

THE STORY OF YING YANG BAO

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In 2002, Prof. Chen Chunming (4th from left) visited Ying Yang Bao trial site in Qingshui county, Gansu province, 2002.

Countering malnutrition among children in the impoverished areas of China means primarily providing sufficient nutrition to infants in the crucial growth period from birth to 24 months of age. Research has already shown that the nutrition status in early childhood will have a lifelong impact on the health and quality of life of the child. Malnutrition in this stage will have irreversible short term and long-term health consequences.

It's Time to Tell the Story of Ying Yang Bao

Fifteen years, that's the amount of time nutritionist Professor Chen Chunming, founding president of the China Academy of Preventive Medicine (now the Chinese Center for Disease Control and Prevention) and her team of scientists have been working on this small, 12 gram Ying Yang Bao "a kind of nutrition pack."

No earthshaking discovery here, nor cutting-edge science; no mysterious or dangerous plots, no fine-sounding titles or honors, just the perseverance and selflessness of responsible scientists driven by their consciences.

Their compassion, determination and hard work inspired all those devoted to the public interest, and pushed the government to take action. As a result, millions of vulnerable infants have been able to enjoy both better nutrition and life, and can now develop in body and mind just like other same-age children: they can start their life's journey on the same footing. This in itself is a huge achievement.

Worldwide, malnutrition is the cause of death for 45% of all children under the age of 5, and this poor nutrition is mostly caused by poverty. Every day 8,500

children die from malnutrition, an annual total of 3.1 million. And even if such infants survived the lack of attention and assistance, they would still suffer from the effects of nutritional deficiency in the form of physical stunting and mental retardation, leading to learning disabilities that in adulthood result in low cognitive functions and reduced abilities to work. This means they are once again unable to break out of the cycle of poverty.

Poverty-malnutrition-poverty is the vicious cycle that plagues least developed and developing countries alike.

China is a developing country. There were large numbers of rural families living in poverty. The total number of infants and young children suffering from malnutrition was even greater. Up till 2009, out of the 100 million children between the ages of 0-6 years in the whole of China, over 7 million lived in the most poverty-stricken rural families. This number was even larger if all those suffering from stunted growth, poor nutrition, anemia, and impaired mental function were included.

Fortunately, there was a group of Chinese nutrition scientists who went to the poorest places in China to investigate the living conditions of the children. They gathered extensive data that resulted in the development of a "nutrition pack supplement," (named Ying Yang Bao in Chinese) a technology and method for nutrition intervention that can counter infant malnutrition. They conducted on-site trials in these regions to test the effects of the Ying Yang Bao and recorded the successful results. These efforts continued over a period of 15 years, starting in 2001. Thanks to their persistence and detailed scientific work, the Chinese government decided to provide Ying Yang Bao for free to improve child nutrition in poor areas as a national policy starting from 2013.



Professor Chen Chunming (5th from left) attended Launch Meeting for Promoting Research of Ying Yang Bao, 2008.

A Worldwide Problem

Micronutrients, including vitamins and minerals, are needed everyday by the human body in small quantities, and their lack can have very serious consequences. This is why today nutritionists say that starting from the age of 6 months, the weaning or breastfed infants must receive extra micronutrients, or else it may suffer “invisible hunger” that can lead to disease and death.

The World Health Organization (WHO) estimates that worldwide 159 million children, 24% of those under age 5, suffer from repeated infections due to malnutrition that stunt their growth; 16 million children are severely wasted, and about 41 million overweight in 2014.

To address the malnutrition of children, the WHO in 2003 developed a global strategy on infant nutrition which included the following: babies should start breastfeeding within one hour after birth; breastfeeding should be the sole source of nutrition during the first 6 months; after that, babies should receive monthly nutritional supplements and be fed complementary safe foods; breastfeeding should continue until two years or longer.

At about the same time, a team of Chinese nutritionists began their investigation and research into how to improve the health of Chinese infants after weaning, and specifically the nutrition of those living in impoverished areas.

After the 1980s, the health of Chinese children generally changed dramatically, as shown by the significant reduction of infant mortality, and the improvement in child nutrition. According to the China Health Statistics, in 1991, newborn infant mortality was 33.1 per thousand, while in 2010 this had dropped to 8.3 per thousand, a 75% decrease. Overall infant mortality in 1991 was 50.2 per thousand, while in 2010 it was 13.1 per thousand, a 74% drop. Mortality rates for children under 5 were 61 per thousand in 1991, and 16.4 per thousand in 2010, a 73% drop.

Statistics also showed that in the past 20 years between 1990 and 2010, the underweight rate for

children under 5 dropped by 74%, from 13.7 per thousand in 1990 to 3.6 per thousand in 2010. The rates of stunting also fell by 70% from 33.1 per thousand in 1990 to 9.9 per thousand in 2010. There is no doubt that these are all extraordinary achievements.

However, China has a huge population. With nearly 100 million children under the age of 6, if even 10% are undernourished the number is still large, the equivalent of a medium-sized country, and cannot be ignored. Most of these children live in poor rural areas. The national average rate of infant malnutrition is not a good indicator of the actual severity of the condition, because of the great differences between urban and rural areas.

Though there was much praise for the improvements in overall childhood nutrition, nutritionists themselves were acutely aware that, between 1990 and 2010, the nutrition status of infants under 5 living in rural areas was still very different from those living in urban ones. The rate of stunting was 3 to 4 times higher than in urban areas, and for the poorer places, the rate was again double that. Even in 2010, 20% of the poorest children under 5 suffered from stunting, and had not reached the normal body height for children their age.

Growth in height is associated with the quality of diet, including protein and micronutrients.

Anemia is an important indicator of iron deficiency. In 2010, studies showed that still 28.2% of Chinese babies between the ages of 6-12 months were anemic, the figure for those between 13 and 24 months was 20.5%. Once again, there was significant urban and rural differences, in particular in poor rural areas anemia rate were much higher than the average rate.

A number of studies had indicated that in the first six months of breastfeeding, Chinese babies grew at the same rate as the international standard. However, after weaning the rate of physical development (especially height) was lower than the international standard. This was the result of lack of nutritious complementary foods. Stunted growth and anemia may occur at any time in a child's development, but the studies showed that they were concentrated in the period between 6 months and 2 years, which coincides

with the time when the infant is starting to eat complementary foods.

The huge challenge facing Chinese society was how to improve this nutritional deficiency in the 6-24 month age group, especially in the most impoverished areas.

Another key to solving infant malnutrition

Poverty is without doubt the fundamental reason for childhood under nutrition, but it is not the only cause. While poverty alleviation was clearly important, it became clear to Chinese investigators that infant malnutrition was also quite widespread in areas that were no longer that poor anymore, so even though families had increased their income, they were not necessarily providing the right foods for their children.

For one thing, investigations into all rural areas not just the poorest, revealed widespread inappropriate feeding of infants. In 2010, nutrition monitoring showed low rates of breastfeeding for babies under 5 months, and also the over-early introduction of complementary foods, particularly in the poorer regions.

When their infants reached the age of needing complementary foods, many mothers followed the traditional custom of feeding them rice or wheat porridge, occasionally adding a pinch of salt and chopped vegetables. This provides less than half the energy and nutrients of the same amount of breast milk, and cannot meet the child's growth needs. The studies showed that 52.4% of babies between the ages of 6 and 24 months had already started such complementary feeding before even reaching 6 months. Lack of food variety was also a problem. Such inappropriate feeding practices and the lack of nutritious complementary foods were the reasons for insufficient micronutrients and stunting.

By the age of 6 months, a baby of normal birth-weight has used up practically all of the iron it was born with and must rely on external sources of food to meet its needs. A baby grows fast and needs as much iron as an adult, but since it has a small stomach and eats much less than an adult, it's very easy for it to become anemic from insufficient iron intake. The complementary foods fed to babies in rural areas are

mainly cereals that are already low in iron, whose absorption is then further hindered by the presence of the antinutrient phytic acid in the grain.

Even in 2010, only 9.8% of those questioned knew about and were adding iron supplements to their infants' diet. This mineral deficiency was causing a high rate of childhood anemia.

Based on the on-site investigation on the malnutrition of Chinese infants and young children during 1990-2000, the Chinese nutritionists began to put together a plan for addressing the issue, particularly in the poorer areas. This can be summarized as follows:

- 1 Childhood malnutrition must not be ignored, even though the overall nutrition of infants under 5 had greatly improved. Dealing with it remained an important part of the efforts to improve the general health of the Chinese population.
- 2 The focus for combating infant micronutrient deficiencies must be placed in the rural areas, and particularly in the most impoverished ones. This not only impinged on general health but also on the elimination of poverty and on greater social development.
- 3 The complementary foods presently fed to many children were nutritionally insufficient and unable to satisfy growth needs. This was not simply a poverty elimination issue, but a lack of knowledge of the science behind good feeding practices.
- 4 The problem not only needed funding, but also coordinated efforts to provide widespread education on proper feeding methods, and the practical ways of doing so.

These were the general principles that guided Prof Chen Chunming and her team in their long endeavors.

From Trials to Standards

Resolving infant malnutrition in the impoverished areas of China means primarily providing sufficient nutrition in the crucial period between 0 and 24 months of age. Research has already shown that the



Prof. Chen Chunming (1st from left) attended a workshop for drafting the national standard of complementary food supplement, 2008.

amount of nutrition in early childhood will have a lifelong effect on the health and quality of life of the child. Malnutrition in this stage will have irreversible short term and long-term consequences, including chronic conditions like obesity, diabetes, heart disease and high blood pressure. Improving appropriate nutrition at this stage produces the best results.

Field visits and investigations convinced nutritionists that the first 1,000 days of life are vital to combating infant undernutrition in poor rural areas. They decided to undertake a number of trials to gather more reliable and practical data to back their solution. What was the most efficient and economical way to persuade rural families to follow nutritionists' guidance and increase the nutritional value of the food they fed their children? The answer was to develop a supplement that was appropriate, easy to use and effective. It had to contain the micronutrients suitable for Chinese infants, be cheap, convenient, fit in with feeding methods, customs and tastes.

Most nutritional complementary food supplements for infants and young children currently in use around the world are in the form of: micronutrient fortified foods, micronutrient supplements, micronutrient spreads, and micronutrient powder. The micronutrient fortified food supplements are mainly a Chinese development, called the "infant and toddler nutrition pack" or "nutrition pack" for short. In Chinese, the common name is Ying Yang Bao.

This is a soy bean-based supplement fortified with vitamins and minerals commonly lacking in Chinese infants and young children. One pack a day can satisfy nutritional needs and make-up for the deficiencies. It is easily mixed with water, or can be added to different kinds of porridge (rice, cornmeal, wheat) that suit the eating habits of both the child and the caregiver. This high quality supplement is cheap, easily popularized in poorer areas, and has proved very effective.

The first trials of the Ying Yang Bao took place in five

counties of Gansu province: Tianzhu, Dixi, Jingtai, Jingning and Qingshui. Gansu province in western China is one of the poorer regions of the country, and these five counties are recognized as national-level impoverished counties. Nutritionists of the China Center for Disease Control and Prevention and International Life Sciences Institute China Office were in charge of the project.

Between 2001 and 2003, the intervention group of 1,000 infants between the ages of 4 to 12 months in the trial villages were given soy bean-based Ying Yang Bao, while another group of 500 kids of the same age served as the control group.

Each day, the infants in the intervention group were given one 10-gram Ying Yang Bao that contained 6 mg of iron, 4.1 mg of zinc, 385 mg of calcium, 0.2 mg of vitamin B2 (riboflavin), 7 micrograms of vitamin D, and 3.8 grams of protein, for a total of 167 kilojoules. The control group was given a 10-gram pack of rice flour without adding any vitamins or minerals, and also a vegetable oil supplement to ensure the energy intake was the same as for the intervention group. Every 6 months all the infants were given a large dose of vitamin A. This continued until the toddlers were 24 months old.

The results showed that after 12 months, anemia rate in the intervention group had dropped from 35% to 8.2%, much lower than in the control group. Body length/height and weight for that age was also significantly better than for the control group. The overall development quotient at 24 months for the intervention and control groups were respectively 97.2 and 95.5, which showed markedly higher cognitive development in the former.

Follow-up studies were carried out on both groups at the ages of 3, 4 and 5 years. The results showed that at 3 years old, those who had received Ying Yang Bao had a development quotient of 92.7, while those in the control group had 90.4; at 4 years of age, the figures were 96.7 and 94.5; at 5 years old, the figures were 101.1 and 98. After controlling for other intervening factors, it was still clear that the use of Ying Yang Bao for infants between the ages of 6 and 24 months not only positively affected their cognitive development at those ages, but that the effects were sustained over

time. In 2009, further follow-up visits found that the children in the intervention group, now between 8 and 9 years old, had an overall cognitive index 2 points above those in the control group.

The nutritionists who carried out this project over the 1 year of intervention and over the 3 years of follow-up were gratified by the clear results and very encouraged.

After 7 years of research, experimentation and repeated review, the “Workshop on Nutrients Requirements in Infants and Young Children and Complementary Foods” was held in Beijing on November 11, 2007. Support came from the Department of Women, Children and Community Health and Department of Disease Control of the Chinese Ministry of Health, and the United Nations International Children’s Emergency Fund (UNICEF). The attending high-level domestic and international experts gave their full endorsement to the Ying Yang Bao project carried out in Gansu province.

The next step was for the Chinese nutritionists to transform their experiences, methods and conclusions into national norms, so that the Ying Yang Bao could be widely used in a standardized manner. They had to define “nutritional supplements for complementary foods,” determine which populations needed them, provide guidance on which nutrients should be added and how much, recommend daily servings and how to apply them. They also had to set production criteria, safety standards, packaging, labeling, storage and transport requirements. Once national standards were in place, regions could follow their guidance and



Child was fed with Ying Yang Bao in rural area in Sichuan province, 2010.

distribute the packs to improve infant nutrition.

These became the “General Standards for Complementary Food Supplements” <that were jointly drafted by the Institute of Nutrition and Food Safety, and the Office of Fortified Foods, both of China CDC, and by the International Lifesciences Institute China Office. The standard was promulgated in December 2008 by the Ministry of Health and the National Committee for Standardization.

The research project to improve infant nutrition in poor regions of China was successfully completed, and Professor Chen Chunming, one of the leaders, was by then already over eighty. She could have decided to withdraw from active work, but instead threw herself into the effort to mobilize wide use of the Ying Yang Bao.

Popular Need is a Call to Action

Shortly before the “Standards” were made public, an 8.0 earthquake struck Wenchuan in Sichuan province on May 12th 2008. Over 100,000 square kilometers were affected, 69,227 people were killed, 17,923 went missing, and 374,646 people were injured. The nutrition and health status of babies and young children became a serious issue. Though each adult in the affected regions was provided with 500 grams of grain and 10 yuan a day to ensure sufficient food, this was not addressing the needs of fast growing babies.

Three months after the disaster, when the period of most urgent assistance and relief was over, nutritionists rushed to the stricken counties of Beichuan and Lixian. Their findings showed that infants between the ages of 18 to 23 months were underweighted in both counties: 15.6% in Beichuan and 9.1% in Lixian. Growth was also stunted: 26% and 24.2% respectively. Acute malnutrition for this age-group in Beichuan was 9.1%. About 49.6% and 78.8 % of all children were affected by anemia, while medium-level severe anemia (rarely seen in China) affected 7.7% and 19.9% respectively.

Following these results, Professor Chen Chunming and other experts in child health care made a proposal to the Ministry of Health through China CDC to begin emergency intervention to address child malnutrition

in the Wenchuan earthquake stricken areas.

Following urgent consultations between the Ministry of Health and other ministries, the decision was taken to immediately start distribution of Ying Yang Bao. One month later, with the support of UNICEF and the Global Alliance for Improved Nutrition (GAIN), China CDC distributed Ying Yang Bao to some 6,000 children between the ages of 6 and 24 months in the seriously affected counties of Beichuan, Lixian and Maoxian. Eighteen months later, follow-up evaluation in Lixian showed that average blood hemoglobin levels had increased to 15.1 g/l, much higher than before the intervention; the rate of anemia had also dropped from 78.8% to 30.8%. The results demonstrated the use of Ying Yang Bao was very feasible and efficient and that they could be an important measure of countering infant malnutrition in disaster-hit areas.

These positive results, together with the national “Standards” issued by the government and its strong support made it possible for Ying Yang Bao to be used on a larger scale across many sections of society, by both public and non-profit organizations.

—— in September 2009, the China Development Research Foundation initiated a 3-year project on early childhood development in poor regions in Ledu county, Qinghai province. All infants in the 9 trial villages and towns starting from the age of 6 months were given a daily Ying Yang Bao until they reached the age of 24 months.

—— in April 2010, China CDC supported by UNICEF began an 18-month nutrition intervention project in 8 counties spread over Sichuan, Gansu and Shaanxi provinces. Daily Ying Yang Bao were provided to over 30,000 infants and toddlers between the ages of 6 and 24 months.

—— in 2011, a large public campaign to “Eradicate Infant Anemia” was launched jointly by the Ministry of Health, All-China Women’s Federation and the China Children’s Foundation. It was funded by voluntary donors. The first stage of the campaign focused on 32 poor counties in 10 of the provinces in China’s western region, and benefited some 230,000 children between the ages of 6 and 36 months.

- in November 2011, the government of Qinghai province allocated 10 million yuan to an infant nutrition campaign using Ying Yang Bao as the major measure.
- on June 20, 2012, the second stage was launched of the joint campaign by the Ministry of Health, All-China Women’s Federation and the China Children’s Foundation to eradicate infant anemia. Thirty-five more poor counties in 11 of the provinces of the western region were included, benefiting another 230,000 children.
- in July 2012, the All-China Women’s Federation and the Ministry of Health jointly launched a wider intervention project in poor regions. The central government allocated 100 million yuan to provide daily free Ying Yang Bao to 270,000 infants and young children between the ages of 6 and 24 months living in 100 counties of 10 provinces nationwide.
- in 2013, this project was extended to 300 counties in 21 provinces, and involved 400,000 children. The central government allocated 300 million yuan in dedicated funds.
- in 2014, funding for this project was increased to 500 million yuan. All 1.37 million infants living in 341 poor counties of 21 provinces were provided with free daily “nutrition packs”.

Other Significant Outcomes

Chinese nutritionists were both excited and gratified by the extensive use of the Ying Yang Bao and by the growing number of children benefiting from them. However, other concerns began to surface too: how to guarantee the quality, transport and storage of Ying Yang Bao? Were the families using them properly? Who was to supervise their timely distribution, encourage their use, and check on the results? Education and training now became part of the



Mothers were receiving Ying Yang Bao in Wenchuan earthquake regions in Sichuan province, 2008.

responsibilities of nutritionists and children's health care experts alike.

It was here that the three-tiered health network of county, township and village played a key role. The county hospitals, township clinics and village doctors were responsible for printing educational materials, holding "Classes for Mums," making family visits, regularly distributing Ying Yang Bao to each family, making scheduled check ups and evaluations.

The results were: project coverage and acceptance was over 80%; infant anemia dropped by 48% from the base line (before using Ying Yang Bao); iron nutrition status improved greatly; all those who participated in the project acquired more skills and knowledge; parents and family members also learnt about nutrition and good feeding methods.

And most importantly of all, an overwhelming majority of families welcomed the use of Ying Yang Bao. They reported their babies liked them, fell ill less frequently, and they themselves found the nutrition education and training both enlightening and useful.

The three-tiered healthcare network proved to be the guarantee of success for the whole huge project. This

network that covers all rural areas is very special to China, and is also one of its great strengths. The successful experience of the Ying Yang Bao campaign was the result of joint efforts between government departments, scientific teams and grassroots health workers. This is an invaluable practical addition to scientific research.

The international community has also taken note of the Ying Yang Bao application. Some international organizations call it YYB (the first letters of Ying Yang Bao), and point out that China's experience could provide useful guidance for improving child nutrition in the poor areas of Africa and other parts of Asia.

Fifteen years have passed since the start of this huge endeavor in 2001. Throughout those years, Professor Chen Chunming and her team worked tirelessly to improve the health of thousands of children for the benefit of society. Today, Professor Chen is ninety years old, and many of her team have spent some of the best years of their lives on what was once a scientific project but has now become a national one.

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