

SOCIO-ECONOMIC BACKGROUND OF CHILDREN  
ADMITTED TO KENYATTA NATIONAL HOSPITAL

WITH

KWASHIORKOR

BY

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the University of Nairobi.

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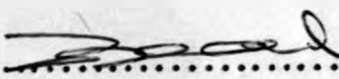
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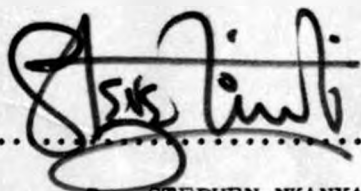
DECLARATION

This is my original work and has not been presented for a degree in any other University

Sign.  ..... Date 5.4.1984

Dr. James Wambura Nyikal  
(CANDIDATE)

This thesis has been submitted for examination with my approval as University Supervisor.

Sign.  ..... Date 5.4.1984

Dr. STEPHEN NKANYA KINOTI  
(SUPERVISOR)

DEDICATION

To all those children of peasants and workers of the developing and underdeveloped countries who strive to survive under the yoke of starvation and want in a world technologically capable of producing enough food for all mankind.

With these children I share roots and perhaps destiny.

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S U M M A R Y

In this study the socio-economic backgrounds of children admitted to paediatric observation ward of Kenyatta National Hospital between October 1982 and March 1983 were studied and compared with those of matched normal children attending Child Welfare Clinic of the same hospital and over the same period of time. A total of 103 cases of Kwashiorkor and 93 controls were seen and their parents interviewed.

The majority of children with Kwashiorkor (48%) were from Nyanza Province in contrast to overall paediatric admission in the hospital, of which 47% were from Central Province. A large proportion of children with Kwashiorkor were not resident in Nairobi, 51% compared to 8% for controls. Thus most children admitted in this unit with Kwashiorkor came from rural areas.

Compared to mothers of controls, mothers of children with Kwashiorkor were found to be younger, (62% below 23 years), of lower formal education and many (41%) were either single, in polygamous marriages or divorced. 86% of these mothers had less than eight years of formal education compared to 35% for mothers of controls. 84% of mothers of children with Kwashiorkor were either unemployed or employed on lowly paid unskilled manual jobs (58% for control mothers) Fewer (25%) of mothers of malnourished children used contraceptives compared to mothers of controls (44%).

Fathers of children with Kwashiorkor were also found to have low formal education (46% below eight years of education, for controls 15%) and low income jobs. Average monthly incomes were KShs. 490 for fathers of malnourished children and KShs. 1,285 for fathers of controls.

Overall household factors were adverse amongst children with Kwashiorkor. Family incomes and therefore money spent on food were less in the malnourished group compared to controls, on average KShs. 390 and KShs. 984 per month respectively. Children with Kwashiorkor were cared for by younger maids and were weaned on low protein diets. These children also lived in poorer houses with unsatisfactory water supply and sanitation.

No differences were demonstrated between the two groups as regards maternal pregnancy at the time of study, fathers' ages, birth interval, and number of siblings in the family. Age at which supplements were introduced in a child's diet and length of bottle feeding were also found not to be different in the two groups.

Factors underlying these differences are discussed and conclusions drawn. From the conclusions recommendations are made regarding areas where improvements are needed.

## I N T R O D U C T I O N

Kwashiorkor is a Ghanian (Gha) word meaning "a child displaced from its mother by a subsequent pregnancy". This term which was introduced into Medical Literature by Cicely Williams 1933-35<sup>1</sup> refers to severe form of protein energy malnutrition whose principal features include apathy, skin changes, hair changes and oedema.

Although this terminology tends to make Kwashiorkor appear as a solely tropical or African malady, it is fundamentally the same syndrome described as "Mehlmarshden" (Starch Dystrophy) seen in Europe about one hundred years ago<sup>2</sup>.

Malnutrition is a world wide problem. In the World Food Conference in Rome 1974 as quoted by Kinoti<sup>3</sup>, it was estimated that half a billion people in the underdeveloped countries are affected by malnutrition. These are mostly children under five years of age and lactating women especially if they come from underprivileged and poverty stricken sector of the society. In Africa nutritional deficiencies contribute to 30-50% of all hospital deaths<sup>3</sup> and ranks second or third as a cause of death in children. In rural Kenya, it is estimated that nearly one-third of children under five years of age are suffering from mild to moderate protein energy malnutrition<sup>4</sup>. Severe protein energy malnutrition on the other hand afflicts 2-5% of all children below the age of five years. In a country where children under five years of age constitute 20% of the population<sup>5</sup>, these figures represent a large number of children.

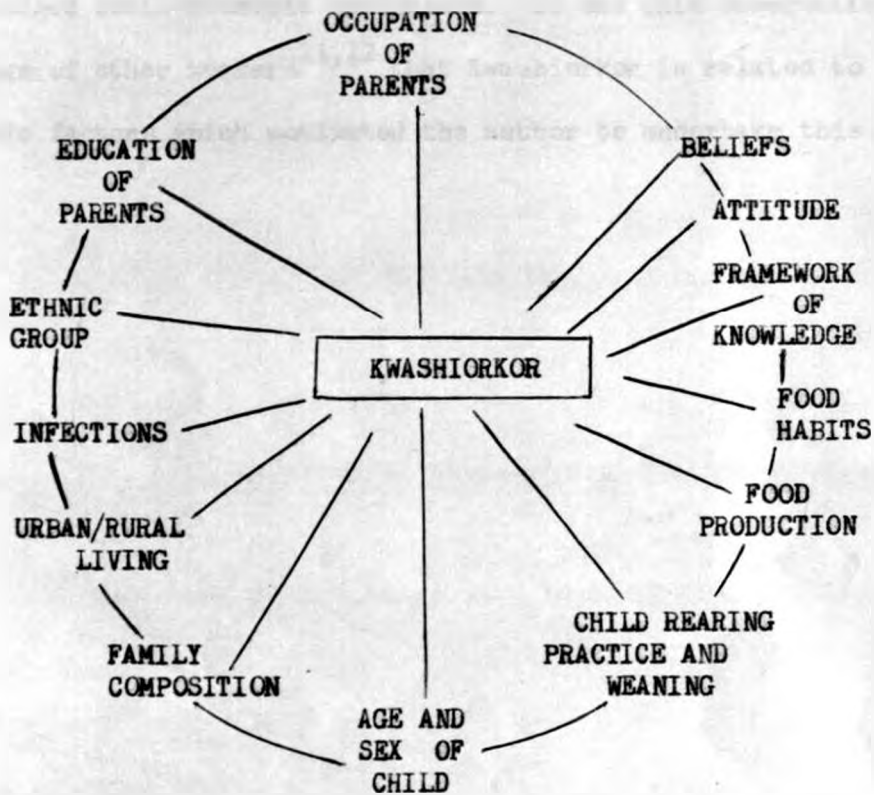
Moreover the one-third with mild to moderate malnutrition are children who are apparently normal but whose nutritional status is critical and can readily be tipped into severe malnutrition by hazardous socio-economic factors. Figure 1 gives a graphical presentation of such factors and their relationships.

Underlying all these factors are the three major problems of poverty, ignorance and disease. Various authors have laid different emphasis on the relative contribution of these factors in the aetiology of Kwashiorkor. Some have pointed to poverty as the most significant contributory cause of Kwashiorkor<sup>6,7,8,9,10,11,12,13,14.</sup> Others have emphasised that ignorance is the most important factor. Kwashiorkor solely due to ignorance has been reported<sup>15</sup>. The reported cases were amongst the affluent and were due to prolonged withholding of feeds especially milk as a therapeutic measure in children with gastro-enteritis.

<sup>16</sup>  
Goodall working in Kampala in 1979 showed positive correlation between the occurrence of Kwashiorkor and the presence of the following socio-economic factors in the child's family:-

1. Mother is not the child's attendant in the hospital
2. Change in child's attendant
3. Mother is pregnant
4. Parents are separated
5. Child lives away from both parents
6. Bad reason for weaning
7. Father is poor

**Fig. 1 : Factors responsible for Kwashiorkor in a community**



Adapted from: **Medical Care in Developing Countries**

Ed. Maurice King  
Oxford University Press 1966<sup>17</sup>

The role of disease in protein energy malnutrition is well established <sup>18,19</sup> but is not under consideration in this study.

During one year period 1980/81 when the author worked in the paediatric observation ward of Kenyatta National Hospital, he observed that children admitted with Kwashiorkor seemed to be of poor and underprivileged socio-economic background. It was this observation and findings of other workers <sup>11,12</sup> that Kwashiorkor is related to socio-economic factors which motivated the author to undertake this study.

## AIMS AND OBJECTIVES

To determine the relationship between occurrence of Kwashiorkor in a child and the presence of the following socio-economic factors in the child's family:-

1. Maternal factors such as age, level of education, income, occupation and marital status
2. Factors related to the father such as income, age, formal education and number of dependants
3. Factors related to the child like age, sex and ethnic group
4. Family factors such as number of siblings, birth interval, weaning practice, morbidity and mortality in the family
5. Environmental factors related to sanitation

## MATERIALS AND METHODS

### Study Design:

Socio-economic backgrounds of children admitted to paediatric observation ward of Kenyatta National Hospital were compared with those of normal children (controls) attending child welfare clinic at the same hospital. Using a pretested questionnaire the author interviewed the mothers or guardians who brought these children to hospital regarding socio-economic conditions obtaining in the children's families. Information received from the two groups were compared. Any differences noted were subjected to statistical testing to show their significance.



Study period and study area:

The study was carried out between October 1982 and March 1983 in Paediatric Observation Ward of Kenyatta National Hospital. This is the acute admission unit for the department of paediatrics.

Selection of Patients:

All children admitted into this unit during the study period with diagnosis of Kwashiorkor and who also met the following criterior were admitted into the study:-

1. They satisfied the wellcome criterior for diagnosis of Kwashiorkor<sup>20</sup>
2. They had the following other features of Kwashiorkor
  - (i) Apathy
  - (ii) Hair changes and/or
  - (iii) Skin changes

All children were examined by the author within twenty-four hours of admission. The weights were taken with a mechanical table balance model SECA No. 62075 routinely used for weighing children in the unit. The parents of selected children were interviewed by the author using the questionnaire, see Appendix IA. Where a child was accompanied by a guardian, effort was made as far as possible to get one of the parents to give the required information.

Selection of Controls:

The controls matched with the patients for age, sex and tribe

were selected from amongst normal children attending the child welfare clinic at Kenyatta National Hospital. Every consecutive child who satisfied the matching was admitted into the study. The same questionnaire was administered to the parents of the controls by the author.

#### Data Analysis:

Frequency distribution tables were constructed for the various factors under investigation. These were compared for the two groups and differences subjected to students T test or Chi Square test as appropriate.

### DATA ANALYSIS

#### Analysis for food score

In order to analyse the nutritional value of supplement introduced into a child's diet, the food mentioned was scored for its major nutritional constituents. A score of one was awarded for each major constituent. For example,

1. "Githeri" which is a mixture of potatoes, maize, beans,

meat and green leafy vegetables scored as follows:-

Protein - 2 (beans and meat)

Calorie - 2 (potatoes and maize)

Vitamins and minerals - 1 (green vegetables)

2. Mashed Potatoes and minced meat

Protein - 1 (meat)

Calorie - 1 (potatoes)

## 3. Uji (maize flour + water)

Protein	-	0
---------	---	---

Calorie	-	1
---------	---	---



Plate 1 above : Child with Kwashiorkor in Paediatric Observation Ward showing apathy, muscle wasting, skin changes and oedema.

Plate 2 below : Child recovering from Kwashiorkor. Note mother young, has another sibling after afflicted one.





Plate 3 : Child with Kwashiorkor in Paediatric Observation Ward.  
Note mother pregnant and child is on bottle feeding.



Plate 4 : Child with Kwashiorkor. Attendant is not the child's mother. Mother seperated from husband, and left child behind.



Plate 5 above : Severe Kwashiorkor. Tube feeding necessary.  
Note dehydration despite oedema.

Plate 6 below : Mothers with normal children at Child  
Welfare Clinic.





Plate 7 : Nutritional rehabilitation at Child Welfare Clinic. These are children recovering from malnutrition on follow up.



Table 1. Age distribution of children with Kwashiorkor and controls

RESULTS

A total of 196 children were studied, comprising 103 with Kwashiorkor and 93 normal controls.

AGE DISTRIBUTION

The mean age of children with Kwashiorkor was 16 months with a range of 7 to 60 months see Table 1. 76 children (76%) in the Kwashiorkor group were between the ages of 9 and 26 months. Only 3 children (3%) were over the age 38 months. There was no child with Kwashiorkor below the age of 7 months.

SEX DISTRIBUTION

53% of children with Kwashiorkor were males while 47% were females giving a male female ratio of 1.1:1

Age (months)	Number of children	Percent of total
7-8	0	0%
9-10	10	10%
11-12	15	15%
13-14	20	20%
15-16	25	25%
17-18	10	10%
19-20	5	5%
21-22	3	3%
23-24	0	0%
25-26	0	0%
27-28	0	0%
29-30	0	0%
31-32	0	0%
33-34	0	0%
35-36	0	0%
37-38	0	0%
39-40	0	0%
41-42	0	0%
43-44	0	0%
45-46	0	0%
47-48	0	0%
49-50	0	0%
51-52	0	0%
53-54	0	0%
55-56	0	0%
57-58	0	0%
59-60	0	0%
61-62	0	0%
63-64	0	0%
65-66	0	0%
67-68	0	0%
69-70	0	0%
71-72	0	0%
73-74	0	0%
75-76	0	0%
77-78	0	0%
79-80	0	0%
81-82	0	0%
83-84	0	0%
85-86	0	0%
87-88	0	0%
89-90	0	0%
91-92	0	0%
93-94	0	0%
95-96	0	0%
97-98	0	0%
99-100	0	0%
101-102	0	0%
103-104	0	0%
105-106	0	0%
107-108	0	0%
109-110	0	0%
111-112	0	0%
113-114	0	0%
115-116	0	0%
117-118	0	0%
119-120	0	0%
121-122	0	0%
123-124	0	0%
125-126	0	0%
127-128	0	0%
129-130	0	0%
131-132	0	0%
133-134	0	0%
135-136	0	0%
137-138	0	0%
139-140	0	0%
141-142	0	0%
143-144	0	0%
145-146	0	0%
147-148	0	0%
149-150	0	0%
151-152	0	0%
153-154	0	0%
155-156	0	0%
157-158	0	0%
159-160	0	0%
161-162	0	0%
163-164	0	0%
165-166	0	0%
167-168	0	0%
169-170	0	0%
171-172	0	0%
173-174	0	0%
175-176	0	0%
177-178	0	0%
179-180	0	0%
181-182	0	0%
183-184	0	0%
185-186	0	0%
187-188	0	0%
189-190	0	0%
191-192	0	0%
193-194	0	0%
195-196	0	0%

Table 1 : Age Distribution of children with Kwashiorkor and controls

Age in months	Number of children with Kwashiorkor	Number of Controls
3 - 8	13	15
9 - 14	40	37
15 - 20	27	19
21 - 26	12	13
27 - 32	3	4
33 - 38	5	4
Over 38	3	1
Range	7 - 67 months	7 - 67 months
Mean	16 months	16.8 months
Median Age	14 months	13.5 months

$$T = 0.64$$

$$p > 0.52$$

**Table 2 : Regional Distribution of Children with Kwashiorkor**

Case Origin by Province	% Children with Kwashiorkor	% All Children admitted over same period
Nyanza	48	18
Central	23	47
Western	13	11
Eastern	11	12
Others	5	12
n	103	93

REGIONAL DISTRIBUTION - BY PROVINCES

48% of the children with Kwashiorkor were from Nyanza Province, comprising mainly of the Luo ethnic group. Central Province came second with 23%. This was in sharp contrast with the regional distribution of total paediatric admission over the same period of time of which 47% were from Central Province while only 18% came from Nyanza, suggesting that malnutrition may be more prevalent in Nyanza, see Table 2.

MATERNAL FACTORS

1. Maternal Age

Most of the mothers in both groups were between the ages of 20 years and 27 years (53% for mothers of children with Kwashiorkor and 63% for mothers of controls). However mothers of children with Kwashiorkor tended to be younger. 22% of them were below 20 years of age, while for controls this was 10%. The mean ages were 23.1 and 24.7 years for Kwashiorkor and control groups respectively. See Table 3.

Table 3 : Maternal Age

Age of Mother in Years	% Proportion of Kwashiorkor Group	% Proportion of Controls
16 - 19	22	10
20 - 23	40	35
24 - 27	13	29
28 - 31	17	14
Over 31	5	12
S D	4.8	5.9
n	99	93
Unknown	3	0

T = 2.38

p = .02

## 2. Maternal Education

Mothers of children with Kwashiorkor were found to have significantly lower formal education than controls. Only 14% had more than 7 years of formal education while amongst the controls this was 65%, See Table 4.

Table 4 : Maternal Education

Level of Education of Mother	% Proportion of Kwashiorkor Group	% Proportion of Controls
Never went to School	17	5
Primary School 1-7 years Education	69	30
Secondary School 8-11 years Education	14	62
High School 12-13 years Formal Education	0	1
University Education	0	2
n	103	93

$$T = 6.68$$

$$p < < .01$$

### 3. Marital Status of Mothers

There were more single mothers amongst Kwashiorkor Group 17% than in the control group 11%. For married mothers polygamy was higher amongst mothers of children with Kwashiorkor, 15% as compared to 3% in the controls. Divorce cases were 9% and 5% amongst Kwashiorkor and control groups respectively. Thus overall, more mothers of children with Kwashiorkor had adverse marital relationships, see Table 5.

Table 5 : Marital Status of Mothers

Marital Status	% Proportion of Kwashiorkor Group	% Proportion of Controls
Single	17	11
Monogamous Marriage	58	78
Polygamous Marriage	15	3
Divorced	9	5
Widowed	1	3
n	103	93

$$x^2 = 11.54$$

$$p = .01$$

It was shown that 60% of mothers of children with Kwashiorkor were living separate from their husbands. Amongst controls this was 25%. This was because most of the husbands were employed in urban areas as manual or casual labourers, while their wives were left in the rural areas attending to often unproductive peasant holdings.

#### 4. Mothers Occupation

In this study there was a significant difference in the occupations of mothers whose children had Kwashiorkor compared to mothers of normal controls. In the Kwashiorkor group 68% of mothers had no regular salaried jobs. Amongst the controls, this constituted 53%. For those on regular jobs, more mothers in Kwashiorkor group (16%) were on unskilled jobs like cleaners and factory hands compared to 5% in the control group. On the other hand, more mothers in the control group were on skilled jobs like nursing, teaching and secretarial jobs (31%) and 3% for Kwashiorkor group. This difference was found to be statistically significant at  $p < 0.001$  as shown in Appendix I.

#### 5. Mothers Incomes

There was a statistically significant difference in the incomes of the two groups of mothers. Mothers of children with Kwashiorkor had lower incomes than mothers of control group. It is important to note that only regular and quantifiable incomes like salaries, profits from trade, regular cash crop sales were compared. Subsistence peasant produce was not taken into consideration as these were often difficult to assess and quantify accurately, see Table 6.

Table 6 : Income of Mothers

Monthly Income (Ksh.)	% Proportion of Kwashiorkor Mothers	% Proportion of Control Mothers
0	70	53
900 and Below	25	11
900 - 1800	2	26
Over 1800	0	9
* Mean (KSh./Month)	156	576
* Unknown	3	1
n	103	93

\* Calculation for mean monthly income excluded people whose incomes were unknown.

$$T = 5.17$$

$$p < 0.001$$



### 6. Money spent on Food

Families of children with Kwashiorkor spent less money on food than families of controls. 73% spent less than KShs. 600 per month on food, while this was 35% for controls.

The most striking difference was at expenditure of over KSh. 1,400 per month. No such expenditure was recorded for Kwashiorkor group, while it constituted 24% of control group, see Table 7.

Table 7 : Money spent on Food

Money spent on food per month (KShs.)	% Proportion of families of Kwashiorkor Children	% Proportion of Families of Controls
600 and below	73	28
601 - 1400	11	41
Above 1400	0	24
* Unknown	16	7
* Mean	KShs. 390	KShs. 984
n	103	93

\* Families whose incomes were unknown excluded from calculation of the mean.

$$T = 7.75$$

$$p << 0.001$$

### 7. Use of Contraceptives by Mothers

Use of contraceptives was more prevalent amongst mothers of controls (43%) than amongst mothers of children with Kwashiorkor (22%). The pill was the most commonly used contraceptive amongst mothers of children with Kwashiorkor. In the control group both the pill and intrauterine devices were equally used. This is shown in Table 8.

Table 8 : Use of Contraceptives amongst Mothers

Type of Contraceptive used	% Proportion of mothers of Kwashiorkor group	% Proportion of mothers of control group
None used	75	56
Pill	18	21
Intrauterine Devices	2	19
Others	2	3
Unknown	3	1
n	103	93

$$\chi^2 = 18.41$$

$$p \ll .005$$

Age of Parents

There was no significant difference in the age of parents of children with Kwashiorkor and children in the control group. However, the overall differences are not statistically significant.

**8. Pregnancy amongst Mothers**

At the time of the study, there were more pregnancies amongst the mothers of children with Kwashiorkor, see Table 9.

**Table 9 : Pregnancies amongst mothers at time of study**

Pregnancy	% Proportion of mothers of Kwashiorkor Group	% Proportion of mothers of Controls
Pregnancy	30	17
Not Pregnant	65	81
Unknown	5	2
n	103	93

$T = 2.15$

$p < .05$

FACTORS RELATED TO THE FATHER1. Age of Father

Some tendency for fathers of children with Kwashiorkor to be young was noted. However, the overall difference was not statistically significant, see Table 10.

2. Level of Education of Fathers

Fathers of children with Kwashiorkor were found to have less formal education than fathers of controls. Only 20% had more than seven years of formal education while in the control group this constituted 68%. 51% of fathers of the controls had 8-11 years of formal education. Amongst fathers of children with Kwashiorkor this was 20%. These are shown in Table 11.

Table 10 : Age of Fathers

Age of Fathers in Years	% Proportion of Fathers of Kwashiorkor Group	% Proportion of Fathers of Control
Below 24	4	2
24 - 27	19	11
28 - 31	23	30
32 - 35	6	22
36 - 39	5	8
40 - 43	3	3
Above 43	6	4
Unknown	34	20
Mean	30.9 Year	32 Year
S D	6.8	5.6
n	103	93

$$\chi^2 = 1.34$$

$$p > 0.25$$

Table 11 : Level of formal Education amongst Fathers

Level of Education	% Proportion of Fathers of Kwashiorkor Group	% Proportion of Fathers of Controls
No Formal Education	2	1
Primary School 1 - 7 years of formal Education	44	14
Secondary School 8-11 years of formal Education	19	51
Above Secondary School	1	17
Unknown	34	17
n	103	93

$$T = 6.12$$

$$p < 0.005$$

### 3. Fathers Income

Incomes of fathers of children with Kwashiorkor were significantly lower than those of fathers of controls. The mean monthly incomes were KShs. 490 and KShs. 1,285 for Kwashiorkor and control groups respectively, see Table 12.

Table 12 : Fathers Income

Monthly Income in KShs.	% Proportion of Fathers of Kwashiorkor Group	% Proportion of Fathers of Controls
1000 and Below	51	14
1000 - 2000	11	18
Over 2000	3	38
* Unknown	35	30
* Mean (KShs. per Month)	490	1,285
n	103	93

$$T = 4.89$$

$$p < 0.001$$

\* Fathers whose income were not known were excluded from calculation of the mean

#### 4. Fathers Dependants

No significant difference was noted in the number of dependants of fathers of children with Kwashiorkor and of fathers of controls.

#### 5. Alcohol Consumption by Fathers

No significant differences were noted in alcohol consumption between the two groups.

## HOUSEHOLD FACTORS

### Number of Siblings

There was no significant difference in family size in the two groups. The average number of siblings in the two groups were 2.9 and 2.8 children per family in Kwashiorkor and control groups respectively, see Appendix II.

### Death of Siblings

There were more sibling deaths in families of children with Kwashiorkor than in the families of controls. The difference is clearly shown on Table 13.

The causes of deaths amongst the siblings of children with Kwashiorkor in order of frequency were malnutrition, measles and diarrhoea/vomiting. Amongst the siblings of controls the causes were measles, respiratory illnesses and meningitis. Respiratory illness comprised mainly of pneumonia.

Table 13 : Deaths amongst Siblings

Number of Siblings who have died in family	% Proportion of Kwashiorkor	% Proportion of Controls
0	66	87
1	20	9
2	8	4
Over 2	3	0
Unknown	3	0
n	103	93
Sibling Deaths per 100 cases	36 per 100 Children with Kwashiorkor	18 per 100 Controls

$$T = 3.02$$

$$p < .01$$

#### Illness in Preceding Three Months

Morbidity was higher amongst children with Kwashiorkor than amongst the control group. 85% of children with Kwashiorkor had some illness in the preceding three months. For the control group, the figure was 59%. Four leading causes of illness in children with Kwashiorkor were found to be diarrhoea/vomiting, measles, fevers and respiratory illnesses. Amongst the controls these were respiratory



illnesses, diarrhoea/vomiting and fever, see Table 16.

### Birth Interval

By comparing age differences with preceding and with following siblings, it was shown that birth intervals were not significantly different in the two groups. Tables 14 and 15 are presented to emphasize this unexpected finding.

Table 14 : Age difference with Preceding Sibling

Age Difference with preceding Sibling (Months)	% Proportion of children with Kwashiorkor	% Proportion of Controls
10 - 14	11	9
15 - 19	12	11
20 - 24	15	13
25 - 29	15	6
30 - 34	8	5
Over 34	15	19
No preceding Sibling	24	37
*Mean Age Difference	26 Months	26 Months
n	103	93

$$T = 0.51$$

$$p > 0.50$$

\* Children with no preceding sibling were excluded from calculation of the mean age difference

Table 15 : Age Difference with following Sibling

Age Difference with following Sibling (Months)	% Proportion of Children with Kwashiorkor	% Proportion of Controls
14 and Below	1	1
15 - 20	6	7
21 - 26	2	2
27 - 32	0	1
33 - 39	1	1
Over 39	1	0
Unknown	1	0
No following sibling	88	88
* Mean Age Difference	21.7 Months	20.4 Months
n	103	93

$$T = 0.8$$

$$p > 0.42$$

\* Calculation of mean age difference excluded cases where age of siblings were not known and cases with no following sibling.

Table 16 : Type of Illness in Preceding Three Months

Type of Illness	% Proportion of Kwashiorkor Children	% Proportion of Controls
Respiratory Illness	9	46
Diarrhoea and Vomiting	50	15
Diarrhoea alone	5	13
Vomiting alone	1	4
Measles	22	4
Fever	10	9
Worms	1	2
Others	2	7
n	103	93

WEANING PRACTICEBreast feeding

At the time of study more children amongst the controls were breastfeeding (39%) than amongst the Kwashiorkor group (21%) as shown in Table 17.

Table 17 : Breastfeeding at the time of Study

	% Proportion of Children with Kwashiorkor	% Proportion of Controls
Breast Feeding	21	39
Not Breast-Feeding	79	61
n	103	93

$$T = 2.50$$

$$p = .012$$

There was a significant difference in the ages at which children stopped breast feeding in the two groups. For Kwashiorkor group this was 9.2 months while for controls it was 7.2 months.

The reasons for stopping breast feeding were also different in the two groups. Mothers of children with Kwashiorkor gave the following reasons:- Maternal pregnancy 29%, sick child 18% and child refusing the breast when started on bottle feeding. Mothers who gave this last reason felt that bottle feeding made their children refuse the breast.

Amongst controls the reasons were:- Pregnancy 24 cases, maternal absence 14 cases, and child stopped by mother 9 cases. Maternal absence included mothers who were away at work from morning to evening 10 cases, mothers who were sick and admitted to hospital 2 cases and mothers who were resident in training institutions 2 cases. Of the children who were stopped from breast feeding by mothers, the reasons given by mothers for stopping them were:- Child old enough 6 cases, refusing other foods 2 cases and child biting mothers nipples 1 case, see Appendix IV.

#### Bottle Feeding

No difference was demonstrated between the two groups as regards length of bottle feeding. However, when the data was analysed for whether child had ever been bottle fed, it was shown that more children in the control group had some bottle feeding than amongst those with Kwashiorkor, see Appendix V.

#### Introduction of Supplements

No significant difference was demonstrated between the two groups in regard to the age at which supplementary foods were introduced into the child's diet. The mean ages were 4.1 and 4.3 months for Kwashiorkor and control groups respectively.

#### Child Feeding

To analyse answers to the question who feeds the child, the answers were grouped as follows:-

## 1. Fed by mother:-

- If child was exclusively fed by mother

## 2. Fed by mother and other:-

- If child was fed by the mother at times and by some other person such as maid, grandmother or other members of the family

## 3. Fed by other:-

- Fed by other if child was exclusively fed by somebody other than mother

## 4. Self Fed:-

- If child was always given food to take by itself.

The results showed that more children in the Kwashiorkor group ( 65%) than in the control group (46%) were fed by their mothers. On the other hand 40% of controls were fed by mother and other as compared to 8% amongst Kwashiorkor group. See table 18.

Table 18 : Who Feeds the Child?

Who Feeds the Child	% Proportion of Children with Kwashiorkor	% Proportion of Controls
Mother	65	46
Mother and Others	8	40
Others	15	6
Self fed	12	8
n	103	93

$$\chi^2 = 27.06$$

$$p < < 0.01$$

Type of Supplement Introduced into the Child's diet

When supplements introduced into the diets of children were analysed for nutritional value (as per score system indicated under Materials and Methods) the scores for all three major food types were significantly lower in the Kwashiorkor group compared to the control group. See Tables 19,20 and 21. However the difference was much smaller for calorie score compared to protein and vitamin/mineral scores (for calories score  $p$  value  $< 0.01$  for protein score and vitamin/mineral score  $p$  value  $< 0.001$ ). This shows that diets of Kwashiorkor though deficient in all nutrients, contain relatively more carbohydrates than proteins.

Table 19 : Protein Score

Protein Score	% Proportion of Children with Kwashiorkor	% Proportion of Controls
0	16	1
1	62	11
2	16	33
3	5	30
Over 3	1	25
Mean Score	1.1	2.7
n	103	93

T = 9.11  
 $p << 0.001$

Table 20 : Calorie Score

Calorie Score	% Proportion of Children with Kwashiorkor	% Proportion of Controls
0	4	0
1	39	16
2	31	44
3	20	33
Over 3	6	7
Mean Score	1.86	2.3
n	103	93

$$T = 3.27$$

$$p \ll 0.01$$

Table 21: Vitamins and Mineral Score

Vitamin and Mineral Scores	% Proportion of Children with Kwashiorkor	% Proportion of Controls
0	45	13
1	48	56
2	6	23
More than 2	1	8
Mean Score	0.63	1.26
n	103	93

$$T = 5.55$$

$$p \ll 0.001$$



When data was analysed for type of supplement given to babies, it was shown that for both groups milk was the first food given to supplement breast feeding. Uji, cerelac and potatoes came next to milk and were also equally mentioned in the two groups. The main difference between the two groups was that for controls, a larger variety of food types were mentioned than for Kwashiorkor group. Also beans and meat were mentioned more often for controls than for Kwashiorkor group.

Analysis of the type of food the child had been feeding on prior to admission revealed the same pattern as for first supplement. Here the difference between the two groups was that the frequency with which meat was mentioned was remarkable with figures of 8.2% for controls and 0.6% for Kwashiorkor group. See Appendix VI and VIII.

#### Child Care

**Maids:-** Sixty-one per cent of households of control group had maids compared to 28% for households of children with Kwashiorkor. This difference was statistically significant ( $p < 0.01$ ). However, maids in the household of Kwashiorkor children were younger than those in the household of control groups with mean ages of 13 and 16 years respectively.

#### Mother Child Relationship

More children in the Kwashiorkor group (10%) were found living away from their mothers than in the control group, 1%. Of the 10 children in Kwashiorkor group, 9 were children of single mothers and were being taken care of by their grandmothers. One was a child of a married mother and was being taken care of by an aunt because the mother

was sick. The single child in the control group who was staying away from its mother was because the mother was resident in a training institution, see Table 22.

Table 22 : Child Staying with mother or not

	% Proportion of Children with Kwashiorkor	% Proportion of Controls
Staying with mother	90	99
Not Staying with mother	10	1
n	103	93

$$T = 2.31$$

$$p = .02$$

For children living with their mothers the data was analyzed to show whether there was any difference as to who takes care of the child at night and during the day. This showed that more children in the Kwashiorkor group were with their mothers during the day (65%) than in the control group (42%). There was no difference for the night period when most children in both groups were with their mothers, 90% for Kwashiorkor group and 98% for controls.

ENVIRONMENTAL FACTORSResidence

In this study children who had stayed in Nairobi for less than 3 months by the time of the study were considered not to be residents of Nairobi. By this criteria 51% of Kwashiorkor children were found not to be resident in Nairobi. At the time of the study 40% of these children had stayed in Nairobi for less than one month, and 23% for less than one week. (table 23.)

Their original residences were Nyanza Province 50%, Central Province 13% and the rest were from the remaining four provinces.

Table 23 : Duration of Stay in Nairobi

Duration of stay in Nairobi	% Proportion of Children with Kwashiorkor	% Proportion of Controls
Under 1 week	23	6
1 Week - 1 Month	17	2
1 Month - 3 Months	11	0
Normally resident in Nairobi	49	92
n	103	93

$$T = 5.49$$

$$p < < 0.01$$

Housing

Children with Kwashiorkor lived in smaller houses, built of cheaper and poor materials compared to the control group, see Tables 24, 25, 26 and 27.

Table 24 : Type of House - Number of Rooms

Number of Rooms in the House	% Proportion of Children with Kwashiorkor	% Proportion of Controls
1	60	20
2	29	15
3	6	25
Over 3	5	40
n	102*	93

$$T = 9.98$$

$$P < < .001$$

Table 25 : Type of House - Type of Roof

Type of Roof	% Proportion of Children with Kwashiorkor	% Proportion of Controls
Thatched	20	1
Corrugated Iron	70	48
Tiles/Asbestos	10	51
n	102	93

$$T = 6.86$$

$$P < < 0.001$$

\*A guardian of one child with Kwashiorkor was unable to give information on housing.

Table 26 : Type of House - Wall

Type of Wall	% Proportion of Children with Kwashiorkor	% Proportion of Controls
Earth	50	6
Corrugated Iron	6	5
Wood	10	17
Stone/Block	34	72
n	102	93

$$\chi^2 = 46.19$$

$$p < < .001$$

Table 27 : Type of House - Floor

Type of Floor	% Proportion of Children with Kwashiorkor	% Proportion of Controls
Earth	53	9
Cement	47	78
Tiles	0	13
n	102	93

$$T = 7.11$$

$$p < < 0.001$$

In the Kwashiorkor group 48 children (46%) were from families living in rented houses as compared to 68 children (73%) in the control group. 63% of families of children with Kwashiorkor who lived in rented houses paid rents of below KShs. 200 per month in contrast to 16% in the control group. 61% of control group paid rents of over KShs. 400 per month, while only 6% of Kwashiorkor group paid similar rents. See Appendix VIII.

### Toilets

Use of communal toilets was more prevalent amongst family of children with Kwashiorkor (85%) than in families of controls 45%. Most families in the control group (55%) had private toilets. Toilets used by families of children with Kwashiorkor were mainly pit type (81%). Amongst families of controls most toilets were water closet type 66%. See Table 28.

Table 28 : Toilet Ownership

Toilet Ownership	% Proportion of Children with Kwashiorkor	% Proportion of Controls
No Toilet	6	0
Communal toilet	85	45
Family Toilet	9	55
n	102	93

$$\chi^2 = 50.8$$

$$p < < 0.001$$

Water Source

Main water sources for families of children with Kwashiorkor were streams or rivers 30% and communal taps 60%. Of those getting water from communal taps, 50% pay directly for it at a cost of 50 cents for four gallons.

Amongst controls the main water sources were house tap 52% and community taps 31%. See Table 29.

Table 29 : Water Source

Water Source	% Proportion of Children with Kwashiorkor	% Proportion of Controls
Water Vendor	4	2
Stream/River	30	5
Communal Tap Sold Directly	30	10
Communal Tap	31	31
House Tap	5	52
n	102	93

$$\chi^2 = 72.75$$

$$p < < 0.001$$

Table 30 : Summary of Factors found to be significantly different in the two Groups

Factor	Difference Between Kwashiorkor and Control Groups	Test	p Value
<b><u>MATERNAL FACTORS</u></b>			
Age	Mothers of children with Kwashiorkor younger than controls.	T = 2.38	p = 0.02
Formal Education	Lower in mothers of Kwashiorkor group.	T = 6.68	p << 0.01
Marital Status	Single mothers, polygamy and divorce higher in Kwashiorkor group.	X <sup>2</sup> = 11.54	p = 0.01
Occupation	Mothers of Kwashiorkor children employed mainly in unskilled and manual jobs.	X <sup>2</sup> = 30.9	p < 0.001
Income	Mothers of children with Kwashiorkor who are on regular jobs earn less than their control counterparts.	T = 5.17	p < 0.001
Use of Contraceptives	Fewer mothers of Kwashiorkor children use contraceptive devices as compared to controls.	X <sup>2</sup> = 30.9	p < 0.001
<b><u>FACTORS RELATED TO THE FATHER</u></b>			
Education	Fathers of children with Kwashiorkor have lower formal education.	T = 6.12	p < 0.005
Income	Income of fathers of Kwashiorkor children were significantly lower than of control group.	T = 4.89	p < 0.001
<b><u>HOUSEHOLD FACTORS</u></b>			
Money spent on Food	Money available for food was less in homes of children with Kwashiorkor. (Subsistence produce was not included for rural families)	T = 7.75	p << .001



Table 30 cont...

Factor	Difference Between Kwashiorkor and Control Groups	Test	p Value
Death of Sibling	There were more sibling deaths in Kwashiorkor Group	T = 3.02	p < 0.01
Preceding Illness	Morbidity higher amongst Kwashiorkor Group	T = 3.94	p < 0.001
<u>WEANING PRACTICES</u>			
Breast Feeding at time of Study	More children in Kwashiorkor group on breast at time of study.	T = 2.50	p = 0.012
Person who feeds Child	More children in Kwashiorkor group fed by mother. Children in control group fed by mother and other people.	$\chi^2=27.06$	p < 0.01
Child stays away from mother	Common in Kwashiorkor group	T = 2.34	p = 0.02
Type of Supplement	Children with Kwashiorkor received supplements low in proteins, minerals and vitamins compared to controls. Also had less variety in meals.	T = 9.11 (Proteins)	p < 0.001
		T = 5.5 (Vitamins/Minerals)	p < 0.001
Presence of Maid	More maids in the families of controls. Maids of Kwashiorkor children younger.	T = 4.47	p < 0.01
<u>ENVIRONMENTAL FACTORS</u>			
Urban/Rural Residence	More children with Kwashiorkor were from rural areas.	$\chi^2 = 40.22$	p < 0.01
Housing	Kwashiorkor children lived in poorer and smaller houses	$\chi^2=46$	p < 0.001
Toilet Facilities	Kwashiorkor group had poorer toilet facilities - mainly communal pit latrines	T = 6.54 (Type)	p < 0.001
		$\chi^2=50.8$ (Ownership)	p < 0.001
Water Source	Main water sources for Kwashiorkor group were stream or river and communal taps. For controls main source - house tap.	T <sup>2</sup> =72.75	p < 0.001

Table 31 : Summary of Factors found not to be significantly different in the two Groups.

Factor	Test	p Value
Maternal pregnancy at the time of study.	T = 2.15	p > 0.05
Fathers Age	T = 1.16	p > 0.246
Number of siblings	T = .4	p > .40
Birth Interval	T* = .51	p <sup>1</sup> > .50
	T** = 0.8	p <sup>2</sup> > .42
Length of Bottle Feeding	T = 0.58	p > .50
Age at which Supplement introduced	T = .67	p > .50

\* Age difference with Preceeding Sibling

\*\* Age difference with following Sibling

## DISCUSSION

Several factors like maternal age, education, marital status, and income were found to be associated with severe malnutrition. Also associated were paternal factors such as level of education and income. Household and environmental factors like, weaning practice, family income, type of house, sanitation and water source also bore similar relationship with severe protein energy malnutrition. All these associations are discussed below.

### AGE OF CHILD

The finding that most of the children with Kwashiorkor in this study were between 9 and 24 months of age is in agreement with those of several other authors<sup>16,21,22,23</sup>. However, Coker and Jallow 1972<sup>23</sup> showed a significant number of children in their study to be below 6 months of age in contrast to the finding in this study. Goodal in Kampala (1969-1972)<sup>16</sup> showed no Kwashiorkor cases below six months of age, a finding strikingly similar to this study. The observed mean age of 16 months compares well with the view expressed by King<sup>17</sup> that the child with Kwashiorkor is usually about 16 months old. That Kwashiorkor is rare after 3 years is corroborated in this study by the finding that only one child was over 38 months old.

Prevalence of Kwashiorkor in this age group can be explained by the critical nature of this period. It is when the child is being weaned, is more exposed to infections as maternal antibodies wane and has high caloric demand for growth.

## REGIONAL DISTRIBUTION

Majority of children with malnutrition in this study were from Nyanza Province (48%). This is an unexpected finding as Kenyatta National Hospital, though a referral centre is in Central Province. It would therefore, be expected that most patients seen here be from Central Province. Indeed analysis of all Paediatric admissions over the same period confirmed this. Similar pattern has been observed before<sup>24,25</sup>.

Hospital records<sup>25</sup> show that majority (50%) of children seen with malnutrition at the nutrition clinic are from Nyanza. Most of whom are not normally resident in Nairobi but had just recently arrived from Nyanza. In the Mwanamugimu Nutrition and rehabilitation unit Mulago report of 1965-67, 10% of children with Kwashiorkor were from Nyanza<sup>26</sup>. Amolo in 1974 working in Nyanza Province observed the high prevalence of Kwashiorkor in the area and attributed it to change in the food habits of the people of Nyanza, resulting in some nutritious food being shunned<sup>26</sup>. All these observations suggest a high prevalence of severe protein energy malnutrition in Nyanza.

Child nutritional survey in Kenya 1978/79<sup>27</sup> showed that stunting and emaciation were higher in Nyanza than all other provinces except Coast. Stunting was associated with high calorie low protein weaning diet especially cassava porridge, while emaciation was associated with prolonged breast feeding (which was found to be longest in Nyanza 15.2 months). These findings indicate a high rate of mild and moderate malnutrition which provides a large pool of children

with precarious nutritional status, who can easily be plunged into severe protein energy malnutrition.

Infections may also have a role in the nutritional problem of Nyanza. The nutritional survey mentioned above<sup>27</sup> revealed that the three provinces, Coast, Western and Nyanza which had the highest rates of febrile illnesses amongst children, also had the highest proportions of malnourished children. These are also well known malaria areas. It is therefore possible that febrile illness probably due to malaria contributes to the pool of children with mild and moderate malnutrition and precipitates severe protein energy malnutrition in some of these children.

Migration may also have a role in the aetiology of malnutrition. It was shown in this study that many of the children from Nyanza who had malnutrition had just recently arrived in Nairobi from their rural homes. They were in company of their mothers who had come to visit their husbands who are employed in Nairobi on salaries hardly enough to maintain them (the men) in Nairobi. They therefore repatriated little or no money to their rural homes. It is likely that women left alone in rural homes with children to raise, without economic support from their husbands are unable to provide adequately for the childrens' nutritional needs.

From the foregoing, factors associated with high rate of malnutrition amongst children from Nyanza Province can be summarised as follows:-

1. Prolonged breast feeding over one year with low protein weaning diet of mainly maize and cassava uji

2. Change in dietary pattern with exclusion of some high protein diets such as millet, sorghum and shunning away of some types of fish<sup>26</sup>.
3. Increased frequency of febrile illness, most probably due to malaria
4. Split families with women and children left in rural homes while men are employed in urban areas

### MATERNAL FACTORS

From the findings of this study, the prototype of a mother of a child with Kwashiorkor is a young woman in her early twenties with less than eight years of formal education who is either single, in a polygamous marriage, divorced or married but living apart from her husband, is either unemployed or employed as a manual worker earning an average KShs. 150.00 per month (US \$ 10) and is not using any contraceptive device. This picture fits the findings of several workers who have studied the socio-economic circumstances surrounding severe protein energy malnutrition<sup>12,16,28,29</sup>.

### Marital Status

Adverse marital status such as divorce, being single, polygamous marriage were found to be associated with severe energy malnutrition. Okeahialam<sup>28</sup>, Goodal<sup>16</sup> and Kago<sup>30</sup> 1975, 1979 and 1980 demonstrated similar association. This association can be explained by the pathosociology in such marital settings.

For example, children of single or divorced mothers are often left in the care of old grand parents. These old people are then called upon to care for babies in socio-economic circumstances drastically different from those that obtained in their days. This is difficult and they usually resort to bottle feeding with its associated hazards. The result is diarrhoea on and off which often is the beginning of severe malnutrition. The problems of mothers in polygamous marriages are similar to those of mothers living apart from their husbands which has been described.

#### Mother's Occupation and Income

This study showed that mothers of malnourished children were either unemployed or employed on very low wages. This is very similar to the findings in the Dar es Salaam study<sup>28</sup>. Mothers of malnourished children in this study who were employed earned an average of KShs. 1800 (US \$ 120) per year. This level of income is inadequate even for rural families who would supplement it with peasant produce. By 1973, the poverty level for an average rural Kenyan was defined by an annual income of KShs. 1500 (US \$ 100)<sup>32</sup>. This must have gone up several times in the past ten years.

It may be expected that a child whose mother is away at work most of the time would be prone to malnutrition as he is left in the care of other people. Findings here are contrary. Children whose mothers are on regular employment are better nourished than those mothers who are unemployed or employed on low salaries. Maternal income therefore appears to be more contributory towards a child's nutritional status than mere physical and emotional proximity of the mother.

### Maternal Education

Children whose mothers have little formal education (in this study less than 8 years) are more likely to have severe protein energy malnutrition. Advantages accruing from good education are several, affecting various aspects of life all of which contribute towards better nutrient intake. Literacy is a prerequisite in following and practising modern child care techniques as advised in child welfare clinics. Literate mothers are also better motivated to take their children to these clinics. Educated mothers are better placed (both financially and in feed preparation) in the use of commercial baby foods whenever they are to be used as is often the case at the time of weaning. Women with good education usually marry men of similar or better educational standards with good job opportunities and high incomes. Many times such women are themselves employed on reasonable salaries. These families therefore enjoy high incomes, good housing with adequate sanitation and clean water supply. Their children are therefore as expected well nourished. This finding thus just confirms what many workers have observed<sup>12,28,30</sup>.

### FACTORS RELATED TO THE FATHER

Children whose fathers have little education are likely to suffer from severe protein energy malnutrition. This can be explained through the premises of reduced income as illustrated in Figure 2. People with little formal education often acquire employment in low



paid positions such as manual workers or subordinate clerical officers. This indeed was the finding in this study. Fathers of children with Kwashiorkor apart from being of low education, earned significantly lower salaries in comparison to fathers of well nourished controls. The average monthly incomes were KShs. 490 (US \$ 32) and KShs. 1,285 (US \$ 86) for Kwashiorkor and control groups respectively.

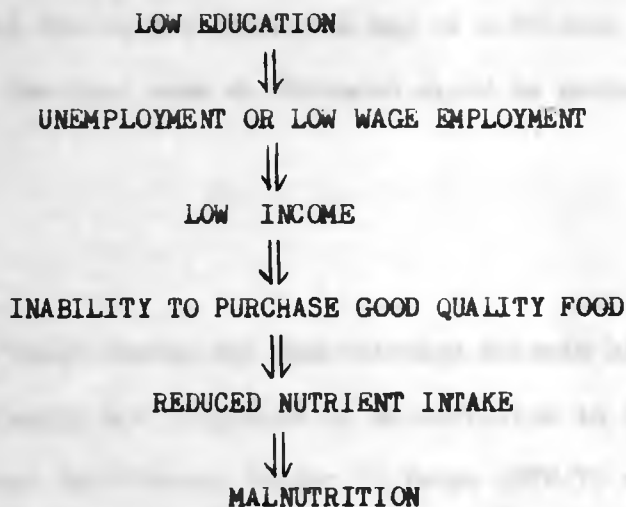


Figure 2 : Relationship between low income/ low education and malnutrition

As regards the number of people dependant on a child's father, no significant difference was demonstrated between fathers of children with Kwashiorkor and fathers of controls. However, fathers of controls tended to have more dependants (other than wife and children). This may be due to the fact that with the extended family system, relatives tend to crowd around people with good income who may be of assistance.

## HOUSEHOLD FACTORS

### Number of Siblings

In this study no relationship was demonstrated between the occurrence of severe protein energy malnutrition in a child and the number of siblings in the child's family. However, the mothers of the two groups of children studied were young (mean ages of 23 and 24 years and had small families (average number of siblings 2.9 and 2.8). With such small families differences may be difficult to demonstrate. With larger families some differences could be probably demonstrated.

### Death of Siblings

A significant relationship was demonstrated between history of child death in a family and occurrence of malnutrition in latter siblings. The National Nutritional Survey in Kenya 1978/79 showed a correlation between malnutrition and infant mortality in the various districts of the country<sup>27</sup>. It is possible that siblings of children with severe malnutrition suffer mild or moderate malnutrition and therefore succumb to illnesses that would otherwise not be fatal. The finding that history of Kwashiorkor was more common in families of cases than controls adds strength to this argument.

### Morbidity and Malnutrition

More children amongst the Kwashiorkor group than amongst controls had some illness in the period preceding the study. The most common ailments were diarrhoea/vomiting, measles, fevers and

respiratory illnesses. The association between infection and malnutrition is well known<sup>3,17,18,21,30</sup>, particularly diarrhoea/vomiting, tuberculosis and measles.

Childhood illness especially if febrile is associated with increased nutrient and calorie requirements. While actual intake is reduced through loss of appetite, diarrhoea and vomiting which are common symptoms in sick children. In some infections gut absorption is actually significantly reduced<sup>31</sup>. It is therefore not surprising that increased morbidity is associated with malnutrition. The higher rate of respiratory illnesses amongst controls, may be explained by lack of reporting in the Kwashiorkor group. Since these children are already very sick complaints like cough and running nose may not be reported by their mothers.

#### Money spent on Food

Families of children with Kwashiorkor had very little money for food purchase. Since many of these children were resident in rural areas, the significance of this finding may be doubtful as rural diet may be mainly from farm produce. However, it has been shown that rural peasants require some cash to supplement farm produce in order to meet their nutritional requirements<sup>29,32</sup>. Bhodal 1968 found that in rural areas many families have inadequate calorie intake only one to two months after harvest<sup>29</sup>. In such cases food has to be bought.

Even for urban parents the incomes were lower for Kwashiorkor group than for controls. Meagre cash income is therefore a risk

factor in childhood malnutrition.

## INFANT FEEDING

### Breast Feeding

A tendency for malnourished children to be breast fed for longer periods than controls was noted, suggesting that prolonged breast feeding is associated with malnutrition. The two nutritional surveys in this country 1977<sup>33</sup> and 1978/79<sup>27</sup> confirmed this relationship. Stunting was found in children breast feeding after eighteen months of age. Children weaned between 6 and 12 months of age had most satisfactory growth. Breast feeding beyond one year was clearly associated with increased rates of malnutrition.

The association between prolonged breast feeding and malnutrition may be more related to supplementation than breast feeding as such. Mothers from poor socio-economic settings tend to rely on breast feeding and delay supplementation<sup>27</sup>.

Reasons for stopping breast feeding were different in the two groups. Pregnancy was the only reason common to both groups. Amongst children with Kwashiorkor reasons indicated circumstances beyond the mothers controls while for the controls reasons indicated that breast feeding was stopped on the mother's wish. It is likely that a child who is willingly stopped from breast feeding will have well planned diet, for a normal mother is unlikely to put her child off the breast unless a substitute she considers satisfactory is available. Mukolwe<sup>12</sup> 1977 found that many educated mothers put their children off the

breast when they felt the children were old enough and this was not associated with malnutrition.

#### Age of Introducing Supplements

No difference was shown between children with Kwashiorkor and normal controls as regards the age when supplements were introduced. It has been shown that before six months of age, there is no relationship between nutritional status and the time when supplements are introduced in a child's diet. After that children whose supplements are delayed tend to be malnourished<sup>27</sup>. This is in keeping with the fact that before six months breast milk alone meets child's nutritional requirements.

#### Type of Supplement

For both groups of children in this study 'UJI' - a thin gruel made from maize flour, and milk were mentioned most often by mothers as the first foods they used to supplement breast milk. Kago 1980<sup>30</sup>, Mukolwe 1977<sup>12</sup> and Ochieng 1976<sup>11</sup> had similar findings. Others, however, have found 'uji' to be the most frequent first supplement<sup>27,29</sup>.

It is not surprising that no difference was demonstrated between the two groups because the recall system used to gather data is qualitative and does not indicate quantity of food consumed. Despite that, two important differences were noted:-

1. That the control group consumed a wider variety of food than children with Kwashiorkor

2. High protein foods like meat, eggs and beans and expensive food preparations like 'weetabix' and macaroni were mentioned more often amongst the control group than in the Kwashiorkor group.

These observations can be explained by the fact that families of controls had higher incomes. This points to the significance of family income in childhood nutrition.

#### Housing, Sanitation and Water source

In this study children with malnutrition were found to live in poorer houses than normal controls. A nutritional survey in Machakos district also showed that children who lived in better less crowded houses were better nourished<sup>12</sup>. Good housing reflects high socio-economic status, which is associated with other factors like better parental education, high family income, good sanitation and hygienic water sources, all of which positively contribute to a child's nutritional status. Rivers, streams and communal taps were the main water sources for families of children with malnutrition while hometaps were more in households of controls. It has been shown that use of or proximity of a household to, poor water sources is associated with childhood malnutrition<sup>27</sup>. Clean water is necessary for hygienic preparation of a child's food. Moreover, such a supply is unlikely to be a source of infection.

Households of controls had better sewage disposal than the households of children with Kwashiorkor. Amongst controls water closets were the most common types of toilets, while for Kwashiorkor

group pit latrines were more frequently used and many families had nothing at all.. Proper sewage disposal is an important aspect of good environmental hygiene. Appropriate use of good toilets will considerably reduce the rate of infections especially those of feacal-oral route of transmission such as gastro-enteritis which often precipitates Kwashiorkor in children

(a) ... of ... status ...  
... ..  
... ..

(b) ... ..  
... ..  
... ..  
... ..

(c) ... ..  
... ..

(d) ... ..  
... ..  
... ..

(e) ... ..  
... ..  
... ..  
... ..

## C O N C L U S I O N S

1. Several maternal factors are associated with malnutrition:-
  - (a) Children of young mothers especially of mothers of 23 years and below are more likely to be malnourished than those of other mothers
  - (b) Children of mothers whose marital status are unfavourable such as single mothers, polygamy and divorced mothers have a high risk of malnutrition
  - (c) Occupation and income of a mother have direct bearing on her child's nutritional status. Mothers who are employed on unskilled jobs and whose earnings are below KShs. 900.00 per month (US \$ 60) are likely to have children with Kwashiorkor
  - (d) Kwashiorkor is likely to occur in children whose mothers do not use any contraceptive device
2. Level of education and income are the only paternal factors found to be related to child malnutrition in this study. Children of fathers with less than 8 years of formal education are likely to have Kwashiorkor.
3. Family income, particularly money available for purchase of food is an important factor in the aetiology of Kwashiorkor. A child from a family of two children, a mother and father and where KSh. 600 (US \$ 40) or less is spent on food per month is likely to be malnourished



4. There is some association between weaning practice and Kwashiorkor.

(a) Children breast fed for long periods after 6 months of age without adequate supplement are prone to severe malnutrition

(b) Children looked after by maids of 16 years or more while their mothers are away at work are unlikely to have severe malnutrition.

(c) Children with Kwashiorkor are fed on diets poor in all nutrients carbohydrates, protein, minerals and vitamins. However, protein deficit is greater than the other nutrients

5. From this study environmental factors associated with Kwashiorkor are poor urban/rural residence, poor housing, poor sanitation and unhygienic water source.

(a) Children seen at Kenyatta National Hospital with Kwashiorkor are mainly those who have recently arrived from their rural homes. Permanent residents of Nairobi form a small proportion

(b) Poor housing is associated with high risk of developing Kwashiorkor

(c) Inadequate sewage disposal facility predisposes to Kwashiorkor

(d) Inhygienic water supply is a significant contributory factor in the aetiology of Kwashiorkor

6. Childhood Malnutrition in Nyanza Province.

Nyanza Province has been shown to be a high risk area for childhood malnutrition and infant mortality. Factors such as change in dietary habits, high prevalence of febrile illness and migration of young men into towns seem to be responsible for this.

RECOMMENDATIONS UNIVERSITY OF NAIROBI  
LIBRARY

1. Improving educational standards of mothers.

Provision of adequate education (up to 12 years of formal education) will reduce the prevalence of childhood malnutrition

2. Improving family income

(a) Increasing urban minimal wage to at least KShs. 1500 will help curb malnutrition amongst the children of urban workers. It is therefore recommended that wage guidelines be reviewed with the aim of raising the minimal wage to the suggested level

(b) Ways should be sought of increasing job opportunities and income generating activities in the rural areas. Financial and technical aid to rural peasant farmers should be increased to help them increase their productions

Such measures would boost rural cash income and crop production and thus significantly reduce malnutrition of children under five years of age.

3. Improvement of Housing, Sanitation and Water Supply

Improved housing, sanitation and water supply especially in rural areas will contribute positively to the general good health of children and thus influence their nutrition. For example people who are employed and wish to own houses in rural areas should be encouraged. Soft loans from employers,

savings and credit societies and bodies like National Social Security Fund may be useful in such ventures. These will help people to construct rural residential houses with appropriate sanitation such as improved pit latrines.

Rural water projects are commendable and should be expanded.

#### 4. Weaning Diets and Child Care

Health education programmes and personnel should put a lot of emphasis in the area of weaning and child care.

Adequate supplementation at the ages of four to six months

together with continued breast feeding should be emphasized.

Bottle feeding should be discouraged. The practice of employing very young persons below the age of 16 years to care for children should be condemned.

Research should be undertaken by bodies like Kenya Medical

Research Institute to produce a cheap local weaning food prepared from locally available foods.

#### 5. Family Health Activities

Social workers, teachers and parents should combine efforts in educating and guiding school girls to help them avoid premarital pregnancies. Social workers should strive through family counselling to keep married couples together. Children of single mothers are at risk of malnutrition

For married couples use of contraceptives should be popularised and services made available. Benefits of child spacing to the family should be emphasized over national benefits. National targets are unlikely to motivate individual families.

6. Nutritional Survey in Nyanza Province

It is recommended that a detailed nutritional survey be conducted in Nyanza Province to elucidate the factors involved in the high prevalence of childhood malnutrition and high infant mortality in the area. This would make it possible to initiate corrective measures.

7. Early recognition of children at risk of developing malnutrition:- Some of the recommendations given above are long term and may not be readily feasible. It is therefore necessary to identify what can be done within the limits of available resources.

The author proposes adoption of a risk score approach to the problem of malnutrition. All factors involved in the aetiology of Kwashiorkor should be identified. This can be done by a detailed nutritional survey in sampled areas of the country. Once these factors are identified their risk rating could be worked out either singly or in combination. From this a chart could be designed for rapid identification of children at risk of developing Kwashiorkor

Such a system would be taught to health workers who come into first contact with children. These personnel would pick out children at risk and institute corrective measures such as nutritional

education, social counselling, simple treatment and referral if necessary.

In this study the following factors were shown to indicate some risk of malnutrition in a child:-

1. Young mother of age below 23 years
2. Mother has low formal education less than 8 years
3. Unfavourable marital status of mother:-
  - Single
  - Polygamy
  - Divorced
4. Mother employed as unskilled manual worker with low income of KShs. 900 per month or less
5. Mother not using any contraceptive
6. Father living in an urban centre and has income of KShs. 1000 and below
7. Family living in a town and spend less than KShs. 600 per month on food
8. Recent history of illness especially diarrhoea and vomiting
9. Child stays away from mother
10. Child in family which recently migrated into town from a rural home
11. Family has poor toilet facilities, i.e. no toilet or communal pit latrine
12. Family using poor water source such as river, stream or communal tap where water is sold directly

How significant these factors are as risk indicators cannot be ascertained due to small sample size and method of and type of analysis used.

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APPENDIX 1AQUESTIONNAIRE:

SOCIAL BACKGROUND OF CHILDREN  
 ADMITTED TO K.N.H. WITH MODERATE  
 AND SEVERE KWASHIORKOR

Date ..... Hospital No. .... Serial No. ....

THE BABY

Name ..... Tribe ..... Weight .....

1. Age in months ..... 2. Sex: Male/Female

3. Number of Siblings: Male ..... Female .....

3 and below .....

4 - 6 .....

7 - 9 .....

9 and above .....

4. Number of siblings who have died .....

Causes of death and age at the time of death .....

.....

5. Age difference with preceeding siblings

10 - 17 months .....

17 - 24 " .....

24 - 31 " .....

Over 31 " .....

No preceeding sibling .....

## 6. Age difference with following sibling

10 - 17 months	.....
17 - 24 "	.....
24 - 31 "	.....
Over 31 "	.....
No following siblings	.....

## 7. Ages of other siblings .....

## 8. Is mother pregnant now Yes/No

## 9. At what age was breast feeding stopped

Never breast fed	.....
Below six months	.....
6 - 12 months	.....
12 - 18 "	.....
18 - 24 "	.....
Above 24 months	.....

## 11. Why? .....

## 12. At what age was supplement introduced?

Below 4 months	.....
4 - 6 "	.....
6 - 8 "	.....
Over 8 "	.....

## 13. What supplement?

## 14. Was child ever bottle fed? Yes/No

## 15. If Yes, for how long?

## 16. What foods has child been feeding on in the last one month?

## 17. Who feeds the child?

Mother	.....
Other	.....
Self	.....
Specify	.....

## 18. What illness preceded current condition? (fever, diarrhoea, cough, measles, etc).

Gadget

19. When was child taken for treatment for this illness (from onset)

Within 1 week	.....
8 - 14 days	.....
15 - 21 "	.....
22 - 30 "	.....
Over 30 days	.....

20. When did child lose appetite (prior to admission)

Months	.....
Weeks	.....
Days	.....
Never lost appetite	.....

#### THE MOTHER

21. Is mother in hospital with child? Yes/No

22. If No, who is in hospital with child and why?

23. Does the child normally stay with mother? Yes/No

24. If No, who stays with child and why?

25. Who usually takes care of child

During the day	Mother	.....	Specify
	Other	.....	

At Night	Mother	.....	Specify
	Other	.....	

26. Upto what age was child sharing bed with mother? .....

27. Age of mother .....

28. Level of Education

Never went to School	.....
Primary school	.....
Secondary school	.....
High school and above	.....

29. Marital Status

Single	.....
Monogamous marriage	.....
Polygamous "	.....
Divorced	.....
Widowed	.....

30. Are parents staying together? Yes/No

31. If No, Why?

32. Occupation of mother

33. Income of mother

Salary KShs./month .....  
 Other sources .....  
 Total .....

34. How much money is spent on food?

From mother KShs./month .....  
 From father KShs/ " .....  
 Total .....

35. Is mother using any contraceptive? Yes/No

36. Does mother drink alcohol? Yes/No

If Yes, how many times a week?

1 or 2 times .....  
 3 to 4 " .....  
 Over 4 " .....

THE FATHER

37. Age .....

38. Level of Education

Never went to school .....  
 Primary school .....  
 Secondary school .....  
 High School and above .....

39. Income

Salary KShs./month .....  
 Other sources .....  
 Total .....

40. How many other people are directly dependent on Father other than wife and children?

No. ....  
 Nature of dependence .....

41. Does father drink alcohol? Yes/No

If Yes, how many times a week?

- 1 or 2 times .....
- 3 or 4 " .....
- Over 4 " .....

42. Do you think he spends a lot of money on drinking? Yes/No

THE ENVIRONMENT

43. Does child normally stay in Nairobi? Yes/No

44. If No, when did child come to Nairobi?

- Under 1 month .....
- 1 - 3 months .....
- Over 3 months .....

45. Home District

46. Residential area in Nairobi

47. Type of House

(i) Number of rooms including kitchen

- One .....
- Two .....
- Three .....
- More .....

(ii) Walls

- Stone/Block .....
- Wood .....
- Earth .....
- Paper .....

(iii) Roof

- Tiles/Asbestos .....
- Iron .....
- Paper .....

(iv) Floor

- Wood/Tiles .....
- Cement .....
- Earth .....



(v) Rent KShs./month .....

(vi) Toilet - Attached .....  
                   Communal .....  
                   None .....

(vii) Toilet Type - Closed .....  
                           Pit .....  
                           Bucket .....

48. Number of people staying in the house

                          2 - 4 .....  
                           5 - 6 .....  
                           7 and over .....

49. Water source

River/stream .....  
 House tap .....  
 Community tap .....  
 Water vendor .....

APPENDIX I - Occupation of Mother

Type of Job	% Proportion of mothers of Kwashiorkor children	% Proportion of mothers of Controls
No salaried job (Housewife peasant)	68	53
Self employed (Trade)	12	10
Employed non- skilled job	16	5
Employed skilled job	4	32
n	103	93

$$p < 0.001$$

$$\chi^2 = 30.9$$

APPENDIX II - Number of Siblings in Family

Number of Siblings in Family	% Proportion of Kwashior- kor children	% Proportion of Controls
0	0	1
1 - 2	44	54
3 - 4	44	26
5 - 6	7	17
More than 6	5	2
n	103	93

$$T = 0.41$$

$$p > 0.40$$

APPENDIX III - Causes of Death of Siblings

Causes of Death	No. of Siblings of children with Kwashiorkor	No. of Controls
Diarrhoea and Vomiting	4	0
Malnutrition	6	0
Difficult Labour	7	0
Respiratory Illness	3	2
Measles	5	4
Prematurity	2	1
Meningitis	1	2
Jaundice and Fever	0	0
Sickle cell Disease	0	1
Still Birth	0	1
Unknown Cause	4	4
<b>TOTAL</b>	<b>32</b>	<b>12</b>

APPENDIX IV - Reasons for stopping Breast Feeding

Reason for stopping Breast Feeding	No. of Children with Kwashiorkor	No. of Controls
Child refused	6	2
Child Sick	14	2
Child refused when bottle feeding started	11	7
Mother pregnant	24	14
Milk dried up	6	6
Milk dried up when mother commenced using contraceptive pills	6	1
Mother absent	4	14
Breast Disease	4	2
Mother sick	2	2
Stopped by mother	5	9

APPENDIX V - Length of Bottle Feeding

Duration of Bottle Feeding - Months	% Proportion of Children with Kwashiorkor	% Proportion of Controls
6 and below	27	28
7 - 12	32	48
13 - 18	9	13
19 - 24	5	7
Over 24	0	0
Still bottle Feeding	24	3

$$T = 0.58$$

$$p > 0.50$$

APPENDIX VI - First Supplement

CONTROLS			KWASHIORKOR		
SUPPLEMENT	No. of Times Mentioned		SUPPLEMENT	No. of Times Mentioned	
	ABSOLUTE	%		ABSOLUTE	%
Milk	79	29	Milk	76	33
Uji	37	13.6	Uji	51	22.2
Cerelac	36	13.6	Cerelac	23	10
Potatoes	31	11.4	Potatoes	19	8.1
Bananas	18	6.6	Bananas	17	7.4
Vegetables	17	6.3	Ugali	15	6.5
Fruit Juice	15	5.5	Vegetable	12	5.2
Eggs	12	4.4	Eggs	10	4.3
Beans	9	3.3	Beans	4	1.7
Meat	7	2.6	Fish	2	0.9
Ugali	4	1.5	Ribena	1	0.4
Peas	3	1.1			
Glucose	1	0.4			
Ribena	1	0.4			

APPENDIX VII - Type of Food Child being fed on prior to admission

K W A S H I O R K O R			C O N T R O L S		
FOOD	No. of Times mentioned		FOOD	No. of Times mentioned	
	ABSOLUTE	%		ABSOLUTE	%
Milk	78	20.5	Milk	103	17.3
Uji	68	18.9	Vegetables	68	11.4
Potatoes	44	12.2	Potatoes	66	11.4
Bananas	36	10	Uji	58	9.7
Ugali	34	9.4	Meat	49	8.2
Vegetables	28	7.8	Eggs	42	7
Cerelac	23	6.4	Cerelac	38	6.4
Eggs	21	5.8	Bananas	38	6.4
Beans	16	4.4	Beans	36	6
Fish	6	1.6	Ugali	31	5.2
Rice	2	0.6	Fruits	26	4.4
Meat	2	0.6	Fish	12	2
Oranges	1	0.3	Rice	12	2
Glucose	1	0.3	Peas	11	1.8
			Bread	2	0.8
			Chapatis	1	0.2
			Macaroni	1	0.2
			Weetabix	1	0.2

APPENDIX VIII - Rent (for those living in rented houses)

Rent KShs./Month	% Proportion of Kwashiorkor Children	% Proportion of Controls
Less than 200	63	16
200 - 400	31	23
Over 400	6	61
Mean	188	390
n	48	62

$$T = 6.12$$

$$p < < 0.001$$

APPENDIX IX - Illness in Preceeding 3 months

	% Proportion of Children with Kwashiorkor	% Proportion of Controls
No illness	14	41
Had some Illness	85	59
Unknown	1	0
n	102	93

$$T = 3.94$$

$$p < 0.001$$