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INFLUENCE OF TOP NUTRI-MULTIPLE MICRONUTRIENT SUPPLEMENT  
FOR NUTRITIONAL STATUS OF STUNTED CHILDREN BETWEEN 12-36  
MONTHS-OLD

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The conference will be held in Conference Hall '202  
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## ONE. INTRODUCTION

### 1.1. Background of the study

The lack of food can be perilous for young children since it retards their physical and mental development and threatens their survival. More than a quarter of children under age 5 in developing countries are malnourished and hundreds of millions of children suffer from micronutrient deficiencies, so-called 'hidden hunger' or chronic malnutrition.

According to the 3<sup>rd</sup> National survey of "Nutritional status of Mongolian children and women", PHI, MoH, UNICEF 2004, 19.6% of all Mongolian children between 6-59 months -old suffered from chronic malnutrition or stunting, 0.6% from acute malnutrition and 6.7% were underweight. Compared to the results of previous surveys, underweight prevalence has been declined two-fold; wasting has been declined by six times and stunting by only 5.0%. There is no significant improvement in decrease of stunting among under 5-years-old in Mongolia.

Mongolia faces serious problems of micronutrient deficiencies and growth retardation. According to the previous surveys, it is clear that the main consequence of micronutrient deficiency is stunting. Micronutrient deficiencies in iron, iodine, and vitamin D are highly prevalent. According to the national survey conducted by the Nutrition Research Centre of Mongolia (NRC) and UNICEF in 2004, 21.4% among children 6-59 months-old are anemic, 13.8% of children (7-12 years old) presents with goiter, and rickets affects 41.5% of children between 6-23 months-old.

In the framework of nutritional activity, ACF (Action Contre La Faim)-Mongolia international network reached around 2004 malnourished children who lived in outskirts area of UB city and 95% of them were stunted.

The one of activities being implemented by government is 'Mother and child micronutrient deficiency prevention strategy' which was adopted in 2005 and it included the fundamental principle as "To provide target population with micronutrient supplements until the use of food products enriched and fortified with micronutrients increases to a certain sustained level in society". In the framework of the strategy, the children under 3 years-old are determined as a target population.

Moreover, the activities to be implemented include the following: "to reflect into the budget a required budget necessary for supplying the target population with micronutrients supplements.

Therefore, we decided to study the effect of multiple micronutrients supplement -Top Nutri for children with chronic malnutrition and to find the possibility to introduce it into the practice in order to investigate the way to treat and prevent from micronutrient deficiency.

TopNutri contains a Protein, 13 minerals and 13 vitamins concentrate.

It is first time that ACF-Mongolia international network imported Top Nutri in Mongolia in order to improve the nutritional status of target population of own program. The influence on stunting of this product has never been studied for 12-36 months old children in Mongolia.

## **1.2. The aim of the study**

To investigate the effect of multiple micronutrients supplement -Top Nutri for improving the growth retardation of children under 3 years old and to develop a solution on how to introduce it into the practice

## **1.3. Objectives:**

1. To evaluate the general life condition of subjects and caretakers' knowledge on malnutrition.
2. To investigate the effect of Top Nutri on height and weight of stunted children. To evaluate the effect of Top Nutri comparing to age group.
3. To study its acceptability for the target population.

## **1.4. Innovative scientific aspects of the study**

1. Although, there are some multiple micronutrients supplements supplied by international organizations, their effects on malnutrition status haven't ever been studied in Mongolia. The effect of Top Nutri-multiple micronutrients supplement on malnutrition status was firstly studied among children 12-36 months old in Mongolia.
2. The acceptability of Top Nutri was also firstly studied in Mongolia.

## **1.5. Issues to be considered:**

1. Effect of Top Nutri on improvement of height and weight for subjects
2. Difference of effects among age groups
3. Acceptability of Top Nutri for Mongolian children

## **1.6 Presentation of the study**

1. Influence of Top Nutri-multiple micronutrients supplement for 12-36 months- old stunted children., School of Public Health, HSUM, Department of Preventive Medicine, Approval of study methodology, November, 2006.
2. Influence of Top Nutri-multiple micronutrients supplement for 12-36 months- old stunted children., Bio-medical ethical committee, HSUM, Approval of study methodology, 2006.11.14
3. Influence of Top Nutri-multiple micronutrients supplement for 12-36 months- old stunted children., Bio-medical ethical committee, HSUM, Conclusion of ethical committee, 2007.04.03
4. Influence of Top Nutri-multiple micronutrients supplement for 12-36 months- old stunted children., School of Public Health, HSUM, Research meeting of Department of Preventive Medicine, March, 2007.
5. Influence of Top Nutri-multiple micronutrients supplement for 12-36 months- old stunted children., International Baby Food Action Network, East Asian Strategy meeting, Seoul, Republic of Korea, December, 2006.

## **TWO. METHOD OF THE STUDY**

### **2.1. Study design**

This study is designed as a clinical trial.

### **2.2. Methodology of the study**

Total 152 children from four family clinics which are located in outskirts area of Songinokhairkhan district of UB city were randomly selected for the survey. Inclusion criteria of subjects in the selected area were as follows: 12-36-months-old, willingness to participate, Height/Age index is less than -2 SD/ Standard Deviation/ by Z score. However, we tried to involve approximate number of participants in each age group (12-17, 18-23, 24-29 and 30-36 months) and in each study group.

1. At baseline, the questionnaires were taken from total 152 caretakers of children of both groups to compare their socioeconomic background and knowledge on malnutrition.

2. Anthropometric measurements were done at baseline and at the end of the experiment for both control and target groups to evaluate their nutritional status in terms of height/age, weight/age, weight/height. Z-scores and percent of median were derived from comparison of children in the survey sample to the NCHS/CDC/WHO reference population.

Length was recorded to the nearest 0.1 cm, with the child lying down for child up to 24 months old and standing for children 24-36 months old, using the WHO recommended measuring board.

Weight was recorded to the nearest 0.1 kg, with the child minimally clothed, using a Salter scale.

The following three indexes can be calculated to evaluate the nutritional status. But we more focus on chronic malnutrition.

#### **Weight for age index (W/A)**

This index is an indicator that shows low weight in relation to age. If this index is below minus two standard deviations ( $WAZ < -2 SD$ ) from median weight for age of reference population it is considered as underweight or acute/chronic malnutrition. Moderate underweight is below minus two standard deviations from median weight for age of reference population. Severe is below minus three standard deviations ( $WAZ < -3 SD$ ) from median weight for age of reference population.

#### **Height for age index (H/A)**

This index is an indicator that shows low height in relation to age. If this index is below minus two standard deviations ( $HAZ < -2 SD$ ) from median height for age of reference population it is considered as stunting or chronic malnutrition. Moderate stunting is below minus two standard deviations from median weight for age of reference population. Severe is below minus three standard deviations ( $HAZ < -3 SD$ ) from median weight for age of reference population.

### **Weight for age index (W/A)**

Wasting is an indicator of short-term or acute malnutrition. When a child has a very low weight compared to other children of the same height. Moderate wasting is below minus two standard deviations (WHZ<-2 SD) from median weight for height of reference population. Severe is below minus three standard deviations (WHZ<-3 SD) from median weight for height of reference population.

3. One pack or 52.5 g of Top nutri was added to meal of children of target group per week for 2 months. At the end of the study, the post distribution monitoring tests were taken from caretakers of children of target group to evaluate the acceptability, correct usage and side effects of Top Nutri.

### **2.3. Statistical analysis**

The following programmes were used to analyze the data:

1. SPSS-10 programm was used to analyse the data collected from questionnaires.
2. EPI INFO-2000 and EPI NUT programm was used to calculate the nutritional indexes.

### **2.4. Ethical consideration**

Prior to the survey, mothers of the selected children were informed by the investigators about the purpose of this study and the protocol of the survey. Assurance was given that participation was voluntarily and that no negative consequences would result for those who decided not to participate in the study. Mothers who are voluntarily participating in study signed in the consent paper. The Ethical Committee of Health Sciences University of Mongolia approved the study protocol 36/2 on 14, November, 2006 prior to implementation of the study. The ethical conclusion was made on 3 April, 2007.

## **THREE. RESULTS OF THE STUDY**

### **3.1. Study population and assessment of life condition of them**

The approximate number of participants involved in each age group (12-17, 18-23, 24-29 and 30-36 months) and in each study group. All 152 children were randomly divided into 2 groups: target /76/ and control /76/ (Table 1).

Table 1.

Description of participation of subjects in the study

Age group /by month/	Target group				Controlgroup			
	Male		Female		Male		Female	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent

12-17	9	25.0	11	27.5	8	23.5	9	21.4
18-23	8	22.2	12	30.0	11	32.4	9	21.4
24-29	8	22.2	8	20.0	7	20.6	12	28.6
30-36	11	31.6	9	22.5	8	23.5	12	28.6
Total	36	100	40	100	34	100	42	100

Income per member of family is 23204.24 MNT for target group and 25147.22 MNT for control group, which means the income of both groups was lower than the minimum amount of life standard /42800MNT/ confirmed by NSO in 2006.

42.1%of target group and 38.2%of control group were migrants from countryside. 11.8%of target group and 13.2%of control group had female heads. 13.2%of target group and 11.8%of control group hadn't been registered in UB yet.

56.9% of target group and 59.7 % of control group live in yurt.

67.1%of target group and 46.7% of control group had no understanding on well balanced diet.

98.7% of target group and 947% of control group were provided by safe water. The water from public kiosk and well was considered as safe water.

Caretakers' age: 25%of caretakers of target group and 19.7%of control group were over 35 years old.

Caretakers' educational background: 86.8%of target group and 78.9%of control group had obtained general education. /Table 2/

Table 2

Age of caretakers and their educational level

Study group	Age of caretakers				Education							
	Up to 35		Over 35		No		Primary		Secondary		Bachelor	
	number	%	number	%	number	%	number	%	number	%	number	%
Target	57	75	19	25	2	2.6	5	6.6	66	86.8	3	3.9
Control	61	80.3	15	19.7	4	5.3	9	11.8	60	78.9	3	3.9

10.5% of target group and 15.78% of control group were derived from family with more than 2 children under 5 years old. 26.3%of target group and 27.6%of control group were derived from family with more than 2 children between 0-16 years old. /Figure 1/

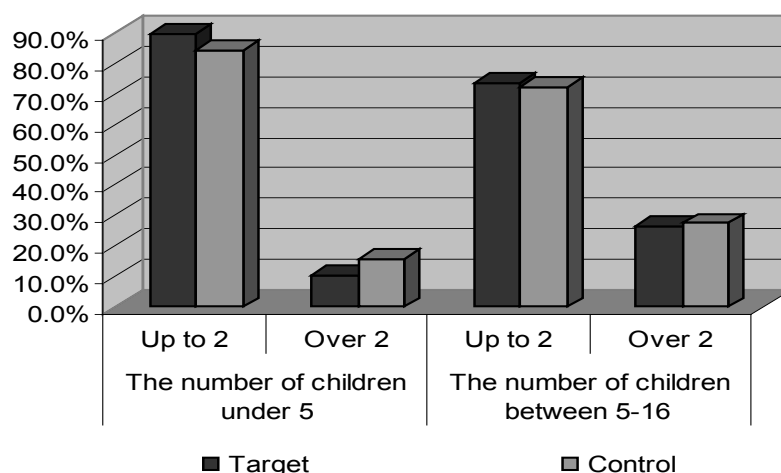


Figure 1. Number of children derived from family with children between 5-16

#### Knowledge and attitude of caretakers on malnutrition:

As mentioned above, we involved 152 children with moderate and severe stunting and all caretakers of both groups were asked whether their children were malnourished or not.

According to the analysis of questionnaire, only 48.7% of target group and 64.5% of control group considered that their children were malnourished.

93.4% of target group and 86.8% of control group had same opinion as it is possible to prevent from malnutrition.

68.4% of caretakers of target group and 65.8% of control group have knowledge on iron deficiency.

47.4% of caretakers of target group and 64.5% of control group have knowledge on vitamin D deficiency.

### 3.2. Evaluation of malnutrition status of children

We involved 152 children with moderate and severe stunting because our main focus was about the difference of stunting status between two groups after and prior to implementation of study. So, there were no children with mild stunting and with normal growth in both groups.

60 children or 78.9% of target group were moderately stunted and 16 children or 21.1% of target group were severely stunted. There were 70 children /92.1% with moderate stunting and 6 children / 7.9% with severe stunting in control group.

After completion of study the anthropometric measurements were done for children of both groups.

According to the result of final measurement, 39.5% of target group had mild stunting, 48.7% had moderate stunting and 11.8% had severe stunting. For control group, 25% had mild stunting, 60.5% had moderate stunting and 14.5% had severe stunting. /Figure 2/

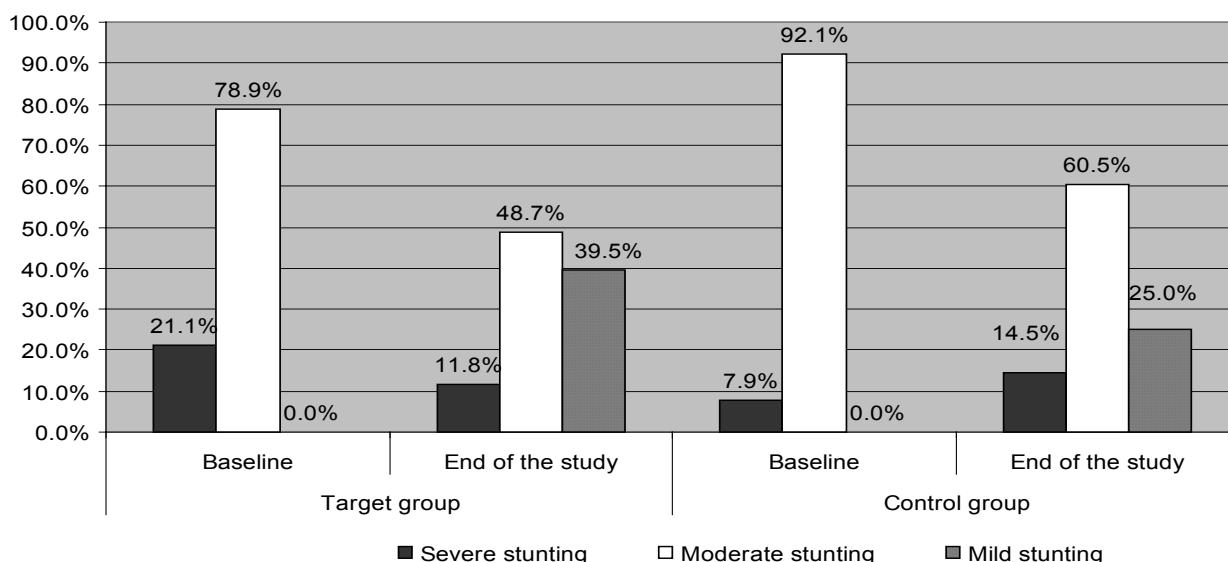


Figure 2. The change of stunting /by study group/

32.2% of all children of both groups were assessed as mildly stunted, 54.6%-moderately stunted and 13.2%- severely stunted.

After completion of study all participants were divided into 2 groups depending on their improvement of nutritional status in terms of weight for height, height for age and weight for age indexes. 51.3% of children of target group had improvement on their growth and 48.7% had no improvement. On the contrary, 26.3% of children had improvement on their growth and 73.7% of children of control group had no improvement (Table 3).

**Table 3.**

Comparison of malnutrition status in the beginning and at the end of the survey

		Improved		Not improved	
		Number	Per cent	Number	Per cent
Weight/Age /underweight/	Target	30	39.5	46	60.5
	Control	14	18.4	62	81.6
Height/Age /stunting/	Target	39	51.3	37	48.7
	Control	20	26.3	56	73.7

We compared the improvement of height for age index of children who used Top Nutri or not as following:

$g\% = [b/a+b] * 100\%$  - The increment of height of children who used Top Nutri

$h\% = [d/a+d] * 100\%$  - The increment of height of children who did not use Top Nutri

- a- Number of children who used Top Nutri but have no increment on stunting
- b- Number of children who used Top Nutri and have increment on stunting
- c- Number of children who did not use Top Nutri and have no increment on stunting
- d- Number of children who did not use Top Nutri but have increment on stunting

According to our result  $g\%=51.3\%$  and  $h\%=26.3\%$ .  $g\%>h\%$  means there is statistical difference between two groups.  $g\%/h\%=51.3\% / 26.3\% = 1.95$ . The possibility of improvement of stunting condition is 1.95 times higher for 12-36-month-old children who received Top Nutri than peer children who did not receive this supplement. Using this formula we calculated the difference between increment on w/h, h/a and w/a indexes./Table 4/

Table 4

The improvement of nutritional status./ by age group/

Age /by month/	Increment on W/A /times/	Increment on H/A /times/
12-17	1.98	2.55
18-23	2.33	2.17
24-29	2.61	1.66
30-36	1.67	1.86
12-36	2.14	1.95

The change in stunting from baseline to post-treatment was 2.17-2.55 times greater in the 12-24 months-old children compared to the peers of control groups, which means the highest effect comparing to the age group.

The mean of H/A, W/A and W/H indexes was calculated at baseline and at the end of the study. /Table 5/

Table 5

Mean of H/A, W/A and W/H indexes  
/by Z score, SD/

	Baseline		End of the study	
	Target group	Control group	Target group	Control group
Height/Age	-2.47	-2.41	-2.17	-2.42
Weight/Age	-1.94	-1.84	-1.35	-1.55

T-test was used to reveal the difference between two groups and increment of indexes. The mean of indexes calculated at baseline was compared with increment of indexes for both group. For target group  $t=2.83$  / $p=0.006$ / and there is difference with statistical significance between indexes measured at baseline and at the end of the study. On the contrary, for control group  $t=0.661$  / $p=0.511$ / and there is no difference with statistical significance between indexes measured at baseline and at the end of the study. /table 6/

## T test

Study group	Target		Control	
	t	p value	t	p value
Indexes				
Height/age	2.83	0.006	0.661	0.511
Weight/age	7.079	0	5.736	0

### 3.3. Evaluation of the acceptability, correct usage and side effects of Top Nutri

The post distribution monitoring /PDM/ test was taken from caretakers of children of target group in order to assess the acceptability and correct usage of Top Nutri.

- According to the PDM test, 65.8% of children who received Top Nutri used this product according to the manufacturer's instructions. They administered correct dosage of Top Nutri. The survey shows that there is a correlation between correct usage of Top Nutri and improvement of stunting /  $P=0$  &  $p<0.05$ /. /Figure 3/
- 64.5% of children used Top Nutri answered that they know the importance of Top Nutri. 75.5% of them had improvement on their growth. /Figure 3/
- 75 % of target group were used Top Nutri according to manufacturer's instruction. /Figure 3/

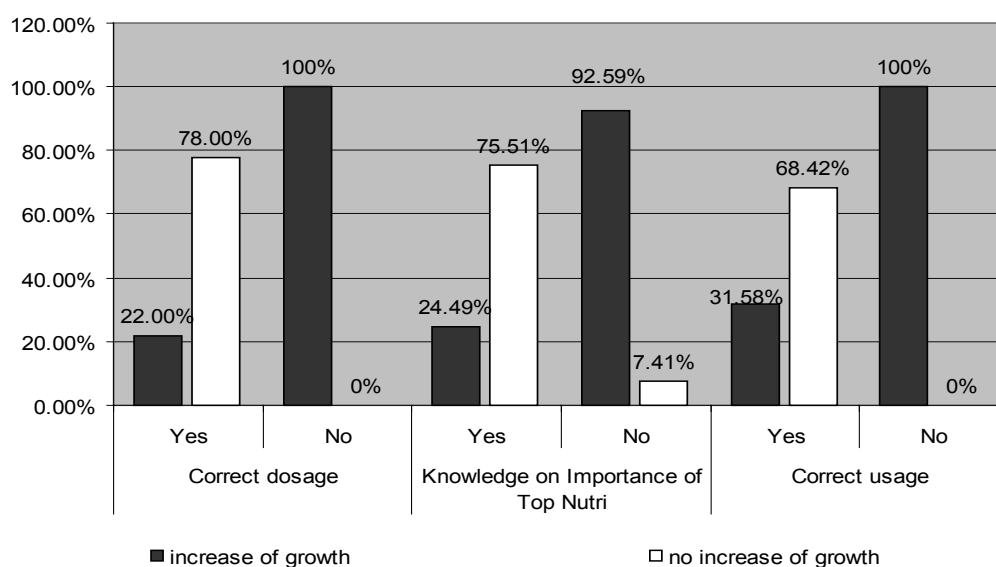


Figure 3. Usage of Top Nutri

94.7% of children provided by Top Nutri had not faced any difficulties to use Top Nutri according to the recommendation and others had some suggestions such as, it is better to use it in pill or tablet form, also the amount in per meal is too much and it complicates the daily use.

Furthermore, 97.4% of children of target group hadn't experienced any side effects. /Figure 4/

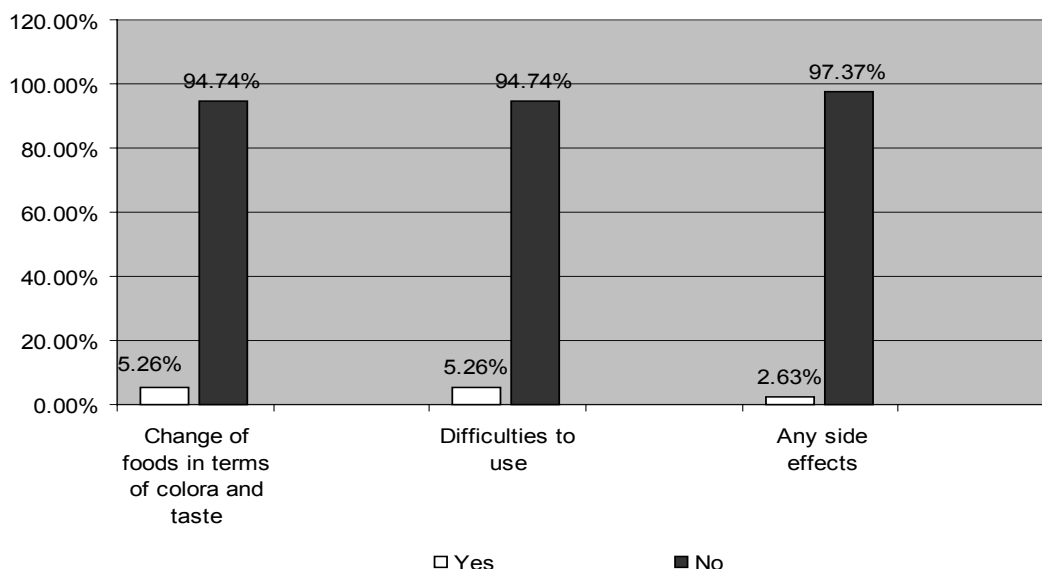


Figure 4. The problems faced to consumption of Top Nutri

#### FOUR. DISCUSSION

In recent years, certain micronutrient products have become available on the international market. The aim of these products is to increase the general quality of the food aid ration provided to populations in distress. Each of these products is slightly different in composition and aspect, taste, and colour. They are prepared to be added in meal with lack of vitamin and micronutrient composition.

Sprinkles and Pally biscuits-vitamin and mineral supplement were being distributed in the frame of international organizations' aid such as UNICEF, World Vision in Mongolia. In 2001-2004, the iron deficiency anemia decreased by 28% and rickets decreased by 10% within 2 years among 6-59 months -old children who used sprinkles of multiple micronutrients supplement provided by World Vision in Mongolia. However, the influence on stunting of this product hasn't been studied yet.

The result of community based survey conducted in 14 countries, such as China, Canada, Bangladesh, India and Pakistan shows that sprinkles can decrease the iron deficiency anemia by 49-91%. It is considered to be acceptable product for Mongolian children to treat and prevent from diseases caused by vitamin and mineral deficiency. But influence on stunting of this product hasn't also been studied yet. Unfortunately, we didn't have a possibility to study the influence on anemia and rickets of Top Nutri because of financial problems.

However, according to the above mentioned results Top Nutri can be considered to be a product with high possibility to treat anemia and rickets as it contains full range of vitamins and minerals /13 vitamins and 13 minerals/ compared to sprinkles which contains 8 vitamins and 6 minerals.

Influence on stunting of Top Nutri hasn't ever been studied in Mongolia but acceptability trials have been conducted in different countries.

Our result confirms those of the many other micronutrient supplementation trials that have shown a positive effect on growth of Vietnamese infants. For example, Thi Hop and Jacques Berger, 2001 and Ninh and Thu, 2005, “Multiple Micronutrient Supplements Improve Micronutrient Status and Anemia of Vietnamese children”.

The survey about reason and possibility of treatment of stunting was conducted among children between 1-5 year-old in Pakistan and result shows that there are many factors which affect stunting but the main reason is vitamin and mineral deficiency for young children. Our survey result shows the highest effect for children in their younger age /2.17-2.55 times/ and it corresponds to the result of survey “Determinants of stunting at 6, 12, 24, and 60 months and postnatal linear growth in Pakistani children”.

Additionally, our study and the study conducted between under 2 years old children in China in 1999 agree that stunting should be treated for early age of children.

Our result about acceptance of Top Nutri corresponds to the result of the acceptability trial conducted in Afghanistan.

Moreover the trial carried out by Medicine San Frontier in Zambia and our clinical trial have same results showing that Top Nutri can be acceptable product for population who are at greatest need of vitamin and minerals.

The result of survey conducted in East Timore, Sri Lanka and Afghanistan shows that 93-96% of all participants agreed that the Top Nutri is easy to use product and these results correspond to our survey result.

According to Yves Kameli (2000), at least three years are required to completely treat the stunting. So the result shown within the 2 months confirms that if we can use this product in appropriate way it is fully possible to completely treat and prevent from stunting.

Therefore, Top Nutri may influence on treatment and prevention of stunting if it is used correctly in terms of quantity and quality, because firstly as it contains full range of vitamins and minerals, secondly as it is easy to use and finally as it has no side effects.

## **FIVE. CONCLUSION**

1. The life condition is almost same for both groups and it can be considered that the sample population of study meets the requirements of clinical trial as principles of being same except intervention using in research.
2. The possibility of improvement of stunting condition is 1.95 times higher for 12-36-months-old children who received Top Nutri than peer children who did not receive this supplement. The possibility of improvement of underweight condition is 2.14 times higher for 12-36-months-old children who received Top

Nutri than peer children who did not receive this supplement. This product has more positive effect for young children rather than old children.

3. Top Nutri can be acceptable product for young children in Mongolia.

## **SIX. RECOMMENDATION**

In the framework of principles “to provide target population with micronutrient supplements until the the food products will sustain sufficient amount of enriched and fortified micronutrients” of “Mother and child micronutrient deficiency prevention strategy” adopted in 2005, Top Nutri- multiple micronutrient supplements can be used for the target population.

Moreover, in the frame of activities “to reflect into the budget a required budget necessary for supplying the target population with micronutrients supplements” of this strategy, this product is cost effective and acceptable product for Mongolian children.

Since multiple deficiencies coexist, there has been increased interest in the potential benefits of multiple micronutrient supplements.

## **SEVEN. The publication of study**

1. Influence of Top Nutri-multiple micronutrients supplement for 12-36 months- old stunted children., Mongolian Journal of Health Science. 2007. April, Vol4 N 1 (accepted);
2. Influence of Top Nutri-multiple micronutrients supplement for 12-36 months- old stunted children., Public Health and Education Research Conference. p 118-124, UB 2007.