久米島における栄養調査

Nutritional Survey on Kumejima

By

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Introduction

The health of the individual is determined to a large degree by the nutritional adequacy of his diet. Information available on the nutritional adequacy of the diet consumed by the Ryukyuan people indicates a general lack of calorie, protein, calcium, iron and certain vitamines[2].

The occurrence of nutritional deficiencies in school children has been reported by Kaichiro Kuroda[5]. The report showed active vitamin B_2 deficiency in 24.0 percent of the primary school children and 14.4 percent of the junior high school children. It also indicated 27.8–36.6 percent of school children to have pigmentation on gums, and follicular keratosis (Vitamin A deficiency) in 19.2 percent of the primary school children and 9.8 percent of the junior high school chidren.

The results of nutritional survey on the Ryukyus, conducted by the Social Welfare Department of GRI shows the similar findings to those of Dr. Kuroda[6].

The purpose of this nutritional survey is to discover whether the subjects investigated are obtaining sufficient amounts of the right kind of foods. By throwing light upon the nutritional situation on Kumejima, the authors hope that these data will be of value in initiating practical programs concerned with agricultural planning and nutrition education.

Method of Survey

The survey was conducted by two groups, medical group and nutritional group, working simultaneously. The medical survey was conducted in accordance with procedures outlined in the Manual Surveys by the Interdepartmental committee on Nutrition for National Defense[4] by Colonel Iirvine H. Marshall and Capt. Byron F. Francis, assisted by two medical officers from the U. S. Army Hospital, the Kumejima public health nurses and technicians from Naha Health Center Laboratory. An abbreviated medical examination was given every child and every fifth child was given a detailed medidal examination.

The nutritional survey was conducted by the authors and our associates from the University of the Ryukyus assisted by the local home economics teachers. The method used is twenty-four-hour recall method. The survey was conducted for the youngest group of children whom it was felt could provide reciable answeres as to what they had eaten in the previous twenty-four hours. It was felt that the 4th grade or 10 year old children would provide a suitable survey group from a preliminary testing in a local school. We obtained information from each child as to what and how much had been eaten in the previous twenty-four hour period by using weighed servings of foodstuffs purchased in the market[1].

All of the records were numbered so comparisons of individual records could be made. The two teams worked independently and the findings were not known until all of the data had been tabulated.

The actual survey was conducted on Kumejima on 9–11 September 1959, and included 232 boys and girls in the 4th grade in the Gushikawa and Nakazato primary school (227 examined in medical phase). The Kumejima was selected to conduct the study because it had a

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population which would provide a group of children which could be examined in the time available and it had a rural economy with dependence for the most of its food on what was produced on the island.

Results and Discussion

The physical findings are presented in Table 1. The results are tabulated to show the number of children presenting one major sign for which examined and the number showing more than one. There were 106 of the 227 children (46.7 percent) who, on examination, were found to have a mojor sign used in the clinical evaluation of nutritional deficiencies. The other 121 children presented multiple signs. The definitions of the signs are provided in the manual which was used in this study as the guide. The findings will be discussed in presenting the signs and their relationship to the deficiencies.

Table 1. Physical Findings on 227 Children in Kumejima. 4th Grade in School 9–11, Sept. 1959.

Clinical Signs	Single Finding						Multiple Findings						Grand Total		% of 227 Children
	Male		Female		Total		Male		Female		Total				
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	%
Glands															
Thyroid			2	3.9	2	1.9			2	2.2	2	0.9	4	1.2	1.8
Skin Face															
Nasolabial Seborrhea							10	7.8	8	8.8	18	8.2	18	5.5	7.9
Eyes															
Bitots Spots	1	1.8			1	0.9	4	3.1	4	4.4	8	3.7	9	2.8	4.0
Lips															
Angular Fissures	9	16.4	8	15.7	17	16.1	21	16.4	13	14.3	34	15.5	51	15.7	22.5
// Scars	25	45.5	21	41.2	46	43.5	26	20.3	26	28.6	52	23.7	98	30.0	43.2
Cheilosis	1	1.8	2	3.9	3	2.8	6	4.7	1	1.1	7	3.2	10	3.1	4.4
Tongue															
Magneta			1	2.0	1	0.9	6	4.7	8	8.8	14	6.4	15	4.6	6.6
Filiform Papatro	4	7.3	3	5.9	7	6.5	21	16.4	13	14.3	34	15.5	41	12.6	18.1
Grossitis			2	3.9	2	1.9	1	0.8			1	0.5	3	0.9	1.3
Gums															
Scorbutic type															
Skin General															
Follicular Keratosis	13	23.6	12	23.5	25	23.6	26	20.3	13	14.3	39	17.8	64	19.7	28.2
Scrotal Dermatitis	1	1.8			1	0.9	1	0.8			1	0.5	2	0.6	0.9
Pellagroid Lesions															
Lower Extremities															
Bitot Edema															
Loss Ankle Jerk															
Calf Tenderness	1	1.8			1	0.9	6	4.7	3	3.3	9	4.1	10	3.1	4.4
Total	55	100.0	51	100.0	106	99.9	128	100.0	91	100.1	219	100.0	325	99.8	

Table 2. Biochemical Findings in (17 male, 26 female) Kumejima. 4th Grade 43 Students.

Serum Protein					Hemoglobin				
gm /100 cc	Male		Female		mg /100 cc	Male		Female	
	No.	%	No.	%		No.	%	No.	%
4.8	1	5.9	1	3.8	8.0	1	5.9	1	3.8
6.3	10	58.9	13	50.0	9.8	2	11.8	2	7.7
6.5	1	5.9			10.0	5	29.4	11	42.3
7.8	5	29.4	12	46.1	10.6	1	5.9		
					11.3	4	23.5	1	3.8
					11.8	1	5.9	8	30.8
					13.2	2	11.8	1	3.8
					13.8	1	5.9	1	3.8
					14.2			1	3.8
Total	17	100.1	26	99.9		17	100.1	26	99.8
Av.	6.7 gm/100		6.9 gm/100		12.5	14	82.2	23	88.5
					Av.	10.9 gm/100		10.95 gm/100	

Total serum protein 6.0—7.5 gm/100 cc
Hemoglobin 14.0—16.0 gm/100 cc
Anemia < 10.0 gm/100 cc

There were 43 students who received a detailed examination and for whom serum protein and hemoglobin values were determined. The average total serum protein for the boys was 6.7 gm. per 100 cc of blood and for the girls 6.9 gm. per 100 cc. Normal range for serum proteins is 6.0—7.5 gm. per 100 cc blood. Dependent edema is an indication of protein deficiency and no cases were noted. Hemoglobin averaged for the boys 10.9 gm. per 100 cc of blood and 10.95 gm. per 100 cc for the girls. The normal range for hemoglobin is 14.0—15.0 gm. per 100 cc of blood. In children under 14 years anemia is considered present when the quantity is less than 10.0 gm. per 100 cc of blood. There were 3 of the 43 students (7.0 percent) who would be classified as anemic.

The clinical and biochemical examination would indicate in this small sample that the protein intake was adequate for the group, however 2 of the 43 students (5 percent) had an inadequate protein intake. There were 6 of the 43 students examined who showed definite evidence of anemia, iron deficiency. The group as a whole were not anemic although 49 percent showed 10.6 or more grams of homoglobin per 100 cc and 86 percent showed 10 or more grams.

The criteria for vitamin deficiencies in relation to the clinical signs are shown in Table 3. Vitamin A deficiency is indicated by a condition of the skin-follicular keratosis. This clinical sign was positive in 28.2 percent of the total group examined. The finding of 5 percent more positives in adults is considered abnormal and an indication of a vitamin A deficiency in the diet.

Vitamin B_1 deficiency is indicated by a finding of more than 1—2 percent with absent Achilles tendon reflexes. There were none examined who showed an absence of this reflex.

Niacin deficiency is indicated by tongue lesions more advanced than hypertrophy at the tip of the tongue in more than 5 percent of the group. Twenty-two or 9.7 percent of the entire group showed moderate to serve tongue involvement. A reddened tongue is excess of 1—2 percent of which 1.3 percent showed abnormal signs. Pellagrous dermatitis of any degree is

Table 3. Percentage Positive Findings in 227 School Children. Kumejima (4th Grade), Sept. 1959.

Nutrient	Clinical Signs	Abnormal	Findings in 227 School Children
Vitamin A	Follicular Keratosis	+5 (Adults)	28.2%
Thiamine	Absent Achilles tendon reflexes	+1—2%	0%
Niacin	Tongue lesion more advanced than hypertoophy at tip of tongue	+5%	18.1% (9.7% moderate-severe)
	Reddened Tongue	+1—2%	1.3%
	Pellagrous Dermatitis	0%	none
Riboflavin	Angular stomatitis	+5%	Comb. 1 Sign Lesions 22.4% 7.5% Scars 43.2% 20.2% Total 65.6% 27.7%
	Conjunctival Hyperemia	+5%	
	(Circum Corneal Injection)		—
	Magenta Tongue	+0%	6.6%
Ascorbic Acid	Red Hyperemic Gums	+5—10% (Adults)	none
	Perifolliculosis	+0%	none
Protein	Dependent Edema	+0%	none
	Total Serum Protein	<6.0 gm/	average 0% (43)
		100 cc	(2/43—5%+)
Iron	Anemia-decreased	<10 gm/	average 0%
	Hemoglobin	100 cc	(6/43—14%+)

Table 4. Dietary Survey Results. 4th Grade Students, Kumejima, Sept. 1959. (A-Gushikawa, B-Nakazato)

Food	No. Students Eating						Av/Student Intake	
	A (158)		B (74)		Total (232)		A	B
	No.	%	No.	%	No.	%	gms	gms
Rice	156	98.7	74	100.0	230	99.0	831	859.8
Noodles	111	70.2	42	56.5	153	66.0	129.5	93.4
Sweet Potatoes	78	49.3	38	51.3	116	50.0	242.0	168.8
Miso	132	83.3	61	82.4	193	83.1	15.3	22.2
Fat	73	46.2	21	28.3	94	40.5	5.6	4.2
Fish	79	50.0	46	62.2	125	53.9	55.6	44.0
Meat	13	8.2	5	6.7	16	6.9	7.0	5.4
Candy-Gake	33	20.8	16	21.6	46	21.1	5.7	3.8
Canned Fish	16	10.1	4	5.1	20	8.6	4.3	2.2
Beans & Bean Products	17	10.1	2	2.7	19	8.2	10.6	2.2
Other Vegetable	47	29.8	23	30.8	70	30.2	52.1	38.9
G & Y Vegeyables	89	56.3	33	44.6	122	52.5	28.0	22.1
Fruits	2	1.3	1	1.4	3	1.3	2.1	0.9
Eggs	7	4.4	3	4.1	10	4.3	1.6	1.3
Seaweed	14	8.8	6	8.1	20	8.6	0.5	0.05

considered abnormal, however no cases were noted in the group.

Vitamin B_2 deficiency is evidenced by angular stomatites in over 5 percent of the group studied. Angular scaring or graying with no open lesions was considered to be evidence of recently healed lesions of angular stomatites. There were positive findings of angular stomatites in 22.5 percent of the group and 16.1 percent of the entire group presented this as a single clinical sign. Angular scarring was found in 43.2 percent of the entire group. It would appear that 65.7 percent of the group showed active lesions or recently healed lesions indicating this dietary deficiency. Conjunctival hyperemia in excess of 5 percent is considered abnormal, none of the group showed this sign. Magenta tongue of any degree showed this sign, however, only 1 case showed this as a single finding.

Vitamin C deficiency is evidenced by red hyperemic gums and perifolliculitis. None of the children showed either of these clinical signs.

The dietary survey results were based on data obtained by interviwing 232 children. Table 4 shows the various foodstuffs in the diet, the number of children eating each food and the

Table 5. Dietary Survey Results. 4th Grade Students. Kumejima, Sept. 1959.

Total

Group	Cal	Prot. gm	Ca mg	Fe mg	A l.u	B_1 mg	B_2 mg	Niacin mg	C mg
Requirements	2100 −2000	70–75	600–700	10.0	4000	0.9–1.0	0.9–1.0	9.0–10.0	65.0
Gushikawa (158)	1800	45.3	181.4	6.0	1293	0.93	0.44	6.7	86.7
Nakazato (74)	1850	48	155	6.8	818	0.9	0.46	6.34	70.5

Boys

	Cal	Prot gm	Ca mg	Fe mg	A l.u	B_1 mg	B_2 mg	Niacin mg	C mg
Requirements	2100	70	600	10.0	4000	1.0	1.0	10.0	65.0
Gushikawa	1926	47.2	190	6.2	1403	0.97	0.47	8.4	90.5
Nakazato	2029	49.9	142	6.5	902.5	1.03	0.46	5.75	80.9

Girls

	Cal	Prot gm	Ca mg	Fe mg	A l.u	B_1 mg	B_2 mg	Niacin mg	C mg
Requirements	2000	75	700	10.0	4000	0.9	0.9	9.0	65.0
Gushikawa	1765	43.6	179	5.8	971	0.92	0.40	5.0	83.9
Nakazato	1725	43.3	132	7.1	1042	0.72	0.45	6.92	60.2

Average boys and girls

	Cal	Prot gm	Ca mg	Fe mg	A l.u	B_1 mg	B_2 mg	Niacia mg	C mg
Requirements	2050	73.0	650	10.0	4000	0.95	0.95	9.5	65.0
Intake	1825	46.6	168	6.4	1055	0.915	0.45	6.5	78.6
Intake % of Required	88.5	63.8	25.7	64.0	26.3	96.3	47.3	68.4	100+

Does not include 1 oz of dried milk (26 gm) per child per day.
In February 1960 flour program started (1 oz per child).

average grams intake per child per day.

A nutritional analysis of the food intake by sex, by school and combined provides the basis of the data in Table 5[3)7)].

As it is seen on Tables 4 and 5, the diet of surveyed children lacks in many important nutrients. The average intake seems to be low in all nutrients except in vitamin C.

The average intake of carbohydrate sources such as rice, noddles and sweet potatoes are relatively high whereas the average intake of protein sources and vitamin sources are very low. However, the total Calorie intake of average boys and girls is only 1,825 Cal. that is 89.0 percent of the requirements.

For protein foods, fish is used extensively since the island is surrounded by the sea. Other protein foods such as meat, eggs, beans and its products are taken in very small amount. This gives the average protein intake of 46.6 grms. per child per day, that is 63.8 percent of the requirements.

Milk and its products are taken in negligible amount which gives average calcium intake of 168 mgs., 25.9 percent of the requirements. This survey was done wright after the summer vacation was over, and the schools had not yet started the milk program. Therefore, 1 oz. of dried milk (26 gms.) per child per day is not included.

According to the clinical evidence, the most prevalent deficiency syndrome was that due to a lack of riboflavin and vitamin A, and this is obviously seen from the results of dietary survey. The average vitamin A intake of the children is 1,055 I.U. that is only 26.4 percent of the requirements. Also, the average riboflavin intake is 0.485 mg. that is 51.0 percent of the requirements.

Though the average intake of vegetables and fruits was very low, the vitamin C intake is very high. This was mainly due to a large intake of sweet potatoes in their diet. However, the great loss of vitamin C in preparation of sweet potatoes should be taken into consideration. Since the very small amount of vegetables are eaten raw, there is the need for further investigation in the preparation of vegetables.

A high degree of correlation between medical findings and dietary results on the whole was found.

Summary

The nutritional survey was conducted on Kumejima on 9—11 September 1959, and included 232 boys and girls in the 4th grade in the Gushikawa and Nakazato primary schools (227 examined in medical phase).

Summarizing the clinical findings it is believed that the following indicate the nutritional deficiencies which existed in a group of 227 children in the 4th grade of the primary schools in Kumejima.

Nutrient Deficients	*Percent of group showing Deficiency*
Protein	5 percent
Iron	14 percent
Vitamin A	28 percent
Vitamin B_1—Thiamine	None
Niacin	18 percent
Vitamin B_2—Riboflavin	22—65 percent
Vitamin C—Ascorbic Acid	None

Summarizing the dietary survey the following deficiencies appear to have existed in the group studied.

Nutrients Deficient	*Percent of Daily Dietary Deficiency*
Calories	11.5 percent
Protein	36.2 percent
Calcium	74.3 percent
Iron	36.0 percent
Vitamin A	73.7 percent
Vitamin B_1	3.7 percent
Vitamin B_2	52.7 percent
Niacin	31.6 percent
Vitamin C	0

These findings indicated that the children investigated were not eating a nutritionally adequate diet. Clinical and dietary evidence is presented which verifies this statement.

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久米島における栄養調査（摘要）

新垣博子・尚　弘子

本報は1959年9月9日より同11日に久米島の具志川，仲里の両小学校において4年次児童232名について行なった栄養調査の結果である。

私共の健康が毎日の食事の摂り方と密接な関係がある事は周知の通りである。殊に児童の栄養は将来の健康を大きく左右する。児童の栄養調査に就いては黒田氏に依る沖縄学童の栄養状態調査についての報告があるが，これは専ら身体症候調査に依るもので食事調査と医師による精密検査を同時に行なったものがない。

ここで今度医療および食事の両面から之を行ない，今後の栄養教育と農業生産指導の一資料とする事を目的とした。

調査は医療班と栄養班に分れ，夫々数名の助手の協力の下に行なった。医療班は琉球民政府公衆衛生部長マーシャル医師とフランセス医師の指導の下に軍病院より2名の医師と那覇保健所の技術員および公衆衛生看護婦の協力を得て本調査を施行した。尚本調査は Interdepartmental Committee on Nutri-

tion for National Defense の調査方法に基いて施行し，学童 227 名について身体症候調査を行ない，5 名に 1 名の割で精密検査を行なった。

栄養班に筆者等が当たり琉球大学家政学科職員 2 名および久米島高等学校家庭科担当教官の協力を得て栄養摂取量の調査を行なった。方法は 24 時間回顧法を採用し，学童の回顧を助けるため調査地に於ける最も代表的な 1 日の食事の sample（予備調査により資料を得る）を数種作り面接の際に用いた。

身体症候調査および精密検査の結果は第 1 表，第 2 表，第 3 表に，食品摂取状況と実際摂取量は第 4 表第 5 表に，栄養摂取量は性別，学校別，全体平均に分けまとめた。

これ等の表より身体症候調査による栄養欠乏率と栄養摂取量調査に見られる栄養欠乏率に強度の差はあるが相関関係が見られた。

栄　養　素	身体症候調査に見られる欠乏率	栄養摂取量調査に見られる欠乏率
熱　　量		11.5%
蛋　白　質	5%	36.2%
Ca		74.3%
Fe	14%	36.0%
ViA	28%	73.7%
B_1	0	3.7%
B_2	22～65%	52.7%
ナイアシン	18%	31.6%
ViC	0	0