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Kengkok - KhamphaoInsisiengnay, Udi Anothay, Phiou Phasuat, and Sue Dick.
Phone Sim - Souphalom Meksavan, Bounlay Mouddavong, and Sue Dick.

Sayaboury Province:
Maug Phieng - Somchit Boriboun, Youvaly Bounkeovisan, and Carol Wells.

Sedone Province:

Vientiane Province:
Sithantay - Mme. Thong Phoui Phiphat, Carol Ireson, and Chi Chaidiao.
Vang Vieng - Theo, Bouachan Sengchanthavong, and Barbara Gingerich.

The Agriculture Division of USAID-Laos supported the survey through Mrs. Joanne Augspurger, Mrs. Carol Wells and Miss Vanida S. Mongkhone of the Home Economics section of that division. Dr. Francis Bell and Dr. Robert Laubis of USAID Agriculture contributed technical advice and moral support. Miss Chi Chaidiao assisted me in analyzing and collating data. The IVS office staff typed most of the questionnaire forms.

Several individuals from other agencies also helped. Miss Isabel Coenengrcchts, World Health Organization nutritionist, weighed, measured, and examined survey children to determine their nutritional status and to observe any deficiency signs. She also contributed technical information. Mrs. Habibab Vachananda, chief of the Nutrition Division of the Thai Department of Health, analyzed several Lao vegetables for nutritional composition. Dr. Joe Wray of the Hamathibodi Medical School faculty, and Dr. Paul Gyorgy, head of Philadelphia General Hospital, offered technical advice. Father Brix, a Catholic priest, contributed botanical information.

I would like to extend my sincerest thanks to all of these wonderful people.
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NUTRITION SURVEY OF SIX LAO VILLAGES

organized and coordinated by Carol Ireson, IVS, in cooperation with IVS home economists and the RLG Home Economics Extension Department.
August, 1969

INTERNATIONAL VOLUNTARY SERVICES, INC.
Vientiane, Laos
1969
PURPOSES

1. To obtain general information about the typical Lao family that is related to the adequacy of each family member's diet.
2. To determine specific dietary deficiencies: by the educational level of particular family members, by village and by season.
3. To determine the amount of various foods consumed per capita per year.
4. To obtain a general measure of the nutritional status of the children in the sample families.
METHOD

Government home extension agents were trained in techniques of administering questionnaires and conducting the survey. IVS home economists in each area supervised the surveying of the families. The six Lao villages were arbitrarily selected according to location, ease of access by the IVSer and home agents, and relative security. The villages are Muong Phiang in Sayaboury province; Vang Vieng, north of Vientiane in Vientiane province; Sithentay, on the Mekong near Vientiane; Phone Sim, 16 kilometers from Savannakhet; Kangkok in Savannakhet province; and Houei Lao, on the Mekong near Pakse in Sekone province. The nine sample village families were randomly chosen from the selected village. An additional one to three families were arbitrarily selected on the basis of their relatively higher educational level. These families included village chiefs, teachers and government extension agents from home economics or agriculture. Each of the selected families was visited at least twice a day during a period of three consecutive days. All food to be eaten in that period was weighed before being cooked. Provisions were made to account for rice given to the monks, leftovers, food eaten away from home, and guests. The composition of the family by age and sex was noted so that the nutritional requirements of the family could be accurately calculated.

Five villages were surveyed during the cold season, five during the hot season and two during the rainy season. In generalizing the data obtained in each season, the three day survey period was assumed to be a representative sample of the food eaten during that entire season.

Miss Isabel Coenegrachts, a WHO nutritionist, weighed, measured and examined children for deficiency signs in Vang Vieng, Sithentay, Phone Sim and Kangkok. The children in Muong Phiang were weighed by the IVSer and the home agents.
NUTRITION SURVEY LOCATIONS IN LAOS
General Information Obtained by Questionnaire

Pregnancy and child mortality:
At any given time, 12.3% of all sample females ages 18-45 were over three months pregnant and 41.4% were breast-feeding their children. The average number of total live births for all women over 40 was 7.7. 5% of all children born alive to all mothers in the sample population had died before one month of age; 17% of all children born had died before one year; before reaching two years of age, 21% had died; before reaching 4 years, 27% had died; before reaching six years, 30% had died; before reaching 11 years, 39% had died.

Child feeding practices:
A mother's ideas about child care and feeding are an important factor in determining whether or not her children will eat an adequate diet. Questions asked about child feeding practices and ideas elicited the following information. Over half the mothers think that a child must eat rice so that he can grow big and strong. One-third of the mothers say he must eat fruit. Meat and milk are also mentioned as important for child growth by some mothers. A child younger than 7 years should not eat sour, green fruit, according to one-third of the mothers. One-third of the mothers said a young child should not eat hot, peppery foods. One-fifth of all children three years and younger are assisted in eating, and almost every mother says she watches her child to make sure he eat enough. The mothers in almost half of the families say the children eat before the rest of the family. In about one quarter of the families the parents eat first and another quarter of the families eat together.

Other than medicine, "Khaw piak", or mushy, boiled rice, seems to be the standard preparation for a sick child. In one-half of the families, when a child has a fever he is fed "khaw piak", while one-third of the families recommend medicine for a feverish child. Almost two-thirds of the families
suggest medicine for a child's cold, while $\frac{1}{3}$ each suggest "kha\text{piak}" and fish. Two-fifths of the families recommend medicine for a child with a stomachache, while one-third recommend "khaw piak".

Nursing children are given supplemental feedings of rice in two-thirds of the cases, adult food in one-fifth of the cases and nothing in one-tenth of the cases. 90% of all children who have stopped nursing eat an adult diet. A survey taken at Sithantay suggests that children are eating many elements of an adult diet by the age of one year. The information is presented below.

<table>
<thead>
<tr>
<th>food</th>
<th>% of mothers that give before 4 years</th>
<th>average age these mothers begin feeding</th>
<th>% of mothers that do not feed this food to children before 4 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>rice</td>
<td>100</td>
<td>(\frac{3}{4}) months</td>
<td>0</td>
</tr>
<tr>
<td>eggs</td>
<td>60</td>
<td>10 months</td>
<td>40</td>
</tr>
<tr>
<td>meat</td>
<td>83</td>
<td>9% months</td>
<td>17</td>
</tr>
<tr>
<td>vegetables</td>
<td>71</td>
<td>12% months</td>
<td>29</td>
</tr>
<tr>
<td>fish</td>
<td>92</td>
<td>12 months</td>
<td>8</td>
</tr>
<tr>
<td>fruit</td>
<td>80</td>
<td>11% months</td>
<td>20</td>
</tr>
</tbody>
</table>

In evaluating this information, however, it should be noted that Sithantay is the richest, most developed village of the six survey villages and is by no means typical of rural Laos.

39% of all families surveyed say that their children have eaten vitamins. In response to a question asking how much food their children eat, 52% of the families report "average", 39% report "much", and 6% report "not very much".
Child care:
The daily activity of most children consists of playing and going to school, but about one-fourth report that the children work and sleep. In most cases, one of the parents watches the children, but in one-fifth of the families the older sister takes care of the children and in one-tenth of the families the grandmother looks after the children. When the mother has work to do, most children help her or do children’s work. Children in less than one-fifth of the families either carry water or care for younger children.

When asked what they do to help their children grow big and strong, most parents reply that they give their child food to eat, more specifically milk, rice and fruit. Vitamins are also mentioned by a few families as important to child growth. When asked what they do to help their children become intelligent, most parents reply that they send them to school, but one-third didn’t know and one-tenth say they train their children at home.

General family diet:
During seasonal periods of heavy work, changes in diet could not be ascertained although young men tended to say they ate more. Over two-thirds of the families eat at least one meal in the fields when they are working there. The family diet at the rice field remains approximately the same, with a heavier dependence on water creatures (fish, snails, crabs, frogs).

83% of the families surveyed obtain drinking water from a well, while 11% obtain drinking water from the Mekong River. 46% of the families surveyed say they boil water to drink (which doesn't mean that they drink only boiled water). 33% say that parents eat more than children.

Availability of food:

<table>
<thead>
<tr>
<th>% of families raising crop</th>
<th>crop raised</th>
</tr>
</thead>
<tbody>
<tr>
<td>61</td>
<td>paddy rice</td>
</tr>
<tr>
<td>50</td>
<td>green leafy vegetables</td>
</tr>
<tr>
<td>41</td>
<td>hill rice</td>
</tr>
<tr>
<td>34</td>
<td>fruit trees</td>
</tr>
<tr>
<td>14</td>
<td>dry season rice</td>
</tr>
</tbody>
</table>
% of families raising animals | kind raised
--- | ---
52 | chickens
40 | buffalo
31 | pigs
8 | ducks
81 | raise at least one kind of animal

In Sithantay, all of the families who plant gardens or raise animals eat their garden produce and their animals (or animal products, such as eggs), whether or not garden produce or animals are sold. The sale and slaughter of pigs, however, is government controlled, so pig-raisers generally cannot eat their own pigs. 54% of all families say they buy rice sometime during the year and 87% of all families report having enough to eat.

Availability of money:
50% of the families surveyed contain wage-earning members: 49% of these wage-earners are soldiers, and 26% are laborers. However some of these families were selected because they contained government employees. Of the ordinary village families selected, 42% contained wage earning members: 16 soldiers, 8 laborers, 5 medics, 2 irrigation pump operators and 5 other workers.

The average actual expenses recorded were 200 kips per family per day for the ordinary villagers and 350 kip per family per day for the educated-salaried villagers (village chief, teacher and agriculture or home economics agent).

When questioned how they would spend a large sum of money if they had it, 40% replied that they would build a house. 17% would buy land and 13% would buy buffalo. The purchase of a car, pump, clothes and food were also mentioned by a significant number of families.
Family health as reported:
56% of the families report adult sickness as a common occurrence. The most common complaints are headaches, stomachaches and being tired. 67% of the families report child sickness as a common occurrence. The most common complaints are stomachache (57%), cold (23%), and fever (13%).
Almost all families spend less than 500 kip for expenses in case of sickness.

The average family - other information:
The average family size is 7.41 people with the following distribution:
- average number of adult males (over 16): 1.88
- average number of adult females: 1.89
- average number of boys: 1.57
- average number of girls: 2.14

The population frequency distribution is portrayed in the following graph.
There is an expected shortage of males between the ages of 16 and 35, because of the military draft and the war. There are however, at least two villages that are near large army camps (Houei Lao and Vang Vieng) and some soldiers were living with the village families.
The average family has one guest eat an average of two meals in a week. The most common guests are adult males. The average family consumes 3,460 kg. of rice, 51 gm. of fish sauce, 111 gm. of padek (salted, fermented fish), and 27 gm. of red peppers every day.

Specific Dietary Deficiencies: Educated-Salaried Group Compared with Ordinary Villager Group

With the exceptions of calorie and riboflavin intakes, the families of the teachers, the agriculture and home agents and the village chiefs eat significantly more nourishing diets than do the ordinary village families. As can be seen in Figure 1, the diets of the educated families are still deficient in some respects. They are 17% short on calories, as compared with the villager shortage of 10%. Vitamin A intake, although higher than that of ordinary village families, is still 41% below standard. Due to loss during cooking, thiamine intake is substantially lower than the 12% shown in Fig. 1. Riboflavin intake of the educated group is almost as deficient as that of ordinary villagers and, due to cooking loss, is somewhat less than the stated 60%. Niacin intake, even considering losses in cooking, may be adequate for the educated group. Unlike ordinary village families, Vitamin C intake in the educated group is more than adequate. Protein, calcium and iron intake are all above standard. 28% of the protein consumed by the educated group is from animal sources, while 26% of the protein consumed by the ordinary villager is from animal sources.

Since the educated-salaried families eat a generally more adequate diet than ordinary village families, the data from the educated families is excluded in the following discussion of dietary intake. This will give us a clearer picture of the dietary strengths and weaknesses of the ordinary village diet.

Specific Dietary Deficiencies: by Village and by Season

Calories:

Villagers average 10% below the standards of the Foods and Nutrition Board.¹

¹Food and Nutrition Board, National Academy of Sciences-National Research Council (revised 1963). The recommended daily allowance for a man age 18-34 is 2900 calories.
Fig 1: Educated salaried group versus village group.

- Calcium
  - Educated group: 38
  - Village group: 4

- Iron
  - Educated group: 17
  - Village group: 5

- Vitamin A
  - Educated group: 43
  - Village group: 4

- Thiamine
  - Educated group: 4
  - Village group: 3

- Niacin
  - Educated group: 25
  - Village group: 12

- Riboflavin
  - Educated group: 17
  - Village group: 6

- Calorie
  - Educated group: 60
  - Village group: 62

Educated group (Village chiefs and government employees)

Village group
in calorie consumption in data gathered during all three seasons of the year. In no one season is calorie consumption significantly better or worse than this average. Certain villages, however, consistently consume more calories than other villages (see Figs. 2-4). Sithantay, for example, has the best average yearly calorie consumption: only 3% below standard.

Vang Vieng and Kengkok fall 6% below the standard, while Phone Sim, a village near Savannakhet, falls 15% below. If the data gathered during the cold season in both Muong Phieng and the hot season in a village near Pakse are assumed to be indicative of the year-round calories intake of those villages (which is likely since there is little seasonal fluctuation), Muong Phieng would average 22% below the standard and the Pakse village would fall 3% below standard. Clearly, calorie intake is not adequate to maintain the good health of a moderately active person.

Protein:

Surprisingly, the villager's yearly average protein consumption is only 4% below Food and Nutrition Board standards. Of the protein consumed comes from animal sources. Unlike calorie consumption, protein intake does seem to vary significantly with the season (see fig.2-4). On the average, protein consumption varies from 3% above standard in the cold season to 3% above in the hot season with a sharp drop in the rainy season to 15% below standard. Individual villages differ in the variation in protein consumption between the hot and the cold seasons, but both of the villages surveyed in the rainy season showed a substantial decline in protein intake.

Sithantay and Vang Vieng have the best average yearly protein intake with Sithantay 13% above standard and Vang Vieng 10% above. Kengkok is 1% below standard and Phone Sim 12% below. Since protein intake varies according to the season, there is not enough information to accurately estimate the average yearly protein intake of Muong Phieng and the Pakse village. However, it should be noted that the Pakse village is 17% below standard (fig.3) when all other villages are at or above standard, and Muong Phieng

---

2 recommended daily intake: 1 gram per kilogram of body weight. The standard Lao man, age 18-34 was assumed to weigh about 60 kg, the average weight of a sample of Thai soldiers of comparable age examined in the ICRHD survey of Thailand (1962).
is also somewhat below standard (fig. 2). Three cases of kwashiorkor (protein deficiency disease) were found in Sithantay.

Even though the average yearly protein intake is only 4% below standard, that does not necessarily mean that a near-adequate amount of protein is being consumed by each family member. It is likely that adults, especially the men, eat a large share of the protein consumed by the family, while young children eat mainly rice.

Calcium:
Villager yearly average intake of calcium is 4% above the required standard. It varies from season to season with a high intake 30% above standard in the cold season, dropping to 5% below in both the hot and rainy seasons. The variation in averages does not accurately reflect the pattern of fluctuations from season to season in each village. This can best be seen by comparing the calcium sections of figures 2, 3, and 4. The average yearly calcium intake in Vang Vieng and Kengkok is 26% and 25% above standard. At Sithantay it is 6% above and at Phone Sim it is 8% below standard. Since calcium intake fluctuates widely from village to village and season to season, there is not enough information to estimate the average yearly calcium intake in Muong Phieng and the Pakse village. Muong Phieng, however, has the lowest cold season calcium intake. This suggests that the yearly calcium intake in Muong Phieng is probably below the +4% average. The hot season intake in the Pakse village is above the yearly average, so the yearly intake may be adequate. One case of rickets and two cases of skeletal irregularities were observed when sample children were examined.

Most of the calcium comes from the solid portion of padak (salted, fermented fish). Any family eating little or no padak is not able to ingest enough calcium.

3 100-500 mg./day, FAO, Rome standards.
Iron:

Villagers' yearly average iron intake is 5% above standard. Intake varies from season to season with an average high of 30% above standard in the cold season to 5 and 6% below standard in the hot and rainy seasons (see figs. 2-4). Like calcium, a substantial percentage of the iron comes from padek, so changes in iron intake roughly parallel those of calcium intake. Average yearly iron intake fluctuates from village to village. Sithantay and Kongkok are both above standard: 25% and 19% respectively. Phone Sin is 8% below standard and Vang Vieng is 9% below. Although information is not complete enough to accurately project yearly iron intake in Muong Phieng and in the Pakse village, it can be seen that Muong Phieng's cold season intake lower than any other village and that the iron intake in the Pakse village was also considerably below standard.

Although the average iron intake is just adequate, women need 1.5 times more iron than men. It is a well established fact that many Lao women suffer from some degree of iron deficiency anemia. In the Vang Vieng hospital the average hemoglobin for pregnant women visiting the hospital in six months of 1968 was 11.2%.

Vitamin A:

Villagers' yearly average consumption of vitamin A is 40% below standard. It varies from season to season, but always averages significantly below standard (figs. 2-4). In the cold season, the average is 24% below standard; in the hot season 70% below standard; in the rainy season 51% below standard. Sithantay and Vang Vieng average 32% and 31% below standard, while Kongkok averages 58% below and Phone Sin 69% below. Muong Phieng and the Pakse village seem to follow the season average with Pakse very low in the hot season and Muong Phieng about average in the cold season. 14 cases of xerosis conjunctivitis (inflammation and changes in the outer layers of

4 10 mg./day, Food and Nutrition Board standards.
* The average range for American women is 12.5 to 16.0. Iron pills are usually prescribed when hemoglobin drops below 13 or 14.
5 Practical daily requirement for reference man: 3500IU.
Vitamin A deficiency:  11% of sample children were found to have xerophthalmia (dry eye, caused by vitamin A deficiency) were found among sample children. Vitamin A consumption is obviously very inadequate.

The main sources of vitamin A are medium and dark green leaves from gardens and the forest, sweet potatoes and organ meats. In every village surveyed during the hot season when vitamin A consumption is lowest, at least one family ate one kind of food that was high in vitamin A, so some vitamin A containing food available in the environment is probably not being utilized. The most commonly available foods were the talung leaf and clover, both of which can be gathered from the forest or fields.

Vitamin B1 - Thiamine:

The yearly average intake of Thiamine is 18% below the standard with cold and hot season averages of 11% below and a rainy season average of 25% below (figs. 2-4). All villages are generally below standard in yearly intake with Vang Vieng 9% below, Kongkok 13% below, Sithantay 18% below, and Phone Sin 23% below. Huang Phieung and the Pakse village are below the seasonal averages in the cold and hot seasons respectively.

Over three-quarters of the thiamine consumed by the villagers comes from rice. Unfortunately, over 80% of the thiamine in raw rice is lost in the traditional method of preparing the rice. Therefore, the average amount of thiamine that is consumed is probably 70% below standard if cooking losses are taken into account. Although no obvious cases of beri beri were observed among the sample children, 11 children showed the following symptoms of thiamine deficiency: calf tenderness, lack of knee and ankle reflexes, and muscle wasting of the arms, legs and back. It is evident that villagers are deficient in this vitamin.

---

6 1.2 mg./day, Food and Nutrition Board standards
* As analyzed by the Nutrition Department at the University of Wisconsin.
In the United States it is estimated that 40% of the thiamine requirement is supplied by enriched flour and bread. Even in a country with great variety and abundance of food supplies, bread and flour had to be enriched to enable the average person to meet his thiamine requirement. In Laos enrichment of flour and bread are not important. The enrichment of rice, however, should be considered since it is probably the only alternative to continued thiamine deficiency.

Vitamin B2 - Riboflavin:
The yearly average consumption of riboflavin is 62% below the Food and Nutrition Board standards. There are slight changes from season to season with hot season consumption the highest (figs. 2-a). All villages share the same tremendous lack of riboflavin, but Vang Vieng, Phone Sim and Kengkok are somewhat lower in riboflavin intake than Sithantay. Even Sithantay however, is 52% below standard. Muang Phoing is a little better than average in the cold season, but the Pakse village is below average in the hot season.

Over one-third of the riboflavin in the Lao diet comes from rice. Probably 70% of the riboflavin present in raw rice is lost in the traditional cooking process.* Losses in cooking other food sources of riboflavin may also be significant. Therefore, it is likely that the yearly average intake of riboflavin is more than 70% below standard.

11% of the children in the families surveyed had active angular stomatitis; another 16% had scar tissue from previous cases of angular stomatitis; another 12% had cheilosis. Both angular stomatitis and cheilosis are usually caused by riboflavin deficiency.

Even in the United States, some clinicians report that mild riboflavin deficiency may still be a prevalentavitaminosis. In fact, the average American is not likely to get an optimum amount of riboflavin unless he

---

7 1.7 mg./day
* As analyzed by the Nutrition Department at the University of Wisconsin.
Figure 3: HOT SEASON

% Above or below dietary requirement:

- Calories
- Protein
- Calcium
- Iron

Legend:
- Kengkaw
- Pakse
- Phone Sim
- Sithantay
- Vang Vieng
Fig. 1A: Alimentary requirement

- Proteins
- Fat
- Carbohydrates
- Vitamins
- Minerals

Above or below the dietary requirement.
consumes generous quantities of milk (Cooper, et al, 1963). The best
sources of riboflavin, organ meats and milk products, are expensive and
not readily available to the Lao villager.

Niacin:
The yearly average intake of niacin is 11% above Food and Nutrition Board
standards with little seasonal variation. Phonsin and Sithantay average
23% and 21% above the standard, while Vang Vieng and Kongkek average 10%
and 7% above standard. Muong Phiang's average intake is a little below
standard in the cold season and the Pakse village is significantly below
the standard in the hot season.

A significant amount of niacin in the Lao diet comes from rice. Since
niacin is a water-soluble vitamin, some of the niacin in rice is lost
in the traditional rice preparation method, and niacin intake is not as
high as indicated by the averages.

Vitamin C:
The yearly average intake of Vitamin C is 11% below standard. The
seasonal averages vary widely due to the seasonality of vitamin C
containing fruits and vegetables. The cold season average is 2% above
standard, while the hot season intake is 5% below the standard. The
rainy season average is 9% below standard. Since the need for vitamin C
is constant and since vitamin C cannot be stored by the body in large
amounts for long period of time, it is likely that the average Lao
experiences a definite shortage of Vitamin C during the hot season. No
cases of scurvy were observed in the sample families, however.

Average per Capita Intake of Various Kinds of Foods
As can be seen from figure 5, the consumption of various foods varies
between seasons and villages. Daily rice consumption is lowest in the

---

8 19 mg./day
9 suggested practical requirement for reference man: 30 mg./day
<table>
<thead>
<tr>
<th>all figures in</th>
<th>RICE</th>
<th>GREEN, LEAFY VEGETABLES</th>
<th>OTHER VEGETABLES</th>
<th>FRUITS</th>
<th>MEAT &amp; EGGS</th>
<th>FISH &amp; INSECTS</th>
<th>ROOTS &amp; OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kilograms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Average consumed by 1 person:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>in 1 day</td>
<td>9.026</td>
<td>9.340</td>
<td>12.915</td>
<td>6.050</td>
<td>27.750</td>
<td>0.760</td>
<td>0.13</td>
</tr>
<tr>
<td>in 1 year</td>
<td>163.100</td>
<td>28.990</td>
<td>6.050</td>
<td>2.319</td>
<td>7.200</td>
<td>0.270</td>
<td></td>
</tr>
<tr>
<td>Cold season:</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>in 1 day</td>
<td>14.56</td>
<td>9.340</td>
<td>12.915</td>
<td>6.050</td>
<td>27.750</td>
<td>0.760</td>
<td>0.13</td>
</tr>
<tr>
<td>in 1 season (90 days)</td>
<td>43.300</td>
<td>14.56</td>
<td>4.800</td>
<td>3.760</td>
<td>7.605</td>
<td>2.270</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>in 1 day</td>
<td>5.09</td>
<td>9.026</td>
<td>10.66</td>
<td>0.06</td>
<td>0.29</td>
<td>0.73</td>
<td>0.13</td>
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<tr>
<td>in 1 season (90 days)</td>
<td>45.600</td>
<td>1.835</td>
<td>6.000</td>
<td>1.700</td>
<td>6.005</td>
<td>2.920</td>
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<td>Rainy season:</td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>in 1 day</td>
<td>0.09</td>
<td>9.026</td>
<td>10.66</td>
<td>0.06</td>
<td>0.29</td>
<td>0.73</td>
<td>0.13</td>
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<td>in 1 season (180 days)</td>
<td>74.000</td>
<td>3.365</td>
<td>18.190</td>
<td>8.520</td>
<td>4.040</td>
<td>13.945</td>
<td>1.450</td>
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<td>Projections for yearly consumption:</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>in Kengkio</td>
<td>159.700</td>
<td>36.350</td>
<td>18.150</td>
<td>5.160</td>
<td>27.590</td>
<td>6.710</td>
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<tr>
<td>in Phonx Xim</td>
<td>164.600</td>
<td>23.600</td>
<td>11.610</td>
<td>6.610</td>
<td>23.200</td>
<td>4.065</td>
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<td>in Sihantay</td>
<td>174.700</td>
<td>38.750</td>
<td>22.790</td>
<td>7.380</td>
<td>33.440</td>
<td>7.930</td>
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<tr>
<td>in Vang Vieng</td>
<td>152.100</td>
<td>23.650</td>
<td>14.220</td>
<td>4.650</td>
<td>26.360</td>
<td>2.400</td>
<td></td>
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</tbody>
</table>

1 These are "per capita" figures. In other words, each person from the smallest baby to the oldest man was counted as 1 person.

2 Since Muong Phieng and Pakse were surveyed only once, the likelihood of inaccuracy in making yearly consumption projections is greatly increased. Therefore no yearly projections are made for those two villages. However, data from Muong Phieng and Pakse are used in calculating the seasonal and yearly per capita intakes.

3 Includes red peppers.

4 Includes "padek" (salted, fermented fish).

5 "other" includes rice noodles, fish sauce, sugar and cooking oil.
rainy season and highest in the hot season. Sithantay villagers tend to consume significantly more rice than other villagers. Daily consumption of green, leafy vegetables (a main source of vitamin A and C) is highest in the cold season. Sithantay and Vang Vieng villagers tend to eat substantially more green leafy vegetables than Kengkok and Phone Sim villagers. More "other vegetables" are eaten daily in the rainy season than in other seasons. Kengkok and Sithantay villagers obviously eat more "other vegetables" than do the other villagers. Almost no fruit is consumed during the hot season; although some fruit is eaten during the cold and rainy seasons. Kengkok and Sithantay villagers consume considerably more fruit than the other villagers. Vang Vieng diets are very low in fruit.

The most meat is eaten per day in the cold season. Sithantay and Phone Sim villagers tend to eat more than villagers in Kengkok and Vang Vieng. Fish consumption fluctuates little from season to season.

Sithantay villagers eat significantly more fish than other villagers and Phone Sim villagers are definitely low in fish consumption. Insect consumption is insignificant. Roots and "other foods" are most often consumed in the cold season. Kengkok and Sithantay villagers tend to consume more than other villagers.

In sheer quantity of food consumed per capita per year, Phone Sim and Vang Vieng vie for last place, while Sithantay is definitely in first place. Kengkok falls in the middle. Sithantay villagers eat a wider variety of foods other than rice, while Phone Sim villagers have the least dietary variety.

Nutritional Status of Sample Children

The weight versus age graphs1 (figures 6 and 7) provide a method of classifying the nutritional status of 160 children in the survey sample.

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1 Dr. Joe Wray of Ramathipidi Hospital Medical School faculty in Bangkok kindly supplied me with the basic graph for children up to 72 months of age, developed by Gomez and used widely in Latin America and elsewhere for surveying the nutritional status of children. Miss Isabel Oomenraets WHO nutritionist, supplied me with other information to complete the basic graph through 15 years of age.
Fig 6: NORMAL WEIGHT AND DEGREE OF MALNUTRITION
Sample children from five Lao villages

- Kilograms

Age in months

Kengkok
Muong Phieng
Phone Sim
Vang Vieng
Sithantay
Fig. 7: NORMAL WEIGHT AND DEGREE OF MALNUTRITION
Sample children from five Lao villages

Age in years

Kengkok  Phone Sim  Wang Vieng
Muong Phiang  Sithantay
The observed weight of a particular child of a given age is compared with the expected weight of a child of that age. A child 15% or more below the expected weight is considered malnourished. The degree of malnutrition (1st, 2nd, or 3rd) depends on the percentage of an adequately nourished child. According to Wray (1968) and Jeliffe (1966), weight is a most sensitive indicator of a child's nutritional status since a child's body adjusts to malnutrition become evident. This also allows early discovery of incipient malnutrition.

Figure 6 shows the distribution of children regarding the degree of malnutrition. The median child (or, roughly speaking, the average child) in this group (ages 1-72 months) is 32% below his expected weight. In the older group (figure 7) the median child is 26% below his expected weight. The median child in each village is very similar, with the exception of Kengkok. The median child in Huang Phiang is 22% below his expected weight, in Sithantay, 23% below his expected weight; in Vang Vieng, 26% below his expected weight; in Phone Sim 26% below his expected weight. In Kengkok, the median child was 31% below his expected weight.

136 of the children in the sample families were examined for specific nutrient deficiencies. The results closely parallel the food survey results. The largest and most consistent deficiencies noted in the Lao diet were deficiencies of vitamin A and riboflavin. Most of the deficiency symptoms exhibited by the children were caused by shortages of these vitamins.

39% of the children showed deficiency symptoms usually associated with a prolonged lack of riboflavin: angular stomatitis and cheilosis. 11% had active cases of angular stomatitis, while another 16% had scars from previous cases. Another 12% had cheilosis. 10% of the children had xerosis conjunctivitis, a vitamin A deficiency disease that causes inflammation and changes in the outer layers of the eye.
23% of the children had a slightly enlarged thyroid gland, attributable to the lack of iodine. This could be corrected in many cases by iodizing the salt. For example, in Vang Vieng, 26% of the children in the families surveyed there had small goiters. Almost every family ate salt. The average daily per capita consumption of salt in Vang Vieng was 2.9 grams. If the salt eaten by these families were .02% sodium iodine (a usual rate of iodization for table salt), each person would have consumed, on the average, .58 mg. of iodine per day. Ingestion of .1 mg. of iodine per day is considered to be adequate.

There were several kinds of deficiency signs that are usually associated with a lack of thiamine. Five children had either no ankle reflex or no knee reflex; four children exhibited muscle wasting of the arms, legs, or back (may also be a result of protein deficiency); two children had calf tenderness.

Four cases of gingivitis (inflammation of the gums) were found. This is usually associated with deficiencies in the B vitamins and ascorbic acid (vitamin C). Six children exhibited papillary atrophy of the tongue, a symptom linked to B vitamin complex deficiencies. Three children showed signs of skeletal abnormalities usually associated with a lack of vitamin D, calcium and phosphorus. One of these exhibited a definite case of rickets. Five children showed general pallor that might be attributable to deficiencies in iron, folic acid, vitamin B12, and/or vitamin C. Two children had cases of kwashiorkor (protein deficiency disease) and two others exhibited kwashiorkor-related dermatitis.

The nutritional condition of 11% of the children was poor, i.e. premarasmic, but no actual cases of marasmus (calorie deficiency disease) were found.
CONCLUSION

The Lao diet is generally very deficient in riboflavin and vitamin A, somewhat deficient in calories, protein, thiamine and vitamin C, barely adequate in calcium and iron, and adequate in niacin. The gross deficiencies manifest themselves in specific deficiency symptoms and disease (angular stomatitis, xerosis conjunctivitis, etc.) while the other deficiencies are manifested in low growth curves, greater susceptibility to disease and vague symptoms of tiredness, lack of appetite, and discomfort that the Lao often consider normal. It should be noted that most of the children showing deficiency symptoms are sub-clinical cases. The educated-salaried group of families ate generally more adequate diets, but the obvious deficiencies experienced by ordinary villagers (vitamin A and riboflavin) were also experienced by this group.

At this point it can be seen that Sithantay villagers generally eat more food, a greater variety of food, and a somewhat more adequate diet than the villagers in any of the other survey villages. Lest we become complacent about the inevitability of nutritional progress as villages become richer, more developed, and have easier access to good food markets (which is what has happened at Sithantay in recent years), it is important to note a few things about the Sithantay survey families:

1. The only three cases of kwashiorkor found in the entire survey sample were in a Sithantay family. These three children lived in the household of the farmer association chief, a village leader who was lacking in neither education nor money. This suggests that although enough protein was available or could have been available in this family, the younger children did not have access to it.

2. Although the diets of Sithantay villagers as a group are better than those in other villages taken as a group, the growth curve for Sithantay children (figs. 5-6) is nearly the same as the growth curves of Muong Phieng and Vang Vieng children.
3. In Sithantay only 30% of the children had no overt signs of specific nutritional deficiencies. In Phone Sim, a village with a lower child growth rate curve, and less available food, 52% of the children showed no overt signs of specific deficiencies. Some mothers may know what their children should eat, but may still not be motivated to feed their children properly. For example, although home agents have had basic food and nutrition training, the child of one home agent surveyed had rickets; a child of another home agent surveyed suffered from third degree malnutrition. Knowledge without motivation does not produce change.

Recommendations for correcting the existing nutritional deficiencies in the local diet can be made, but it must be stressed that increased villager knowledge of good nutrition and incentives to use that knowledge must be an important part of any program to improve the village diet.

Recommendations:
1. Rice consumption should be increased 10% to correct the caloric deficiency.
2. Fish and meat consumption should be increased 30% and a larger share of this protein food should be given to the children, beginning as early as at 6-9 months of age.
3. The recommended increase in rice and animal protein foods would provide the 35% increase in iron necessary to insure that women would get all of the iron they need.
4. Intake of green leafy vegetables should be increased by 10% to prevent vitamin A deficiencies. Village women should also be taught how to prepare these vegetables to prevent vitamin loss.
5. Tropical fruit consumption should be increased 15% to increase the intake of vitamin C.
6. In order to meet thiamine requirements, pork and organ meat intake would need to be increased by an unrealistic amount: as much as 200% or almost 100 grams per person per day.
7. Riboflavin intake should be increased at least 200%. The already suggested increases in green leafy vegetable consumption, meat and fish, pork and particularly organ meats would produce all of the necessary riboflavin increase.

The ideal average food intake, per capita per day and per year, is charted below. The amount of meat necessary to meet nutritional requirements is obviously unrealistic, especially considering that a good share of that must be organ meats.

<table>
<thead>
<tr>
<th>all figures in kilograms</th>
<th>per day</th>
<th>per yr</th>
</tr>
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<tbody>
<tr>
<td>Rice</td>
<td>.492</td>
<td>179.110</td>
</tr>
<tr>
<td>Green, leafy vegetables</td>
<td>.052</td>
<td>19.440</td>
</tr>
<tr>
<td>Other vegetables</td>
<td>.080</td>
<td>28.990</td>
</tr>
<tr>
<td>Fruits</td>
<td>.040</td>
<td>14.725</td>
</tr>
<tr>
<td>Meat and eggs</td>
<td>.159</td>
<td>58.050</td>
</tr>
<tr>
<td>Fish and insects</td>
<td>.098</td>
<td>35.400</td>
</tr>
<tr>
<td>Roots and other</td>
<td>.013</td>
<td>4.640</td>
</tr>
</tbody>
</table>

There is enough food available locally for most villagers to be able to increase their green vegetable consumption. Fish and meat are available in limited quantities throughout the year and it is at least possible that fish and meat consumption could be increased to meet protein and iron needs. Tropical fruits are available in the forest in some seasons and are available in markets at most times of the year. Proper cultivation of fruit trees during the hot season (i.e., watering the trees, etc.) could make fruits available year round.

If the villagers are educated in the value of eating adequate meals, and are taught what a nutritionally adequate meal consists of; and if some increases in the production of already existing products (such as fish, fruits, and green vegetables) can be made, it is conceivable that...
calorie, protein, iron, vitamin A and vitamin C deficiencies can be alleviated. The villagers must be educated by every means available: home economics classes, not only for unmarried girls but for young mothers who are in the process of raising children; movies and posters; radio programs about how to feed a child so that he will grow big and strong; in-service training programs in nutrition for home economics agents, agriculture agents, and medics. The first step in improving the nutritional status of the Lao people, however, is a firm commitment by the Royal Lao Government to do so. Once that commitment is made, an organized country-wide program could begin that would involve personnel from several government divisions, such as the Directorate of Agriculture, the Ministry of Health and the Commission of Rural Affairs. All of the above mentioned ways of educating the villagers could then be coordinated. A child development program, focusing on the health and nutrition of preschool child, could be started in several village locations manned by a staff with medical, nutrition, sanitation and home economics training.

The present sources of inexpensive riboflavin and thiamine are definitely inadequate. Milk fat products (excellent sources of riboflavin) are not generally available; pork, other meats and organ meats, in the large quantities necessary, are too expensive and often not available. Even in the United States, mild thiamine and riboflavin deficiencies were problematic until flour and bread were enriched. The only reasonable alternative to the chronic B vitamin deficiencies in Laos is to enrich some commonly used food, like rice, with thiamine and riboflavin.
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