Original Article

Local food supplementation and psychosocial stimulation improve linear growth and cognitive development among Indonesian infants aged 6 to 9 months

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Background and Objectives: To evaluate the effect of culturally-relevant food supplementation and psychosocial stimulation on infant growth and development. **Methods and Study Design:** A community-based randomized controlled trial was conducted in 40 clusters from 5 selected villages in Tanah Datar District of West Sumatera, Indonesia. We assessed 355 infants aged 6 to 9 months at the beginning of the study. The infants were divided into 4 groups: 1) Food Supplementation (FS); 2) Psychosocial Stimulation (PS); 3) Food Supplementation and Psychosocial Stimulation (FS+PS); and 4) Control Group (CG). The formula food supplement was comprised of a variety of local food sources (local *MP-ASI*) and adjusted for the local habits. The quality of psychosocial stimulation was assessed with the Infant HOME inventory method. Progress at 6 months was assessed by anthropometry and the Bayley scores of cognition, language and motor function. **Results:** There were improvements in linear growth, cognitive and motor development of children in the FS ($p<0.05$) and the FS+PS ($p<0.01$) groups compared to the CG. After six months of intervention, mean length increased to 6.86±2.08 cm and 6.66±2.41 cm for FS and FS+PS respectively ($p<0.05$). With the combination of food supplementation and psychosocial stimulation (FS+PS), cognitive development increased to 21.4±12.2 points (effect size 0.56) ($p<0.01$) and motor development increased to 20.7±18.4 points (effect size 0.50) ($p<0.001$). **Conclusion:** Combined intervention with local food supplementation and psychosocial stimulation improved infant growth, cognitive and motor development.

Key Words: food supplementation, psychosocial stimulation, growth and development, infants, Indonesia

INTRODUCTION

Stunting (unhealthy shortness) and what it means for nutritional status remains a threat to health, growth and development of children worldwide. The Lancet Series on Maternal and Child Undernutrition estimated that some 178 million children under 5 years suffer from stunting, the vast majority in South-Central Asia and Sub-Saharan Africa.[1] In Indonesia, the Basic Health National Survey of 2013 showed a prevalence 37% for stunting in children-under-five.[2] From conception until two years of age, children grow and develop rapidly,[3] and nutritional demands are high. Most growth faltering happens in this period of life, and low birth weight contributes to it. Nutritional problems that have been experienced in the prenatal period and during early childhood not only increase the risk of infant morbidity and mortality, but also affect long-term growth and child development.[4] Early life interventions to prevent growth failure and support optimal growth in children are needed.[5]

Intervention studies on nutritional supplementation and psychosocial stimulation conducted towards Indonesian infants showed that complete intervention was more effective with social, emotional, mental, and psychomotor development.[6,7] However, data on the impact of nutritional supplementation and psychosocial stimulation for growth and development of children is still inconsistent. Intervention study towards infants with nutritional supplementation and psychosocial stimulation based on local culture approach has not been conducted yet in West Sumatera Province. The aim of this study therefore was to design and to investigate the effect of nutritional supplementation and psychosocial stimulation on growth and development, based on local culture approach, towards infants aged 6 to 9 months living in Tanah Datar District, in West Sumatera Province, Indonesia.

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METHODS

Study design and subjects

The study design was a cluster-randomized control trial. It was conducted from January to December 2013 in Tanah Datar District of West Sumatra Province, Indonesia. The district was chosen on account of a high prevalence of so-called 'stunting' (36%) in infants aged 6 to 12 months. Tanah Datar is the centre of Minangkabau culture in West Sumatra Province. Families were of low to middle socio economic status and the area was easily accessible.

We included infants aged from 6 to 9 months at study commencement who were apparently healthy, predominantly breast-fed, and did not have symptoms of chronic or severe illnesses, severe clinical malnutrition or congenital abnormality. Infants with low birth weight or growth faltering were included. The targeted sample size was 54 infants, calculated on a 1.5 design effect for cluster randomized design. The total sample size was 81 infants for each intervention group. With a dropout of 10%, the total sample size for four groups was 355 infants. This was calculated using sample size formula hypothesis testing between two means.[8]

Selection and randomisation

In Tanah Datar district, 40 sub-villages *(Jorong)* from five sub-districts were selected and formed the study clusters. First, a list of infants aged 6 to 9 months, with the names and demographics from all of the sub-villages was obtained from the Community Health Center with the help of the midwives. The list was confirmed by Community Health Workers in each sub-village. Each cluster had 6 to 12 eligible infants with a total number of 355 infants. The sub-villages or *Jorong* were randomly assigned to one out of four interventions in a 2x2 factorial design, namely 1) Food Supplementation group (FS-group); 2) Psychosocial Stimulation group (PS-group); 3) Food Supplementation and Psychosocial Stimulation group (FS+PS-group); and 4) Control group (C-group). Randomisation was done with random number tables. All infants in any cluster received the same intervention.

Interventions

All mothers or caregivers of the infants were invited to Community Health Centers. They were expected to bring identification card. They received a full explanation about the purpose of the study, as well as the study procedures. Weight and length of the infants were assessed and mothers were interviewed for characteristics of parents, health status, food intake and lactation habits. Assessments of cognitive, language and motor development were made using the Bayley Scale of Infant Development Third edition (BSID-III), and assessment of quality of psychosocial stimulation using The Infant HOME Inventory Method.[9,10] Finally, infants were enrolled into their assigned intervention group. After 180 days of intervention, all baseline measurements were repeated.

Food supplementation

The food supplement was developed in collaboration with the Department of Nutrition of the Polytechnic of the Health Ministry of Health in Padang, West Sumatra. In 2010-2011, a formula food was devised using local food sources (local *MP-ASI*) and adjusted for local habits in West Sumatra. Three formulas were pre-tested for acceptance by mothers and their infants. These three local formulas contained red sweet potatoes, purple sweet potatoes, red rice, red bean, green bean, soy bean, and dried fish. All formulas ware mixed with cooking oil, a little sugar and salt as three composite food supplements, each iso-protein and iso-energetic. The three formulas were used as slurry with the addition of water; they met the WHO ideal criteria for energy density, pH, and viscosity. Viscosity was measured with a rotation viscosimeter RV no.4 at 50 rpm (40℃). pH was assessed with an Accumet pH-meter. The nutrient composition was analysed using the Nutri Survey Programme and lists of the nutrient composition of local foods.

Packets of formula were adjusted for age group (6-8 months, 9-11 months, >12 months) with 200 to 250 kcal of energy and 6 to 8 gram of protein. The nutrient compositions were standardized according to the nutrition recommendations for infants in the three age categories. A hand book for mothers or caregivers was written to explain how to prepare and administer the food supplements, and provided other information about complementary feeding for their infants at home.

Psychosocial stimulation program

Mothers or caregivers of infants that were assigned to one of the psychosocial stimulation groups were invited to attend weekly parenting classes. Parenting classes were conducted every week in the Center of Early Child Education (PAUD) or in the Center of Integrated Services (*Posyandu*) in each village and took place at least 24 times for one hour during the 6-month intervention study.

A hand book for psychosocial stimulation, *Manjujai*, written in local language, was developed in conjunction with a psychologist and an anthropologist. It contained 24 play sessions to enable the mothers or caregivers to play with their infants. This was based on a previously successful study conducted in Lombok, East Nusatenggara, Indonesia.[11] The play sessions were standardised according to the social, emotional, cognitive and motor development of children aged 6 to 24 months. The book comprised plays and songs traditional for the Minangkabau culture of West Sumatra, Indonesia. During the parenting class, mothers or caregivers were taught how to be responsive to their infants and to give them psychosocial stimulation in order to promote their child's development. The main focus of the play session program was to improve maternal-child interaction.

Community Health Workers and field assistants were also trained in the study procedures and psychosocial stimulation following a semi-structured curriculum. This aimed to improve the knowledge of field workers about child growth and development, as well as to give mothers and caregivers the skills to provide psychosocial stimulation at home. The training lasted two days and was run by an expert in parenting and child development. Trained community health workers conducted the *Manjujai* play sessions and parenting class for one hour each week with the infants and their mothers or caregivers. Mothers or caregivers were expected to practice the *Manjujai* play

activities at home every day. To facilitate this activity, toys and picture books were provided so that mothers or caregivers had the necessary facilities at home.

Follow-up measurements

All infants and their mothers were visited weekly by a trained health worker to monitor and reinforce compliance with the two intervention programs. During the visits, mothers or caregivers in the PS and FS+PS groups performed the *Manjujai* with their infants at home. Other family members of the infants were also encouraged to perform *Manjujai* with the infants as is usual in Minangkabau culture. Preparation of the food supplements was monitored in the FS and FS+PS groups, and problems corrected. Compliance data for food supplement usage and psychosocial stimulation were recorded for monthly evaluation.

Anthropometry

All anthropometric measurements were performed by trained dietitians using standard techniques as described by Gibson R.[12] Before and during the study, dietitian performance as interviewers was monitored. The inter-observer reliability between interviewer and researchers for 20 infants was high (r from 0.86 to 0.92). Anthropometric measurements were taken at baseline (month 0), at mid-point (month 3), and at the end of the intervention (month 6). Body weight of infants, who wore light clothes without shoes, was measured with an electronic scale (precision of 0.1 kg). Length for recumbent children under 2 years was recorded with a measuring board (precision 0.1 cm).

Dietary intake

Infant dietary intakes were assessed at home by dietitians using a 24 hour food recall at baseline and study end. Intakes from breastfeeding were not measured. Any nutrition supplement given by mothers or caregivers was recorded in the monthly dietary assessment and at the final evaluation.

Development assessment

The cognitive, language, and motoric development of infants ware assessed by using The Bayley Scale of Infant Development the Third Edition (BSID-III) at baseline and study end, administered by trained psychologists at the Community Centre. Those who could not come to the Community Center were tested at the infants' houses. All items in the Bayley III instrument have been translated into Indonesian language and the testing was under supervision by a Psychologist Consultant.

The HOME inventory assessment

The quality of stimulation at home was assessed by questionnaire and observation according to the Calldwell and Bradley HOME inventory for infant or toddler. This instrument has been modified for Indonesian infants. The internal reliability was tested before the beginning of the study and the final instrument comprised 40 questions for which Cronbach's alpha was 0.826. Two psychologists visited the infants' homes and administered the HOME inventory at baseline and after 6 months of intervention. Inter-observer reliabilities with 50 mothers were >0.92 for interviewers' HOME inventories.

Compliance

Compliance was recorded in two ways: by daily record of health volunteer/cadres who distributed the food supplements and by weighing the remaining of food supplements at the end of each weekly period. Two assistant researchers observed mothers or caregivers who had practiced the psychosocial stimulation module in the parenting class. The assistant researchers stayed on location to organize and monitor compliance.

Ethical approval

The study protocol was approved by the Ethics Committee of the Faculty of Medicine of Andalas University Padang, Indonesia. Each mother received an explanation about the purpose and how the research was to be conducted. Both oral and written parental consent were obtained before the start of the trial. Research permits were obtained from the Faculty of Medicine, Andalas University, of Padang as well as from the district government of Tanah Datar Distric in West Sumatra Province.

Statistical analysis

The data were analyzed using the SPSS-Win version 20 (SPSS Inc. Chicago). After collecting the data, cleaning and coding, the data entry was conducted. The normal distribution of continuous data was checked by using the Kolmogorov-Smirnov test of normality. Anthropometric indices were calculated with WHO Anthro 2005 software and expressed as mean±SD of the z-score for weight-for-age (WAZ), height-for-age (HAZ), and weight-for-height (WHZ).

Cognitive, language and motor development scores were expressed as mean±SD. Baseline characteristics of all subjects at the end of the intervention were compared to those of infants that were lost to follow-up by using independent-samples t test. The relation between the nutrition status and development variables with characteristics and socio-economic background were examined by Pearson's correlation. Paired samples t test was used to compare the groups at baseline in order to confirm the homogeneity within groups in terms of nutrition status and development outcomes, and other possible confounders during the intervention period. Statistical comparisons were done by Wilcoxon signed rank test and Kruskal-Wallis test for variables that were not normally distributed. Group comparisons (control vs intervention) were perfomed by using independent-samples t test for continuous variables and Chi-square test for categorical variables. We compared the characteristics of the groups to each other by using Analysis of Variance (ANOVA). Cohen's effect size was applied to measure difference of WAZ, HAZ, WHZ and developmental score. Multiple linear regression analyses was used to measure the relationship between the age of each infants, weight and birth length, number of births, father's occupation and age, food intake, HOME score as covariates with score anthropometry and score development as the study outcomes.

RESULTS

There were 355 infants aged 6 to 9 months enrolled in 40 clusters in randomised cluster trial at the baseline. Each cluster consisted of 6 to 12 infants who were randomly allocated to Food Suplementation-group FS (n=92), Psychosocial Stimulation-group/PS (n=90), Food and Psychosocial Stimulation group/FS+PS (n=93) and Control-group /CG (n=80). All infants in a cluster got the same intervention. About 23% (84 infants) were not able to be measured in the final assessment leaving a total 271 infants included in the analysis (Figure 1). The reasons for loss to follow-up were mainly migration out of the residential area, migration into other towns, refusal from the infants' parents, and the death of one infant during the study. The comparable test showed that there were no significant differences of available sample infants included in the analysis with the infants who dropped out (p>0.05).

Baseline characteristics

A number of characteristics of the infants and their parents were measured at the beginning of the study and these are listed on (Table 1). There were no significantly difference between groups of any of these characteristics infants and their parents at the time of enrolment (p>0.05).

Treatment effects

Growth and nutrition status

There was a significant difference before and after 6 months of intervention among groups for anthropometric

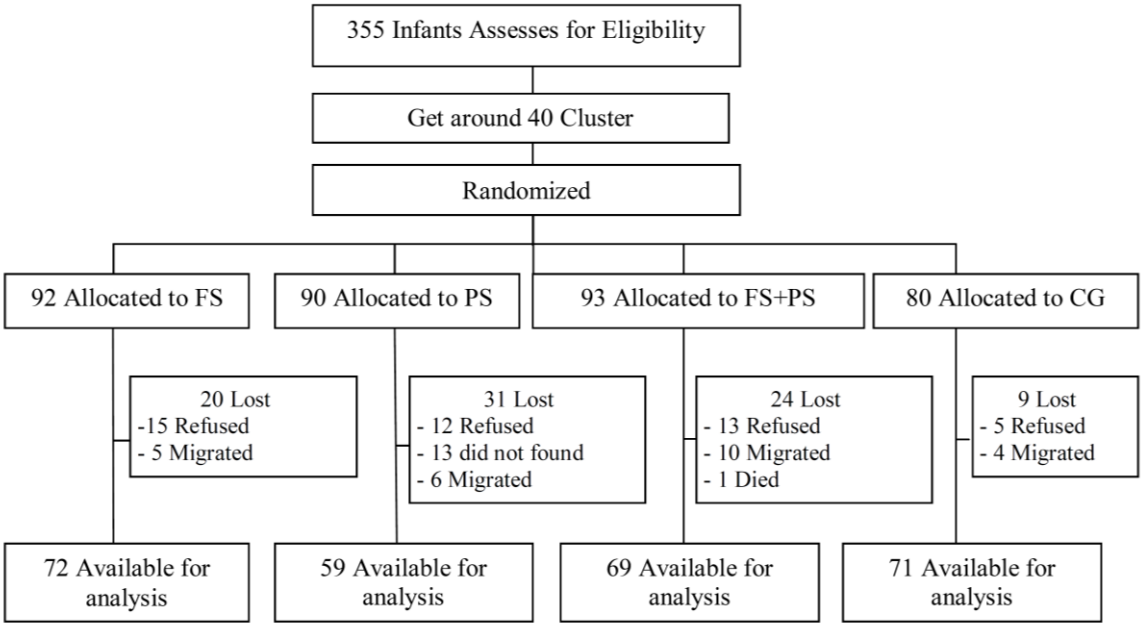

Figure 1. Study Profile. Flow charts of the sample enrolled untill final analyses

Table 1. Characteristics of infants and their parents by group of treatment on enrolment

Characteristics	FS-group (n=72)	PS-group (n=59)	FS+PS-group (n=69)	C-group (n=71)	p value
Infants					
Age (year, mean±SD)	7.5±1.18	7.6±1.12	7.6±1.25	7.9±1.26	0.650*
Sex (n (%))					
Boys	37 (51)	31 (48)	41 (59)	40 (59)	0.772**
Girls	35 (49)	28 (52)	28 (41)	31 (41)	
Exclusive breastfeeding (n (%))	41 (57)	25 (42)	31 (45)	43 (60)	0.096**
Birth weight (kg, mean±SD)	3.15±0.42	3.06±0.42	3.13±0.44	3.03±0.40	0.393*
Birth length (cm, mean±SD)	49.3±2.50	47.6±3.30	47.9±3.55	47.9±4.80	0.191*
Birth order (mean±SD)	2.29±1.40	2.39±1.50	2.26±1.33	2.06±1.10	0.579*
Parents (mean±SD)					
Mother's age (year)	31.1±3.57	30.1±6.32	30.7±6.02	29.9±5.69	0.163*
Mother's length of education (year)	11.8±2.59	10.7±2.93	11.2±3.21	10.7±2.85	0.085*
Mother's BMI	22.7±3.41	22.2±3.01	22.7±3.84	21.9±3.25	0.327*
Mother's parity (person)	2.39±1.46	2.39±1.50	2.22±1.07	2.10±1.10	0.531*
Father's age (year)	36.4±7.58	34.5±6.70	35.0±5.93	33.9±6.16	0.522*
Father's length of education (year)	10.6±3.11	9.36±2.96	10.4±3.04	10.3±2.82	0.119*
Number of household members (person)	4.85±1.53	4.83±1.85	4.55±1.33	4.35±1.33	0.186*

FS-group: Food Supplementation-group; PS-group: Psychosocial Stimulation-group; FS+PS-group: both Food Supplementation and Psychosocial Stimulation-group; C-group: Control-group.

* p>0.05 (One way ANOVA test); ** p>0.05 (Chi-square test).

measurements. Body length was significantly increased in the food supplementation (FS) and the combined food supplementation and psychosocial (FS+PS) groups by comparison with the control (CG) and psychosocial alone (PS) groups (Figure 2). Infants who received psychosocial stimulation only and had combined food supplementation and psychosocial stimulation showed significant increases in Z-scores for WHZ (effect size 0.6), in contrast with Z-scores for HAZ (effect size -0.5) when compared with control (Table 2). The smallest changes were in the Z-scores for HAZ before and after the intervention, with an average of -0.24 (±0.88) found in food groups. There was a significant difference in the Z-score changes for HAZ (p<0.05), but there were no significant differences in the Z-scores for WAZ in any group (p>0.05).

Development

The Bayley Scale III measurement at table 3 showed that the cognitive score at baseline was 97.7 points (±11.2) and increased to 119 points (±9.52) with the difference 21.4 points (±12.2) after 6 months of intervention with the combination of food supplementation and psychosocial support. There were significant differences in the scores of cognitive and motor development of infants at the end of the intervention in each group (p<0.01), but there were no significant differences in the score for language development.

DISCUSSION

The present study shows that there is a significant difference in length of the infants before and after 6 months of intervention with nutrition supplementation. However, the percentage increase in body weight was lower. Based on the results of this study, the body length of the infant increased to an average of 4.51 cm after 3 months, and 6.86 cm after 6 months of the intervention with food supplementation. It was concluded that the increase in body length of the infants given food supplementation was significantly greater than the control group.

Combined food supplementation and psychosocial stimulation *Manjujai* has been shown to have a positive effect on the nutritional status of infants. There was a decrease in the proportion of underweight infants (z-scores WAZ), 4.1 % lower than that of the control group at the end of the intervention. However, the treatment did not decrease stunting (z-scores HAZ). The proportion stunted increased by 7.4 % at the end of intervention. The decline in infant growth, based on Z-scores for WHZ, HAZ and WAZ, is typical in developing countries, including Indonesia. In the present study, we found that energy intake improved with food supplementation and appetite enhancement in association with psychosocial stimulation.

Food supplementation can increase weight and height within 6 months, but it is less effective in regard to linear growth (catch-up) of stunted infants with a limited time frame. It seems that the acceleration of linear growth is difficult if infants live in a poor neighborhood. Nevertheless, height potential defies determination ahead of puberty[13,14] and, indeed, even in retrospect. The question of optimal height is now under scrutiny and has implications for the efforts to address the perceived problem of stunting, which often captures those who are healthfully short.

A Bangladesh study showed that children given food supplements did not have a change in linear growth, since the children continued to be in a state of malnutrition and remained stunted after 6 months of intervention. This study concluded that combined nutrition supplementation and psychosocial stimulation should be pursued for longer periods.[15]

With nutrition supplementation for 3 months of infants aged 12-18 months in Bogor, Indonesia, there was a posi-

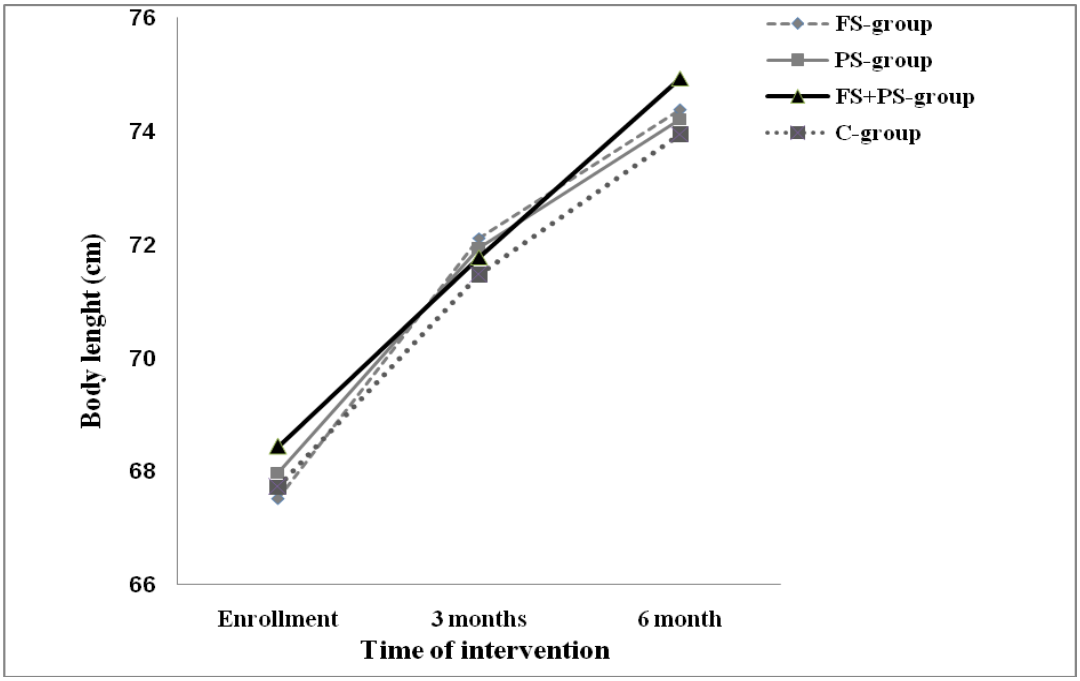

Figure 2. Increasing of body lenght (cm) of infants from enrollment to 6 mo of intervention. Each groups: FS-group: Food Supplementation-group (n=72); PS-group: Psychosocial Stimulation-group (n=59); FS+PS-group: both Food Supplementation and Psychosocial Stimulation-group (n=69); C-group: Control-group (n=71).

Table 2. Anthropometric indexes of the children at enrolment and 6 mo later‡

Variables	FS-group (n=72)	PS-group (n=59)	FS+PS-group (n=69)	C-group (n=71)	*p* value
Weight (kg)					
Enrollment (mean±SD)	7.64±0.84	7.55±0.93	7.52±0.85	7.52±0.90	0.853
6 mo	8.92±1.04	8.89±0.94	9.03±0.86	8.77±0.84	0.850
Change (Δ)	1.28±0.76*	1.33±0.07*	1.50±0.73*	1.43±0.761	0.197
Length (cm)					
Enrollment	67.5±2.45	68.0±2.90	68.4±2.97	67.7±2.59	0.219
6 mo	74.4±2.64	74.2±2.77	74.1±2.27	73.5±2.11	0.673
Change (Δ)	6.86±2.08*	6.24±2.30*	6.66±2.41*	5.81±2.50*	0.013**
Weight for length z score/WHZ					
Enrollment	-0.21±0.99	-0.61±0.98	-0.74±1.09	-0.42±0.92	0.449
6 mo	-0.37±1.07	-0.31±0.94	-0.17±0.81	-0.41±0.91	0.011**
Change (Δ)	-0.16±1.12	0.30±0.88	0.57±1.15	0.00±0.93	0.001**
Length for age z score/HAZ					
Enrollment	-0.61±1.01	-0.36±1.25	-0.24±1.15	-0.78±1.05	0.281
6 mo	-0.86±1.04	-0.89±0.92	-1.11±0.93	-0.80±0.81	0.021**
Change (Δ)	-0.24±0.88*	-0.53±1.17*	-0.87±1.12*	-0.01±0.86*	0.002**
Weight for age z score/WAZ					
Enrollment	-0.55±0.83	-0.71±0.93	-0.73±0.99	-0.79±0.93	0.636
6 mo	-0.68±1.01	-0.65±0.88	-0.62±0.78	-0.80±0.81	0.468
Change (Δ)	-0.12±0.78	0.06±0.76	0.11±0.88	0.01±0.86	0.368

FS-group: Food Supplementation-group; PS-group: Psychosocial Stimulation-group; FS+PS-group: both Food Supplementation and Psychosocial Stimulation-group; C-group: Control-group.
‡All values are mean±SD. Value for Z-Score from National Center for Health Statistics reference data.
*Significantly different before and 6 mo later within groups. $p<0.05$ (Paired *t*-test).
**Differences significantly different from that in the control groups. $p<0.01$ (One way ANOVA).

Table 3. Bayley scores of all groups at baseline and final test session‡

Developments	FS-group (n=72)	PS-group (n=59)	FS+PS-group (n=69)	C-group (n=71)	*p* value
Cognitive Score					
Enrollment	100±8.10	100±8.50	97.7±11.2	98.0±11.0	0.205
6 mo	117±11. 7	119±10.3	119±9.52	113±10.8	0.003
Change (Δ)	16.0±10.5*	18.9±12.6*	21.4±12.2***	15.3±12.6*	0.014**
Language Score					
Enrollment	97.5±10.5	99.4±11.7	95.6±10.5	98.5±12.5	0.233
6 mo	109±13.0	112±11.2	108±11.0	108±11.0	0.280
Change (Δ)	11.0±12.7*	12.4±14.1*	12.7±14.0*	11.4±13.7*	0.591
Motoric Score					
Enrollment	95.3±12.6	95.3±12.6	91.0±16.7	98.2±17.5	0.811
6 mo	111±14.7	112±14.3	112±13.9	109.8±10.8	0.012
Change (Δ)	16.5±16.4*	15.8±16.8*	20.7±18.4**	11.6±15.8*	0.005**

FS-group: Food Supplementation-group; PS-group: Psychosocial Stimulation-group; FS+PS-group: both Food Supplementation and Psychosocial Stimulation-group; C-group: Control-group.
‡All values are mean±SD assessed by The Bayley Scale Infant Development Thirth Edition (2006).
*Significantly difference before and 6 mo later within groups. $p<0.05$ (Wilcoxon sing ranks test).
**Significantly different from that in the control groups. $p<0.01$ (Kruskal Wallis test).
*** Siginificantly different the FS+PS-group. $p<0.01$ (Kruskal Wallis test).

tive effect on body weight, but a longer period (12 months) with added micronutrients was needed to improve body length.[16] Yet it has been found that combined food supplementation and psychosocial stimulation can minimise growth faltering in infants, in order to reach WHO standards.[5,17]

Our study significantly improved cognitive and motor development scores, especially in the group which combined nutrition supplementation and psychosocial stimulation. The success of the study depended on the training and ability of field workers (cadres and health workers). The field workers were active cadres who also worked as early child educators in the local community. They distributed the nutrition supplements and held monthly parenting education sessions. Field workers recorded the acceptance of food supplements and the quality of psychosocial stimulation of *Manjujai*, given by mother or caregiver at home. Supervision of home visits was provided by researchers along with field workers.

According to McGregor, environmental practices can foster psychosocial stimulation and correlate with cognitive development, formation of motor skills, and contribute to emotional wellbeing.[18] A sub-scale of the indicators in environmental practices which foster psychosocial stimulation identifies parents or caregivers responsive to the needs, emotional and verbal, of the infants.[19]

According to Wachs et al[20] the integration of nutrition supplementation and psychosocial stimulation sufficient

since the early age of the child's life contributed to improve the interaction between mother and child and their biological and psychological processes that occur in improving child development. This process can also improve the child's immune system and decrease morbidity risk. The first two years of life is sensitive to adequate nutrition and psychosocial stimulation for growth and brain development.[20]

Although there are limits to the provision of different games for infants, most parents found simple games to be available in their respective households. After 6 months, all parents could teach at least 24 games for psychosocial stimulation by *Manjujai* as developed in the parenting classes. The study showed there to be an increase in the total score and in two aspects of the HOME subscales. These two were the parents response to their infants' emotional and verbal cues, and the ability to provide varied and daily stimulation.

We found that infants in the food supplementation groups, with the additional intake of nutrients, including energy protein and other food components, were more active and able to carry out activities and have better motor development. Provision of the psychosocial stimulation *Manjujai* in this study also encouraged the interaction of mothers or caregivers with their infants and improved the HOME environment that impact on improve cognitive development of infants. Therefore, food supplementation and psychosocial stimulation based on local culture might be applied consistently and regularly, for a more holistic and integrated approach to infant growth and development.

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AUTHOR DISCLOSURES

The authors declare that none has a conflict of interest with the manuscript. The views expressed are those of the individual authors, and not attributable to any support organization.

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