MICRONUTRIENT MALNUTRITION IN THE PACIFIC AND ITS PREVENTION

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INTRODUCTION

This paper focuses on the micronutrient interventions in which the United Nations Children's Fund (UNICEF), internationally, has been providing assistance for many years. Here in the Pacific, our involvement in this specific area of nutrition has been more recent.

Two global conferences took place at the beginning of this decade, and they were critical to the current thinking and activities in public health nutrition. They were the World Summit for Children in 1990 and the International Conference on Nutrition in 1992. These conferences set specific goals and targets for reducing micronutrient deficiencies and improving child nutrition (UNICEF 1991; FAO/WHO 1992). They helped form a global political consensus that not only could these goals be achieved, but that they should be achieved by the Year 2000 (Alnwick 1998).

There were three goals specifically related to improving the micronutrient status of children and women:

- the virtual elimination of Iodine Deficiency Disorders (IDD)
- the virtual elimination of Vitamin A Deficiency (VAD) and its consequences (including blindness);
- a reduction in iron deficiency anaemia (IDA) in women by one third of 1990 levels.

The term virtual elimination was used to indicate the elimination of the deficiency as a public health problem, and all of these goals were set to be achieved by the year 2000.

In 1990, it was not really clear which countries had a problem of public health significance in relation to Iodine or vitamin A, nor was it clear which indicators could be used to monitor progress toward achievement of these goals. Much has been done to clarify indicators since that time. In the Pacific, the quantification of the problems is still not completely clear.
For prevention of micronutrient deficiencies, a combination of interventions and strategies is required. These include supplementation, fortification, and dietary improvement, as well as breastfeeding and improved public health measures such as provision of safe water and sanitation. The supplementation, fortification and dietary improvement were almost seen as mutually exclusive once upon a time, with supplementation being seen as "short-term", and with dietary diversification as a "long-term" strategy. It is now clear that a combination of all available interventions will be needed, depending on the circumstances, and that what were once perceived as "short-term" solutions may need to be part of a longer term response.

**Iodine Deficiency Disorders (IDD)**

Iodine deficiency and its outcome as goitre and cretinism has been known since ancient times. The thyroid gland requiring iodine for producing its hormones enlarges in iodine deficiency making goitre (enlarged thyroid) the best known sign of deficiency. Goitre is now known to be just the tip of the iceberg, thus the term iodine deficiency disorders has been developed to cover the milder physical and mental retardation, the miscarriages and still births, and the reduced IQ that comes with low intakes of iodine. Globally, iodine deficiency is the most common cause of preventable mental retardation. Around 1.6 billion people live in areas that lack sufficient iodine and about 655 million have goitre. The aetiology of IDD is different from the other two major micronutrient deficiencies in that it is geological, and not a result of social or economic conditions.

The iodization of edible salt supplies to combat what is now known as IDD was introduced in Switzerland, in the USA and in New Zealand in the 1920's, and proved to be safe and effective in reducing Iodine Deficiency. Salt iodization is probably the best known example of an effective fortification programme. Yet its implementation is not completely straightforward, and some areas remain ambiguous and challenging. In countries where IDD is severe and cretinism occurs, IDD control activities also include the administration of iodized oil, orally or by injection, while efforts are made to establish iodised salt programmes.

Monitoring of the virtual elimination of IDD, is done by using one or all of the following indicators:

- % of population in iodine deficient areas consuming adequately iodised salt
- proportion of school-age children with any grade of goitre by palpation (TGR)

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- proportion of school age children whose thyroid volume (measured by ultrasonography) > 97th percentile

- percent newborns having serum Thyroid Stimulating Hormone (TSH) levels > 5mIU/l

- percent population (school aged children or general population) with urinary iodine < 10 mcg/dl (WHO/UNICEF 1993).

The existence of laws or policies is also one of the more straightforward indicators of progress that can be monitored at the global level.

Tracking what has happened in Fiji is instructive. Goitres were well known in Fiji in the 1930's with rates of approximately 80% reported from the Sigatoka Valley. Surveys, focusing on the Ba and Sigatoka valleys continued to confirm the presence of goitres. In 1994, Government requested a consultant to verify the presence of IDD at a level that warranted any kind of action. A UNICEF consultant travelled to Suva and the Ba and Sigatoka valleys and worked closely with Ministries of Education and Health to undertake ultrasound examination of thyroid glands and to collect urine samples in July 1994 from 324 school children and 30 pregnant women. His findings were that:

- the high goitre rates and low urinary iodine levels indicated a mild to moderate rate of IDD (that was independent of cassava consumption);

- that IDD was prevalent in Fijians and Indians, in boys and girls and also among pregnant women in Suva;

- that all salts tested were not sufficiently iodized.

Since that time, Fiji, in 1995, through the mechanism of its Coordinating Committee on Children developed a Cabinet Paper which proposed new legislation. All salt being imported into the country was to be iodized (and non-iodized salt for human consumption was relegated to the status of a prohibited import along with fire-arms). In 1996, this was enacted into law, and the importers and wholesalers of salt were advised that there was a grace period up until the end of 1996. During 1997, with the assistance of another UNICEF consultant, an WHO-sponsored IDD monitoring workshop was held. Since then, the Health Inspectors have been working with the relevant customs and other officials to set up a functioning monitoring system.

There were a number of recommendations made in late 1997:

- That legislation state that "all food grade salt that is imported is iodised, including that intended for human, livestock and food industry-based
use. This excludes salt intended for use in the dyeing and tanning industry”.

- Only iodized salt should be included as a commodity in the "Pure Food Act". The industrial-grade salt that is not intended for human consumption should be mentioned and a clear distinction made.

- All salt imported should contain 50ppm of elemental iodine (approximately 85ppm of potassium iodate or 64 ppm of potassium iodide) and a maximum level of 80 ppm of elemental iodine (which corresponds to approximately 135ppm of potassium iodate or 105 ppm of potassium iodide).

- That a workshop for salt importers, major wholesalers and health inspectors be convened, to convey to them the importance of IDD and to increase awareness of their roles and responsibilities;

- That when salt enters the country and is not iodized, one written warning will be given followed by actions such as publishing information on brands not meeting the standard, imposing fines, and restricting or revoking import licences;

- Import permits should include the following information - Brand name of salt manufacturer; iodine compound used, ie KI or KI03; level of iodization;

- That testing of salt be done for shipments of salt entering the country and at the warehouse level;

- That periodic surveys be conducted, in schools or villages, to assess the coverage of population groups with adequately iodized salt. At a later stage a similar sample, ie a total sample size of 300, say 10 students in 30 schools or say 10 households in 30 villages, of urinary iodines would be collected and analysed to assess the trends in relation to urinary iodine for a biochemical monitoring of the situation.

One of the interesting issues for the IDD prevention efforts in Fiji is that we have had to be very careful not to give mixed messages about increasing consumption of salt. A lot of education work has been done so that the general population is aware of the risks of excess salt consumption and hypertension. Hence the legislation in Fiji has focused on ensuring that salt being used in snack foods, breads, and for human consumption generally is also iodized.
Links with chemist's analytical skills in the area of IDD are clearly needed, and we will defer to the PNG presentation to discuss more on this. Suffice to say, Fiji is proud of the changes it has made to its laws to improve the health and IQ of its population. UNICEF has suggested to the governments of Vanuatu and Solomon Islands, that they too may benefit from verification or otherwise of their urinary iodine status, and if necessary some of the same steps taken in Fiji could be supported in those two countries over the next few years.

**Vitamin A Deficiency (VAD)**

VAD is the single most important cause of childhood blindness in developing countries, and is the second largest cause of global blindness after cataracts. It also contributes significantly, at subclinical levels, to morbidity and mortality from common childhood infections such as diarrhoea and measles. A meta-analysis of ten different trials, which was commissioned by the United Nations Sub-Committee on Nutrition determined that there was conclusive evidence that improving vitamin A status of young children in areas where VAD occurred reduced mortality rates by 23% (Beaton et al 1993). Based on this work, UNICEF and other agencies gave priority to reducing the prevalence of VAD in younger children.

Clinical signs of VAD begin when a child can no longer see in dim light and thus suffers from what is known as "night blindness". As the affliction continues, the eye's conjunctiva and cornea become dry, lesions then appear on the cornea and, in the severest (clinical) form, the cornea just melts away causing total blindness.

VAD exists in more than 60 countries, at a clinical and or subclinical level. It is estimated that 2.8 million children 0-4 years of age are clinically affected by VAD, while those subclinically affected number around 251 million (WHO/UNICEF, 1995).

The major cause of VAD is inadequate dietary intake of the preformed retinol or precursors of vitamin A. Increased vitamin A requirement in certain physiological or pathological conditions, inadequate absorption, or loss of intestinal contents in diarrhoea may also contribute to VAD.

The criteria for VAD are both clinical and biological (WHO/UNICEF 1995). The classification of xerophthalmia and prevalence criteria constituting a public health problem are:
Criteria Minimum Prevalence

Night blindness (XN) > 1.0%
Bitot's Spots (X1B) >0.5%
Corneal Xerosis and/or ulceration >0.01%
(X2,X3,X3B)
Xerophthalmia-related corneal scars >0.05%

Prevalence of VAD in children >= 1 year of age of serum values <= 0.70 micromol/1 is defined as follows:

<table>
<thead>
<tr>
<th>Level of public health problem</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>&gt;=2-&lt;10%</td>
</tr>
<tr>
<td>Moderate</td>
<td>&gt;=10-&lt;20%</td>
</tr>
<tr>
<td>Severe</td>
<td>&gt;=20%</td>
</tr>
</tbody>
</table>

For the Pacific, there are many gaps in the data available, however it is clear that we are dealing with some of the highest VAD rates in the world in the Micronesian countries.

Around of clinical surveys was undertaken in the late 1980's and early 1990's, mostly under the auspices of USAID funding of a group called "VITAL". Other surveys in Micronesia were conducted opportunistically (unpublished reports, VITAL or UNICEF 1989-1997). From 1994, USAID completely withdrew from the Pacific, and the opportunity for follow-up by those groups has been lost.

- Cook Islands (atolls)* no cases of xerophthalmia found
- Kiribati* 14.7% of pre-school children from 6 Gilbert islands with clinical signs of VAD
- Marshall Islands 4.0% clinical signs (part of their National Nutrition Survey)
- Federated States of Micronesia
  - Chuuk State 46% abnormal serum retinol with Conjunctival Impression Cytology (n=455 aged 3-7 years)
- Palau no case of xerophthalmia found (opportunistic survey)
- Solomon Islands* 1.5% (from 7 islands)
- Tuvalu* no cases of xerophthalmia found
- Vanuatu* 0.05% clinical signs

* Surveys were conducted by VITAL
Subclinical assessment of VAD using serum retinol as an indicator have been undertaken in Chuuk and Pohnpei in Federated States of Micronesia and Marshall Islands. They reveal extremely high rates of VAD, and in a recent global review on prevalence rates only Lesotho appeared to be worse than the situation in Micronesia (Alnwick 1998).

<table>
<thead>
<tr>
<th>Vitamin A Status</th>
<th>Chuuk 18-36 months</th>
<th>Chuuk 3-6 years</th>
<th>Pohnpei 24-47 months</th>
<th>Marshall Islands 1-5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>45%</td>
<td>23%</td>
<td>49%</td>
<td>37%</td>
</tr>
<tr>
<td>&lt;0.7 micromol/l</td>
<td>44%</td>
<td>56%</td>
<td>44%</td>
<td>55%</td>
</tr>
<tr>
<td>&lt;0.35 micromol/l</td>
<td>11%</td>
<td>20%</td>
<td>7%</td>
<td>8%</td>
</tr>
</tbody>
</table>

VAD prevention programs have been ongoing for up to seven years in four Pacific Island Countries. Pohnpei State will launch its first ever VAD campaign in September 1998.

In Marshall Islands and Chuuk, vitamin A capsules (VAC) are distributed prophylactically every 6 months to children aged 1 year to 12 years, as well as to post partum mothers within 1 month of birth. In Chuuk, monitoring of their distribution program has always been good, and though it dropped in 1997, it has been consistent, with generally more than 80% of children receiving their VAC on each round of distribution. Marshall Islands is starting to improve its monitoring which of distribution of VACs which began in 1995. It is exemplary on Majuro, but less is known about Ebeye and the outer islands. In the protocols for both places, anti-helminths are also provided at the time of the VAC distribution, and this is regarded as rather innovative with only one other country in the world reported as doing this at present (Alnwick 1998).

In Kiribati, the VAC distribution is every 4 months, for children 6 months to 6 years and for post partum women within one week of parturition. Monitoring of coverage rates has been weak in the past, but 1997 data indicate that coverage on Tarawa is around 100%, on outer Gilberts it ranges from 50-80%, and in the very distant Line and Phoenix Islands, coverage is unknown.

Efforts to incorporate nutrition and health education outreach activities with schools, youth groups, and the general population; improvement of availability of foods rich in vitamin A and the pre-cursors through family food gardens, and other activities with agriculture departments; along with promotion and support of breastfeeding, are ongoing with the VAC distributions.
Determination of the impact of large-scale routine vitamin A supplementation programmes on survival, health or growth is a big challenge for the Pacific at this stage. Costs and logistics can be quite daunting, for example, the finger prick test that is being developed for rapid assessment of VAD is looking like it may cost around $20.00 per test at this stage of its development.

The challenges to understand more in the area of VAD are tremendous, especially among adolescents (there are many anecdotal reports of nightblindness among secondary school children, especially those in boarding schools) and among pregnant women. The implications are clear, if mothers to be and adolescents are vitamin A deficient, their resistance to infection and their health generally will be impaired. We have previously concentrated our efforts on the young child, but adolescents and mothers to be appear also to be at risk.

Similarly, there is much more work to be done to understand the nature of the Pacific foods we eat. Recent work has indicated that the conversion of pre-carotenoids into vitamin A from green leaves may not be as efficient as once thought, that red coloured fruits and vegetables may be “better converters”(de Pee at al, 1996), and since these foods and strategies have been so important in the Pacific, a better understanding is needed.

Also, besides the supplementation, dietary improvement, and improved public health strategies, VAD in other parts of the world is being tackled through food fortification. Sugar in Guatemala, margarine in the Philippines, Vanaspati or hydrogenated fat in India, milk and milk powder in refugee situations are some examples. The scope for this food fortification intervention seems more limited in the Pacific, but is worth consideration.

**Iron Deficiency Anaemia (IDA)**

IDA is the world's most prevalent nutritional deficiency. Approximately 2 billion people are said to be at risk globally, and almost half of all women and children in developing countries have anaemia (WHO 1992). Pregnant women with IDA are at significantly increased risk of birth complications and of giving birth to a low birth weight child. IDA in adults causes fatigue and contributes to low work capacity. Awareness of the importance of IDA in young children is growing, particularly because of the strong associations between IDA and impaired mental and motor development among infants and young children, and poor school achievement in older children (Draper, 1997).

There is less global consensus on indicators for global monitoring progress, or even on optimum strategies for pregnant women at present (Alnwick, 1998). A recent workshop on IDA in Fiji revealed that doctors were taking very individual approaches to diagnosis and treatment of IDA in pregnancy. The
value of folate along with the iron supplement in pregnancy has not been sufficiently emphasised in most of the Pacific Island countries to date.

Only scant data are available for the Pacific and those listed below were compiled at the time of the International Conference on Nutrition in 1992, and are therefore somewhat dated, but indicative nonetheless (WHO 1993).

<table>
<thead>
<tr>
<th>Country</th>
<th>Prevalence of Anaemia in pregnancy %&lt;11g/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSM</td>
<td>40</td>
</tr>
<tr>
<td>Fiji</td>
<td>40</td>
</tr>
<tr>
<td>Kiribati</td>
<td>69</td>
</tr>
<tr>
<td>Northern Marianas</td>
<td>11</td>
</tr>
<tr>
<td>Palau</td>
<td>16</td>
</tr>
<tr>
<td>PNG</td>
<td>81</td>
</tr>
<tr>
<td>Polynesie France</td>
<td>45</td>
</tr>
<tr>
<td>Solomon Islands</td>
<td>30</td>
</tr>
<tr>
<td>Tonga</td>
<td>38</td>
</tr>
<tr>
<td>Vanuatu</td>
<td>10-73</td>
</tr>
<tr>
<td>W Samoa</td>
<td>56</td>
</tr>
</tbody>
</table>

Despite inclusion of prevention of anaemia in the "Safe Motherhood" and other global initiatives, it is clear that not enough attention has been given to the basics on IDA all over the world as well as in the Pacific. Is there a policy on IDA supplementation during pregnancy, does the primary health care system reach women during pregnancy, are the supplements available, are they the correct dose, is there counselling about side effects and compliance? These are all questions which need to be answered and too often are not (Yip, 1996).

Similarly, there is evidence of the adverse effects of IDA on young children, but this evidence has yet to be translated into clear programming to improve the lives of children.

The fortification of a variety of food stuffs with iron has been a success in some countries, for example with wheat flour in Venezuela. Other foods which have been chosen for iron fortification include infant foods, salt, sugar, rice, curry powder and fish sauce.

The Government of Fiji is very keen to pursue the possibility of iron fortification, and UNICEF will work with them to identify appropriate technical expertise in this new area for the Pacific. The steps in the development of a food fortification program are many, and all of them need attention for any such program to work.

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These steps include the following (MI/IAC 1996):

1. Determination of the prevalence of micronutrient deficiency.
2. Segment the population if prevalence data indicate the need.
3. Determine the micronutrient intake from a dietary survey.
4. Obtain consumption data for potential vehicles.
5. Determine micronutrient availability from the typical diet.
6. Seek government support (policymakers and legislators).
7. Seek food industry support.
8. Assess the status of potential vehicles and the processing industry chain (including raw material supply and product marketing).
9. Choose the type and amount of micronutrient fortificant or mixes.
10. Develop the fortification technology.
11. Perform studies on interactions, potency, stability, storage, and organoleptic quality of the fortified product.
12. Determine bioavailability of the fortified food.
13. Conduct field trials to determine efficacy and effectiveness.
14. Develop standards for the fortified foods.
15. Define final product and packaging and labelling requirements.
17. Promote campaigns to improve consumer acceptance.

**CONCLUSION**

Micronutrient deficiencies in the Pacific pose a significant threat to the health and well being of the population. There are tremendous opportunities to work more closely with the OCEANIAFOODS scientists gathered here today to both better understand these problems as well as finding solutions to them, and to monitoring their continued success.

**REFERENCES**


AN OVERVIEW OF IRON DEFICIENCY ANAEMIA IN FIJI

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INTRODUCTION

Anaemia has been long recognised as a public health problem in Fiji, mainly affecting young children, women and the poorer sections of the population. Women of child bearing age are particularly vulnerable. Early medical research indicated that anaemia was a relatively rare disorder among Fijians and only recognised as a health problem amongst Indians'. However, trends over the years indicate an increasing prevalence of anaemia amongst Fijians.

Methods of Assessing Anaemia

Most of the studies that have been undertaken to assess the anaemia status of persons in Fiji have used WHO standard for serum haemoglobin levels.

Except for the 1993 National Nutrition Survey, it is difficult to compare findings from other studies due to differences in methods of determining haemoglobin levels and other limitations in the study methods used. Nevertheless, the findings do provide some basis for comparison over the years and appear to indicate an increasing trend in the prevalence of anaemia.

Findings

The most recent 1993 National Nutrition Survey found that 27% of the total population were anaemic. The problem was prevalent in both children and adults: 40% of young children under 5 years, 32% of the female and 22% of the male population were anaemic. Indian women of child bearing age had the highest rate of anaemia at 40% compared to Fijian women at 26%. This survey also reported a high prevalence rate of anaemia in pregnant women with 62% amongst Indians and 52% amongst Fijians.

A similar observation for children under 5 years was made by Chand (1995) while examining factors contributing to anaemia in pregnant women and preschoolers in Fiji. She found 32% of children under 5 years anaemic. It was also reported that there was no significant difference in the rate of anaemia between Indian and Fijian pregnant women. Chand's study found that 25% of
Pregnant women were anaemic, whilst the National Nutrition Survey reported 56%. The difference may be due to differences in small sample size.

Although other studies have been undertaken to assess the status of anaemia in the country, it would be difficult to attempt a direct comparison of these studies due to the different study methods, sample sizes and locations. However, their findings, tabulated below, provide an indication of the general trend of anaemia in Fiji.

<table>
<thead>
<tr>
<th>Year</th>
<th>Locations</th>
<th>Children Under 5 years</th>
<th>Men % (sample no)</th>
<th>Women % (sample no)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>% Fijian</td>
<td>Indian</td>
<td>Fijian</td>
</tr>
<tr>
<td>1969</td>
<td>Koronubu^4</td>
<td>24 (309)</td>
<td>9 (22)</td>
<td>7 (221)</td>
</tr>
<tr>
<td>1975</td>
<td>Suva, Nausori, Lomaivuna and Rewa Valley^5</td>
<td>20 (261)</td>
<td>6 (947)</td>
<td>7 (946)</td>
</tr>
<tr>
<td>1982</td>
<td>Suva, Wainunu &amp; Sigatoka^6 (NNS)</td>
<td>36 (103)</td>
<td>38 (102)</td>
<td>37 (35)</td>
</tr>
<tr>
<td>1986</td>
<td>Suva, Lakeba &amp; Sigatoka^7</td>
<td>-</td>
<td>25 (664)</td>
<td>24 (504)</td>
</tr>
<tr>
<td>1991</td>
<td>Central &amp; Western^3</td>
<td>32 (522)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1993</td>
<td>National^1^2 (NNS)</td>
<td>40(512)</td>
<td>25 (627)</td>
<td>20 (668)</td>
</tr>
</tbody>
</table>

*pregnant women (Food & Nutrition in Fiji, Volume Two; NNS 1993)

Admitted hospital cases reported by the Ministry of Health showed that anaemia is increasing. It is high amongst Indians than Fijians and also high amongst females than males^3 (see Table 1). This report is in line with trends observed in other studies that have been carried out.
Table 1: Anaemia cases reported by race and sex: 1993 -1996
(provisional figures)

<table>
<thead>
<tr>
<th>Year</th>
<th>Fijian</th>
<th>Indian</th>
<th>Others</th>
<th>Total</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>167</td>
<td>217</td>
<td>18</td>
<td>402</td>
<td>179</td>
<td>223</td>
</tr>
<tr>
<td>1994</td>
<td>173</td>
<td>233</td>
<td>14</td>
<td>420</td>
<td>205</td>
<td>215</td>
</tr>
<tr>
<td>1995</td>
<td>163</td>
<td>255</td>
<td>16</td>
<td>434</td>
<td>182</td>
<td>252</td>
</tr>
<tr>
<td>1996</td>
<td>176</td>
<td>231</td>
<td>16</td>
<td>423</td>
<td>191</td>
<td>232</td>
</tr>
</tbody>
</table>

(MOH, 1998)

Some government-implemented programmes already exist to improve iron deficiency anaemia. For example, the Ministry of Health is currently implementing the iron supplementation programme for pregnant women who attend ante-natal clinics. UNICEF has been active in the prevention of anaemia in the country through funding programmes such as "Family Food Production and Nutrition Project". This programme was carried out through the National Food and Nutrition Committee aimed at improving the nutritional and health status of mothers, infants and pre-schoolers who are the most vulnerable to nutritional deficiencies.

**Significance of Anaemia**

The overall effect of anaemia is of great concern to the country. The negative aspects are enormous. These include poor growth and development of children, low birth weight babies and reduced productivity of adults. At national level, millions of dollars may be lost due to low work productivity and morbidity associated with generally poor health.

**Possible Causes**

Past studies cite poor dietary intake of iron and hookworm infestation as possible causes of anaemia in the country. Chand (1995) suggested that a nutritional cause, lack of iron containing foods, was the primary contributing factors causing anaemia in Fiji.

Similarly, the 1993 National Nutrition Survey, attributed the high prevalence of anaemia to the following possible causes:

- Low consumption of foods which provide iron and protein e.g meat and dark green leafy vegetables;

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• Infections and hookworm infestations as a result of poor sanitation especially in rural areas;

• Frequent pregnancies with short birth intervals (leaving mothers highly susceptible to anaemia); and

• Lack of continuation of antenatal and postnatal care, particularly among teenage unsupported women.

Furthermore, the 1993 National Nutrition Survey confirmed the change in food preference from a traditional diet to a cereal-based diet with high consumption of sugar, cereals, vegetables, animal fat and low dietary fibre and animal protein. This change may contribute to heart disease, diabetes and iron deficiency anaemia as many of these foods are low in nutritional value.

What can be done

Public health measures to improve this situation should include measures recommended in the Fiji Plan of Action for Nutrition (FPAN) which was approved by Cabinet recently. These were some of the actions recommended in this FPAN:

• Introduction of policy measures and increase public awareness on ways to prevent anaemia and the negative implications of the disease;

• Iron (and folic acid) supplementation should be continued with pregnant women, and possibility to expand the regime to include children be investigated;

• Iron fortification of food be seriously considered as a preventive measure;

• Promote the growing and consumption of iron rich foods in the community.

CONCLUSION

The high rate of anaemia in Fiji is alarming. This disease has negative effects on the growth and development of children and on their academic performance, as well as the poor health of anaemic mothers and their babies. It also reduces the economic productivity of adults. It is hoped that the relevant ministries and NGOs will mobilize their efforts to reduce the prevalence of anaemia in all segments of society in Fiji.
REFERENCES


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*Proceedings of the 5th OCEANIAFOODS Conference*
EXPERIENCES IN THE USE OF IODISED SALT IN PAPUA NEW GUINEA

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INTRODUCTION

Several forms of malnutrition have been identified in Papua New Guinea (PNG). Those of public health importance are protein energy malnutrition (PEM), nutritional anaemia and iodine deficiency disorders (IDDs). In addition to these are the problems of non-communicable diseases (NCDs). Deficiencies of other nutrients such as vitamin A and zinc also exist in the country.

That iodine deficiency occurs in many areas of the country is well known (Buttfield and Hetzel, 1967, Heywood et al., 1986 and Heywood and Verrall, 1987). Out of the 423 million people currently at risk of iodine deficiency disorders in the Western Pacific region, including China, two million are in PNG (WHO/UNICEF/ICCIDD, 1993), representing nearly 50% of the total population of the country. This makes PNG the country with the second highest percentage of the country's population at risk in the region after Philippines.

The IDD Problem In PNG

Iodine deficiencies were identified in PNG as far back as 1957. Up to the seventies and eighties, the known goitrous areas were mostly in the mountainous areas on the country (Buttfield and Hetzel, 1967). Recent small surveys on school children indicate that goitre is not only common in mountainous areas but also in lowland coastal areas, raising the possibility of even higher percentage of people at risk than was formerly thought. This translates into the possibility of more intellectually impaired or permanently brain damaged children, more neonatal and infant deaths, more cases of infertility in women and perhaps even more cretins.

That iodine deficiency affects the brain is now universally accepted. The early surveys in New Guinea (1970-1987) revealed reduced cognitive and motor performances in children borne to iodine deficient mothers. The series of investigations showed a constant significant correlation between a variety of measures of the child's performance over a period of years and the level of maternal thyroid hormones (Pharoah and Connelly, 1993). Psychomotor function is closely related to skillful and nimble exercises, so severe iodine deficient individuals will perform poorly in tasks requiring skillfulness and
agility. Intelligence Quotient (IQ) distribution studies in IDD endemic areas in China showed a definite left shift of 10-15 IQ points in IDD endemias (Ma, 1994). This is a 10-15 points loss of intrinsic IQ which will reduce the individual's potential competitiveness.

Our own observations using Raven's Progressive Matrices Test in a limited preliminary studies in 1996 of 8-10 year old school children in the Menyamya district of the Morobe Province of Papua New Guinea seem to support this (Fig. 1) (Amoa et al. 1997), although the results should be interpreted with caution. This is because IQ conversion score sheets established for use with rural Chinese school children were used in the absence of any standards for Papua New Guinea. It may be incorrect to place too much emphasis on the absolute IQ scores. What may safely be deduced from the results is the difference in the performance between the school children from the IDD and non IDD control areas.

The low median iodine levels in the urine samples which we collected from the school children in the same survey further supports the endemic status of Menyanya area (Table 1). The levels were all below the International Commission for Control of Iodine Deficiency Disorders (ICCIDD) cut off point of 10mg/dl. In the absence of any re-evaluation of the known goitrous areas in the country, it is reasonable to assume that IDD is still a major problem and efforts to bring about development in the country may be limited by a passive iodine deficient population including particularly children.
Table 1. IDD Severity and the Need for Correction

<table>
<thead>
<tr>
<th>Stage*</th>
<th>Goitre*</th>
<th>&quot;types Goitre Prevalence*</th>
<th>Median Urinary Iodine mg/dl*</th>
<th>Need for Correction*</th>
<th>Menvamva District Study*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+</td>
<td>5 - 19.9%</td>
<td>5.0-9.9</td>
<td>Important</td>
<td>Median Urinary Iodine mg/dl</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7.5(Kwaplalim)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7.8(Kapo)</td>
</tr>
<tr>
<td></td>
<td>++</td>
<td>20 -29.9%</td>
<td>2.0-4.9</td>
<td>Urgent</td>
<td>4.6(Menyamya)</td>
</tr>
<tr>
<td></td>
<td>+++</td>
<td>&gt;30</td>
<td>&lt;2.0</td>
<td>Critical</td>
<td>-</td>
</tr>
</tbody>
</table>

+= Dunn et al,(1993)
1=Amoaeta,(1997)

IDD Control Measures

Various measures have been suggested by ICCIDD to control the IDD epidemic in the world. These include:

- Iodinated salt
- Iodinated oil
- Iodinated water supplies

The two most frequently used control measures for iodine deficiency are iodised salt and iodised oil. The pioneering use of iodised oil in PNG for the control of IDDs and the gazetting of food regulations for iodization of salt took place in the early seventies. The iodised oil program came to an end in the mid seventies and there was virtually no monitoring of iodine levels in salt. Ninety percent of salt samples collected from various areas in the country in 1994 were either not iodised or inadequately iodised (Ma, 1994). The gazetting of the amendment to the salt legislation in 1995 sought to strengthen control measures in the country. It also indicated that the authorities have chosen salt iodization as their method of combating IDDs in the country in the long term.

Since then, has there been any progress in the provision of adequately iodised salt to communities in the country? All salt sold in the country is imported. Papua New Guinea has three main ports and seven small ports of entry for goods into the country. So on paper, it should be relatively easy for Department of Agriculture and Livestock (DAL) and Department of Health quarantine officers at all these ports to monitor iodine content of salt imports. It should also be easy for health inspectors to regularly check iodine content of salt in...
the supermarkets and trade stores. There is virtually no monitoring activity at the seven small ports.

Of the three major ports, salt imports into Lae and Rabaul were not monitored for iodine content in the period up to the end of 1997. Quarantine officers did not monitor salt imports into Lae and Rabaul unless a complaint was made to them about a particular consignment. Such instances were quite rare. Salt at the wholesale and retail outlets in these two cities was not regularly checked by health inspectors either. Our own periodic monitoring in 1996 and 1997 in Lae indicated an increase in the percentage of wholesale salt samples containing more than the standard 30ppm iodine from 61.5% in 1996 to 90.9% in 1997. The level of improvement was not so great with the retail samples during the same period (73.5% to 87.1%). Not all the households in the city were consuming adequately iodised salt either (Amoa et al., 1998). The story is not different this year. Uniodised salt, salt iodised but in the prohibited potassium iodide not iodate form and salt packaged in water permeable containers which are also prohibited are still available in the supermarkets (Table 2). Lae is the gateway of food imports to the highlands and Morobe Province where IDDs have been shown to be particularly problematic. The story of inactivity in the monitoring area is the same in Port Moresby.

### Table 2. Iodine content of salt samples in Lae city

<table>
<thead>
<tr>
<th>Trade Name</th>
<th>Country of Origin</th>
<th>Declaration on Packaging</th>
<th>Packaging Material</th>
<th>Iodine Level (ppm) (iodate test kit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black and Gold</td>
<td>Australia</td>
<td>Iodised KI 25-40ppm</td>
<td>Polypropylene</td>
<td>Nil</td>
</tr>
<tr>
<td>Nambawan</td>
<td>Germany</td>
<td>Iodised KI0₃ 70ppm</td>
<td>Polyethylene</td>
<td>75</td>
</tr>
<tr>
<td>Cerebos</td>
<td>Australia</td>
<td>Iodised KI or KI0₃ 70ppm</td>
<td>Polypropylene</td>
<td>75</td>
</tr>
<tr>
<td>Saxa</td>
<td>Australia</td>
<td>KI or KI0₃ 0.01%</td>
<td>Paper box</td>
<td>75</td>
</tr>
<tr>
<td>Home and Garden</td>
<td>U.S.A.</td>
<td>Iodised KI 0.01%</td>
<td>Paper tube</td>
<td>Nil</td>
</tr>
<tr>
<td>La Paz Margarita</td>
<td>U.S.A.</td>
<td>None</td>
<td>Polypropylene</td>
<td>Nil</td>
</tr>
<tr>
<td>Kooka</td>
<td>Australia</td>
<td>Iodised</td>
<td>Polyethylene</td>
<td>75</td>
</tr>
</tbody>
</table>

### Guidelines for Monitoring

So with this rather bleak picture, where do we go from here? At this rate, will PNG meet the year 2000 deadline set by WHO/UNICEF/ICCIDD for the global eradication of IDDs? The answer is obviously no but a lot can be done to bring

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the country closer to achieving the goal by simply following the WHO/UNICEF/ICCIDD guidelines for monitoring iodine status and adequacy of iodine levels in salt (WHO/UNICEF/ICCIDD, 1996). According to the guidelines:

• **An IDD committee of qualified individuals who are responsible for program monitoring and evaluation must be set up.**

A lot of flourish was made in late 1994 and early 1995 about the setting up of a committee as part of an IDD control program, in the lead up to the launching of the amendment to the salt legislation, but nothing eventuated. Activities to help eradicate IDDs in the country did not even warrant a mention in the 1997 five year development program of the health department, even though micronutrient deficiencies, including IDDs, have been highlighted in the current (1995) national nutrition policy. Apparently IDD is currently not a priority in PNG, yet we know the devastating effects which IDDs have on the development and welfare of a nation.

• **There must be regular quality control of iodine concentration in salt at the ports of entry in the country by using reliable test kits and rechecking of suspect consignments by titration.**

• **An independent laboratory capable of carrying out salt titration and urine iodine analysis must be set up to ensure external quality control.**

Currently the health department uses the National Agriculture Chemistry Laboratory for salt titration tests on a very infrequent and ad hoc basis. However, my laboratory seems to be the only one interested in and actually carrying out urinary iodine analysis in school children and pregnant women.

• **There must be periodic monitoring of salt iodine levels in retail shops and households using test kits.**

All health inspectors at the provincial and district levels and city authorities have been issued with test kits. A system must be set up whereby the inspectors are required to submit test results at set intervals through their provincial offices to the quarantine officer in the national health department. This officer must be a member of the IDD monitoring committee. Spot checks should be carried out to ensure that tests are actually carried out and figures returned by the health inspectors are accurate.

• **A nationwide survey must be conducted to ascertain the current prevalence of IDDs.**

This was one of the recommendations at the UNICEF sponsored IDD training workshop in Mount Hagen in 1994 but yet to be implemented. Subsequent
surveys after this nationwide one, should be limited to occasional ones only. Small surveys conducted in certain areas in the country returned goiter rate figures of 0.5%-54%. Some of these are yet to be confirmed. The exercise will also provide the opportunity to identify areas where very little salt is consumed for the relevant intervention program to be set up for those areas. The per capita salt consumption which is currently unknown can also be determined during the exercise. My data for Lae is 6.95g/day (Amoa et al., 1998). The figure for other areas in the country need to be ascertained.

Finally, the WHO/UNICEF/ICCIDD guidelines stipulate that regular urinary iodine measurements must be carried out. The results, together with the other monitoring results, will provide the basis for adjusting salt iodine levels. The current PNG salt legislation was based on the assumption of 10g/day salt consumption.

On the web site of WHO IDD prevalence and control program data, against all the indicators for PNG are the words "No data available". The question that can be asked is "When are the blank spots going to be filled?". This is because IDD problems in the country are real and urgent actions need to be taken. With commitment from the relevant government departments to ensure that all salt imports are adequately iodised as well as pressure on the salt exporting companies outside the country to send only qualified salt to PNG, political commitment together with interagency, public and private sector collaboration backed up with adequate funding, Papua New Guinea should be able to pull herself out of the IDD stranglehold. If Africa with her deteriorating trend of protein-energy malnutrition can report spectacular successes in the fight against IDD (Kavishe, 1997), why can't we achieve the same thing in PNG? This is a major challenge but it can be done.

REFERENCES


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