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THE FOOD AND GROWTH OF GOGO CHILDREN

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180

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INTRODUCTION

The drought of 1960/61 with ensuing famine over most of East Africa focused stark public attention on the subsistence agriculture, nutritional insufficiencies and retarded growth patterns of many African tribes. As a result of the generosity of the Save the Children Fund, the African Medical and Research Foundation in cooperation with Mvumi Mission organized a project to investigate the developmental problems of the children of the Gogo, a tribe living in the Central Province of Tanganyika. The priliminary findings reported in this paper centre upon the relationship between nutrition and the growth patterns of the Gogo children. The sociological findings and implications will form a separate report by Mr. A.C. Holmes, a Health Education specialist.

Roughly 1,200 children from four fairly representative villages (those underlined on map - Fig. 1) of the Dodoma District of the Central Province were examined, thus establishing an initial cross-sectional growth curve for Gogo children. In addition, the dietary habits of the Gogo tribe were investigated by both first hand observations of feeding situations and a series of interviews of Gogo parents.

BACKGROUND

The Gogo live in a flat, hot country at an altitude of about 3,600 feet. Rain, averaging about 22-24 inches per year falls almost exclusively between November and March. The rest of the year, the climate is hot, dry and windy; the land assumes a desert-like appearance, as the parched red sandy soil supports only a sparse cover of thornbush and dry grass. The rains however, transform the land into a sea of green, with cereal crops, legumes, and leafy vegetables blanketing the soil by February. Most crops are harvested by the end of May, and by July, the country is again relatively barren.

The Gogo grow a wide variety of crops (see Ugogo Crop Calendar Table 3). Even Henry Stanley, as he passed through Gogoland in his quest for Livingstone, was impressed by the variety of the Gogo diet. He noted that, "the quantity and variety of provisions which arrived at our boma did not belie the reports respecting the production of Ugogo. Milk, sour, and sweet, honey, beans, matama, maweri, Indian corn, ghee, peanuts and species of bean-nut very like a large pistachio or an almond, water melons and cucumbers were brought ....." (H.M. Stanley, "How I Found Livingstone in Central Africa" Page 144).

Large numbers of cattle are maintained in the villages. In Chihembe, one of the four villages examined in the study, 105 or 179 households claimed to possess a total of 1,000 head of cattle. These 105 homes accounted for 70% of the village children. However, only rarely and reluctantly are the cattle sold or butchered; they function mainly as symbols of status and wealth. When questioned as to "What are the best things in life?" 34 of 82 families replied "Cattle". It must be noted however that the cattle are valuable in providing milk for the village. The exact quantities of milk produced by the Gogo cattle has not yet been determined but it appears that during the

rainy season, when grass is plentiful, milk production is considerably increased. (Local estimates per cow are: Rainy season 3 - 4 pints per day and Dry season:- ½ - 2 pints per day) 29% of households keep goats, the average number is seven.

Sheep, goats and chickens, although frequently found in the court-yards of village homes, are unfortunately rarely found in the cooking pots. Eggs laid by the hens represent a potentially valuable source of nutrients. But, due to tribal taboos and lack of familiarity with them as a food, eggs are virtually never eaten by the tradition-oriented Gogo. Instead, they are marketed in Dodoma and Dar-es-Salaam. 24% of the households keep bees but the honey goes mainly to market or into beer making.

GENERAL SURVEY OF GOGO DIET

The dietary practices of the Gogo are clearly outlined and regimented by tradition. To attempt to understand the Gogo feeding patterns, as a series of 82 interviews were conducted with Gogo families and related to a number of firsthand observations of feeding situations made at the end of July and the beginning of August, two months after the end of the harvest and six months before the next fresh crop.

From birth until about 18 months, the infant is nursed by the mother. If the infant is afflicted with diarrhoea, the witchdoctor often attributes it to the "bad" milk of one breast and prescribes unilateral breast feeding. It is estimated that at least 25% of nursing mothers feed with one breast only.

At any time from one day to 8 months, the infants' intake of breast milk is supplemented with uji. Uji is prepared by boiling cereal flour (maize, millet or sorghum) in water until it achieves a gruel-like consistency. (Proportion roughly 1 + 6) Sugar is sometimes added. Mothers begin feeding their babies this uji when they "feel" that their breast milk is insufficient for the child. The most common age at which uji is introduced into the diet appears to be about three months. The initial amount consumed is small, perhaps ½ to ¾ of a cup per day. This is introduced by "palm feeding". As the child ages, the amount of uji is increased, until at about 1 year, he will consume up to 2½ cups per day. Occasionally, during the first year of life, small amounts of cow's milk may be given to the infant if the family is fortunate enough to have a sufficient number of cows to provide this above and beyond that required for the other members of the family! Very often, when it is considered that the child is ready for weaning he is sent to grandmother at some other village.

From 12 to 18 months the child is taken off his diet of uji and introduced to the family dietary patterns. The Gogo usually eat two meals a day, at noon and in the evening. Between meals, they munch extensively on groundnuts. The family eats as a unit, each person dipping into a central plate of food. The 1 year olds are fed by their parents, but the 2 year olds must fend for themselves.

The staple food in the Gogo diet is ugali. Ugali, like uji, is prepared by mixing millet, maize or sorghum in boiling water. Ugali, however, is much more solid, having the consistency of bread dough or hard porridge and is always eaten with at least one sauce. Sauces may include soured milk, legumes, leafy vegetables or meat. The legumes and leafy vegetables are generally prepared by boiling them in water while curshed groundnuts (always) and milk (occasionally) are added. The favourite

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and most abundant sauces are prepared from sesame and cowpea leaves and tomatoes, onions and aloes are commonly added. Bambara nuts, beans and cowpeas figure less prominently in the diet. Small amounts of meat, bought at the local store, are eaten once a week at best by most families. In homes with cows, soured milk is served at about 50% of the meals, often as the only sauce with the ugali, but occasionally legumes are also prepared. The standard fare is enlivened with sweet potatoes or pumpkins which are simply boiled over the fire and served as the sole food at the meal.

ROUGH QUANTITATIVE ANALYSIS OF THE GOGO DIET

The exact amounts of food consumed by the Gogo children is indeed difficult to quantify. However, attempts were made to determine approximately the amount of food eaten at each meal by directly observing the Gogo in their own homes.

In order to minimize the disturbance of the normal feeding routine, measuring instruments were not brought into the homes. Hence, the accuracy of the quantitative results depend on the judgments of the observer. Despite the imprecision of the measurements, the authors feel that the data has significance in that it sheds some light on the nutritional status of the developing Gogo child.

Tables 1 & 2 reveal the observed average daily food intake with its nutritional equivalent for children living in homes with cows*. The nutritive analysis of the foods was carried out by securing laboratory measurements of the exact quantities of foodstuff incorporated in the uji, ugali and sauce. Amounts to be used and actual cooking were left to African mothers. Uji turned out to be 22% maize and ugali 39% maize (by weight). A sauce prepared for a family of 5 contained about 200 grams of cooked green leaves and 50 grams of chopped groundnuts.

GROWTH CURVES

The programme for measuring the children was laid out so that nearly all children in each village were examined. Maps were made, village authorities mobilized and accurate census taken to ensure that the results would be as cross-sectional as possible.

Probably the gravest difficulty encountered in obtaining the growth curves of the gogo was that of determining the ages of the children investigated. For the Gogo, calendars are non-existent, and dates meaningless. Ages could only be determined by engaging in careful discussions with the parents and village elders in each locale attempting to relate children's birth dates to significant events in recent local and tribal history, such as the State Visit of Princess Margaret to Dodoma in 1956, the floods of 1961, the famines of 1955 and 1960 etc. Key points of reference were established by the few mothers who were delivered in hospitals and retained their children's birth certificates. The names of the children were helpful for they were often related to the doctor who delivered them. The crop time of year when the children were born was invariably recalled by the parents. Table 3 illustrates the "calendar" for Chihembe village.

* As noted in the foregoing, 70% of the children in Chihembe village are reared in homes with cows. When compared with children living in homes without cows, this 70% showed a slight, but statistically insignificant advantage in both height and weight.

YEAR	E V E N T
1952	Earliest talk of Mau Mau in Kenya
1953	Famine
1956	Princess Margaret's visit
1959	Dr. Hannach left Church build
1960	Drought begins
1961	American maize Dam built
1962	Airstrip built

Table 3 "Calendar"

Once the age of the children was ascertained, each child was given a metal disc with a code number impressed on it. It is hoped that the children will retain these discs to facilitate follow up studies on the growth and development of individual children. The child's number, age and name were recorded in a ledger, and his height and weight measured.

All measurements were taken in the village [illegible]. The children wore very little clothing and what they did wear was corrected for by test sample weighings. Weight was taken on a UNICEF bean balance which was tested frequently with a plumb bob and standard weights.

Height was read from the same UNICEF vertical scale in inches (to the nearest inch) or in the case of infants on a table-top scale. Arm circumference was taken around the mid-upper right arm with the arm in extension. Measurement was in mm. on a very flexible metal rule. Skinfold thickness was taken over the triceps of the dependent right arm with a Harpenden type caliper exerting a pressure of 10 gm/sq. mm. of face. All measurements were taken by or under the direct supervision of one investigator (R.S.). Table 4 and 5 [illegible] contain the data obtained.

CLINICAL FINDINGS

Although this study was not primarily a clinical exercise, some simple clinical observations should be noted. In the course of the survey (of 1,176 children), only one marasmus and no frank kwashiorkor were found. But, it is the authors' impression that many children appeared to be nutritionally sub-par. This is corroborated by the records of Mvumi Hospital (20 miles south-east of Dodoma) which lists malnutrition as the second commonest cause of child morbidity.

Excessive degrees of morbidity and mortality in the area are evidenced by the present findings in Chihembe village of a more than 40% infant and child mortality rate. This approximates Latham's (1964) figure of a 43.7%, derived during a famine year (1961/62) from the Dodoma and Kondoa Districts of the central Province.

The following data reflects the disease pattern of three years at Mvumi Hospital. These were kindly supplied by Dr. Joseph Taylor.

	Morbidity	Mortality
Infant 1 year	Malaria Relapsing Fever Bronchopneumonia	Anaemia from Malaria Baccillary Dysentry Meningitis Pneumonia
Child 2 - 5 yrs.	Malaria Malnutrition Bilharzia	Meningitis Other causes rare.

DISCUSSION

The most definitive findings in this study underline the "retarded" growth patterns of Gogo children. A two year average of birth weights at Mvumi Hospital came to 6 lbs. to 3 and a third ounces. Close to 65% of the African youngsters trail their United States counterparts by one year or more in height and 75% by one year or more in weight. The Gogo infants develop well for the first three months of life, but by the fourth month they already begin to fall behind American infants. The difference in weights between the two groups tends to progressively increase from the fourth month right through to the twelfth year; the difference in heights, however, increases through the second year, but from then on tends to remain relatively constant. The Gogo children therefore lean toward the height axis on the Wetzel grid, their growth curve cutting across the normal channels of development. This implies a comparative state of malnutrition. The Wetzel grid interpretation of the Gogo growth curve is corroborated by the Gomez scale of measuring nutritional status. According to this scale, under three years of age the average child suffers at least grade 1 malnutrition. We have deferred plotting ranges in each category as the sample is as yet so small.

Both the Wetzel grid and the Gomez scale reflect "comparative malnutrition". But it must be emphasized that a state of "comparative malnutrition" may result from a variety of causes - from undernourishment, disease, or heredity.

It is most commonly assumed that African growth retardation is largely due to undernourishment. Table 1 compares the United States optimum mutrient requirements with the observed calorie, protein, and vitamin A intake of Gogo children. Before discussing the implications of this chart we must mention its limitations.

1. Data based on limited sampling.

2. Analytic data not based on Gogo foodstuffs.

3. Relative plentitude of food at time of sampling uncertain i.e. cannot be sure this is an "average" condition.

4. Does not take into account the very significant amount of peanut munching which goes on between meals.

Granted the above limitations the following impressions emerge.

1. A nine month old child whose mother's lactation falls off is in a high state of risk of both protein and calorie deprivation as well as avitaminosis A. As implied earlier, just at the time of his greatest need he has a low priority on available cow's milk. This is a sociological problem of the first magnitude. It might be circumvented somewhat by the introduction of enriched peanut uji. This is the subject of an experimental project now being carried on and will be reported on in Mr. Holmes' paper. The avitaminosis A is reflected in McLaren's (1960) finding of xerosis conjunctival cornea in nearly 5% of toddlers.

2. By 18 months, the child has begun to dip into the family sauce bowl, thus availing himself of a good supply of Vitamin A. However, he is still deficient in protein and calories. Both deficits would be made up by about 50 grams of peanuts munched between meals. How much these children do eat between meals is a moot point. We know that in the older groups this munching is a significant factor, at least in Chihembe village.

3. By the age of four and thereafter the child seems to be on a good footing nutritionally and his between-meal peanut munching would seem to give him a wide margin of safety. [illegible] but [illegible] his weight curve continues to fall increasingly behind that of North American children. Whence the retardation? (A similar finding is reported by Dutra (1964) in seemingly well fed day clinic children in Brazil).

The high mortality rate amongst Gogo children points to the importance of disease in influencing child development. Its effect on growth has yet to be objectively studied in Ugogo. To help understand the relative effect of malaria upon growth, a project [illegible] organized to protect the children of Chihembe village against malaria with CI 501 (a long term prophylactic drug) over a three year period. However due to continued uncertainties regarding the drug the project was abandoned. Malaria is a problem only from March through to June, but during that time it is a severe problem according to Dr. Taylor of Mvumi Hospital.

MacGregor (1956) and Bruce-Chwatt (1952) have already investigated the effects of malaria on growth curves of children against malaria. Both authors found more growth retardation in unprotected infants than in protected infants during the first two years of life. MacGregor however, proceeds to suggest that the unprotected infants soon develop resistance to the deleterious effects of malaria and grow rapidly enough to equal the weight of the protected children by the age of three. In this regard Welbourne (1955) found Luo children taller and heavier than Buganda children. She felt that the difference was due to more prolonged breast feeding and a higher protein diet and despite the fact that the Luo children were dirtier, less well looked after and were just as prone in infectious diseases.

One important body of data not yet elicited in this study is the prevalence of parasitemia. We may yet find ourselves corroborating Platt's (1960) suggestion that "the nutritional status of man can be improved more rapidly and at less cost by eradicating parasites than by improving feeding."

It must be emphasized that our findings of Gogo growth "retardation" is based upon comparison with United States norms. The significance of the potential error thus introduced by comparing two different genetic stocks is recognized by the authors. However, at present the genetic factor remains an unknown quantity.

Greulich (19[illegible]) has reported on the relative influence of changing environment of Japanese somato-type, and the genetic implications. It is hoped that with improvement in the quality of study being carried out in Ugogo that similar information will be forthcoming.

CONCLUSIONS

1. Our baseline growth studies reveal the common African pattern of a good start while on the breast followed by a relative "falling off" of weight thereafter.

2. Gogo infants are well below Baganda infants (IMRU) in weight.

3. A great deal of further study is needed along the following lines:

   (a) Lactation patterns of Gogo mothers.

   (b) Between meal peanut munching, age of onset and quantities.

   (c) Problem of milk priority within family circle.

   (d) Age determinants.

   (e) Technical analysis of local foods.
   (f) Parasite rates.

4. The problem group are the weanlings. With regard to them Dean (1960) has well said "..... it should be practical to supply from local (Tanganyika) sources a complete food that would benefit the young children who stand in need of it ..... We are not so sure that the introduction of the foods into the diets of the children, and into their mouths is so easy of accomplishment. The need for educating the parents to understanding of the special requirements of the children may perhaps be found to be the greatest need of all. Perhaps we may have to educate, first of all, the educators".

NOTE This project could not have been carried out without a high degree of esprit-de-corps in the field team, which included Miss Genevieve Cutler S.R.N., Miss June Cabena S.R.N., Stanley Ugoma and Alfred Njole.

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					9 months				18 months				4 years				8 years			
FOOD	Unit of Cons.	Prot.	Cal.	Vit A	Unit of Cons	Prot	Cal.	Vit A	Unit of Cons.	Prot.	Cal.	Vit.A	Unit of Cons	Prot	Cal.	Vit A	Unit of Cons	Prot	Cal	Vit A
Uji	1 cup (55 gm. maize)	4.9	198	241	2 cups	9.8	396	482												
Ugali	"ball" 28 gm. (10.9 gm. maize)	.98	39.4	48					12	11.7	472	576	25	24.5	985	1200	36	35.1	1416	1728
Milk † (whole, cows)	Cup (8 oz. 224 gm.)	7	152	358	UNCERTAIN -----				1	7	152	358	1.5	10.5	228	537	2	14	304	716
Green Leaves (cooked)	40gm.	.92	8	4712					20	.5	4	2356	30	.7	6	3540	40	.9	8	4712
Peanuts (in sauce)	5 gm.	1.3	28	0					5	1.3	28	0	7.5	2	42	0	10	2.6	56	0
TOTALS (at meals) per day						9.8	396	482		20.5	656	3290		37.7	1261	5277		52.6	1784	7156
Daily Amount per bodyweight Kg.					@7.54	1.3	525		@10Kg.	2.05	656		@14.3	2.6	90		@23Kg	[illegible]	77.5	
U.S. Amount Recommended*						3.5	110	1500		3	100	3000		2.5	90	3000		2.5	80	3000
% of Protein of Animal Origin										34%				27%				27%		

† See note next page

Table 1--

QUALITATIVE AND QUANTITATIVE ESTIMATE OF GOGO CHILDRENS DAILY FOOD INTAKE BASED ON PERSONAL OBSERVATION (Based on Fig4) OF TWENTY-SIX FAMILY MEALS.

† Milk, (whole, cows) (Table 1)

The observed estimated milk consumption in the home produced a figure higher than that obtained by statistical deduction as follows:-

$\frac{1000 \text{ cattle in Chiherbe}}{179 \text{ households}}$ = 5.6 cattle per household.

Assume $\frac{1}{2}$ cattle are females and $\frac{1}{2}$ of them lactating at any one time, giving an average of 1 quart per day.

Therefore, $\frac{5.6}{4}$ x 1 quart = 1.4 quarts per day per household.

(A count of 100 families with children revealed 2.4 children per family. We here assume 5 people per family).

Thus .28 quarts per day per person

OR .24 litre per day per person.

Yielding 3.1 x 2.4 = 7.44 grams protein per person per day from milk.

The discrepancy could be in the proportion of cattle lactating and/or quantity of milk given.

FOOD NUTRIENT ANALYSIS

(from: Wooster, H.A. "Nutritional Data", Heinz Co. Pittsburg,Pa.1954)

FOOD per 100 gm.	PROTEIN	CALORIES	VIT. A
Maize	9	362	440
Milk - whole cow's.	3.1	62	160
Green Leaves (spinach)	3.1	26	11,780
Peanuts (roasted)	26.9	559	0

Table 2

U G O G O C R O P C A L E N D A R

P = planting; H = Harvesting; S = storage.

I P A N H A Kupanda		I L I M A N Z U W A Kulima Kupalilia			I T I K A Mavuno		N H W A N G A Kutwanga		NDAWAMBELEJE Ngombe Lulamabua		M B E L E J E Safisha shamba	
← rain												
November	December	January	February	March	April	May	June	July	August	September	October	November
← P	P	maize	P	H	→	S	S	S	S	S	S	S
S	S	S	← P	maize H	H	H →	S	S	S	S	S	S
← P ←	P	P	millet H	H	H	→	S	S	S	S	S	S
S ←	P	P	ground-nuts	H H →	S		S	S	S	S	S	S
S ←	P	ground-nuts, red	H	s	S	S	S	S	S	S	S	S
S	P	P	bambara nuts	H	→	S	S	S	S	S	S	S
← P	P	P	cow peas	H	H	H	H →	S	S	S	S	S
S	S	S	cowpea leaves, (safwa) (dry)			S	S	S	S	S	S	S
← P kidney bean		H →	S	S	S	S	S	S	S	S	S	S
←	P	P	rice	H	H	H	H →	S	S	S	S	S
←	P	P	P	dolices bean		H	H	H	H	H	H	H
←	P	P	P	P pigeon pea		H	H	H	H	H	H	H
S	S	←	P	P cassava		H	H	→	stored in the ground indefinately			
H	H	H	H	H cassava leaves (cisamvu)			H	H	H	H	H	H
		←	P sweet potatoes		H	H	H ←	P (in river)	H	H	H	H →
					←	sweet potatoes H		H	H	H		
				← P	P	tomatoes	H	H →	H —(near water)→ H			
←	P pumpkins		H →	S	S	S	S	S	S	S	S	S
		← P	P amaranth		H →							
		←	P	P sugar cane			H	H	H	H →		
H	H	H	H	H sesame leaves (ilende)			H	H	H	H	H	H
S	S	S	S	S pumpkin leaves (dry) (Nhatile) Sweet potato leaves (dry)				S	S	S	S	S