# VITAMIN A SUPPLEMENTATION AND MEASLES OUTCOME

AT

KENYATTA NATIONAL HOSPITAL

A DISSERTATION SUBMITTED IN PART FULFILLMENT FOR THE DEGREE OF MASTER OF MEDICINE (PAEDIATRICS) IN THE UNIVERSITY OF NAIROBI.

1990

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# DECLARATION

THIS DISSERTATION IS MY OWN ORIGINAL WORK AND HAS NOT BEEN SUBMITTED FOR A DEGREE IN ANY OTHER UNIVERSITY.

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## ETHICAL CLEARANCE

THIS STUDY WAS CARRIED OUT WITH THE APPROVAL FROM THE ETHICAL AND SCIENTIFIC COMMITTEE , KENYATTA NATIONAL HOSPITAL (KENYA).

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# DEDICATION

DEDICATED TO ALL CHILDREN IN DEVELOPING COUNTRIES WHO SUFFER SO MUCH MISERY AND DIE IN GREAT NUMBERS FROM MEASLES, A DISEASE THAT IS PREVENTABLE.

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**ACKNOWLEDGEMENTS**

The accomplishment of this study was made possible through a lot of assistance and encouragement from many people.

I would wish to extend my most sincere gratitude and appreciation to the following.

1. My supervisors, Dr. V.A. Orinda and Dr. F.E. Onyango for their tremendous help, untiring guidance, encouragement, and useful criticisms throughout the production of this work.

2. Dr. S. Gathua the physician in-charge of IDH for allowing me to carry out the study in the Hospital

3. The Ministry of Health in the Kenya Government for the scholarship which enabled me to undertake the course.

4. To all children and parents who took part in the study.

5. To staff nurse G. Njoroge, sister in-charge block III, IDH and all the nursing staff who were in the measles ward of IDH during the period of the study.

6. To Dr. A. Gallachi, the Roche products Manager who greatly assisted me in acquiring the Vitamin A and Placebo capsules used in the study from Brussels and for his financial assistance for Serum Vitamin A analysis

7. Dr. N. Mirza, Lecturer Department of Paediatrics who gave me the initial encouragement to undertake the study and for the part she played in the blinding aspect of the study.

8. Miss Mina Desai, Senior Technologist in KEMRI and her supportive support for doing the Serum Vitamin A analysis.

9. Mr. S. Obote, the Statistical Clerk attached to IDH at the time of the study for his assistance.

10. Miss Janet Musia of the Computer Room, Department of Paediatrics for her assistance.

11. To my family members and especially my wife Sarah for her encouragement, help and patience during the study period.

12. To the Ethical Committee for the permission to carry out the study.

13. Finally but not least, to mrs. Hellen Anching'a for her excellent secretarial services.

## SUMMARY

A double blind controlled clinical trial, on the effect of Vitamin A supplementation on the immediate outcome of measles, was carried out at the infectious disease Hospital (IDH), of Kenyatta National Hospital (KNH) Nairobi, Kenya. A total of 294 children admitted with measles (146 treatment and 148 controls) were randomly allocated into the treatment and control groups. A single oral dose of Vitamin A or Placebo was given at admission. There was comparability between the two groups in age and sex distribution, nutritional status, vaccination status against measles, residence in Nairobi, duration of measles illness before admission, serum retinol level and in prevalence of malarial parasitaemia:

39.8% of the children were malnourished and 33% were below the age recommended for vaccination against measles in Kenya. 48.1% of the children had serum retinol level less than 20.0µg/dl. The most prevalent complications were L.T.B., diarrhoea, pneumonia and otitis media.

Vitamin A supplementation significantly reduced the severity of diarrhoea and L.T.B. as well as the incidence of otitis media $P < 0.05$. Vitamin A supplemented children had a better weight gain at one month after discharge. The overall mortality was 2.7%.

## INTRODUCTION/LITERATURE REVIEW

Measles is a severe viral infection that damages the epithelial mucosa throughout the body. The disease kills over two million children annually (1, 2), which is about 50% of all the deaths resulting from all the infectious diseases earmarked for prevention by WHO/UNICEF in control programme through the expanded programme of immunization (2).

Measles is particularly severe in the African child for reasons that are not clear, though, it has been attributed to the young age of presentation, malnutrition, overcrowding and possibly, genetic factors (3-7). The high morbidity and mortality associated with measles infection are primarily secondary to its many complications such as bronchopneumonia, L.T.B., malnutrition, diarrhoea, otitis media and conjunctivitis (7-9). Some of these complications may result in prolonged periods of hospitalization or fatal outcome.

Several studies have shown that following measles infection, the serum Vitamin A levels are significantly reduced (10-13). The disease probably increases the utilization of Vitamin A and there is also reduced Vitamin A intake, which is secondary to the general anorexia and oral sores that occur during measles infection. Measles enteritis per se also causes some degree of malabsorption, further reducing the total amount of Vitamin A absorbed (14).

Vitamin A deficiency is a major public health problem in many developing countries (14). Many children in these countries have been found to have marginal liver stores of Vitamin A. These children with marginal Vitamin A liver stores may develop acute Vitamin A deficiency following measles infection, resulting in eye damage and possibly increased morbidity and mortality from respiratory and diarrhoeal complications (15, 16).

Vitamin A is necessary for the support of growth, health and life of higher animals. It is required for vision, for reproduction, and for the maintenance of differentiated epithelia and for mucus secretion (17-19). The molecular mechanisms underlying these biological effects of Vitamin A are not known, except for the well documented role of Vitamin A in vision (18, 19).

Vitamin A has been found useful in the prevention and treatment of cancer and some dermatological conditions (19). It is almost unbelievable that we still do not understand the metabolic role of Vitamin A outside the visual cycle, despite the fact that Vitamin A deficiency is a serious disease and may be fatal, particularly in infants and young children who are malnourished.

In Vitamin A deficiency states, mucosal epithelium undergoes squamous metaplasia with resulting keratinization of various epithelial mucosa such as that of the respiratory, gastro-intestinal, genitourinary systems among others, thus increasing the risk of bacterial colonization and infection (20). Indeed, Vitamin A deficient individuals have been reported to have an increase in both frequency and severity of infection such as acute respiratory infections and diarrhoea (21). Several other studies have shown that Vitamin A deficiency impairs immune status especially cell mediated immunity (21-24).

A recent study in Indonesia by Sommer and co-workers showed that Vitamin A supplementation on pre-school children significantly reduced morbidity and mortality associated with ARI and diarrhoeal disease (15, 16).

Another study in Tanzania showed a significant reduction in measles related mortality in children admitted with measles who were given Vitamin A supplementation on admission, though the sample size was small (6).

Measles is one of the major leading causes of paediatric admissions in Kenyatta National Hospital, only superceded by ARI and diarrhoea. In 1987, there were 2,982 children admitted with measles, 988 in 1988 and 2,478 in 1989 with mortalities of 5.6, 4.7 and 3.2% respectively (25). A recent study in IDH by Dr, Onyari (26) revealed an overall mortality of 4% in all children

admitted with measles and the main complications were diarrhoea 60%, bronchopneumonia 53.5%, otitis media 53.5% and L.T.B 28.5%.

Following the results of the Tanzanian study (6) and the Indonesian study (16), WHO and UNICEF have come up with a recommendation on Vitamin A supplementation to all children with measles, in communities where measles case fatality rate is more than 1% and where Vitamin A deficiency is a recognized problem (2). However, this has not been implemented in many countries including Kenya.

It is with the above background information that the author was motivated to carry out a double blind placebo controlled clinical trial on the effect of Vitamin A supplementation on measles morbidity.

## OBJECTIVES

1. To determine the effect of Vitamin A supplementation on the duration of hospital stay in children admitted with measles.

2. To determine the effect of Vitamin A supplementation on the incidence of the common complications of measles.

3. To determine the effect of Vitamin A supplementation on the severity of the common complications of measles.

# MATERIAL AND METHOD

## STUDY AREA

The study was carried out at Kenyatta National Hospital Nairobi, Kenya in a Measles ward at the Infectious Disease Hospital (IDH), between April and September 1989. All children with Measles requiring hospital admission and isolation are routinely admitted to the Measles ward at the IDH.

## STUDY POPULATION

Children aged below 5 years admitted to IDH with measles took part in the study. The diagnosis of Measles was clinical, based on the presence of history of a prodromal illness, catarrh, red eyes, morbilliform skin rash, Koplik spots, fever, dry cough with or without pneumonia or L.T.B. (15, 26). All the children who met the inclusion criteria (outlined below) were randomly allocated into the treatment and control group. Block randomization was used and each block consisted of 10 patients (5 controls and 5 in treatment group). The reference population was children with Measles who normaly reside in Nairobi and the source population was children with Measles at the Infectious Disease Hospital (IDH).

## INCLUSION CRITERIA:

All children aged less than 5 years admitted with Measles

EXCLUSION CRITERIA:

1) Those children who were moribund at admission (i.e those who required oxygen, sodium bicarbonate, i.v fluids, intubation e.t.c.
2) Those who had other major illness such as leukaemia, lymphoma, meningitis, etc.
3) Children with xerophthalmia at admission.

METHODS

The study was a randomized double blind placebo controlled clinical trial. Children were selected and randomly allocated into either the control or treatment group using block randomization. Details of social-demographic data, history of the illness and clinical examination were collected. Each child had a weight and height taken. Blood for haemogram, malarial parasite examination and serum retinol level estimation were taken.

Oral capsules of Vitamin A and identical placebo were used for the study. With the help of the block randomization tables the capsules (Vitamin A and placebo) were numbered from 1 to 294 and stored in a cool, dry place. The first child who was selected was given study number 1 and received capsule number 1, the second child was number 2 and received capsule number 2 . This sequence was followed throughout the study such that the last patient was number 294 and received capsule number 294. This method of

selection and randomization ensured that for every 10 patients seen, 5 received the Vitamin A capsule and 5 placebo capsule. Neither the investigator nor the patient knew who was given a Vitamin A capsule or a placebo.

The strength of Vitamin A used was 200,000 international units. After repeated testing, it was established that a 200,000 i.u. Vitamin A capsule contains 8 drops of oily suspension, if the tip of the capsule is out at a certain point. So we were able to give the 3 different doses i.e. 200,000 i.u., 100,000 i.u., and 50,000i.u. for age groups more than 12 months, 6-12 months and less than 6 months respectively. The dispensing of the drugs was solely done by the investigator.

The patients were then seen daily by the investigator, noting the various complications of Measles till they were discharged. Patients in both the treatment and control groups other than Vitamin A supplementation received standard ward management for Measles and its complications.

The weight of each child was taken both on admission and discharge, weighing was done with the patient naked using a spring balance. The same balance was used throughout the study. Height in centimetres was taken on admission using a board and tape measure.

While in the ward the patients were examined daily and clinical findings recorded till they were discharged. A set discharge criteria (outlined below) was used to discharge patients.

**DISCHARGE CRITERIA:**

1) A temperature of less than 36.9°C for at least 4 consecutive reading at 6 hourly intervals.

2) Absence of crepitation, bronchial breath sounds, chest retraction and normal air entry on chest auscultation and respiratory rate of less than 40 per minute.

3) No diarrhoea, i.e less than 3 diorrhoeal episodes per 24 hours.

4) Normal voice.( No hoarseness of voice.)

5) child who is bright and cheerful, and feeding well.

6) No more reddening of eardrum and normal light reflex.

## LABORATORY MEASUREMENTS

(i) Serum Retinol Determination

Neeld and Pearson Method was used to determine the serum retinol levels. Retinol was extracted from a mixture of serum (1.0 ml) and alkaline ethanol with light petroleum B.P at 40-60°C. The absorbance of the extract was measured at 450nm using vitatron reaction rate photometer. After the removal of the solvent, the lipid residue was dissolved in chloroform (0.1 ml), trifluoroacetic acid (1.0 ml) was then added and absorbance was measured at 620nm exactly 30 seconds after addition of the acid. The concentration of retinol was then calculated after making corrections of the absorbance contributed by -carotene at 620nm (27).

(ii) Haemogram

A coultergram model S class V was used for haemoglobin determination and total white cell count. A thin blood smear stained with Nay Grunwald Giemsa (N.G.G) stain was used for white blood cell differential count and malarial parasite examination.

## DEFINITIONS

1. **DIARRHOEA**

Diarrhoea was defined as three or more loose stools per 24 hours.

- Mild diarrhoea - Less than 5 loose stools per 24 hours.
- Moderate diarrhoea - Between 5 and 10 loose stools per 24 hours.
- Severe diarrhoea - More than 10 loose stools per 24 hours.

2. **PNEUMONIA**

Child was said to have pneumonia if the following were present: tachypnoea with respiratory rate of more than 50/minute, chest retractions, bronchial breath sounds, local or generalized crepitations with or without chest x-ray.(26)

3. **OTITIS MEDIA**

History of ear ache or pulling of the ears, definite reddening and bulging of the eardrums, obliteration of the light reflex, or acute purulent discharge from the middle ear (26).

4. **L.T.B.**

Child was said to have L.T.B. if there was hoarseness of voice, aphonia, barking cough, inspiration stridor with increasing restlessness, dyspnoea or tachypnoea.

**L.T.B. Grades**

Grade I - Cough, stridor only audible with stethoscope, normal breath sounds, mental state, and colour, with no chest retractions.

Grade II - Cough, stridor audible without stethoscope, breath sounds slightly diminished, anxious with mild chest retractions and restlessness.

Grade III - Child cyanotic, with marked chest retractions, very loud stridor marked diminished air entry, very restless.

Grade IV - Child is pale, obtunded, extreme or absent chest retractions, stridor almost absent.

(28)

5. **DEATH**

Any death occurring within the first 30 days of contracting measles,(6).

6. **MEASLES CASE**

Child was said to be suffering from measles if there was history of coughing, presence of catarrh, suffused eyes, morbilliform skin rash, Koplik's spots, fever with or without measles associated complications,(3,4,15,26).

## RESULTS

A total of 294 patients all aged between 2 and 60 months were recruited into the study.

### AGE DISTRIBUTION

As shown on table 1 below, 167 (56.8%) of the children were in the 0-12 months age group and only 62 (21.1%) of the children were more than 2 years of age. The youngest child seen was 2 months old and the mean age was 16.6 months in the treatment group and 16.1 months in the control group. There was no significant statistical difference between the control group and treatment group in age distribution P = 0.60.

TABLE 1 AGE DISTRIBUTION

| AGE | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | NO | % | NO | % | NO | % |
| 0-12 | 81 | 55.5 | 86 | 58.1 | 167 | 56.8 |
| 13-24 | 31 | 21.2 | 34 | 23.0 | 65 | 22.1 |
| > 24 | 34 | 23.3 | 28 | 18.9 | 62 | 21.1 |
| TOTAL | 146 | 100.0 | 148 | 100.0 | 294 | 100. |

P = 0.60

**SEX**

There were more males (59.9%) than females (40.5%). 58.2% of the treatment group and 60.8% of the control group were males. There was however no significant statistical difference between the two groups as regards sex distribution, P value = 0.74.( Table 2)

**TABLE 2: SEX DISTRIBUTION**

| SEX | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| MALE | 85 | 58.2 | 90 | 60.8 | 175 | 59.5 |
| FEMALE | 61 | 41.8 | 58 | 39.2 | 119 | 40.5 |
| TOTAL | 146 | 100.0 | 148 | 00.0 | 294 | 100.0 |

$x^2$ = 0.11, P = 0.74, ODDS RATIO = 0.90, 95% C.I. = 0.55 -1.47

**MEASLES VACCINATION STATUS.**

About 1/4 (24.6%) of the children with measles had been vaccinated against Measles . There was no significant difference between the two groups of children, with regards to Measles vaccination status. But 33.1% of the children were less than 9 months and therefore had not been vaccinated against Measles. (Table 3)

**TABLE 3: MEASLES VACCINATION STATUS**

| VACCINATION STATUS | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | No. | % | No | % | No. | % |
| YES | 33 | 22.8 | 39 | 26.4 | 72 | 24.6 |
| NO >9/12 | 66 | 45.5 | 58 | 39.2 | 124 | 42.3 |
| NO <9/12 | 46 | 31.7 | 51 | 34.4 | 97 | 33.1 |
| TOTAL | 145 | 100.0 | 148 | 100.0 | 293 | 100.0 |

P = 0.54

**NUTRITIONAL STATUS:**

A total of 177 (60.2%) patients were well nourished. 56.8% in the treatment group compared to 63.5% in the control group. A total of 15 (5.1%) of patients were severely malnourished. Ten of them in the treatment group and five in the control group. Of the 15, five were cases of kwashiorkor (4 in the treatment group and one in the control group) and 10 were cases of marasmus Six of whom were in the treatment group and four in the control group. There was no patient with marasmic kwashiorkor. There was no significant statistical difference between the two groups in terms of their nutritional status P=0.29, (Table 4).

TABLE 4: NUTRITIONAL STATUS

| NUTRITIONAL STATUS | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | NO | % | NO | % | NO | % |
| NORMAL | 83 | 56.8 | 94 | 63.5 | 177 | 60.2 |
| UNDERWEIGHT | 53 | 36.3 | 49 | 33.1 | 102 | 34.7 |
| SEVERE MALNUTRITION | 10 | 6.9 | 5 | 3.4 | 15 | 5.1 |
| TOTAL | 146 | 100.0 | 148 | 100. | 294 | 100.0 |

P = 0.29

**RESIDENCE**

43.9% of all the children admitted with Measles came from tw main slum areas of Nairobi, (i.e 29.6% of the children came fro Kibera and 14.3% from Mathare). There was no significan statistical difference between the two groups of patients a regards their residence in Nairobi, P = 0.68.

**TABLE 5: RESIDENCE**

| RESIDENCE | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | NO | % | NO | % | NO | % |
| Kibera | 42 | 28.8 | 45 | 30.4 | 87 | 29.6 |
| Mathare | 25 | 17.1 | 17 | 11.5 | 42 | 14.3 |
| Kariobangi | 17 | 11.6 | 21 | 14.2 | 38 | 12.9 |
| Dandora | 7 | 4.8 | 9 | 6.1 | 16 | 5.4 |
| Others | 55 | 37.7 | 56 | 37.8 | 111 | 37.8 |
| Total | 146 | 100.0 | 148 | 100.0 | 294 | 100.0 |

$X^2 = 2.29$ df = 4 P = 0.68

MALARIAL PARASITE

Five (4.1%) patients in the treatment group and four (3.1%) in the control group had positive single blood slides for malaria. All were P. falciparum. (Table 6)

TABLE 6: MALARIAL PARASITES

| MALARIA PARASITES | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | NO | % | NO | % | NO | % |
| Yes | 5 | 4.1 | 4 | 3.1 | 9 | 3.6 |
| No | 116 | 95.9 | 124 | 96.9 | 240 | 96.4 |
| Total | 121 | 100.0 | 128 | 100.0 | 249 | 100. |

P = 0.93

**HAEMOGLOBIN**

Only 8 children (5.6%) had Hb less than 8g/dl and over 58.5% of children had Hb of more than 10.1g/dl. There was no significant difference between the two groups, in regards to haemoglobin levels, P = 0.87 (Table 7).

**TABLE 7: HAEMOGLOBIN**

| HAEMOGLOBIN | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | NO | % | NO | % | NO | % |
| <8 | 4 | 5.6 | 4 | 5.6 | 8 | 5.6 |
| 8.1 - 10.0 | 27 | 38.0 | 24 | 33.8 | 51 | 35.9 |
| >10.1 | 40 | 56.4 | 43 | 60.6 | 83 | 58.5 |
| TOTAL | 71 | 100.0 | 71 | 100.0 | 142 | 100. |

P = 0.87

DURATION OF MEASLES BEFORE ADMISSION

For the purpose of this study, the duration of the Measles rash in days before admission was used as an estimate of the duration of Measles illness before admission. The patients in the treatment group were then compared to those in the control group. As shown in table 8, there was no difference on the duration of Measles illness between the treatment group and the control group before admission i.e. before Vitamin A supplementation was given.
P = 0.98

TABLE 8: RASH DURATION BEFORE ADMISSION

| RASH DURATION BEFORE ADMISSION (IN DAYS) | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | NO | % | NO | % | NO | % |
| 1 | 21 | 14.4 | 20 | 13.5 | 41 | 14.0 |
| 2 | 73 | 50.0 | 75 | 50.7 | 148 | 50.3 |
| >3 | 52 | 35.6 | 53 | 35.8 | 105 | 35.7 |
| TOTAL | 146 | 100.0 | 148 | 100.0 | 294 | 100.0 |

$X^2 = 0.049$ df = 2 P = 0.98

SERUM RETINOL:

Blood for serum retinol level was taken from a total of 164 patients, but 29 samples were reported as either insufficient or the blood haemolysed before serum was separated. So a total of 135 samples were analyzed; 69 in the treatment group and 66 in the control group. A total of 13 (9.6%) children; (4 in the treatment group and 9 in the control group) had serum retinol level of less than 10 ug/dl, a level at which clinical xerophthalmia occurs by WHO criteria. However the difference in the serum retinol levels was not statistically significant. ($p = 0.38$). Sixty seven (48.1%) of the patients had low (< 20µg/dl) serum retinol levels. (Table 9).

TABLE 9: SERUM RETINOL

| SERUM RETINOL ug/dl | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | | % | NO | % | No | % |
| <10 | 4 | 5.6 | 9 | 13.6 | 13 | 9.6 |
| 10.1-20 | 27 | 39.1 | 25 | 37.9 | 52 | 38.5 |
| 20.1-60 | 34 | 49.3 | 27 | 40.9 | 61 | 45.2 |
| >60.1 | 4 | 5.6 | 5 | 7.6 | 9 | 6.7 |
| TOTAL | 69 | 100.0 | 66 | 100.0 | 135 | 100.0 |

P = 0.38

Of the 13 children with serum retinol less then 10 ug/dl, 7 (53.8%) were underweight and 6 (46.1%) had normal weight. Eight (61.5%) were aged between 6 and 12 months and the remaining five (38.5%) were aged between 13 and 24 months. None of the children with serum retinol levels less than 10 ug/dl had severe malnutrition, none was older than 2 years and none died. Eleven and ten of these children had diarrhoea and bronchopneumonia respectively.

OCCURRENCE OF COMPLICATIONS

As shown on Table 10 below, the prevalence of the common complications of Measles were compared between the treatment and control group. The most prevalent complication was Laryngotracheobronchitis which was seen in 84.2% in the treatment group and 86.5% in the control group, this was followed by Diarrhoea, pneumonia and Otitis media as is shown in table 10

TABLE 10: OCCURRENCE OF COMPLICATIONS

| COMPLICATIONS | TREAT. GP | | CONT. GP | | TOTAL | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| L.T.B. | 123 | 84.2 | 126 | 85.1 | 249 | 84.7 |
| DIARRHOEA | 109 | 74.7 | 108 | 73.0 | 217 | 73.9 |
| PNEUMONIA | 103 | 70.5 | 104 | 70.5 | 207 | 70.5 |
| OTITIS MEDIA | 70 | 47.9 | 77 | 52.0 | 147 | 50.0 |

OTITIS MEDIA

(i) Incidence after admission (Supplementation).

Three patients (3.8%) patients in the treatment group developed otitis media after admission as compared to 12 (15%) in the control group. This difference was statistically significant P = 0.03. (Table 11).

TABLE 11: OTITIS MEDIA INCIDENCE.

| | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | NO | % | NO | % | NO | % |
| YES | 3 | 3.8 | 12 | 15.0 | 15 | 9.4 |
| NO | 76 | 96.2 | 68 | 85.0 | 144 | 90.6 |
| TOTAL | 79 | 100.0 | 80 | 100.0 | 159 | 100.0 |

$x^2$ = 4.6 P = 0.03 ODDS RATIO = 0.22

95% CONF. LIMIT = 0.06 - 0.90

ii) Duration of Otitis media in those who had otitis media at admission.

133 (40.1%) of the patients with measles presented with Otitis Media at admission. Of these 67(50.4%) were in the treatment group and 66(49.6%) in the control group. 67.2% in the treatment group had Otitis Media for less than five days as compared to 69.7% in the control group. However there was no significant statistical difference between the two groups

P = 0.91 (Table 12)

TABLE 12 OTITIS MEDIA DURATION

| OTITIS MEDIA DURATION | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | NO | % | NO | % | NO | % |
| ≤ 4 | 45 | 67.2 | 46 | 69.7 | 91 | 68.4 |
| > 4 | 22 | 32.8 | 20 | 30.3 | 42 | 31.6 |
| TOTAL | 67 | 100.0 | 66 | 100.0 | 133 | 100.0 |

$x^2$ = 0.016 P = 0.90 ODDS RATION = 0.89

95% CONFIDENCE LIMITS 0.04 - 1.97

15 of the patients who developed otitis media after admission 3 were in the treatment group and 12 in the control group. The duration of otitis media was compared . 33% in the treatment

group and 50% control group had otitis media for more than 4 days. However the numbers were too small for any meaningful conclusion to be made.

**PNEUMONIA**

(i) Incidence after admission.

A total of 93 (63.7%) children in the treatment group and 87(58.5%) in the control group had pneumonia at admission. Of those who did not have pnneumonia at admission relatively more of them in the control group (27.9%) compared to 18.9% in the treatment group developed pneumonia after admision. This difference however was not statistically significant, P = 0.36. (Table 13).

TABLE 13: PNEUMONIA AFTER ADMISSION

| | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | NO | % | NO | % | NO | % |
| YES | 10 | 18.9 | 17 | 27.9 | 27 | 23.7 |
| NO | 43 | 81.1 | 44 | 72.1 | 87 | 76.3 |
| TOTAL | 53 | 100.0 | 61 | 100.0 | 114 | 100.0 |

$X^2$ = 0.82 P = 0.36 ODDS RATION = 0.60

95% CONFIDENCE LIMITS : 0.22 AND 1.58

DURATION OF PNEUMONIA AMONG THE INCIDENT CASES.

a) Table 14 shows the duration of persistence of signs and symptoms of pneumonia in children who developed pneumonia after supplementation. As shown in table 14, 80% of children in the treatment group against 58.5% in the control group had no clinical evidence of pneumonia by the 4th day. And 20% in the treatment group as compared to 41.2% in the control group had persistence of their pneumonia beyond day 4. The differences were not statistically significant P = 0.24

TABLE 14: PNEUMONIA DURATION

| DURATION | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | NO | % | NO | % | NO | % |
| ≤ 4 | 8 | 80 | 10 | 58.8 | 18 | 66.7 |
| > 4 | 2 | 20 | 7 | 41.2 | 9 | 33.3 |
| TOTAL | 10 | 100 | 17 | 100.0 | 27 | 100.0 |

P = 0.243 (Fisher's Exact Test used).

b) Table 15 shows the duration of pneumonia in those children who had pneumonia at admission. There was no statistical difference when comparing the treatment versus the control group children. P = 0.81.

TABLE 15 DURATION OF PNEUMONIA AMONG THE PREVALENT CASES.

| DURATION | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | NO | % | NO | % | NO | % |
| ≤ 4 | 67 | 72.0 | 65 | 74.7 | 132 | 73.3 |
| > 4 | 26 | 28.0 | 22 | 25.3 | 48 | 26.3 |
| TOTAL | 93 | 100.0 | 87 | 100.0 | 180 | 100.0 |

$x^2$ = 0.0056 P = 0.81 ODDS RATIO = 0.87

95% CONFIDENCE LIMITS = 0.43 AND 1.78

DIARRHOEA

(i) Incidence after admission.

Twenty six (41.3%) patients in the treatment group developed diarrhoea after admission as compared to 23 (35.9%) in the control group. There was no difference between the two groups. P = 0.66,(Table 16 ).

TABLE 16: DIARRHOEA AFTER ADMISSION (SUPPLEMENTATION)

| DIARRHOE | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | NO | % | NO | % | NO | % |
| YES | 26 | 41.3 | 23 | 35.9 | 49 | 38.6 |
| NO | 37 | 58.7 | 41 | 64.1 | 78 | 61.4 |
| TOTAL | 63 | 100.0 | 64 | 100.0 | 127 | 100.0 |

$x^2$ = 0.19 P = 0.66 ODDS RATIO = 1.25 95% C.L = 0.58 - 2.73

DIARRHOEA DURATION INCIDENT CASES.

As shown in Table 17, comparatively more patients in the control group (60.9%) than in the treatment group (34.6%) had diarrhoea for more than 4 days. However statistically there was no difference

P = 0.12.

TABLE 17: DIARRHOEA DURATION AMONG INCIDENT CASES

| DURATION | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | NO | % | NO | % | NO | % |
| ≤ 4 | 17 | 65.4 | 9 | 39.1 | 26 | 53.1 |
| > 4 | 9 | 34.6 | 14 | 60.9 | 23 | 46.9 |
| TOTAL | 26 | 100.0 | 23 | 100.0 | 49 | 100.0 |

$X^2$ = 2.41 P = 0.12

ODDS RATIO 2.94 95% CONFIDENCE LIMITS 0.79 AND 11.2

DIARRHOEA DURATION AMONG PREVALENT CASES.

b) Table 18 below shows the duration of diarrhoea in those children who had diarrhoea at admission . 37 (44.6%) in the treatment group and 89 (61.9%) in the control group had diarrhoea for more than 4 days. There was a significant statistical difference between the two groups. P = 0.037, Odds ratio = 2.0, 95% C.L = 1.04 - 3.93 . This results suggests that the children who were given Vitamin A had diarrhoea for a shorter duration than in the non-supplemented group.

TABLE 18: DIARRHOEA DURATION AMONG PREVALENT CASES.

| DURATION | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | NO | % | NO | % | NO | % |
| < 4 | 46 | 55.4 | 32 | 38.1 | 78 | 46.7 |
| > 4 | 37 | 44.6 | 52 | 61.9 | 89 | 53.3 |
| TOTAL | 83 | 100.0 | 84 | 100.0 | 167 | 100.0 |

$X^2$ = 4.36 P = .037

ODDS RATIO 2.0 95% CONFIDENCE LIMITS 1.04 AND 3.93

DIARRHOEA FREQUENCY

Table 19 shows the mean diarrhoeal episodes per 24 hours between the controls and the treatment groups. 42 (38.5%) of patients in the treatment group had 4 or less mean diarrhoea episodes per 24 hours as compared to 27 (25.2%) children in the control group. Similarly, 20 (18.4%) of patients in the treatment group had more than 6.1 mean diarrhoeal stools per 24 hours as compared to 34 (31.8%) in the control group. Relatively more patients in the supplemented group had less frequent episodes of diarrhoea as compared to the control group, P = 0.03.

TABLE 19 DIARRHOEAL FREQUENCY

| DIARRHOEA STOOLS PER 24 HOURS | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| < 4.0 | 42 | 38.5 | 27 | 25.2 | 69 | 31.9 |
| 4.1-6.0 | 47 | 43.1 | 46 | 43.0 | 93 | 43.1 |
| > 6.1 | 20 | 18.4 | 34 | 31.8 | 54 | 25.0 |
| TOTAL | 109 | 100.0 | 107 | 100.0 | 216 | 100.0 |

$X^2$ = 6.85 DF = 2 P = 0.032

L.T.B

(i) Incidence after admission (Supplementation).

Atotal of 116 (79.4%) in the treatement group and 119 (80.4%) in the control group had LTB at admission. However of those who did not have LTB at admission, 7 from each group developed LTB after admission. There was no statistical difference between the two groups, (Table 20).

TABLE 20: L.T.B. INCIDENCE AFTER ADMISSION

| | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | NO | % | NO | % | NO | % |
| YES | 7 | 23.3 | 7 | 25.9 | 14 | 24.6 |
| NO | 23 | 76.7 | 20 | 74.1 | 43 | 75.4 |
| TOTAL | 30 | 100.0 | 27 | 100.0 | 57 | 100.0 |

$X^2$ = 0.0065 DF = 1 P = 0.94

ODDS RATIO = 0.87 95% CONFIDENCE INTERVAL 0.22 AND 3.4

PROGRESSION OF L.T.B.

a) All the children who had L.T.B. on admission clinically had L.T.B. grade I. 18 children in the treatment group had their L.T.B. progressing to grade II as compared to 13 children in the control group. 4 children in the control group progressed to L.T.B grade III while no child in the treatment group had L.T.B grade III, (Tables 21 and 22 and figure I). This may suggest vitamin A has a role in preventing development of severe forms of L.T.B.

TABLE 21 PROGRESSION OF L.T.B

| | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | NO | % | NO | % | NO | % |
| I | 105 | 85.4 | 109 | 86.5 | 214 | 85.9 |
| II | 18 | 14.6 | 13 | 10.3 | 31 | 12.4 |
| III | 0 | 0 | 4 | 3.2 | 4 | 1.6 |
| TOTAL | 123 | 100.0 | 126 | 100.0 | 249 | 100.0 |

TABLE 22 L.T.B. GRADES

| L.T.B. GRADE | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | NO | % | NO | % | NO | % |
| II | 18 | 100.0 | 13 | 76.5 | 31 | 88.6 |
| III | 0 | 0 | 4 | 23.5 | 4 | 11.4 |
| TOTAL | 18 | 100.0 | 17 | 100.0 | 35 | 100.0 |

P = 0.04 (Fishers exact test used).

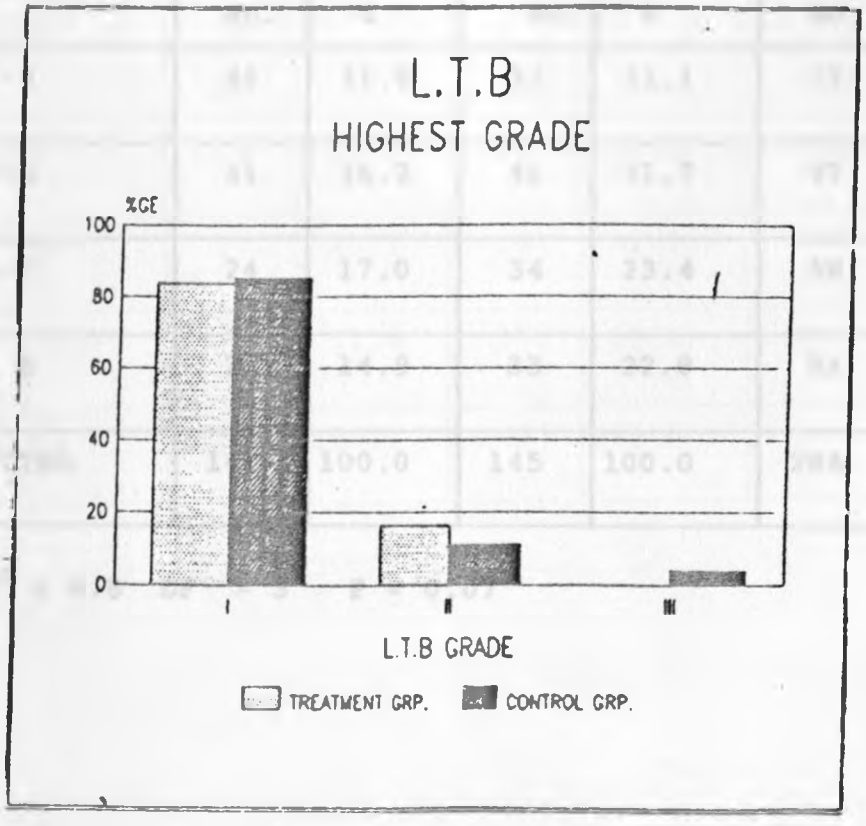


FIGURE I

DURATION OF HOSPITAL STAY

The duration of hospital stay in days was compared between the control and treatment groups. Forty five (31.9%) of children in the treatment group and 32 (22.1%) in the control group were discharged by the 3rd day post admission. 67 (46.2%) children in the control group stayed in the hospital for more than 6 days as compared to 45 (31.9%) in the treatment group. These differences however were not statistically significant P = 0.07. (Table 23). The mean duration of hospital stay was 5.2 days in the treatment group and 5.7 days in the control group.

TABLE 23 STAY DURATION

| STAY DURATION IN DAYS | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| 1-3 | 45 | 31.9 | 32 | 22.1 | 77 | 26.9 |
| 4-5 | 51 | 36.2 | 46 | 31.7 | 97 | 33.9 |
| 6-7 | 24 | 17.0 | 34 | 23.4 | 58 | 20.3 |
| > 8 | 21 | 14.9 | 33 | 22.8 | 54 | 18.9 |
| TOTAL | 141 | 100.0 | 145 | 100.0 | 286 | 100.0 |

$X^2 = 6.8$ DF = 3 P = 0.07

MEAN WEIGHT GAIN

The mean weight gained at one month after discharge was compared between the treatment and control group. A total of 94 children were followed up for one month; 51 in the treatment group and 43 in the control group. More children in the treatment group (31.4%) gained more than 100gm/Kg/Month as compared to 25.6% in control group however there was no significant statistical difference between the two groups P = 0.47, (Table 24 and Figure II). The trend shows that children who were given vitamin A had a better weight gain after discharge as compared to placebo group.

TABLE 24 MEAN WEIGHT GAIN

| MEAN WEIGHT GAIN | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| < 50 | 13 | 25.5 | 16 | 37.2 | 29 | 30.9 |
| 51-100 | 22 | 43.1 | 16 | 37.2 | 38 | 40.4 |
| 101-150 | 16 | 31.4 | 11 | 25.6 | 27 | 28.7 |
| TOTAL | 51 | 100.0 | 43 | 100.0 | 94 | 100.0 |

P = 0.47

However, as shown in figure II, which shows the percentage of children in each of the weight gain categories, one sees that more children in the control group (37.2%) gained < 50 gms/kg/month as compared to 25.5% in the treatment group. And more children in the treatment group (31.4%) gained more than 100 gms/kg/month as compared to (25.6%) in the control group. Though there is no statistical difference between the two groups, the trend however shows that children who were given Vitamin A had a better weight gain after discharge as compared to the control group.

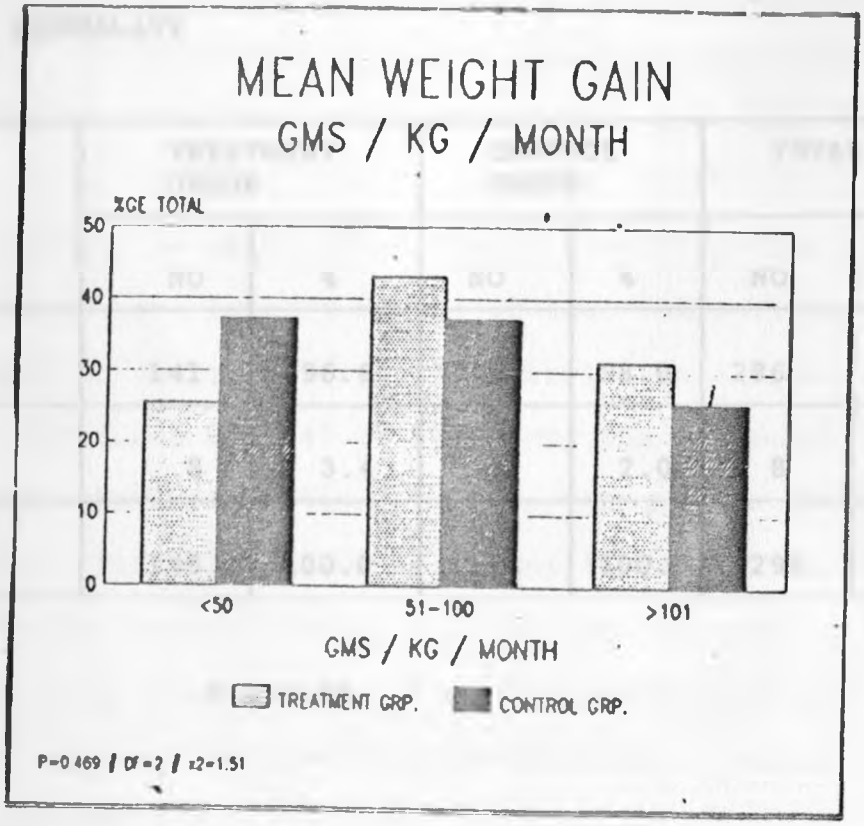


FIGURE II

MORTALITY

Table 25 shows that 5 (3.4%) patients in the treatment group died as compared to 3 (2.0%) in the control group. All the children died of pneumonia or a combination of pneumonia and L.T.B.

As shown in Appendix II, 5 out of 8 children who died were aged less than 12 months and 2 out of 8 had severe form of malnutrition and another 2 were underweight. Of the children who died four were less than nine months, giving age specific case fatality rate of 4.1% as compared to overall mortality rate of 2.7%.

TABLE 25 MORTALITY

| | TREATMENT GROUP | | CONTROL GROUP | | TOTAL | |
|---|---|---|---|---|---|---|
| | NO | % | NO | % | NO | % |
| ALIVE | 141 | 96.6 | 145 | 98.0 | 286 | 97.3 |
| DIED | 5 | 3.4 | 3 | 2.0 | 8 | 2.7 |
| TOTAL | 146 | 100.0 | 148 | 100.0 | 294 | 100.0 |

P = 0.35

## DISCUSSION.

It is evident from literature that Measles is one of the diseases that significantly contribute to the high childhood morbidity and mortality present in many developing countries (1, 2). It has also been shown that Vitamin A deficiency is a significant public health problem in many countries (14), and Vitamin A supplementation has been associated with a significant reduction in both childhood morbidity and mortality (6, 15, 16).

In the current study, the effect of Vitamin A on Measles outcome was evaluated. The patients in the treatment group and control group were fairly well matched as regards their age and sex distribution, vaccination status against measles, nutritional status, residence in Nairobi, duration of measles illness before admission and serum retinol levels before supplementation. This comparability suggests that the randomization procedure was well done.

In this study 56.8% of the patients were less than 12 months of age and 78.9% were less 24 months of age. This is in agreement with Dr. Onyari's study done in the same Hospital in 1986, where she found that 47.1% were less than 12 months and 67.5% were less than 24 months. The proportions are slightly higher in this study because we only considered children up to 5 years whereas Dr. Onyari's study took to consideration all children admitted with measles. A similar pattern of age distribution has also been seen in several other studies (3,4,7,9,11,26,29).

Evidence available show that the Measles tend to be more severe in children less than 2 years of age. (3-11).

One third (33.1%) of all the children who took part were less than 9 months old and so they were not yet due for vaccination against measles. This is in agreement with Dr. Onyari's study where she found the percentage of those less than 9 months to be 26.3%. Though the protection against Measles following vaccination is not 100%, a number of these children could have been protected against Measles if they had been vaccinated earlier. Those developing Measles after vaccination would have suffered a less severe form of disease too.

The percentage of children who were undernourished was 39.8%, and 5.1% had severe malnutrition. Barclay, Foster and Sommer in their Vitamin A supplementation on Measles done in Tanzania, 65% of their children were malnourished (6). Several studies have shown that measles tends to be severe in the undernourished child (3-9).

Various studies have shown that serum retinol levels are decreased following measles infection (10-13). In this study 48.1% of children had serum retinol levels of less than 20 ug/dl, 9.6% had serum retinol levels of less than 10 ug/dl, a level at which xerophthalmia is known to occur.

In Dr. Mjomba's study 25% of her children had serum retinol levels of less than 10 ug/dl and 67% had serum retinol levels of less than 20 ug/dl,though her sample size was small (15).

The major complications associated with Measles in this study were L.T.B 85%, Diarrhoea 74%, Bronchopneumonia 70.5% and Otitis media 50%. These prevalence are higher than those reported by Dr. Onyari in her study done in the same Hospital in 1986 (26) and those of Kimati and Lyaruu in Mwanza teaching Hospital in 1972 (8). In the last 2 years there has been a more intensive screening of children admitted with measles, such that only those with complications are referred to Kenyatta National Hospital for further evaluation and admission. This may explain the higher prevalence of complications seen in this study as compared to previous studies.

At admission 52.0% had pneumonia, 40.1 % had diarrhoea, 76.5% had L.T.B. and 41.8% had otitis media. Of those who had no complications at admission 23.7 developed pneumonia, 38.6% developed diarrhoea, 24.6% developed L.T.B and 9.4% developed otitis media. There was no difference on the incidence of pneumonia, diarrhoea and L.T.B between the control and treatment group after supplementation. However 12 (15%) children in the control group developed otitis media as compared to 3 (3.8%) in the treatment group and this was statistically significant. $P = 0.03$ .

Vitamin A supplementation had no effect on the duration of pneumonia, otitis media and LTB. However the duration of diarrhoea was significantly shorter in the supplemented children ,P = 0.037. Also the mean frequency of diarrhoea was lower in the supplemented group ,P = 0.03.

In a randomized community trial in Indonesia, Vitamin A supplementation reduced the incidence of both diarrhoea and Acute Respiratory Infections (ARI) (17). How Vitamin A exactly acts to reduce the severity of diarrhoea is not clear. Measles is a disease of the epithelial mucosa and the aetiology of diarrhoea in Measles is multifactorial ranging from actual Measles enteritis to secondary bacterial infections due to immunosuppression and mucosal damage from Measles virus. Since Vitamin A is important in epithelial repair process, it probably enhances the gastrointestinal epithelial repair which results in the subsequent acceleration of the mucosal healing process and early cessation of diarrhoea. Vitamin A also enhances both humoral and cell mediated immunity especially in Vitamin A deficient states, and this might lead to reduction in the rate of secondary bacterial infection as well as reducing the severity of Measles enteritis.

All the children who had L.T.B. on admission clinically had L.T.B. grade I and 14.1% of the children developed severe forms of L.T.B. while in the ward. 4 children in the control group developed L.T.B. grade III and no single child in the treatment

group had L.T.B. grade III. (P = 0.04). Overall, no child had L.T.B. grade IV in either the treatment or control group. How exactly Vitamin A could protect one from developing a severe form of L.T.B. is not clear, it could probably be related to the enhanced immune response associated with Vitamin A supplementation in Vitamin A deficient individuals,and enhanced rate of epithelial repair.
More children in the Vitamin A group had a better weight gain at one month as compared to the control group. The possible explanation for this is that Vitamin A significantly reduced the severity of diarrhoea and so these children lost less weight as compared to the controls. It is also known that children with Vitamin A deficiency are anorexic (20), so Vitamin A supplementation may have improved their appetite. However these children were of different age groups and they were discharged to different home environments which might have influenced their rate of weight gain.

A total of 8 children died, 5 from the treatment group and 3 from the control group, giving an overall case fatality rate of 2.7%. This is in agreement with a very recent study done by Dr. V.A. Orinda, which showed an overall case fatality rate of 2.2% (In press), and that of Dr. Onyari 1986 which had a case fatality rate of 4.0% (26). In Dr. Alwar's study of 1985/86, the case fatality rate was 5-6% (29) and 10% in Dr. Donovan's study in 1971 (7). The case fatality rate for measles has shown a

steady decline for the last two decades in this hospital and this may be related to the improved patient management,, nutritional status of the children and possibly earlier admission of measles cases. The age specific case fatality rate for those less than 9 Months was 4.1%.

Five of the children who died were less than 12 months and all except one were less than 18 months of age. Out of the 8 children who died only one had been vaccinated against measles. Measles has been reported to be milder in the vaccinated child. None of the children who died had serum retinol levels of less than 10 ug/dl.

## CONCLUSION

1. VITAMIN A SUPPLEMENTATION REDUCED THE INCIDENCE OF OTITIS MEDIA, THE SEVERITY OF DIARRHOEA, AND L.T.B..

2. VITAMIN A SUPPLEMENTATION HAD NO EFFECT ON THE DURATION OF HOSPITAL STAY.

3. ABOUT 10% OF CHILDREN ADMITTED WITH MEASLES HAVE SERUM RETINOL LEVEL OF LESS THAN 10 ug/dl; A LEVEL AT WHICH CLINICAL XEROPHTHALMIA OCCURS, AND ANOTHER 40% HAVE SERUM RETINOL LEVELS OF 10-20 ug/dl. NORMAL RANGE IS 20-60 ug/dl.

4. 55% OF CHILDREN ADMITTED WITH MEASLES AT I.D.H. WERE LESS THAN 12 MONTHS OF AGE, AND 33.1% WERE LESS THAN NINE MONTHS.

5. 24.6% (1/4) OF CHILDREN WITH MEASLES HAD BEEN VACCINATED AGAINST MEASLES AND 33.1% (1/3) WERE NOT YET DUE FOR VACCINATION AGAINST MEASLES AS PER E.P.I. SCHEDULE IN KENYA.

6. 39.8% (2/5) OF THE CHILDREN ADMITTED WITH MEASLES WERE MALNOURISHED.

## RECOMMENDATIONS

1. HIGH DOSE VITAMIN A SUPPLEMENTATION SHOULD BE GIVEN TO ALL CHILDREN ADMITTED WITH MEASLES IN THIS COUNTRY, AS IT SEEMS TO BE BENEFICIAL.

2. REVIEW OF THE MEASLES VACCINATION AGE WITH A VIEW OF REDUCING THE AGE FROM 9 MONTHS AND POSSIBLY GIVING A BOOSTER AT A LATER AGE.

3. A STUDY ON THE EFFECT OF VITAMIN A SUPPLEMENTATION ON ACUTE DIARRHOEA IN CHILDREN IS SUGGESTED, SINCE VITAMIN A SEEMED TO REDUCE THE SEVERITY OF MEASLES DIARRHOEA.

4. A COMMUNITY-BASED STUDY ON THE EFFECT OF VITAMIN A SUPPLEMENTATION ON CHILDHOOD MORBIDITY WITH SPECIAL INTEREST ON THOSE WHO WILL DEVELOP MEASLES AND DIARRHOEA AFTER THE SUPPLEMENTATION PROGRAMME IS SUGGESTED.

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## APPENDIX I QUESTIONNAIRE

1. a) Name.....

b) I.P. No.....

c) Study No.....

d) Age.....

e) Sex _____ 1. Male, 2. Female

f) Admission date.....

g) Residence 1) Kibera _____

2) Mathare_____

3) Kariobangi_____

4) Dandora_____

5) Others_____

h) Vaccination against measles _____ 1) Yes

2) No

3) Under Age

2. MEASLES 1 - Yes, 2 - No

a) Maculopapular skin rash ____

b) Conjuctivitis ____

c) Koplik's spot ____

d) Running nose ____

e) Coughing ____

f) Temperature ____ $^{0}$

g) Duration of rash before admission ____ days

3. NUTRITION

Admission Weight _____ Kg

Height _____ cm

Presence of oedema _____ 1) Yes 2) No

Presence of skin changes _____ 1) Yes 2) No

Presence of hair changes _____ 1) Yes 2) No

4. DIARRHOEA

| | Yes | No |
|---|---|---|
| Presence of diarrhoea | ___ | ___ |
| Dry mucous membranes | ____ | ____ |
| Loss of skin turgor | _____ | ____ |
| Sunken eyeballs | _____ | ____ |

Characteristics of the stool

1. Watery ____
2. Mucoid ____
3. Blood stained___
4. Greenish ____

5. ANTIBIOTICS

Antibiotic treatment Yes _____ No_____

Indication fo antibiotic

1 - pneumonia _____

2 - Otitis media _____

3 - G/enetritis _____

Specific antibiotic given

1 - Crystalline penicillin (x-pen)

2 - X-pen + Gentamycin

3 - Others

Duration of antibiotic treatment _____days

DAILY DATA SHEET I

| DAY | TEMP C | DIARR-HOEAL FREQ-UENCY | MEAS-LES RASH | RESPI-RATORY RATE | PNEUMONIA | | |
|---|---|---|---|---|---|---|---|
| | | | | | CHEST RETRA-CTION | FLARI-ING OF ALAE NASI | CREP: TATI( |
| 1 | | | | | | | |
| 2 | | | | | | | |
| 3 | | | | | | | |
| 4 | | | | | | | |
| 5 | | | | | | | |
| 6 | | | | | | | |
| 7 | | | | | | | |
| 8 | | | | | | | |
| 9 | | | | | | | |
| 10 | | | | | | | |
| 11 | | | | | | | |
| 12 | | | | | | | |
| 13 | | | | | | | |

DAILY DATA SHEET II

| | L.T.B | | | | | OTITIS MEDIA | | | |
|---|---|---|---|---|---|---|---|---|---|
| DAY | HOARSENESS OF V. | TOTAL LOSS OF V. | BARKING COUGH | INSPIRATORY STRID. | LTB GRADE | REDNES OF EAR DRUM | BULG. EAR DRUM | LOSS LIGHT REFL. | PUS DISCHARGE |
| 1 | | | | | | | | | |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |
| 4 | | | | | | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |
| 14 | | | | | | | | | |
| 15 | | | | | | | | | |
| 16 | | | | | | | | | |

6. LABORATOY RESULTS

Hb_____g/dl

WBC_____

Polymorphs_____%

Lymphocytes_____%

Eosinophils_____%

Malarial parasites_____ YES/NO

Serum retinol levels _____ ug/dl

7. DISCHARGE

Date of discharge_____

Duration of hospital stay_____days

Discharge weight_____Kg

8. FOLLOWUP

| WEEK | WEIGHT | COMMENTS |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |

APPENDIX II:

SAMPLE SIZE AND DATA ANALYSIS

The minimum sample size was 126 for each group i.e. treatment and control group. The following formula was

$$n = \frac{p_1(1-p_1) + p_2(1-p_2)}{(p_1 - p_2)^2} \alpha/\beta$$

n = sample size

$p_1$ = current incidence

$p_2$ = expected incidence

$\alpha/\beta$ = constant 10.51

Taking diarrhoea as an example:

$p_1$ = 60% (0.6)

$p_2$ = 40% (0.4)

$$n = \frac{0.6\ (1.0-0.6) + 0.4\ (1-0.4)}{(0.6 - 0.4)^2} \times 10.51$$

$$= \frac{0.6 \times 0.4 + 0.4 \times 0.6}{(0.2)^2} \times 10.51$$

$$= \frac{0.24 + 0.24}{0.04} \times 10.51$$

$$= \frac{0.48}{0.40} \times 10.51$$

$$= 126$$

2

Data Analysis

Two statistical tests were used.

(i) Chi-square ($x^2$) test:

(This was used to test qualitative association between two categorical variables).

$$x^2 = \Sigma \frac{(o-e)^2}{e}$$

Where

$\Sigma$ = sum of the difference

o = observed value

e = expected value

$x^2$ = Chi-square

The P value was determined by reading off the value at the correct degrees of freedom from appropriate statistical table.

Degrees of freedom (df) = (r-1) (c-1)

where r = rows

c = columns

(ii) Fishers Exact Test:

This test was used where the expected value in any one cell in a 2 x 2 table was less than 5.

APPENDIX III:

DESCRIPTION OF THOSE WHO DIED

A total of 8 children died, 5 in the treatment group and 3 in the control group. The following is a brief clinical summary for each of the children who died.

TREATMENT GROUP

1) R.M. 2 years 10 months Wt 8kg (m)

Admitted with 3 days history of high temperature and coughing. Rash for 2 days. He was not immunized against measles. Clinically, the child was small for age, underweight, bilateral crepitations with grade I L.T.B.. He developed diarrhoea on the 3rd day of admission. Blood slide for malaria parasites was negative. He was started on crystapen and gentamycin. On the 5th day, the L.T.B had progressed to grade II and child developed subcutaneous emphysema around the neck and anterior chest wall. Child was transferred to P.E.W. where the child died after one day - died on the 6th day.

2) J.M. 6 months wt 5 kg (m)

Admitted with 2 days history of high temperature, difficulty in breathing and skin rash with red eyes. He had been vaccinated against measles, child was started on crystapen 3/4 mega units QID and 20mg of gentamycin B.D. He remained very dyspnoeic throughout the period he wa in the ward, died on the 3rd post admission day.

3) M.N. 8 months 4.6kg (m)

Admitted with history of high temperature, cough, measles rash. He was oedematous, had hair changes, peripheral and gluteal dermatosis was dyspnoeic, with bilateral crepitations. He had not been vaccinated against measles though he had not reached the vaccination age of 9 months. He was started on crystapen and gentamycin and nasogastric

feeding. Child died on the 2nd post admission day.

4) D.O. 10 months 7.0 Kg (f)

Admitted with history of rash, high temperature, coughing, red eyes. Child had not been immunized against measles. She was having bilateral crepitations, he was started on crystapen. On the 3rd post admission day, she was reported to be very dyspnoeic with hoarseness of voice. She was started on steam inhalation and gentamycin was added. She remained dyspnoeic with very severe bronchopneumonia and finally died on the 4th post-admission day.

5) M.O 13 months 7.8 kg(f)

Admitted with history of cough, red eyes, running nose and high temperature. Child had not been immunized against measles. An elder brother had been admitted earlier with measles and discharged home two days prior to her admission. She was dyspnoeic on admission with chest retraction and bilateral crepitations. She was started on crystapen and gentamycin but the condition deteriorated and died of severe bronchopneumonia on the 3rd post admission day.

CONTROL GROUP

1) J.O. 7 months 6.4 kg (m)

Admitted with 2 days history of high temperature, respiratory distress and a measles skin rash with conjunctivitis. He had not been vaccinated against measles. He had been having diarrhoea 24 hours prior to admission. He was moderately dehydrated, temperature was 40.2$^0$ C, had bilateral crepitations, L.T.B. grade I. He was started on antibiotics both crystapen and gentamycin. He remained sick, the diarrhoea got less but the child died on

the night of the 3rd post admission day.

2 ) L.N. 1 Year 1 Month 6.5 Kg (f)

Admitted with 2 days history of high temperature, coughing, red eyes and skin rash. Had not been vaccinated against measles. She was in severe respiratory distress, bilateral coarse crepitations, barking cough. She was started on antibiotics and she improved a bit. She developed L.T.B. on day 2 and was transferred to P.E.W. and the child died in P.E.W. 12 hours after admission there.

3) F.O. 7 months 7.5 Kg (F)

Admitted with a history of fever, rash and coughing for 3 days. She had not been vaccinated against measles though she was not yet 9 months the age recommended for vaccination against measles. On admission she had severe pneumonia, L.T.B. grade I and a temperatur of $39.5^{0}$ C. She was started on antibiotics crystapen and gentamycin with no improvement. Terminally, the child's L.T.B. worsened. She was transferred to P.E.W. and later died in ICU during the 4th post admission day.