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Hospital-based maternal nutrition education for low-income families in managing child tuberculosis

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Abstract

Purpose: Children with tuberculosis from low-income families are often referred to hospitals, yet research on hospital-based support is limited. This study evaluated a private hospital's tailored maternal nutrition education program and its impact on the food consumption and nutritional status of children with tuberculosis (24–59 months) from underprivileged families. **Methods:** This observational analytical study employed a one-group pretest-posttest research design. It was conducted from January to March 2024 at the Outpatient Department of Islami Mutiara Bunda Hospital, Brebes Regency. Secondary data from 2023 medical records of children with TB (24–59 months) from low-income families who received maternal nutrition education during the intensive phase were analyzed. A total of 59 samples were obtained through total sampling. **Results:** Among the children, 29 (49,2%) were boys and 30 (50,8%) were girls. By age, 33 children (55,9%) were 24–36 months, and 26 (44,1%) were 37–59 months. The percentage of energy deficiency before intervention in boys is higher than in girls (90% vs 74%). Almost all subjects experienced protein deficiency. After the intervention, there was an improvement in energy and protein adequacy. Both age groups experienced malnutrition at the age of 24-36 months, as much as 48%, and of 37-59 months, as much as 19%. After the intervention, the malnutrition group obtained good nutrition. Statistical tests ($p<0,05$) indicated maternal nutrition education significantly improved food consumption and nutritional status during the intensive phase. **Conclusion:** Tailored maternal nutrition education with two-way communication effectively enhances food consumption and nutritional status in children with TB from low-income families.

Keywords: food consumption; low-income families; maternal nutrition education; nutritional status; tuberculosis

INTRODUCTION

Tuberculosis (TB) is an infectious disease caused by Mycobacterium tuberculosis, which remains a global health threat, especially in developing countries. TB remains one of the top 10 causes of death worldwide, causing approximately 1,3 million deaths per year. According to data from the Global Tuberculosis Report 2023, Indonesia ranked second in the world for the highest number of TB cases after India [1]. The highest number of reported cases in 2022 was 724.000, an increase from 397.377 cases in 2021 [2]. Socio-economic determinants can influence the high number of TB cases in the community in the form of malnutrition, inadequate home environmental conditions, finances, and difficult access to health services. This indicates that family income reflects economic capacity, which influences aspects of life, especially the family's adequate nutrition intake [3,4].

Brebes Regency is one of the regions in Central Java with a high poverty level, with a percentage of poor people of 15,6%, higher than the national percentage of poor people of 9,4% [5]. Besides that, the highest number of TB cases in Central Java is found in Brebes Regency, with an incidence rate of 1,840 cases, with 7.2% of these cases occurring in children aged 0-5 years [6]. The high number of TB cases in Brebes Regency might affect the nutritional status and health level of children. Malnutrition in children with TB will affect the treatment process and can increase the risk of mortality [7].

Improving food consumption is the treatment for malnutrition in children with TB. Food consumption in children cannot be separated from maternal nutritional behavior as caregivers of children [8]. Maternal nutrition behavior in low-income families can occur due to not being able to prepare food well, the portion served not being sufficient for the needs of children, and not providing proper food. This can be remedied with maternal nutrition education intervention given individually so that its application adapts to the family's abilities [9].

Maternal nutrition education is crucial for improving children's food intake, as most TB patients experience loss of appetite [10]. A study by Ardhani in 2023 highlighted that maternal nutrition education for children with TB is one of the most significant interventions that can influence children's eating habits and nutritional status [11].

Improving the food consumption of children with TB is particularly crucial during the first 2 months of treatment, known as the intensive phase. Elsi's 2017 study on 43 children with TB in Bengkulu demonstrated a clear correlation between improved food intake and the nutritional status of children during this phase [12]. Good nutritional status during the beginning of TB treatment reduces the prevalence of disease recurrence, accelerates the conversion of Acid Resistant Bacteria (ARB) sputum when the anti-tuberculosis drug is administered, and reduces the treatment period [13,14].

Our study, conducted on children with TB from low-income families at the hospital, aimed to identify effective interventions for the prevention and treatment of malnutrition. Given the challenges faced by low-income families in meeting adequate nutritional needs, individual nutrition education gives mothers the independence to meet these needs according to their ability and with the food ingredients the family can access. As our study found, the improvement of food consumption ensures optimal growth and development of children. Therefore, our study's findings on the effects of maternal nutrition education on food consumption and nutritional status of children (24-59 months) with TB from low-income families at Islami Mutiara Bunda Hospital, Brebes Regency, are of significant importance.

METHODS

This study used the observational analytical method with a retrospective cohort design to analyze the impact of maternal nutrition education on food consumption and nutritional status of children (24-59 months) with TB from low income during the intensive phase. It was conducted from January to March 2024 at the Outpatient Department of Islami Mutiara Bunda Hospital, Brebes Regency, using secondary data as medical records.

The population of this research consisted of medical records of children of 24-59 months with TB from January to December 2023 who received maternal nutrition education during the intensive phase. For children from low-income families, income is less than the Regional Minimum Wages Regulations for Brebes Regency in 2023 IDR 2.018.837 [15]. The amount of sample used in total sampling, which is the number of samples, is the same as the population. The study was initiated by screening the data of children in the Hospital Information Management System (IMS), which met the inclusion criteria: 1) children who received maternal nutrition education and monitored for 2 months; 2) income is less than the Regional Minimum Wages Regulations for Brebes Regency in 2023; 3) children undergoing anti-tuberculosis drug treatment during the intensive phase, for the exclusion criteria were as follows: having comorbid diseases, congenital

disabilities, and multi drugs resistance. Based on the inclusion and exclusion criteria, 59 samples were obtained for this study.

This study is part of research titled "Maternal Health Behavior, Food Consumption, and Nutritional Status of Children (24-59 Months) with Tuberculosis in Brebes Regency." The study has been approved by the Health Research Ethics Committee of the Faculty of Medicine, Airlangga University, with an identification number of 1288/HRECC.FODM/XI/2023.

The patient's medical record data consists of name, date of birth, TB treatment phase, weight, nutritional status, food consumption of the children, and income families. The independent variables in this study were maternal nutrition education, while the dependent variables were the children's food consumption and nutritional status.

The nutrition education was carried out face to face and interactive communication between nutritionists and children's mothers. The maternal education simulation is presented in Figure 1. The nutrition education was performed by a nutritionist once a month when the patient goes for a TB check-up with a pediatric specialist. The nutrition education covers balanced nutrition, appropriate portion sizes, and scheduling of mealtimes for the children. Leaflets and food models were provided to help the mothers of the children understand the nutritionist's explanation. The leaflet used as a tool to explain the goals and requirements of the diet is presented in Figure 2. In addition, a menu planning sheet for a week was provided to be discussed with the mother. Before joining the hospital education team, nutritionists were given training in providing appropriate education. This aims to ensure that nutritionists are able to provide effective explanations and can help mothers understand the material provided.

Children's food consumption was assessed based on the amount of energy and protein intake compared to the needs of the children during illness. The energy requirement of children with infectious disease increases by 13% above their Basal Metabolic Rate (BMR). In addition to increased energy needs, children with infectious diseases require protein, constituting 15-20% of total energy [16]. The energy and protein intake amount was calculated using a 2 x 24-hour-recall questionnaire with Nutrisurvey 2007 software. Food consumption was measured twice, before and after 2 months of nutrition education. The adequacy level of energy and protein are categorized into four groups, namely severe deficit (<70%), moderate deficit (70-79%), mild deficit (80-89%), and normal (> 90%) [17].

The nutritional status of children in this study used a weight-for-age (W/A) anthropometric index. The children's weights were measured using a digital scale with a capacity of 100 kg and an accuracy of 0,01 kg. The W/A indicator provides an overview of body mass. Body mass is highly sensitive to sudden changes such as infection, loss of appetite, and change of food consumption. The anthropometric data was processed using WHO Anthro Plus Version 1,0,4 for Windows program, which is categorized into three groups: malnutrition (Z score < -3SD), undernutrition (-3 SD < Z score < -2SD), and good nutrition (Z score > -2SD). The nutritional status was measured twice, before and after 2 months of nutrition education [18].

Figure 1. Face to face maternal education simulation

Figure 2. Nutrition education leaflet about diet for children with TB

The data analysis used Microsoft Excel 2013 and IBM Statistical Program for Social Science (SPSS) version 23,0 for Windows. The data analysis was carried out in two stages: univariate and bivariate. The univariate analysis described each variable through frequency distribution and mean values. The described data include age, gender, nutritional status, and children's food consumption. Then, the normality of the data was tested using Kolmogorov-Smirnov to determine the appropriate type of bivariate analysis. Bivariate analysis in this study utilized paired samples t-test to compare the mean values of two dependent variables before and after the intervention. The dependent variables were nutritional status and food consumption. Meanwhile, the treatment in this study was maternal nutrition education of the children. Confidence level of 95% was used, so if the p-value < 0,05, it is considered statistically significant.

RESULTS

Hospital profiling of TB services

Mutiara Bunda Islamic Hospital is a private hospital in the western part of Brebes Regency. Almost 90% of hospital patients are health insurance patients, and 70% are government-funded health insurance patients. This Hospital is one of the TB referral health facilities because it has a TB DOTS (Tuberculosis Directly Observed Treatment Short Course) unit. The TB DOTS Unit serves TB patients with a strategy that emphasizes complete supervision of patients. The goal of the DOTS strategy is for TB patients to complete therapy and prevent drug resistance. The hospital's internal service network for TB patients can be seen in Figure 3.

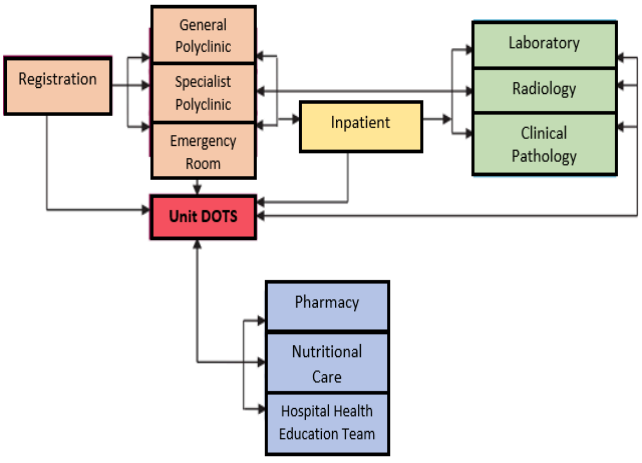


Figure 3. The internal network of TB service hospitals

The TB service network flow begins with the patient coming to the General Polyclinic, Specialist Polyclinic, Emergency Room, or the DOTS Unit. If a suspected TB patient is found, supporting examinations (laboratory and radiology) are carried out, and patients diagnosed with TB are then sent to the DOTS unit. Curative health services are carried out in this unit.

Curative is carried out using the DOTS strategy through the clinical pathway for TB services. A clinical pathway is a care plan carried out collaboratively and structured by various health personnel from nursing, radiology, laboratory, pharmacy, nutritional care, and the hospital health education team. The health education provided includes caring for TB sufferers at home: environmental sanitation, treatment monitoring, nutrition, and a sense of comfort.

In Addition, the TB program consists of promotive, preventive, and rehabilitative. Promotive is health promotion to the community, a program implemented in collaboration with community health centers around the hospital to educate the public about TB prevention. Health promotion is also carried out using social media, such as Instagram. Preventive measures are carried out by capturing TB suspects and reporting them to the District Health Office through the TB Information System. This report aims to prevent transmission to other families who live in the same house as the sufferer. Rehabilitation for TB sufferers is carried out in a Polyclinic setting by providing and monitoring treatment and improving nutritional status with nutritional education.

Subject and family characteristics

The number of subjects from the medical record who met the inclusion criteria was 59 study subjects. The toddler characteristics were differentiated based on the gender and age of the children. The distribution of subjects based on gender and age is presented in Table 1.

Table 1. Subject characteristics distribution (n=59)

Characteristics	n	%
Gender		
Boys	29	49,2
Girls	30	50,8
Age (months)		
24-36	33	55,9
37-59	26	44,1

Table 1 shows that more than half of the toddlers were girls aged 24-36 months. The characteristics of families from this study are those with income less than the Regional Minimum Wages Regulations. Apart from that, the characteristics of the family consist of maternal age, education and employment of parents, and number of family members. More than half of mothers were aged 26-35 years. This is considered early adulthood, the psychologically ideal age for raising children. More than half of mothers and fathers in education did not graduate from high school. Most

mothers' occupations are not working or housewives, while most fathers work as traders. The number of family members living in one house is mostly in the medium category, consisting of 5 to 7 family members. Most families still live with other family members such as grandparents, uncles, and aunts.

Maternal nutrition education

Handling TB in children cannot be separated from the mother's role as a caregiver who determines the food to be given. Therefore, the target of education is mothers. Mothers in low-income families have limited access to food, so providing education requires appropriate and effective strategies. Nutritionists must collaborate and find the right solution so that children can consume adequate food according to the household's capabilities.

Maternal nutrition education is given when the child is checked into the polyclinic. It is given at least two meetings and is mandatory in the first two months of treatment (intensive phase). Intervention until the child has finished TB treatment or has fulfilled food consumption and the toddler has reached normal nutritional status. The stages of maternal nutrition education are shown in Table 2.

Table 2. The stages of maternal nutrition education

Educational material	Aids	Achievement
The first meeting - Introduction to balanced nutrition. - Explain the need for energy, nutrients, and food that supports TB healing. - Appropriate portion sizes and scheduling of meal times for the children - With the mother, create a menu with food according to the household's budget and eating habits. - Make an achievement plan.	- Leaflet - Food models - Menu planning sheet	- Weight gain of 500 g and improvement in nutritional status based on weight-for-age indicators (Z score > -2SD). - Improved eating habits with sufficient energy and protein needs ≥80%.
The next meeting - Evaluate achievement plans. - Discuss the obstacles faced and find solutions with the child's mother. - Re-education regarding making food menus.	- Food models - Menu planning sheet	

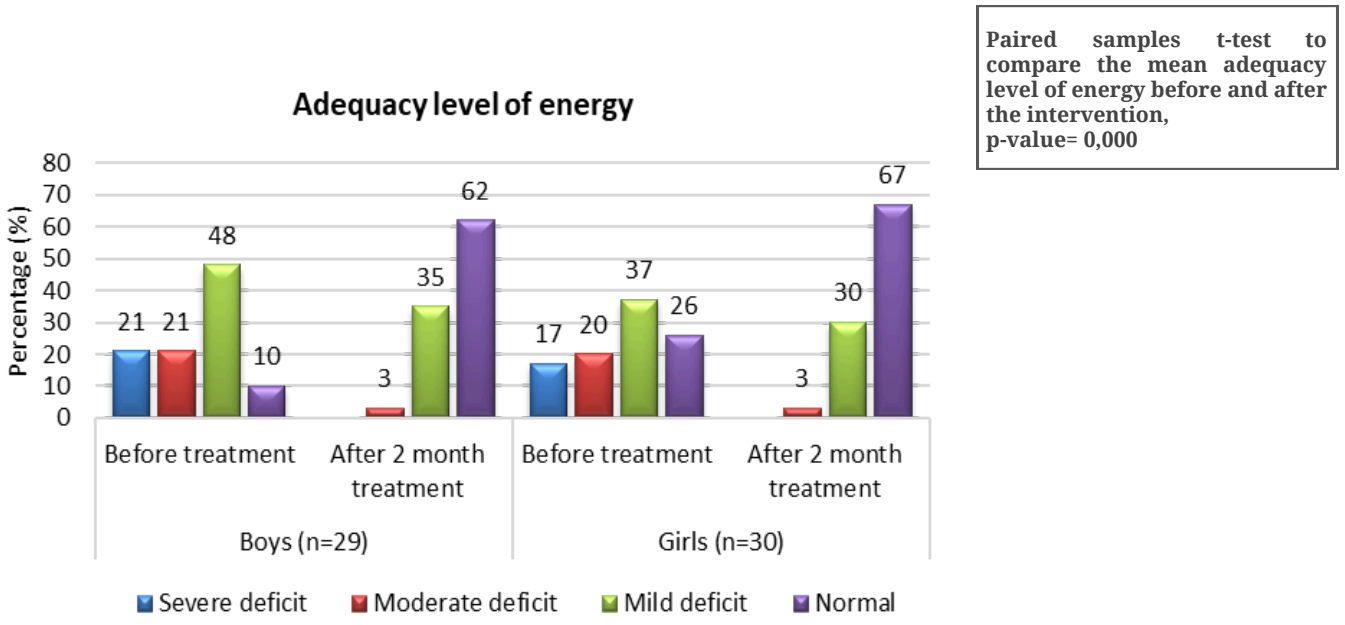


Figure 4. Distribution of subjects based on improvements in adequacy level of energy by gender (n=59)

The effects of maternal nutrition education on food consumption of children

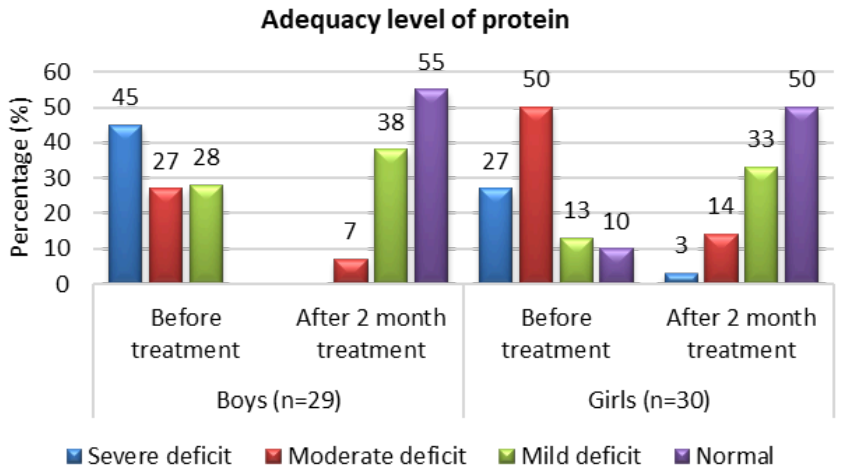
Food consumption in this study was observed based on adequacy level of energy and protein. One of the things that influence food consumption is gender. This is related to the higher metabolism of boys compared to girls. The distribution of subjects based on improvements in the adequacy level of energy after intervention during the intensive phase by gender is presented in Figure 4.

Figure 4 shows the percentage of energy deficiency before intervention in boys is higher than in girls (90% vs 74%). After the intervention, there was no severe energy deficiency in all children. In addition, there was a significant increase in energy adequacy in the normal category. In girls, there was a higher increase than in boys (67% vs 62%). Based on bivariate analysis, there was a significant difference in the level of energy adequacy in children before and after maternal nutrition education was carried out in the intensive phase. This is indicated by an average increase from 81% (mild deficit) to 98.7% (normal).

The distribution of subjects based on improvements in the adequacy level of protein after intervention during the intensive phase by gender is presented in Figure 5.

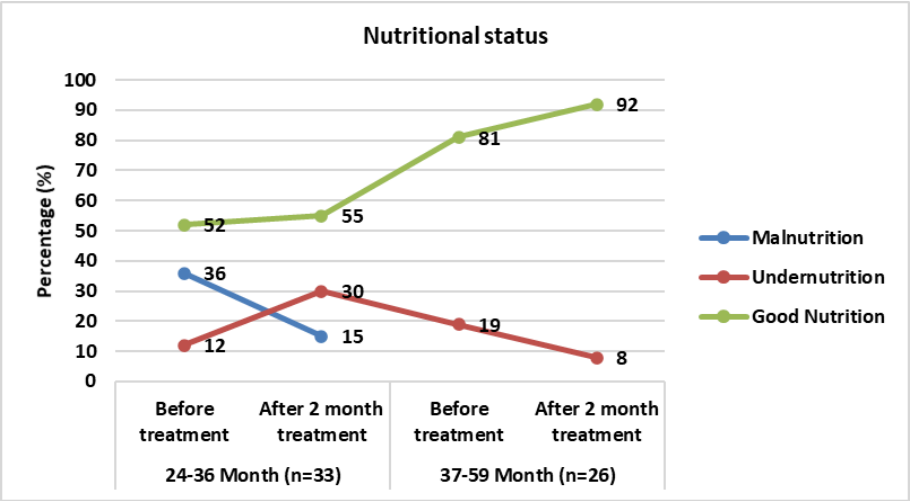
Figure 5 shows that almost all subjects experienced protein deficiency before the intervention. After the intervention, there was an improvement in protein adequacy, especially in boys who did not have severe protein deficiency. In addition, protein adequacy was significantly increased in the normal category. There was a higher increase in boys than in girls (55% vs 50%). Based on bivariate analysis, there was a significant difference in the level of protein adequacy in children before and after maternal nutrition education was carried out in the intensive phase. This is indicated by an average increase from 73,4% (moderate deficit) to 94,7% (normal).

Improving food consumption has a direct impact on improving nutritional status in children with TB. The distribution of subjects based on improvements in the nutrition status after intervention during the intensive phase by age is presented in Figure 6.



Paired samples t-test to compare the mean adequacy level of protein before and after the intervention, p-value= 0,000

Figure 5. Distribution of subjects based on improvements in adequacy level of protein by gender (n=59)



Paired samples t-test to compare the mean nutritional status before and after the intervention, p-value= 0,000

Figure 6. Distribution of subjects based on improvements in nutrition status by age (n=59)

Figure 6 shows the significant improvement in children's nutritional status after being given maternal nutrition education in both age groups. In the 24-36 month group, before the intervention was carried out, almost half of the toddlers experienced malnutrition. After the intervention, malnutrition decreased, and the proportion of toddlers with good nutrition increased. Likewise, in the 37-59 month group, before the intervention, one-third of children experienced malnutrition. After the intervention, the malnourished group achieved good nutrition.

Based on bivariate analysis, there was a significant difference in the nutritional status of children before and after maternal nutrition education was carried out in the intensive phase. This is indicated by the shift from undernutrition to good nutrition and from malnutrition to undernutrition. On average, children gained 586 grams in weight after their mothers received individual nutrition education with two-way communication during intensive phase treatment.

DISCUSSION

The internal hospital service network for TB patients with the DOTS strategy is an integrated patient-centered service. Patients from low-income households have characteristics, so services must have effective strategies. Family income can affect family health. This is because people with low incomes have limited access to healthy food compared to people with high incomes. Restricted access to food in families with children is vulnerable to malnutrition [19]. Malnutrition in children causes decreased immunity, making them susceptible to various diseases, including TB. On the other hand, TB also contributes to malnutrition [20]. Mothers play a role in determining the food served in the family, so nutritional education is essential when choosing nutritious food ingredients. Individual education is carried out for mothers with low family incomes so that mothers can independently provide food according to their abilities and with good nutritional content.

The study results showed that boys are susceptible to energy and protein deficiency. This is because the metabolism of boys is higher than that of girls. In addition, TB infection causes a decrease in appetite, thereby increasing the risk of energy and protein deficiency. Another thing that influences energy and protein intake is the family's socio-economic status [21].

The results indicate that providing individual maternal nutrition education to mothers from low-income families significantly affects the improvement of food consumption among children with TB regarding energy and protein intake. This finding aligns with a study in Sedayu District, Bantul Regency, Special Region of Yogyakarta, which showed that maternal nutrition education significantly increases energy and protein consumption in children [22]. Similarly, a study conducted in South India also showed increased energy and protein intake among children whose mothers were given nutrition education [23]. Maternal nutrition education can enhance energy and protein consumption by positively influencing nutritional knowledge and attitude and improving children's nutritional status [24,25].

The study results show that age influences the nutritional status of children. This is because children of younger ages have lower immune systems, so they are susceptible to infectious diseases, in line with research conducted at an Ethiopian Hospital on children with TB, which showed that more than half of TB sufferers are children under 3 years old. This research also shows that more than half of children with TB aged under 5 years experience malnutrition [26].

Achieving good nutritional status in children is inseparable from the role of parents, especially mothers, in managing family meals. The results from this study suggest that maternal nutrition education significantly improved the nutritional status of children with TB during the intensive phase. This was related to the objective of nutrition education, which is to improve eating habits for children. Consistent with the previous research, dietary habit impacts nutritional status, especially for patients with infectious diseases such as TB [27]. Another study involving 33 children in Gorontalo Regency also showed a relationship between the implementation of dietary habits by the mothers and the growth and development of children [28].

Children with TB must have their energy and protein intake fulfilled to improve their nutritional status and boost recovery. Insufficient energy and protein intake weaken immune defense mechanisms against diseases [29]. Although this study did not analyze the influence of food consumption on the nutritional status of children with TB, previous studies have shown that sufficient energy and protein fulfillment during TB treatment significantly affect the nutritional status of children [30].

The strength of this study was that it was carried out individually on each subject, so nutrition education was performed in two ways. The mothers could ask questions and discuss solutions regarding their issues and challenges when feeding their children. Therefore, nutrition education significantly impacts food consumption and nutritional status. Consistent with this result, in Poland, individual health education is

more effective than group education regarding shifts in behavior and nutritional status [31].

This study also had several limitations. First, the provided nutrition education only limited dietary habit improvement and did not cover other nutritional status factors. The nutritional status of children is not only a reflection of food consumption but also their entire environment, including factors such as social, psychological, and medical history. Secondly, this study was conducted in a single location: the Outpatient Department of Islami Mutiara Bunda Hospital, Brebes Regency. Thirdly, this research has limitations regarding the scope of study subjects. The number of study subjects involved was smaller than that of similar studies.

CONCLUSION

The role of nutritional care in the DOTS strategy is to provide nutritional education to overcome malnutrition. Individual maternal nutrition education with two-way communication improves the energy and protein intake levels of children with TB from low-income families. Sufficient energy and protein requirements can increase children's nutritional status. The good nutritional status of children at the beginning of TB treatment is expected to support the recovery process.

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