PACIFIC JOURNAL OF MEDICAL SCIENCES
{Formerly: Medical Sciences Bulletin}
ISSN: 2072 – 1625

Pac. J. Med. Sci. (PJMS); Volume 8, No. 2, May 2011
Special Issue:
National Nutrition Survey Papua New Guinea, 2005; (NNS 2005)

www.pacjmedsci.com. Email: pacjmedsci@gmail.com.

Department of Health of Papua New Guinea
UNICEF Papua New Guinea
University of Papua New Guinea
Centers for Disease Control and Prevention

Chapter 1: Background: Pages 1 – 8

- Malnutrition in PNG
- Nutrition Interventions to date
- Rational for the PNG National Nutrition Survey
- Objectives

CHAPTER 1. BACKGROUND

1.1 Context

Papua New Guinea (PNG) is the largest of the Pacific Islands Nations. It comprises the eastern half of the Island of New Guinea in the Western Pacific, several large volcanic islands and some 600 small and scattered islands to the north and east in the Bismarck and Solomon Sea respectively. The total land area is over 462,840 square kilometers. PNG has a land border with the Indonesian province of Irian Jaya, and sea boundaries with Solomon Islands and Australia. The topography is among the most rugged in the world, with altitudes of over 4000 meters. PNG is extremely diverse geographically, with offshore volcanic islands, coral atolls, lowland forests and extensive swamps, dry savannah and alpine forests. Poor road networks, especially in the rural areas, make travelling difficult and very expensive, as many areas are not easily accessible. PNG relies heavily on coastal shipping and domestic air services, rather than road transport. It is estimated that about a third of the population lives below the poverty line (World Bank 1999) and more than 85 % lives in rural areas (National Statistical Office 2001).

Administratively, PNG is divided into 20 provinces and 89 districts. These are grouped for convenience into four regions, Southern, Highlands, Mamose and Islands.

1.2 Malnutrition in Papua New Guinea

Papua New Guinea displays an enormous diversity in its geography, ecology and human biology. The Papua New Guinea National Nutrition Survey 1982/83 (NNS 1982/83) found great variation in the extent of protein-energy malnutrition (PEM) among children under 5 years between different regions. Even within provinces there was considerable variation between districts (Heywood et al 1988).

1.2.1 Nutritional status

Nutrition plays a critical role in the survival, growth and development of children, who can not reach their full potential if they are malnourished in childhood. Malnutrition in all its forms affects socio–economic development in PNG. The development goals outlined in the government Medium Term Strategic Plan (MTSP), the Millennium Development Goals (MDGs), cannot be achieved if malnutrition remains a public health issue.

Malnutrition is considered one of the most important underlying causes of poor health outcomes in PNG. The National Nutrition Survey (NNS) of 1982/1983 was conducted on children 0-59 months of age. According to this survey 29.9% of mainly rural children 0-59 months of age were underweight and 43.2% stunted and 5.5% wasted (Heywood et al 1988). The National Household Food Consumption Study of 1996 reported that 8.1% of the children in PNG were wasted and 42.9% stunted based on the NCHS/CDC/WHO reference (Gibson and Rozelle 1998). Both the 1982/83 survey and the 1996 survey found that children in their second year of life were most at risk of being wasted and stunted.

The 1982/83 NNS also found that children in the Highlands region (> 600 m) were significantly shorter but also significantly heavier than lowland (0-600 m) children (Heywood 1988). The Papua New Guinea Household Food Survey in 1996 also

identified a much higher prevalence of stunting and a lower prevalence of wasting in the children living in the Highlands compared to children in coastal areas (Gibson and Rozelle 1998).

The prevalence of malnutrition appears to be lower in urban areas. A survey carried out in 1986/87 on 568 children under the age of 5 years reported a much lower prevalence of underweight, stunting and wasting in urban areas in comparison to rural areas (Jenkins and Zemel 1990).

Low birth weight (LBW) (<2500g) is thought to be a serious problem in PNG. A study by Muller et al found that within PNG, birth weights vary according to geographic location. Children from the central highlands and from affluent lowland areas had the highest birth weights, while they were lowest in the Sepik, Western, Madang and Milne Bay Provinces and remote highland fringe areas. Maternal education, socio-economic status and diet were important predictors, but only differences in maternal diet were correlated with the observed spatial patterns (Marks 1992 and Muller at et 2002).

The 1982/83 survey collected 6128 self reported birth weights. The mean birth weight was 2.93 Kg and 18.6% of babies had a birth weight less than 2.5kg (Muller et al 2001).The National Health Information System (NHIS) reported a prevalence of low birth weights of around 9-10 % nationally for the period 2002-2006, which is lower than the NNS 1982/83 prevalence (Muller at al 2001). The NHIS also found differences in LBW prevalence between provinces. Rates of LBW were highest in those provinces with high levels of child under-nutrition (Western, Milne Bay, Madang, East Sepik and Sandaun provinces), as well as National Capital District. In a retrospective study at Port Moresby General Hospital, researchers reported a mean birth weight of 3252 grams for babies born at term. Babies of Highland descent were significantly heavier than babies of Papuan ancestry (Klufio 1992).

There is very little data on the nutritional status of adults and no nationally representative data on under and over nutrition in adults in Papua New Guinea. One study by Taufa et al (1993) found in a survey of men and women in Lihir a substantial reduction of weight with age, (associated initially with a decline in fat reserves and eventually with a decline in lean body mass) and a minor reduction in height with age in rural female adults in Papua New Guinea. The trend for weight loss in men with age was less striking (Taufa 1995).

Another study conducted by Hodge et all in 1996 found that men and women older than 18 in rural communities in Papua New Guinea have a relatively low prevalence of obesity (Body mass index BMI >30), especially in the Highlands. Obesity is more prevalent in the urban coastal areas (27% and 38% for men and women respectively) compared to the rural Highlands (3% and 2% for men and women respectively).

A longitudinal study of the Wopkaimin people, landowners of the Ok Tedi mine in Western Province compared changes in health and nutrition status with the people of Mount Obree in the Central Province. At the start of this study in 1982, health and nutrition status was comparable in both groups. After 10 years, the mean weight had increased in all age groups of the Wopkaimin population, whereas mean body weight of the Mount Obree population remained the same. The royalties of the Ok Tedi mine had led to the economic development of the Wopkaimin people, whereas in the Mount Obree region, no economic development had taken place (Taufa 1995[1]).

1.2.2 Micronutrient status

Neither the 1982/83 survey nor the 1996 survey looked at micronutrient deficiencies in PNG. Limited data on local and selected populations have shown that micronutrient deficiencies might be common in at least some populations. The available data has suggested that there are considerable differences in the prevalence of micronutrient deficiencies and disease burdens between regions and even between districts. Most of the data that does exist concerns young children and there is little information on the status of adults.

Iodine deficiency

There are no national data on the prevalence of iodine deficiency in PNG. There have been several studies that have shown a high prevalence of goitre especially in the Highland areas, with the prevalence increasing with altitude (Hipsley et al 1947 and McCullagh 1963). There has been no systematic study of the spatial distribution of endemic goitre but there have been reports of goitre from most provinces in PNG (Heywood 1992).

Despite the availability of iodized salt some studies conducted in the late 1990s indicate that endemic goiter is still present in specific isolated areas of the country. For example, in Memyamya District the incidence of goitre in 1997 was 14 % among the schoolchildren surveyed (Amoa et al 1997).

Recent studies on urinary iodine (UI) concentrations in women and children in different parts of Papua New Guinea confirm the presence of iodine deficiency disorders in remote locations suchas Hella Region, Southern Highlands Province, see Table 1.1 (Temple et al 2005).

Table 1.1: Urinary iodine (UI) concentrations in women and children in regions of Papua New Guinea

	Median UI (µg/L)	% with UI level below 50 µg/L
Children age 6-12 years (Hella Region SHP) [1]	48	52.8
Male children age 6-12 years (Hella Region SHP) [1]	67	46.7
Female children age 6-12 years (Hella Region SHP) [1]	44	59.8
Pregnant women (Lae City) [2]	231	3.3
Non-pregnant women (NCD*) [3]	163	7.2
Lactating women (NCD) [3]	134	17.5
Pregnant women (NCD) [3]	180	6.6

[1] Temple et al., 2005
[2] Amoa and Rubiang, 2000
[3] Temple et al., 2006,
*National Capital District

Vitamin A

There are very limited data on vitamin A status in PNG. There are very few reported cases of night blindness and other clinical manifestations of Vitamin A deficiency. A study, conducted in East Sepik province in 1990 reported that 91% of participating children-under-15 years had serum retinol levels below 0.70 µmol/L. In 1994, a hospital-based survey was conducted in several provinces in Papua New Guinea, and six children among 1027 (6 –72 months) were identified with clinical xerophthalmia (USAID VITAL 1993).

Between 1996 and 1998, a study of children 6-71 months old was carried out in several major centers and some remote locations. Of the 322 children 6-59 months surveyed, 27.6 % were vitamin A deficient ($\leq$ 0.7 Mm/L) (Friesen et al 1998).

Anemia, iron deficiency and iron deficiency anemia

Data on anemia are also limited and most population based anemia data was collected in the 1970-80's. Most of the results were obtained as by products of large-scale population surveys for blood groups and other genetic and anthropological markers.

The review paper by Kariks and Woodfield (1972) reported that 21.5% of the total population had a hemoglobin value of < 10 g/dl and 63.3% had a hemoglobin below 12 g/dl. Regional patterns were noted and anemia was reported to be more prevalent in coastal areas. Anemia was also more prevalent in people living in isolated areas who subsist on a mainly vegetarian diet.

There are some anemia data on pregnant women but almost all of these studies are on women who attended antenatal clinics. Most of the studies were also conducted in Port Moresby clinics and hospital. Most of these studies reported very high levels of anemia in pregnant women. In 1986, in a study of 600 pregnant women at Port Moresby General Hospital, 81% percent of the participating women had a hemoglobin level below 11 g/dL, and 59% had a hemoglobin level below 10 g/dL (Sill et al 1986).

A survey carried out in 1998 identified a high prevalence of anemia in children under five years (Hb<11 g/dL) (Friesen et al 1998[1]). The highest prevalence of anemia was observed in the East Sepik Province, where 91% of children less than five years had a Hb<11g/dl. The prevalence of anemia was lowest among children from the Western Highlands Province, with 35% having a Hb<11g/dl. In addition, a lower percentage of children in the Western Highlands Province had positive malaria slide.

Malaria

All four Plasmodium species (Plasmodium falciparum, Plasmodium vivax, Plasmodium malariae and Plasmodium ovale) are present in PNG. The severity of malaria infections range from "anaphelism sans malaria", through unstable low levels of endemicity where outbreaks are common, to holo-endemic transmission comparable to the most endemic areas of Sub-Saharan Africa (Muller at al 2003).

Before the 1950s, malaria transmission was unusual in most parts of the Highlands, particularly at high altitudes (above 1200 m.). Malaria outbreaks became common after opening of the Highlands Highway, with increased travel to and from the coast (Dapeng 2004). Malaria epidemics in the highlands, often in the late rainy and early dry season, are characterized by relatively small, isolated outbreaks that result in a large number of deaths in all age groups among the non-immune population. This pattern is different from malaria in coastal and islands regions, where there is a constant transmission throughout the year. As the population is more accustomed to malaria outbreaks, deaths are rare and most occur among young children.

Hemoglobinopathies

Other factors that might impact the hemoglobin status of Papua New Guineas included alpha thalasseamia and other hemoglobinopathies which can decrease the hemoglobin concentrations in the blood. Various studies have shown that α- thalassemia is very common in PNG and is particularly common in coastal areas where malaria is endemic. In a study by Flint et al (1986), DNA samples were analyzed from throughout the South Pacific. From the PNG samples, 4% of the Highlands samples had the trait, whereas the rate for the coastal samples was 39%. Coastal samples showed variation; of the north coastal samples 68 % had α thalassaemia; of south coastal samples, 22% and of the east coastal samples, 38%.

Preliminary geographical and linguistic analyses suggest that the prevalence of α-thalassaemia may be related to altitude rather than linguistic grouping and hence that resistance to malaria may be at least one reason why α-thalassaemia is so common in some populations (Oppenheimer 1984). Hypochromic anemia in tropical or subtropical populations should not necessarily be attributed to iron deficiency (Bowden 1985).

In a recent study by O'Donnell et al (2006), the effect of maternal α-thalassaemia on pregnancy was assessed in the north coastal region of Papua New Guinea (PNG), where malaria is hyperendemic and α-thalassaemia is extremely common.
The median haemoglobin concentration during pregnancy and after delivery was about 1.0 g/dl lower in homozygous α-thalassaemia than in women with a normal α- globin genotype ($P < 0.001$). The frequency of the -α genotype in mothers was 0.61. Although the median haemoglobin concentration was significantly lower in mothers homozygous for alpha+ -thalassaemia than those with a normal alpha-globin genotype, this did not result in adverse pregnancy outcomes.

Helminthes

The review by Kariks and Woodfield (1972) estimated that intestinal parasites (worms) affect approximately 75% of the population. The intensity of the infestation is generally low and depending on the intensity of the infestation 2 to 100 ml of blood is lost per day. In addition to hookworms, bites and loss of blood from mosquitoes, sand flies and other blood sucking insects contribute to the prevalence of anemia.

1.2.3 Infant and young child feeding

Most studies on infant and child feeding report that breastfeeding is almost universal and usually continues well into the 2nd year of life (Frisen at al 1998 and Mgone 2002). One survey from two districts in EHP and Madang found that nearly all children under 4

months of age were breast fed and of those children 85% were exclusively breast fed (EBF), this decreased to approximately 80% at 6 months (Mgone 2002). Several other studies have also supported the findings that a large proportion of children under 6 months of age are breastfed in PNG. Several studies have shown that while breastfeeding is very common many women do not give colostrum to the child due to beliefs such as this milk is “dirty milk”. Breastfeeding is also much less prevalent in women in formal employment (Friesen 1995). Some studies also found that bottle feeding is more common in adopted children and adoption in the Highlands provinces is higher than other parts of PNG (Peters 2000).

The NNS 1982/83 contains information on food consumption (24-hour-recall). Diet and socioeconomic status were found to be the two most important variables in predicting patterns of child growth in Papua New Guinea. While socioeconomic status was the most important factor determining variation in growth within areas, differences in diet and the physical environment were the main determining factors between regions (Muller 1999).

The NNS 1982/83 concluded that the cause of the high prevalence of stunting appears to be the late introduction, infrequent feeding and low nutrient density of complementary foods. The bulkiness of the root crops, from which up to 80% of the total dietary energy is derived, may make it difficult to consume enough to satisfy requirements for energy, protein and other nutrients. Many other studies also support the findings of this survey and report that as many as 40% of children 6-9 months have not received any complementary foods.

Acute food shortages are rare and usually related to extraordinary climatic events such as El Nino phenomenon (Allen 1997). Therefore quality rather than quantity seems to be the major nutritional problem in rural PNG (Muller 1999). Mueller found that consumption of rice, tinned fish and meat, fresh fish and legumes, were significantly positively correlated with child growth in length and /or weight. These food items are much higher in protein, zinc and energy contents than the local staple foods (Ohtsuka 1984). Children in villages with high consumption of sago on the other hand were significantly lighter.

1.3 Nutrition Interventions to date

There are several nutrition interventions that have been established in PNG to help improve the nutrition status of the population. These strategies are as follows:

1.3.1 Iodized salt

In 1995, PNG amended the Pure Food Standards (PFS) making it mandatory for all salt imported into the country to be iodized with potassium iodate at 30 ppm. In February 2007, the National Executive Council (NEC) endorsed the Food Sanitation Regulation 2007, which is now enforced. The household coverage of iodized salt has never been determined nationally. Some small surveys show a wide variation in estimates of coverage in different locations.

1.3.2 Vitamin A supplements for children 6-59 months

In 2002, based on recommendations by the PNG Pediatric Society and UNICEF, the National Department of Health introduced distribution of high dosage vitamin A capsules to children at 6 and 12 months by adding it to the routine immunization schedule. Reporting the number of capsules distributed will be included in the revised National Health Information System, as currently this is not required. According to the PNG National Immunization Coverage Survey 2005-2006 around 70% of children, 6-12 month old, received at least one dose of vitamin A. There are differences in coverage for the regions; the Highlands Regions has the highest estimates with nearly 75 % of children 6-12 months old receiving at least one dose of Vitamin A capsules and Mamose the lowest with around 60% (National Department of Health 2007).

1.3.3 Anemia prevention and malaria control in pregnancy

Iron and folic acid supplementation is available to all pregnant women who attend antenatal clinics in PNG. Since the early 1960s iron supplementation and chloroquin prophylaxis for malaria (in areas of endemicity) have been part of the standard treatment in antenatal clinics in PNG. Folic acid was added to iron supplementation in the late 1970s (Fefol is used, which comprises of 200-mg ferrous sulfate and 0.5 mg of folic acid)

1.3.4 Population malaria control

In 2004 a universal bed net distribution program began. Using funding from the Global Fund to combat HIV/Aids, Malaria and TB the Department of Health began the process of supplying long lasting treated bed nets to the total population.

1.3.5 Improved infant feeding practices

In 2007 the Department of Health embarked on training health workers in infant and young child feeding counseling. TOT (Trainer-of-trainers) workshops have been completed for all regions on the WHO/UNICEF Infant and Young Child Feeding Counseling Course.

There are several NGO's that also actively work at improving infant and young child feeding.

1. 4 Rationale for the Papua New Guinea National Nutrition Survey

The survey was initiated by the Department of Health (DoH) and UNICEF in a collaborative effort with the U.S. Centers for Disease Control and Prevention (CDC) and the University of Papua New Guinea, Medical school. This survey is the first since the pioneering nutrition survey expedition in 1947 to include biochemical papameters and is part of an ongoing effort to develop national capacity in nutrition assessment, programming and monitoring.

The PNG survey is an integrated survey that describes the overall nutritional and micronutrient status of the population. The survey was implemented in order to:1) Prioritize and plan nutritional interventions in PNG; 2) Advocate to secure and sustain the required political and financial commitment for nutrition programs; 3) Serve as a baseline for monitoring the impact of nutrition interventions. Furthermore, conducting this survey was considered an opportunity to develop capacity of DoH and other partners and to establish useful institutional linkages involving various institutions, including the School of Medicine and Health Science at the University of PNG, the Centers for Disease Control and Prevention, and various laboratories.

1.5 Objectives

The objectives of the survey were to:

- Determine the household coverage of adequately iodized salt
- Determine the urinary iodine levels among non-pregnant women of child bearing age 15-49 years
- Determine the prevalence of anemia, iron deficiency and iron deficiency anemia in children 6-59 months of age and non-pregnant women of child bearing age 15-49 years and prevalence of anemia in adult men 18 years and older
- Determine the prevalence of vitamin A deficiency in children 6-59 months of age and non-pregnant women of child bearing age 15-49 years
- Assess the anthropometric status of preschool children (6-59 years) and non-pregnant women of reproductive age (15-49 years) and men (18 years and older)
- Determine the contribution of malaria to anemia in children and non-pregnant women of child bearing age and the contribution of hookworm to anemia in children 24-59 months of age
- Assess the use and consumption levels of centrally-processed staple foods, in order to determine their suitability as vehicles for fortification