Special Report

Expert meeting on child growth and micronutrient deficiencies – new initiatives for developing countries to achieve millennium development goals: executive summary report

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Undernutrition in early childhood has long-term physical and intellectual consequences. Improving child growth should start before the age of two years and be an integrated effort between all sectors, covering all aspects such as diet and nutrient intake, disease reduction, optimum child care, and improved environmental sanitation. To discuss these issues, the Indonesian Danone Institute Foundation organized an expert meeting on Child Growth and Micronutrient Deficiencies: New Initiatives for Developing Countries to Achieve Millennium Development Goals. The objective of the meeting was to have a retrospective view on child growth: lessons learned from programs to overcome under-nutrition in the developed countries and to relate the situation to the Indonesian context, as well as to discuss implications for future programs. Recommendations derived from the meeting include focus intervention on the window of opportunity group, re-activation of the Integrated Health Post at the village level, improvement of infant and young child feeding, expand food fortification intervention programs, strengthen supplementation programs with multi-micronutrient, and strengthening public and private partnership on food related programs.

Key Words: child, growth, micronutrient, deficiencies, Indonesia

INTRODUCTION

Undernutrition is still a problem in developing countries, including Indonesia. In the last ten years, this situation is worsened by the non-prioritization of nutrition in the government planning and policies. The inconsistencies of programs and interventions call for a new re-spirited effort in combating the malnutrition problems. This expert meeting is one of the three satellite meetings held in conjunction with the IX National workshop on Food and Nutrition, a four-yearly event organized by the Indonesian National Institute of Sciences. Recommendations from the workshop are an important reference for government planning. This expert meeting presents retrospective view on child growth, including lessons learned from programs to overcome under-nutrition in developed countries, and to relate the situation to the Indonesian context. Conclusion and recommendation for future programs were derived from the meeting.

LONG-TERM PHYSICAL AND INTELLECTUAL CONSEQUENCES OF UNDERNUTRITION IN EARLY CHILDHOOD

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Background

Stunting, defined as a height for age more than two stan-

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dard deviations below the reference median (<-2 Z-score), is a marker of deficient physical and cognitive development in children and is the best predictor we have of long-term human capital. About a third of the world's young children are stunted.[1] The process of linear growth failure begins in utero and continues up to the second or third year of life, depending on the setting. The causes of growth failure can ultimately be traced to poverty and are well identified through the UNICEF conceptual framework of undernutrition. Inadequate quantity and quality of food available to households, suboptimal family sanitation and poor access to quality health care, as well as poor parenting and childcare practices are causes that operate at the household level. These factors lead to inadequate nutrient intakes and high rates of infection in children, which in turn interact to cause growth failure and poor nutrition. When growth failure occurs it means that many functions, such as immune function, are compromised. For this reason, undernutrition increases case fatality rates. Children who fail to grow well also interact poorly with their environment and have fewer and less productive learning experiences. Poor nutrition also affects brain development directly. The long-term consequences of undernutrition in children are now better documented. They include short adult height and reduced lean body mass, characteristics that place women at greater risk of having newborns of low birth weight as well as increased risk of delivery complications and possibly death. These body size characteristics also lead to reduced work capacity and earnings. Long-term studies document strong relationships between stunting in early childhood and compromised measures of human capital such as school achievement, reading ability and intelligence, even after controlling for parental education and early life socioeconomic status.

Study Design and methodology

The Instituto de Nutrición de Centro America y Panama (INCAP) longitudinal study was undertaken between 1969-1977 to examine the effect of improved nutrient intakes, particularly protein, on physical and mental development of children in Guatemala.[2] Two large villages and two small villages were randomly selected for the study out of 300 rural communities. Since 1969 two villages (1 large and 1 small, selected at random from the two pairs) received Atole, a nutritious supplement made from Incaparina (a vegetable protein mixture), milk and sugar, and two (1 large, 1 small) villages received Fresco, a less nutritive drink. In 1971 both supplements were fortified with micronutrients in equal concentrations. All children seven years or younger in 1969 were enrolled as were all newborns born between 1969 and 1977; all children were studied until they turned 7 years of age or until the end of the study. The study involved 2392 children who were studied for varying periods of time from 0-7 years of age. Between 2002-2004, 77% of those alive and living in Guatemala (n=1856) were re-interviewed and examined; they were about 32 years old by then.

Results and Discussion

There were no differences between the lengths of children in Atole and Fresco villages at baseline. However, after supplementation, children from Atole villages grew faster during the first three years of life than those in fresco villages and were longer at three years of age. Atole did not improve growth after 3 years of age. In a series of publications we have shown the effects of exposure to Atole during childhood on adult function (height and lean body mass, intellectual functioning, schooling, and wages) but here we wish to emphasize findings from our study that relate to stunting at three years of age to adult function. For these analyses, the degree of stunting at three years of age was divided into three categories: severe (less than 3 standard deviations below the median or -3 Z-score), moderate (between -2 and -3 Z-score) and mild (not stunted or above -2 Z-score). Stunting at three years of age was a strong predictor of adult height and the increment between three years of age and adult height was similar across all categories of stunting; this indicates the absence of catch up growth. Sixty five percent of girls with severe growth retardation (<-3 Z-score) at three years of age were stunted as women (<149 cm), in comparison to only 4% of women with mild growth retardation (>-2 Z-score) at three years of age. There was also a significant difference in terms of birth weight (in grams) of the next generation according to levels of growth retardation in height at three years of age of the mother. The mean birth weight of children of mothers with mild growth retardation (>-2 Z-score) at three years of age was 67 grams more than the grand mean of birth weight of all 3 groups and the mean birth weight of children of mothers with severe growth retardation (<-3 Z-score) was 80 grams lower than the grand mean, 2988 grams (n=446). Thus, the birth weight difference between newborns of women with mild compared to severe growth retardation was about 150 grams. The incidence of intrapartum Cesareans was associated with maternal height in a separate study conducted in the Social Security Hospital of Guatemala.[3] The shorter the maternal height, the greater the incidence of Cesarean section. For example among those with stature <148 cm, the incidence was 23.9%, while in the tallest quartile, the incidence was only 11.1%.

Reading Scores (Inter-american Series) were lower among those who experienced severe stunting at 3 years of age. The difference among the extremes was 15 points in men, and 11 points in women. Similar trends were observed for years of schooling; those with severe stunting at 3 years of age had the lowest years of schooling.

The results also showed substantially lower incomes in adults who were severely stunted at three years of age. Annual income per capita (USD) was lower in those who experienced severe stunting at three yrs of age as compared to those with mild stunting at 3 years of age. The difference between the extremes in men was USD 903, and in women was USD 656.

Conclusions

Evidence from Guatemala has confirmed that undernourished children are more likely to become short adults and to give birth to smaller babies; stunting is associated with poor cognitive development and lower educational achievement; poor fetal growth or stunting in the first 2 years of life leads to reduced economic productivity in adulthood. These findings indicate that child's height for age is the best predictor we have of human capital.

Other evidence indicates that children whose early growth is restricted and who gain weight rapidly later are more likely to have high blood pressure, diabetes and both cardiovascular and metabolic disease; supporting programs to improve early nutrition and growth, could, therefore, lower the incidence of chronic disease. There is no evidence that rapid length gain in the first two years increases risk of chronic diseases. Rapid weight gain, or more precisely rapid increases in weight for height or BMI, particularly after two years of age, increase risk of later chronic disease.

In summary, damage suffered in early life leads to permanent impairment and rapid weight gain after being undernourished increases chronic disease risk as adults. The evidence is overwhelming that child undernutrition is a significant public health problem that is both an outcome of poverty as well as a cause of poverty because it reduces human capital and earnings.

IMPROVING CHILD GROWTH–THE POTENTIAL CONTRIBUTION OF VARIOUS INTERVENTIONS
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Background
The global picture of under-weight among children under the age of five shows similar pattern across regions (Africa, Asia, and Latin America and the Caribbean), whereby growth faltering starts at 3-6 months. This condition will have negative consequences on achieving optimal potential growth. The growth of these children can be shifted to approaching close to optimal growth within 10-15 years by a sound nutrition intervention and favourable living environment. A nutrition surveillance program in the United States showed that it took more than ten years for Asian refugee children to catch-up growth, i.e. the decline in stunting prevalence from 19% in 1981 to 5% in 1993. These children were refugee children from Vietnam, Cambodia, and Laos, who came to the US post Vietnamese war. Furthermore, there was an upward shift of the entire Height distribution by 1.2 SD or an increase of 8 cm height or 3 kg in weight (using children at the age of 2 years as a reference). From this example, we can see that nutrition improvement does not happen over night. I would like to take this gain of 8 cm height and 3 kg weight as the focus of my presentation. This gain may have also increase IQ to 10 points. However, there is limited measurement that can measure IQ (learning powers).

This paper showed evidence about what can account for the improvements, how much can we gain by improving feeding in infancy and childhood, efficacy, how micronutrients make a difference on growth, the impact of infectious disease (diarrhea) on growth, and the importance of integrated strategy for achieving potential height. I would like to present some good quantitative information, so that we can do some really good economic analysis, to make arguments to support nutrition and to convince policy makers.

Results and Discussions
As nutritionists, we tend to improve nutrition by improving diet and nutrient intake. In the UNICEF Conceptual framework for assessing and analyzing the causes of malnutrition, we can see that there are other factors that we have to consider, such as environment, sanitation, clean water, better health care, socio economic development, and education. All those factors contribute to the outcome and should be faced as an opportunity or challenge.

The impact of dietary intervention
A meta analysis study shows that complementary feeding gave increase in height and weight as a result of various intervention strategies, an average of about 0.25 Z-score.[4] In other words, this type of intervention will result in about 2 cm increase in height and 0.7 kg in weight by two years of age. Intervention studies included in the analysis were: education, complementary food, education and complementary food, fortification of complementary food, and increase energy density.

Micronutrient supplementation
Micronutrient makes a difference on children's linear growth. A meta-analysis concluded that zinc intervention can increase 0.35 Z-score on height by 2 years of age or about 2.5 cm.[5] However, the effectiveness of zinc intervention will be better if combined with other micronutrients, e.g. vitamin-A, iron, zinc and calcium.

Another meta-analysis showed that zinc supplementation can reduce diarrheal episodes by about 14 percent.[6] As diarrheal episodes of children age before 24 months increase, the odds ratio of stunting increases. For children with 5-9 diarrheal episodes before the age of 24 months, the odds ratio for stunting is 1.5 and the impact of height reduction can be 2 cm. For children with more than 20 diarrheal episodes, the odds ratio is 3.0 and the impact of height reduction can be 12 cm. Thus, potential height gain by improving feeding, micronutrient supplement, and diarrhea reduction is 6.5 cm or about 1.0 Z-score.

Improve Feeding and Micronutrient intake from animal sources
Global food supply of total vitamin A partitioned by sources showed that about two-third of vitamin A came from animal sources, except in Asian countries where both animal and plant foods are the same in terms of sources of vitamin A.

A case in China revealed the following statistics: (1) Vitamin-A deficiency mostly suffered by children from poor families. (2) Rural children are likely to suffer from stunting as compared to their urban peers (15% and 3% respectively), with the prevalence found to be even higher in Tibet (>30%). (3) Urban families are more likely to introduce eggs at earlier ages compared to their rural peers. At 4 month old, 70% of urban children were introduced to eggs; and at 6 month old 100% were introduced to eggs. In rural areas and Tibet, even at the age of 12 months, only 50% of the children received eggs. (4) Urban families are more likely to introduce meat at earlier ages compared to their rural peers. By the age of 6 months, almost 90% of the children in urban areas were introduced to meat, while in rural areas only 10-15%. In Tibet, milk, meat and cheese are commonly available in the households, but they were not fed to the children, (5) The age of introduction of starch is lower in Tibet compared to urban and rural areas. In Tibet, the breastfeeding cycle may be disturbed by feeding the children with starch. In urban areas, 60% of the children were introduced to starch at 4 months, while in rural areas 30% were introduced at the age of 4 months. This is where nutrition education can play a role, i.e. to postpone the introduction of starch to 6 months. Furthermore, barley which is often used as supplementary foods for infants is only made up from mineral water and barley powder, without any protein. (6) The prevalence of anemia in Mongolian children is high, especially for children up to 1 year of age. The prevalence of anemia for children under the age of five is between 12 to 70%. This is contradictory to the situation, whereby iron-rich food such as milk, cheese and meat are available throughout the year, especially in winter, when vegetables are scarce, (7) Only one-third (30%) of the children consumed iron-rich food 3 times or more per week, while about 85% of mothers consumed iron-rich food 3 times or more per week. The percentage of children and mother consuming folate-rich foods 3 times or more per week is similar (about 30%). This shows that quality foods are available, but the people are not able to make use of it. This is where nutrition education can play a role.

In Indonesia, two apparent reasons for delayed introduction of animal foods into the infant diet were: tradition & lack of knowledge for children 6-11 months and unaffordability for older children.[7]

Conclusions and Recommendations

Improving child growth can be exercised by better nutrient intake before 2 years of age, including earlier and more frequent use of foods from animal sources and use of complement and multiple micronutrient fortified food.

Reduction of childhood disease, especially diarrhea can have fruitful results through exclusive breastfeeding, multiple micronutrient fortified food, clean water supply and adequate sanitation, as well as better access to primary health care. We should be communicating messages more specifically on iron and informing mothers that after the age of 6 months, it is a good idea for the children to consume chicken, meat or milk.

Although, improving child growth is not an easy task, it will be successful by integrating all efforts such as diet and nutrient intake, disease reduction and better care. Efforts made to improve the fundamental factors such as education level and socio-economic status can have an impact on the immediate factors.

FOOD FORTIFICATION WITH IRON, ZINC AND CALCIUM. PROS AND CONS FROM A NUTRITIONAL AND TECHNOLOGICAL POINT OF VIEW

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Background

Micronutrient deficiency is a world nutritional problem especially in developing countries. The most vulnerable groups in terms of deficiency are Infants and children, Teenagers, Women of reproductive ages, and pregnant women. The main causes of micronutrient deficiencies are low micronutrient intake, low bioavailability, increase micronutrient demands, as well as worm infestation and infection.

Micronutrient deficiencies may increase premature birth risk, maternal and newborn death frequency, growth retardation, impairment of cognitive function, altered immune response, and decrease work capacity and productivity. Losses attributable to incapacities and death represent 5% of the gross domestic product.[8] Combating these deficiencies in a comprehensive and sustainable manner would cost less than 0.3% of Gross Domestic Product (GDP). The cost-benefit ratio is 20, meaning that for every single dollar we invest in controlling micronutrient deficiency, economic returns due to improvements in productivity, as well as saving from health care spending amount to USD 20.

There are three strategies to cope with micronutrient deficiencies, namely pharmaceutical supplementation, consumer education and dietary change, and food fortification. Among those, food fortification is the most cost effective program, especially in developing countries. Food fortification program is usually applied to the foods that are widely consumed by the risk groups.

This paper discussed factors to be considered in the selection of fortificant, and types and bioavailability of fortificant, especially iron, zinc and calcium compounds, for food fortification, and their upper limits.

Results and Discussion

Foods used as carriers for the fortificants may include dairy product, water, beverages, juices, cereal, and derivatives, such as flour, salt, sugar, and some spices. Five factors should be considered in the selection of the fortificant, namely stability, acceptability (organoleptic), bioavailability, interactions, toxicity and cost. Stability is important since fortified food sometimes stored for long term periods, under extreme humidity, and cooked at high temperatures. Compound added to the fortificant may adversely interact.

Micronutrients have to be able to be absorbed and have good bioavailability. In addition, technology, quality control (doses and bioavailability), efficacy factors (impact evaluation), and harmonization of the food fortification process should also be considered. The doses should not cause toxicity. The procedure applied should not modify its bioavailability.

Iron

The prevalence of Iron deficiency worldwide is 30%, while in developing countries it is 40-50%, and in developed countries, 10%. The main consequences of iron deficiency are: increase premature birth risk, increase maternal and newborn death frequency, decrease psychomotor development, and decrease work capacity and productivity. The main causes of iron deficiency are low iron intake, low bioavailability of iron intake, increase of iron demands, and worms as well as *Helicobacter pylori* (Hp) infection. The following population groups are at risk of iron deficient: infants and children, teenagers, women in reproductive ages, and pregnant women.

The types of iron compounds that can be used are divided in three groups: iron compounds soluble in water, insoluble in water and poorly soluble in a diluted acid solution, and iron-protected compounds. There are four components of iron compounds, namely hemoglobin, EDTA-Fe (III), microencapsulated ferrous sulfate, and iron associated to amino acids. Hemoglobin is the natural iron compound, brown in color, and has good bioavailability. EDTA is a good fortificant for soy sauce, soy fish, and flour.

The bioavailability of iron compounds of encapsulated Ferrous sulfate (FS), Ferrous ascorbate and SFe-171 are better than iron powder and Ferric pyrophosphate. Although the bioavailability of stabilized Ferrous gluconate (SFG) is better than micro-encapsulated iron and FS, the cost of SFG is higher than micro-encapsulated iron and FS. The upper limit of SFG is about 2,050 mg/kg body weight.

In Argentina, fluid milk is fortified with microencapsulated ferrous sulphate. Fluid milk is the most important food for children but has a very low iron content. Adding standard iron, e.g. ferrous sulphate – would oxidize its fat content and produce a metallic compound, which is not safe for children. The microencapsulated ferrous sulphate was used after going through several studies, namely bioavailability study in the laboratory, toxicity study in mice, and absorption study in humans. The iron absorption of microencapsulated ferrous sulphate in milk is two times higher (9.2%) than the absorption of ferrous sulfate in milk (4%).

In Argentina we also fortify petit Suisse cheese, a common food consumed in Latin American countries, with stabilized Ferrous Gluconate. The iron compound was used after several tests, e.g. bioavailability study and toxicity in rats, and absorption study in humans. The Cuban government with its National Food Fortification Program, fortified concentrated milk with iron and zinc (30 mg/L). The program reached 120,000 children between the age of 6 to 12 month, since 2003. Now, the government wants to increase the outreach to children age 6-7 years.

Zinc

Zinc deficiency has become a world nutritional problem since it affects developed and developing countries. The median zinc intakes range between 50-80% of the recommended dietary allowances (RDA). Although newborn, children, adolescents, pregnant women and older people are considered the main risk groups, zinc deficiency may affect the whole population. The main consequences of zinc deficiency are: growth retardation, impairment of cognitive function, altered immune response, increased abortion risk, anorexia, and emotional disorders. The main causes of zinc deficiency are: low zinc intake, low bioavailability of zinc consumed, and increase in zinc demands.

Zinc compounds are classified into three categories: soluble in water (zinc sulphate), insoluble in water and soluble in diluted acid solution (zinc oxide), and zinc-protected compounds (zinc metionine, stabilized zinc gluconate). Zinc oxide has lower bioavailability than zinc sulphate. Both zinc metionine and stabilized zinc gluconate have good bioavailability and have very good behavior in various types of food. Zinc metionine, however, may transfer some sulphate to the food.

Study in rats shows that the bioavailability of zinc sulfate (ZF), zinc hydroxide (ZH), zinc gluconate (ZG) and stabilized zinc gluconate (SZG) are relatively similar (25.0–28.2 among female and 22.3–28.0 among male). The upper limit of SZG is about 2,055 mg/kg body weight.

In Argentina, we fortify petit Suisse cheese with stabilized zinc gluconate, because this type of zinc has better technological behavior and fulfilled the standard of bioavailability, metabolism, and toxicity tests. The normal growth rate in rats is recovered after a period of zinc deficiency by restoration of zinc supply as means of zinc fortified petit Suisse cheese.

Calcium

The followings are biological functions of Calcium: it is the most important extracellular cations, represents 1.5-2% of our body weight, support of the skeletal contractility, nervous excitability, blood pressure, and blood clots. The following people are at risk of calcium deficiency: older people (principally women), people during the growth period, and pregnant women. During the growth period, calcium deficiency may cause failure to reach peak bone mass. In later life, calcium deficiency may cause osteoporosis, osteopenia, decrease skeletal integrity, and increase risk of fracture.

From several food types, dairy products, meat, cereals, fruits, and cheese - cheese has the highest calcium content (600-1200 mg/100 g); as compared to milk (120 mg/100 g). Calcium can be classified into two categories: freely water soluble calcium compounds, and water insoluble calcium compounds and soluble in diluted acids. Examples of the first type are: calcium lactate and calcium gluconate. Examples of the second type of compounds are: calcium carbonate, calcium phosphate, and calcium citrate. The protected calcium compounds are: amino acid-chelate, calcium gluconate stabilized with glicine, and calcium phosphate (micro dispersion). Dairy products are fortified with calcium gluconate stabilized with glicine, after testing it for its bioavailability, biodistribution, and toxicity.

The bioavailability of Calcium Gluconate stabilized with glicine (SCaG) is better than Calcium Gluconate (CaG). The upper limit of SCaG is about 14,000 mg/kg body weight. Milk is usually fortified with calcium. The dose of calcium fortification in milk and yoghurt is 2,000 mg/L and 4,000 mg/L respectively. Currently, study on bioavailability of micro dispersion of calcium phosphate on milk fortification is being done.

Conclusions and Recommendations

In terms of bioavailability of iron, zinc and calcium compounds, the stabilized compound of each fortificant had better bioavailability than the non-stabilized compound. Bioavailability, toxicity and cost, as well as efficacy factors should be considered in planning and implementing a food fortification program.

DISCUSSION

The discussion focused on the case similarities of stunting and possible permanent growth retardation in Indonesia and the importance of nutrition improvement. From the new Basic Health data, which was collected in 2007, the prevalence of underweight is 24%, stunting 38%, and wasting 15%. These are all very high numbers. From a total number of 456 districts, only 12 districts had a prevalence of underweight below 10%. Furthermore, the mean poverty level nationally is 16%. On the contrary, the prevalence of overweight children is about 12%, whereby half of them are stunted. The new data, which is to be further analyzed, will give us an overview of health and nutrition problems countrywide. This new picture will call for a new and different approach to solve this preventable problem. Priorities should be given to districts, whereby poverty and the prevalence of both stunting and underweight are below the national average.

Although the cause of malnutrition could be genetic, genetic issues should not be an issue across countries. In an optimumal environment, child growth is very similar among most children. Reports from all five study sites of the WHO standards shows that, given the same environment, all children grow at the same rate. In rural areas of Ghana, the rural and urban children have different height, not because of their genetic differences, but because of the environment.

Intervention at infancy and before the age of two years is absolutely necessary, since it increases the chance of survival and decreases morbidity. Intervention to older children would be ineffective, because they have passed their growth potential and any rapid growth increases their chance of degenerative diseases later in life.

Because there is now convincing evidence that malnutrition is a determinant of nation building, the situation analysis in Indonesia to date gives us a challenge on how to develop appropriate intervention programs. It is very important to discuss not only on the technical issue, but also the design in the community setting. In addition, the timing of the intervention is very crucial. We should start early on, even before the programming stage at the fetus starts - we should start from pregnant woman, or mother-to-bes. To know the long term impact of an intervention, however, measurement of its cost-effectiveness has to be studied in each country. To promote the concept of measurement, the use of a simple tool such as a pull-up measuring pen is a good idea. The conditional cash transfer with a strong education component works in Latin America. Many programs give money to the wife, because when money is given to the wife (mother), it is more likely that it is used to support nutrition and health, rather than giving it to the husband. The issue on sustainability is related to cost. Once implemented, it is also politically difficult to withdraw.

The protective effect of multiple micronutrient fortification on height-for-age was underlined. There are five potential intervention solutions to reduce/eliminate micronutrient deficiencies in Indonesia, namely: (1) micronutrient supplements, (2) food fortification, (3) salt iodization, (4) dietary diversification, and (5) nutrition education. The first four alternatives have the potential of reducing 80-100% deficiencies. The challenges faced are: (1) how to maintain high rates of coverage of supplementation, (2) how to improve access, acceptance, appropriate technologies and enabling the environment for fortifying food; (3) how to integrate the micronutrient intervention with other programs, and (4) how to ensure that micronutrient programming is integrated as an important part of reaching the Millennium Development Goals.

Although policy makers are beginning to understand that improvement in nutrition is part of investment in human capital, work is not nearly over. Intervention should start from the intrauterine stage and continue until two years of life. The action itself has to be done at the district level and below. Integrating agriculture and food components with the participation of the local government are important.

Conclusions derived from the meeting: (1) stunting is a significant physical deficient as a result of chronic nutrition deficiency (2) stunting is the best predictor of long-term human capital, (3) the process of linear growth failure started in utero (pregnancy period) and continues up to the second or third year of life, (4) undernourished children are more likely to become short adults and deliver smaller babies, (5) improving child growth from 0-2 years has greatest impact as compared to beyond two years, (6) improving child growth should be an integrated efforts, including diet and nutrient intake, disease reduction, optimum child care, and improved environmental sanitation, (7) the positive effect of multiple micronutrient supplementation and fortification (Ca, Fe, Zn) in early life are: higher reading scores, higher years of schooling, higher stature in adult, higher income, and increase birth weight of the next generation, (8) food fortification is visible. Current technology is available for various carriers. The stabilized compound of fortificants (Fe, Zn, and Ca) has better bioavailability than the non-stabilized compounds.

Recommendations from the meeting: (1) intervention should focus on the window of opportunity group: pregnant women and children 0-2 years, (2) integrated health posts (locally known as POSYANDU) should be reactivated effectively by emphasizing growth monitoring and action to prevent early growth retardation. It should focus on children 0-2 years, especially the poor, (3) improvement of infant and young child feeding; e.g. support and promote exclusive breastfeeding; adequate, appropriate and timely complementary feeding, (4) expand food fortification interventions, (5) strengthen supplementation programs with multi-micronutrients, especially for the poor, (6) strengthening public and private partnership on food related programs.

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專家會議討論兒童生長和微量營養素缺乏–發展中國家達到千禧年發展目標的新倡議：執行總結報告

兒童早期營養不良會造成長期身體和智力的後果。改善兒童成長應始於兩歲以前，而且是一個整合各部門的工作，涵蓋所有方面，如飲食和營養攝取、疾病減低、最佳兒童照顧、及改善環境衛生。為討論這些問題，印尼 Danone 機構基金會組織了一次專家會議，討論兒童生長和微量營養素缺乏：發展中國家達到千年發展目標的新倡議。會議的目標是回顧展望兒童的成長：從已開發國家克服營養不良的計畫經驗中學習，並與印尼的現況相關連，進而討論未來計畫的意涵。會議建議包括重點介入之適當時機，重新啟動鄉村的健康整合據點，改善嬰兒和幼兒的餵食，擴大食物強化介入計畫，加強多種微量營養素補充計畫，在相關飲食計畫中加強公營和私營的夥伴關係。

關鍵字：兒童、生長、微量營養素、缺乏、印尼