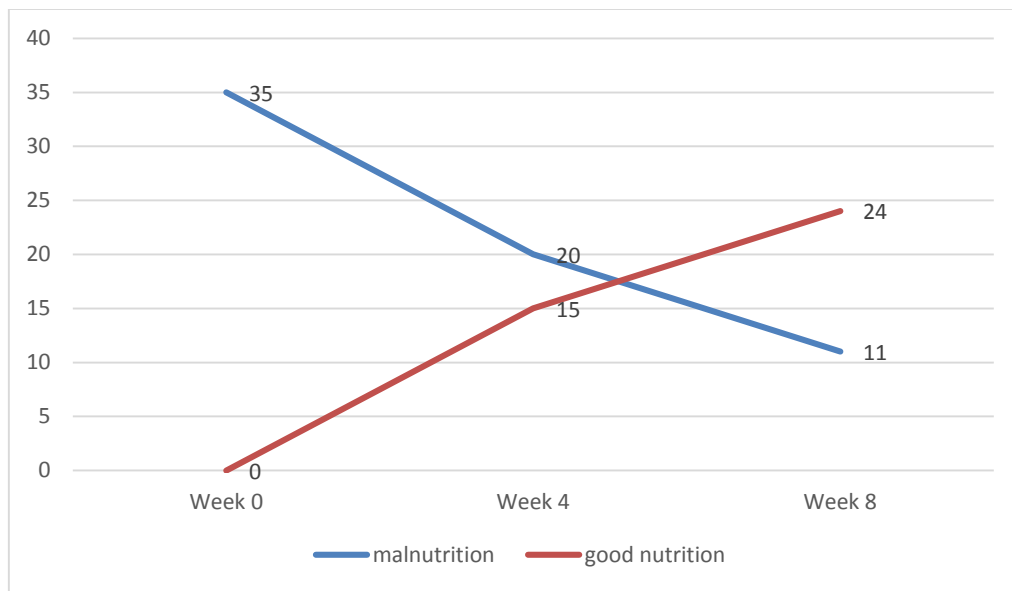


Fig. 3. Graphical representation of the differences among childhood with malnutrition status before, during, and after the treatments.

Table 3 presents the results of the Wilcoxon Signed Rank Test to distinguish development in nutritional status of children in 2 groups of pairs per four-week measurement. Based on table 3, there were significant differences in nutritional status before and after consumed honey for 4 weeks ($Z = -5.169$; $p < 0.05$). Moreover, there was a significant difference in nutritional status between 8 weeks after consumed honey and before consumed honey ($Z = -5.175$; $p < 0.05$), and there were significant differences in nutritional status between 8 weeks of consumed honey and 4 weeks of consumed honey ($Z = -5.202$; $p < 0.05$) as well.

Table 3. Nutritional status test results for children 2-5 years old consumed *A. cerana* honey

	Week 0	Week 4	Week 8
Z value	-5.169	-5.175	-5.202
p value	0.000	0.000	0.000

This research shows that there are a positive effect of honey by an increase in nutritional status in 2-5 years old children who consumed *A. cerana* honey regularly at a minimum period of four weeks. From the results of this study assert that consumed honey should be done regularly and in a period of time sufficient to provide optimal results. The result also stated by Ajibola *et al.* (2012) that regular consumption of natural honey can provide all the benefits of honey.

Honey that taken regularly for at least 4 weeks by malnutrition children, will provide a synergistic effect of antioxidants possessed by honey. Eteraf-Oskouei and Najafi (2013) postulated that natural honey is around 200 substances, including various amino acids, vitamins, minerals and enzymes. Most of these compounds work together to provide a synergistic effect of antioxidants. Antioxidant compounds can suppress the formation of free radicals and have potential as a therapeutic. In addition, consumed honey regularly can stimulate the formation of antibodies in the body to prevent various diseases (Al-Waili and Haq, 2004).

From observations and interviews conducted by researchers, on improving the nutritional status of the children who were given honey regularly, their appetite for eat increases. Researcher's assumptions, appetite and complete or good nutritious food intake, as well as the nutrition value of honey consumed by the increase children's weight. According to Bogdanov *et al.* (2008), honey can increase the nutritional status as well as the health condition increased by increased nutritional status. For this assumption protein, enzymes, amino acids, minerals, vitamins, and polyphenols contained in the honey were responsible to the health improvement of the children here. Ajibola *et al.* (2012) states, that honey's high nutritional profile with a variety of nutrients (albeit in small amounts) encourages its use as a healthy food.

However, not all of the childhood who for eight weeks consumed honey can improve their nutritional status. The unhealthy or sick condition of the childhood during the experiment time, could ask more nutrients that needed for the recovery phase. Secondly, although the appetite had increased, it did warrant that the children will eat more, because food was not enough at their homes. The lack of volition to handle (e.g. to eat more) can be the reason of this case (Frith, 2013). In line with the statement of Ajibola *et al.* (2012) that honey contains components of micronutrients that will improve digestion and absorption of major food components and are needed for metabolism and bodily functions. The reason might explain why the recoveries of children delayed. After sick condition, for the first, the child need to make their body functions in balance before the body improvement nutritional status.

CONCLUSION

Honey of *A. cerana* which was taken regularly for a minimum of four weeks by children two to five years old in East Manggarai Regency, East Nusa Tenggara - Indonesia could significantly improve the nutritional status from malnutrition into good nutrition.

Regular consumption of *A. cerana* honey in children significantly improve of nutritional status, from poor to good nutritional status.

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