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## **Nutrition Knowledge, Attitude, and Practice of Mothers and Children Nutritional Status Improved after Five Months Nutrition Education Intervention**

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### **Abstract**

The objectives of this research were to evaluate the effects of nutrition education to the nutritional knowledge, attitude and practice of mother and nutritional status of children under five. The research was carried out in two sub-districts of Bogor: Sub-District of Ciomas and Sub-District of Darmaga. As many as 16 posyandus (Integrated Health and Nutrition Services) that met research requirements were selected. A total number of 240 mothers participated in the posyandus were involved in this study. The posyandus in each sub-district divided randomly into control and intervention groups. An experiment was made to determine the effect of nutrition education on respond variables: mother's nutritional knowledge, attitude, and practice, under-five-year children's nutritional status based on Z-score. The experiment had been conducted for five months in the form of providing nutrition education once in two weeks. Based on the General Linear Model analysis, the intervention in the forms of nutrition education had a significant effect on nutritional knowledge, attitude and practices among mothers and nutritional status of children less than five years based on the Z-score of body weight for age.

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Intervention did not have significant effects on the nutritional status according to Z-score of height for age or Z-score of weight for height. This is possible because the five-month intervention was not yet enough to improve the nutritional status.

**Keywords:** Nutrition Knowledge; Attitude; Practice; Children Nutritional Status

## **1. Introduction**

The nutritional status of a community is influenced by a lot of interrelated and complex factors. At the level of households, the nutritional status is affected by the household ability to provide adequate food in both quantity and quality, mother's pattern of upbringing children, nutrition knowledge, and other socio-cultural factors. This indicates a close relation between food security along with its nutritional status and public health. Therefore, efforts in improving food security and a community nutrition must become a global commitment. In the International Conference on Nutrition 1992 and World Food Summit 2002, it was confirmed that it is necessary for each nation including Indonesia to have commitment to continue to improve food security, to eliminate poverty and malnutrition [1].

The major nutritional issue in Indonesia is centered on 4 problems: namely, protein-energy malnutrition, iron anemia, vitamin A deficiency, and iodine deficiency disorders. Another problem, predicted to become worse if not solved immediately, is over-nutrition. An analysis of some random data indicates that there is little or weak nutritional extension because of limited quality of cadres and fund available.

A study conducted in the mountainous regions and coastal areas of Indonesia indicates that the mothers of poor households turned out to have better nutrition knowledge than those of non-poor households [16]. This may be due to the fact that the mothers of the poor households go more frequently to Posyandu, having more interaction to their cadres. This is supported or confirmed by the finding of research in West Java - mothers who often go to Posyandu have a higher score for the knowledge of nutrition than those who rarely do so [17].

Nutritional extension has a positive impact on public health and nutrition because with a good knowledge of nutrition, mothers will apply it in their households, and in this way a healthy generation is created, in which children can grow and develop optimally. The involvement of cadres who are responsible in the villages can guarantee the elements of capacity building and sustainability.

This research would be useful for the improvement of nutritional knowledge, attitude, and practices among mothers participated in Posyandu (Integrated Nutrition and Health Services). The participating mothers of Posyandu in Indonesia commonly have a low education. They have no adequate access to any media to increase their nutritional knowledge. For this reason, this research, one activity of which is to give nutritional education to mothers, would be very important and beneficial. With an improved nutritional knowledge of mothers, it is expected that they can apply it for a better feeding pattern to their children, thus preventing the risk of moderate or severe malnutrition.

This study investigated the relationship between potential criteria mothers use to select foods for their children,

their food knowledge, and food consumption of their children. These data indicate that families can be segmented according to the importance of beliefs about healthfulness of foods and that this segmentation predicts quality diet of children. This study suggests that interventions should be designed to increase mothers' beliefs in the importance of health in choosing foods. For those mothers whose food choices are dominated by children's tastes, interventions should be directed at how to prepare healthful foods to taste good to children [5].

## **2. Methods**

### **2.1. Location**

The research was carried out in two sub-districts of Bogor: Sub-District of Ciomas and Sub-District of Darmaga. The former is closer to the center of Bogor Town, and has a large number of new comers or residents, whereas the later is rather far away from the Bogor Town, and has native population of Bogor. Darmaga was selected as the location to obtain posyandu with poor socio-economic condition, while Ciomas was selected to get posyandu with better socio-economic condition. Posyandu is a nutrition and health program which was run routinely each month by health staff and cadres. The entire study was conducted for 12 months.

### **2.2. Research Steps**

This research started with a preliminary study as the first step and experimental design as the second step. The preliminary study was intended to collect baseline data so that the experimental design could be formulated correctly. The experimental design was formulated to analyze data and to test the research hypotheses.

Preliminary steps included selecting villages, posyandu and household baseline data collection. As many as 16 villages and 15 mothers having children under five were selected. In every selected village, one posyandu with many participants was chosen. Type of baseline data were nutrition knowledge, attitude and practice of mothers and nutrition status of children under five and food consumption and socio-economic variables.

### **2.3 Experimental Design**

An experiment was made to determine the effect of nutrition education on respond variables: mother's nutritional knowledge, attitude, and practice, under-five-year children's nutritional status based on Z-score weights for age, weight for height, and height for age [7]. It was expected that after completing the experiment, the mothers' knowledge of food and nutrition improved, and that they applied the knowledge to improve their children's nutritional status.

In the experiment, some mothers were given nutritional education, and some got no intervention ("*control*") [8]. Mothers in "*control*" groups were still participants of posyandu (a nutrition and health program which was run routinely by health staff), and they had an access to get posyandu services. Thus, there was only one factor of nutritional education with two treatments (one with the treatment of nutritional education, and the other without the treatment). Nutritional education was conducted in 5 months with the frequency of twice a month. Each of which lasted about 60 - 90 minutes. Topics of nutritional education include: 1) Food (food composition, food processing, food preparation, food additives, and food safety); 2) Maternal and child nutrition (dietary

guidelines for mothers and children; nutrition intake recommendation for infants and children; malnutrition problems such as vitamin A deficiency, iron anemia, protein-energy malnutrition, and iodine deficiency disorder; promoting growth monitoring for children and pregnant women; nutrition for pregnant women and lactating mothers; and complementary feeding). To support nutritional education intervention, some materials of promotion was used such as: leaflet and poster. These materials were distributed to participants (mothers and or cadres) and posyandus.

A posyandu was considered as experimental unit. Each unit of experiment consists of 15 households (15 mothers plus 15 children) and 5 posyandu's cadres who got nutritional education, so each class of nutritional education had 20 participants. This class size was considered to be effective for a successful education where knowledge transfer and classroom interaction could run well.

Besides the nutritional education, there were other variables that had some effect on respond variable. Different levels in former knowledge of nutrition had some influence on the later knowledge of nutrition. Similarly, the children's former nutritional status and nutrient adequacy level determined the children's nutritional status after intervention. Therefore, to minimize the error of the experiment, a blocking of posyandu based on sub-district socio-education-economic was made; and initial children's nutritional status, adequate level of energy and protein consumption, and nutrition KAP of mothers and cadres were considered as covariate variables in the model.

Posyandu was classified into two blocks: those with less socio-education-economic condition as first block and those with better socio-education-economic condition as the second. A posyandu was put into the first block if the posyandu was in Dramaga Sub District, and into second one if it was in Ciomas Sub District.

A nutritional education given to mothers of low educational condition can improve their average nutritional knowledge by 3 points on the scale 0-10, with the standard deviation of 1.2 [32]. By taking type one error  $\alpha=0.05$ , power test at  $1-\beta=0.95$ , standar deviation  $\sigma=1.2$  and  $\delta=3$ , and putting into the replication formula [34], so:

$$n = \frac{(z_{0.05} + z_{0.05})^2 2 \times 1.2^2}{3^2}$$

$$n = \frac{(1.64 + 1.64)^2 2 \times 1.2^2}{3^2}$$

$$n = 3.442688 \text{ or rounded up into}$$

$$n \approx 4$$

According to the resulted computation above, the experimental replication was conducted four times for both the treatment and control. The number of experimental units required is indicated below:

$$\begin{aligned} \text{Number of experimental units} &= \text{block number} \times \text{treatment number} \times \text{replication} \\ &= 2 \times 2 \times 4 \\ &= 16 \text{ posyandus or experimental units} \end{aligned}$$

Because each unit consists of 15 mothers, then the total number of mothers needed were 240 persons.

The statistical model for the respond variables of mother's nutritional knowledge, attitude, and practice and children's nutritional status was the covariance analysis based on the block's random design or it is called as General Linear Model. The models are as follows:

(1) For respond variable of mother's last knowledge or attitude or practice

$$Y_{ijk} = \mu + B_i + \beta X + \tau_j + \varepsilon_{ijk}$$

Notes:

$Y_{ijk}$  = mother's average nutritional knowledge or attitude or practice for the  $k^{\text{th}}$  posyandu, the  $i^{\text{th}}$  block with the  $j^{\text{th}}$  treatment.

$\mu$  = common average parameter of  $Y_{ijk}$

$B_i$  = effect of the  $i^{\text{th}}$  block;  $i = 1$  block of posyandu in Dramaga

$i = 2$  block of posyandu in Ciomas

$X$  = mother's average nutritional knowledge or attitude or practice before intervention

$\beta$  = parameter of regression coefficient of  $X$

$\tau_j$  = effect of the  $j^{\text{th}}$  treatment

$j = 1$  means with training to the posyandu

$j = 2$  means with no training to the posyandu

$\varepsilon_{ijk}$  = error effect of the  $k^{\text{th}}$  posyandu for the  $i^{\text{th}}$  block because of the  $j^{\text{th}}$  treatment

(2) For respond variable of children's nutritional status

$$Y_{ijkl} = \mu + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + B_i + \tau_j + \varepsilon_{ijkl}$$

Notes:

$Y_{ijk}$  = average respond variable at the  $k^{\text{th}}$  posyandu, the  $i^{\text{th}}$  block with the  $j^{\text{th}}$  treatment.

The average respond variables are three: z-score weight for age or z-score weight for height or z-score height for age.

$\mu$  = common average parameter of  $Y_{ijk}$

$X_1$  = average z-score: can be initial z-score weight for age, initial z-score weight for height or initial z-score height for age according to its respond variable

$X_2$  = average adequate level of energy consumption

$X_3$  = average adequate level of protein consumption

$\beta_m$  coefficient parameter of covariate variable  $X_m$ ,  $m=1,2,3$

$B_i$  = effect of the  $i^{\text{th}}$  block;  $i=1$  block of posyandu in Dramaga

$i=2$  block of posyandu in Ciomas

$\tau_j$  = effect of the  $j^{\text{th}}$  treatment

$j = 1$  means with training to the posyandu

$j = 2$  means with no training to the posyandu

$\varepsilon_{ijk}$  = error effect of the  $k^{\text{th}}$  posyandu for the  $i^{\text{th}}$  block because of the  $j^{\text{th}}$  treatment

#### **2.4. Data Collection**

Data of children included age, sex, weight, and length/height for anthropometrics measurement. Weight was measured with electronic scale. The scale was periodically calibrated. All subjects were weighed shoeless in light clothing only. Length/height was measured with infant length/height measuring boards which recommended by WHO.

Data of parents included age, education, income, food and non food expenditure was collected through interviewing respondents. Data on nutritional knowledge, attitude and practices (KAP) was collected from mother. The nutrition knowledge, attitude and practices (KAP) was measured using a set of instruments. A multiple choice test of nutrition knowledge was administered, while nutrition attitude was measured by a set of statement which was filled by agree or disagree. The nutrition practice includes food consumption habits.

#### **2.5. Data Analysis and Management**

General Linear Model (GLM) was used to analyze respond variables such as mothers’ nutritional knowledge, attitude, and practice and children’s nutritional status. This GLM was used also to test research hypothesis whether sub-district as block, covariate variables (nutrition knowledge or attitude or practice before intervention, nutritional status children under five before intervention, adequacy level of energy and adequacy level of protein before intervention) and nutritional education as factor had significant effect or not on the respond variables. Duncan test was used to test whether respond variables means from mother who got nutritional education is higher or better than respond variables means from mother who did not get nutritional education (control).

**3. Results**

**3.1 Social and Economic Characteristic**

The length of husband’s education in the intervention sub district is equivalent to the second year of junior high school – lower than that of the control sub district, which is equivalent to the third year of junior high school. Thus, the heads of families in both the control and intervention sub districts only have elementary school certificates. This condition is similar to that of other sub districts in Indonesia where the education of the people is of elementary school graduates. Meanwhile, housewives’ educational levels are lower than their husbands’; in the intervention sub districts, housewives’ education is equivalent to the first year of junior high school and in the control sub district it is equal to the second year of junior high school as can be seen on Table 1.

**Table 1:** Baseline Socio-Demographic Characteristics of Households

Variable	Control	Intervention	<i>p</i>
Education (years)			
- Husbands	9.3 ± 8.0	8.1 ± 3.5	0.4104
- Wives	8.1 ± 3.5	7.7 ± 3.2	0.5309
Age (years)			
- Husbands	34.6 ± 7.2	35.1 ± 8.0	0.7035
- Wives	30.0 ± 6.7	29.6 ± 6.9	0.7434
Family members	4.6 ± 1.5	5.0 ± 1.7	0.1448

Almost all of the husbands or wives are able to read and write because they graduated the elementary school. Despite their low education, they can absorb the information through printed media. Therefore, the intervention sub districts are especially expected to absorb the patterns of thought and action resulting from the nutritional extension

Most of the husbands work in the service sector, namely, 52.9% in the control sub districts and 58.4% in the intervention sub districts. Others work in the field of agriculture, 10.1% in the control sub districts and 7.5% in the intervention regions. Almost all of the wives in both in control and intervention sub districts do not have any

occupation (as housewives). The job in which most wives are engaged is in the service sector. This is indeed the picture of life among most wives in the rural areas because they are generally less educated or only primary school graduates and so they do not have the bargaining power to get a job of their interest, and they eventually work in the service sector.

Compared to the standard of poverty in [32], namely, Rp183067/capita/month; the income of respondents is far above the standard. The average income in the control sub districts is IDR 240 497/capita/month and IDR 235 013/capita/month in the intervention sub districts (Table 2). However if compared to the World Bank's poverty line (US\$2/capita/day), or around IDR 600 000/capita/month, then almost all respondents still have incomes below the poverty line.

If the expenditure approach were used, then most expenditure (66.9%) was allocated for non food (in the control sub districts) and 33.1% for food, while 30.3% of the expenditure in the intervention sub districts was for food and 69.7% for non-food as can be seen on Table 2.

**Table 2:** Baseline Statistics of Income and Expenditure (IDR/Cap/Month)

Statistics	Control	Intervention	<i>p</i>
Income	240 497 ± 177 219	235 013 ± 245 406	0,8655
Expenditure			
a. Food	183 646 ± 81 015	197 101 ± 95 629	0,3633
b. Non Food	371 993 ± 308 948	453 444 ± 737 751	0,1531
Expenditure Percentage (%)			
a. Food	33.1	30.3	
b. Non Food	66.9	69.7	

### **3.2. Nutritional Knowledge**

The test of nutritional knowledge reflected the aspects of food, nutrition, and health as stated in the modules of nutrition extension which were implemented in this action research. The majority of respondents from the control and intervention groups were unable to answer the 20 questions perfectly. Only three questions were answered correctly: (1) one of the nutritional problems in Indonesia is protein-energy deficiency; (2) the cause of malnutrition is poverty; and (3) washing hands before eating is one aspect of maintaining individual sanitation.

There was a considerable decrease in the number of respondents in the control group who gave correct answers (questions about nutritional knowledge). On the other hand, in the intervention group, the number of the respondents answering the questions correctly was higher. There was a positive impact of the nutritional extension for every test item on nutritional knowledge. GLM analysis shows that block (sub-district), early



nutritional knowledge as covariate variable and nutritional education as factor have significant effect on last nutritional knowledge ( $p < 0.05$ ). The GLM model for nutritional knowledge had a coefficient of determination of  $R^2 = 94.32\%$  and this indicates that the model consisting of intervention, nutritional knowledge at the baseline data and block could explain the respondents' diverse nutritional knowledge of 94.32 %. The score mean of nutritional knowledge after intervention was significantly higher in the intervention group rather than in control group ( $p < 0.01$ ) as shown on Table 3.

**Table 3:** Duncan Test of Mother's Nutritional Knowledge Score based on Treatment

Variable	Level	Mean
Nutritional knowledge	Intervention	53.584 <sup>a</sup>
	Control	34.875 <sup>b</sup>

### 3.3. Nutritional Attitudes

Most respondents from both groups had a positive attitude towards nutrition. There was a positive impact of nutritional extension given to the mothers, i.e. the increased number of mothers having positive attitude towards nutrition. In the control group were compared, it appeared that there was a decrease in the scores from 73.8 to 70.2 (falling by 3.7 points). On the other hand, in the intervention group, there was an increase in the scores i.e. from 71.8 to 76.9 (increasing by 5.1 points). In terms of nutritional attitude, the implemented intervention could improve the respondents' nutritional attitude by 8.8 points. GLM analysis shows that early nutritional attitude as covariate variable and nutritional education as factor have significant effect on last nutritional attitude ( $p < 0.05$ ). A determinant coefficient of  $R^2 = 56.28\%$  on the respondents' nutritional attitude was obtained from GLM model. This indicates that the variation of attitude as much as 56.28 % could be explained by the model consisting of intervention, and nutritional attitude at the baseline data.. The score mean of nutritional attitude after intervention was significantly higher in the intervention group rather than in control group ( $p < 0.05$ ) as shown on Table 4.

**Table 4:** Duncan Test of Mother's Attitude Score based on Treatment

Variable	Level	Mean
Attitude	Intervention	76.916 <sup>a</sup>
	Control	70.166 <sup>b</sup>

### 3.4. Nutritional Practice

In this research, the nutritional practices are reflected by various habits of the respondents, involving the habits of having breakfast, drinking milk, providing fruits, side-dish food intake, consuming iodized salt, and etc.

The distribution of family members who have the habit of having breakfast. In both groups, the percentage of children having a breakfast was higher than that of their parents. In the control group, the percentage of parents and children who are accustomed to breakfast was relatively high. However, there was a decrease in the percentage of respondents having breakfast. Further, the decrease was higher in the control group than in the intervention group.

The distribution of family members having a three-time meal. In general, the number of children who have three meals a day was higher than that of their parents. There was a decrease in the number of family members having three meals; however, the decrease was relatively lower in the intervention group.

The habit of drinking milk in the family. Children under five are usually prioritized to obtain milk. More than 50 % of the children under five drank dairy milk. Although the other members of the family also drank milk, the percentage was lower.

The distribution of side-dish consumption. The majority of the community frequently consumed salted fish, eggs, and tofu/tempe (soybean cakes or fermented soybean) possibly because these foods are relatively inexpensive. In general, it can be said that the side-dish consumption in both control and intervention groups was similar. However, the percentage of meat consumption in the control group was higher than that in the intervention group. The habit of consuming side-dishes among children under five years old (within the last week). Only one-thirds (in control and intervention) consumed liver and meat, and the rest (a bigger percentage) consumed eggs, fish, tofu, and tempe. GLM analysis shows that early nutritional practice as covariate variable and nutritional education as factor have significant effect on last nutritional practice ( $p < 0.05$ ). A determinant coefficient of  $R^2 = 51.12\%$  on the respondents' nutritional attitude was obtained from GLM model. This indicates that the variation of nutrition practice as much as 56.28 % could be explained by the model consisting of intervention, and nutritional practice at the baseline data. The score mean of nutritional practice after intervention was significantly higher in the intervention group rather than in control group ( $p < 0.05$ ) as shown on Table 5.

**Table 5:** Duncan Test of Mother's Practice Score based on Treatment

Variable	Level	Mean
Practice	<b>Intervention</b>	<b>54.8738<sup>a</sup></b>
	Control	<b>53.3300<sup>b</sup></b>

### **3.5. Nutritional Status**

At baseline, the prevalence of underweight in the control and intervention sub districts village was 16.7% and 19.3% respectively. The stunting prevalence of each was 64.5% and 46.5% respectively, whereas the wasting prevalence was 2.7% and 2.6%. According to the WHO criteria (1995) about the category of how serious the problem of health in community is, underweight is categorized into medium (between 10-19%); stunting is categorized as very high (more than 40%); and wasting is considered acceptable (less than 5%).

Based on the malnutrition prevalence, it is clear that the malnutrition problem in the community for this research is a chronic malnutrition. This can be seen from the stunting prevalence that is very high, namely more than 40%. Problems of such chronic malnutrition are usually caused by the low socio-economy condition.

Five months after intervention it appeared that the stunting prevalence became worse in both groups, while the underweight prevalence was a little bit lower in the intervention group, but in the control group is the opposite. Meanwhile, the wasting prevalence is still normal (acceptable). This shows that the intervention/nutrition education had a tendency of preventing the worsening rate in the nutritional status with the increasing age of children.

The description of the analysis results of overweight prevalence shows that: 1) overweight prevalence of children under five years in villages was quite high; 2) there was a tendency of increasing overweight prevalence during the five-month intervention; 3) children under five years in villages faced double nutritional burdens; they suffer not only from under nutrition problem, but also from over nutrition problem.

Based on the analysis of GLM, it was found that intervention had significant impact on the nutritional status of children under five years based on WAZ (the Z-score of body weight/age) (Table 6). Intervention did not have significant effects on the nutritional status according to HAZ (Z-score of height for age) or WHZ (Z-score of weight for height). This is possible because the five-month intervention was not yet enough to improve the nutritional status.

**3.6. Factors Affecting Nutritional Status**

Based on the analysis of General Linear Model (GLM), it was found that intervention had significant impact on the nutritional status of children under five years based on WAZ ( $p < 0.05$ ). Another independent variable as a covariate variable who is influential variable was WAZ before the intervention. Meanwhile, initial energy and protein sufficiency level before the intervention did not have significant effects ( $p > 0.05$ ). Similarly, the district location as a block did not show any distinction in the nutritional status according to WAZ ( $p > 0.05$ ). The score mean of nutritional status based on WAZ after intervention was significantly higher in the intervention group rather than in control group ( $p < 0.05$ ) as can be seen on Table 6.

**Table 6:** Duncan test of Children Nutritional Status according to WAZ

Nutritional Status	Level	Mean
WAZ	Intervention	-1.3088 <sup>a</sup>
	Control	-1.4425 <sup>b</sup>

GLM shows that intervention did not have significant effects on the nutritional status according to HAZ or WHZ ( $p > 0.05$ ). This is possible because the five-month intervention was not yet enough to improve the nutritional status. The nutritional status of HAZ was an effect of a long-term food consumption and the five-month intervention was not enough to improve it. This also applies to energy and protein sufficiency level, which did not show significant effect on the two nutritional statuses. Location as a block or sub district did not show differences in nutritional status either. This means that nutritional status according to HAZ and WAZ in Dramaga and Ciomas Sub Districts were not so much different.

#### **4. Discussion**

The large number of children with malnutrition reflects a big problem of human resources in Indonesia. In the period of 1989-2003 the Indonesian Government could only reduce malnutrition by  $< 1\%$  annually [20]. Malnutrition has many roots: inadequate food supply, limited purchasing power, poor health conditions, and incomplete knowledge about nutrition [3]. The absolute number of undernourished children under five years old reaches five millions. This indicates the serious problems of nutrition faced by the next generation of youth.

Children differ from adults because their nutritional intake must provide not only for the maintenance of tissues but also for growth [21]. The critical period of childhood is the first five years after birth. If the growth and development in this period of childhood is optimal, then he would become a quality human being. Research shown that early learning has lasting effects on development although they are rarely reversible [33]. To accelerate progress in tackling malnutrition, adequate food, health, and care must be ensured throughout the lifecycle. Good nutrition during pregnancy reduces the likelihood of low birth weight and improves pregnancy outcomes. Promotion of growth and development in the young infant and child leads to well-nourished school aged child who can participate fully in the educational process. Good nutrition during adolescence, especially for girls, is important for their growth, development, and wellbeing, and eventually for their childrens [10]. Therefore, the main target of Posyandu (Integrated Health and Nutrition Services) is children under five, in addition to pregnant and breastfeeding women.

Poverty is the major problem responsible for the emergence of nutritional problems in Indonesia. Socioeconomic factors have a stronger impact on the quality of parenting including protecting nutritional health than cultural factors, although other related factors may take some roles, such as knowledge, culture, food habit, etc [19]. In addition, four important causes of malnutrition are lack of knowledge, lack of food production, uneven distribution of food, and infectious and parasitic diseases [18]. The knowledge of nutrition is an important prerequisite for the changes in attitude and behavior towards nutrition. Because the lack of knowledge, people are often unaware of the need to feed young children fairly frequently [18]. In contrary, a good knowledge of nutrition will encourage a mother to provide good feeding pattern for her children. It will motivate her to choose nutritive and safe foods for her family members. Mother's education is an important factor and related to the quality of children upbringing [12]. Furthermore, education level was the predominant variable influencing nutrition knowledge, and nutrition attitude was the primary variable influencing food purchasing practices [2]. Although, a high level of formal education level without an adequate knowledge of nutrition was found to have an effect on the choice of food for the family [28]. A comprehensive health

education course was designed for mothers in West Bank villages, a relatively low socioeconomic population. In a multiple linear regression the two most significant predictors of knowledge were course participation and level of maternal formal education [2]. The higher the nutritional knowledge of mothers, the better the food consumption of children and their family would be.

Nutritional knowledge and attitude of mothers are required to improve children feeding patterns so that adequate nutrition for the children is reached, and in this way they can grow and develop well. The mother's nutrition knowledge applied in daily life greatly affects the condition of the family nutrition [31]. Degree of knowledge could be influenced by intellectual ability. Degree of knowledge itself will influence to someone attitude and behavior because their correlation with logical reasoning, experience and clarity concept about certain object [35]. One can receive nutrition knowledge through an extension or mass media. The criterion of successful education therefore not the accumulation of knowledge, but action a change in some aspect of behavior. In short people behavior in matters of health involves choice and choice, may be determined by economic factors, as when a reasonably nutritious locally ground food is replaced by a less nutritious but more profitable cash crop, social factors such as labour and time saving procedures, including the purchased of processed food, psychological factors such as anxiety and need for reassurance that may make them feel that an expensive patent food must be better than their own breast milk. She also emphasize that other influences are at work on families in rural tropical area today, such as the infiltration of new ideas resulting from the construction of new roads and easier contact with the towns, the broadcasting of radio programs and the spread of literacy, the slow improvement in the economic standard of living, and the increasing use of demand for various forms of medical services [11].

Feeding practices to children have a strong effect on their health and nutritional status. Data from feeding index showed that feeding practices were strongly and significantly associated with child HAZ (height-for-age Z scores), especially after 12 month of age [25]. Similarly, a mother's ability to introduce new food to children has a great influence on their favored food and food acceptance. Acknowledging the interactions of culture, genetics, and socialization among family members would expect to find a strong resemblances in food preferences and food acceptances [4].

The significant influence of interventions on the response variables shows that the GLM model was accurately designed. The GLM model for nutritional knowledge had a coefficient of determination of  $R^2 = 94.32\%$  and this indicates that the model consisting of intervention, nutritional knowledge at the baseline data and block could explain the respondents' diverse nutritional knowledge of 94.32%. By using Duncan test, an average score of 53.58 on the nutritional knowledge of the respondents in the intervention group was obtained, which was higher than that of the respondents in the control group i.e. 34.88. In other words, the intervention on nutritional knowledge could improve the respondents' knowledge in nutrition by 18.7 points. In Lesotho, Two-stage least-squares estimation was used to test the mediating role of nutrition knowledge between maternal schooling and child weight-for-age. Result showed that both the importance of maternal schooling and the mechanism by which it affects the child's weight-for-age are contingent upon the family's socioeconomic status. While maternal schooling was positively associated with weight-for-age for both wealthier and poorer households, the size of the effect was much larger for the latter group. The effect of maternal schooling on weight-for-age was

mediated by the mother's nutrition knowledge only among wealthier households. These results imply that, in Lesotho, nutrition education for mothers could contribute to improving children's growth, but only in households that have access to a minimum level of resources. For poorer households, nutrition education would not be sufficient [25].

A determinant coefficient of  $R^2 = 56.28\%$  on the respondents' nutritional attitude was obtained from GLM model. This indicates that the variation of attitude as much as 56.28 % could be explained by the model consisting of intervention, nutritional attitude at the baseline data and block. The result of Duncan test shows that the average score of nutritional attitude in the intervention group was significantly higher (76.92) than that in the control group (70.12). Therefore, it can be said that intervention could increase the score on attitude by 6 points. Pearson's product-moment correlation was used to determine relationships among the variables and knowledge, attitudes, and practices. Differences in attitudes, knowledge, and practices were determined by one-way analysis of variance. Findings indicated that nutrition attitudes were more highly related to food purchasing practices than was nutrition knowledge to food purchasing practices. Education level was the predominant variable influencing nutrition knowledge, and nutrition attitude was the primary variable influencing food purchasing practices [2].

A score of 51.12 % on the nutritional practice was obtained from the GLM model as shown by its determinant coefficient of  $R^2$ . The result of Duncan test shows that the average score of the respondents' nutritional practice in the intervention group was significantly higher (54.87) than that of the control group (53.33). It can be seen that the intervention on nutritional practice only improved the score by 1.5. This indicates that improving the nutritional practice was much harder than improving the knowledge and the attitude in nutrition of the respondents. The nutritional practice may also be influenced by a person's purchasing power. Life in urban areas presents special challenges for maternal child care practices. Data from a representative quantitative survey of households with children < 3 y of age in Accra, Ghana were used to test a number of hypothesized constraints to child care including various maternal (anthropometry, education, employment, marital status, age and ethnic group) and household-level factors (income, availability of food, quality of housing and asset ownership, availability of services, household size and crowding). Three care indices were created as follows: 1) a child feeding index; 2) a preventive health seeking index; and 3) a hygiene index. Multivariate analyses (ordinary least-squares regression for the child feeding index and ordered probit for the two other indices) showed that maternal schooling was the most consistent constraint to all three categories of child care practices. None of the household-level characteristics were associated with child feeding practices, but household socioeconomic factors were associated with better preventive health seeking and hygiene behaviors. Thus, poor maternal schooling was a main constraint for child feeding, health seeking and hygiene practices in Accra, but the lack of household resources was a constraint only for health seeking and hygiene [14].

A nutrition education program was provided by a physician nutrition specialist in a family practice residency program. The nutrition education program resulted in an increase in physicians' nutrition knowledge scores ( $p < 0.01$ ) and an increase in the frequency with which physicians discussed nutrition and recommended diets for their patients ( $p < 0.05$ ). This suggests that nutrition education by a physician nutrition specialist within a family practice residency program can be effective in increasing nutritional care provided to patients [13].

The poverty may, in fact, become the root of nutritional problems. However, this is made worse by the people's little knowledge of nutrition and little effort in applying the knowledge in daily life. A high level of economy of an individual does not necessarily guarantee a good nutritional status, without an adequate knowledge of nutrition as well. Reference [10] results reflect that Family income, mother's education, and mother's eating patterns were significantly correlated with their children's diet. Beside that, family size also correlated with children's diet, when a family is barely subsisting, additional children may reduce the per capita availability of food to a dangerous level [27]. Understanding the dietary patterns of low and middle income mothers and their influence on their children's diet is helpful to educators in making recommendations to upgrade the quality of diets of young children.

*Posyandu* is a center which is run by member of the community and which provides services, such as Family Planning, Mother and Child Health, Nutrition, and Immunization. One *Posyandu* renders services to approximately 50 children under 5 years of age, or its services are adjusted to the capability of the workers and to local conditions, such as geographical conditions, distance between dwellings, number of households, etc. The operational of *Posyandu* is supported by medical doctor or midwife from sub district clinic and cadre or village health post volunteers. Degree of participations in *Posyandu* activities can be measured by ratio between number children who come to be weighed and total number of children [30]. It is widely acknowledged that inadequate cadre motivation and subsequent high rates of drop-out are a chronic problem for the Indonesian primary health care strategy.

Study showed that participants who actively visited *Posyandu* had low education (61% graduated from primary school, 25% graduated from high school, and 2% graduated from university) [9]. And almost all participants (97.5%) were housewives who didn't work for earning money, the average income was only US \$ 8/capita/month which is categorized as poor (World Bank categorizes income US \$ 30/capita/month as poor). Economic crisis and sociopolitical instability are generally associated with worsening health and nutrition in developing countries. In Africa, the routine health activities index declined sharply from 1993 to 1996. Its introduction in the regression model including all other explanatory variables led to a sharp decrease in the effect of the year on children's nutritional status, showing the important mediating effect of routine health activities. This result was encountered across all economic categories of households [23].

Study showed that 56% of active *Posyandu* participants were only primary school graduates and there were no participants who graduated from university [6]. Based on job characteristics, the participants worked in informal sectors (17%) and the rest were housewives. The average income of the participants was US \$ 9/capita/month. Participation in the *Posyandu* shows a relationship with socio-economic status of the households.

*Posyandu*'s cadres and village midwives in Indonesia are the spearhead responsible for the implementation of nutritional programs in villages. They weigh children under five to monitor their nutritional status and conduct immunization such as against measles, chicken pox, TBC, etc. They should also provide nutritional extension, but this is not fully implemented.

Nutritional extension is one weak aspect of *Posyandu* in Indonesia. Such activity can become an entry point for

a better empowerment of cadres in villages, particularly in providing nutritional education. Apart from that, it is expected that the sample mothers after being given the intervention of nutritional extension can immediately apply their knowledge of nutrition for the improvement of their children's food consumption patterns. Essentially, women have more tendencies to apply their acquired knowledge, especially if it is related to the betterment of children's growth and development.

Based on the analysis of General Linear Model (GLM), it was found that intervention had significant impact ( $p < 0.05$ ) on the nutritional status of children under five years based on the Z-score of body weight for age. Weight for age indicator more reflects nutritional status of this moment. Weight reflects muscle and fat of the body which are very sensitive to sudden changes, such as infection disease, deflation of eat appetite or amount of food consumption [24]. Another factor as a constraint and influential variable was Z-score of Weight for Age (W/A) before the intervention. Meanwhile, initial energy and protein sufficiency level before the intervention did not have significant effects. Poor families live on diets that fail to reach proper standards in almost every nutrient and energy [22]. Inadequate income is a major constraint to good nutrition [29]. Similarly, the district location as a block did not show any distinction in the nutritional status according to Z-score W/A.

Intervention did not have significant effects ( $p < 0.05$ ) on the nutritional status according to Z-score of Height for Age (H/A) or Z-score of Weight for Height (W/H). This is possible because the five-month intervention was not yet enough to improve the nutritional status. The nutritional status evaluation is depending on the stage of time, cost, energy, nutrients deficiency and degree of research accurateness, and how many people will be evaluated [15]. The nutritional status of H/A was an effect of a long-term food consumption and the five-month intervention was not enough to improve it. Height for age index reflects the past nutritional status. A height reflects skeletal growth [24]. This also applies to energy and protein sufficiency level, which did not show significant effect on the two nutritional statuses. The method of Location as a block or sub district did not show differences in nutritional status either. This means that nutritional status according to body height for age and body weight for age in Dramaga and Ciomas Sub Districts were not so much different.

### **Acknowledgments**

The researchers want to express their sincere gratitude to the following parties : The Nestle Foundation that has facilitated this research; Heads of Ciomas and Dramaga Sub Districts with their staffs who gave advice for implementing this research; all cadres and participants of posyandu program who participated in the intervention; Head of Department of Community Nutrition, Faculty of Human Ecology, Bogor Agricultural University (IPB); and the research assistants as well as enumerators who had collected data in the field.

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