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The Effectiveness of Home and Hospital Enteral Nutrition: A Preliminary Study

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ABSTRACT

Home enteral nutrition (EN) at dr. Mohammad Hoesin Hospital (RSMH) was rare. Its acceptability and effectiveness were not known. This study was aimed to determine the effectiveness of home EN compared with EN for hospitalized patients as the control group. We conducted a preliminary quasi-experimental study with anthropometric measurements every seven days until the twenty-eighth day. There were 15 subjects for each group. The acceptability rate of home EN was 100%. The mean of initial weight for height (WHZ T0) between the control group and home EN group was -2.83 (2.49) vs -2.46 (2.44). The mean of WHZ at T7 was -2.51 (2.29) vs -1,99 (2.49). There was an increase in each group (P=0.009), but the difference was not significant (P=0.584). Complications occurred in 13.3% of subjects in the control group and 66.7% in the home EN group. There was a significant WHZ change affected by complications, but the change was not significant (P=0.186). We concluded that home enteral nutrition had the same effectiveness as in the hospital.

Keywords: Anthropometric measurement, complication, home enteral nutrition, WHZ.

1. Introduction

As a nutritional support, enteral nutrition (EN) is more widely used than parenteral nutrition (PN). Enteral nutrition, which is defined as giving food directly to the gastrointestinal tract through a nose or stoma, has several advantages including more physiological and can maintain the trophic effect of the gastrointestinal tract. Enteral nutrition administration is easier to work on, the risk of systemic infection is lower and the costs required are less than PN. It is also the main choice for patients who need long-term nutritional support because it can be performed at home safely and rarely cause severe complications [1–3].

Assessment of the effectiveness of home EN is done by monitoring the acceptability, tolerance and efficacy. Acceptability can be assessed from the compliance of patients and parents in receiving and giving EN. Tolerance is assessed by monitoring the complications that can occur, namely gastrointestinal, mechanical, metabolic and psychological complications. Effectiveness was assessed through a change in the anthropometric indexes. Enteral home feeding program in Canada showed the average increase in Z score of weight for age (WAZ) in subjects aged 0 to 18 years was 0.42 and Z score of height for age (HAZ) was 0.22. These changes showed a significant correlation with the duration of EN administration. Other studies on cancer sufferers showed that patients with poor nutritional status experienced a significant increase in the WAZ and body mass index for age (BMI/A) at the end of the EN administration [4,5].

Provision of home EN has been done for a long time for patients at dr. Cipto Mangunkusumo Hospital (RSCM) in Jakarta. Monitoring is carried out at the outpatient clinic regularly. At RSMH Palembang, home EN was uncommon. There was a perception of the patient's family that when their children left the hospital, all the tubes both intravenous and feeding tubes, must be removed. Thus, many

patients with various group of diagnosis were hospitalized for a long time just because they still need EN. The parents also refused to give home EN because of worry about the complication that can occur. Therefore, the objective of this study was to identify the effectiveness of home EN compared to those who continued EN at the hospital. Researchers also wanted to know the complications that occur in both groups.

2. Method

Preliminary research with the quasi-experimental design was carried out on two groups. Control group consisted of subjects that continued EN in the hospital and the treatment group consisted of the subjects who received home EN. The study was conducted for five months from May to October 2017 at the inpatient and outpatient clinics of the Child Health Department of RSMH Palembang. Subjects were ranged from one month to five years old and resided in the city of Palembang and its surroundings. The route, method and formula of EN were given according to the instructions of the doctor in charge. The inclusion criteria were subjects with stable hemodynamic conditions and needed EN through a nasogastric tube (NGT). The exclusion criterion was the unwillingness of parents to participate in the study.

The sampling method was carried out in two stages. Consecutive sampling was used to recruit patients who met the inclusion criteria, and then research subjects were recruited based on the convenience of the parents to continue enteral nutrition at home. Education was done twice, at the time of the initial administration of EN and at the time of recruitment of research subjects. Researchers assessed the success of education by filling in a post-education checklist and signed by the parents.

Monitoring of all subjects was carried out for 28 days with data collection carried out every 7 days, namely on the seventh day (T1), fourteenth day (T2), twenty-first day (T3) and the twenty-eighth day (T4). At each visit, anthropometric measurement and identifying of the complications were carried out. The effectiveness of EN was assessed from the increase of WHZ mean and mid-upper arm circumference (MUAC) for age. The Z score was an output from the anthropometric index inputted into the WHOanthro software. The types of complication observed were gastrointestinal and mechanical complications.

The data were displayed in the mean, standard deviation, median, interquartile range, with $P<0.05$ considered statistically significant. The analysis was done using statistical programs for social sciences (SPSS) version 20. An independent t-test was used to assess the relationship between dependent and independent variables. To assess the change between the two groups, ANOVA repeated measurement test was used. Data were presented in tables and diagrams.

This research had received permission and passed the ethical feasibility issued by the Permanent Ethics Committee for Medical/Health Research Faculty of Medicine Universitas Indonesia/RSCM and the RSMH health research ethics committees.

3. Result

There were 74 EN treatments at the hospital during the study period. Subjects who met the inclusion criteria for home EN were 17 patients. After receiving education and providing information about research, all parents agreed to continue EN at home and permitted their children to participate in the study as a treatment group. One subject died at home on the sixth day after leaving the hospital, and one subject experienced readmission before T1. Both subjects were not included in the final analysis. The sample recruitment for the control group was carried out on patients who were still hospitalized until the end of August and added over the next two months period until a minimum of 15 subjects were obtained.

A total of 30 subjects, consisted of 15 subjects for the home EN group and 15 subjects for the control group. The mean age of subjects in the control group was 15.27 (13.93) months, the mean length of stay was 18.07 (6.39) days

and there were two subjects with macrocephaly. The mean age of subjects in the home EN group was 14.47 (12.19) months, the mean length of stay was 14.73 (6.57) days, there was one subject with macrocephaly and one subject with massive hepatomegaly. The diagnosis group showed the same distribution of neurological and respiratory diseases, each of which was 26.7%. Severely wasted was the majority of nutritional status in both groups, 46.6% in control group and 53.3% in the home EN group. Most of the subjects in both groups used the formula for specific medical purposes (FSMP). In control group, 8 (53.3%) subjects received a home-made formula in the form of F75, F100 or liquid food, 5 (33.3%) subjects received commercial formula and 2 (13.3%) subjects were breastfed. In the home EN group, 9 (60%) subjects received home-made formula, 5 (53.3%) subjects received commercial formula and 1 (subject) 6.7% was breastfed. Only T1 could be fulfilled by all subjects in both groups.

Weight for height Z scores were assessed on 26 subjects while 4 other subjects used the Z score for MUAC for age (MUAC/A) because of organomegaly (table 1). The mean of WHZ T1 for each group could be seen in table 2. Mean for WHZ T2 in the control group is only obtained for two subjects, whereas for T3 and T4 could not be assessed because there was no subject hospitalized more than 14 days. Based on ANOVA for repeated measurements, it showed that in each groups there was a significant increase between WHZ T0 and T1 (P=0.009). When we compared the two groups, the increase of WHZ were not significant (P=0,584) (figure 1).

Table 1. Distribution of anthropometry indexes (T0)

Characteristics	Control group $\bar{x}$ (SB)	Home EN $\bar{x}$ (SB)	P	95% CI
Weight (kg)[a]	5,8(1,69 - 11,75)[c]	6,1(3,33 - 22,8)[c]	0,573*	
MUAC (cm)[b]	9,25 (0,35)	12,75 (3,18)		
WHZ [a]	-2,83 (2,49)	-2,46 (2,44)	0,704^	-1,62 sd 2,37
MUAC/A[b]	-5,68 (0,41)	-1,49 (3,34)		

[a] n=26
[b] n=4
[c] Mean (minimum-maximum)
*) Mann-Whitney test
^) Independent t-test

Table 2. Distribution of WHZs during the time of monitoring

Time of monitoring	Control group $\bar{x}$ (SB)	Home EN $\bar{x}$ (SB)	P*	95% CI
T1	-2,51 (2,29)[a]	-1,99 (2,49)[a]	0,584	-1,42 sd 2,46
T2	-2,76 (1,08)[b]	-1,24 (2,84)[c]		
T3		-0,85 (3,39)[d]		
T4		-0,65 (2,68)[e]		

*) Independent t-test
[a] n=13, [b] n= 2, [c] n=11, [d] n=9, [e] n=7

Complications which were found during the monitoring consisted of gastrointestinal, mechanical and combination of both. Those were more common in the home EN group. Only 13.3% in the control group experienced complications, and all of them were vomiting. As many as 66.7% of subjects in the home EN group experienced complications, and vomiting was the most common complication (40%). Other complications were the detachment of NGT, which was experienced by 26.7% of subjects, diarrhea in 13.3% of subjects, bloating and bloody defecation each experienced by 6.7% of subjects. As many as 50% of subjects in the home EN group experienced gastrointestinal and mechanical complications simultaneously. There was a change in the mean of WHZ influenced by complications but based on two-way ANOVA for repeated measurement test the difference was not significant (P=0.186) (figure 2).

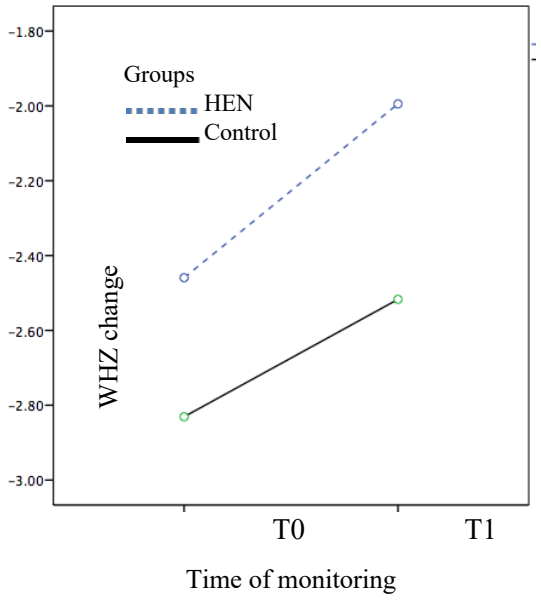

Figure 1. The association between WHZ change and the time of monitoring.

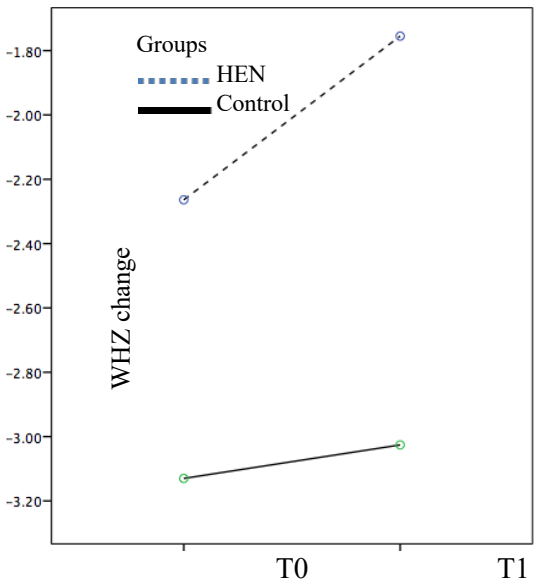

Figure 2. WHZ change based on complications.

4. Discussion

The high acceptability in this study was quite surprising. This showed that with repeated education, the fears and worries of the patient's family to provide home EN could be reduced. At Mount Sinai Medical Center, all parents or caregivers received training provided by experienced nurses who were part of a multidisciplinary team. Ninety-four per cent of the subjects were decided to receive EN services at home. Other studies also carried out training provided by nurses, dietitians and representatives of formula and tool companies, and supported by dietitians and general practitioners in the community who conduct routine monitoring, especially if complications arised [6,7]. In this study, training was not given by the hospital team. However, based on the post-education checklist, it was found that most of the parents understood how to administer EN at home and stated that they were willing to do it at home.

At the beginning of the study (T0), there were no significant differences in the distribution of weight between the two groups (p = 0.573). The initial WHZ also did not show a significant difference with P = 0.704 (95% CI -1.62 to 2.37). There was an increase in WHZ at T1. The home EN group experienced an increase of 0.47 in the WHZ while the control group increased by 0.32 (p=0.009). There was no significant different in WHZ change when we compare the two groups (p=0.584). We assumed that in the short period of monitoring, home EN was as effective as EN given in the hospital.

In a Turkish study which assessed the effects of EN and PN in the hospital, an increase in WHZ was found but the increase was also not significant (p=0.08). A significant increase was found in the WAZ and HAZ with P=0.01 and 0.02, respectively [8].

A retrospective study in Canada using the National Center for Health Statistics growth charts (NCHS) software showed an increase in WHZ from -1.18±0.15 to -0.94±0.15. Other parameters, WAZ and HAZ, also increased. The mean of WAZ was 0.42 and HAZ was 0.22. A significant increase was obtained in the WAZ (P=0.0013), while WHZ and HAZ did not show a significant change (P=0.11 and P=0, 06 respectively) [4]. Other retrospective study at Mount Sinai medical centre in New York that assessed the growth of patients who were discharged with NGT identified an increase in BMI, WAZ and HAZ. The two studies above had different method from this study, and most of the subjects included in their study were patients with chronic diseases. The designated monitoring time was also longer than 28 days. All patients in those study used an infusion pump for formula administration techniques, and there were subjects on gastrostomy [4,6].

The distribution of the nutritional status of the subjects at the beginning of the Canadian study were good (38%), stunted (45%), and wasted (17%). The most catch-up growth was experienced by the wasted group with 92% having a weight improvement and 70% having an increase in height after a monitoring of 8.9 months. There were differences in the types of formulas given to wasted and/or stunted subjects, namely high calories formula (1 kcal/ml). Similar conditions were also seen in a study in Turkey that used a 1.5 kcal/ml formula as a standard in malnourished subjects [4,6,8].

Complications in home EN group were found in 10 subjects (66.7%) and were a combination of gastrointestinal and mechanical complications (50%). In the EN group in the hospital, complications occurred in two subjects (13.3%) and all in the form of vomiting. Kang et al found that the complications were vomiting (2.6%), detachment of NGT (1.3%), and other complications which more related to the gastrostomy tube (15.4%). Boland et al compared the complications between child and adult populations who received home EN. The study showed a tendency of child population to experience gastrointestinal complications rather than mechanics. The incidence of vomiting was significantly different between the two populations ($p<0.001$). The most common mechanical complication was re-administration of NGT, but it was more frequent in the adult population (P=0.04) [4,7].

The incidence of vomiting in this study was experienced by many subjects, especially in home EN group. It occurred because of the difference in the equipment used among subjects. Most subject in the control group used infusion pumps or infusion tubes, while most of the subject in home EN group used 20 ml syringe with the gravity method. In addition, 85.7% of subjects who experienced vomiting were those who got a home-made formula. Thus, the wrong composition and bad hygiene could also contribute to causing vomiting. When subject experienced a complication at home in the afternoon or evening, parents usually waited until the next morning to go to the nearest health facility or wait for the routine visit to the RSMH clinic. Studies in Canada and New York showed that all

subjects with home EN used an infusion pump for formula administration. Complications such as vomiting were also unavoidable, but the incidence was less than other complications, especially compared to mechanical complications [4,6].

Report from Gazi University hospital in Turkey (2004) showed the complications related to the caloric density of the formula. Subjects who received 1 kcal/ml formula encountered the tube occlusion (26.92%), a long-term transition to oral feeding (11.53%) and vomiting (7.69%). Whereas in subjects who received a 1.5 kcal/ml formula, 50% experienced tube occlusion, a long-term transition to oral feeding (15.38%) and diarrhea (3.84%).

Multicentre research in Italy found that the complications related to home EN were 12.80%, consisted of vomiting, diarrhea, aspiration pneumonia, constipation and electrolyte and glucose imbalance. The incidence of mechanical complications was 2%, consisted of blockage or detachment of NGT, skin irritation, tissue granulation and leakage of food or gastric fluid from the gastrostomy stoma [8,9].

This study was the first study which compares the incidence of complications between the administration of EN at the hospital and home EN, as well as its association in changing WHZ. Figure 2 showed that WHZ was increased more in the group that did not experience complications, but the difference between the two groups was not statistically significant (P=0.186). It could be caused by a small number of subjects and a short monitoring period. Based on the analysis, it was found that administration of EN in the hospital was a protective factor against the incidence of complications with an OR 0.077 (95% CI 0.012-0.482).

5. Conclusion

There was no significant difference in increasing the WHZ between home EN and EN
given at the hospital. However, complications were found more often in the home EN group. The most common complication identified was vomiting, and there was a significant increase in WHZ in the group with no incidence of complication. It more subjects and longer period of monitoring is highly needed to obtain the more powerful result.

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