

Nutritional Status of Villagers in Laos

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THE NUTRITIONAL status of Lao villagers was an important aspect of a health survey conducted by the Thomas A. Dooley Foundation and the University of Hawaii School of Public Health in 1968 and 1969. The objectives of the survey were to define major health problems among inhabitants of the Mekong River Valley in Laos in order to assist the Lao Government in its planning for curative and preventive health services.

Breakey and Voulgaropoulos (1) have reported the background of the study, general methods, results, and recommendations. We describe the dietary intakes, related health problems, and suggested programs of applied nutrition for future implementation.

Briefly, Laos is a landlocked country of approximately 61,000 square miles in Southeast Asia. About three-fourths of the estimated 2½ million people live in

villages along the Mekong River, and one-fourth in mountainous areas. Approximately 50 percent of the population is ethnic Lao, originally from southwest China, while the remainder includes tribal groups from neighboring countries of Asia. Subsistence agriculture is the primary occupation of 85 to 90 percent of the villagers, and the major crop is rice.

The survey included 15 sampling sites (see map), ranging

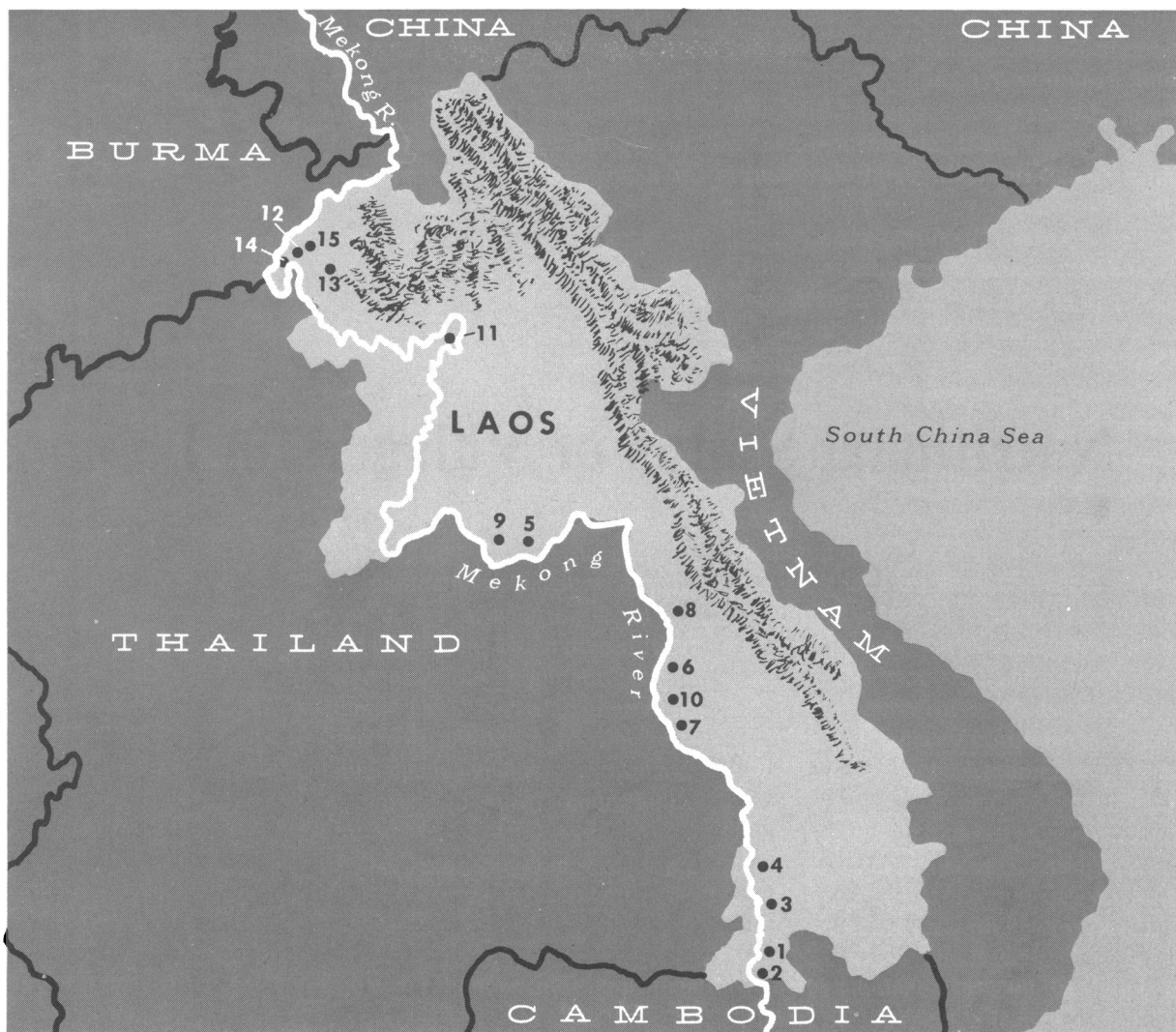
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Key to Villages

Rural: 1. Ban Veunkhao. 2. Ban Muong. 3. Ban Mophou. 4. Ban Nakeo.
5. Ban Na Hai. 6. Ban Tha Seno. 7. Ban Sompoi. 8. Ban Na Muong.
Urban: 9. Vientiane. 10. Savannakhet. 11. Luang Prabang.
Tribal: 12. Ban Maysingkam (Thai). 13. Ban Tong Om (Thai).
14. Ban Houei Au (Yao). 15. Ban Nam Ngao (Meo).

from approximately 200 to 2,000 each in population. Since security problems prevented random sampling of villages, the survey team selected sites that appeared typical of northern, central, and southern Laos. Consequently, the findings of this study pertain only to the populations of the 15 areas.

Eight areas were rural Lao villages that had received no pre-

vious American or other international assistance; three were urban districts within the major cities of Vientiane, Savannakhet, and Luang Prabang; and four were non-Lao tribal groups of mountainous origin (Thai, Yao, and Meo), resettled near the river in recent years for security reasons.

The survey team visited each site, drew a village map, and, using an estimate of five persons

per household, randomly selected households for samples of approximately 200 persons per village. In each area, team members appraised the environmental sanitation; conducted household interviews for data on family composition, food intakes, reproductive histories, and infant feeding practices; and examined each family member for preselected clinical and biochemical measurements.



Hill tribe woman with large goiter, waiting for a boat on the banks of the Mekong

Methods

Collection and analysis of food intakes. At home visits, trained Lao interviewers obtained from mothers a 24-hour recall of the family's total food intakes. The mothers estimated amounts according to usual practices, such as kilograms of rice, bunches or heads of vegetables, and various-size bowls of other items.

We reviewed the data on food intakes, rejected records with incomplete measurements, and developed standard procedures for coding the acceptable records. Published tables on food composition appropriate for this geographic area were used for computing the household and per capita dietary intakes (2,3). We also calculated the recommended dietary intakes of each household according to the age and sex distribution of its members, based on the World Health Organization (WHO) interim standards for Western Pacific countries (2).

Table 1. Distribution of dietary sample among 15 Lao villages in survey

Village ¹	Survey households			
	Population	Acceptable records	Incomplete records	Persons in survey
Rural:				
Ban Veunkhao.....	374	19	0	112
Ban Muong.....	300	20	20	101
Ban Mophou.....	450	41	2	208
Ban Nakeo.....	2,000	31	5	180
Ban Na Hai.....	349	28	1	195
Ban Tha Seno.....	800	30	0	218
Ban Sompoi.....	650	32	1	212
Ban Na Muong.....	486	33	0	214
Urban:				
Vientiane.....	1,900	37	2	208
Savannakhet.....	1,022	28	2	198
Luang Prabang.....	480	32	1	219
Tribal:				
Ban Maysingkam.....	728	28	16	139
Ban Tong Om.....	226	38	0	219
Ban Houei Au.....	1,060	27	3	217
Ban Nam Ngao.....	250	37	0	207
All villages.....	11,075	461	53	2,847

¹ See map.

Since breast milk was the major food of infants, we omitted persons under 1 year of age from these calculations. Standards for females over 16 years of age were based on the following conditions: (a) nonpregnant, non-lactating; (b) pregnant, third

trimester; or (c) lactating. Nursing mothers who also were pregnant were classified as lactating.

Clinical and laboratory examinations. The team physician evaluated the general health status of each person and examined scalp hair, eyes, skin, mouth, and ex-

Table 2. Average minimum per capita

Village ¹	Number of persons	Calories ²	Protein ² (gm.)	Fat ² (gm.)	Carbohydrate ² (gm.)	Calcium ² (mg.)
Rural.....	1,440	1,870±240	52±7	13±3	376±51	187±50
Ban Veunkhao.....	112	1,900	61	20	362	229
Ban Muong.....	101	1,605	45	10	325	207
Ban Mophou.....	208	2,000	57	16	400	253
Ban Nakeo.....	180	2,370	60	14	487	183
Ban Na Hai.....	195	2,000	53	13	408	139
Ban Tha Seno.....	218	1,655	46	13	331	157
Ban Sompoi.....	212	1,650	42	10	340	114
Ban Na Muong.....	214	1,745	57	12	344	242
Urban.....	625	1,985±225	56±2	28±4	370±44	173±18
Vientiane.....	208	1,765	53	24	327	190
Savannakhet.....	198	1,890	57	26	351	182
Luang Prabang.....	219	2,285	57	34	428	149
Tribal.....	782	2,370±150	52±3	20±8	484±26	193±38
Ban Maysingkam.....	139	2,500	56	15	524	194
Ban Tong Om.....	219	2,135	48	11	451	248
Ban Houei Au.....	217	2,430	53	20	498	181
Ban Nam Ngao.....	207	2,475	54	33	479	147
All villages.....	2,847	2,030	53	18	404	186

¹ See map.

² Calories and vitamin A rounded to nearest 5 or 0; protein, fat, carbohydrate, and calcium, to nearest whole number.

Table 3. Average minimum per capita food intakes, grams per day, in 15 Lao villages in survey

Village ¹	Number of persons	Rice	Tubers	Legumes and nuts	Green and yellow vegetables	Other vegetables	Fruits	Meat, fish, poultry, eggs	Pork fat
Rural.....	1,440	466	10	2	42	59	45	90	1
Ban Veunkhao.....	112	438	27	6	52	22	75	151	1
Ban Muong.....	101	404	1	3	40	10	70	74	0
Ban Mophou.....	208	498	10	5	48	84	15	96	2
Ban Nakeo.....	180	614	9	0	38	40	10	76	1
Ban Na Hai.....	195	510	10	0	63	52	8	81	0
Ban Tha Seno.....	218	410	0	4	27	73	48	78	1
Ban Sompoi.....	212	413	21	0	12	97	127	49	1
Ban Na Muong.....	214	426	5	0	62	46	25	130	1
Urban.....	625	452	17	2	56	76	42	114	10
Vientiane.....	208	397	18	3	91	81	34	115	7
Savannakhet.....	198	421	20	4	39	21	90	141	7
Luang Prabang.....	219	532	12	0	37	120	7	88	15
Tribal.....	782	600	31	1	46	83	9	39	6
Ban Maysingkam....	139	652	14	0	57	104	29	36	2
Ban Tong Om.....	219	565	4	0	46	106	0	32	1
Ban Houei Au.....	217	610	56	0	32	114	0	36	4
Ban Nam Ngao.....	207	592	44	3	54	11	14	52	17
All villages.....	2,847	500	17	2	46	69	34	81	4

¹ See map.

tremities for signs of malnutrition. From the recorded weight and age, we compared the current weights of children under 6 years of age with the appropriate WHO standards for borderline malnutrition (2).

Blood samples obtained from

finger pricks were collected into heparinized microhematocrit tubes and centrifuged for 3 minutes at 12,000 rpm for hematocrit readings. Red cells were examined for malarial parasites by Worth's method (4), and stool specimens from a subsample of

402 children aged 3, 6, 9, and 12 years were examined for intestinal parasites (1).

Results and Discussion

Distribution of the dietary sample in the 15 villages is shown in table 1. Ninety-five percent of the total sample of approximately 3,000 persons were in households with acceptable food records.

Per capita intakes of nutrients and food groups by village are presented in tables 2 and 3. Since foods eaten away from home were usually not recorded, we assumed that the calculated intakes represented minimal estimates for most nutrients. Calorie intakes generally were lowest in the rural areas and highest among the tribal groups. Protein intakes were similar in all the areas, but intakes of fat were considerably higher in urban than in rural villages.

dietary intakes in 15 Lao villages in survey

Iron (mg.)	Vitamin A ² (I.U.)	Thiamine (mg.)	Riboflavin (mg.)	Niacin (mg.)	Ascorbic acid (mg.)
7.4±.8	1,135±320	0.94±.08	0.45±.08	16.9±1.9	50±20
8.0	1,005	.92	.47	18.9	91
6.2	815	.78	.31	14.5	54
8.6	1,615	.98	.52	18.1	70
8.3	1,035	1.12	.43	19.9	42
7.3	870	.96	.36	17.1	34
6.9	1,245	.91	.39	13.9	38
6.3	715	.89	.56	16.3	25
7.4	1,515	.88	.47	16.5	67
8.7±.9	1,300±375	1.03±.17	.46±.01	16.9±.5	64±26
8.4	1,300	.90	.45	16.3	87
7.7	1,780	.91	.46	17.1	79
9.8	865	1.26	.47	17.4	29
8.7±.6	700±80	1.20±.10	.38±.03	17.7±1.1	58±19
8.9	825	1.25	.43	18.8	76
8.0	680	1.06	.34	16.1	67
9.5	590	1.31	.40	17.7	66
8.6	745	1.20	.37	18.7	27
8.0	1,050	1.03	.43	17.1	55

In the cities and in the Meo village of Ban Nam Ngao, families used pork fat in cooking and also ate more meat than fish; the rural people usually consumed fish and ate little or no extra fat. The distribution of calories among the total sample was 11 percent protein, 8 percent fat, and 81 percent carbohydrate. Rice was the only cereal grain reported, and the average daily

intake of 500 grams contributed about 85 percent of the total calories and 67 percent of the protein.

As shown by the standard deviations in table 2, wide variation of mineral and vitamin intakes occurred within rural, urban, and tribal groups; and no consistent trends were visible. The favorable intakes of thiamine and niacin resulted from the use of

home-pounded rice. These values were probably overestimated, however, because no deductions were made for the potential losses of these nutrients in cooking.

Although the quality and quantity of vegetables and fruits varied among the villages, the totals provided adequate per capita intakes of ascorbic acid in most areas. Dark leafy vegetables were

Table 4. Percentage of households with less than 90 percent of recommended dietary intakes in 15 Lao villages

Village ¹	Number of households	Calories	Protein	Calcium	Iron	Vitamin A ²	Thiamine	Riboflavin	Niacin	Ascorbic acid
Rural.....	234	52	5	77	86	98	30	95	27	42
Ban Veunkhao.....	19	58	0	89	84	100	42	95	16	32
Ban Muong.....	20	70	5	80	95	100	55	100	60	50
Ban Mophou.....	41	44	5	76	78	88	22	90	22	32
Ban Nakeo.....	31	19	3	9	87	100	13	97	3	27
Ban Na Hai.....	28	46	0	100	86	100	21	100	25	43
Ban Tha Seno.....	30	70	3	93	97	100	37	100	40	47
Ban Sompoi.....	32	66	13	97	88	100	39	90	29	71
Ban Na Muong.....	33	52	6	82	82	97	30	91	27	39
Urban.....	97	42	2	96	74	94	19	97	18	40
Vientiane.....	37	46	0	89	70	95	16	95	14	22
Savannakhet.....	28	57	7	100	82	89	39	100	25	39
Luang Prabang.....	32	25	0	100	72	97	6	97	16	62
Tribal.....	130	26	4	94	75	100	12	99	19	28
Ban Maysingkam.....	28	25	4	96	82	100	11	100	21	14
Ban Tong Om.....	38	29	3	87	76	100	10	100	24	16
Ban Houei Au.....	27	15	0	100	78	100	7	100	11	0
Ban Nam Ngao.....	37	32	8	95	65	100	19	97	19	70
All villages.....	461	43	4	88	82	99	24	98	23	39

¹ See map.

² Recommended intakes based on WHO interim standards for developing Western Pacific Countries. SOURCE: Reference 2. Since major source of vitamin A was vegetables, recommended values for beta-carotene were used as standard and converted to international units; 1 I.U. vitamin A = 0.6 µg. beta-carotene.

Table 5. Number and percentage of children below malnutrition borderline for weight, by age group and area

Area	0 to 2 years ¹			2 to 4 years ¹			4 to 6 years ¹		
	Number of children	Malnourished		Number of children	Malnourished		Number of children	Malnourished	
		Number	Percent		Number	Percent		Number	Percent
Rural.....	98	29	30	99	60	60	86	60	70
Urban.....	55	14	25	52	22	42	51	25	49
Tribal.....	42	15	36	59	22	37	56	21	38
Total.....	195	58	30	210	104	50	193	106	55

¹ Borderline weights range from 15 percent below Iowa standards in infancy to 30 percent below in older children. SOURCE: Reference 2.

lacking; the use of legumes, nuts, and eggs was minimal; and dairy products were absent from all households, which resulted in extremely low per capita intakes of calcium, iron, vitamin A, and riboflavin.

Comparison of estimated to recommended dietary intakes (table 4) revealed that a large proportion of families in all villages consumed less than 90 percent of the recommended values of calories and selected nutrients. Although the intakes of protein appeared to be satisfactory, this nutrient probably was used for energy rather than tissue growth or maintenance because of the low intake of calories. As noted previously, the calculated intakes were probably minimal. WHO's standards are also conservative and generally lower than the recommended dietary allowances proposed for the United States (5).

The team physician reported

no cases of severe protein-calorie malnutrition, beriberi, scurvy, or obesity in the clinical examinations. Retardation of physical growth—an intermediate sign of protein-calorie malnutrition—among children under 6 years of age was apparent (table 5). Using the criterion of weight per age, we found that malnutrition in this subsample increased from 30 percent among the 0- to 2-year-olds, to 50 percent among the 2- to 4-year-olds, to 55 percent among the 4- to 6-year-olds. The trends were similar in all areas, but the proportions were greater in the rural villages than among the urban or tribal groups.

Data for the well-nourished Lao children were not available; as noted in the WHO publication (2), these standards range from 15 percent below the Iowa values for infancy to 30 percent below for 5- and 6-year-olds.

Official vital statistics for Laos

among children under 10 years were not available, but the household interviews provided further evidence of the potential lethal effects of malnutrition. Among the study population, infant mortality was estimated at 15 percent and childhood survival at 55 percent. Women 50 years old or over had an average of five living children and recalled approximately 10 pregnancies. The detrimental effects of repeated pregnancies on maternal and child health and on infant mortality have been well documented (6).

The clinical examinations revealed some signs of possible dietary deficiencies. Ten cases of Bitot's spots among persons over 10 years old were found in two of the tribal villages where vitamin A intakes were particularly low. Eighteen cases of keratomalacia and 45 of blindness were reported in the survey. Except for three cases of blindness

Table 6. Number and percentage of persons aged 10 years and over with hematocrits of less than 34, by sex and village

Village ¹	Total sample	Males		Total sample	Females	
		Number	Percent		Number	Percent
Rural.....	479	58	12.1	619	181	29.2
Ban Veunkhao.....	35	6	17.1	45	20	44.4
Ban Muong.....	70	6	8.6	78	35	44.9
Ban Mophou.....	79	15	19.0	84	41	48.8
Ban Nakeo.....	66	10	15.2	103	32	31.1
Ban Na Hai.....	52	3	5.8	78	17	21.8
Ban Tha Seno.....	74	6	8.1	76	6	7.9
Ban Sompoi.....	51	4	7.8	79	19	24.0
Ban Na Muong.....	52	8	15.4	76	11	14.5
Urban.....	188	9	4.8	227	27	11.9
Vientiane.....	67	1	1.5	68	5	7.4
Savannakhet.....	57	5	8.8	66	11	16.7
Luang Prabang.....	64	3	4.7	73	11	15.1
Tribal.....	259	46	17.8	351	144	41.0
Ban Maysingkam.....	79	9	11.4	88	20	22.7
Ban Tong Om.....	54	6	11.1	90	20	22.2
Ban Houei Au.....	65	16	24.6	100	60	60.0
Ban Nam Ngao.....	61	15	24.6	73	44	60.3
All villages.....	926	113	12.2	1,197	352	29.4

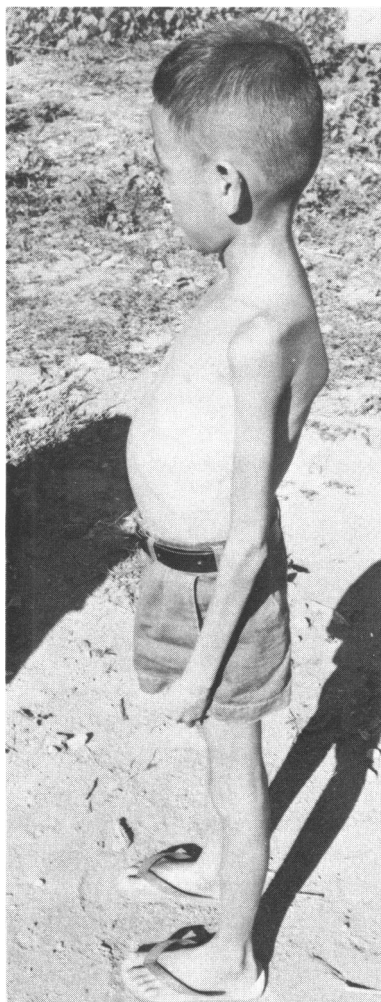
¹ See map.

among children under 10 years, these symptoms occurred only in older persons. Although vitamin A deficiency could be the causative factor of visual impairments, especially among young children, the condition could also be due to factors such as trachoma, gonorrhea, injury, or cataracts.

Other manifestations of possible dietary deficiencies were primarily angular stomatitis, cheilosis, nasolabial seborrhea, enlarged thyroid glands, and low hematocrit values. The physicians observed angular stomatitis or related signs among 23 to 74 percent of the village populations. Differences between rural, urban, or tribal villages were not consistent. Riboflavin intakes were low in all villages, and there is no apparent explanation for the varied prevalence of these signs.

One hundred persons had enlarged thyroid glands, with greatest frequency among the tribal refugee groups; for example, 38 of 217 persons in the Yao village of Ban Houei Au had visible evidence of goiter. The effects of previous or current residence on thyroid status are unknown since the iodine content of soils in mountainous and valley areas was not analyzed.

The hematocrit readings of persons 10 years and older were compared with the value of 34, arbitrarily defined as the lower level of normal. Values suggested by WHO (2) are 37 for 10- to 14-year-olds, 42 for male adults, 35 for nonpregnant women, and 29 for pregnant women. We excluded younger children because of their lower normal levels of hematocrits. The number and percentage of males and females with low hematocrit readings in each village are shown in table 6. The relative frequencies of low values were considerably greater



Lao boy, who suffers from schistosomiasis

for females than for males, and the proportions increased progressively from urban to rural to tribal villages for both sexes. The estimated per capita intakes of iron suggested no association with these findings.

Parasites were found in 56 percent of the subsample of 402 stool specimens, and about 8 percent contained hookworm. Smears positive for malaria were identified in 207 persons or 7 percent of the 2,989 persons examined. About three-fourths of these positive findings occurred among the tribal groups, who also had the highest frequency of low hematocrits.

Recommendations

The results of the Lao health survey suggest that malnutrition may be a major factor contributing to the high infant mortality, low survival in childhood, and retarded physical growth of young children in this population. These findings are similar to data reported in studies of other developing countries (7,8), and it may be possible to modify and adapt previously tested programs of applied nutrition in Laos.

Since mothers, infants, and young children are the most vulnerable groups of the population, further data on their diets and nutritional status would be necessary for developing meaningful programs.

Recalls of household diets provided general information on the availability of particular foods, eating patterns, and estimated intakes of nutrients by families in each village. To obtain specific baseline data, the interviews should include questions concerning kinds and amounts of foods eaten by each mother and young child. Occasional home visits at meal hours could be arranged for direct observation. Also, repetitive interviews among random samples in the same village would furnish knowledge of seasonal factors related to diet. These data, collected by trained Lao interviewers, would provide the essential information for both planning and evaluation of programs.

The observed high mortality rate among infants and the low survival rate in childhood indicate an urgent need for maternal and child health programs, which could and should include education in nutrition, household sanitation, and family planning components. Both mothers and fathers must be convinced that well-

nourished women can produce five surviving children from five pregnancies instead of the current "two for one" ratio. During clinic activities, demonstrations in cooking and infant feeding, based on available foods and familiar utensils, could be conducted, supplemented by followup home visits from community workers.

Since the dietary intakes per capita and per household were generally low, it is highly probable that mothers and young children would not receive any bonus proportions of foods. With initial technical and monetary assistance of agricultural and fishery experts, it might be possible to increase the total food supply of the Lao families. Greater production of native green leafy vegetables and cultivation of small fishponds would add considerable amounts of essential nutrients like protein, iron, calcium, vitamin A, and riboflavin to the dietary intakes.

The effectiveness of Mothercraft Centers in improving physical growth and decreasing infectious diseases among malnourished preschool children has been demonstrated in Haiti (9) and in other areas (10). Similar pro-

grams, adapted to the various ethnic groups of Laos and planned with the villagers, could be used for training and education in environmental sanitation, medical care, and nutrition.

These and other programs of applied nutrition will require the participation and coordination of multiple disciplines, such as agriculture, education, community development, and health; the administrative and financial support of the Lao Government, international agencies, and educational institutions; and the direct involvement of village leaders in program planning. Perhaps conditions in Southeast Asia will soon permit programs that will improve the health status of the Lao people.

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HANKIN, JEAN (University of Hawaii School of Public Health), BREAKEY, GAIL, and CHULARERK, UDOMPORN: Nutritional status of villagers in Laos. HSMHA Health Reports, Vol. 87, February 1972, pp. 145-153.

A health survey of random households in 15 rural, urban, and tribal villages of Laos was conducted in 1968 and 1969. There were no consistent trends by area, and the per capita dietary intakes of the 2,847 persons studied were extremely low in calories, calcium, vitamin A, and riboflavin. Intakes of ascorbic acid varied. Total protein, thiamine, and niacin appeared adequate owing to the large consumption of undermilled rice.

Clinical cases of protein-calorie malnutrition, beriberi, or scurvy were not found, but signs of possible dietary deficiencies, such as angular stomatitis, cheilosis, enlarged thyroid, and low hematocrits, were reported. Borderline malnutrition, based on weight per age, increased from 30 percent among the 0- to 2-year-olds, to 50 percent among the 2- to 4-year-olds, to 55 percent among the 4- to 6-year-olds. Among the study households, infant mortality was estimated at 15 percent and childhood survival at 55 percent.