HOSPITAL-BASED DIARRHOEAL DISEASE SURVEILLANCE IN BANGLADESH: URBAN-RURAL DIFFERENTIALS IN MAJOR FINDINGS

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Background

ICDDR,B maintains a Diarrhoeal Disease Surveillance System (DDSS) at its Dhaka (urban) and Matlab (rural) hospitals to monitor emergence of new enteric pathogens, re-emergence of conventional pathogens, changes in antimicrobial susceptibility of common bacterial isolates, and changes in characteristics of patient populations.

Aims

To examine urban-rural differentials in the annual isolation rates and trends in the isolation of common enteric pathogens from diarrhoea patients, antimicrobial susceptibility of V. cholerae and Shigella, and presenting characteristics in children under five years old.

Methods

DDSS of ICDDR,B was established at the Dhaka Hospital in 1979 and was extended to the Matlab Hospital in 1999 to collect information on demographic, epidemiological and clinical characteristics of patients. A systematic 2% sample of patients attending the Dhaka Hospital and all patients attending the Matlab Hospital from the Health and Demographic Surveillance System (HDSS) area of ICDDR,B are enrolled in the DDSS. Using a structured questionnaire, trained personnel interview patients and/or their attendants to collect relevant information including: socioeconomic and demographic characteristics; housing and environmental conditions; feeding practices, particularly of infants and young children; and use of drugs and fluid therapy at home. Information on clinical characteristics, anthropometric measurements, and treatments received at the facilities and outcomes of patients are also recorded. Extensive microbiological assessments of fecal samples (microscopy), culture, and ELISA) are performed to identify diarrhoeal pathogens and to determine antimicrobial susceptibility of bacterial pathogens.

Results

Vibrio cholerae O1 was isolated from 16% of patients in Dhaka and 3% of patients in Matlab in 2008. Stool specimens from diarrhoea patients in Dhaka yielded Shigella from 3% and 9% of the patients at these two hospitals, respectively. The isolation rate of rotavirus was similar (23% vs. 21%) at the Dhaka and Matlab Hospitals. In Dhaka, 68% of the Vibrio cholerae O1 isolates were resistant to tetracycline while 84% of the isolates were resistant in Matlab in 2008. However, all (100%) Vibrio cholerae O1 isolates in Dhaka were resistant to erythromycin compared to 84% in Matlab. In Dhaka, a rising trend in isolation of Vibrio cholerae O1 was noted while a declining trend of the same enteropathogen was observed in Matlab. In Dhaka, consistently high isolation of rotavirus was reported for the last few years while a reduced isolation rate of rotavirus was observed for last 3 years in Matlab in children under 2 years. Shigella detection rates are declining in Dhaka while they are rising in Matlab. Urban children under five were significantly more malnourished and less immunized than their rural counterparts.

Conclusions

The factors contributing to different isolation rates of pathogens, and childhood malnutrition in urban and rural settings need to be identified to better understand the epidemiology. Our findings also highlight the fact that establishment of a surveillance system might not provide data representative of the population at large, and there is a need for establishment of surveillance system at strategic locations in a country.

CASELOAD IMPLICATIONS OF 2006 WHO CHILDGROWTHSTANDARDSFORCHILD HEALTH & NUTRITION PROGRAMMES TREATING WASTED INFANTS AGED <6 MONTHS: SECONDARY DATA ANALYSIS OF 21 DHS DATASETS

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Background

Treating wasted infants aged <6 months old (infantU6m) is challenging. One problem is lack of background disease-burden data. Programmes cannot easily know population coverage,; whether individual or public-health strategies are appropriate, and ; whether they these approaches are making an impact. Better defined epidemiology of infantU6m wasting is important.

Aims

To describe the prevalence of wasting among infantU6m in nutritionally vulnerable settings and examine the influence of 2006 WHO Child Growth Standards (WHO-GS) compared to National Centre for Health Statistics (NCHS) growth references.

Methods

Secondary analysis was carried out on 21 representative developing country Demographic and Health Survey (DHS) country datasets . Data were available for 15,534 infantU6m and 147,694 children aged 6-<60m (mean per country: 7,773, range: 1,710-45,398). Severe wasting was defined as weight-for-height (WHZ)<-3. Moderate wasting was defined as WHZ≥-3 to and <-2 (NCHS or WHO-GS). Regression lines were calculated to illustrate the magnitudes of change from NCHS to WHO-GS for infantU6m and children. Population data from the UN World Population Division was used to explore how changes might manifest in terms of numbers eligible for selective feeding programmes.

Results

Using NCHS references, country infantU6m wasting (WHZ<-2) prevalence ranges from 1.1%-15.0% (mean 6.6%) in the countries examined (equivalent to 3.7 million wasted infantU6m worldwide). Using WHO-GS, prevalence increases, ranging from 2.0%-34.1% (mean 18.4%, equivalent to 10.3 million wasted infantU6m worldwide). Taking the slope of NCHS-WHO regression lines to illustrate magnitudes of change, country prevalence of severe infantU6m wasting increases 3.54-fold and moderate wasting increases 1.43-fold using WHO-GS z-scores rather than NCHS z-scores. This compares to 1.68-fold and 0.86-fold changes for severe and moderate wasting in children aged 6 to <60m.

Conclusions

Wasting among infantU6m is prevalent. Transition to the WHO-GS significantly increases the numbers eligible for feeding programme admission. This represents important opportunities to treat more infantU6m and move towards realising MDG4. However, there are also considerable risks,

including treatment programmes designed for older age-groups becoming overwhelmed, and of efforts to treat (e.g. early complementary feeding), undermining or failing to adequately support establishment of exclusive breastfeeding as a treatment outcome. Policy makers and programme managers should plan for these changes and consider the how to minimise risks and maximise benefits.

BREASTFEEDING VERSUS OTHER FEEDING IN RELATION TO MICRONUTRIENT AND ENTEROPATHOGEN IN BANGLADESHI CHILDREN WITH ACUTE DIARRHOEA

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Background

The nutritional status of infants largely depends on their feeding practices. There is inadequate information about the relationship between recovery from diarrhoea and nutritional status, diarrhoeal pathogens, and feeding practices or micronutrient status of young children hospitalized for acute diarrhoea.

Aims

To assess the relationships of dietary pattern with nutritional status, micronutrient status and bacterial pathogens in young children with acute diarrhoea.

Methods

Two hundred and nine children between 4 and 24 months of age with fewer than 3 days of diarrhoea were randomly selected from Dhaka Hospital of the ICDDR,B on their admission day. Feeding practices of the subjects were recorded during an interview of their caretakers. Nutritional status was assessed with standard anthropometric measurement. Diarrhoeal pathogens were isolated by microbiological assay and serum zinc and vitamin A were assayed using biochemical analysis.

Results

Twelve percent of the children were exclusively breast-fed, 10% were fed formula, 37% were fed breast milk and formula, 14% were fed rice gruel with powder milk, and 27% were fed the family diet along with milk. Breast feeding rate was 67% and 28% in the infants below 5 months and children above 1 year, respectively. Sixteen percent of the illiterate mothers exclusively breast fed their infants compared to 7% of mothers above primary education ($p=0.01$). 15% of the poor mothers exclusively breast fed their infants compared to 7% of the middle class mothers ($p=0.01$). Serum zinc and Retinol Binding Proteins (RBP) of the exclusively breastfed babies were higher compared to those of formula-fed infants. Stool pathogens were isolated from 67% of the subjects. Exclusively breastfed infants had fewer bacterial pathogens than non-breastfed subjects (12% vs. 25%). On the other hand, rotavirus was more frequently isolated from breastfed subjects. Fifty three percent of the study children were moderately malnourished (≤75% of wt/age of NCHS median). The results of the study suggested that children's age, mother's education and socioeconomic status had a negative relationship with breast-feeding and nutritional status.

Conclusions

Exclusive breast-feeding was associated with fewer bacterial pathogens and higher serum zinc and retinol level among the young infants who presented with diarrhoea.

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INFANT AND YOUNG CHILD FEEDING BEHAVIORS DURING AND AFTER ILLNESS IN MALAWI

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Background

Acute and chronic illnesses and inadequate feeding practices are among the principal causes of malnutrition in children. Illness does not result in chronic malnutrition when children are well-fed before, during, and after illness.

Aims

To gain an understanding of infant and young child feeding practices, including during and after illness.

Methods

The study employed a consultative research design in which qualitative data were collected from mothers of well and sick infants and young children 6–23 months of age. In-depth home interviews and observations were conducted with 60 mothers from the three regions of Malawi to determine what and how they were feeding their children.

Results

All mothers said that the illness itself was the most important factor affecting appetite in children who stop eating during illness. Some mothers only breastfeed their babies during illness while others offer other foods to the child. Mothers reported that maize porridge, rice, and biscuits are foods that are good for sick children. Foods to avoid include carbonated drinks, cassava leaves with sodium bicarbonate, raw cassava and sweet potatoes, roasted maize, eggs, and cold foods. Taking the child to the hospital to correct illness was mentioned by some mothers as an important way to improve appetite when the child is ill.

When asked if they feed their infants more, less, or the same when the child has recently recovered from an illness, about one-quarter of mothers said they feed more or more frequently and about one-quarter said they feed the same amount and types of food. A few mothers reduce the food children receive after the illness and gradually increase it thereafter. Other mothers add ingredients to increase the energy density of the normal diet. Only a few mothers said the reason they feed more after illness is so their babies "gain weight."

Conclusions

Increasing knowledge about optimal infant and young child feeding practices during and after illness is an important strategy for reducing malnutrition in Malawi.

MOLECULAR GENOTYPING OF CRYPTOSPORIDIUM ISOLATES FROM CHILDREN IN KUWAIT WITH DIARRHOEA

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Background
Cryptosporidiosis is recognized worldwide as a significant cause of diarrhoeal diseases in both adults and children, especially those less than 2 years of age.

Aims
Cryptosporidium spp. isolated from young children in Kuwait was characterized at the molecular level to understand the transmission of infection.

Methods
Over a period of 2 years, fecal specimens from 97 Kuwaiti children with persistent diarrhoea, which were found to be positive for Cryptosporidium spp. by microscopy, were genotyped and sub-typed with a small subunit rRNA-based PCR-restriction fragment length polymorphism analysis. Informed consent was taken from all individuals included in the study.

Results
The median age of infected children was 4.9 years, and the majority of the infections (>70%) occurred during the cooler months (January to April), indicating a marked seasonal variation. More than 85% of the children with cryptosporidiosis had only Cryptosporidium infection. Socio-demographic information did not reveal any particular mode of transmission of infection. Genotyping of the organisms isolated showed that ninety-five (95%) of the children had C. parvum, 4 (4%) had C. hominis, and 1 (1%) had both C.parvum and C. hominis. Altogether, 9 subtypes of C.parvum and C. hominis were observed.

Conclusions
Our study revealed a very different distribution of Cryptosporidium genotypes in Kuwaiti children compared to other tropical countries. The genotypes and subtypes isolated are discussed with relation to the seasonality and possible mode of transmission of this infection in Kuwait.

A RETROSPECTIVE STUDY OF CRYPTOSPORIDIUM DIARRHOEA IN A REGION WITH A HIGH HIV PREVALENCE

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Background
Cryptosporidium has emerged as an important cause of diarrhoea in children. No data are available describing cryptosporidial diarrhoea in the Western Cape Province of South Africa.

Aims
The aim of this study was to describe cryptosporidial diarrhoea in children presenting to Tygerberg Children's Hospital, a referral hospital in the Western Cape, South Africa.

Methods
A retrospective review was performed of patients presenting to Tygerberg Children's Hospital with diarrhoea and cryptosporidium detected in the stool from June 2004 to April 2005. Demographic details, duration of hospitalisation, mortality, HIV status and long term outcome of HIV infected children were recorded. Data are summarised with means and standard deviations or medians where appropriate. Medians were compared with the Mann- Whitney U Test. Categorical data were compared with the Chi-squared test.

Results
Cryptosporidium was found in 90 stool specimens of 63 children younger than 18 years. Thirty-nine (62%) were male. The mean age was 18.7 months (sd 17 months). Fifty-two (83%) were younger than 2 years. Thirteen children were HIV positive, 19 were HIV negative, and the HIV status of 31 was not determined.

There were eight deaths related to the cryptosporidium infection. Four were known to be HIV infected (all were also severely malnourished). The median CD4 count (percentage of total lymphocyte count) of survivors was significantly higher than that of those who died (28 % vs 12.5%, p 0.033). Two of the remaining 4 children who died were also malnourished.

Forty-eight children required hospitalisation and 15 were treated as outpatients. The median duration of hospitalisation for HIV infected children was significantly longer than for children not infected with HIV or of unknown status (18 days vs 8.5 days, p =0.018). Records were available for 8 of 9 surviving HIV infected children (median follow-up period 27 months (range 0.4- 39 months)). All except one received HAART. No patient developed signs suggestive of cholangiopathy.

Conclusions
The mortality and morbidity of cryptosporidium diarrhoea is high. Most deaths occur in HIV-infected or malnourished children. The majority require hospital admission. There was no evidence of cholangiopathy in HIV infected survivors receiving HAART.

A REVIEW OF BACTERIAL INFECTIONS IN MALNOURISHED INFANTS AGED UNDER 6 MONTHS: IMPLICATIONS FOR CASE MANAGEMENT IN DEVELOPING COUNTRIES

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Background
Management of severe acute malnutrition (SAM) in infants aged <6 months (infantsU6m) is challenging. One cause of excess mortality is infection. Optimizing antimicrobial therapy has the potential to improve outcomes.

Aims
To review whether current guidelines (many recommending amoxicillin as initial therapy) are consistent with current evidence on underlying infection in infantsU6m SAM.

Methods
We searched MEDLINE & Embase databases for studies reporting on the prevalence of bacterial infection in malnourished infantsU6m. Differentiating urinary tract infections (UTI), pneumonia and septicaemia, we examined all available data on causative organisms and antibiotic sensitivity patterns.

Results
Many studies identified were old, and few focused exclusively

on malnutrition. Only one reported on infantsU6m. The rest presented aggregate data on infants and children of varying ages and varying nutritional status. Prevalence of UTI in 14 studies ranged from 3.3-38%. Of 197 positive cultures, 51.8% were E.coli, and 17.3% Klebsiella sp. Gram negative bacteria accounted for 92.4% of isolates. Prevalence of pneumonia in 10 studies ranged from 11-63%. Of 167 isolates, 61.1% were Gram negative bacteria. Staphylococcus aureus made up the majority of Gram positive isolates(21.6%). Prevalence of bacteraemia ranged from 5.5-36%. Commonest organisms were Salmonella sp.(20.3%), Staphylococcus aureus (12.6%), Klebsiella sp.(12.3%), E.coli (12.1%) and Streptococcus pneumoniae (10.5%). Outcomes in malnourished children with bacteraemia were poor; CFR ranges were reported as 13-78% and 22-31% compared to 5-11% in non-bacteraemic children. Younger children were more at risk of bacteraemia in one study; children <1 year had a RR of 1.77(CI 1.43-2.18) of bacteraemia relative to older children. Of the studies reviewed, median in vitro sensitivity of isolates was 24% for amoxicillin and 25% for ampicillin.

Conclusions

Evidence to support the choice of antibiotic protocol infantsU6m SAM is limited. Interim guidelines can be based extrapolation from closely related patient groups like malnourished children and non-malnourished infants. Reports of low sensitivity to current 1st line antibiotics suggest that antibiotic use in infantU6m SAM urgently need to be reviewed. To inform future guidelines and intervention strategies, directly applicable and up-to-date studies are needed, notably RCTs of different antimicrobial regimes. These would offer far stronger evidence than currently available from observational studies.

PRESENTATION AND TREATMENT RESPONSES AMONG HIV-INFECTED AND UNIFECTED CHILDREN WITH SEVERE MALNUTRITION

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Background

HIV infection and exposure makes a significant contribution to the burden of childhood malnutrition in sub-Saharan Africa. Case fatality rates are reported higher in HIV infected children. It is however unclear which, if any, components of anti-microbial, supportive, or nutritional care may need to be specifically tailored for HIV-infected children.

Aims

To compare the clinical presentation, invasive bacterial species and antimicrobial resistance profile, co-morbidities, rates of weight gain, episodes of diarrhoea, duration of rehabilitation and outcome among HIV-infected and uninfected children with severe malnutrition.

Methods

Children aged 6 months to 5 years admitted to Kilifi District Hospital, Kenya from 2005 to 2008 with weight for height z score<-3 or MUAC <11cm or kwashiorkor were included. Standardized clinical data plus a blood culture, HIV rapid test, full blood count and malaria slide were collected at admission. Daily progress and clinical signs were recorded.

Results&Conclusions

Approximately 20% of children with severe malnutrition were HIV-infected. Clinical features at presentation, microbial species and sensitivities of blood cultures, co-morbidities, weight gain, occurrence of persistent and/or secondary diarrhoea, survival curves and multivariable analysis of the effect of HIV infection will be presented.

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THE ROUTINE USE OF ANTIBIOTICS DOES NOT IMPROVE OUTCOMES IN THE HOME-BASED TREATMENT OF SEVERE ACUTE MALNUTRITION

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Background

The treatment of severe acute malnutrition in children with ready-to-use therapeutic food has become the standard of care although controversies continue to exist regarding the optimal means of implementation.

Aims

To determine if the routine inclusion of antibiotic therapy improves outcomes in the home-based treatment of severe acute malnutrition with ready-to-use therapeutic food.

Methods

This retrospective cohort study compared longitudinal data from the treatment of two groups of children in rural Malawi aged 6-60 months presenting with uncomplicated severe acute malnutrition. One group received a 7 d course of amoxicillin at the onset of treatment according to the standard protocol in Malawi. The other group was not prescribed any antibiotics. All children were treated at home with ready-to-use therapeutic food. The primary outcome of this study was recovery, defined as weight-for-height z score (WHZ) > -2 and no edema. Cox regression modeling using time as a covariate assessed the longitudinal effects of initial differences in the patient population on recovery.

Results

2364 children were included in this study; 514 children were treated according to the standard protocol and 1850 were treated without antibiotics. The two study populations differed in that the standard protocol group was more wasted and less likely to have edema. After 12 weeks, the proportion of children in the standard protocol group who recovered was lower (84%) than those in the no antibiotic group (88%) (P = 0.02). Regression modeling indicated that recovery was associated with not receiving amoxicillin.

Conclusions

These preliminary results suggest that routine antibiotics may not be useful in the treatment of uncomplicated severe acute malnutrition. A randomized, placebo-controlled trial is necessary to definitively determine the effect of antibiotics on recovery from uncomplicated malnutrition with home-based therapy.

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(24.2% in placebo group), which RIX4414 reduced by 25.1% (95%CI:4.7–40.8).

Conclusions

Children in Malawi experience a high rate of severe RVGE during the first year of life caused by a wide diversity of RV strains. RIX4414 reduced severe RVGE episodes by half and all-cause severe GE by a quarter. Rotavirus vaccination is expected to have a major public health impact in Malawi and other developing countries with high rotavirus and diarrhoeal disease burden.

THE ENHANCED DIARRHEAL DISEASE CONTROL INITIATIVE

Evan Simpson, MPH

Background&Aims

In June, 2009 the World Health Organization's Strategic Advisory Group of Experts (SAGE) recommended the inclusion of rotavirus vaccination into all national immunization programs. Concluding their recommendation, SAGE stated:

"Use of the (Rotavirus) vaccine should be part of a comprehensive strategy to control diarrhoeal diseases and should include, among other interventions, improvements in hygiene and sanitation, zinc supplementation, community-based administration of oral rehydration solution and overall improvements in case management." (Weekly Epidemiological Record, 5 June, 2009)

In this presentation, participants will learn of a comprehensive strategy to control diarrhea by stimulating awareness and demand for new interventions, including rotavirus vaccine, zinc treatment, and low-osmolarity oral rehydration solution, while also expanding coverage of established interventions such as breastfeeding. This program, the Enhanced Diarrheal Disease Control Initiative (EDD), addresses the policy and implementation challenges of scaling-up new interventions through a comprehensive approach.

The scientific achievements leading to the development of rotavirus vaccines, zinc treatment and low-osmolarity ORS signals the potential for a new era in diarrheal disease control. However, these interventions must be made relevant and accessible to the public health agenda of developing countries. Doing so requires stimulating demand, updating policies, and ensuring availability.

EDD is one potential mechanism for advancing evidence around these new interventions in the context of public health impact. In this presentation the audience will learn of the formative research that lead to the development of EDD and some preliminary outcomes from pilot projects in Asia and Africa.

Methods

This project utilized qualitative research surveys for hypothesis testing and which informed the development of this advocacy, policy and communications strategy to advance new interventions for diarrheal disease control.

Results

Pilot projects in Vietnam and Kenya have achieved significant changes in policies and protocols necessary for the eventual uptake of new interventions for diarrheal disease control.

Conclusions

A portfolio or coordinated approach to introducing several new interventions for diarrheal disease appears to be effective in stimulating policy and protocol changes leading to adoption.

GLOBAL UPDATE ON THE STATUS OF ROTAVIRUS VACCINES

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Background

In 2006, two new rotavirus vaccines were found to be safe and efficacious in large clinical trials in Europe and the Americas and subsequently were introduced into the immunizations programs of several countries. In 2009, based on early promising results of vaccine trials in Africa and Asia, the World Health Organization extended its recommendation for use of rotavirus vaccines to all countries globally. This presentation will review the status of rotavirus vaccines worldwide including results of post-introduction monitoring to assess vaccine effectiveness, impact, and safety and will discuss challenges to vaccine introduction.

Methods

A review of published and unpublished data regarding rotavirus vaccine effectiveness, the impact of vaccination on disease burden, and the status of introduction of rotavirus vaccines globally will be presented.

Results

Post-introduction data from the Americas suggest that rotavirus vaccination is highly effective and safe in preventing severe rotavirus disease. Early data from clinical trials in Africa suggest that rotavirus vaccination will also prevent substantial disease in developing countries. However, challenges to vaccine introduction still exist including lack of data on interaction with other EPI vaccines, especially OPV, and safety issues such as the risk of intussuception and administration to HIV-infected infants. Issues such as supply and price of the vaccine and equity of distribution of these new vaccines also need to be addressed.

Conclusion

Rotavirus vaccines have great potential to reduce the substantial global burden of rotavirus disease. Additional data is needed to fully quantify the impact of rotavirus vaccination programs but these data will become available as additional countries introduce vaccine.

IMPACT OF DOUBLE SUPPLEMENTATION ZINC-VITAMIN A ON MORBIDITIES AMONG YOUNG CHILDREN IN BURKINA FASO: A RANDOMIZED, DOUBLE BLIND, PLACEBO-CONTROLLED INTERVENTION

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Background
Zinc and vitamin A are essential micronutrients required for normal immune system functioning and can help build resistance to infections, including diarrhea, pneumonia, and possibly malaria.

Aims
To assess the impact of the double supplementation zinc-vitamin A on the morbidity and nutritional status among preschool children in Burkina Faso.

Methods
We used a randomized, double blind, placebo-controlled intervention trial. 320 healthy children aged 36–60 months were randomly assigned to one of two intervention groups: 10 mg Zn/6d/week plus 200.000 IU vitamin A for the supplemented group and zinc placebo plus 200.000 IU vitamin A for the placebo group. Children had daily follow-ups to assess morbidity, including malaria and diarrhea, with detection and recording over a period of six months. Microscopic examination of blood smears was done in the case of fever (T ≥37.5ºC) for malaria detection. The profile of malaria immunoglobulin G (IgG) anti-msp1 and IgG anti-csp was assessed in the two intervention groups using ELISA method. Anthropometric data were performed at baseline and at the end of the study in two cross-sectional surveys, and were were transformed into z-score indexes. Plasma zinc was used to assess zinc status.

Results
A total of 268 children completed the study. The double supplementation permitted a significant reduction of anemia cases from 18.0 to 5.4% (p 0.05). Malaria and fevers attacks were, respectively 23% (p=0.009) and 13.3% (p<0.001) lower in the supplemented group. In the supplemented group, a significant increase of the IgG anti csp (p=0,034) and IgG anti msp1 (p=0,008) was noted. Additionally, the supplementation permitted a significant improvement of children's linear growth relative to the placebo group (0.50 vs 0.39 cm/mo; p<0.0001). We also found a reduction from 35.31% to 10.17% cases of zinc deficiency in the supplemented group, but found no significant difference relative to placebo group (p< 0.28).

Conclusions
Zinc supplementation and adequate vitamin A status improves the immune system, and thus, may protect against some diseases such malaria and anemia and help to resolve nutritional deficiencies in low income countries.

STABLE ISOTOPE TECHNIQUE TO ASSESS BREASTFEEDING DURING EARLY LIFE IN BURKINA FASO

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Background
Following WHO recommendations, the current guidelines recommend exclusive breast-feeding for at least 6 months of age in Burkina Faso, but few women exclusively breast-feed beyond 4 months. Many questions remain today; at what time do maternal prenatal nutrients stores become depleted, for exclusively breast fed infants? What may be the optimal duration of exclusive breast-feeding in our context? The technique of administering deuterium oxide (D2O) doses to the mother offers an accurate measure of maternal body composition and milk intake.

Aims
To evaluate the national breast-feeding program in order to establish the exclusive breast-feeding practice rates in Burkina Faso.

Methods
We recruited 24 mother/baby pairs within 7 days after delivery in a rural health centre of "Valley du Kou" village, located at 25 km from Bobo-Dioulasso. Anthropometry, clinical data, and saliva samples were collected at the inclusion date (M0), 2nd month (M2), 4th month (M4) and 6th month (M6). At these scheduled follow-up times, saliva samples were collected before and after D2O dose administration (30 ml) to the mother (D0, D1, D3, D4, D13 and D14). The body composition, breast milk and other liquid intake were measured using the FTIR techniques.

Results
This report concerns only the data of the M0. The average intake of breast milk was 498.08 mL (107.00 mL, 816.00 mL). 17 women breastfed exclusively. The average proportion of mother's fat-mass tissue was 21.7% (9.0%, 39.5%).

Conclusions
Few women breastfed exclusively; other liquids are introduced into babies' diets at an early stage of life. The stable isotope technique is a helpful tool for the breastfeeding program assessment and could be used to determine effective implementation in Burkina Faso.

IRON DEFICIENCY AND RISK OF INFECTION IN YOUNG MALAWIAN CHILDREN

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Background
A major unresolved concern that may influence iron deficiency control strategies is the interaction between iron

status, iron supplementation and susceptibility to infection. There are two main postulates: firstly that iron deficiency (ID) aids immunity (the 'nutritional immunity' hypothesis), and secondly that it hinders host defence against infection.

Aims
To assess the risk of infection in iron deficient Malawian children.

Methods
Children presenting to hospital with an Hb <5g/dl were recruited as cases of severe anaemia, children attending for all other reasons apart from severe anaemia were recruited as hospital controls[HC]; and children residing in same area as an anemia as community controls[CC]) in two districts in southern Malawi. We measured the prevalence of iron deficiency, bacteraemia, malaria, and HIV infection at recruitment.

Results
A total of 1161 children (381 cases, 377 HC, 380 CC) were recruited. The prevalence of iron deficiency among cases (49%) was much lesser than HC (68%) or CC (75%). There was a significant decrease in prevalence of ID with age in all groups. However there was a non-significant association between ID and bacteraemia, malaria or HIV infection by study groups.

Conclusions
It appears that children presenting with severe anaemia are less likely to have ID which is in agreement with the nutritional immunity theory. This has important implications of iron supplementation in the management of severe anaemia in children.

Plenary Presentation

THE INTERNATIONAL LIPID-BASED NUTRIENT SUPPLEMENTS PROJECT (ILINS PROJECT)

Professor Ken Maleta (on behalf of the iLiNS research Project group)

BACKGROUND
In recent years there has been great success with the use of novel lipid-based fortified foods such as Plumpy'nut® for treating severely malnourished children. The next step is to make it cost-effective to use similar products, but with a much lower daily ration, to prevent malnutrition. Our research consortium adopted the term lipid-based nutrient supplements (LNS) to refer generically to the range of products in which multiple micronutrients are embedded in a lipid-based food product. The daily ration of LNS can range from as little as one teaspoon (5 g, ~25 kcal) (e.g. "Grandibien", being marketed in Niger) to more than 200 g/day (e.g. Ready-to-Use-Therapeutic Foods (RUTF) such as Plumpy'nut®, used for treating severely malnourished children. The daily ration of LNS and its micronutrient composition can also be adapted depending on the needs of the target population. Although most of the LNS products to date have included peanut butter, there are alternative formulations without peanuts. Thus, there is great flexibility in the choices of LNS products that can be used for a given program or for retail sale.

We have pioneered the use of LNS for home fortification of complementary foods in Ghana and Malawi respectively, and our results suggest that this approach increases linear growth of infants, normalizes their gross motor development, and prevents severe stunting, effects that have not been demonstrated with micronutrient supplements alone. We believe that there is also great potential for using LNS to improve nutritional status of pregnant and lactating women, and thereby also enhance their children's growth and micronutrient status. In addition, a food-based approach such as LNS offers the possibility of local economic benefits via purchase of locally grown ingredients and product distribution and sales. For these reasons, we believe that the LNS approach represents a potential breakthrough in nutritional strategies to prevent malnutrition.

OBJECTIVES:
The goal of the International Lipid-based Nutrient Supplement Project (iLiNS Project) is to contribute to the reduction of maternal and child undernutrition by providing an evidence base for the use of lipid-based nutrient supplements in low-income populations. This will be addressed by answering 5 key questions

1) How to adapt LNS formulations to the nutrient composition of locally available vegetable oils
2) How to reduce cost, while maintaining the benefit for linear growth, by modifying the ingredients and daily ration size of LNS for infants and young children
3) How much zinc to include in LNS to achieve the desired effects on growth and functional outcomes for infants and young children
4) To what extent can LNS provided to pregnant and lactating women improve maternal nutrition, birth outcomes and child growth
5) How to make LNS an economically feasible approach for preventing malnutrition, by determining how much populations are willing to pay for LNS, the cost-effectiveness of LNS, and efficient delivery systems

METHODS
The project entails a series of clinical trials in three African countries ranging from testing the acceptability of the reformulated products; efficacy of products for children and pregnant and lactating mothers; efficacy of formulations containing zinc and economic studies of LNS use. Additionally to influence policy, the project has an advocacy component which entails coordination meetings and production of a technical LNS document.

Collaborators
This project is a joint effort of the University of California, Davis, the University of Tampere (Finland), the University of Malawi, the University of Ghana, the Institut de Recherche en Sciences de la Santé (Burkina Faso), Nutriset (France), Project Peanut Butter (Malawi) and Helen Keller International made possible with generous grant to the University of California by the Bill and Melinda Gates Foundation. The project started in January 2009 and will continue until December 2013.

Project Team
The iLiNS research group includes Seth Adu Afarwuah, Lindsay Allen, Per Ashorn, Ulla Ashorn, Kenneth Brown, Kathryn Dewey, Sonja Hess, Anna Lartey, Kenneth Maleta,

Mark Manary, .Jean Pierre Bosco Ouedraogo, John Phuka, Stephen Vosti and Mamane Zeilani

OUTPATIENT TREATMENT OF SEVERE ACUTE MALNUTRITION AS A ROUTINE PART OF PRIMARY HEALTH CARE ACTIVITIES IN LUSAKA ZAMBIA.

S Collins, A Hailu, PD Kabi, N Dent, C Muleya, B Amadi, MO Bachmann, S Mollison

Background/Aims

Severe acute malnutrition (SAM) currently affects about 13 million children under five years old worldwide and is associated with 1-2 million preventable child deaths each year. Community-based Therapeutic Care (CTC) is a new model of care that treats most cases of severe acute malnutrition solely as outpatients. The model has proved to be highly effective in emergency settings when implemented by Non-Governmental Organisations and has recently been endorsed as the recommended model for the treatment of SAM by the United Nations. However, there is little data about non-emergency situations, where CTC is implemented as part of standard primary health care. This study describes the outcomes of a CTC programme implemented over a 25 month period by the Lusaka District Health Management Team with minimal external support.

Methods

A prospective cohort study within a CTC programme was implemented in 12 government clinics in Lusaka. Data were collected from the clinical records of 2860 admission events of children aged 6 -59 months admitted into to the programme with marasmus, kwashiorkor or marasmic kwashiorkor between September 2005 and September 2007. Outcomes were recovery, mortality, default, discharge, transfer to hospital, and length of stay.

Results

Of 2523 recorded exits from the programme 1865 (73.9%) patients recovered, 65 (2.6%) died, 150 (5.9%) were referred to hospital, 8 (0.3%) were discharged unrecovered and 435 (17%) defaulted.

Conclusions

The outpatient management of SAM in this context produces outcomes that exceed international standards for the treatment of SAM and can be effectively integrated into urban primary healthcare services in resource poor countries. However, difficulties in logistics and ongoing community mobilisation activities are considerable barriers to implementing such programmes in the long term. The intervention was highly cost-effective in terms of cost, lives saved, and DALY gained.

PROBIOTIC/PREBIOTIC-ENHANCED THERAPEUTIC FOOD FOR TREATMENT OF SEVERE ACUTE MALNUTRITION IN A HIV PREVALENT SETTING:

A DOUBLE-BLIND EFFICACY RCT IN MALAWI

M.Kerac J.Bunn A.Seal M.Thindwa A.Tomkins K.Sadler P.Bahwere[6] S.Collins

Since original submission to the CAPGAN meeting, the full report of this research has been published as a paper whose full reference is: Kerac M, Bunn J, Seal A, Thindwa M, Tomkins T, Sadler K, Bahwere P, Collins S. Treatment of Severe Acute Malnutrition (SAM) using probiotic/prebiotic-enhanced therapeutic food in a HIV prevalent setting: A double-blind efficacy RCT in Malawi(The "PRONUT study" ~ PRObiotics in malNUTrition) – The Lancet, Vol 374, Issue 9684, p 136 to 144, 11th July 2009. doi:10.1016/S0140-6736(09)60884-9 http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(09)60884-9/abstract

Background/Aims

Severe Acute Malnutrition (SAM) is a global public health priority affecting 13 million children worldwide and causing 1-2 million deaths per year. Aims were to determine the clinical and nutritional efficacy of a probiotic/prebiotic functional food (Synbiotic2000ForteTM) for treating SAM in a HIV prevalent setting.

Methods

From July 2006 to March 2007, 795 Malawian children were enrolled in a randomised, double-blind, placebo controlled efficacy study. All SAM admissions to the nutrition ward of a large referral hospital were eligible. After stabilization with milk feeds, children were randomised to Ready-to-Use Therapeutic Food(RUTF) with or without Synbiotic. The average prescribed Synbiotic dose was ≥1010 colony-forming-units lactic acid bacteria/day for duration of treatment (median 33 days).

The primary outcome was nutritional cure (weight-for-height >80% of NCHS median on two consecutive outpatient visits). Secondary outcomes included death, weight gain, time to cure, and prevalence of diarrhoea, fever or respiratory symptoms.

Results

Groups were wellmatched at baseline. Outcomes were similar: 53.9%(215/399) cure in Synbiotic patients, 51.3%(203/396) in controls($p=0.40$). Other secondary outcomes were also similar($p>0.05$), including total deaths (27.1%(108/399) Synbiotic deaths vs. 30.0%(119/396) control deaths ($p=0.31$)). HIV seropositivity was associated with worse outcomes, but it did not confound the overall negative results. Subgroup analyses showed possible trends towards reduced late mortality. There were no group differences in initial inpatient deaths ($p=0.38$). Deaths throughout the remainder of the study were 47/338(13.9%) in the Synbiotic group and 67/344(19.4%) in controls ($p=0.05$). There were no occurrences of probiotic-associated sepsis and no excess probiotic-associated mortality in the HIV seropositive group.

Conclusions

In our setting, Synbiotic2000 ForteTM, did not improve SAM outcomes. Explanations other than no effect include: deaths from causes unaffected by Synbiotic actions, organism sensitivity to cotrimoxazole antibiotics, Synbiotic sharing or cross-infection between children, and suboptimal dose/dose

regime. The observation of reduced outpatient mortality may be due to bias, confounding variables or chance, but it is biologically plausible and has potential for public health impact.

EFFICACY OF A STANDARDIZED PROTOCOL USING LOCAL DIET DURING NUTRITIONAL REHABILITATION OF SEVERELY MALNOURISHED CHILDREN IN BANGLADESH

MM Islam T Ahmed B Nahar M Ali GG Fuchs RM Suskind

Background

Adequate catch-up growth of severely malnourished children requires feeding with diets that are nutritious, inexpensive, easy to prepare, and culturally acceptable. Locally available diets for nutritional rehabilitation (NR) are less expensive and sustainable. A standardized diet protocol (SDP) was developed based on such diets for improving catch-up growth during NR.

Aims

To assess the efficacy of a standard protocol using local diets for management of severe acute malnutrition in children.

Methods

Severely malnourished children with diarrhea and other acute illnesses were managed according to a treatment protocol based on WHO guidelines. After completion of acute phase of management, children aged 6-60 mo underwent nutritional rehabilitation when the SDP based on khichuri, halwa, and a milk-cereal diet were used. The amount of milk-cereal diet was gradually reduced such that the children were mostly on khichuri and halwa at the time of discharge. Multivitamins, zinc and iron were also given. The Nutrition Rehabilitation Unit (NRU) is located at the Dhaka Hospital of (ICDDR,B).

Results

From June 1996-December 2003, 1,712 severely malnourished children were managed in the NRU. Criteria for admission included improvement in general condition following care in the longer-stay ward and having any of the following nutritional indexes: weight-for-length <70% of NCHS median, weight-for-age <50% or bipedal edema. For statistical analysis, children were divided into groups based on their daily body weight gain (g/kg/d), group A (≥ 5.00 g/kg/d) and group B (0-4.99 g/kg/d). Eighty-one percent of the children had a body weight gain ≥ 5.00 g/kg/day. Overall, the children required a median of 12 (IQR 8,18) days to achieve a odema-free weight-for-length >80%. Logistic regression analysis shows that each unit less in weight-for-height/length z-score on admission of children who did not have oedema on admission, did not become ill during rehabilitation phase, stayed at NRU for more than 12 days, and completed the usual rehabilitation at the NRU, correlated with a higher probability of poor weight gain.

Conclusions

The use of a standardized diet protocol based on locally prepared and culturally appropriate diets is an efficacious and sustainable method of nutritional rehabilitation of severely malnourished children.

SUPPLEMENTARY FEEDING WITH LIPID BASED NUTRIENT SUPPLEMENT BUT NOT CORN/SOY BLEND IMPROVES WEIGHT GAIN AMONG MODERATELY UNDERWEIGHT CHILDREN: A RANDOMISED CONTROLLED 12-WEEK TRIAL IN RURAL MALAWI

C Thakwalakwa, P Ashorn, J Phuka, Y Cheung, A Briend, M Kataja, T Puumalainen, K. Maleta

Background

Poor growth and early childhood undernutrition, especially between 6 and 18 months old, is very common in rural Malawi and elsewhere in Sub-Saharan Africa. No good community level treatment for this special group has been identified. Lipid-based nutrient supplements (LNS), also known as ready- to-use therapeutic food, appear more beneficial than supplementation with corn-soy blend (CSB) in severely undernourished children. However, no comparisons have been made between supplementation with LNS or CSB to no supplementation to determine efficacy in promoting growth in moderate underweight children.

Aims

To test the hypothesis that 6-15 –month old, moderately malnourished infants and children receiving food supplementation with LNS or corn-soy blend (CSB) grow more during a 12-week intervention than control infants not receiving any supplementation.

Methods

We did a single- centre, randomised, controlled, single-blinded trial in Mangochi district, rural Malawi. 192 moderately malnourished infants aged 6-15 months and children were randomized into either corn-soy blend (CSB), lipid-based nutrient supplement (LNS) or control (no supplementation) group. The main outcome measure was weight gain. Analysis was by intention to treat.

Results

The mean weight gain was 470g in the control group, 610g in the LNS group and 510g in the CSB group (p=0.109). Mean weight-for-age increase was -0.32, 0.02 and -0.31 (p=0.030).. The differences were more marked when adjusted for baseline age and weight-for-age. No differences were observed in length, weight-for-length and length-for-age in the three groups. The proportion of children who improved i n weight-for-age was 24%, 47%, and 27% in control, LNS and CSB groups, respectively, with an inter-group difference in proportion (p=0.010). No statistically significant differences were observed between in the improvement in weight-for-length and length-for-age in the three intervention groups.

Conclusions

In a poor food-security setting, moderately underweight infants and children receiving lipid based nutrient supplements for 12 weeks gain more weight than those not receiving food supplementation.

Children receiving corn-soy blend and those not receiving supplementation gain about the same weight. However, in this trial, LNS and CSB were not directly compared.

ALTERNATIVE FOODS FOR ADDRESSING MODERATE MALNUTRITION: PRELIMINARY RESULTS OF A RANDOMISED INTERVENTION TRIAL WITH COMPARISON OF THREE TYPES OF SUPPLEMENTARY FOODS.

L Rossi[1], V Angelini[2], M Grossiord[3], AD Israel[4]

Background

Recently claimed hypotheses state that lipid-based supplements (high energy and micronutrient) would be better adapted for a programme addressing moderate malnutrition than high protein and low nutrient dense foods.

Aims

To compare whether the use of different food supplements, namely, Supplementary Plumpy (SP), Plumpy Doz (PD) and standard dry ration (CTL), would be efficacious on treatment of moderate acute malnutrition.

Methods

The study took place in Action Contre la Faim (ACF) Supplementary Feeding Centres (SFCs) of Northern Rakhine State (Myanmar). The protocol was a comparative trial of 3 foods for treatment of moderate malnutrition in children aged 6-59 months. 12 weeks of intervention with weekly assessment of weight, height and mid-upper arm circumference (MUAC) were planned. Preliminary data related to the first 6 weeks of treatment are presented. The results are presented as means, analysed with one-way ANOVA (Bonferroni correction), and proportions (%), cross tabulated and analysed with chi-square test.

Results

1 479 children (752M - 727F) were allocated PD (521), SP (468), CTL (490). After 6 weeks, the nutritional status of more females (54) than males (27) deteriorated (indicated by transfer to therapeutic feeding centres). The majority (56%) were treated with PD, 28% were treated with SP, and 26% were treated with CTL. 54 children dropped out (27M/F) with a larger proportion of PD (46%) and SP (39%) than CTL (15%). SP caused greater weight increase (g/kg/wk) 12,9 ± 8,5 than PD 11,0 ± 8,9 ($p<0,05$) and CTL 11,7 ± 7,7 (not significant). PD resulted in a larger MUAC increase 3,7 ± 4,3 than SP 2,7 ± 3,5 ($p<0,05$) and CTL (2,7 ± 7,2) (not significant). At the mid-point of intervention, children significantly improved in weight-for-height SD (-2,60 ± 0,28 vs -1,96 ± 0,49). SP showed larger increases of weight-for-height 0,67 ± 0,46 than PD 0,58 ± 0,51 ($p<0,05$) and CTL 0,61 ± 0,43 (not significant).

Conclusions

After 6 weeks of intervention, low acceptance of beneficiaries to the new products was revealed. Better performance of SP than PD on children growth was observed even though both products seemed not to perform better than CTL. Further confirmation of these findings will be provided at the end of the trial.

Use of LNS in Pregnancy and Infancy

SUMMARY OF TWO PROPOSED LNS TRIALS IN THE GAMBIA

S Unger

Trial 1:

A randomised trial to investigate the effects of pre-natal and infancy nutritional supplementation on infant immune development in rural Gambia (The ENID Trial: Early Nutrition and Immune Development)

We are conducting a randomised controlled trial of combined pre- and post-natal nutritional supplementation among pregnant women and their infants in the West Kiang region of The Gambia. The aim of this study is to determine the impact and potential mechanisms of different supplementation regimens, including LNS, on infant immune development. The primary outcome of this study will be thymic development during infancy. Antibody response to vaccination will be assessed as a key secondary functional outcome. Subsidiary analysis will also investigate impact on growth and development.

We hypothesise that early-life immunocompetence can be enhanced by a 'life-course' approach involving LNS to achieve nutritional repletion in late gestation and infancy, and, consequently to reduce vaccine failures and morbidity as well as to enhance growth.

Trial 2:

A randomised trial to investigate the effects of physician-prescribed, lipid-based multiple micronutrients on the health of children presenting to a primary health care centre in The Gambia (The MMCT – Multiple Micronutrients Clinical Trial) We are conducting a randomised, controlled trial of lipid-based multiple micronutrients prescribed by physicians to children under five of the West Kiang region of The Gambia who present to the clinic at MRC Keneba. The aim of the study is to determine the therapeutic efficacy of providing lipid-based multiple micronutrients to children in primary health care clinics in sub-Saharan Africa. The primary outcome of this study will be the frequency of self-referred clinic return attendances. Anthropometry, appetite and micronutrient status will be used as secondary outcome measures. Further immunological investigation will be undertaken in a subgroup of children presenting with a lower respiratory tract infection (LRTI).

We hypothesise that physician-prescribed LNS with a comprehensive set of micronutrients will improve the health status of children self-presenting to a primary health care clinic. We also hypothise that supplementing vulnerable children with LRTI with LNS will produce a more balanced immune response that will result in faster resolution of LRT-disease.

FOOD CONSUMPTION PATTERNS AND CAREGIVER FEEDING BEHAVIOURS AMONG MODERATELY MALNOURISHED CHILDREN IN RURAL MALAWI DURING SUPPLEMENTATION WITH LIPID-BASED NUTRIENT SUPPLEMENTS OR CORN-SOY BLEND

V. L. Flax,J. Phuka, Y. B. Cheung, U. Ashorn, K. Maleta,

P. Ashorn,

Background

The way caregivers use supplementary food for malnourished children and integrate it into feeding patterns impacts the benefits achieved by supplementation. The present study adds to our previous research on usage patterns of lipid-based nutrient supplements (LNS) by investigating caregivers' behaviors and including corn-soy blend (CSB) for comparison.

Aims

To identify differences in feeding patterns and caregivers' feeding behaviors for children receiving either LNS or CSB.

Methods

Observational data for each participant were collected on semi-structured forms during one 11h home visit. Comparisons between the study groups were made using t-test and Fisher's exact test.

Results

A total of 170 children aged 6- to 17-months received either LNS (n=85) or CSB (n=85) during a 12-week intervention trial in southern Malawi. When all meals and breastmilk were examined, there was no difference between the study groups in total mean number of feeding episodes or mean daily time spent feeding. Supplement was fed more frequently to children in the LNS (1.0) than the CSB (0.8) group (p=0.035). Differences between the study groups were found in type of utensil used to feed supplement (spoon CAB 94%, LNS 48%, p <0.001); caregiver handwashing before supplement meals (CSB 64%, LNS 36%, p =0.001); and proportion of supplement that was not consumed by the child during supplement meals (CSB 24%, LNS 8%, p<0.001). These behaviors were similar for CSB and LNS mixed with porridge (spoon 96%, hand washing 63%, supplement lost 21%), but not for plain LNS (packet 69%, hand washing 20%, supplement lost 2%).

Conclusions

Most differences between the study groups appear to be linked to the way LNS are served (plain vs. mixed with porridge). Programs promoting LNS in Malawi should consider behaviors related to mode of serving and provide appropriate advice to caregivers in order to optimize supplement intake and hygiene.

IMPACT OF COMMUNITY-BASED FOLLOW-UP CARE, WITH OR WITHOUT FOOD SUPPLEMENTATION AND/ OR PSYCHOSOCIAL STIMULATION, ON THE RECOVERY OF SEVERELY UNDERWEIGHT BANGLADESHI CHILDREN: A RANDOMIZED INTERVENTION TRIAL

MI Hossain[1,2], B Nahar[1], T Ahmed[1], JD Hamadani[1], Janet M Peerson[2], and KH Brown[2,3]

Background

Improved community-based management regimens need to be developed and evaluated for the management of severely malnourished children.

Aims

The study was done to assess the effect of community-based follow-up care, with or without food supplementation and/or psychosocial stimulation, as alternatives to current hospital-based follow-up care of severely underweight children previously hospitalized for diarrhoea.

Methods

507 severely underweight (WAZ <-3) children 6-24 months of age hospitalized at ICDDR,B- Hospital were randomly assigned to one of five outpatient treatment regimens once they recovered from diarrhea: i) fortnightly follow-up at the ICDDR,B-Hospital, including growth monitoring, health education, and micronutrient supplementation (H-C, n=102); ii) fortnightly follow-up at the community-clinics, using the same treatment regimen as Group H-C (C-C, n=99); iii) follow-up as per Group C-C plus supplementary food (SF) to provide 225kcal/d as a cereal, legume, oil mixture (C-SF, n=101); iv) follow-up as per Group C-C plus psychosocial stimulation (PS) (C-PS, n=102); or v) follow-up as per Group C-C plus both SF and PS (C-SF+PS, n=103).

Results

The children's mean±SD age was 12.6±4.0 months, WAZ was -3.83±0.61, and WLZ was -2.71±0.76. There were no significant differences in baseline characteristics by treatment group. The rate of spontaneous attendance at scheduled follow-up visits differed significantly by treatment group (C-SF > C-SF+PS > C-PS > C-C > H-C; p<0.05). The mean rates of weight gain (absolute weight in kg/3 months, and percent weight gain from baseline) differed significantly by treatment groups and were: C-SF+PS, C-SF, and C-PS varying from 0.88 to 1.01 kg, and 15.1 to 17.3% > C-C and H-C varying from 0.63 to 0.76 kg, and 11.1 to 13.2 % respectively; p<0.05). Children of all groups managed at the community had greater linear growth than those in group H-C (p<0.05). Wasted children (admission WLZ < -2) had a greater weight gain than non-wasted children especially in C-SF and C-SF+PS groups.

Conclusions

Community-based provision of follow-up services increases adherence to the follow-up schedule, and provision of FS with or without PS enhances the rates of nutritional recovery. Community-based service delivery, especially including supplementary food permits better rehabilitation of greater numbers of severely underweight children.

INVESTIGATING THE ECONOMIC DIMENSIONS OF LNS USE FOR PREVENTING MALNUTRITION

T Phiri, S Vosti

Policy decisions related to LNS products cannot be taken on the basis by nutritional efficacy alone. Individuals and households have preferences regarding how to spend their scarce time and other assets, and they also have strategies for improving their welfare and dealing with uncertainty – all of these factors can influence both the value households place on LNS products and households' willingness and ability to consume them when faced with non-zero prices for LNS products. In addition, few envision LNS products being distributed only through health clinics; some target

populations may be more cost-effectively served by alternative distribution mechanisms, e.g., retail food markets or female-run small-scale enterprises. Research at all three iLiNS research sites will be undertaken to address these and related issues, all of which have policy content. In this presentation we focus on LNS demand and on the cost-effectiveness of distributing LNS products using alternative distribution mechanisms.

Three types of studies will be used to assess demand for LNS products. First, field-based survey questionnaires will be used to generate estimates of 'willingness-to-pay' for LNS products by caregivers (or others responsible for food purchases) in the households participating in the LNS trials; these individuals will have direct experience with the LNS products and will have opinions about a given product's effects and (hence) 'value.' Second, we will use new techniques in field-based experimental economics that allow researchers to use 'auctions' to better understand the value decisionmakers place on LNS products and to generate more refined estimates of demand for them. Third, in a subset of LNS nutrition trial villages, village-wide market tests involving the offer of LNS products for sale (at prices that vary randomly each month, for approximately 4 mo) will be undertaken to measure LNS product demand in a market setting, and to identify household-level and other factors influencing that demand.

Cost-effectiveness analysis will be used to generate estimates of the cost-effectiveness of LNS products with regard to several nutritional and developmental outcomes (e.g., stunting, cognitive skills development, iron-deficiency anemia). These studies will generate an array of estimates of cost-effectiveness based for alternative LNS product distribution mechanisms, for each site. These estimates will be compared with cost-effectiveness measures taken from the literature on other interventions aimed at achieving the same outcomes.

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CHILDHOOD MALNUTRITION: THE ASIAN PERSPECTIVE

T Ahmed

Of the 20 countries with the highest burden of childhood malnutrition, the most populous countries are in Asia. In India and Bangladesh, malnutrition (underweight, weight-for-age <-2 SD) affects more than 40% of under-five children, while in Pakistan more than 30% children are malnourished. These rates are much higher than in many sub-Saharan countries. Since most childhood deaths in developing countries are associated with mild and moderate malnutrition, it is imperative to improve the overall nutritional status of this huge segment of child population in Asian countries. The most florid form of malnutrition, severe acute malnutrition (SAM) characterized by weight-for-height <-3 SD or nutritional edema, is also widely prevalent Asian countries, with the rate for Bangladesh being 2.9%. The case fatality rates of children suffering from SAM in the community are unknown. However, the CFR ranges from 5-30% among children with SAM treated in facilities. Global estimates of the number of deaths due to SAM vary greatly. The latest figure of close to 0.5 million deaths due to SAM is based on recent WHO estimates as reported in the Lancet Nutrition Series.

Concerted efforts are needed to reduce the burden of childhood malnutrition in Asia. For prevention and treatment of millions of children with moderate malnutrition in Asia, existing large scale nutrition programs have to be improved in terms of quality of service provided, the package of interventions and the effectiveness of counseling of care providers. Such programs should be instituted in countries that have a high prevalence of childhood malnutrition but are currently making no large scale efforts. The WHO guidelines for management of acutely ill children with SAM have been shown to effectively reduce CFR in facilities. But implementation of the guidelines has to be scaled up to reach the lowest level health care facilities. The ultimate goal, however, is to reach out to children with SAM through community-based management. This is however not a reality in Asian countries because of lack of policy decisions, data on acceptability, cost-effectiveness and sustainability of the newly developed ready-to-use-therapeutic foods (RUTF). Local recipes for RUTF are a must for making community-based management of SAM sustainable.

The importance of taking care of childhood malnutrition, including SAM, has to be ingrained at the policy level in all Asian countries. At the least, if we are to achieve Millennium Development Goals 1 and 4, appropriate mobilization of health human resources, training, ensuring therapeutic food and other supplies are mandatory and will have to be done immediately.

LONG-TERM FOLLOW-UP OF CHILDREN TREATED FOR SEVERE ACUTE MALNUTRITION: A LONGITUDINAL COHORT STUDY

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Background

Tackling Severe Acute Malnutrition (SAM) is critical to achieving child survival targets, such as Millennium Development Goal 4. Most feeding programmes treating SAM report patient outcomes on discharge from the programme. Research on whether children subsequently remain alive and well is currently limited, particularly in settings where HIV is prevalent.

Aims

To describe long term outcomes following an episode of SAM

Methods

We followed up on all surviving children discharged from a large urban NRU-based malnutrition programme one year after completion of a probiotic RCT (with no overall effect). HIV patients started cotrimoxazole prophylaxis and were referred for ARVs if meeting WHO (2005) HIV staging criteria [3].

Results

From July 2006 to March 2007, 1024 patients contributed to 1187 admission episodes for treatment of SAM. 697/1024(68.1%) had oedematous malnutrition, 459/1024(45%) were HIV seronegative, and 445/1024(43%) were seropositive. HIV status was unknown in 120/1024(12%).

There were 238/1024(23.2%) inpatient deaths: 42/459(9.2%) among HIV seronegative children, 126/445(28.3%) among seropositives, and 70/120(58.3%) among those not tested. Overall programme nutrition cure (weight-for-height>80% on 2 consecutive outpatient visits) was 471/1024(46.0%): 310/459(67.5%) among seronegatives and 155/445(34.8%) among seropositives.

Long-term 1-year-outcomes were identified for 900/1024(87.9%) children. 365/471(77.5%) of children discharged as cured were alive and 37/471(7.8%) were reported dead. 28/37(75.6%) of these late deaths in the year since discharge were HIV-positive. Total cumulative programme deaths had risen to 428/1024(41.8%):; 77/459(16.7%) among HIV seronegative children; 274/445(61.6%) among known seropositives.

Conclusions

In this study, the majority of children discharged cured from a programme treating SAM were still alive 1 year after discharge. Overall programme mortality was high, however; HIV and failure to achieve cure were major underlying factors. Routine, short-term programme reporting systems would have underestimated this long-term post-SAM mortality. More studies are needed to explore long-term outcomes from other approaches to SAM treatment (notably in Community Management of Acute Malnutrition, CMAM programmes). Future analyses of variables in our programme will also play a role in understanding and addressing factors underlying positive or negative long-term outcomes.

MORTALITY A YEAR AFTER ADMISSION WITH HIV AND SEVERE ACUTE MALNUTRITION (SAM) IN MALAWI: A COHORT STUDY

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Background

Up to half the children in Nutrition Rehabilitation Units in Malawi are HIV seropositive. The mortality of HIV infected children during admission with SAM is 30%, but long-term outcomes, and uptake of HIV services, are unknown.

Aims

To determine the outcome, and service uptake, of HIV infected children admitted with SAM, one year after discharge.

Methods

Mortality was determined for 445 HIV sero-positive children attending an urban NRU in Blantyre. This represented 43.4% of all children admitted between July 2006 and March 2007. Ward discharges were followed up in the community if they defaulted from Outpatient Therapeutic Programme (OTP), and at one year after OTP discharge.

Results

There were 126 deaths during ward admission (28.3%). A further 94 children (29.5%) died within OTP, or were readmitted and died. 196 children were traced in the community at one year, with 29 (6.5%) not found. Another 54 deaths were identified (12.1%), giving a known one year mortality of 274/445 (61.6%) of admissions, and a known survival of 32%.

Taken as a proportion of the 319 NRU discharges, the early (OTP) mortality was 29.5%, and late (post OTP) mortality was 16.9%, representing 46.4% (148/319) of children surviving to ward discharge. Over half (28/54) the late deaths were in children achieving nutritional cure in OTP. Less than half (44.5%) of HIV sero-positive children discharged from the NRU was known to be alive at 1 year.

Most (149/161, 92%) children were reported as taking regular cotrimoxazole, with 78/116 of those alive having taken a dose in the previous 2 days. Supplementary feeding in the community was accessed by 81% (133/164). ARV information was available on 159 children (71%); of whom 121 were alive at one year. Of these 56% had started ARVs; 17 prior to NRU admission; 28 during admission or OTP; and 44 following OTP discharge.

A subgroup was asked about change in family circumstances in the year since admission. Orphaning occurred in 31/122 (25.4%) families, and parental separation in a further 24/122 (19.6%).

Conclusions

Almost two thirds of HIV infected SAM children die within a year of admission, and over half these deaths occurr after ward discharge. ARVs are not normally started for children with SAM until response to nutritional therapy can be assessed. As over 20% of nutrition cures (WH>80%) died (28/136) within a year, this suggests attainment of nutrition 'cure' in HIV does not adequately predict low mortality risk. Earlier, and possibly universal, access for HIV infected children to ARVs might be able to reduce this unacceptably high HIV related mortality in children with SAM.

CAN SEVERE ACUTE MALNUTRITION CASE FATALITY RATE IN HIV-INFECTED CHILDREN BE REDUCED? OUTCOMES OF A PROGRAMME TO IMPROVE MANAGEMENT OF SAM IN LEA TOTO PAEDIATRIC HIV SERVICES.

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Background

The Lea Toto Programme has provided paediatric care and support to some 4000 HIV positive children in 6 Nairobi slum areas since 1998. In September 2007, it recognized the increasing number of children with severe acute malnutrition (SAM) and introduced an approach that included greater concern for community and staff, more systematic nutritional screening and Outpatient Therapeutic Care (OTC).

Aims

To describe outcomes of children admitted to the therapeutic feeding programme.

Methods

This was a retrospective analysis of routine programme data. The programme admitted children based on usual criteria for admission (oedema, MUAC<110mm, WHZ<-3 z-score (NCHS), return from defaulting, readmission) but also using new criteria aimed at ensuring early initiation of therapeutic feeding (persistent weight loss, static weight, very low weight for age and visible wasting). In this programme, CD4 count was the main criteria for initiating antiretroviral treatment (ART).

Results

From September 2007 to March 2009, 206 children (224 admissions) aged from 6 to 196 months have been discharged from the programme. 74.4% of the admissions were for children between 6 and 59 months of age. Marasmus (MUAC<110mm or WHZ<-3), which represented 52.1% (116/223) of children, was the predominant admission criteria. Oedematous malnutrition represented 9.9% (22/223) of all admissions. Recovery rate (53.2%), mortality rate (13.7%) and default rate (19.7%) did not meet the SPHERE standard. In univariate analysis, mortality was significantly higher in the presence of vomiting (25.0% versus 11.6%; p=0.053), in the presence of dehydration (37.9% versus 7.8%; p<0.001), in the presence of chest retraction (38.5% versus 12.0%; p=0.020), and when inpatient care was required (46.2% versus 9.0%). The average (SD) length of stay from admission to recovery was 84.3 (65.6) days, which was longer than the 6 to 8 weeks previously reported in programmes treating predominantly HIV-negative children.

Conclusions

SAM in children infected with HIV is associated with high mortality even when antiretroviral drugs are accessible. Although the outcomes in this setting do not meet SPHERE standards, they in are encouraging since the rate of mortality is lower than that observed by other teams. These better results are probably the consequence of early detection and treatment.

GLUCOSE PRODUCTION AND ABSORPTION IN CHILDREN WITH KWASHIORKOR COMPARED TO MARASMUS.

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Background

Protein-energy malnutrition (PEM) is one of the major health problems of the third world. The most severe form of PEM is Kwashiorkor, which is associated with metabolic derangement that leads to a fatty liver and hypoglycemia. The etiology of the hypoglycemia in kwashiorkor is currently unknown.

Aims

To determine glucose production and absorption in children with kwashiorkor and marasmus.

Methods

Children with kwashiorkor (n=12), marasmus (n=6) and control subjects (n=5) were fasted overnight. During the overnight fast and study protocol, all children received a glucose infusion (2 mg/kg/min) to prevent hypoglycemia. A primed, constant infusion (0,15 mg/kg/min) of [6,6H2] glucose was infused intravenously for 2 hours. A subset of patients received an oral bolus of 1.75 g glucose per kg labeled with 10 mg/g [U-13C]glucose. Blood samples were taken regularly to determine glucose, insulin and c-peptide concentrations. Analysis of labeled glucose was performed via gas chromatography-mass spectrometry. Mathematical modeling was applied to determine pancreatic insulin response and oral glucose absorption.

Results

Albumin concentrations were significantly lower in children with kwashiorkor compared to marasmus and controls (P< 0,05). Hepatic glucose production was significantly lower in children with kwashiorkor (5,5 ± 0,3 mg/kg/min) compared

to marasmus (7,7 ± 0,5 mg/kg/min) and controls (7,6 ± 0,9 mg/kg/min, P< 0,05). Glucose absorption was severely impaired (<40%/2 hrs) in 50% of kwashiorkor patients. Interestingly, glucose absorption was also impaired in 75% of marasmus patients ± edema, but with hypoalbuminemia. A similar pattern was seen in β-cell function with impaired insulin responses in kwashiorkor and hypoalbuminemic marasmus patients ± edema. Cortisol concentrations were similar in all groups, but glucagon concentrations at the end of the overnight fast were significantly lower in children with kwashiorkor compared to those with marasmus (P<0,05).

Conclusions

This study indicates impaired glucose production and severely decreased absorption in children with kwashiorkor. Decreased glucose production could be related to an impaired glucagon response, but it is not caused by increased insulin secretion. These results highlight the importance of adequate glucose intake in children with kwashiorkor. Children clinically diagnosed as marasmus, but with hypoalbuminemia show metabolic features resembling a kwashiorkor phenotype.

SEVERE DEHYDRATING DIARRHOEA IN MALAWIAN CHILDREN

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Background

Diarrhoea remains one of the most common causes of childhood deaths worldwide despite the widespread use of oral rehydration solution (ORS). The vast majority of the nearly 2 million deaths occurring annually in children under five years of age are in resource-poor areas of south Asia and sub-Saharan Africa. Signs of critical illness in severely dehydrated children are poorly recognised, particularly in a resource-poor setting where management protocols have not been adequately evaluated.

Aims

We wish to highlight severe dehydrating diarrhoea (SDD) as an important target for both clinical and laboratory research. Although considerable efforts have gone into establishing the management of diarrhoeal disease in general, there is surprisingly little understanding of the aetiology, metabolic processes and risk factors for the very high mortality associated with SDD.

We suggest that the degree of fluid requirement as well as the prevalence of electrolyte disturbances, in particular hypokalaemia, are seriously under-recognised and may be contributing significantly to mortality. The heterogeneity of children with SDD renders the generic 'one size fits all' approach to fluid and electrolyte management in these critically ill children inadequate. There is a need to re-evaluate the efficacy of prevailing intravenous fluid protocols in resource-limited settings, especially in relation to electrolyte content and fluid volumes in well conducted multi-centre interventional trials.

Method

We will finally present the preliminary findings from an observational study on severe dehydration in Malawi which highlights some of the issues outlined above.

MODIFICATION OF THE PRUDHON INDEX FOR HIV PREVALENT SETTINGS

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Background

HIV prevalence is high within sub-Saharan Africa, and mortality within nutrition rehabilitation units (NRUs) is strongly associated with HIV status. The standard marker of NRU performance is the Prudhon index (PI), which does not account for HIV status of the child or population.**Aims**

To determine the risk of death in children with severe malnutrition taking into account HIV status, and to calculate an HIV adapted PI for NRUs in HIV-prevalent settings. To then test the equation on a cohort of children admitted in the subsequent year.

Methods

All 1470 children, aged 6-59 months old, admitted to the NRU in Blantyre, Malawi between July 2006 and July 2007 were entered into a database. Anthropometry, HIV serostatus and ward mortality were available for 1454 children. The model for Prudhon index was modified to account for HIV status. The model was then tested on the admissions from the subsequent year.

Results

HIV status was known for 1331/1454 (90.5%) children of whom 55% were seropositive. Oedema was present in 957/1454 (65.8%). During admission, 372/1454 (25.6%) of children died. According to univariate analysis, oedema was associated with lower mortality (OR 0.44, 95%CI 0.34-0.55), and HIV was correlated with higher mortality (OR 4.17, 3.09-5.71). Age and gender were not predictive. In multivariate analysis ORWH (optimum ratio Weight Height1.74) was strongly associated (OR 0.01, 0.005-0.035)) with mortality, followed by HIV (OR 2.66, 1.87-3.79). As in the PI, oedema was positively associated with mortality (OR 1.35, 0.99-1.85). The modified PI model to predict the individual probability of death adjusted for HIV was:

Using this in 2007-8, when there were 1232 admissions and 348 deaths (28.2%), the modified PI predicted 297(24%), and the PI 79(6.4%) deaths. If HIV status had not been known, and an estimated prevalence of 55% used (from 2006-7), the modified PI predicts 276 deaths.

Conclusions

An HIV modified PI could be used to assess performance of NRUs in settings with high HIV prevalence. The HIV modified PI may also be used in units where individual HIV status is unknown, but where population prevalence is known. Generalisability is unknown, so testing in other HIV prevalent settings is required.

DIARRHEA IN UNINFECTED INFANTS OF HIV-INFECTED MOTHERS WHO STOP BREASTFEEDING AT 6 MONTHS: THE BAN STUDY EXPERIENCE

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Background&Aims

To describe diarrhea among early-weaned, uninfected infants of HIV-infected mothers enrolled in the currently ongoing Breastfeeding Antiretroviral Nutrition (BAN) Study.

Methods

Breastfeeding HIV-infected mothers at a major central hospital in Lilongwe, Malawi with CD4 counts>250/ mm3 and their infants are randomised to a maternal or an infant antiretroviral regimen or to standard of care during breastfeeding. Mothers are counselled to exclusively breastfeed followed by rapid weaning by 28 weeks. In addition, mothers are also randomised to receive or not receive a nutritional supplement during breastfeeding. We examined the rates of diarrhoea, hospitalisations and diarrhoea-induced deaths due to diarrhoea in HIV-uninfected infants from April 2004 to June 2006 in comparison to national Malawi data in infants who follow local feeding practices of extended breastfeeding into the second year of life.

Results

Between April 2004-May 2006, 771 HIV uninfected infants had been enrolled of whom 225 reached 28 weeks. There was an increase in diarrhoea cases around the weaning time that continued through the end of the first year of life. Hospitalisations due to diarrhoea also peaked around weaning. The frequency of diarrhoea was consistent with rates published in the literature. There was a higher probability of infant diarrhoea in the rainy season relative to the non-rainy season ($p<0.001$). The overall infant mortality (43/1000) was much lower than that reported in the MDHS, 2004 Edition (76/1000 live births).

Conclusions and Recommendations

Diarrhoea increased during and following weaning among exclusively breastfed infants reportedly weaned at 6 months. This is consistent with the pattern seen in populations who practice prolonged breastfeeding, as this time coincides with introduction of complementary infant foods. Greater emphasis should be placed on hygienic preparation of weaning foods and water purification to reduce infant diarrhoeal morbidity in resource-limited settings.

HIV PREVALENCE AND MORTALITY AMOUNG CHILDREN UNDERGOING TREATMENT FOR SEVERE ACUTE MALNUTRITION IN SUB-SAHARAN AFRICA: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Background

Although there have been individual studies reporting high HIV prevalence and mortality among children with SAM, no systematic review has synthesized the data across the region.

Aims

Systematic review and meta-analysis. Included studies reported on HIV infection within a sample of children with SAM where HIV status was assessed using a blood test and SAM was defined using the WHO, Gomez, Wellcome or Waterlow definitions. Community based treatment was defined as including programmes delivered at community level and those with early discharge from nutrition rehabilitation unit (NRU) to hospital.

Results

Children from 17 studies were included in the analysis (n = 4891), of whom 29.2% were HIV-infected. HIV-infected children were significantly more likely to die than HIV-uninfected children (30.4% vs. 8.4%; $P < 0.001$; relative risk = 2.81, 95% CI 2.04—3.87). HIV negative children treated within community-based programmes had lower mortality (4.3%) than those treated within an inpatient nutrition rehabilitation unit (NRU) (15.1%).

There was no significant difference in mortality for HIV-infected children with SAM treated in the community based (30.0%) or NRU (31.3%) settings.

Conclusions

HIV prevalence is high in children with SAM in sub-Saharan Africa, and HIV-infected children are at significantly increased risk of mortality. There is an urgent need to integrate HIV testing and treatment into care for children with SAM in regions of high HIV prevalence.

BIOAVAILABILITY OF ZINC FROM TWO DIETS IN BANGLADESHI CHILDREN WITH PERSISTENT DIARRHOEA USING ZINC STABLE ISOTOPES

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Background

Zinc supplementation maintained the serum zinc level during persistent diarrhoea. Until now, there has been no accurate information about serum biochemical changes in children with persistent diarrhoea using reliable methods such as stable isotopes.

Aims

To measure the serum biochemical changes from two different therapeutic diets and supplementation of zinc during and after persistent diarrhoea.

Methods

A randomized, double-blind, placebo-controlled trial was conducted in 52 moderately malnourished male children, aged 6-24 months, with persistent diarrhea who were supplemented with 20 mg elemental zinc per day for a 2-week period. Children were randomly allocated to 3 groups: (a) rice-based diet + zinc, (b) chicken diet + zinc, and (c) rice-based diet + placebo. A 7-day metabolic balance study was done. Absorption of zinc was measured from the diet and supplementation using 70zinc and 67zinc isotopes. Zinc, copper and magnesium were analyzed from serum and stool by an atomic absorption spectrophotometer. The study was conducted at the ICDDR, B, Hospital, during March 1998-March 2000.

Results

There was a significant difference between absorption of supplemental zinc during diarrhea from the rice-based (43.93□13.02 vs 51.37□11.36, $p=0.02$) and chicken-based (38.42□11.63 vs 51.84□7.59, $p=0.04$) diets whereas absorption of zinc from the therapeutic diet was non-significant. Lactulose excretion at day-15 was significantly lower in the rice-based diet with zinc [20.9(12.53-45.3) vs. 7.05(1.73-16.45), $p=0.003$] and chicken-based diet with zinc

[23.9(14.15-52.1) vs 9.0(2.33-18.4), p=0.04]. Endogenous loss of total zinc (mg) in stool over 4 days during diarrhoea and after recovery between the groups (rice-based and chicken based) was significant.

Conclusions

The moderately malnourished children suffering from persistent diarrhea had an adequate absorption of zinc from therapeutic supplementation and diet, either rice or chicken-based.

QUANTITY AND ZINC CONTENT OF MATERNAL MILK CONSUMED BY EXCLUSIVELY BREASTFED BABIES IN MOROCCO

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Background

Zinc is a trace mineral that is of critical importance to the young infant for normal growth and development. It is generally admitted that nutritional requirements for zinc are met for term infants by exclusive breastfeeding for about the first 6 months of life.

Aims

To provide longitudinal data on human milk consumption, using stable isotope techniques, at one, three and six months of life in normal birth weight (NBW) babies, and to determine zinc concentrations in maternal serum and milk.

Methods

Twenty paired mothers and babies were recruited. The amount of human milk consumed by the baby over a period of 14 days was assessed by the deuterium oxide "dose-to-mother" technique. The mother was given 30g of deuterium. Saliva samples were collected from both the mother and her baby. The technique also allows estimation of the baby's intake of water from sources other than human milk and the mother's body composition. The concentration of zinc in milk and plasma was determined using Selectable-Mode Inductively Coupled Plasma (ICP-SM).

Results

The average quantity of the mother's milk consumed by the NBW babies was 667,72 ± 373,68 g/day, 889,27± 519,39 g/day and 1211,18 ± 778,02 g/day, respectively, at one, three and six months after childbirth. The rate of exclusive breast-feeding was 42% in the first month. This rate decreased to 33,3% at the third and sixth months. The average quantity of zinc in mother's milk was 2.35±1.44 mg/ml, 1.98±1.01 mg/ml and 1.44±0.99 mg/ml, respectively, at one, three and six months after childbirth. Zinc in maternal serum was 0.58±0.18 mg/l, 0.59±0.16 mg/l and 0.47±0.15 mg/l, respectively, at one, three and six months after childbirth.

Conclusions

The isotope dilution method is an easy, non-invasive and accurate method for the assessment of human milk intake. The percentage of mothers who breastfeed is still low particularly after 3 months. Zinc deficiency is high among the studied group and a large scale study would be needed to confirm this.

REGULAR CONSUMPTION OF A COMPLEMENTARY FOOD FORTIFIED WITH ASCORBIC ACID AND FERROUS FUMARATE OR FERRIC PYROPHOSPHATE IS AS USEFUL AS FERROUS SULFATE IN MAINTAINING HEMOGLOBIN CONCENTRATION ABOVE 105 G/L IN YOUNG BANGLADESHI CHILDREN.

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Background

Non-water soluble iron compounds have been reported to be less well absorbed than ferrous sulfate in young children, and concern has been raised about their usefulness as food fortificants.

Aims

To evaluate the usefulness of ferrous fumarate and ferric pyrophosphate relative to ferrous sulfate in maintaining hemoglobin concentration above 105 g/L in Bangladeshi children.

Methods

A double blind study was conducted with 235 children (7-24 months; Hb >105 g/L) randomized into 3 groups. One serving of iron fortified infant cereal (9.3 mg iron; ascorbic acid:iron molar ratio 3:1) was consumed per day, 6 days/week, during 9 months. Blood samples were drawn at 4.5 months and 9 months.

Results

Raw data were reformatted and a "time to event" was calculated corresponding to reaching the following thresholds: Hb <105 g/L, plasma ferritin <12 ug/L or plasma C-reactive protein >10 mg/L at baseline, 4.5 months or 9 months. Data were censored when children did not reach the threshold or were lost to follow up. A Kaplan-Meier approach was used to compare the 3 groups. No statistically significant differences were observed for Hb <105 g/L (p=0.943), plasma ferritin <12 ug/L (p=0.601) or plasma C-reactive protein above 10 mg/L (p=0.508).

Conclusions

Contrary to earlier concerns, these results do not indicate differences in the usefulness between water soluble and non water soluble iron compounds in maintaining hemoglobin concentration and preventing iron deficiency. These data will be of importance in the development of food fortification strategies to combat anemia and iron deficiency in highly vulnerable population groups.

WOMEN'S ORGANISATIONS AND SOCIAL CAPITAL TO REDUCE PREVALENCE OF CHILD MALNUTRITION – LESSONS FOR SOCIAL CHANGE IN SUB-SAHARAN AFRICA?

Cost-effective technical interventions implemented at a national scale could reduce undernutrition related mortality and disease burden by 25%. Further sustainable progress in reducing undernutrition requires long-term investments in women's empowerment.

Persistently high levels of undernutrition with child and maternal mortality in Sub-Saharan Africa, particularly in rural areas, suggest that effective action is rarely a priority in high-burden countries

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Barriers to scaling up range from limited national attention regarding undernutrition and technical recommendations to limited funding by donors for relevant cross-sectoral interventions.

A recent initiative in Kenya, Uganda and Tanzania holds that public pressure and debate in mass media are more effective drivers of change towards better public services than technical solutions or expert-driven technocratic reforms. Empowered women's groups typically contribute to advocacy for better services and outreach. Women's health groups in Nepal, Pakistan and Ethiopia have been empowered with knowledge of interventions to successfully reduce exposure to infection. Informed women's support groups cannot but strengthen "a unique mechanism for group counselling and promotion of positive behaviours." A critical step towards sustainability occurs when women themselves take ownership of interventions. Similarly, for members of women groups engaged with microcredit, child undernutrition has improved. Further assessments of microcredit initiatives need to be undertaken for their effect on nutrition outcomes.

Our two studies of women groups in Nepal and PNG offer lessons. Results suggest that membership in well-performing, informal women's organisations that do not access external assistance contributes to reduced child undernutrition in vulnerable households. Access to training for externally supported women's organisations with intensive support is associated with reduced prevalence of stunting. These studies represent at least a departure in the search for more insight into the context and impact of women organisations and their social capital in reducing undernutrition. In Nepal, informal women's groups listened to the radio, which was found to be significant in reducing child undernutrition.

We suggest that studies be undertaken to explore how informal women organizations in Sub-Saharan Africa may network with each other; improving their social capital and maternal nutrition knowledge, whilst, supported by radio, building advocacy for improved interventions for nutrition with child and maternal health.

FOOD PROVISION IN POST-DISCHARGE FOLLOW-UP OF CHILDREN WITH SAM HALVES ABANDON RATES AND REDUCES DAYS OH HOSPITALISATION IN LUANDA, ANGOLA

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Background

The Hospital Divina Providencia (HDP) serves a poor suburban area of Luanda. A nutritional program with an inpatient centre and a clinic for follow-up visits has been implemented there since 2002.

Aims

To evaluate a policy of providing food at home after discharge from hospital to children admitted with severe malnutrition

Methods

Hospital staff admitted children who had: a) weight/height < 70% (NCHS standards), b) bipedal oedema, c) weight/height between 70 and 80% but signs of complication.

Treatment was according to WHO guidelines. Children were discharged when they had a good appetite, had gained weight, and their oedema had resolved. Mothers were trained on how to manage the child, how to prepare foods, and when to return for follow-up. From May 2007, we provided food after discharge. We gave milk powder, with added sugar (the equivalent of 200 Kcal/kg/day and 6gr/kg/day of protein). Follow-ups initially occurred on a weekly basis. If the child had good weight gain, follow-ups were made every two weeks. Outcomes were recorded prospectively. We compared the outcomes of children in the two phases (with and without food provision).

Results

90 children were given only nutritional advice (January to May 2007). 412 children also received food provision (May 07 to December 2008). 28/78 (36%) children returned for follow-up visits when food was not provided compared to

285/362 (79%) when food was provided (RR 2.19; 95% IC 1.62 to 2.96; p<0.0001). The number of children reaching a weight/height > 85% remained stable.. The mean number of days of hospitalisation was reduced from 21+- 9.5 to 15 +- 8.7 after food provision (p< 0.0001). No deaths were observed during follow up but 3/285 children relapsed in the group given food. The cost of the food provided was 10 Euros per child for the whole follow up .

Conclusions

The number of children lost at to follow up was high, but it was reduced by 42% after food provision. Food provision also significantly reduced the duration of hospitalisation while the rate of rehabilitated children remained stable., at a cost of 10 Euros per child treated.

STABLE ISOTOPE TECHNIQUES TO ASSESS VITAMIN A BODY POOLS.

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Traditional methods to assess vitamin A status of groups have included serum retinol concentrations and relative dose response tests. Tracer dilution techniques with stable isotopes of vitamin A have emerged as a select method for estimating total body vitamin A pool size and for answering specific biological questions related to vitamin A metabolism. The isotopes of hydrogen (i.e., deuterium) and carbon (i.e., 13C) have been successfully applied to humans to assess vitamin A status. Isotope dilution techniques consist of 1) administering an oral dose of isotopically labeled vitamin A to subjects, 2) collecting a blood sample after the tracer has mixed with endogenous vitamin A, 3) measuring the plasma isotopic ratio of tracer to tracee (unlabeled vitamin A), and 4) estimating the total amount of vitamin A in the body using a prediction equation. The plasma isotopic ratio of tracer to tracee can be measured using gas chromatography-mass spectrometric methods with a variety of different detection instruments. Aside from liver biopsy, the isotope dilution technique is the only assessment technique that provides a quantitative estimate of total body vitamin A pool size. Because the technique is responsive to food and therapeutic supplementation with vitamin A, it can be used to evaluate the efficacy or effectiveness of intervention programs by quantitatively assessing the change in total body vitamin A stores in response to an intervention. An added advantage is that the technique can estimate total body vitamin A along the entire continuum of vitamin A statuses from deficient to hypervitaminotic states. Additionally, it is not necessary to select subjects with deficient- or marginally-depleted initial status to detect a change in vitamin A status in response to an intervention. Thus, the tracer dilution technique can be useful for assessing change in vitamin A status in populations with low but adequate initial status, whereas the other indirect assessment techniques are only useful for detecting a change in status when initial status is deficient or marginally depleted. Vitamin A tracer studies have successfully assessed vitamin A status of groups and the efficacy of interventions in groups at risk of deficiency in several different countries. With improvements in the sensitivity of mass spectrometers, the method has gained momentum and is now more broadly available to those who wish to use the method to evaluate interventions. Although the degree of sophistication of the laboratory and resources available will usually dictate which vitamin A assessment method is chosen for population assessment and intervention evaluation, isotope dilution techniques have been used globally.

TROPICAL ENTEROPATHY AND ZINC HOMEOSTASIS

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Background

Tropical enteropathy and zinc deficiency are major public health problems worldwide. Tropical enteropathy is characterized by an increased urinary lactulose-mannitol ratio (L:M) when a site-specific sugar absorption test is administered with unmetabolized sugars. Zinc homeostasis is quantified with a dual stable isotope test of zinc absorption and excretion.

Aims

To test the hypothesis that endogenous fecal zinc (EFZ) was significantly correlated with tropical enteropathy

Methods

A site-specific sugar absorption test and dual stable isotope test was performed on 25 healthy Malawian children aged 3-5 y at high risk for enteropathy and zinc deficiency. EFZ as well as total zinc absorption and net zinc retention were calculated and correlated with the L:M ratio and fractional absorption of unmetabolized sugars.

Results

22 children (88%) had tropical enteropathy (L:M > 0.10), and the L:M ratio was 0.24 ± 0.10 (mean ± SD) . EFZ was 1.68 ± 1.06 mg/d, a quantity greater than is seen in healthy populations from the developed world. EFZ was positively correlated with the L:M ratio ($r = 0.62$, $P < 0.001$). Net zinc retention (0.67 ± 1.6 mg/d) was negatively correlated with the L:M ratio ($r = -0.47$, $P = 0.02$).

Similar significant correlations between the fraction of mannitol absorbed and EFZ and net zinc retention were found. Total absorbed zinc was not significantly correlated with the L:M ratio

Conclusions

A significant relationship between the L:M ratio and zinc homeostasis exists, suggesting that zinc deficiency is associated with tropical enteropathy in children.

MICRONUTRIENTS AND MALNUTRITION IN CHILDREN

T Ahmed

Children suffering from protein-energy malnutrition are also depleted in micronutrients; provision of micronutrients therefore is one of the key elements in the management of malnutrition. There is ample evidence that suggests that zinc supplementation should be considered in the management of acute diarrhea and in prevention of growth faltering in children specially those who are malnourished. Iron and zinc supplementation are also associated with 40% lower risk of severe acute lower respiratory infection in less well-nourished infants. On the other hand, multiple micronutrient supplementation has been found to be associated with an increased risk of diarrhea in less well-nourished infants. The efficacy of multiple micronutrient sprinkles in children with malnutrition still needs clarity. Results of a meta-analysis show that the use of sprinkles did not have any effect on

growth, although there was a marked impact on anemia. The weight-for-age, length-for-age and weight-for-height indicators had insignificant overall effect with the weighted mean difference being 0.00, (95% CI -0.37, 0.37), 0.04, (95% CI -0.16, 0.24) and 0.04, (95% CI -0.44, 0.51) respectively.

Desirable intakes of micronutrients during the acute initial phase of severe acute malnutrition are known. A recent report suggests that the serum levels of micronutrient normalize within 15-30 days of therapy. Supplementation with a high dose of zinc in children with severe acute malnutrition has been associated with increased case fatality from septic illness; it is prudent not to exceed the recommended dose and period of supplementation with zinc in these children.

STABLE ISOTOPE TECHNIQUE TO EVALUATE IRON BIOAVAILABILITY IN INFANTS

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The prevalence of iron deficiency is unacceptably high globally, in particular among infants, children and women of child-bearing age in developing countries. Effective, food-based strategies to combat iron deficiency are, therefore, urgently needed. As only a fraction of dietary iron is absorbed and utilized, access to data on iron bioavailability from foods, diets and iron fortificants is crucial in the development of food fortification strategies and interventions based on dietary diversification.

From a methodological point of view, the rapid incorporation of newly absorbed iron into erythrocytes is a great advantage. Stable isotope technique to evaluate iron bioavailability has been developed based on the incorporation of stable iron isotopes into erythrocytes 14 days after administration of labelled test meals.

In most studies, the incorporation rate is assumed to be constant, 80-90 % in adults and infants respectively. However, when the incorporation rate cannot be assumed to remain stable, for example during pregnancy, incorporation of a stable isotope administered intravenously can be used to correct for changes in incorporation rate.

Large interindividual variation in iron bioavailability has been demonstrated, primarily due to differences in iron status between subjects, and paired comparisons are therefore essential when evaluating iron bioavailability from different foods or food fortificants. By using a double isotope technique, i.e., administration of two stable isotopes of iron (57Fe and 58Fe) - on consecutive days - information about iron bioavailability from two different test meals can be obtained simultaneously. Over the last few years, this technique has been used to generate new data on, in particular, iron bioavailability from iron compounds used in food fortification programs and information about dietary enhancers and inhibitors of iron absorption in infants and children.