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# NUTRITIONAL STATUS OF HOKKAIDO ORPHANAGE CHILDREN 1960-1970

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## INTRODUCTION

A cross-sectional study of the growth of Japanese youth during a period of 60 years (1900-1960) showed a gradual increase in stature up to 1939, a loss in stature at every age level 1939-1948 and a rapid increase in growth after 1950<sup>1)</sup>. These findings prompted an inquiry into the changes in food patterns during the war and since. Data on food consumption was limited but pointed to the probability that protein limitation during the war and a more adequate supply 1950-1960 was significant.

The desirability of studying the growth of children who might still be retarded in growth by an inadequate diet prompted an inquiry into the situation in the orphanages in Hokkaido. The prefectural Government of Hokkaido kindly cooperated in providing data on the physical measurements of children in 22 orphanages for the years 1959, 1960 and 1961. It appeared from these data that the stature of the orphanage children was significantly less on the average than that for Hokkaido children of the same age<sup>2,3)</sup>.

These observation prompted an inquiry into the food patterns of these orphanage children. Foods served in these institutions had been recorded for three-day periods during four seasons 1960-1961. The food patterns as analysed showed adequate calories but some borderline levels of protein, vitamin A, calcium, riboflavin and ascorbic acid intake. The quality of the protein was questioned particularly and it was found that animal protein constituted from 18.1 to 38.7 percent (average 29.2 percent) of the total protein in 1960 with a protein score averaging 73<sup>2)</sup>. It seemed possible that protein quality might have been the crucial factor influencing growth-preventing, some children from realizing their full inherited potential. In visiting the orphanages in 1961 the authors noted that the children appeared to be well but seemed short and stocky in build.

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The published report of these findings<sup>2)</sup> brought the problem to the attention of the Governor and Hokkaido Prefectural Government. They subsequently voted to provide 180 g of milk per child per day beginning 1964. At about same time the National Government provided for an annual increase in the food budgets for all orphanages in Japan. This increase in food budgets made possible more protein foods as well as the milk allowance. Thus it seemed appropriate to make a second survey of the institutions in 1965 to see whether the physical status of the children had improved. These findings published by SANTO in 1968<sup>4)</sup> showed encouraging results.

The increments of increase in stature for both boys and girls were greater than those recorded for Hokkaido children especially for adolescent girls.

The continued increases in food budgets for the orphanages and the provision of an egg a day per child in 1968 meant a considerable improvement in the quality of protein available. A third survey of the nutritional status of the children in the 24 orphanages was therefore done in 1970. This made possible a comparison of data over a period of ten years, which is reported in this paper.

### SUBJECTS OF STUDY AND METHODS

These surveys were made of the orphanages of Hokkaido 1960, 1965 and 1970, the number of institution and the total children from 1 to 17 years of age included in each survey are shown in the following table I.

TABLE I.

Survey number	Year	Number of orphanages	Number of boys	Number of girls	Number of total children
1	1960	22	877	592	1469
2	1965	23	954	544	1498
3	1970	24	993	594	1587

The location of the 24 orphanages is shown on the accompanying map FIG. I. The physical measurements included in each survey were standing height, sitting height, chest girth and weight. In order to compare the data on physical measurements of the orphanage children with the national averages, the data of the School Health Statistical Report, Ministry of Education Japan was used. This report gives the best data on Japanese youth ranging from 5 to 21 years of age<sup>5,6,7)</sup> and therefore the age groups

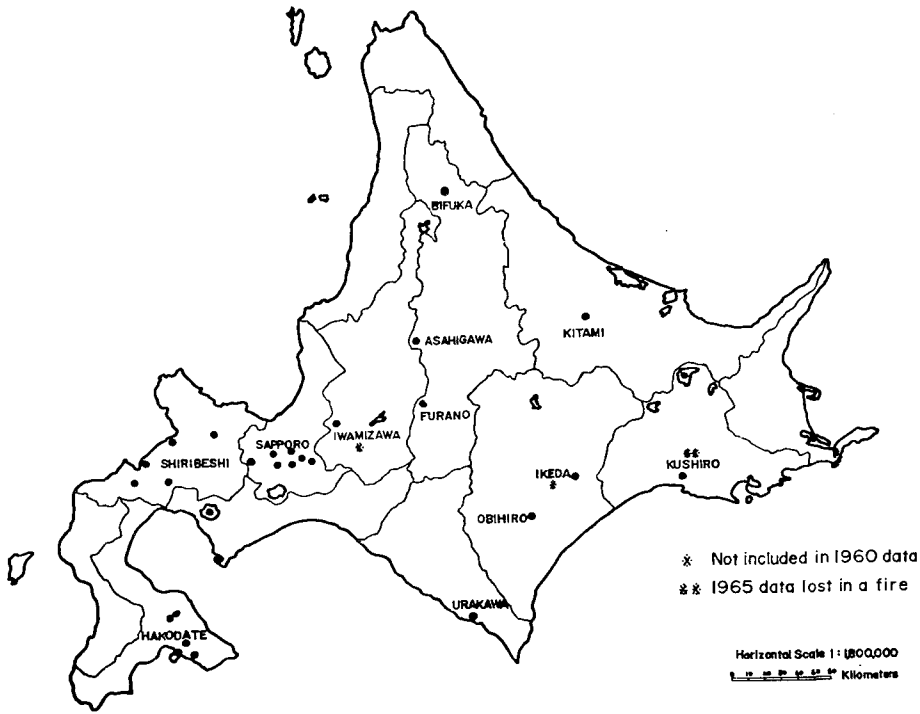


FIG. I. Location of 24 Orphanages in HOKKAIDO

charted FIG. IIB and FIG. IIG the elementary school age group, 6 to 11 years old, and the junior high group, 12 to 14 years old, were chosen with statistical consideration. The significance of the differences is tested by the following "t-distribution formula" and 5% and 1% significant levels are shown the sign of \* and \*\* respectively.

$$t_{(m+n-2)} = \frac{|\bar{x} - \bar{y}|}{s} \sqrt{\frac{mn}{m+n}}$$

$$s^2 = \frac{(m-1)s_x^2 + (n-1)s_y^2}{m+n-2}$$

- $m$ ; Number of examinees of national children.
- $n$ ; Number of examinees of orphanage children in Hokkaido.
- $\bar{x}$ ; Mean value of national children.
- $\bar{y}$ ; Mean value of orphanage children in Hokkaido.
- $s_x$ ; Standard deviation of national children.
- $s_y$ ; Standard deviation of orphanage children in Hokkaido.

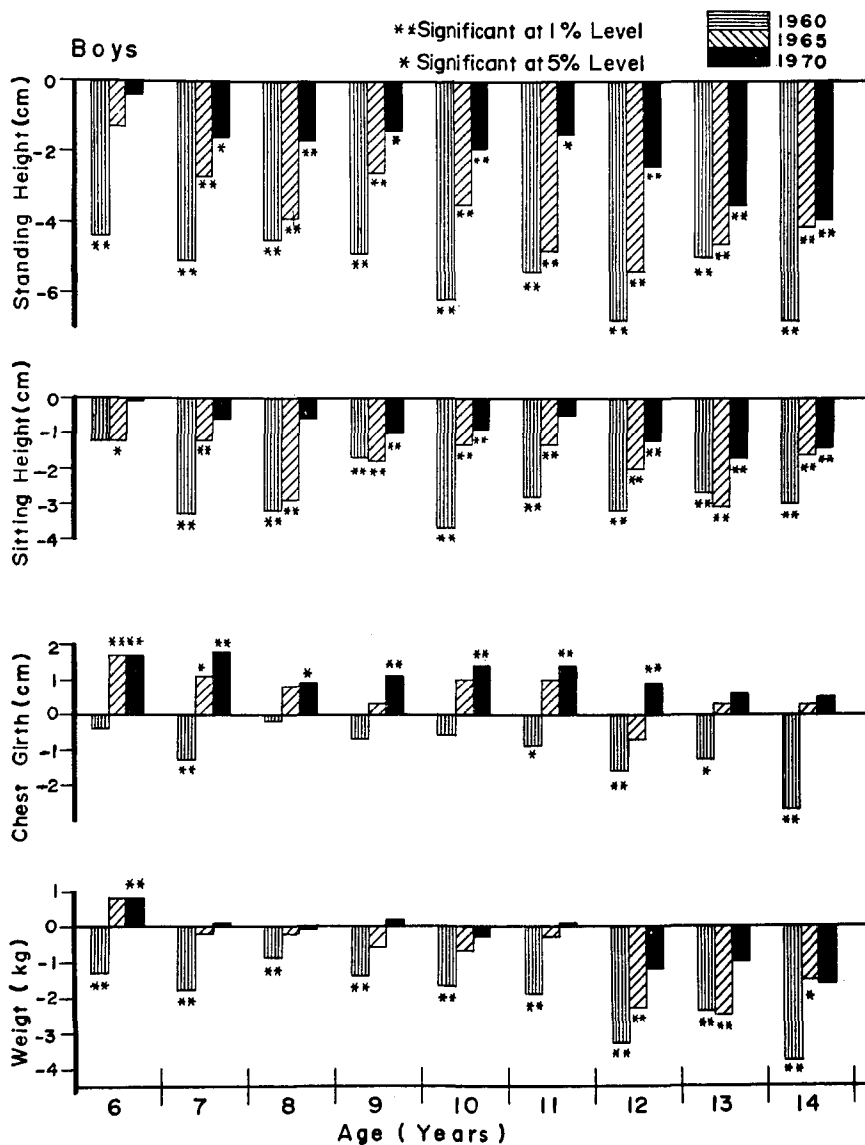


FIG. II B Differences in Physical Measurement of Orphanage Children from National Averages in 1960, 1965 and 1970

The estimates of food consumption were based on food records of the supervisors in each orphanage for 1960 and 1965. The 1970 survey for physical measurements and food consumption was conducted by SANTO and her assistants who weighed and measured all the children and did one day

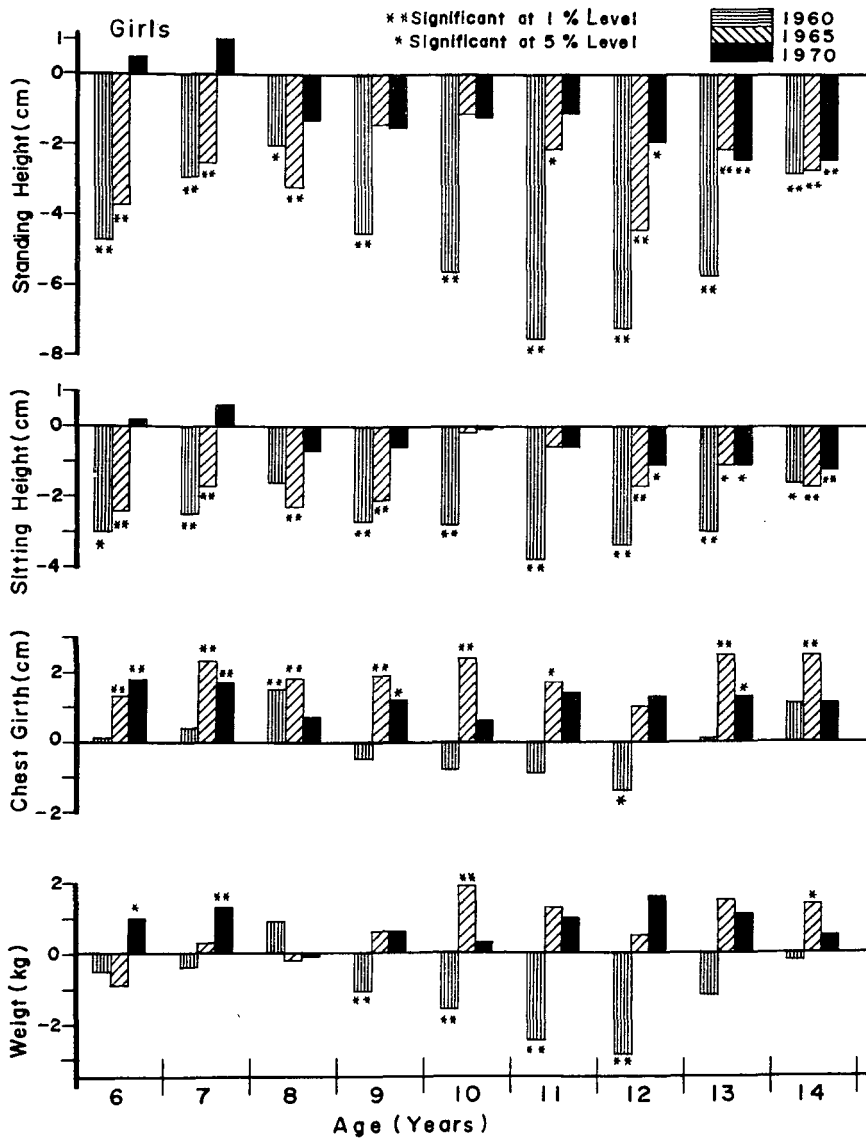


FIG. IIG Difference in Physical Measurement of Orphanag Children from National Averages in 1960, 1965 and 1970

survey of food intake by using weighing method of individual child for all subjects. The data on regular school lunch in public school were collected by SANTO from the principal and nutritionist of each school by interview method.

The nutrient intake per child per day was calculated from the food consumption data by using "Composition of Foods in Japan 3rd ed." and other food composition tables<sup>8,9,10,11,12</sup>. The recommended dietary allowances for children of each age<sup>13</sup> were applied on a proportional basis according to the numbers of each age and sex in each institution in order to estimate nutrients which should be recommended for each orphanage. The estimated nutrient intake for each orphanage was then compared with the recommended figure for that orphanage. The FAO/WHO 1965 method of protein scoring<sup>14</sup> was used in 1960, 1965 and 1970 for estimating the protein quality of the orphanage diets. The amino acid value of these diets was calculated from "The Amino Acid Composition of Foods in Japan"<sup>15</sup>.

## RESULTS AND DISCUSSION

FIG. IIB (boys) and FIG. IIG (girls) show the differences of the mean value on physical measurements of these orphanage boys and girls from the national averages in each age group in 1960, 1965 and 1970.

According to FIG. IIB, the orphanage boys were significantly smaller than national averages in standing height, sitting height and weight in 1960. In subsequent surveys, 1965 and 1970, the differences decreased to the extent that standing height for 6 year old boys and sitting height for 6, 7, 8 and 11 years olds were not significantly below national averages. Chest girth for orphanage boys was not far below national averages for any age group except the teen agers in 1960 and by 1970 chest girths were equal to or above national averages for all age groups. The body weight of orphanage boys which were significantly below national averages in 1960 caught up to national figures for the boys 11 years old and younger but not for the older boys. The slower improvement of the older boys may reflect their retardation in earlier years and is likely to show progressive improvement in future years.

According to FIG. IIG it is evident that in 1960 the orphanage girls, like the boys, were significantly behind the national averages in standing height, sitting height and weight for the 9 to 12 year olds. Only the 12 year olds were significantly below national average in chest girth.

The growth changes 1960 to 1970 for the girls were similar to the boys, but the girls tended to approach the national average more rapidly than the boys in both standing and sitting height and exceeded national figures in chest girth and weight. The junior high orphanage girls were still significantly shorter than the national averages in 1970 as were the boys.

The food consumption data for the same three periods 1960, 1965 and

1970 show some striking changes due to improvement in food budgets and special provisions by the Government for extra milk and eggs.

TABLE II gives an estimate of each class of foods consumed by the orphanage children during the three different years. The four-fold increase in milk consumption between 1960 and 1965 was due to the milk allowance of 180 g per day in addition to that already being used. The increase in egg consumption between 1965 and 1970 was due to the provision in 1968 of an egg per day per child. Other major increases in foods were largely due to the more generous food budgets permitting purchase of more fish, meat,

vegetables and fruits. The less desirable increases in sweets and snack foods such as soft drinks were made possible by budget increases but poor control as to how the money was spent.

In comparing the food nutrients supplied in each orphanage with the Japanese RDA revised in 1969 the percentages in each survey were given in TABLE III. Since the recommendations are calculated to be generous and not minimum, 80% of the recommendation may be taken as level below which the nutrient supply may be considered inadequate or at least subject to improvement, and therefore the value below 80% were shown as a bold type in TABLE III. From TABLE III it would appear that the orphanage food provided adequate calories, iron and thiamine in all orphanages for the three surveys 1960, 1965 and 1970. Protein intake has improved in quality as well as quantity animal protein constituted 29.2% in 1960, 36.5% in 1965 and 46.3% in 1970. Calcium and riboflavin intakes have also improved since 1965 by reason of the milk provision. Vitamin A was still low in half of the institutions in 1970 because the children dislike certain green and yellow vegetables and partly due to poor planning by the food managers. The niacin RDA for 1969 is relatively high and therefore difficult to meet. The improvement in ascorbic acid intake was due to more fruits and fresh vegetables in season but not consistently throughout the year. Vitamin D showed the poorest intake among 10 nutrients tabulated in TABLE III.

TABLE II. Food Consumption

Food Groups	grams per child per day			Ratio		
	1960	1965	1970	1960	1965	1970
Milk	64	247	268	1	3.9	4.2
Eggs & Roes	7	21	60	1	3.0	8.6
Meat & Poultry	9	23	45	1	2.6	5.0
Fish & Shellfish	62	77	51	1	1.2	0.8
Legumes & Nuts	98	74	63	1	0.8	0.6
Grains	476	442	318	1	0.9	0.7
Sugar & Sweets	25	68	93	1	2.7	3.7
Fats & Oils	8	11	16	1	1.4	2.0
Fruits	27	47	71	1	1.7	2.6
Starchy roots	83	65	55	1	0.8	0.7
Vegetables Green & Yellow	41	33	37	1	0.8	0.9
Others	79	167	225	1	2.1	2.8
Miscellaneous	4	29	64	1	7.2	16.0



TABLE III. Percentage of Nutrient Intake to Recommended Dietary Allowances 1960-1970

Nut. Inst.	Calories			Protein			Calcium			Iron			Vitamin-A			Vitamin-D			Thiamine			Riboflavin			Niacin			Ascorbic Acid			Below 80		
	'60	'65	'70	'60	'65	'70	'60	'65	'70	'60	'65	'70	'60	'65	'70	'60	'65	'70	'60	'65	'70	'60	'65	'70	'60	'65	'70	'60	'65	'70	'60	'65	'70
1	105	111	125	84	107	90	72	102	98	120	117	133	80	71	61	27	13	2	93	102	98	65	104	103	79	74	65	128	130	110	5	3	3
2	121	124	126	118	123	137	119	131	152	119	126	157	141	95	114	33	26	24	117	118	114	123	150	158	92	90	93	205	240	115	1	1	1
3	128	132	102	120	135	101	109	128	92	136	159	146	91	85	69	22	24	3	138	112	114	118	140	93	106	87	68	160	205	183	1	1	1
4	113	125	121	97	116	122	98	100	119	96	122	110	44	58	97	16	12	39	105	117	272	86	109	142	76	69	87	73	90	108	4	3	1
5	141	131	137	111	112	105	125	85	123	160	135	116	93	77	67	37	31	1	160	105	143	134	101	122	149	98	95	251	176	217	1	2	2
6	104	114	124	78	97	114	51	99	112	120	105	150	64	92	137	13	43	40	111	137	123	65	129	158	86	74	81	142	202	180	5	2	1
7	133	123	130	124	120	116	72	93	135	156	108	129	134	85	72	36	38	21	143	116	117	92	123	121	111	84	102	258	125	253	2	1	2
8	127	106	126	107	97	143	84	89	149	135	138	138	62	58	75	15	25	28	134	89	170	99	112	174	110	70	78	113	123	288	2	3	3
9	89	117	121	75	98	97	50	105	140	130	134	121	73	62	131	42	15	15	109	106	424	63	106	110	96	83	94	138	144	415	5	2	1
10	99	118	128	73	91	101	171	100	116	112	136	152	79	89	51	41	34	2	92	91	334	68	102	120	81	76	81	122	158	251	4	2	2
11	122	117	121	104	94	127	60	84	138	131	122	113	86	79	143	36	25	87	93	101	130	66	101	181	97	74	118	148	171	320	3	3	0
12	106	117	105	88	100	105	70	119	114	98	110	110	80	75	95	18	38	4	84	102	109	60	110	145	74	67	59	90	195	212	5	3	2
13	109	103	107	80	83	106	45	88	84	101	96	115	37	51	84	17	26	20	91	82	92	45	95	133	81	63	80	85	70	170	5	4	2
14	110	123	118	93	97	110	101	145	79	112	145	150	127	49	59	20	20	9	103	93	92	104	117	103	75	73	74	140	108	115	2	3	4
15	97	121	104	88	101	114	80	99	131	107	126	120	89	96	74	16	33	27	97	111	101	103	133	119	73	80	70	188	185	205	3	2	3
16	—	114	91	—	107	105	—	109	91	—	116	128	—	60	47	—	25	18	—	117	86	—	106	128	—	84	75	—	155	203	—	2	3
17	109	116	116	80	97	125	54	90	122	113	105	132	103	76	217	6	22	47	96	93	443	50	105	222	88	80	90	105	98	150	4	3	1
18	112	91	124	100	81	103	92	71	86	120	89	123	128	67	78	12	31	44	130	115	97	83	101	127	97	55	101	190	131	345	1	4	2
19	—	127	136	—	113	111	—	92	120	—	106	145	—	68	40	—	42	63	—	99	85	—	104	96	—	85	99	—	163	105	—	2	2
20	101	—	105	94	—	106	88	—	78	137	—	116	50	—	115	19	—	16	82	—	99	60	—	123	85	—	66	75	—	238	4	—	3
21	112	110	119	100	95	123	99	86	108	143	101	243	52	87	310	27	28	45	111	113	112	87	114	235	96	61	146	115	138	213	2	2	1
22	116	133	96	90	113	89	113	116	77	125	150	102	98	71	49	11	21	35	118	130	97	83	122	97	104	93	60	155	250	133	1	2	4
23	103	122	118	102	115	114	102	122	130	131	130	132	125	136	167	22	14	3	104	138	227	99	155	163	88	72	59	158	265	263	1	2	2
24	118	118	127	94	105	113	117	87	139	164	141	127	208	71	200	8	42	53	148	103	102	110	111	165	119	81	66	265	133	137	1	2	2
Below 80	0	0	0	5	0	0	9	1	3	0	0	0	10	15	12	22	23	23	0	0	0	9	0	0	5	14	12	2	1	0	62	54	50

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There were no orphanages that met the vitamin D RDA except one in 1970. The calcium and riboflavin (V-B<sub>2</sub>) intake was improved between 1960 and 1965 due mainly to 180 g of milk per child per day since 1964 and also the vitamin A intake met the RDA in 1970 due to the provision since 1968 of an egg per day per child. The vitamin D intake has not been improved at all for the ten years. According to the report of YAMAKAWA<sup>16)</sup> 107 IU of vitamin D per capita per day (about one fourth of the RDA) could be supplied by sea food in Japan. The orphanage children had had approximately the same amount of vitamin D as that calculated by YAMAKAWA. HIRO *et al.*<sup>17)</sup> had written that during winter time in Hokkaido a dose of 5 mg of vitamin D a month for early child or infant could prevent rickets. Therefore it is recommended that unless enough vitamin D is to be expected from their foods during the winter months, medical authorities should provide some supplementary source of vitamin D for the infants and younger children in the institutions of Hokkaido. High thiamin (V-B<sub>1</sub>) ratio in 1970 was due to the use of enriched rice in several institutions shown by the values of 2 to 4 times of the thiamin RDA in TABLE III.

These nutrients were calculated from the food consumption of the subjects by using food composition tables as raw foods. In consequence nutrient losses in preparation were not considered and therefore the vitamin intake of the children must be lower than the values given.

In order to obtain the nutrient pattern of the diets the percentage of nutrient intake from different foods is shown in FIG. III. The amount of animal foods such as milk, eggs, meat and fish had been increasing gradually i.e. 13% in 1960, 27% in 1965 and 33% in 1970 while grains had decreased year by year. The greater part of food energy came from grains, mainly rice i.e. 70% in 1960, 60% in 1965 and 50% in 1970 as a round numbers. For protein, approximately 50% in 1960, 40% in 1965 and 30% in 1970 was derived from grains and about 30% in 1960, 35% in 1965 and 45% in 1970 from animal foods. The protein scores were 73 in 1960, 79 in 1965 and 82 in 1970. For calcium, about 30% in 1960, 45% in 1965 and over 45% in 1970 was from milk. These figures show that milk is an important source of calcium in the diets. As to iron, grains, legumes and vegetables were superior sources in three period surveys. The greater part of vitamin A, 80% in 1960 and 60% in 1965, was derived from vegetables while vitamin A from animal foods was less than 20% in 1960 and 40% in 1965 but in 1970 55% of the vitamin A came from animal foods approximately. Vitamin D was obtained exclusively from fish in these diets i.e. 98% in 1960, 97% in 1965 and 90% in 1970. Over 50% of thiamine

was supplied by grains. Riboflavin derived from animal foods was 50% in 1960, 55% in 1965 and 70% in 1970 (milk supplied about 30–40% of riboflavin intake in these diets). Niacin was mostly from plant foods i.e.

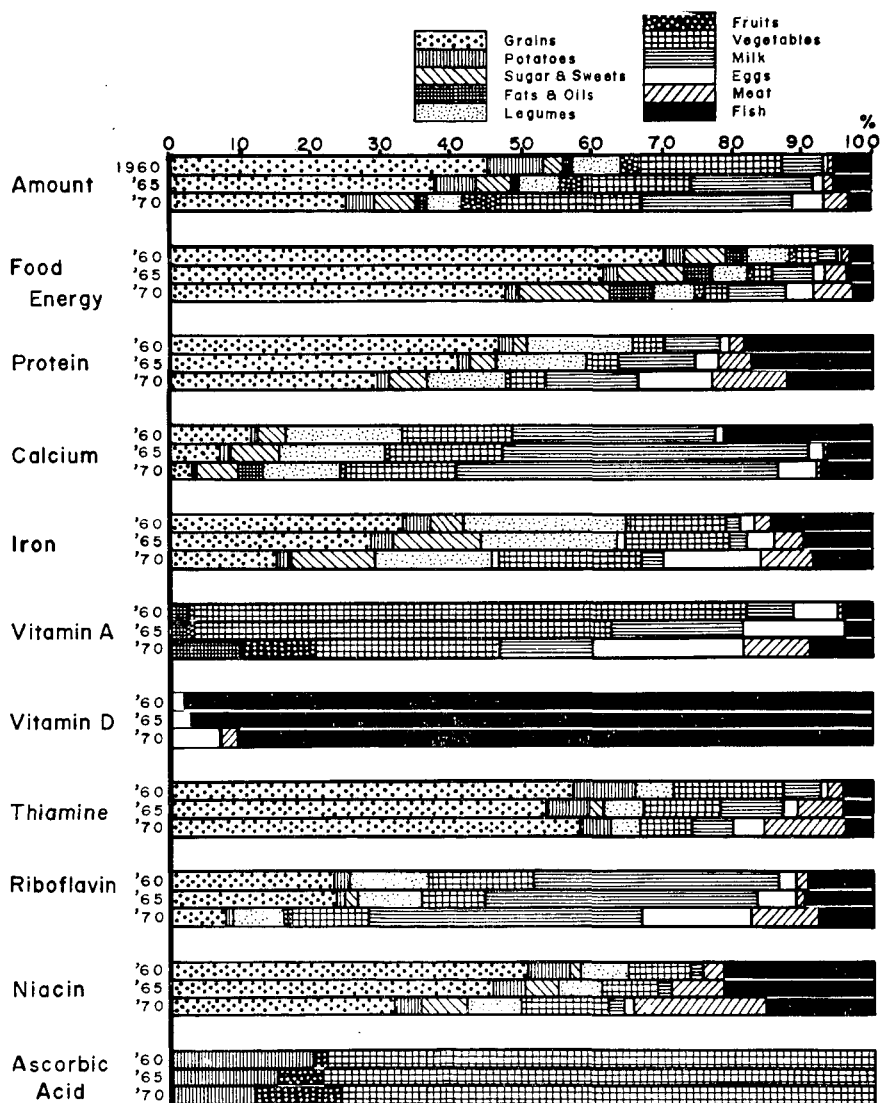


FIG. III Percentage of Nutrient Intake from Different Food Stuff

75% in 1960, 70% in 1965 and 65% in 1970. A major sources of niacin were grains and fish in 1960 and 1965 and grains, meat and fish in 1970. Approximately 75% of the ascorbic acid was from vegetables in three period surveys.

### SUMMARY

Physical measurements (standing height, sitting height, chest girth and weight) of children in Hokkaido orphanages have been made at five year intervals. These data have been compared with similar measurements for all Japanese children. In general it is apparent that these orphanage children have gradually caught up to and even surpassed the national averages in the following order ; chest girth, weight, sitting height and standing height during the ten years 1960-1970. It is also concluded that the rate at which the orphanage children reach the national averages is faster for younger children than for older ones and for girls than for boys. It seems that the orphanage children are later than the national average in reaching the spurt of growth.

The food intake of the orphanage children has been estimated from records or actual measurements and nutrient value calculated. The nutrient intake has improved considerably during the ten years 1960-1970. But vitamin A, vitamin D and niacin were still low in over a half of all institutions and the less desirable increases in sweets and snack foods such as soft drinks were made possible by budget increases but poor control as to how the money was spent. Therefore it is recommended that the Hokkaido Prefectural Government ought to employ some dietitians to work on menu planning and food purchasing for these orphanages. It would be helpful if Japanese food composition tables could include the vitamin D content of foods other than fish, shell fish and certain meats.

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