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ENTERAL NUTRITION AND BURN WOUND RECOVERY OF PEDIATRIC PATIENTS: A CASE OF KIRUDDU NATIONAL REFERRAL HOSPITAL. A DESCRIPTIVE CROSS SECTIONAL STUDY.

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Abstract

Background:

The study aimed at finding the relationship between normal oral nutrition, use of liquid supplements, tube feeding, and burn wound recovery of pediatric patients at Kiruddu National Referral Hospital.

Methodology:

A descriptive cross-sectional study design was conducted among caretakers of pediatric burn patients using the prospective sampling method. Socio-demographic factors, medical history, dietary history, 24 hr. recall, and biochemical analysis were assessed.

Results:

45 caretakers of pediatric burn patients (mean age = 4.08) were studied. The patients sustained between 02-55% TBSA burns. The majority of burns occurred for children aged between 0-5. With (71.1%) largest burns caused by scalds, (20%) flames, and (8.9%) chemicals. Overall, 73.3% of pediatric patients were placed on normal oral nutrition while 26.7% were tube feeding. None of the pediatric patients under study received a liquid supplement. Data analysis of enteral nutrition feeding routes and nutrition outcomes was conducted using the chi-square. The results showed that there is a significant and positive relationship between normal oral nutrition, tube feeding, and white blood cells (p= 0.005), red blood cells (p= 0.001), hemoglobin (p= 0.000), platelets (p= 0.000), creatinine (p= 0.000), urea (p= 0.000), sodium (p= 0.000), potassium (p= 0.000), chloride (p= 0.000) and albumin (p= 0.002,). The blood cells, protein, and biochemical parameters are indicative of wound healing. With linear regression, the relationship between normal oral nutrition, tube feeding, and albumin was found to be of no significance (p=0.553).

Conclusions:

The study illustrated a significant relationship between normal oral nutrition, burn wound recovery, and a positive relationship between tube feeding and burn wound recovery of pediatric burn patients at Kiruddu National Referral Hospital.

Recommendations:

There is a need to carry out a biochemical analysis test that includes transferrin, transthyretin, magnesium, zinc, and copper as these tests can help in determining the nutrition status of the patients.

Keywords: Relationship, normal oral nutrition, liquid supplements, burn wound recovery, and Pediatric patients., Submitted: 2023-05-22 Accepted: 2023-08-16

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1. Background of the study.

Burns are tissue damage from hot liquids, the sun, flames, chemicals, electricity, steam, and other causes (Staff, 2022). In Kiruddu Hospital, 55% of burns represented in patients are caused by open flames from candles and locally made winked lamps or Tadooba. About 40% are scalds from hot liquids, especially hot water, bean soup, and hot cooking oil. 5% of burns are evenly distributed with chemical burns presenting a higher incidence than electricity and/or arch burns. Contact burns occur due to a comorbidity such as a seizure or alcohol intoxication with radiation burns occurring rarely (Staff, 2021). The classification of burns is dependent on how deeply and severely they penetrate the skin's surface. There are four classes of burns and these include: first-degree or superficial burns, second-degree or partial thickness burns, third-degree or full-thickness burns, and fourth-degree burns (Eric Perez, 2019)

At a global scale, burns are a public health concern with the majority of the disease burden affecting low- and middle-income countries (Francoise Mukagaju, 2021) especially in the WHO African and South East Asia regions (WHO, 2018). Burn injury is a significant cause of morbidity and mortality (Samuel P. Mandell, 2014) with an estimated 180,000 deaths occurring every year (WHO, 2018) the vast majority of which occur in low- and middle-income countries.

In the Sub-Saharan African region including Uganda, mortality of children aged 1-14 years from burns is at 4.5 per 100,000 compared to the global scale of 2.5 per 100,000 out of 103 countries studied. (Mathilde Sengoelge, 2017). On the other hand, non-fatal burn injuries are the leading cause of morbidity including prolonged hospitalization, disfigurement, and disability often with resulting stigma and rejection (WHO, 2018).

The economic impact of burns is such that in 2000, the United States of America exceeded US$211 million in care of children with burns while in Norway, costs for hospital burn management in 2007 exceeded € 10.5 million. In South Africa, an estimated US$ 26 million is spent annually for the care of burns from kerosene (paraffin) cook stove incidents (WHO, 2018).

Burn management involves a multitude of actions from prevention measures to first aid and pharmacological remedies to surgery depending on the extent of the burn. Prevention measures such as the installation of smoke alarms, and the introduction of strict laws on building codes which have proved effective in high-income countries, have not been well evaluated in low- and middle-income countries (Margie Peden, 2008).

In the Sub-Saharan region, burns management is overshadowed by infectious diseases such as AIDS and HIV, malaria, Tuberculosis; political instability, and terrorist acts. As a result, there is little investment in preventive measures, pre-hospital, in-hospital, and post-discharge care of burns which has led to a high number of burns, high morbidity, and high mortality (Nthumba, 2016).

In ancient times topical therapies were used to treat burns, however, they produced almost no effect as they could not prevent bacterial infection which is a major cause of death in burn patients. It is in the early 1900s that it was recognized that burn patients require a high caloric intake along with pharmacological therapies and surgical interventions. The importance of nutritional support was not established until the 1970s (Kwang Chear Lee, 2014).

Survival of a burn patient. Two feeding routes involve Total Parenteral Nutrition (TPN) and Enteral Nutrition (EN). TPN is provided to a severely burned patient as it allows for the provision of elements that do not require digestion or a functioning alimentary tract (Felicia N. Williams, 2011). However, nutrition support given parentally is harmful because it increases immune deficiency and mortality (Herndon D. N., 1989).

EN is the current preferred route because it has been shown to reduce translocation bacteremia and sepsis, maintain gut motility and preserve 'first pass' nutrient delivery to the liver (Felicia

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N. Williams, 2011).

The study aimed at finding the relationship between normal oral nutrition, use of liquid supplements, tube feeding, and burn wound recovery of paediatric patients at Kiruddu National Referral Hospital.

2. Methodology.

2.1. RESEARCH DESIGN.

A cross-sectional descriptive study research design was used to determine the relationship between EN and burn wound recovery of pediatric patients at KNRH. The researcher chose to opt for this research design because of a limitation of funds as well as the time scope in which the researcher was expected to carry out the study.

2.2. STUDY POPULATION.

The study involved all pediatric burn patients; male and female aged 0 to 19 years who were enrolled and admitted at Kiruddu Hospital at the time of the study. The researcher chose to study this population because children are at a higher risk of sustaining burn injuries due to their physical size and sensitivity (Margie Peden, 2008) and for those in deprived and densely populated environments, exposure to hazardous products is greater (Stephanie Burrows, 2010) (Kendrick, 2010) (Peck, 2011). The hospital was also near the researcher's residence.

2.3. SAMPLE SIZE DETERMINATION.

The sample size was determined using the Morgan and Krejcie (1970) sample size determination table (above) as this is the simplest method to use. The researcher determined the study population (N) which was 45 respondents and looked for the corresponding figure (S) which was 40 respondents. The researcher chose 40 participants because it helped to have normally distributed data.

2.4. SAMPLING TECHNIQUES AND PROCEDURES.

The researcher opted to use the purposive sampling method as this would enable the researcher to select informants that she believed were appropriate or connected to the study (Dudovskiy, 2020).

2.5. DATA COLLECTION METHODS.

2.5.1. Questionnaire survey.

Some of the data was collected using the questionnaire survey as this would enable the researcher to collect primary data directly from the respondents. The questionnaire was designed to answer the question about the relationship (if any) between EN and burn wound recovery of pediatric patients. This questionnaire was given to those caretakers who had children aged 0 to 19 years with burns and had consented to the survey as well as the pediatric patients who were old enough to give assent. Other data was collected from the records department of the Plastic surgery and burns unit by reviewing all medical records of the patients.

2.6. DATA COLLECTION INSTRUMENTS.

2.6.1. Questionnaire guide.

Directly administered structured questionnaires having mixed questions were used in the study. Each questionnaire comprised four parts: part A contained items eliciting the sociodemographic factors of the study participants and their pediatric patients. Part B contained items assessing the medical history of pediatric patients. Part C contained items detailing the dietary history and 24 hr recall of the pediatric patients. Part D highlighted the biochemical analysis of pediatric patients.

2.7. QUALITY CONTROL METHODS/ PRE-TESTING.

2.7.1. Validity and reliability.

Validity was used to measure accuracy and reliability to measure the consistency of the questionnaire guide (Middleton, 2019) about the degree of burn and nutrition status. The researcher carried out a pre-test of the questionnaire by submitting it to the supervisor to critique it and offer suggestions for improvement. It was also submitted to a research and ethics committee review board

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Table 1: The Morgan and Krejcie table (1970)

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	246
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	351
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	181	1200	291	6000	361
45	**40**	180	118	400	196	1300	297	7000	364
50	44	190	123	420	201	1400	302	8000	367
55	48	200	127	440	205	1500	306	9000	368
60	52	210	132	460	210	1600	310	10000	373
65	56	220	136	480	214	1700	313	15000	375
70	59	230	140	500	217	1800	317	20000	377
75	63	240	144	550	225	1900	320	30000	379
80	66	250	148	600	234	2000	322	40000	380
85	70	260	152	650	242	2200	327	50000	381
90	73	270	155	700	248	2400	331	75000	382
95	76	270	159	750	256	2600	335	100000	384

Source: (Robert V. Krejcie, 1970)

for ethical clearance. The researcher then made corrections such that they reflected the subjects of the study after which, the questionnaire was handed out to respondents to provide their opinions during the data collection.

2.8. DATA COLLECTION PROCEDURE.

Before the commencement of data collection, the researcher sought permission from the registrar of the Mildmay Institute of Health Sciences and obtained approval from the Mildmay Uganda Research and Ethics Committee as well as the Uganda National Council for Science and Technology. The researcher then conducted an oral presentation about the study to the eligible study participants.

The researcher clarified whatever the respondents had not understood. Questionnaires were then handed out together with consent forms to the eligible participants and they were filled in approximately 30 to 40 minutes.

2.9. DATA ANALYSIS.

2.9.1. Quantitative data analysis

This was a quantitative study. Data was compiled, cleaned, sorted, coded, and entered into the Statistical program Statistical Package for Social Sciences version 16 (SPSS) for analysis.

Descriptive statistics were used to generate frequency counts, percentages, and charts to show the sociodemographic factors, medical history, dietary history, and biochemical analyses of pediatric burn patients.

Percentages of normal oral nutrition and tube feeding were interpreted to indicate the number of pediatric patients using each feeding route.

A Chi-square test between normal oral nutrition, tube feeding, and biochemical parameters as well as linear regression was carried out to find out the relationship between enteral nutrition outcomes and independent variables.

The updated Kuppuswamy socioeconomic status scale for February 2019 (Wani, 2019) was used to determine the socioeconomic status of the respondents in line with the affordability of nutri-

tious foods for the pediatric patients that they were taking care of.

2.10. DESCRIPTION OF VARIABLES.

2.10.1. Dependent variables.

Outcomes of enteral feeding

2.10.2. Independent variables.

These included the age and gender of the child, type of feeding, degree of burn, existing medical conditions, caretaker occupation, and length of hospital stay.

2.11. INCLUSION CRITERIA.

Caretakers of children with burns who are above the legal age of 18yrs. Caretakers of children with severe burns who could not express themselves. Both categories had agreed to consent.

2.12. EXCLUSION CRITERIA.

All caretakers of children aged 0 to 19 years with burns who did not stand the interview were not included in the study.

2.13. ETHICAL CONSIDERATIONS.

As with any research work, these must be adhered to or it may lead to complications in the collection

of data. Some of the ethical considerations include:

The right to privacy of the respondents. The researcher ensured that this right was not violated by not including a section for names on the questionnaires.

The researcher also ensured to obtain informed consent from the respondents before handing them a questionnaire to fill out as this proved that they had understood what the study was about and had agreed to participate in it.

The researcher ensured confidentiality by not disclosing whatever had been discussed with the respondents to third parties without his or her consent.

The researcher is aware that whatever is done concerning this study must be within legal limits to avoid problems that may crop up as a result of wrongdoing during data collection. The researcher ensured the anonymity of respondents by eliminating personal information from the final report of the study and properly citing and referencing other people's work. The researcher endeavored to use the right methods, present the right data that was collected, and avoided adjusting findings. Consent was also obtained from pediatric patients who were old enough to give assent.

3. Results.

3.1. RESPONSE RATE

The response rate can be calculated using the equation:

Total number of responses/ sample size*100

The researcher was able to collect 45 filled-out questionnaires from the participants. This number represents a response rate of 100%.

3.2. SOCIO-DEMOGRAPHIC CHARACTERISTICS

The researcher was interested in exploring the demographic characteristics of the study population such as caretaker, caretaker occupation, age and gender of the child, the person responsible for shopping and preparing food, and birth order of the child. The results are as below:

3.3. CARETAKER/RESPONDENTS AND THEIR OCCUPATIONS

Respondents fell into several categories which included fathers (11.1%), mothers (77.8%), aunt 2% , grandmothers (6 7% and neighbors at home (2 2%

3.4. Pie chart showing study respondents.

Of these, 15.6% (7) are farmers, 6.7% (3) are hairstylists, 13.3% (6) are white collar workers, 2.2% (1) works in restaurant/hotel, 35.6% (16) are self-employed, 24.4% (11) are unemployed and 2.2% (1) is an employee. Considering the occupations mentioned above, only the farmers, white collar workers and self-employed would be able to afford nutritious foods for their pediatric patients

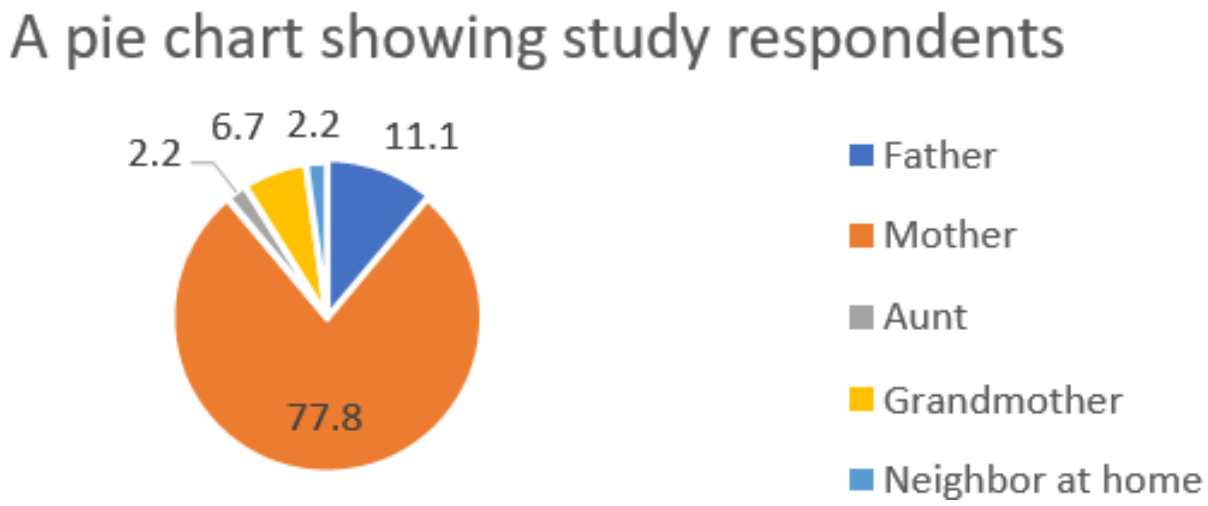

Figure 1: Fig.1 Pie chart showing the different categories of caretakers/respondents interviewed.

Table 2: Kuppuswamy socio-economic status scale updated for February 2019

Occu ation of head of the family	Score
rofessio al (white collar)	10
Semi professio al	6
Clerical, hop owner/farm	5
Skilled worker	4
Semi- killed worker	3
Unskilled worker	2
Unemployed	1

according to the modified Kuppuswamy socio-economic status scale of February 2019 (see below) (Wani, 2019).

However, when caretakers were asked if they could afford meals for their patients, 57.8% (26) said yes, they could, 13.3% (6) said they could do so with help from well-wishers, 8.9% (4) said they could afford the meals sometimes and only 20% (9) said that they could not afford nutritious meals for their patients.

3.5. PERSON RESPONSIBLE ***FOR SHOPPING AND PREPARING FOOD.***

During admission, provision of food for the patients was the responsibility of the caretakers 57.8%, (26) of whom were mothers, 8.9% (4) said that KNRH shopped and provided the food, 6.7% (3) were fathers, 4.4% (2) said that the father shopped and the mother prepared the food, 6.7% (3) said that the mother shopped and KNRH prepared the food, 4.4% (2) were grandmothers, 2.2% (1) cited that the brother shopped and the mother prepared the food, 2.2% (1) was the aunt, 2.2% (1) was the neighbor at home, 2.2% (1) said that the father shopped and the wife prepared the food and 2.2% (1) was the sister-in-law.

3.6. Pie chart showing the person responsible for shopping and preparing food.

3.7. GENDER AND AGE OF THE PEDIATRIC PATIENTS.

Results show that the percentage of female patients under study was 53.3% (24) and the percentage of males was 46.7% (21). The age range

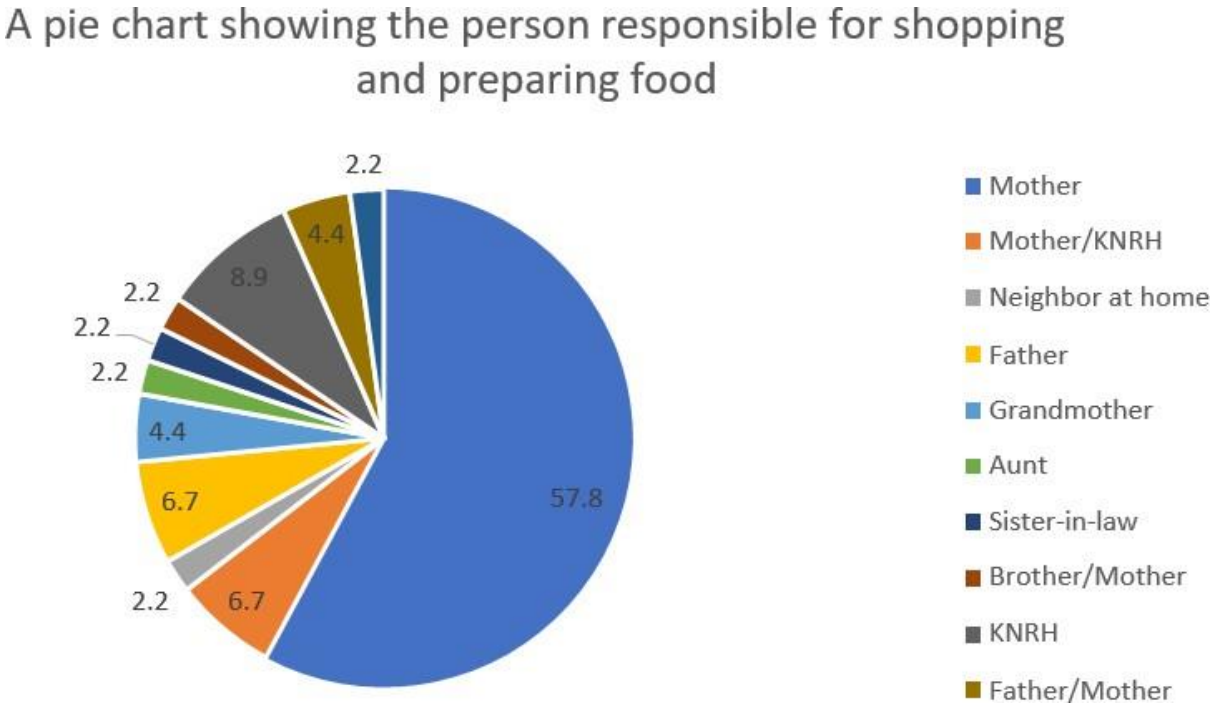

Figure 2: Pie chart showing person responsible for shopping and preparing food.

of the patients was 8 months to 15 years with a mean age of 4.08 years.

3.8. BIRTH ORDER OF THE PEDIATRIC PATIENTS

Results show that 31.1% (14) of the children were firstborns, 20% (9) were second born, 17.8% (8)

Were third born, 6.7% (3) were fourth born, 15.6% (7) were fifth born, 6.7% (3) were sixth born and 2.2% (1) was the seventh born.

Please note that anthropometric measurements of weight and height/length were not possible due to the fact that patients were heavily bandaged with some unable to stand or lie in a manner that would enable the taking of these measurements. MUAC readings were taken for only 18 patients who had one arm free.

3.9. MEDICAL HISTORY

The researcher was interested in knowing the medical history of the pediatric patients such as

Type, cause and degree of burn injury, complications of burns, medications given, hydration status, existing medical conditions and length of hospital stay. The results are presented below:

3.10. TYPE, CAUSE AND DEGREE OF BURN

Results showed that 2.2% (1) were due to chemicals, 2.2% (1) were due to contact, 22.2% (10) were due to flames and 73.3% (33) were scalds.

Results also showed that the burns were caused by charcoal ash 2.2% (1), bean soup 11.1% (5), candle 2.2% (1), dormitory fire 4.4% (2), fire 11.1% (5), house fire 2.2% (1), paraffin 2.2% (1), hot milk 6.7% (3), hot oil 2.2% (1), hot porridge 8.9% (4), hot offal's soup 2.2% (1), hot water 42.2% (19) and cause unknown 2.2% (1).

3.11. COMPLICATIONS OF BURNS

Results revealed that majority (80%, 36) of the patients had an episode of vomiting, fever or

Diarrhea along with other infections such as cough (6.7%, 3). 2.2% (1) had a bout of flu, 24.4% (11) had a low appetite, 4.4% (2) had severe acute malnutrition (SAM), 4.4% (2) had anemia, 6.7% (3) had swelling, 2.2% (1) went into a coma, had

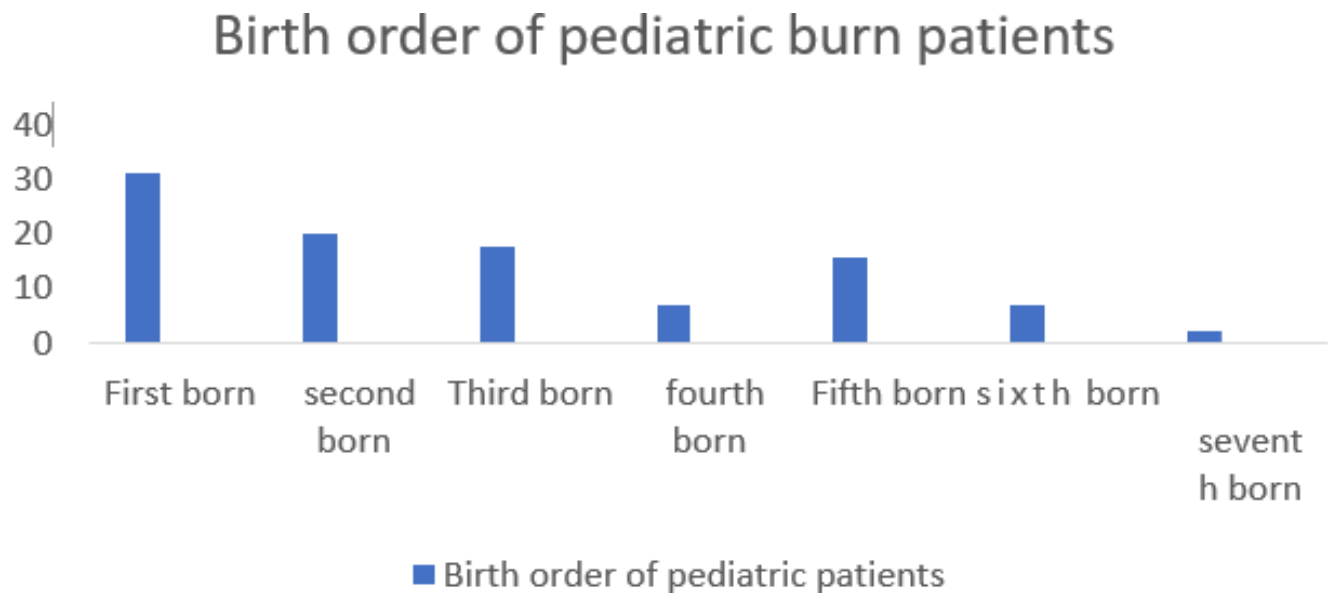

Figure 3: Graph showing the birth order of pediatric patients under study.

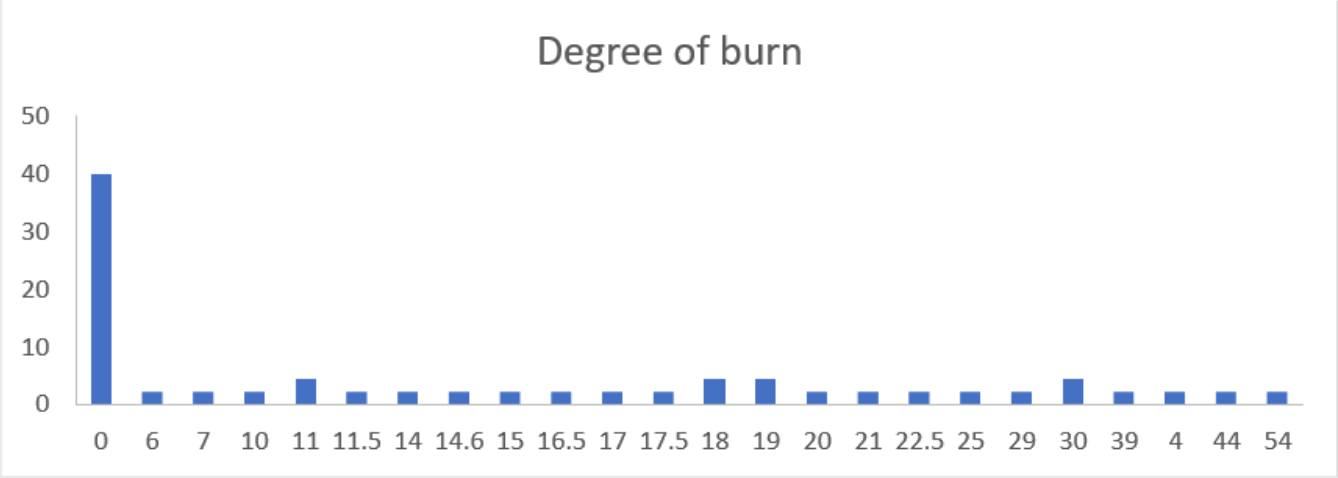

Figure 4: Histogram showing percentage representative of patients with degree of burn

respiratory distress and developed an aversion to meat and 2.2% (1) had difficulty breathing. 13.3% (6) had no complications.

3.12. MEDICAL PRESCRIPTIONS

The most common medications that were given to the patients included Ceftriaxone, Paracetamol, Flucamox, Metronidazole, Dexamethasone, Oral Morphine, Ibumex, Omeprazole among others. Also, patients were often given transfusions of Ringers' Lactate, Packed cells, Albumin and Platelets.

3.13. EXISTING MEDICAL CONDITIONS.

4% patients had Pneumonia and 1 (2 2% had HIV cough as shown below:

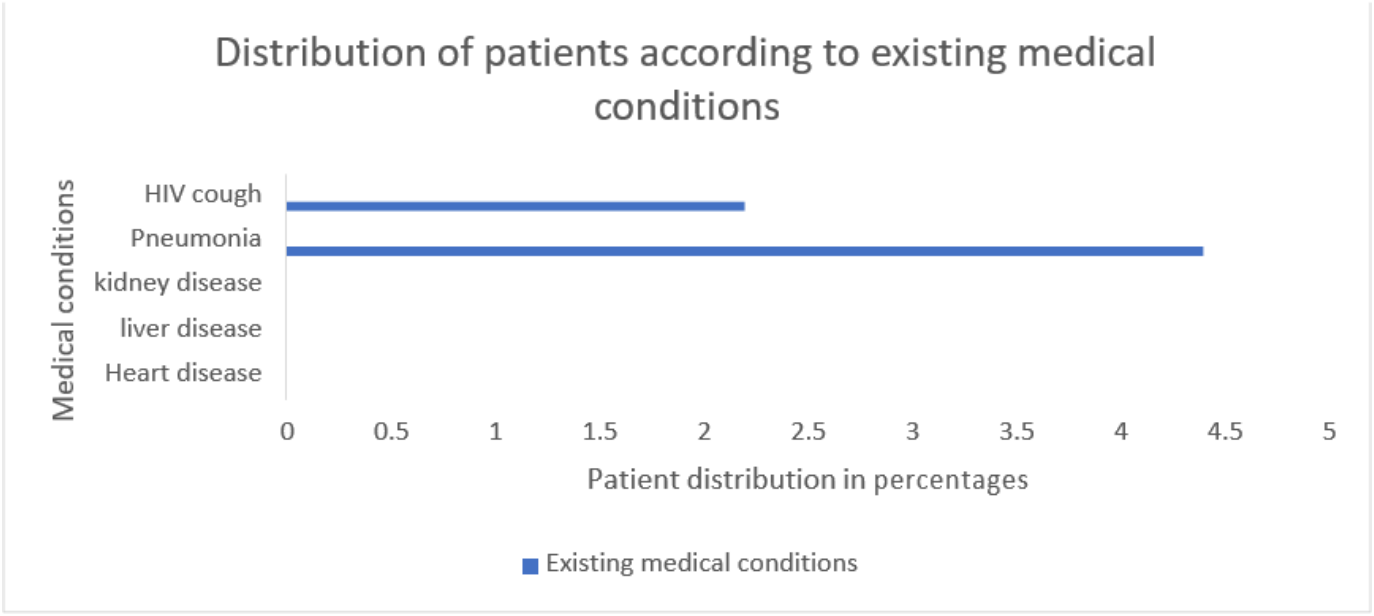

Figure 5: Bar graph showing distribution of patients according to existing medical conditions

3.14. LENGTH OF STAY IN THE HOSPITAL

Results show that 25 (55.6%) had spent between one day and one week in hospital by the time of the study. 9 (20%) of the patients had spent between one and two weeks, while 1 (2.2%) had spent two weeks in hospital. 5 (11.1%) had spent more than two weeks but less than a month, while 1 (2.2%) had spent one month in hospital. 3 (6.7%) had spent two months while 1 (2,2%) had spent three months in hospital by the time of the study.

3.15. DIETARY HISTORY

The researcher was interested in knowing the dietary history of the patients while in hospital suchas dietary supplements received, type of feeding, feeding regimen, food solids and liquids consumed by the patients and their amounts and also when the patient began feeding after being admitted in hospital.

3.16. DIETARY SUPPLEMENTS RECEIVED WHILE IN HOSPITAL.

3.17. TYPE OF FEEDING

The patients were expected to receive their nutrition via three feeding routes which included use of liquid supplements, normal oral nutrition and tube feeding. None of the patients received a liquid supplement during the study due to the fact that these are too costly. 73.3% (33) patients were put on normal oral nutrition while 26.7% (12) were on tube feeding.

3.18. FEEDING REGIMEN

The feeding regimen of the patients was as follows: 2.2% (1) fed every 30 minutes, 2.2% (1) fed every hour, 11.1% (5) fed every two hours, 4.4% (2) fed every three to four hours, 6.7% (3) fed twice a day, 31.1% (14) fed three times a day, 11.1% (5) fed four times a day and 13.3% (6) fed five or six times a day. For 8.9% (4) the feeding was poor and 8.9% (4) the feeding regimen was unknown.

3.19. FOOD SOLIDS, SAUCES AND LIQUIDS.

Results showed that patients were fed one or more of the following foods: matooke, Irish potatoes and rice were the most commonly consumed foods. Cassava, sweet potatoes and posho were the least consumed foods. For sauces; chicken, meat, beans, groundnuts and fish were all consumed by the patients. It should be noted that a

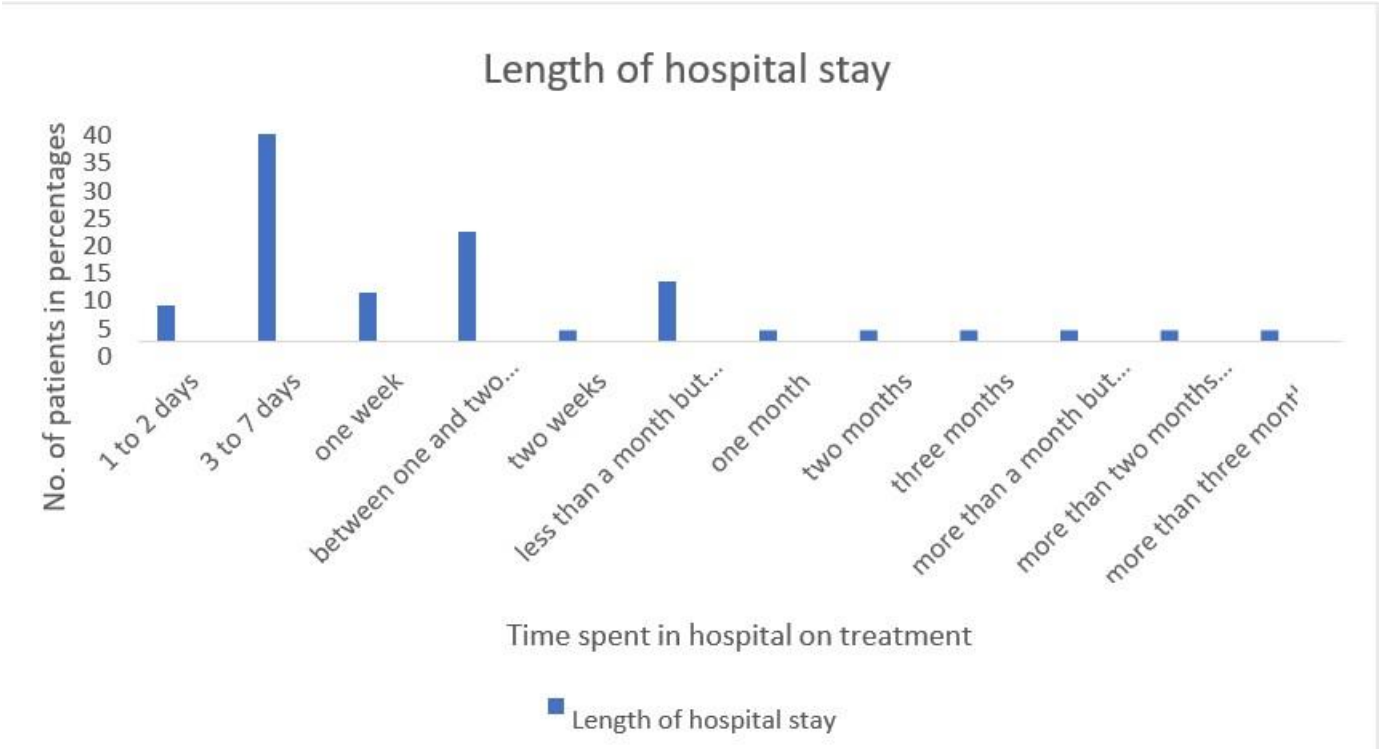

Figure 6: Chart showing the distribution of patients in percentages according to length of hospital stay.

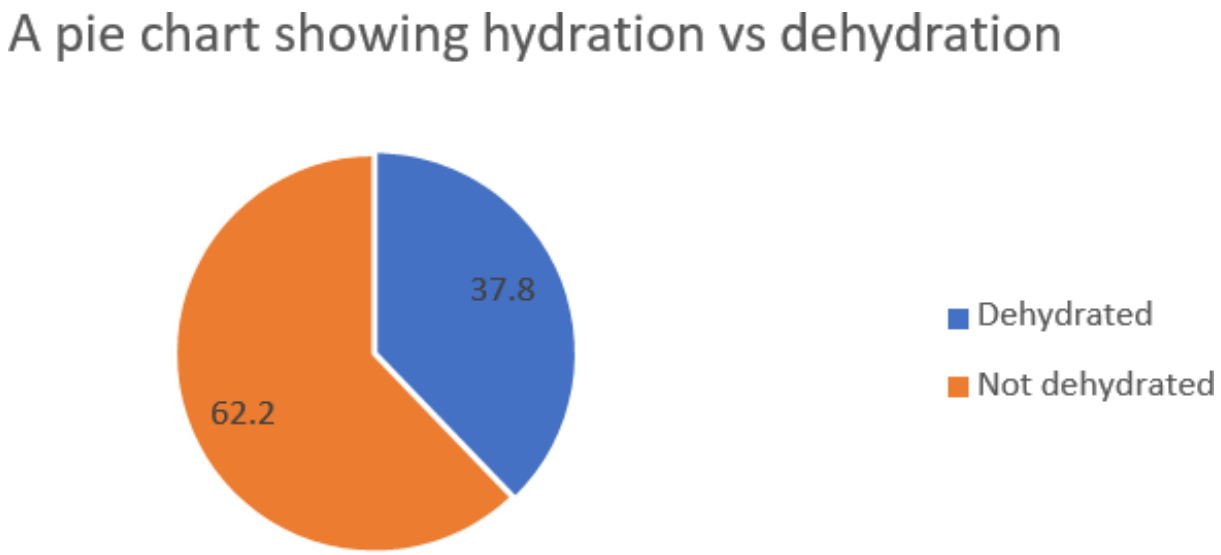

Figure 7: **Pie chart showing the distribution of patients according to hydration**

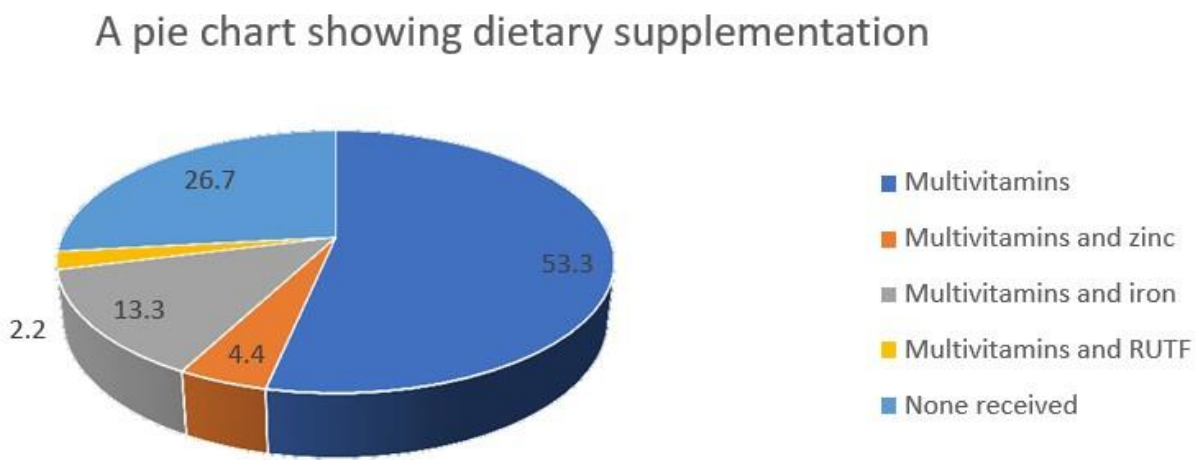

Figure 8: Pie chart showing dietary supplementation

few of the patients were fed snacks such as chapati, namungodi, cakes, samosas and Gorillos instead of the recommended food items.

Liquids included passionfruit juice, milk, water, minute maid mango flavor, lucky mango drink, sun sip juice drink and yoghurt. Enriched porridge was provided by the hospital. This is a finely ground corn-soy blend to which raw eggs, finely ground groundnut paste, finely ground silver fish and sometimes ready-to use-therapeutic-food are added to cater for the very high protein requirement after burn injury in pediatric patients.

3.20. AMOUNTS OF FOOD SOLIDS, SAUCES, FLUIDS AND PORRIDGE CONSUMED.

Results show that 26.7% (12) of the patients consumed 40g of food, 15.6% (7) consumed 20g of food, 2.2% (1) consumed 10g of food, 2.2% (1) consumed 2 tablespoons of food, 6.7% (3) consumed 2 matooke fingers with sauce, 2.2% (1) consumed 3 matooke fingers with sauce, 2.2% (1) consumed 3 matooke fingers and two Irish potatoes with sauce, 2.2% (1) consumed 1 matooke finger and 1 Irish potato with sauce, 17.8% (8) consumed a little food, 4.4% (2) did not know the amounts and 17.8% (8) had none of the foods mentioned previously.

For fluids, 17.8% (8) of the patients consumed a 500mls of fluids, 6.7% (3) consumed 250mls of fluids, 4.4% (2) consumed a bottle of fluids, 13.3% (6) consumed 20mls of fluids per feed, 11.1% (5) consumed a little fluid, 2.2% (1) consumed $\frac{1}{4}$ bottle of juice, 2.2% (1) consumed 500mls of Minute Maid, 2.2% (1) consumed a sachet of yoghurt 2.2% (1) consumed $\frac{1}{2}$ a bottle of fluid and 37.8% (17) did not know the amounts of fluids consumed.

Enriched porridge: 4.4% (2) consumed 125mls of porridge per feed, 8.9% (4) consumed 250mls of porridge per feed, 28.9% (13) consumed 500mls of porridge per feed, 4.4% (2) consumed 5ml of porridge per feed, 11.1% (5) consumed 20ml of porridge per feed, 8.9% (4) consumed a little porridge per feed, 2.2% (1) consumed 15ml of porridge per feed, 2.2% (1) consumed a small flask cup of porridge per feed, 2.2% (1) consumed 100mls of porridge per feed, 17.8% (8) did not know the amount of porridge consumed and 8.9% (4) did not take the porridge.

3.21. FOOD INTAKE INITIATION AFTER ADMISSION.

Results show that for 44.4% (20) patients, food intake commenced a few hours after admission to KNRH, for 26.7% (12) food intake commenced after one day, for 15.6% (7) food intake commenced after two days, for 11.1% (5) food intake commenced after more than two days and 2.2% (1) did not know when food intake commenced.

3.22. NORMAL ORAL NUTRITION AND BURN WOUND RECOVERY OF PEDIATRIC PATIENTS.

The first objective was to examine the relationship between normal oral nutrition and burn wound

recovery in pediatric burn patients admitted at the Kiruddu National Referral Hospital using the Chi-square test. Biochemical parameters were used to determine burn wound recovery. The results are as follows:

showing chi square results of the relationship between normal oral nutrition and blood cell count.

Showing chi square results of the relationship between normal oral nutrition and biochemical parameters

From the table above, results show that the p-value for all biochemical parameters apart from

WBC day 1, RBC Day 1 and albumin; is p= 0.000. The p-value for WBC day 1 is p= 0.005, RBC Day 1 is p= 0.001 and albumin is p= 0.002. These values are all statistically significant as they are all below the 0.05 level of significance.

3.23. USE OF LIQUID SUPPLEMENTS AND BURN WOUND RECOVERY OF PEDIATRIC PATIENTS.

The second objective of the study was to investigate how the use of liquid supplements contributed to burn wound recovery of pediatric burn patients admitted at Kiruddu National Referral Hospital. Of the 45 pediatric patients that were under study, none received a liquid supplement during the study.

3.24. TUBE FEEDING AND BURN WOUND RECOVERY OF PEDIATRIC PATIENTS.

The third objective was to establish the association between tube feeding and burn wound recovery of pediatric burn patients admitted at Kiruddu National Referral Hospital using biochemical parameters as indicators of burn wound recovery. The Chi-square test was used to determine this. The results are summarized below:

showing Chi-square results of the relationship between tube feeding and blood cell count

showingchi square results of the relationship between tube feeding and biochemical parameters

Apart from WBC day1, RBC day1 and albumin results, the p-value for the rest of the parameters was p= 0.000. The p-value for WBC day1 was p= 0.005, RBC day1 is p= 0.001 and albumin is p= 0.002. All these values are statistically significant as they are all below the 0.05 level of significance.

In the current study, patients on tube feeding developed some complications post burn such as cough, flu, fever, diarrhoea, vomiting, lack of appetite, respiratory distress and breathing difficulties all of which, affected their feeding regimen and reduced the daily intake of food. However, initiation of tube feeding was immediate for 33.33%, after a few hours for 8.33%, after one day for 16.67%, after two days for 25%, after more than a week for 8.33% and unknown for 33%.

Linear regression analysis was also conducted for albumin with normal oral nutrition and tube feeding to assess the strength of relationship. Results showed that the p-value was p= 0.553. This value is insignificant. It shows no conclusion about the relationship between normal oral nutrition and albumin as well as tube feeding and albumin. It indicates that there is a 55.3% chance that normal oral nutrition + albumin = 0, also, that tube feeding + albumin =0.

HYPOTHESIS

In this section, the researcher was interested in testing the study hypothesis so as to either accept or reject the null hypothesis.

the results reveal that there are significant relationships between normal oral nutrition and burn wound recovery ($P< 0.05$) as well as tube feeding and burn wound recovery ($p<0.05$).

All null hypotheses have been rejected because the hypothesis testing yielded p- values which are less than the level of significance 0.05.

Table 3: Total (N=45) Normal oral nutrition (N= 33) and Blood cell count

Type of feeding Normal oral nutrition	WBC	PLT	RBC	Hb
Day 1	N=21, 46.7% P= 0.005	N=13, 28.9%P= 0.000	N=21,46.7%P= 0.001	N=4, 8.8%P= 0.000
Day 2	N=5, 11.1%P= 0.000	N=3, 6.7% P= 0.000	N=5, 11.1% P=0.000	N=2, 4.4% P=0.000

Table 4: Total (N=45) Normal oral nutrition (N= 33) and Blood cell count

Day 3	N=3, 6.7% P=0.000	N=2, 4.4% P=0.000	N=4, 8.8% P=0.000	N=2, 4.4% P=0.000

Table 5: **Normal oral nutrition (N=33) and biochemical parameters**

Type of feeding Normal oral nutrition	Creatinine	Urea	Sodium	Potassium	Chloride
Day 1	N=11, 24.4% P= 0.000	N=10, 22.2% P= 0.000	N=3, 6.7% P= 0.000	N=12, 26.7% P= 0.000	N=8, 17.8% P= 0.000

Table 6: Total (N= 45) Tube feeding (N=12) and Blood cell count

Type of feeding Tube feeding	WBC	PLT	RBC	Hb
Day 1	N=21, 46.7% P= 0.005	N=13, 28.9%P= 0.000	N=21,46.7%P= 0.001	N=4, 8.8%P= 0.000
Day 2	N=5, 11.1%P= 0.000	N=3, 6.7% P= 0.000	N=5, 11.1% P=0.000	N=2, 4.4% P=0.000
Day 3	N=3, 6.7% P=0.000	N=2, 4.4% P=0.000	N=4, 8.8% P=0.000	N=2, 4.4% P=0.000

Table 7: **Tube feeding (N=12) and biochemical parameters**

Type of feeding Tube feeding	Creatinine	Urea	Sodium	Potassium	Chloride
Day 1	N=11, 24.4% P= 0.000	N=10, 22.2% P= 0.000	N=3, 6.7% P= 0.000	N=12, 26.7% P= 0.000	N=8, 17.8% P = 0.000

Table 8: Results of the hypothesis testing

Hypothesis	Test	P- value	Result
H0: There is no significant relationship between normal oral nutrition and burn wound recovery of pediatric patients in KNRH	Chi-square	P= 0.000, 0.001, 0.002, 0.005	Rejected
H0: There is no significant positive relationship between use of liquid supplements and burn wound recovery of pediatric patients in KNRH	Nil	Nil	Nil
H0: There is no positive relationship between tube feeding and burn wound recovery of pediatric patients in KNRH	Chi-square	P= 0.000, 0.001, 0.002, 0.005	Rejected

4. Discussion.

4.1. NORMAL ORAL NUTRITION AND BURN WOUND RECOVERY OF PEDIATRIC PATIENTS.

Overall, the results of the study reflected that the majority (73.3%) of the pediatric burn patients were placed on normal oral nutrition. These results agree with the literature that supports direct oral intake when the patient is conscious, motivated, with an intact appetite and swallowing function, and does not have severe and extensive burns (40%) (Dev, 2020). The study that was carried out using the GRADE methodology (Grade of Recommendation, Assessment, Development, and Evaluation) to evaluate human burn clinical trials between 1979 and 2011 is a good example of this. The recommendations by non-burn specialists included limitation of glucose delivery to a maximum of 55% of energy and 5mg/kg/h associated with moderated blood glucose (target ≤8mmol/L) by continuous infusion and associated trace element and vitamin substitution early on(Medline, nutritional Demands and Enteral Formulas for Adult Surgical Patients"). Also, the non-burn specialists recommended elevated protein requirements of 3g/kg in children. The study concluded that nutritional therapy in major burns has evidence-based specificities that contribute to improving clinical outcome(Rousseau et al., 2013).

The recommended dietary reference intakes for pediatric burn patients are:

1. 7g/kg/day for carbohydrates,
2. 5-4g/kg/day for proteins,
3. 3-15% of caloric goal for fats.

With minerals, children aged 0 to 13 years need 0.8-2.8mg of copper and 12.5-25mg of zinc. For ages ≥13, the daily requirement for copper is 40mg and zinc 25-40mg. Caloric needs of pediatric burn patients can then be calculated using the two pediatric formulas below:

Galvestn

0-1 year 2100(BSA) + 1000 (BSA*TBSA)
1-11 years 1800(BSA) + 1300 (BSA*TBSA)
12-18 years 1500(BSA) + 1500 (BSA*TBSA)

This formula would be ideal as it focuses on maintaining the weight.

Curreri Junior

<1 year RDA + 15 (TBSA)
1-3 years RDA + 25 (TBSA)
4-15 years RDA + 40 (TBSA)

For example, for a 1-year and 8-months old child with 17.5% TBSA, the carbohydrate requirement would be 7+ 15 (17.5) = 269.5kcal the protein requirement would be 4+ 15 (17.5) = 266.5kcal

the fat requirement would be 3+ 15(17.5) = 265.5 kcal

Total energy required for this injured child is = 269.5+266.5+265.5 = **801.5 kcal**

This formula commonly overestimates caloric needs and if used, overfeeding may occur bringing about yet more complications for paediatric

patients. The ideal method for determining energy expenditure would be indirect calorimetry, however, it is not used in routine clinical practice due to its high cost (KK, 2016)

In the current study, paediatric burn patients with both <10% and >20% TBSA were put on normal oral nutrition after having determined their nutritional needs. Although this is so, the researcher found it difficult to determine whether the patients were meeting the recommended daily intakes. This is because the study was conducted at a point in time.

On the contrary, (Noe A. Rodriguez, 2011) strongly suggests that nutrition methods that involve oral alimentation are often unsustainable because of the frequency of altered mental status, inhalation injuries, endotracheal intubation, GI dysfunction, and feeding intolerance seen in burned patients. Further, the authors say that even in the absence of these factors, studies have shown that the use of oral alimentation alone is not ideal, as it can allow patients with 40%TBSA to lose up to a quarter of their pre-admission weight by 21 days post-injury. Oral feedings in severely burned patients are also difficult to sustain because of the large and often intolerable amounts of food necessary to manage severe catabolism(Rodriguez et al., 2011). Data on studies concerning normal oral nutrition as an ideal route for managing burn wound recovery and study parameters used to determine burn wound recovery is scanty.

The findings of the study further confirm a significant association between normal oral nutrition and burn wound recovery by the fact that the p-values (P=0.000, 0.001, 0.002, and 0.005) obtained when data were analyzed were less than the level of significance 0.05. This is statistically significant. Hence normal oral intake improves burn wound recovery. The length of hospital stay was 1 to 96 days among these patients.

4.2. LIQUID SUPPLEMENT USE AND BURN WOUND RECOVERY OF PEDIATRIC PATIENTS.

Out of the population of 45 participants, none of the patients was given a liquid supplement during the study. However, as previously mentioned, a high carbohydrate diet is recommended in acutely ill burn patients irrespective of age (Noe A. Rodriguez, 2011). This is something that requires further research, especially in a hospital setting such as that of Kiruddu National Referral Hospital.

4.3. TUBE FEEDING AND BURN WOUND RECOVERY OF PEDIATRIC PATIENTS.

Tube feeding was given to 26.7% of the study population with a TBSA ranging from 19% to >50%. This agrees with the study that was done by JL Pereira et al (1992) and involved 12 patients (8 males and 4 females) admitted to the burn unit! The percentage of body surface affected by burns was 10% in two cases, between 10 – 30% in three cases, between 30 – 50% in five cases, and over 50% in two cases. Initiation was between twenty-four hours and seven days after the burn injury. The study concluded that tube feeding is a suitable nutritional method for patients with burns, which maintains the nitrogenous balance positive and improves the visceral protein parameters in these patients at an early stage, with very few complications. Given the anticipated metabolic responses to injury, initial enteral feeding at 1.2 – 1.4 times the resting energy expenditure in kcal/m2 per day provides adequate nutrients (Williams FN, 2011). Data on tube feeding and study parameters used to determine burn wound recovery is scanty.

The findings of the study further confirm a positive association between tube feeding and burn wound recovery by the fact that the p-values (P=0.000, 0.001, 0.002, and 0.005) obtained when data were analyzed were less than the level of significance 0.05. This is statistically significant. Hence tube feeding improves burn wound recovery. The length of hospital stay was from 1 to 62 days among these patients.

5. CONCLUSIONS.

5.1. NORMAL ORAL NUTRITION AND BURN WOUND RECOVERY OF PEDIATRIC PATIENTS

Burn injury is on the global agenda (WHO 2018). The findings of this study indicated that normal oral nutrition is the preferred feeding route, especially for burns ≤20 TBSA in fully conscious, motivated pediatric patients whose appetite and swallowing function were still intact. Also, this type of feeding route has a positive effect on burn wound recovery.

5.2. LIQUID SUPPLEMENT USE AND BURN WOUND RECOVERY OF PEDIATRIC PATIENTS.

The researcher could not determine whether the use of liquid supplements contributed to burn wound recovery since none of the 45 participants' patients was given a liquid supplement during the study.

5.3. TUBE FEEDING AND BURN WOUND RECOVERY OF PEDIATRIC PATIENTS.

The study revealed that tube feeding is the preferred feeding route for patients with burns >20% TBSA and those experiencing feeding difficulties. It also revealed that this type of feeding route has a significant positive effect on burn wound recovery outcomes.

5.4. HYPOTHESIS.

There was a significant relationship between normal oral nutrition and burn wound recovery at a $p<0.05$ thus the null hypothesis that there was no significant relationship between normal oral nutrition and burn wound recovery of pediatric burn patients at Kiruddu National Referral Hospital was rejected.

There was a positive relationship between tube feeding and burn wound recovery at a $p<0.05$ thus the null hypothesis that there is no positive relationship between tube feeding and burn wound recovery of pediatric burn patients at Kiruddu National Referral Hospital was rejected.

5.5. LIMITATIONS TO THE STUDY.

The researcher was aware that she would face challenges while conducting this study. These Included;

1. Height and weight measurements were not possible as most of the patients were heavily
2. Bandaged, could not stand or lie in such a manner as to enable this activity.
3. Data collected for the biochemical parameters were not normally distributed as not all patients had tests done

5.6. RECOMMENDATIONS

1. There is a need to carry out a biochemical analysis test that includes transferrin, transthyretin,
2. Magnesium, zinc, and copper as these tests can help in determining the nutrition status of the patients.
3. Further research into the effect of the three enteral feeding routes on burn wound recovery outcomes and study parameters used to determine burn wound recovery is needed.

5.7. CONTRIBUTION OF THE STUDY.

The study has provided up-to-date information about normal oral nutrition, liquid supplement use, and tube feeding among pediatric patients in KNRH. This is because this study has not been done before in Uganda and the East African Region. Normal oral nutrition at 73.3% showed that it is the preferred feeding route for most pediatric burn patients even though it may not be the best. The study provided recommendations which included carrying out tests for particular minerals to determine the nutrition status of pediatric burn patients and suggestions for further research into the subject of feeding routes and burn wound recovery outcomes.

5.8. GENERABILITY.

The study included only caretakers of pediatric burn patients and as such the study findings cannot be generalized to the entire population. A

mixed study should be carried out using a representative sample of both children and adults within Kiruddu National Referral Hospital to provide a better understanding of the topic. Also, to enable the generalization of the results to the entire burn population in Kiruddu National Referral Hospital burns and plastic ward.

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6. List of Abbreviations.

WHO- World Health Organization
UNICEF- United Nations International Children's Emergency Fund
GI- Gastrointestinal Tract
ICU- Intensive Care Unit
TBSA- Total body surface area
TEI- Total energy intake
REE- Resting energy expenditure
IV- Intravenous
GDP- Gross Domestic Product
ANOVA – Analysis of Variance
TPN – Total Parenteral Nutrition
EN – Enteral Nutrition
KNRH- Kiruddu National Referral Hospital
RDA- Recommended Daily Allowance

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