



International Symposium on Understanding Moderate Malnutrition in Children for Effective Interventions

26 May 2014 – 29 May 2014

IAEA, Vienna

Compilation of abstracts

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Abstracts of Key Speaker Presentations

What works in managing MAM? A review of the evidence from recent systematic reviews and meta-analyses, and remaining knowledge gaps

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Presenter: Prof. WEBB, Patrick (Tufts University), USA

Options for effective management of MAM have improved in the past decade as new products have been rolled out and coverage has increased through community-based treatment. As a result, the Lancet series on nutrition of 2013 included attention to the management of MAM, whereas it had not in 2008. The Lancet authors concluded that MAM interventions should be included in modelling exercises aimed at estimating the potential impact of packages of interventions to prevent child mortality. However, they also noted that while some evidence of effectiveness exists, sound empirical data on outcomes achieved in emergency and non-emergency settings alike need to be much better documented and appropriately costed.

Since the Lancet series of 2013 was published, at least three separate reviews of the evidence have emerged, involving slightly differing approaches (systematic review, meta-analysis and/or Delphic assessment). This paper for IAEA CN-217 offers an overview of the findings of the Lancet 2013 paper and the content of the three subsequent evidence reviews. It presents a critique of differences in their approaches and findings, and highlights areas where significant gaps in knowledge remain. Lessons for future systematic reviews will be underlined, and priority areas for new research that has operational relevance will be specified.

Panel discussion: UN agencies response to challenges related to the management of MAM

Abstract from Ellen Muehlhoff (Food and Agriculture Organization of the United Nations)

Promoting agriculture and food-based solutions to alleviate hunger and malnutrition is a major aim of the Food and Agriculture Organization (FAO). Interventions that focus on optimal nutrition during the first two years of life are recognized as essential in order to capitalize on the window of opportunity for preventing undernutrition and building healthy and productive future lives.

FAO has been promoting improved complementary feeding for children 6-23 months by empowering rural families to enrich young children's diets using local foods. Working through government health and agricultural extension systems, FAO promotes practical hands-on learning approaches that aim at behavior change in family and young child feeding. The trials of improved practices (TIPs) method is used to provide a comprehensive assessment of current dietary practices and to test feasible culturally acceptable solutions and behaviours with caregivers in a real home environment.

Through farmer field schools and community-based demonstrations, households learn how to: 1) grow different nutrient dense crops; 2) raise small livestock to improve family and children's diets, and generate income; 3) select and prepare nutritious complementary food, including indigenous food, based on taste, seasonal availability and price; 4) incorporate fruit and other healthy snacks into children's diets; 5) feed age appropriate quantities of complementary food to children and continue breastfeeding; and 6) practice improved hygiene and sanitation. None of these actions are intuitive and frequently require learning of new knowledge and practical hands-on skills. Recognizing that good eating habits are learnt during the early years, good complementary feeding can form a basis for lifelong healthy eating patterns and may prevent the onset of diet-related diseases in the future.

Few studies have documented the impact of promoting locally available food on children's diets, nutritional status and growth. Even fewer have looked at the impact of combining targeted food security actions, aimed at increasing the production and availability of nutritious food with intensive nutrition education and behaviour change interventions.

Evidence from FAO programs in Cambodia and Malawi has demonstrated: 1) families' interest in using locally available foods to improve the nutritional content of young childrens' diets 2) the relevance of introducing such skills, and 3) the practical feasibility of using improved recipes in the family setting.

FAO is currently exploring how improvements in complementary feeding are most readily adopted on a larger scale and how health and agricultural extension workers and community nutrition promoters can be trained to assist in scaling up the process. Research is ongoing to evaluate the effectiveness and impact of this approach and results are expected to be available in 2015.

Key words: Complementary feeding, food security, nutrition education, research.

Wasting and stunting – similarities and differences; policy and programmatic implications

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Presenter: Dr. BRIEND, André (University of Tampere, Tampere, Finland); France

The terms wasting and stunting were introduced by Waterlow to differentiate among underweight children those with a low weight-for-height (wasted) from those with a low height-for-age (stunted). Wasting is often called acute malnutrition and stunting chronic malnutrition but these terms may be misleading, and may just reflect that it takes a longer time to diagnose linear growth retardation. These two forms of malnutrition are associated with changes in body composition with a reduced muscle mass but usually a normal brain size in relation to body weight. These changes are more pronounced but more easily corrected in wasting. The reduced muscle mass present in stunting may persist into adult life and may be associated with an increased fat mass.

Muscle is the main store of amino-acids and other essential nutrients needed for the body's immune response and is a major determinant of survival in infections. The low muscle mass observed in both stunting and wasting is likely to explain the association between these two conditions and increased mortality. Hence, health and nutrition programmes aiming to reduce mortality need to prevent both wasting and stunting, especially in young children who have a low muscle mass to start with.

Children having an insufficient food intake lose weight and become wasted but also stop growing in height, becoming stunted if untreated. Growth in height resumes only after wasting has been at least partially corrected. Hence detecting and treating wasting in a timely fashion also helps to prevent stunting. The recent discovery that bone and body fat are both endocrine organs interacting with each other and that bone regulates energy metabolism through osteocalcin (a hormone produced by bone) may explain these observations.

Stunting can also occur in the absence of wasting. A possible explanation is that linear growth requires synthesis of cartilage and bone tissues, which contain more phosphorus, calcium, magnesium and sulphur than other lean tissues. Therefore these nutrients may be required in the diet to prevent stunting. Dairy products can also have an effect on hormonal profile and growth. Fat can be laid down even if nutrients needed for lean tissue synthesis are lacking and may explain the increased fat mass often associated with stunting. Nutrient dense diets are therefore needed to prevent stunting and wasting, promote muscle growth and prevent excessive fat mass.

A Review of Nutrition-Specific and Nutrition-Sensitive Approaches to Preventing Moderate Acute Malnutrition

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Presenter: Ms. BROWN, Rebecca (CMAM Forum)

Recent literature reviews have demonstrated the limited efficacy of targeted supplementary feeding programmes aimed at both treating and preventing moderate acute malnutrition (MAM), with high rates of defaulting, low coverage and high associated costs.

There is a growing interest in a) reviewing and improving protocols / tools for the management of acute malnutrition and b) increasing the quality and variety of products available for the treatment / prevention of moderate acute malnutrition. There is however, varying evidence on the impact of nutritional products aimed at preventing or treating acute malnutrition, or on the comparative efficacy of different products.

Following several literature reviews and operational research with varying results, there is increasing consensus that

MAM should be tackled not only through products, and that clearer guidance should be provided on broader preventive strategies, such as optimal infant and young child feeding (IYCF) and caregiving practices, optimal maternal nutrition, counselling, social protection, food security and livelihoods, and water, sanitation and hygiene (WASH).

The CMAM Forum has commissioned Technical Briefs which aim to summarise current thinking and practice relating to preventive approaches to MAM, looking at the role of both nutrition-specific and nutrition-sensitive interventions. The work is being launched in January 2014 and results will be available for presentation at the IAEA MAM Symposium in May 2014.

The briefs aim to provide:

- An overview of approaches to preventing MAM across different sectors (e.g. agriculture, health, IYCF, social protection, water and sanitation) and in different contexts.
 - A review of current knowledge including:
 - o Evidence from systematic and literature reviews.
 - o Existing approaches and practice for prevention of MAM.
 - o Current guidance on making programmatic choices relating to MAM prevention interventions and decision-making frameworks.
 - o Summary of current large-scale initiatives, publications and tools relating to the prevention of MAM.
- An overview of questions, constraints and gaps in evidence and guidance in relation to the prevention of MAM.
 - Recommendations / areas of focus for future practice and further research.

Assessing impact of blanket interventions for MAM prevention

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Presenter: GRAIS, Rebecca F. (Epicentre)

Blanket interventions for MAM prevention (Blanket supplementary feeding programming (BSFP)) provide a supplementary food ration often accompanied by a basic medical treatment and prevention package to a vulnerable population for a defined period in a defined geographic location. There is little strong evidence on the impact of BSFP on rates of malnutrition and mortality, and scarce guidance on program monitoring and evaluation to improve the implementation of specific programs.

Assessing the impact of BSFP has been fraught with difficulty. Their isolated impact is difficult, if not often impossible to disentangle from larger care and prevention packages, the objectives of BSFP may vary by context, implementing agency, time and geography. Various and often multiple co-morbidities among children in the targeted group complicate matters further with respect to impact assessment. This leads to difficulties in generalizing results from one context to another and the need for more complex metrics to guide operational decision-making.

Ideally, impact or effectiveness of BSFP should be addressed in a research framework where appropriate and complete data is collected in order to address specific questions. The gold standard is the conduct of randomized studies including a control group. These studies have been scarce as they may be perceived as either rarely feasible or not ethical or both. However, as generating evidence on impact of BSFP is essential to provide operational guidance, these studies should be encouraged through a diversity of robust, yet creative and pragmatic, methodological approaches. As a case study, a series of studies conducted over the past decade are reviewed in the same location in Niger highlighting the lessons learned.

The role of unconditional cash transfers during a nutritional emergency in Maradi region, Niger: a prospective observational study

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Presenter: FENN, Bridget (Consultant for ENN)

Cash transfers (CTs) are becoming a popular intervention of choice by agencies and NGOs as a complementary or alternative approach to food-based assistance, as part of an emergency response. There is strong evidence that CT programmes lead to an increase in household income and protect household assets from being sold, resulting in an increase in food quantity and improved dietary diversity which in turn are thought to protect children from malnutrition. However, the evidence for an impact of CTs on undernutrition is mixed and inconclusive. Despite this, CTs are increasingly being used in emergency responses with an objective of preventing acute malnutrition.

The main objective was to assess the effect of an unconditional CT implemented as part of an emergency response to food insecurity during a declared state of emergency in Aguié district, Maradi, Niger. This was a prospective observational study involving 6 consecutive months of data collection starting pre-intervention in April 2012 (baseline), on the same cohort of 'poor' and 'very poor' households, with a non-acutely malnourished child 6-36 months, enrolled by Save the Children in an unconditional CT programme (n=412). Analyses using pre-post intervention data were carried out to assess changes in the potential mediating factors within the causal pathway between CT and acute malnutrition over time and to estimate risk factors associated with acute malnutrition.

The study showed that the living standards of 'poor' and 'very poor' households improved; indicated by reduction in poverty (improvement in household expenditures, incomes, employment, asset protection, wealth rank and access to social networks) and improvement in household food security (reduced household hunger and greater household and child dietary diversity). Child anthropometric outcomes (weight-for-height and MUAC) significantly improved ($p < 0.001$), despite a decline in child health and women's well-being and autonomy. Risk factors for acute malnutrition ($p < 0.05$) were being from a very poor household, starting the lean season with lower weight-for-height z-scores and being ill two weeks prior to a survey. Factors not associated with the risk of acute malnutrition were expenditure on food, household hunger and dietary diversity; ($p > 0.05$).

The results from this study are consistent with the available evidence from impact evaluations of CT programmes and plausibly show that giving cash during an emergency can help safeguard living standards of the very poor and poor in this population. The results also show that the nutrition status of children 6-36 months who remained non-acutely malnourished improved, although without a control group it is difficult to say with certainty whether this was due to the CT programme and/or seasonal or secular trends. The study highlights barriers to preventing malnutrition and challenges previous thoughts as to how CTs work best to prevent acute malnutrition. Knowledge of these barriers and risk factors for acute malnutrition in a particular setting can be used to influence the design of future CT interventions for which a controlled trial would be recommended if feasible.

MAMI background and future needs – making policy when evidence is sparse

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Presenter: Mrs. MCGRATH, Marie (ENN); Dr. KERAC, Marko (UCL), UK

A 2 year investigation into the management of acute malnutrition in infants < 6 months (MAMI-1) in humanitarian programmes found a significant burden of acute malnutrition in infants < 6 months worldwide: an estimated 3.8 million severely wasted and 4.5 million moderately wasted (WHZ <-3 and ≥-3 to <-2 respectively, WHO Standards). Severe wasting increases over 3 fold for infants <6m when transitioning from NCHS to WHO Growth Standards (an extra 3 million infants). The prevalence of moderate wasting increases 1.4 times. This has consequences for caseload profile, numbers and staff capacity needs.

Appraisal of guidance found a range of anthropometric, feeding, clinical and maternal-related criteria for admission.

Guidelines focused on inpatient-based treatment. Specific guidance on moderate acute malnutrition (MAM) was lacking. Community based options for management were not available.

Analysis of NGO-sourced individual and programme data found a significantly higher mortality amongst in infants < 6 months compared to children in the same treatment programmes. Interpretation was severely limited by lack of standardised data, lack of individual and programme contexts, and absence of programme coverage and population prevalence of acute malnutrition in this age group.

At a policy level, there has been progress since MAMI-1. For the first time, infants < 6 months have a dedicated section in 2013 WHO guidance. Outpatient treatment is now an option for uncomplicated cases, while retaining inpatient care for complicated cases. However, it remains that practice is compromised by a paucity of evidence as to what works for this vulnerable patient group. How to define acute malnutrition in infants < 6 months and how to incorporate treatment into existing healthcare programmes are priority research questions.

Acute malnutrition in an infant <6m is a sign of a problem with the infant, mother, family and society. A 2013 review highlighted that maternal nutrition is neglected in emergency interventions; neglect of nutrition and health of mothers has consequences for their infants.

MAMI is a public health opportunity that needs to network health and community service providers, professional organisations, and approaches around mothers and their infants. A MAMI network is needed that galvanises and supports (strategically and technically) country-based initiatives to lead on evidence development, harmonised and shared in a way that informs international policy and global practice.

Assessment and treatment of MAM in infants aged <6 months: lessons from Africa

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It is estimated that worldwide, 8.5 million infants under 6 months are wasted. Moderate acute malnutrition (MAM) defined as weight-for-length between -3 and -2 z score affects 4.7 million infants. In this age group there is lack of data on the outcomes of malnutrition, on the use and interpretation of anthropometry and on potential interventions. The current case definition of acute malnutrition for infants is inferred from results of studies conducted among older children aged 6 to 59 months and is therefore problematic when applied to infants under 6 months.

We have been conducting experiments towards establishing appropriate anthropometric criteria for diagnosing acute malnutrition among infants aged less than 6 months. Informed by the properties outlined within the framework of requirement for selecting of an appropriate screening and diagnosis indicator, we set up experiments to assess the intra and inter-observer reliability, accuracy, validity, objectivity and predictive value of using WFLz and the mid-upper arm circumference (MUAC) among infants below 6 months within community and hospital settings.

Among infants aged below 6 months, the reliability and accuracy of anthropometry performed by rural community health workers (CHWs) was assessed using intra-class correlation coefficient and Bland Altman plots. Absolute measures of MUAC, weight and length were more reliably and accurately assessed than calculated indices, especially length based indices. Secondly, among hospitalized dehydrated infants and children, anthropometry was assessed before and after rehydration. MUAC was less affected by hydration than WFLz and is potentially more suitable for nutritional assessment of acutely ill children. Thirdly, in a survival analysis of longitudinal demographic surveillance system (DSS) data from the Gambia, the hazards and population attributable risks for post-neonatal infant death were demonstrated. MUAC at the age of infant vaccination was highly predictive of death before 12 months of age while very low WFLz, although moderately predictive, had low sensitivity. Lastly, the objectivity of MUAC was assessed by comparing its performance to that of a subjective measure of nutritional status such as maternal perception. Maternal perception assessed by verbal description and pictorial scale was associated with under-classification of acute malnutrition by MUAC emphasizing the added value of objective assessment of infants within a community setting.

Collectively, the results of these studies indicate that MUAC can be measured amongst infants and that in this age-group, MUAC may be more beneficial for nutritional assessment and diagnosis of acute malnutrition than the recommended WFLz.

Further, we have also been conducting research to feed into the clinical guidelines on treatment within this age group. Among children treated for severe malnutrition in Africa, mortality following discharge from hospitals ranges between 8% and 41%. We have been conducting a randomized, double blind, placebo-controlled trial of cotrimoxazole prophylaxis for 6 months among HIV-uninfected infants and children aged 2 to 59 months) with severe malnutrition following stabilization. The primary outcome will be survival at one year. In this conference, we may be able to share data from this study on infants < 6 months.

Community-based breastfeeding support and the management of MAM in infants aged <6 months: Lessons from Asia

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Background and Objectives

Breastfeeding practices are not optimal in Bangladesh, although continued for about two years of age. The Baby-friendly Hospital Initiative (BFHI) was actively implemented in the 1990s, but with about only one-third of pregnant women going for antenatal checks and 80% of home deliveries, breastfeeding messages did not reach the majority of women. To utilize any opportunity for interaction with mothers, we first demonstrated that women with partially breastfed infants below 3 months of age admitted to a diarrhoeal disease hospital could be counselled to revert to exclusive breastfeeding, and then moved to community-based projects. Since then, female peer counsellors have been successfully promoting and supporting exclusive breastfeeding in TAHN's programme areas.

Methods

Four peer counsellors in urban Dhaka (Badda) and 5 in rural Chittagong (Anowara) counsel mothers for optimal breastfeeding in the last trimester of pregnancy, within two days of delivery, around seven days and monthly till babies complete six months. Each peer counsellor is responsible for 50-60 mothers. Babies' weights are recorded within 2 days of birth and information about feeding practices collected by the peer counsellors each month. From January 2012 to September 2013, 740 mothers were counselled, but only records with birth weights were analysed for this presentation.

Results

Among 639 babies, 76 (12%) had low birth weight (LBW - below 2.5 kg) and 563 (88%) had normal weight (NW). Forty (53%) of the LBW babies and 304 (54%) of the NW babies had completed 6 months, but 251 (89%) of the NW babies had exclusively breastfed for 6 months compared to 34 (85%) of the LBW babies. Preliminary analysis of weight-for-age at 6 months showed only 9% of the NW babies were moderately malnourished (-3 to -2 z score), versus 35% of the LBW babies. Peer counsellors said it was difficult for LBW babies to gain weight like the other babies. They reported that some babies lose weight between 3-4 months when they are distracted easily from breastfeeding. It also happens when mothers do not have the patience to feed frequently and for longer duration as babies grow. Complaints of "insufficient breastmilk" occur commonly when mothers want to give other milk or solids, while work outside the home also prevents exclusive breastfeeding.

Conclusions and Recommendations

Peer counsellors could help the majority of mothers to breastfeed exclusively, but found it challenging to improve the growth of one-third of LBW babies. Interventions must also focus on adolescent and maternal nutrition to decrease both LBW prevalence and moderate malnutrition. Frequent and targeted visits are recommended not only to encourage and support mothers for exclusive breastfeeding, but also to monitor babies' growth and take timely action to improve nutritional status. Family members, especially husbands, need to be involved to buy nutritious food, and to encourage pregnant and lactating mothers to eat properly.

Lessons learned in CMAM implementation

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Presenter: Ms DENT, Nicky (CMAM Forum)

In 2013 it was estimated that around 52 million children under 5 years of age were acutely malnourished, with over two thirds of all children affected in Asia. Community-based management of acute malnutrition was first piloted in 2000 and endorsed by the United Nations in 2007 to help manage acute malnutrition and reduce childhood mortality. Since then there has been a rapid increase in service delivery and uptake globally, although some high burden countries have only recently started implementation. UNICEF estimates that current geographical coverage is less than 50% for severe acute malnutrition and not yet successful in covering global or country needs.

There has been a significant shift in the management of acute malnutrition from non-governmental organisation-led emergency programming to an integrated child health care intervention. Global mapping exercises by United Nations indicate that half of the 60 implementing countries aim for countrywide or expanded service provision. Several in-depth country reviews, in both Africa and Asia, in urban and rural contexts, highlight that governments and other stakeholders share comparable challenges in tailoring the approach to their context, especially improving quality of implementation, integration and scale-up of services. A greater understanding of community engagement and coverage and delivery services for management of moderate acute malnutrition is necessary. Coverage assessment methodologies currently under development allow the assessment of multiple indicators including infant and young child feeding and other health interventions.

Initiatives to address challenges include addressing short-term funding, improving supply management, developing course materials for pre-service and in-service training, improving staff retention and motivation, and simplifying treatment protocols to facilitate integration into health systems. Initiatives to address acute malnutrition in specific age groups and contexts are on-going.

Despite the need to adapt protocols and approaches to each specific context, there is a need for a common research agenda and sharing of what works and does not. Concerted efforts have been made to improve information-sharing and to draw on lessons learned to advance technical and organisational challenges. However many health workers have limited access to quality information due to barriers such as internet access and language. For example, one recent initiative identified less than 10% of resources are available in French, despite high caseloads of acute malnutrition in francophone West Africa. Key actions to address challenges in information-sharing include:

- Improve availability of and access to translated information
- Increase use of social media, e-learning and audio-visual materials for extended reach and use of information
- Stimulate interactive dialogue and sharing between practitioners for improved problem solving and learning
- Strengthen the collaboration between complementary initiatives.

In one decade significant advances in the adaptation and implementation of community-based management of acute malnutrition approach have been made in various contexts, but challenges to quality service delivery, scale-up and sustainability remain. It is time to draw on what we know to support scale-up and have equitable access to treatment to the millions of children who still remain outside of existing services.

CMAM integration: Lessons learned from a case study on community-based child survival programmes in Bangladesh

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Bangladesh ranks among the five countries with the highest burden of acute malnutrition in the world. Barisal Division is one of the poorest areas of southern Bangladesh, with low access to health care and high prevalence of malnutrition.

This prospective cohort study examined the effectiveness and feasibility of adding the diagnosis and treatment of severe acute malnutrition (SAM) to the community case management (CCM) package delivered by community health workers (CHWs) outside health facilities in Bhola District, Barisal Division. CHWs were paid a monthly stipend of 800 Taka (US\$11.80). A mid-upper arm circumference measurement and an oedema check for all children under three years old were introduced into routine CHW activities, including monthly growth monitoring and promotion sessions and household visits. CHWs provided ongoing sensitization to households and community members on the causes and consequences of SAM, encouraging early treatment seeking.

Integration into the CCM package of services supported high quality of care for cases of SAM, and promoted program effectiveness. The recovery rate (92%), length of stay (37.4 days) and rate of weight gain (6.7 g/kg/day) were all significantly better than international Sphere standards. Further, the coverage achieved by CHWs in this program was 89% (CI 78%–96%), one of the highest levels achieved by SAM treatment services. CHWs achieved high quality of care, with 89% of workers attaining 90% error-free case management or higher in managing cases of SAM. In receiving SAM treatment within a package of integrated services, children treated by CHWs in this study had low levels of complications and co-morbidities. Doorstep delivery promoted early treatment in this remote area. Therefore cases were easier to treat and average caseloads appeared to be manageable for CHWs. While SAM treatment increased CHW workloads, this did not negatively affect the quality of other preventive and curative services delivered. Finally, services provided by CHWs within their communities were highly cost-effective, at US\$ 26 per disability-adjusted life year (DALY) averted, and resulted in a low cost burden to beneficiary households.

In this setting, high levels of CHW education (average 8 years) and high population density in CHW catchment areas were contextual factors supporting the positive outcomes achieved. Further, workers in this NGO-implemented project received support including regular supervision and monthly stipends. Results should be tested in a setting of routine implementation within national integrated health programs. Small-scale field trials should test the feasibility of adding treatment of moderate acute malnutrition to a CHW workload, avoiding large numbers at start-up which would delay treatment of SAM cases.

Policy change should be promoted to include management of SAM with pneumonia and other recommended community-level treatments. CHWs hold promise to extend access to life-saving services, however these critical tasks require time and effort by frontline workers who have opportunity costs for their time. Sustained resources should be devoted to support CHWs in delivering effective treatment for children suffering from SAM in underserved areas.

Health system strengthening in the context of CMAM

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The approach to the management of acute malnutrition has changed substantially in recent years. There has been recognition that, despite huge advances over the last 25 years on how Severe Acute Malnutrition (SAM) is treated, coverage remains around 7 to 13%. Universal coverage to SAM management can only be achieved by ensuring availability of and access to treatment at all levels of the health system. SAM needs to be considered as a disease to be integrated and mainstreamed as part of the basic package of health services, which highlights the need to review existing implementation approaches to be increasingly horizontal, process oriented instead of vertical, model oriented.

In many countries, programs to treat AM now fall under the responsibility and leadership of the Ministry of Health and its sub-national authorities. This provides an enabling environment for AM management within the health system as it is integrated as an additional component of the basic healthcare package.

In considering SAM as a disease, we can learn from existing large global health initiatives (GHI) experiences, developed in the early 2000s, targeting specific diseases. GAVI (for immunization), PEPFAR (for HIV/AIDS) and Global Fund (for HIV, malaria & TB), applied, at their early stages a “disease based/ vertical approach”. This approach revealed its limitations as the countries where these global health initiatives were implemented had fragile health systems, continuously struggling to operate effectively and to deliver accessible standard quality care.

The nutrition community, in promoting AM management to be integrated into the basic package of health services has been, these last years, faced with similar challenges and questions as GHIs.

There is an increased need to recognize that most of the barriers identified in delivering SAM or MAM management are common to those faced by the health system overall. Therefore, a more global/ general and coordinated effort is required to pertinently tackle those constrains/ barriers. AM specialists need to join efforts with health specialists to achieve the reduction of the barriers identified as “common”.

In order to strengthen coverage, the approach to health systems strengthening has to be two-fold – to increase availability and access as part of the health system. Taking on a more horizontal approach with AM integrated to basic package of health services can support improved availability. In turn, to increase access for AM, there is a need to identify barriers that are specific to SAM/ MAM management within that package. These barriers could be what the “Acute malnutrition champions” could focus on while strengthening the capacity of health actors to mainstream acute malnutrition management in their activities. Efforts have to be coordinated with the health system in order to ensure that the various barriers are addressed nonetheless.

MUAC as admission and/or discharge criteria in nutritional programs

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Background and objectives

The World Health Organization [WHO] has endorsed mid-upper arm circumference [MUAC] as an independent admission criterion to therapeutic feeding programs [TFP] for children 6-59 months old with severe acute malnutrition. However WHO still recommends weight gain to assess nutritional recovery due to lack of evidence. Here we report on nutritional recovery as assessed by weight gain and MUAC for a large TFP using MUAC < 120 mm as the admission criterion and compare program outcomes for both discharge criteria.

Methods

We analyzed data of patients admitted in a TFP in Burkina Faso between 2007 and 2011. From September 2007 – March 2009 [Period A] recovery was defined by 15% weight gain based on admission weight. From April 2009 – December 2011 [Period B] recovery was achieved at MUAC \geq 124 mm, with a 4 week minimum stay.

Results

50,841 children were admitted with MUAC < 120 mm. Median age was 13 months. Ninety percent of all admissions recovered: 22,094 (89.1%) during period A and 23,865 (91.6%) during period B. Average length of stay [ALS] for children recovered during period A was 53.9 days compared to 37.0 for those recovered over period B. During period A, ALS was paradoxically shorter for the most malnourished. During period B, ALS was inversely related to MUAC at admission and anthropometry upon discharge was similar across all MUAC admission categories for both MUAC and weight-for-height Z score [WHZ].

Conclusion

MUAC \geq 124 mm is a superior criterion to assess nutritional recovery in this cohort. Its use allocates program resources more efficiently.

Relapse after treatment of MAM: Should we be concerned? Are we using our resources well?

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An estimated 5% of children less than five years old worldwide suffer from moderate acute malnutrition (MAM), defined as having a weight-for-height Z score (WHZ) between -2 and -3. Previous research has shown that outpatient treatment with supplementary feeding of fortified foods has the potential to treat children with MAM. These children continue to remain at a residual risk for potential deficits in cognitive development and suffer from numerous infectious complications. Experience and observation has also shown that after recovery from MAM, children are at an elevated risk for relapsing back into either moderate or severe acute malnutrition or to death.

Recent work from our group indicates that one third of children who are discharged as recovered from MAM do not remain well-nourished after one year. In a study examining almost 2000 recovered children over a 12-month follow-up period, only 63% of children remained well-nourished, whereas 17% relapsed to MAM, 10% developed SAM, 4% died and 7% were lost to follow-up. Among the children who died, 79% of their caretakers reported the illness at the time of death to be fever, diarrhea, or malaria. Our primary conclusion and concern from those data is that children successfully treated for MAM remain at high risk for poor clinical outcomes.

Operational practice is to either treat children with MAM to goal anthropometric criteria, such as $WHZ > -2$, or treat children for a fixed duration of time. Further research is needed to first examine if treating children for a set duration might be helpful and then determining what that set duration might be. Initial results of a 12 week treatment period indicate that those children treated for a longer duration will tend to do better (73% recovery), and relapse might be reduced, as only 4% developed SAM. Surviving children treated for 12 weeks were also shown to have greater anthropometric indices one year after treatment for MAM. An intervention package has been designed to determine whether offering a sequence of health and nutrition support measures to children after they recover from MAM will reduce the number of poor outcomes in the months following their recovery. These interventions could help to prevent relapse and help to maintain a durable long-term recovery for children who have recovered from MAM.

The importance of body composition as a primary outcome in trials on MAM

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Our understanding of the effects of moderate-acute malnutrition (MAM) in early life is primarily based on measures of anthropometry – mostly weight and height, which are often converted to age- and sex-specific z-scores, but which may also be expressed as weight-for-height, or body mass index (BMI), also in z-score format. Another widely used outcome is mid-upper arm circumference (MUAC). These data provide indices of stunting (short stature) and wasting (low weight for age), which are often categorized using cut-offs. Much information can be gained from such measurements, and data can be compared across populations because of the standardized format. However, the 'abstract' nature of anthropometry means that much is also concealed by these outcomes.

Measurement of body composition represents a novel approach to nutritional status. The simplest approach aims to differentiate fat from lean mass. These two traits have very different implications for short- and long-term outcomes. Fat represents a store of energy that may fund immune function or future growth. Lean tissue represents functional tissue, which may also contribute to immune function. The relative ratio of fat to lean provides an indication of the allocation of energy between 'completed growth' and 'investment potential'. Low levels of fat may indicate reduced resilience to ecological stresses, whereas low levels of lean mass indicate exposure to cumulative stresses. The relative 'survival' value of fat versus lean tissue in early life remains uncertain, hence it is unclear what constitutes the optimum pattern of tissue accretion, and whether variation in fat and lean accretion across populations represents local adaptation or pathology. Equally, it remains unclear whether public health interventions should promote lean mass, fat, or a particular ratio of the two.

Measurement of body composition in early life is now possible through several techniques. Air displacement plethysmography can be used between birth and six months, providing the density of lean tissue has not been perturbed by malnutrition. Measurement of body water by isotope dilution is the only technique that can be used in all age groups, but likewise is only accurate if lean tissue hydration is within the normal range. Bio-electrical impedance analysis has conventionally been used to predict body water, but has low accuracy in individuals. However, Bio-electrical Impedance Vector Analysis (BIVA) is showing greater promise for differentiating variability in lean tissue from variability in hydration. MAM may affect not only fat and lean masses, but also the composition of lean tissue, and BIVA is emerging as a valuable approach for assessing these effects.

A key step forward is to produce reference data for such techniques, enabling individual data or studies to be assessed relative to normal ranges. Reference data has now been published for air displacement plethysmography in Ethiopian infants, while BIVA data is also being acquired. Other studies have collected isotope measurements of body water in large samples. Emerging data on body composition are rapidly describing the characteristics of MAM, and will clarify its aetiology and response to treatment.

Study design issues in trials among children with MAM

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There is a need for acceptable and affordable food aid products for children with moderate acute malnutrition (MAM), which effectively restore body tissues and functions. The effects of potential products need to be assessed through randomised controlled trials (RCT). However, nutritional RCTs pose ethical and scientific challenges.

Control groups are usually given “standard of care”, but recommendations for treatment do not exist in all settings or supplements are not always available. In places where treatment is nonexistent, not giving any food to children in the control group is not without ethical concerns. However, from public health and scientific perspectives, it is problematic to compare with supplements which are not recommended or the effect of which is unknown. Firstly, it is of questionable value for a low-income country that a trial is conducted to compare an experimental supplement to a supplement that is not already standard of care, and national ethics committees may not grant permission for such a trial. Secondly, it is difficult to interpret findings from a trial comparing an experimental supplement to one that has not been properly tested. Hence, where supplementation is not standard of care, it may be ethically justifiable to have an unsupplemented control group. In such cases, mothers should receive health education and the children should receive medical attention, be monitored closely, and referred for further medical examination and treatment if not recovering. Delayed supplementation may also be considered.

Food interventions are complex, since supplements with the same energy content may be based on different ingredients, and nutrients in different forms and amounts. Consequently, there are an infinite number of potential food supplements, yet only a few can be tested in trials. Some components may be potentially important, but costly. If several factors are of interest, then a factorial design may be needed. E.g. the treatFOOD trial uses a 2-by-2-by-3 factorial design among 1600 children to assess the effects of the food matrix (LNS vs CSB), soy protein quality (dehulled vs isolate) and milk protein content (0%, 8% and 20%). If the effects are independent, then there is full power to assess the effects of each of the three factors simultaneously. Potential problems in food supplementation trials include spill-over and differential attrition. I.e. those randomised to the less preferred control supplement may get the experimental supplement and are more likely to drop-out. A cluster-randomised design, where sites rather than individuals are randomised, may reduce these problems, but will require greater sample size and reduce confounding less efficiently.

The effect of a given nutritional intervention depends on the initial nutritional status and the background diet. Children with similar weight-for-height Z-score or MUAC measurement may have different growth patterns, body composition and micronutrient status and intake. Hence, the effect of the same intervention may be different between children and populations. Therefore, it is important to collect data on baseline nutritional status, to assess for effect modification and evaluate the generalizability of the findings.

WinFood data from Kenya and Cambodia: constraints on field procedures

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Background: The broad aim of the Winfoods Project was to alleviate childhood malnutrition via utilisation of traditional foods (by incorporating edible termites and spiders in complementary food (CF) formulations in Kenya and Cambodia, respectively). The efficacy of the developed CF on stunting, lean mass accrual, lipid profile, haemoglobin, iron and zinc status and gross motor development was assessed in a 9-month intervention comparing the CF with CSB+ (Kenya) and CSB++ (Cambodia). We aim to highlight methodological difficulties associated with the assessment of lean mass (LM) and blood nutritional indicators (BNI).

Methodology: In a randomized controlled design, infants received Winfoods for 9 months from 6-15 months of age. LM accrual and BNI (lipid profile, iron and zinc status) were measured cross-sectionally at 9 and 15 months of age, respectively. To determine LM infants were dosed with 3g deuterium oxide [D₂O] (0.5g/Kg body weight) in Kenya or 7g nested D₂O both at 6 and 15 months of age in Cambodia. Saliva was collected from each infant before the oral administration of the dose (baseline sample) and then at [1-hour and 3-hours in Kenya or 2-hour and 3-hours – Cambodia] after administration. D₂O enrichment in saliva was determined by Fourier Transformed Infrared Spectrophotometry locally in Kenya. For Cambodia, samples were exported to Bangalore, India for lean mass analysis. To determine blood indicators, 3ml blood was drawn by venipuncture. Hemoglobin concentration was measured using a Hemocue machine. Whole blood portion was used for determination of lipid profile in Canada. Serum was used for Fe, Zn status assay in Germany.

Results: In Kenya, the food ration was depleted way before the subsequent visit due to food insecurity. Intervention was associated with family planning by a section of the community. High rate of loss to follow up was attributed to relocation for family reunion and household conflicts. Cambodian ethics review committee (ERC) had issues with the locally produced Winfood product hence ethics approval was delayed. Regarding D₂O in Kenya we observed that both ERC and mothers misunderstood the concept of 'special water' and it took a long time to explain. In Cambodia mothers were worried about lengthy waiting time for saliva sampling. D₂O spillage during dosing was a major problem in Kenya due to agitated children, mainly at 15 months who spat deuterium. High morbidity among children depicted as dehydration limited saliva production while mouth sores made saliva sampling difficult (saliva samples were contaminated with mucus, blood and breast milk). Blood assay challenges included high rates of hemolysis due to restless children and inexperienced staff since procedures are not routine. Nervous mothers made the situation worse. Lack of local facilities to measure iron, zinc status and lipid profile increased cost and delayed results.

Conclusions: Challenges were largely contextual. Misconceptions about intervention and procedures, infant morbidity and restlessness affected D₂O assessment. Inexperienced staff and lack of local sample analysis capacity affected blood assays. Local laboratory capacity, training of staff and sensitization of communities and ERC are highly recommended.

Small-quantity lipid-based nutrient supplements, together with malaria and diarrhoea treatment, improve growth and prevent MAM in young Burkinabe children

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Presenter: Dr. HESS, Sonja Y (University of California Davis), USA

Background: Supplementing young children's diets with small-quantity lipid-based nutrient supplements (LNS) may prevent growth restriction, but the optimal amount of zinc to include in these products is uncertain.

Objectives: To assess zinc-related functional responses among young Burkinabe children who received LNS without or with varied amounts of zinc, and to compare these outcomes among children who do or do not receive LNS and selected health services.

Methods: In a partially masked, placebo-controlled, randomized trial, 34 communities were assigned to immediate (II) or non-intervention (NI) cohorts. 2469 eligible II children were randomly assigned to 1 of 4 groups to receive LNS containing 0, 5 or 10 mg zinc (and placebo tablet) or LNS without zinc and 5 mg zinc tablet from 9 to 18 months of age. The daily ration of LNS was 20 g which provided 118 kcal along with 20 other micronutrients in addition to zinc. Weekly morbidity surveillance was conducted at children's homes; malaria treatment was provided for confirmed malaria, and ORS for reported diarrhea. Children in NI (n=797) received neither supplements nor illness treatment. At 9 and 18 months, length, weight, mid-upper arm circumference (MUAC) and hemoglobin (Hb) concentration were measured in all children. Results: Reported adherence was $97 \pm 5\%$ for LNS and tablets. Mean baseline Hb was 89 ± 15 g/L, and 91% were anemic (Hb <110 g/L). At 18 months, change in Hb was greater in II cohort than NI (+8 vs -1 g/L, $p < 0.0001$), but 79% of II were still anemic (vs. 91% in NI). During the 9 month follow-up in the II cohort, the incidence of diarrhea and malaria was 1.15 ± 1.18 and 0.55 ± 0.54 episodes per 100 child-days, respectively and did not differ by intervention group. At baseline, mean length-for-age z-score (LAZ), weight-for-length z-score (WLZ) and MUAC were -1.21 ± 1.10 , -0.99 ± 1.05 and 133 ± 12 mm, respectively, in all groups combined. Mean length, weight and MUAC were significantly greater at 18 months in II children ($p < 0.0001$) compared to NI, but did not differ by II group. Stunting prevalence at 18 months was 39% in NI and significantly lower (29%) in II cohort ($p < 0.0001$). The prevalence of moderate acute malnutrition (MAM; defined as $115 \text{ mm} \leq \text{MUAC} < 125 \text{ mm}$) was significantly lower in II cohort at 18 months (7.1% in II vs 11.1% in NI, $p = 0.001$), but did not differ by II group. The difference in MAM prevalence between II (7.8%) and NI (10.5%) was marginally different ($p = 0.058$) when MAM was defined as $-3 \leq \text{WLZ} < -2$.

Conclusions: Providing 20 g of LNS daily with or without zinc along with malaria and diarrhea treatment significantly increased hemoglobin concentration and growth and reduced the prevalence of anemia, stunting and MAM in this population.

The effect of dietary supplementation on the change in body composition of young Malian children with MAM

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Objective: To compare the effect of four dietary supplements for the treatment of moderate AM (MAM) on the change in body composition.

Methods: 289 Malian children 6-35 months of age with non-edematous MAM were randomized in clusters to receive 1 of 4 supplements, which provided 500 kcal/day for 12 weeks: 1) Supplementary Plumpy (SP); 2) Corn Soy Blend ++ (CSB++); 3) Misola (MI); 4) Locally milled flours plus sugar, oil, and micronutrient powder (LMF). Body composition was assessed at baseline and at the end of the 12 week intervention using deuterium oxide dilution and Fourier Transform Infrared Spectroscopy.

Results: At baseline, the mean \pm SD age, mid-upper arm circumference (MUAC), weight-for-length Z-score (WLZ), body weight, total body water (TBW), fat-mass (FM), and percent FM (%FM) across all subjects was 14.8 ± 7.2 months, 12.1 ± 0.5 cm, -2.20 ± 0.66 , 7.03 ± 1.12 kg, 3.94 ± 0.76 kg, and 29.0 ± 6.32 %, respectively. At 12 weeks, the adjusted increases of 1.23 kg in weight and 1.15 cm in MUAC were greatest in the SP group. FM increased by 0.35 kg, 0.29 kg, 0.25 kg, and 0.41 kg ($p=0.02$) among children in the SP, CSB++, MI, and LMF groups, respectively; however, the change in %FM did not differ between groups ($p=0.13$). Gains in MUAC, body weight, TBW, FM, and %FM were greater in children who recovered from MAM vs. those who did not recover ($p<0.0001$).

Conclusion: Body composition assessment provides additional insight into the type of tissue accrued during recovery from MAM.

Pre-service and in-service capacity building: lessons learned from the Integrated Management of Childhood Illness (IMCI).

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Background:

Integrated management of childhood illness (IMCI) strategy was developed by the WHO and UNICEF in the mid-1990s as a strategy to reduce under-five mortality. Aimed at countries with mortalities >40/1000 live births, it has been adopted by more than 100 countries. The strategy aims not only to improve case management skills of health workers at the primary level health facilities, but also to strengthen health systems, and to improve home and community practices to prevent common childhood illnesses¹.

The strategy has demonstrated success in enhancing health worker performance, improved quality of clinical care for sick children and low cost care per child correctly managed, improved nutrition status among children, and reduced child mortality where fully implemented²⁻³.

Lessons learnt from IMCI training:

IMCI capacity building in both pre-service and in-service training has often been in increasing coverage of trained health workers.

In-service training. Major obstacles with in-service training include the cost of a model reliant on centralised, tutor-based training, a shortage of experienced trainers, inadequate supply of training materials, poor follow-up and support supervision, frequent attrition of trained staff, and reaching few private practitioners. Other practical difficulties include releasing essential staff for off-site training, per diem, travel and accommodation costs, and reluctance to apply locally learned skills from centralised courses.

To mitigate the challenges, countries responded with a number of strategies to increase coverage. Many countries shortened the IMCI course ranging from 5 to 7 days although the content was largely not reduced, and in some cases, was even increased. A meta-analysis that examined shortened IMCI courses demonstrated that the standard course was superior in terms of health work performance.

Pre-service training. This was considered as a feasible solution to increase health system coverage by IMCI trained health workers in a cost effective and sustainable manner and influence practices of health professionals in both the public and private sectors. From inception, many countries responded by introducing pre-service IMCI in the training of nurses, midwives, health officers and medical doctors.

The main challenges for pre-service IMCI have been negotiating adequate time and placement into the curriculum, ensuring adequate facilities and organization for clinical sessions, sustaining the supply of teaching materials and coordinating between different academic programmes.

Addressing IMCI training challenges:

A global technical consultation on IMCI training scale-up recommended several strategies, including the implementation of innovative training approaches to provide alternative training options⁴. A key recommendation was a 'blended approach' of competency-based IMCI training package with strengthened individual study, group learning, local clinical mentoring, limited facilitation by a regional trainer and ongoing evaluation and monitoring. This would require suitable learning materials and approaches that would enable large numbers of health workers to take the responsibility of acquiring most of the knowledge and skills needed. However, these approaches had to maintain important principles of IMCI such as the integrated approach to caring for the sick child, chart booklet, recognition of danger signs, colour coding of risk categories, the assess-classify-treat format, and communication with caregivers.

As a result several training options have been developed for both in-service and pre-service IMCI training. These include shortened IMCI in-service courses varying from 5-7 days training, the use of interactive e-learning programmes such as the IMCI computerised adaptation and training tool (ICATT) and the IMCI distance learning courses (dIMCI) to allow health workers to have non-residential training⁵⁻⁶.

Conclusion:

The lessons learnt from IMCI has been that pre-service training reaches the majority and should be the main focus of training while in-service training should be used for continuing medical education and refresher training. Training should provide several options and approaches suitable for different settings and focussing on core competences.

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Lessons learnt from RUTF development relevant for MAM management

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Presenter: Dr. BRIEND, André (University of Tampere, Finland), France

RUTF was developed by changing the formulation of an existing liquid diet, F-100, recommended by WHO for the rapid catch-up phase of the treatment of children suffering from severe acute malnutrition. The objective was to obtain a solid diet which met specifications for the treatment of SAM but would be safe to store and use at home. For this, about half of the dried skimmed milk used in the F-100 formulation was replaced by peanut butter. The resulting product proved highly effective to promote rapid weight gain both in malnourished children and wasted adults including those infected with HIV, but the high milk content resulted in an expensive product that was difficult to manufacture in developing countries. However, there are uncertainties re. its formulation, as the product is used in outpatient settings, often by children and adults who take other foods in addition to RUTF. Also, the impact of RUTF on micronutrient status after nutritional rehabilitation in home settings has never been assessed. For the last 10 years, attempts have been made to lower the quantity of milk present in the RUTF and to use ingredients that enable local production while supporting the local economy. Results of these attempts will be presented and research gaps highlighted.

New formulations of ready-to-use foods

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Development of improved Ready-to-Use Therapeutic Foods (RUTFs) is a priority since the endorsement of the Community-based Management of Acute Malnutrition (CMAM). The most commonly used formulation is based on peanut and milk powder, but the following issues need to be addressed: acceptability is low in certain cultural contexts; milk powder is very expensive (about 50% of the total ingredient cost) and therefore it constraints the scaling up of local/regional production; peanut are often prone to aflatoxin contamination.

Therefore, Valid International developed and trialled alternative RUTF formulations based on locally available and/or cheaper ingredients: Chickpea- and Sesame-based RUTF (CS-RUTF), Soya-, Maize, Sorghum-based RUTF (SMS-RUTF), and Whey Protein-based RUTF (WPC-RUTF). In Malawi, an observational study highlighted that CS-RUTF was effective in reversing HIV wasting in adults, and bio-electrical impedance measurements suggested a positive direct correlation between weight gain and free fat mass. In the same country, a randomized controlled trial demonstrated that WPC-RUTF was not inferior to the standard peanut and milk-based formulation (P-RUTF) when rehabilitating children under five years of age from severe acute malnutrition (SAM). In other two similar studies conducted in Zambia and Democratic Republic of Congo, SMS-RUTF and P-RUTF were equivalently efficient in rehabilitating SAM in children aged 2 to 5 years, but not in those below 2 years.

In this presentation, we will (i) describe the procedures used for the development of the RUTF formulations, (ii) share successes and challenges encountered in formulating lower cost prototypes that meet international standards, (iii) suggest ways to reduce effect of anti-nutrients, to enhance bioavailability of crucial micronutrients (e.g. iron), and minimize abdominal discomfort. Based on results from efficacy and effectiveness trials, we will discuss their implications for policy-making and implementation of CMAM programmes.

Recent experiences in the development of locally-produced ready to use foods

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Presenter: Dr. RYAN, Kelsey (Washington University School of Medicine), USA

Ready-to-use foods for treatment of moderate acute malnutrition (MAM) are micronutrient-fortified, lipid pastes containing roasted peanuts, oil, micronutrients, sugar, soy and/or dairy ingredient powders. The benefits of pastes like ready-to-use therapeutic food (RUTF), ready-to-use supplementary food (RUSF), and lipid nutrient supplements (LNS) for the treatment of nutritional maladies are that they are shelf-stable due to their low water activity, they are easily transportable, and they can be eaten as-is.

Since the development of ready-to-use foods, cost reduction and local production experimentation have been ongoing. Attempts to replace ingredients like skim milk powder with alternate dairy protein ingredients or non-animal ingredients have been reported, but little food and process development information has been revealed. Linear programming or least-cost optimization mathematical models have been employed to help design low cost paste formulas from a selection of ingredients that also meet nutritional requirements.

A new user-friendly tool can be used to develop new formulas that incorporate locally-sourced ingredients. New approaches to ingredient utilization are necessary for future ready-to-use food production and will require the development of novel processes for local ingredients compared to traditional pastes. The challenges of incorporating novel ingredients include processing changes, flavor and acceptability, and meeting nutrient requirements. Our research is designed to not only look at substitute ingredients, but also to optimize processing conditions in order to reduce cost by energy savings, extended shelf-life, and lower nutrient degradation. An RUSF using a novel dairy ingredient, whey permeate, was recently developed and is currently being tested in a prospective, double-blind randomized clinical trial for children with MAM in Malawi. Recent research in the development and testing of ready-to-use foods for MAM include a programmatic study in Sierra Leone where the same food is used for treatment of both moderate and severe acute malnutrition in an integrated program. Different doses of the same food are given as a child improves from severe to moderate to no acute malnutrition. The logistics of operational programs in which malnourished children are identified in the community, food is distributed, and coverage assessed is equally as important as the food itself.

Maximizing potential for impact: measuring and addressing issues of sharing and diversion in MAM management programs

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Programs to prevent and treat moderate acute malnutrition (MAM) commonly depend on providing supplementary foods to children. The Prevention of Malnutrition in Children Under Two Years of Age (PM2A) approach recommends providing nutritional supplements to pregnant and lactating women and to children six months to two years; some treatment programs reach older children and may provide family rations. Typically, the supplements used in such programs are variants of corn-soy blend (CSB), a micronutrient-enhanced blended food cooked as porridge, sometimes mixed with oil, or a lipid-based nutritional supplement (LNS). A comprehensive review of USAID-supported programs found that the size of the CSB ration targeting children ranged from 17.5g to 400g/ day; one reason for this disparity was differing assumptions about sharing of supplementary food, from none to equal sharing among all household members. WFP bases its ration calculation on the presumed need to provide twice the ration intended for the target child, to account for sharing. Expectations of sharing are thus a critical determinant of the amount of food needed to ensure that the target child receives an effective dose.

Little empirical information is available about sharing supplementary foods, and the majority of such studies have appeared in the non-refereed literature. What literature exists suggests that sharing of supplementary food, at least among children in the household, is the norm. There is little evidence that one type of food is more likely to be shared than another (e.g., that LNS shows different patterns of sharing from CSB variants or that the CSBs vary), and little systematic evidence concerning their perception as a food or a medical treatment (or both). Factors affecting the degree of sharing or diversion of the supplement may include household composition, food insecurity, effectiveness of social and behavioural communication, mother's involvement in child feeding, child age, desirability of the supplementary food or its components (e.g., the oil if provided separately), and other factors.

Two ongoing studies of supplementary feeding, conducted in Malawi by Tufts University with support from USAID, and in Sierra Leone by Tufts University and Washington University in Saint Louis with funding from USAID and the World Food Program, are collecting data on the uses of supplementary foods for MAM treatment, including factors associated with appropriate use, sharing, and diversion. In Malawi, CSB and a separate ration of oil are provided in quantities sufficient to allow for intrahousehold sharing, per the government's required treatment protocol. In Sierra Leone, four foods – one LNS and three variants of CSB, one of which is delivered with a separate oil ration (CSB14), one with oil incorporated into the packaged CSB (Supercereal Plus), and one into which oil is mixed at the time of distribution (Supercereal) – are compared to determine how these characteristics, in concert with other household and food-related factors, affect use and the degree of diversion and sharing of the supplementary food ration. Preliminary data from these ongoing studies assess the determinants and degree of diversion and sharing.

Development and acceptability of ready-to-use supplementary food made of local food ingredients for preventing and treating moderate acute malnutrition (contributed paper)

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Presenter: Dr. ISLAM, M Munirul (International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b)), Bangladesh

Background and objectives: Inadequate energy and micronutrient intake during childhood is a major public health problem in many developing countries including Bangladesh, particularly in food insecure communities. Locally produced ready-to-use supplementary food (RUSF) can improve growth, development and micronutrient status of children. The study was conducted to develop recipes for RUSF based on locally available food ingredients and to test their acceptability among children.

Methods: A checklist was prepared of available and commonly consumed food ingredients that have the potential of being used for RUSF. Linear programming was used to determine possible combinations of ingredients and required micronutrient premix composition, and samples were prepared in the icddr,b food-processing lab. To test the acceptability of the RUSF recipes compared to Pushti-packet (a cereal based food-supplement), an acceptability trial was conducted among 90 children aged 6-18 months in a slum in Mirpur, Dhaka, Bangladesh. The mothers were asked to rate the color, flavor, mouth-feel, and overall liking of the RUSF by using a 7-point hedonic scale (1=dislike extremely, 2=dislike moderately, 3=dislike, 4=neither dislike nor like, 5=like slightly, 6=like moderately, 7=like extremely).

Results: Two RUSFs were developed, one based on rice and lentils and the other one on chickpea. Mean response for each sensory quality of all products was more than 6. The two RUSFs scored significantly better compared to Pushti-packet in terms of 'overall liking'. Children were offered 50g of food and they consumed (mean±SD) 26.1±15.1g RUSF and 17.1±14.3g Pushti-packet which took them 20.9±9.6 minutes. There was no significant difference between two RUSF consumption, but there was a significant difference between chickpea-based RUSF and Pushti-packet (28.4 vs.17.1g) consumption.

Conclusions: Locally available food ingredients were used to develop RUSFs for preventing and treating moderate acute malnutrition. The study results suggest that rice-lentil and chickpea-based RUSFs are highly acceptable by children and their caregivers.
(Supported by World Food Programme)

PlumpyField – Network of local producers of RUF (contributed paper)

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Expanding coverage for the 35 million children in the world suffering from Moderate Acute Malnutrition (MAM) will require sustainably scaling up regional procurement of lipid-based RUSF products. Momentum is now building to achieve this aim through ten local ready-to-use food (RUF) producers in the PlumpyField Network, which was established by the French company Nutriset in 2005. These independently-owned factories, located in Sub-Saharan Africa, Asia, and the Caribbean, currently produce one-third of the world's RUF supply. Overcoming substantial obstacles, they have achieved the same high quality standards of producers in Europe and the U.S., with increasingly competitive pricing. Being part of a mutually supportive and interactive network of RUF producers from around the world provides unique learning and partnership opportunities, from sharing insights on peanut supply chain development, increasingly complex quality challenges, to pooled procurement. This network system has been instrumental to the success of local production for the members of the PlumpyField Network.

Historically, local producers achieving economies of scale and reliable local and international supply chains (i.e. for peanuts, oil, sugar, milk etc.) takes several years, making the cost of locally-procured products more expensive in the short term. However, there are numerous positive outcomes and externalities that cannot be ignored, such as decreased lead times (especially crucial to reach children with acute malnutrition), lower shipping costs, economic development, and maturation of the food processing and microbiological laboratory sectors. UNICEF and WFP have become leaders in local and regional procurement as they continually optimize their strategies to best meet global needs. Local production is often an important stimulant of public-private partnerships, including procurement of RUF by local governments for government-run acute malnutrition programs, furthering nutritional autonomy.

Ms. Hilina Belete, Deputy General Manager of Hilina Enriched Foods in Addis Ababa, Ethiopia, joins the panel as a representative of the PlumpyField Network. Hilina Enriched Foods was established in 1998 to produce food products, such as vitamin A enriched sugar and iodized salt, specifically designed to combat malnutrition and micronutrient deficiencies in Ethiopia. In 2006, with political support from the Government of Ethiopia, technical support from Nutriset, and programmatic support from UNICEF, their production capabilities were expanded to include RUTF. Since that time, production capacity has expanded to include RUSF, and Hilina Enriched Foods now has a production capacity of 12,000 MT per year.

Ms. Hilina Belete will be sharing both the successes and a wide range of challenges that arise from making RUF in a developing economy. Some topics that will be discussed include: local business environment, customer demand, finances, factory set up and technology transfer, partnerships, raw material supply chains, research and development, quality, production and scale-up for emergency demand, and local infrastructure and supply chain. The experiences of PlumpyField members and their programming partners offer important insights for the future of RUSF production for treating MAM.

Possible role of the microbiome in the development of acute malnutrition and implications for food-based strategies to prevent and treat acute malnutrition

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The microbiome is the ecological community of commensal, symbiotic, and pathogenic microorganisms within our bodies. Housed primarily in the small intestine, it contains over 100 trillion microorganisms, 100-fold more genes than the human genome. The microbiome facilitates the absorption of food and plays a role in homeostasis, micronutrient synthesis, detoxification and immune function. The microbiome has adapted to diet and environments to help the host best utilize dietary intakes where dietary intake affects the species and relative abundance of bacteria and genes in the microbiome. In young children, malnutrition hinders the co-evolution of the microbiome and immune system, often impairing the function of the small intestine mucosal lining, which can cause enteropathogen infection and impede nutrient absorption. The core microbiota is made up of a broad spectrum of bacterial species that vary from person-to-person based on age and environment. This finding was observed in a comparative metagenomic study of the gut microbiomes of 531 healthy infants, children, and adults living in the USA, Venezuela, and Malawi which found that the representation of genes related to micro- and macronutrient biosynthesis and metabolism changed during development and based on environment.

In a study examining 317 Malawian twin pairs during the first three years of life, 50% remained well nourished, 43% became discordant and 7% manifested concordance for acute malnutrition. Fecal samples were taken from each twin over time, and those samples were transferred into germ-free mice where meaningful changes in the fecal taxonomic, genetic, and metabolic content accompanied the transplantations. Specifically in kwashiorkor mice, a rapid weight loss was experienced when initially fed a Malawian diet followed by a rapid weight gain with the introduction of therapeutic food and subsequent weight loss after return to the Malawian diet. These data provide evidence that food-based strategies may be part of the solution to treating kwashiorkor.

Systematic biological databases to identify the observational changes in microbiomes would aid in identifying the marked relationship between diet, nutritional status and microbiome configuration. This knowledge would contribute to development of improved therapeutic and supplementary foods to assist in healing the microbiome and alleviate acute malnutrition. A thorough understanding of the microbiome is the first step in developing and furthering treatments for this serious condition.

Metabolomics in nutrition research: assessment of metabolic status, response to treatment, and predictors of mortality in malnourished children

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OBJECTIVE: Malnutrition is a major cause of morbidity and mortality in infants and young children. To identify and target those at highest risk there is a critical need to elucidate the pathogenesis of severe acute childhood malnutrition and to characterize biomarkers that predict complications prior to and during treatment.

METHODS: We applied targeted and non-targeted metabolomic analysis to characterize the hormonal and metabolic status of malnourished Ugandan infants and young children prior to and during nutritional therapy. Children ages

6mo-5yr were studied at presentation to Mulago Hospital and during inpatient therapy with milk-based formulas and outpatient supplementation with ready-to-use-food. We assessed the relationship between baseline hormone and metabolite levels and subsequent mortality.

RESULTS: 77 patients were enrolled in the study; a subset was followed from inpatient treatment to outpatient clinic.

Inpatient and outpatient therapies were associated with significant increases in weight/height z scores, but 12.2% of the children died during hospitalization. The levels of more than 100 metabolites were measured in samples of 1 ml of plasma. Treatment was accompanied by striking changes in the levels of fatty acids, amino acids, acylcarnitines, inflammatory cytokines, and various hormones including leptin, insulin, growth hormone, ghrelin, cortisol, IGF-1, GLP-1, and peptide YY. Multivariate regression analysis controlling for HIV and malarial infection identified a number of biochemical factors that were associated with, and may predict, mortality during treatment.

CONCLUSIONS: Metabolomic analysis provides a comprehensive hormonal and metabolic profile of severely malnourished children prior to and during nutritional rehabilitation. Metabolomics can be used to identify biomarkers associated with mortality and may thereby facilitate the targeting and treatment of those at greatest risk.

Abstracts of Contributed Poster Presentations

IAEA-CN-217--1P

Moderate Malnutrition in Children Aged 0-5 in the Republic of Macedonia

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Background: Undernutrition indicates a lack of the necessary energy, macro or micronutrients in person's dietary intake. FAO reported that one in seven people in the world do not get enough food to be healthy and lead an active life. The objective of our survey was to assess the prevalence of undernutrition among children aged 0-5 in Macedonia.

Methods: Nationally representative household survey was conducted and data for 1376 children under the age of 5 was gathered. The survey included two samples, one for general population and separate one for Roma population living in Roma settlements. Roma children had higher prevalence of undernutrition in previous surveys. The data was gathered in the frames of UNICEF's Multiple Indicator Cluster survey in 2011. WHO Child Growth Standards were used to assess the nutritional status.

Results: Out of general sample children 4.9% were moderately stunted (between -3 and -2 z-scores of height-for-age index), 5.6% boys and 4.3% girls. The percentage of moderately stunted children was over three times higher in the poorest wealth quintile compared to the richest one (7.2% and 2.0% respectively). In general population of children 1.8% were moderately wasted (between -3 and -2 z-scores of weight-for-height index), 2.2% boys and 1.4% girls. Wasting was also 3 times more prevalent in children from the poorest households compared to the richest ones (3.5% and 0.6% respectively). As for the Roma children, 16.5% of them were moderately stunted (21.1% boys, 12% girls) and 4.5% moderately wasted (4.3% boys, 4.7% girls). Nearly 10 times more moderately stunted Roma children were present in the poorest wealth quintile compared to the richest one (28.7% and 3.5% respectively).

Conclusions: The results of the survey indicate low prevalence of undernutrition in the general population of children under 5 years of age in Macedonia which is in acceptable ranges defined by the WHO (<20% for stunting, <5% for wasting). Results for the Roma children indicate that undernutrition existing in this population group is more prevalent compared to the general population. Moreover, stunting among Roma boys and in the poorest Roma households was over 20% which is considered as malnutrition of medium severity. Interventions targeting most affected populations should be introduced and implemented. Those interventions should not include only nutrition-related measures but should be part of the broader social context of the problem.

IAEA-CN-217--3P

Growth during 6–9 months of age and effects of vitamin A and Iron supplementation in an urban cohort of Sri Lankan children.

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Introduction

Moderate malnutrition with micronutrient deficiency is common in Sri Lanka. Data indicate a third of pregnant mothers and half of infants are anaemic and third of infants vitamin A deficient.

A preliminary analysis of data from a study conducted to assess the vitamin A and iron status and effects of supplementation on growth in 6 month old children is presented here.

Materials and Methods

Term singleton healthy 6 month old infants were recruited from the Colombo Municipal Area. An interviewer administered pre-tested questionnaire, was used to collect data on their basic information and feeding practices.

Baseline vitamin A, haemoglobin, serum ferritin and C-reactive protein were assessed. Children were given 100,000 units of vitamin A orally and 3mg/kg daily dose of iron till 9 months of age and all assessments were repeated.

Serum retinol concentration was assessed by reverse phase HPLC. Baseline information was analyzed for n=95 babies (53 boys) at 6 months and paired data (n=53) to analyze effects of intervention. Babies were divided into those with and without MAM at 6 months. Student's t test was used to compare.

Results

At 6 months, the mean weight was 7.1 ± 1.0 kg with SDS of -0.72 ± 1.1 , and length was 68.1 ± 3.4 cm with SDS of 0.61 ± 1.5 . 30 babies had MAM at 6 months (out of 95). Mean vitamin A level was 34.8 ± 7.9 µg/dl and the mean haemoglobin was 11.4 ± 0.98 g/dl. Two babies had low vitamin A levels (< 20 µg/dl) and 41 were anaemic (< 11.0 g/dl). Mean serum ferritin was 21.7 ± 19.6 µg/l at 6 months (data of 82 babies) and 56 had low levels (< 12 µg/l).

Of the 53 pairs with pre and post intervention data, MAM was present in 16 at 6 months and 19 at 9 months. Of the latter, 6 babies had developed MAM during the study period. This change was significant ($p < 0.001$) against only 3 babies who overcame MAM at post intervention.

There was a significant reduction in the serum vitamin A concentration (pre vs. post intervention, 35.01 ± 7.9 µg/dl vs. 29.2 ± 5.8 µg/dl; $p < 0.001$) but not in the haemoglobin. There were no significant differences in both iron and vitamin A status following supplementation in the MAM and non-MAM groups.

Conclusions

The incidence of MAM and anaemia was high but vitamin A levels were normal. Despite vitamin A mega dose the mean Vitamin A level had reduced significantly at 9 months. During the 3 month follow-up a significant number developed MAM.

Although iron supplementation had positive results, vitamin A supplementation did not, at 9 months. This analysis did not identify differences in the response to micronutrient supplementation in babies with and without MAM. Larger studies are, required to identify reasons for reduction in vitamin A status and inadequate growth despite supplementation of 2 important micro nutrients.

IAEA-CN-217--4P

Prevalence of Moderate Malnutrition in Children of Jaffna District, Sri Lanka

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Objective of the study was to determine the moderate malnutrition and associated risk factors among children aged 1-5 years in Jaffna District. In a multi-stage cluster sampling, 846 children were selected from March, 2010 to May, 2012. Anthropometric measurements and biochemical parameters were obtained. Questionnaires were used to obtain associated risk factors. Of the total of 846 children, 414 were males (48.9%). Prevalence of wasting, underweight and stunting were 21.6, 33.1 and 26.4% respectively. Prevalence of moderate forms of wasting, underweight and stunting were 17.7, 27.2 and 22.1% respectively. Prevalence of wasting and underweight of children were under 'very high public health significance' in Jaffna District. Prevalence of severe forms of wasting, underweight and stunting were 3.7, 5.9 and 4.3% respectively while low prevalence of overweight (3.4%) was observed among children. Mean calorie consumption by the children aged 12-23, 24-35, 36-47 and 48-59 months was 782.6 (± 150.3), 918.6 (± 142.5), 998.5 (± 139.2) and 1055 (± 173.5) kcal/day respectively and were lower than RDA ($p < 0.05$). In this study, 85.5 and 30.4% of children consumed low levels of calorie and protein. Risk of wasting (OR: 8.2, 95%CI; 3.1-21.9), underweight (OR: 19.8, 95%CI; 6.4-61.8) and stunting (OR: 3.3, 95%CI; 1.8-5.8) was high in children with calorie deficiency when compared with normal children. The breast and complimentary feeding practices were not satisfactory [Exclusive Breastfeeding: 63.9%]. In addition, 23.4% of the mothers were unaware of the breastfeeding practices. Among the children, 11.1, 29.2, and 30.3% were affected with frequent gastroenteritis, respiratory tract infection and fever respectively. Prevalence of anaemia was 36.4% and it was under 'moderate public health significance'. Prevalence of Iron Deficiency (ID) was 33.4% and among, 31.7% was affected with Iron Deficiency Anaemia (IDA). Among the anaemic children (n308), mean (\pm SD) dietary iron intake [10.0 (± 5.2) mg/day] was significantly lower than that of non-anaemic children [17.2 (± 8.3) mg/day] ($p < 0.05$). Mean urinary iodine excretion was 149.8 (± 53.3) microgram/dL and 17.8% was affected with urinary iodine deficiency (< 100 microgram/dL). In logistic model, children from poor wealth class (Adj.OR 14.36, 95%CI; 1.6-123.2), rural sector (Adj.OR 7.47, 95%CI; 1.59-35.04), low birth weight (Adj.OR 6.7, 95%CI; 2.94-15.34), non-exclusively breast fed (Adj.OR 3.25, 95%CI; 1.82-5.78) and frequent infection (Adj.OR 2.87 95%CI; 1.4-5.73) were at risk of being undernutrition. This study revealed that, high prevalence of undernutrition is identified with calorie deficiency. Identified causative factors can be minimized in Jaffna District by proper remedy measures. High prevalence of anaemia could be controlled with iron supplementation.

IAEA-CN-217--5P

Effects of Animal-Source Foods and Micronutrient-Fortification Complementary Foods on Body Composition, Linear Growth, Iron Status – the WinFood Project in Cambodia

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Keywords: Complementary foods (CF); Body composition (BC); Animal-source foods (ASF)

Background and objective: The nutritional quality of CF in developing countries is often insufficient to sustain optimal growth. The Winfood project evaluated the efficacy of two new, processed rice-fish based CF with local ASF in Cambodia: non-fortified 'WinFood' (WF) with 14% by dry-weight ASF from small-sized fish (*Esomus longimanus* and *Paralabuca typus*) and edible spiders (*Haplopelma* sp.); an adjusted 'lite' WinFood (WF-L) with 10% by dry-weight ASF from small-sized fish of mixed species, and fortified with minerals and vitamins. The products were precooked by extrusion. The WF-products were compared with two standard products from World Food Programme: Corn-Soy-Blend (CSB+) and CSB++ (8% by dry-weight skimmed-milk powder), in a single-blinded randomized trial.

Methods: 419 Cambodian infants at age 6 months were randomized to daily rations of one of the four products for nine months period. BC (deuterium dilution) and iron status (serum ferritin and hemoglobin) were measured before and after intervention; and anthropometry (knee-heel-length, length, weight, MUAC, head circumference and skinfolds) monthly. Data were analyzed by intention-to-treat.

Results: Among 358 children completing the study, no significant difference in BC between the groups were found, but knee-heel length increments differed ($P=0.046$: WF-L: 3.6 cm, CSB++: 3.6 cm, WF: 3.5 cm, CSB+: 3.4 cm), suggesting that micronutrient-fortified products with 8-10% ASF (CSB++ and WF-L) promoted better linear growth than products without fortification or ASF. Knee-heel and total length increment was significantly higher in the highest food compliance quartile compared to the lowest, across food groups. There were no differences in ferritin and hemoglobin concentration. There was higher prevalence of anemic children in the WF group.

Conclusion: Products with ASF (milk or small fish) and micronutrient premix resulted in slightly better linear growth. Small fish is a cheap ASF with high potential to improve locally produced industrially processed CF.

IAEA-CN-217--6P

Moderate Malnutrition in Adolescents in North West of Morocco

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Morocco is undergoing a Nutrition transition where rates of moderate malnutrition are still high but signs of amelioration in stunting are noticed recently from a national Plan Survey. In This optic we aimed to assess that evolution in the region of Kenitra.

Subjects and Methods: Four cohort studies were realized from 2009 to 2012 in a sample of 2115 Schoolchildren aged from 11.6 to 18.9 years. Weight and height were measured according to international standard and anthropometric Z scores were calculated using the WHO growth references 2007.

Results: Average age was 15.45 years \pm 1.64. The sex-ratio is 1.94, 102 girls (34%) and 198 boys (66%). Stunting, underweight and wasting are respectively 9.7%, 12.3% and 10%. Stunting and underweight was revealed more among boys than girls in this study. : For the age groups: [13-14 [; [14-15years [and [15-16 [; stunting is much more pronounced among boys (15.8%; 16.6% ; 15.9%) than girls (4.1%; 3.5%; 3.4%); in the age groups [13-14 [and [14-15 [, thinness affected more boys (16.2%; 9.6%) than girls (7.0%; 5.1%) ; for age groups [13-14 [and [14-15 [, overweight affects more girls (5.8%; 8.1%) than boys (2.8%; 3.0%); obesity is rare for all age groups.

ANOVA analysis confirmed the stability of Moderate Malnutrition during the four years Conclusion:

Rates of malnutrition are lower than the Moroccan average in this relatively intensive agricultural area and moderate malnutrition rates are stable. A focused analysis is needed to determine the part of socioeconomic, nutritional and Cognitive factors and to better understand gender differences.

IAEA-CN-217--7P

Composition, Acceptability and Use of Supplementary Food for the Management of Moderate and Acute Malnutrition: The Philippine Experience

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Malnutrition remains a public health problem in the Philippines, particularly among infants and young children as reported in the 2011 National Nutrition Survey (NNS) done by the Food and Nutrition Research Institute (FNRI). In 2008 the Institute also reported that among 6 months to 5 years old Filipino children, 8 in every 10 were not meeting the recommended intake for energy. For the same age group, 5 in every 10 did not attain the estimated average requirement for protein, 7 out of 10 for iron, vitamin A, vitamin C and calcium, 5 out of 10 for thiamine and riboflavin and 3 out of 10 for niacin. Between 2003 and 2011, no significant decrease in the proportion of severely underweight and under height children. Anemia prevalence was at 55.7% among infants 6 to 11 months. Developing culturally acceptable supplementary foods for the severely affected malnourished children is important and necessary. In response to this problem, the FNRI developed, tested and evaluated a supplementary food using locally available crops available in the country, suitable for moderate and severely malnourished young children. This paper will report on the results of this study.

The study aimed to develop and utilize locally available, affordable and culturally acceptable raw materials for the production of fortified supplementary foods suitable for acute and severely malnourished older infants and young children following the international guidelines. Standardization trials were done in the laboratory to determine the most acceptable formulation and processing conditions of the ready-to-serve complementary foods. The most acceptable formulations were tested for the physico-chemical, microbiological and sensory properties during storage study using suitable packaging materials. Retention of the micronutrient added was assessed. The estimated shelf life of the product was also determined. The product was fed to young children to determine the serving portion size and level of acceptability. Results showed that the fortified complementary foods using locally available and culturally acceptable raw materials was like very much by young children, compared to the currently available foods used by development partners. The micronutrients added were retained and remained stable during one year storage period. Minimal changes in its physico-chemical, sensory and microbiological parameters were noted. The study concluded that a complementary food can be used to help solve the persisting problem of moderate and acute malnutrition. The product is now ready for commercialization and effectiveness study.

IAEA-CN-217--9P

Transformation of Food Habits through Promotion of Under-Utilized Cereals in High Hills of Nepal

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Malnutrition is a persistent social setback in Nepal. High hills in Nepal is considered as the headquarter of the malnourished people as it holds almost the twice of stunted children than the national average. Food insecurity is the major causes of malnutrition as there is low agriculture production followed by difficult terrain and poor road connectivity. Nevertheless, there are several types of locally produced cereals that are under-utilized because of the traditional food-habit of eating rice. In order to bring a change in local food habit by the high-hill residents, attempts were made in processing of under-utilized cereals. Six different cereals were processed into super flour, porridge, cookies, flakes and traditional sweets for which locally accessible home level processing technology was used. Sorghum (*Sorghum bicolor*), Foxtail Millet (*Setaria italica*), Porso Millet (*Panicum miliaceum*), Buck Wheat (*Fagopyrum esculentum*), Amaranth (*Amaranth caudatus*) and Naked Barley (*Hordeum vulgare*) were processed into diverse products that suit to the local taste. The processing steps were standardized and laboratory analysis was carried out. It was then distributed to local development partners through trainers' training. Now, local people have started processing and consuming these products. It is anticipated that processed products promotion helps in solving food insecurity to some extent, and contributes in reducing malnutrition for the children below two.

IAEA-CN-217--10P

Slow weight gain is strongly associated with morbidity in children under 6 months, but health staff fail to recognise it

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Background and aims: Young infants are weighed regularly and plotted on a Road-to-Health (RTH) or similar charts, but it is not clear whether early morbidity is associated with slow weight gain or whether health staff recognises it. We aimed to: 1) Compare the weight gain of very young Nigerian infants admitted to hospital to their healthy peers. 2) Assess whether health staff recognise slow weight gain.

Methods: Weights were collected for 210 infants aged < 6 months admitted to the University of Nigeria Teaching Hospital, Enugu and from the RTH charts of 411 infants attending the well-baby clinic from 0-6 months. Norms for conditional weight gain from birth were calculated using the well-baby clinic data. Paediatric health staff completed survey involving viewing 4 of 12 variant plotted-charts, showing a 2SD-fall, steady growth or catch-up and describing weight gain shown as “slow”, “steady” or “fast”.

Results: The 5th percentile for conditional weight gain in the healthy infants was -1.9SD at 6 weeks and -2.1SD at 6 months; this was used as threshold for slow weight gain. The hospitalized infants had mean weight Z-scores of -1.2 and 23% had shown slow weight gain since birth.

Of the 222 health staff surveyed, 55% were nurses and 78% were hospital-based; only 32% recognised slow weight gain when presented on the RTH format and 56% on the WHO (P<0.001).

Conclusions: A quarter of hospitalized infants had fallen > 2SD in weight, but these falls tend to be unrecognized, particularly when presented on the RTH format.

Key words: health staff, growth patterns, morbidity, infants (0 – 6 months old)

IAEA-CN-217--11P

Significance of Initial Maternal Hemoglobin Concentration during Pregnancy in Birth Weight and Preterm Delivery in Sri Lanka

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Anemia in pregnant women continues to be a major health problem in many developing countries such as Sri Lanka and more than half of the pregnant women in the world have hemoglobin (Hb) concentration levels indicative of anemia. Anemia diagnosed early in pregnancy is associated with increased risks of low birth weight (LBW) and preterm delivery where as in some studies the association between anemia and outcomes is in reversed direction especially at the last stage of pregnancy. LBW and preterm delivery are closely associated with foetal and neonatal mortality and morbidity, inhibited growth and cognitive development and chronic diseases later in life. The provision of iron supplements to pregnant women throughout the pregnancy period is one of the most widely practiced public health measures in Sri Lanka. However the supplementation of routine iron during pregnancy, regardless of whether the mother is anemic, has been debated extensively.

In this study 3,867 pregnant women in Sri Lanka were followed to find the significance of initial maternal Hb concentration during pregnancy in birth weight and preterm delivery. The relative risks were estimated using linear logistic models.

Among the mothers observed 1.1 % and 16 % were in severe anemic and anemic conditions respectively. The average birth weight of 2454.7 g was observed for the severe anemic mothers which was 522.3 g significantly less compare to the average birth weight given by the rests of the mothers ($P < 0.001$). The relative risk of LBW for mothers with severe anemic compared to normal mother was 5.2. The relative risk of giving LBW for the anemic mothers with normal mothers was 1.4. No difference in risk of giving LBW was found between mothers with normal and excess (> 125 g/L) level of initial maternal Hb concentration. Severe anemic mothers had significantly very less weight gain of 6.30 Kg ($P < 0.001$) and had 3.0 – 8.1 fold higher relative risk of preterm delivery compare to the mothers with normal initial Hb concentration. No significant differences in weight gain and risk of preterm delivery were observed among the mothers with normal initial Hb concentration, anemic and excess initial Hb concentration ($P = 0.176, 0.148$)

This study provides substantial evidence that severe maternal initial iron deficiency results significantly very less weight gain of mothers during the pregnancy, increases the risk of preterm delivery and subsequent low birth weight. In overall, the best initial maternal Hb concentration could be 105 to 125 g/L. This study reveals that the excess iron during initial pregnancy does not cause any harmful effect in the pregnancy outcome therefore the practice of routine iron supplementation during the initial pregnancy has to be continued in Sri Lanka.

IAEA-CN-217--12P

Acceptability of Weaning Mixes from Locally Available Foods

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Two types of legume-based (lentils/chickpea) and two types of fish-based (carp/catfish) formulas have been made in the form of dry powder, from locally available foods. By analysis of the nutrient composition of formulas, the lentil formula provides 410 calories (11.7g of protein), chickpea formula (418 calories, 13.5g of protein), catfish formula (428 calories, 16.1g of protein) and carp formula (432 calories, 15.8g of protein) in 100g dry weight of each formula. All the formulas were adequate in protein and energy density to meet the WHO recommended value for nutrition needs of 6-12 months old infants. The results of bacteriological analyses showed all the samples were within the recommended microbiological limits for dried products requiring preparation with boiling water. No physical changes were observed when the formulas were stored in sealed plastic bags at room temperature for 6 months. Developed products were evaluated for their acceptability by a panel of 20 persons using 4-point Hedonic Rating Scale. Results from sensory analysis showed that catfish formula obtained highest score for its color, lentil formula for its aroma and taste, and the lowest to carp formula. In the acceptability trials done on 25 children, 82%-90% of the mothers reported that the mixes were acceptable to their children. No adverse side effects were noticed. More than half of the mothers reported their children refused to eat other family foods and showed an obvious preference for the mixes, especially the one made by lentil.

IAEA-CN-217--14P

CURRENT KNOWLEDGE ON MODERATE MALNUTRITION IN SRI LANKA

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Many studies have been conducted on the nutritional status of children in Sri Lanka. Among which the Demographic and Health Surveys of the Ministry of Health, Government of Sri Lanka takes a leading position. Other studies have gone into details of different aspects of malnutrition in children

In the Demographic and Health Surveys, 6,555 children have been studied in the 2007 survey and for all indices of nutrition, -2SD or below from the median are taken as the affected group. Comparing the data from 1993 onwards shows that there is a general reduction in both stunting and underweight. During 1–5 month age both these indices are less than 5%. However after one year to 5 years a similar level of stunting (12.9%) and wasted (14.1%) and underweight (26.9%) could be seen. In both males and females stunting was present in 12.9%, wasting males 14.4 and females 13.8 under weight males 26.5 and females 27.4. All indices show that in the Colombo metropolitan area the nutritional status is much better than in rural and estate sectors. In all sectors stunting and underweight has improved when compared to the 1993 data however weight for height i.e. wasting is poor when compared to 1993 data.

An independent study conducted in 2002 showed that 16% of school girls in Colombo municipality area were undernourished and were 2% stunted. Another study conducted in the same year demonstrated that children of employed mothers are not receiving adequate amount of energy.

A descriptive cross-sectional study carried out in 2003 to assess the nutritional status of children of 1-5 years belonging to fishing families of Ambalangoda area, revealed that the prevalence of underweight was 31% while stunting and wasting were 23% and 11.3% respectively. Another study conducted in 2003 showed the association between parents' ability to read and understand written material, father's habit of smoking and/or alcohol consumption, frequent quarrels and family disputes with the three forms of undernutrition; stunting, wasting and underweight. A study conducted in 2006 in the central part of the country in the estate sector 46% acutely malnourished, 43% chronically malnourished and 32.9% both acutely and chronically malnourished. Although there were differences between boys and girls those differences were not statistically significant.

Another study indicated the prevalence of protein energy malnutrition, underweight and wasting in State operated foster care institutions were considerably higher than the national levels (2006). No significant associations were there in relation to the studied sociodemographic characteristics with the undernutritional status of children brought up at 'day-care centers' or at home groups (2009).

Selected aspects of infant complementary feeding practice in a district of Sri Lanka and outcome of an intervention aimed at improving these practices (2006)

Since overweight and obesity has attracted the interest of the researchers' under-nutrition has become a topic of yesteryear. Therefore it is important to revitalize research studies on moderate malnutrition in children.

IAEA-CN-217--16P

High rate of malnutrition in young children aged 0 to 59 months and lack of intervention in rural west Cameroon

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Background: Micronutrients deficiencies are public health problem in Cameroon and with physiological and economic consequences. National prevalences of stunting (69%) among Cameroonian children as reports in the last ESDC-MIC are very high. In rural area in real context, no strategies exist either at the health centers or the community.

The aim: This work aimed at determining by anthropometric measurements (aged, weights and heights), the nutritional status of children aged 0 to 59 months in Bangang rural community in Cameroon, in order to prepare nutrition education and intervention mostly focused on food based approaches.

Methods: Across-sectional study was conducted in six health areas in Bangang rural community in western region of Cameroon. Four hundred and forty (440) children (214 boys, 226 f girls) aged 0 to 59 months were randomly selected for anthropometric measurements (heights and weights) NCHS/WHO international growth reference. A questionnaire was developed to collect information on food consumption, food frequency, socio-economic and demographic status of mothers. Statistical analyses of results were done using ENA Smart and SPSS software.

Results: Using NCHS (1976), standard of reference and z-scores, stunting, wasting and underweight rates were respectively: 42.22% (114) (with 18.52% (28) moderate), 3.33% (09) (with 1.85% (05) moderate) and 6.67% (18) (with 5.18% (14) moderate) of children. From BMI classification of nutrition status done according to WHO criteria, 3.38 %, 55.40 %, and 41.22 % of the mothers were underweight, normal and overweight respectively. The most frequents consumed food were cereals and tubers (93.24 %) whose nutrients are poorly bioavailable. The daily intakes of food sources of proteins, minerals, vitamins, were generally poor. Only 3% and 2% of fruits and animal food were consumed in family respectively. No skill on nutrition was observed in families and in health and community centers. No anthropometric materials and documents were seen in health and community centers. Health and community workers were not trained and ignore informations about malnutrition.

Conclusion: In Bangang rural community high prevalences of stunting combined to micronutrients deficiencies (vitamin A, iron and zinc) may be linked to mental and intellectual performances that extend beyond childhood into adult life. In Bangang rural community, there were many diseases related to malnutrition, linked to lack of knowledge, poor access to health infrastructure, illiteracy and poverty. Therefore, application of good feeding practices, dietary diversification and modification with intensified nutrition education and nutrition management training will reduce stunting and other forms of malnutrition.

Key words: Stunting, malnutrition, micronutrients deficiencies, nutritional status, infants, West Cameroon.

IAEA-CN-217--17P

Prevention of Acute Malnutrition during the hunger gap in urban Chad using Ready-to-Use Supplementary Food: challenges and lessons learned from a Randomized Controlled Trial

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Background: In Abeche town in eastern Chad, Action contre la Faim - France (ACF-France) implemented a food-based intervention during the seasonal 'hunger gap' in 2010. The objectives were to assess the acceptability, effectiveness and cost-effectiveness of RUSF to prevent acute malnutrition or wasting (WH <80% of the median of NCHS reference and/or presence of bilateral pitting edema) among children 6-36 months living in vulnerable households. **Method:** The study was a two-arm cluster randomized controlled intervention. All enrolled households in the project received a monthly food package provided by World Food Program (WFP), estimated to cover approximately 1800 kcal/day. Number of food rations received per household was proportional to its size. The intervention group was given a daily 46g of RUSF (Plumpy Doz®, Nutriset, Malaunay, France) during 6 months. A follow up visit was organized 2 months after the last distribution. All analyses were done on an intention-to-treat basis. All the data were double entered in EpiData version 3.1. Statistical analyses were conducted using STATA 11.2 (Statacorp, USA). The statistical significance for all analyses was set at 5% and all tests were two-sided. **Results:** In the end, the intervention achieved a sample of 1038 children. Adding RUSF to a package of monthly household food rations did not result in an important reduction in cumulative incidence of wasting (Incidence Risk Ratio: 0.86; 95%CI: 0.67, 1.11; P=0.25). However, the intervention group had a modestly higher Height-for-Age gain (+0.03 Z-score per month; 95%CI: 0.02, 0.05; P<0.001). In addition, children from the intervention group had a significantly higher hemoglobin concentration at the end of the study compared to children from the control group (+3.8g/L; 95%CI: 0.6, 7.0; P=0.02), thereby reducing the odds of anemia (Odds Ratio: 0.52; 95%CI: 7.1, 23.9; P=0.004). Adding RUSF also resulted in a significantly lower risk of self-reported diarrhea (-29.3%; 95%CI: 20.5, 37.2; P<0.001) and fever episodes (-22.5%; 95%CI: 14.0, 30.2; P<0.001).

Conclusions: Adding RUSF to a general food ration during the hunger gap led to no major effect on the cumulative incidence of wasting. One explanation could be that the energy contribution of RUSF may have been 'diluted' by the general food distribution or that the dose of RUSF and the duration of the supplementation could have been insufficient to support ponderal growth, especially for the older children in the cohort. However it improved significantly hemoglobin status and linear growth in a smaller proportion, accompanied by an apparent reduction in morbidity. These effects suggest that a multiple micronutrient effect is at play. Comparing the effectiveness of RUSF to other micronutrient supplements or bio-fortified foods in terms of preventing acute malnutrition are further research areas to explore.

IAEA-CN-217--18P

Caring Practices, Energy Regulation and the Use of Ready to Use Foods in the Management of Moderate Malnutrition: Lessons from the Developed World

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Aims

This paper aims to consider how developed world evidence on weight faltering (failure to thrive) and energy regulation could inform treatment programmes for moderate malnutrition.

Lesson from the UK

In the UK, weight faltering (failure to thrive) caused by mild to moderate undernutrition occurs in around 2% of infants. Research with such children has revealed that many have individual characteristics of low appetite and fussy eating that predispose them to undernutrition, but that after a structured assessment and advice from their health visitor, their weight gain can be improved.

Infants and toddlers show substantial energy regulation and tend to eat less following intake of high energy drinks. This may be why the use of high energy milks and food supplements in the UK tends to be associated with delayed intake of solids and worsening eating behavior, but not improved growth.

This partly reflects the difficulty of diagnosing moderate acute malnutrition (MAM), since any single threshold tends to also identify constitutionally short or slim children.

Application to the developing world

The recent introduction of new high-energy ready to use therapeutic foods (RUTF) has greatly improved the care of severely malnourished children, but there may be risks in the use of such foods when used in MAM, with children who may have low appetite drive or simply be constitutionally short. The possibly adverse effects include:

- Reduced intake of the normal diet due to energy regulation, leading to more coercive and aversive feeding behavior by carers.
- Displacement of breast milk
- Delayed acquisition of solid feeding skills
- Loss of opportunity to improve family feeding skills
- Energy gap when supplements withdrawn

Conclusions

Trials of the use of RUTF in the management of moderate malnutrition need to consider short term harms and long term efficacy, not just short-term gains in weight and should be compared to interventions that target enhancement of caring practices and home diet, which potentially have a much more lasting effect.

IAEA-CN-217--19P

Pinoy Nutrition Hub: The Philippine Experience in Addressing Moderate Malnutrition

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o Objective:

Malnutrition is a persistent problem in the Philippines. The 2011 survey of the Food and Nutrition Research Institute reported that 3 out of 10 children are malnourished. Data shows 20.2% of children 0-47 months are underweight while 33.6% are stunted. This rate is higher in depressed areas in the country. PD Hearth is a time and tested effective program model to address malnutrition. But the PDH has minimum standards that need to be followed in the program implementation. However, a developing country like the Philippines has limitations in its resources and implementations.

This paper aims to share the Philippine experience in addressing moderate malnutrition through a contextualized and modified PD Hearth approach. The specific objectives of this paper are:

- to describe the challenges in implementing PD Hearth in the context of the Philippines;
- to describe the innovations and modifications in the PD Hearth;
- and, to illustrate the successful intervention of the PNH program against malnourished children in the community.

o Methods:

The Pinoy Nutrition Hub model is an innovation of PD Hearth approach. The first step was the participatory approach evaluation of existing programs on MNCHN in the communities. The next step was for the stakeholders to identify the gaps and address them. This was followed by gathering lessons learned and good practices that arose from implementing PD Hearth. Innovations were adopted to address restrictions and maximize learning in its implementation. The contextualized approach was called Pinoy Nutrition Hub (PNH).

o Outcomes:

- The PNH was piloted in three Area Development Programs (ADP) that represent the three island groups of the Philippines. All three ADPs reported improvement in the weight of the malnourished children enrolled in the program. Below is an illustration of the how the actual weight of children in the Visayas ADP increased.

Figure 1. Average Weight of Malnourished Children enrolled in PNH.

o Discussion:

Data showed that the program successfully increased the weight of malnourished children enrolled in the Pinoy Nutrition Hub program. In one ADP, 80% of the enrolled malnourished children were rehabilitated to normal weight while another ADP reported 60% of the enrolled gained normal weight after only 12 days. Pinoy Nutrition Hub was effective in addressing malnutrition.

o Conclusion:

Pinoy Nutrition Hub was able to maintain some of the basic principles of PD Hearth important in addressing malnutrition. Pinoy Nutrition Hub is an effective contextualized approach useful in the Philippine setting. PNH can effectively improve the nutrition status of malnourished children age 6 months to 5 years old. The PNH approach is a successful strategy in significantly contributing to the reduction of global malnutrition.

IAEA-CN-217--20P

Community Based Integrated Intervention, Lesions Learn from Rural Remote Areas of Bangladesh

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Background and Objective:

Like other south Asian countries, Bangladesh has frequently taken early steps to tackle malnutrition. The country is thus a signatory to a number of international declarations, which has been demonstrated locally as evidenced by the number of nutrition policies and programs at different times initiated by Government and other partners. Country's public health aspects still struggling with achieving MDGs, despite remarkable progress has made in some aspects of child and maternal health. Inappropriate IYCF practices are the major concern and contributing malnutrition mostly. Under this context, World Vision Bangladesh has taken a five years project focusing in increasing uptake of health and nutrition services including reduction of moderate and acute malnutrition in the rural community of Bangladesh through integrated approached, livelihood and food security. This current effort assessed the extent of achievement in terms of output, outcome and goal level project and program indicators after implementing five years project successfully.

Methodology:

The evaluation study followed cross sectional design using both qualitative and quantitative methods. This study used 30 cluster sample design, 30 villages were identified as clusters, 27 households were systematically chosen from the master household listings. With this and the sample size derived from statistical calculations total of 810 households were identified. Purposive sampling method was used to determine the qualitative sample size. 18 Focus Group Discussions (FGD), 32 Key Informants Interview (KII), 6 Case Studies and 30 interviews for "Strength, Weakness, Opportunity and Threat (SWOT)" analysis were used.

Results:

The proportion of children is low compared to the population aged > 50 years. The mean family size was 4.1, around 10.1% of the total population was married before the age of 18 and agriculture is the primary occupation in that locality. In terms of health and nutrition, special emphasis was given at the WVB project activities. However, projects had great impact on behavior change components and mothers' knowledge on basic concepts of nutrition has increased vastly, doesn't effect on reducing severe and moderate malnutrition. The proportions of mildly under nourished children were underweight (30.2%), stunted (29.3%) and wasted (22.8%). The proportions of children being moderately under nourished were underweight (29.6%), stunted (19.9%) and wasted (24.1%). Indeed progress of achieving severe malnutrition, wasting has decreased drastically to 8% which was 17% in the baseline, however, severe underweight and stunting increased compared to baseline and also slightly higher compare to national data. Access in taking services have increased and among the children suffering from Diarrhea, 92.9% treated by the nearest facilities. Among the children eligible for vaccination, around 63.3% has reported to be fully immunized.

Conclusions:

While such community based intervention has impact on changing knowledge and uptake of services, limited in reducing acute malnutrition indeed. So, nutrition intervention redesign is necessary and food supplementation as well as treatment of acute malnourished children should be prioritized.

Key Words: WVB, IYCF, Awareness.

Acknowledgement: This evaluation was made by generous support from World Vision Bangladesh.

IAEA-CN-217--24P

Pilot Study: Mother's Attitude and Practices toward Antenatal Care, Micronutrient Supplementation and Breastfeeding in Salmaniya Medical Complex

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Good nutrition in the first 1000 days provides a stable long term foundation for society, as it ensures a child's growth to his/her potential (1). Pregnant women who suffer from multiple micronutrient deficiencies have been associated with poor pregnancy outcomes including Low Birth weight-LBW (4). Iron deficiency anemia is linked to an increased risk of infections (4), and is still a health problem in the kingdom of Bahrain with the prevalence of 22.7% to 54% (5). The World Health Organization (WHO), United Nation Children's fund (UNICEF) and American Academy of Pediatrics recommendations are to initiate breastfeeding within the first hour of life and to and sustain exclusive breastfeeding for 6 months (6). Several studies have shown a downward trend of breastfeeding in developing countries such as Kingdom of Saudi Arabia (7,8). Studies in Kingdom of Saudi Arabia and Kingdom of Bahrain have shown partial breastfeeding at early months < 6 month age (8,9)

Aim: To provide a preliminary evaluation of the mother's attitude/practices toward antenatal care, micronutrient supplementation and breastfeeding in Salmaniya Medical Complex (SMC), Kingdom of Bahrain.

Methods: A sample of 62 Bahraini mothers - inpatients and outpatients- within the age group of 20 years to 35 years old at SMC were asked by dietitians and diet technicians to answer 7 closed ended questions about importance of antenatal care, compliance to nutritional recommendations during pregnancy and breastfeeding practices.

Statistical Package for Social Science (SPSS) was used in analyzing data collected. Fisher Exact test and Chi-Square test were used to correlate the determinants (age and education level) with mother's attitude/practices. Statistical significance was assumed at $p < 0.05$

Results: Scores showed no significant correlation between education level mother's attitude/practices toward antenatal care, micronutrient supplementation and breastfeeding.

As for age, we found more mothers above 25 years of age agree that micronutrient supplementation during pregnancy is important than younger mothers ≤ 25 years old.

Only 58% of the participants knew the recommendation of The World Health Organization (WHO), United Nation Children's fund (UNICEF) and American Academy of Pediatrics regarding the time to initiate Breastfeeding post birth mostly were older mothers of age above 25 years old.

84% of the sample did breastfeed for at least 6 months. There is a significant positive correlation between age and the period of breastfeeding

Conclusion: There is still a need to improve awareness of the importance of antenatal care, breastfeeding and adherence to multivitamin supplementations. More studies are needed to find the prevalence and determinants of healthy practices and behaviors for healthy maternal and child wellbeing.

IAEA-CN-217--28P

Complementary Feeding Practice of Mothers and Associated Factors in Hiwot Fana Specialized Hospital, Eastern Ethiopia.

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Background:- In developing world infant and child mortality remain quite high. Malnutrition remains one of the main public health problems in Ethiopia that contributing to 53% of infant and child mortality. Over one third of under-five mortality is caused by under nutrition related to inadequate complementary feeding. Child feeding behaviors are an evidence that having important for a children intellectual, health and survival. Therefore, the objective of the study was to assess of complementary feeding practice of mothers to their young child.

Method:- Cross sectional study design was conducted to assess complementary feeding practice of mothers to their young children in Hiwot Fana specialized hospital in January 2013. Two hundred mothers to child pairs were participate in the study to assess their timely initiation practice of complementary feeding and associated factors. Data were collected by using semi-structured questionnaire for face to face interview method. Descriptive statistics, binary and multiple logistic regressions were used for data analysis.

Results: The prevalence of timely initiate of complementary feeding was 60.5%. Nineteen percent of mothers were initiating complementary feeding early (before 6 months). The reason for too early initiation of complementary feeding was lack of knowledge and perceived inadequate breast milk production by mothers were 17(47.2%), 11(30.6%) respectively. Mothers have male child three times more likely timely initiate complementary feeding than female child [AOR=2.9, 95% CI, 1.2, 7.3]. This might be due to traditional gender norm that discriminate female feeding “female eat little talk little” this might start at early age life.

Conclusion: More than half of them initiated complementary feeding timely which was low. The main reason reported by the mothers for early initiation of complementary feeding was lack of knowledge. Mothers who have male child were three times more likely timely initiate complementary feeding than female child. Information about importance of timely initiation of complementary feeding should be implemented via information education and behavioral change communications, and integrating with health extension package is recommended.

IAEA-CN-217--29P

Improving nutritional status of children under 6 through nutrition counseling in rural area

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Nutrition counseling is one of the nutritional activities for improving child nutrition. It is the best way for decreasing malnutrition in children. Goal: To improve nutritional status of children under 6 through nutrition counseling in rural area with high prevalence of malnutrition. Methods: An international study with a total of 660 children with their mothers and with duration of seven months started in Lali district (in Khozestan province of Iran). Data gathered with using a demographic questionnaire and anthropometric measurements in children. Afterwards, malnourished children determined and referred to nutrition counseling centers. After training mothers, planning a diet and monitoring nutritional status were determined. Results: The prevalence of stunting, wasting and underweight in studied children at the beginning of the study were 9.6%, 6.2% and 4.8% respectively, which reached 8.7%, 3.3% and 2.4% by the end of the project ($P < 0.05$). The intervention was most efficient in children suffering growth retardation, with a cure rate of 91%; only 48.6% of malnourished children referred to the center health were cured. Conclusion: Results obtained from this study showed that over 90% of children suffering growth retardation were cured. This means establishing nutrition counseling centers to encourage proper nutrition behaviors, evaluate current issues and find possible solutions, persuade mothers to improve child nutrition status making use of practical and specific methods appropriate with the tradition of the region has had an important role in improving the nutrition status of the children in the region.

IAEA-CN-217--30P

Beneficial effect of nutritional supportive plan among under-nourished children in poor families in Iran with collaborating Ministry of Health and Emam Khomeini

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Malnutrition in the form of Protein – Energy Malnutrition (PEM) and micro nutrient deficiencies, is one of the most important health problems in developing countries, Iran included. The purpose of this study was to improve nutritional status among under-nourished children in poor families. Methods: A total of 50,000 children under 5 (girls and boys) in 30 provinces in Iran which suffered by moderate and severe malnutrition participated (<-2SD weight for age) in this program. Malnourished children belong to poor families were determined; weights and heights were measured and anthropometric indicators were determined based on WHO, 2007. Then, these malnourished children were introduced to Imam Khomeini Foundation. Khomeini Foundation as one of the biggest NGO in Iran which supports poor families since 1979. This study collaborated with Ministry of Welfare, Ministry of Health and Emam Khomeini. They have started to receive monthly supportive food basket which could support their daily nutritional requirements. This basket included (meat, egg, cheese, legumes, milk, tuna fish, chicken, liquid oil). Along with food support community health workers were actively involved with counseling of mothers on the nutritional requirements of children. Nutritional support cut for whoever has been improved nutritional status. However, nutritional education still had continued. Results: The results of monitoring & evaluation (according to anthropometric indicators) of this plan have shown around more than 45% of children that received food basket had consistently improved nutritional status. Conclusion: Likewise other intervention nutrition programs in developing countries this project showed that inter sector collaboration have been the best way for decreasing malnutrition in children.

IAEA-CN-217--31P

Designing and development of a nutrition counseling center in for the primary health care system in Ahvaz,Iran

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Introduction: Malnutrition is one of the most important nutritional challenges in Iran and other developing countries. The aim of this study was to improve the quality of nutritional service provided to children under six years old in rural areas in Ahvaz city through designing nutrition counseling centers.

Methods: An intervention study was conducted on 660 under six year old children from May to November 2007 in Lali district of Ahvaz. Data was gathered using a general questionnaire and anthropometric measurements filled by trained questioners in the Health house. The anthropometric indicators of participants, the knowledge, attitude and practice of their mothers were re-assessed after the intervention.

Results: At the beginning of the study the mean points for knowledge, attitude and practice of mothers on principles of nutrition in children were 71.2%, 68.6% and 69.3% respectively. After the intervention these figures reached 85.6%, 74.4% and 82.1% respectively. The changes were statistically significant ($P < 0.01$, $P < 0.05$ and $P < 0.05$ respectively). The mean points gained by mothers living in suburb villages were lower than mothers living in the main villages before and after the intervention.

Mean knowledge, attitude and practice levels in mothers of both healthy and malnourished children was significantly higher after the project compared to its start ($p < 0.05$). About 68.9% of children were referred to nutrition counseling centers for further treatment after the intervention. The intervention was most efficient in children suffering growth retardation, with a cure rate of 91%; only 48.6% of malnourished children referred to the center were cured ($p < 0.05$).

Conclusion: Results obtained from this study showed that over 90% of children suffering growth retardation were cured. This means establishing nutrition counseling centers to encourage proper nutrition behaviors, evaluate current issues and find possible solutions, persuade mothers to improve child nutrition status making use of practical and specific methods appropriate with the tradition of the region has had an important role in improving the nutrition status of the children in the region. This study showed that training mothers in the principles of nutrition in children improves their nutritional knowledge, attitude and practice, increasing the mean points obtained in each of these from a previous mean. Gathering information on their knowledge and practice levels can help health personnel on child nutrition and out carrying appropriate training sessions to improve the nutritional status in children.

Key words:

Malnutrition, Protein Energy Malnutrition (PEM), Nutrition counseling, Iran

IAEA-CN-217--34P

Factors Affecting the Effectiveness of Programs to The Challenges for Review of the Prevalence of Moderate Acute Malnutrition in Communities Facing Prolonged Crisis: A Case of Warrap State South Sudan

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Background: Despite relative political stability, humanitarian situation in Warrap State in South Sudan remains fragile as several vulnerable households are facing crisis resulting in acute food insecurity. High levels of food insecurity are concentrated in the areas with increased internally displaced populations. The WFP 2012 annual nutrition and livelihood report indicated that 12% and 27% of IDPs and returnees respectively were severely food insecure. These communities live in areas that are adversely affected by multiple shocks, including border insecurity, excessive seasonal flooding, inflation austerity, and a high influx of returnees which contributed to poor humanitarian indicators. World Vision South Sudan (WVSS) provided emergency nutrition support to the communities in Gogrial West, Gogrial East, Tonj North, Tonj South and Tonj East to reduce severe malnutrition and deaths. The nutrition interventions focused on capacity building on community structure that refers children under-five years with severe acute malnutrition for treatment to community-based outpatient therapeutic treatment (OTP) sites, run by WVSS's volunteer workers and other NGO partners.

Objectives: The purpose of this article is to inform the review of the prevalence of moderate acute malnutrition in communities that faced prolonged crisis

Method: review of the baseline and post intervention nutrition survey reports conducted using the ena- for SMART methodology & annual nutrition and livelihood reports. The review covered four areas of operation in Warrap State.

Findings: the findings showed the prevailing nutrition status reflects unacceptable thresholds in most of the years where the survey was conducted. The global acute malnutrition situation is to be critical (above 15%) with little change in the levels of moderate acute malnutrition during the course of the years except seasonal variation due to unchanged underlying and root c(Table1).

Discussion: Addressing humanitarian needs of communities in conflict prone areas such as the South Sudan is a priority for the humanitarian partners when survey findings go beyond for the threshold for action. However, due to the complex nature of the problem the level of malnutrition in these communities remained very high during the course of the years without much change. This could be due to the lifesaving efforts in these humanitarian responses addresses the immediate needs leaving the medium and longer-term approaches that impact the underlying and root causes untouched. These approaches include water, hygiene and sanitation, actions that improve the low agricultural production and productivity, create employment opportunities and address the cultural factors that contributed to some of the worst GAM rates. Moreover, efforts that reduce the impact of floods, conflict, poor road networks and access to basic social services could alleviate the situation.

Conclusion: emergency programs provided timely solution to calm escalating burden of moderate malnutrition and prevent worsening of the situation in areas such as Warrap state. However, the magnitude remained high due to lack of integrated longer term actions.

Recommendation: To change the burden of moderate malnutrition and its resulting consequences comprehensive and multi-sector approach that address underlying causes is needed with emergency responses.

IAEA-CN-217--36P

TRACKING of BODY COMPOSITION in PRE-ADOLESCENT THAI CHILDREN

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Background: Childhood obesity is one of the global malnutrition problem. To assess body composition, stable isotope has been widely used for total body water (TBW) and body fat assessments. In the year 2008, Thailand involved in the IAEA Technical Cooperation Project (TC project) which aimed to develop and validate tools for Thai children to assess obesity in 247 pre-adolescent children aged 8 to 10 years. Later in the year 2011, only 100 children were agreed to be tracked for their body composition assessment.

Objective: To explore the changes of body composition and to compare the changes between gender in 3 years period.

Materials and methods: A total of 100 children (49 boys and 51 girls), who involved the project in 2008 (P1) and later in 2011 (P2) were measured for their body composition. BMI for age using WHO 2007 cut off was used to identify their nutritional status. TBW was determined by deuterium oxide dilution technique. Fat-free mass (FFM) and fat mass (FM) were estimated.

Results: Out of 100 children, 87 children (41 boys and 46 girls) provided the completed data of TBW at P1 and P2. They all grew up with significantly increased in weight, height, BMI ($p < 0.001$). Their body composition in terms of %TBW, %FEM and %FM were not changed in both genders. Boys had significant higher %FFM than girls in P1 (71.5% in boys and 67.4% in girls, $p < 0.05$) while %FM were significant lower than girls (28.5% in boys and 32.6% in girls, $p < 0.05$). However, after 3 years, no significant different between boys and girls was observed.

Over the 3 years period, based on BMI for age, the proportion of overweight and obese children increased from 36.6% to 48.8% for boys, and from 32.6% to 41.3% for girls. Around 17% of normal boys became overweight and obese, and for girls only 8.7% was found. Less than 5% of overweight and obese boys became normal, and none for girls.

Conclusion: The obesity problem was inevitably increased when children are advance in age. However for Thai children, boys have more tendency to become overweight and obese than girls. This is a baseline information to be considered for the lifestyle modification early in life.

Acknowledgement: Special thanks for IAEA financial support. This is part of the RAS/6/50 project.

IAEA-CN-217--38P

Scaling-up Community-Based Program for Management of Child Malnutrition in Rural Thailand

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Despite efforts to address child malnutrition at scale since 1970s, management of child illnesses focused on treatment of common infections. In the fifth National Economic and Social Development Plan (NESDP) (1982-1987), effective scaled-up child nutrition policy and program was implemented, through Primary Health Care (PHC) and Poverty Alleviation Plan (PAP). The PAP provided the mechanism to streamline government resources to poverty stricken areas. Almost 300 districts were identified and sectoral programs implemented in the same priority areas. Provincial planning is the key to allocate the government budget, while the district level implemented and supervised actions at the community level. PHC was implemented with the principle of self-help care and nutrition was one of the PHC elements. Community participation was strengthened through manpower mobilization and capacity building, village financing and organization. As a result, there is an alignment of national resource allocations and micro-level actions. Scaling-up of community-based nutrition program was implemented by adopting the PHC principle, using community participation strategy, namely, mobilization and capacity building of village health volunteers, financing and organization. Growth monitoring, promotion of infant and young child feeding and joint financing via a 'nutrition fund' was implemented in rural areas, particularly in the poorest areas of the northeast and north. Child malnutrition was strategically managed at the community level, whereby differential actions were taken according to the severity of malnutrition. Management of severe and moderate malnutrition was by monitoring growth monthly, with support of basic health services to manage infections and other curative needs. Food assistance for complementary feeding using appropriate technology for village level processing was an integral part of child malnutrition management. Children with mild malnutrition or normal were monitored quarterly and provided with nutrition education and other nutritional supports as determined by the community. Nutrition education included breast feeding promotion, complementary feeding guidelines, and maternal and child nutrition. Maternal nutrition focused on promoting supplementary nutritious foods and iron/multivitamin-mineral supplementation during pregnancy to prevent low birthweight and iron deficiency anemia. Subsequently, nutrition in primary health care evolved to become an integral part of the basic minimum need (BMN) approach, which provided a holistic development framework for the community. Thirty two simple indicators were developed and tested for various components (e.g., nutrition, food production, income, community participation) aiming at improved quality of life of individual, family and community. Child anthropometry was included in the BMN indicators. In terms of process, community was empowered to identify their problems, take initiatives and participate in integrated actions as relevant to a specific community. Technical and financial inputs were obtained or facilitated by frontline government personnel. BMN is an iterative process which helped to facilitate the bottom-up planning and indicators were used for monitoring progress. Within the first five years, child malnutrition declined significantly, and severe malnutrition was practically eradicated. Moderate and mild undernutrition continued to decline and from 1990s, stunting/underweight was about 12-14%; wasting 5-7%, despite social and economic challenges in subsequent years.

IAEA-CN-217--39P

Malnutrition and Associated Factors Influencing Nutrition of Children in Post War Resettlement Areas in the Northern Province of Sri Lanka.

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Introduction: Over 250000 persons were displaced within the Northern Province, Sri Lanka at the end of the war (2009/10). With the ensuing resettlement process, the Japan Social Development Fund emergency project (JSDF) on Local Nutrition interventions for the Northern Province was implemented to combat undernutrition in children. A baseline survey was undertaken to describe prevalence of acute malnutrition among children < 5 years in the Northern Province and associated factors that would inform project activities of supplementary feeding, community mobilization and behavior change communication.

Methodology: A cross sectional survey using a multistage cluster sampling design evaluated nutrition status in a representative sample of 2600 children aged 0-5 years from the Northern Province. Height and weight were measured using standard survey equipment, and anthropometric indices (height-for-age Z, weight-for-age Z, weight-for-height) were calculated using WHO growth standards and Anthro software. An interviewer-administered questionnaire elicited data on breastfeeding, complementary feeding and nutrition knowledge and practices of caregivers. Significant factors associated with nutrition indicators were identified by multiple logistic regression analysis [presented as Adjusted Odds Ratios (AOR)].

Results: Prevalence of Global Acute Malnutrition (WHZ<-2) among children aged 0-5 years was 20.1%; Moderate Acute Malnutrition (MAM; WHZ<-2 and ≥-3) was 15.7% and 5.6 % had Severe Acute Malnutrition (SAM; WHZ<-3). Multivariate analysis of younger children (0-23 months) showed that SAM and MAM were associated with increasing age [12-17 month olds were more likely to be wasted compared to younger children (AOR 1.7)]. Other associated factors were low birth weight (AOR 1.54) and lack of toilets (AOR 2.02), a proxy indicator of poor socioeconomic status. Risk of wasting was greater with recent episodes of acute respiratory infection (AOR 1.51). Assessment of dietary practices and feeding behaviours indicated that 66.7 % were exclusively breastfed and majority of mothers breastfed their infant within one hour of birth. 73% were introduced to solid, semi-solid or soft foods at 8 months. Among 6-23 month children, 48.5% achieved minimum dietary diversity, 65.2% achieved minimum meal frequency and only 35.5% achieved a minimum acceptable diet. Almost 50% of care-givers restricted foods when their children were ill. 58 % of mothers shared the supplementary cereal given to children with MAM, with family members. Mothers' knowledge in basic nutritional values of foods was poor but, 80 % availed themselves of growth monitoring and promotion activities provided by the healthcare delivery programme.

Conclusions: This survey provides comprehensive data on nutrition status and associated factors influencing nutrition in a post-war population. Prevalence of acute malnutrition was high and was associated with infection, inadequate quantity and quality of diet and poor socio economic status. Nutrition knowledge and feeding behaviours of mothers was inadequate. The JSDF interventions, consisting of filling gaps in service delivery, promotion of better feeding behaviours and community involvement in growth monitoring and promotion through formation of mothers clubs would have a significant impact on malnutrition.

IAEA-CN-217--40P

Effectiveness of An Intervention Trial Model for Child Malnutrition Control in Commune Belonging to Ho Chi Minh City, Vietnam

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To find an effective model for child malnutrition prevention interventions, the Nutrition Center of HoChiMinh City has selected An Thoi Dong commune in Can Gio district, where the child underweight prevalence is high (11.1%) for development of the project "child malnutrition control model" for three years from Sep 2008 to Oct 2011.

. Objective: to evaluate the project's effectiveness on child nutrition improvement through the interventions of communication and nutrition practices. Methodology: community-based intervention trial. Providing the knowledge and practices on breast feeding, complementary feeding, prevention of vitamin A deficiency and iron deficiency anemia for all nutrition collaborators, preschool teachers and primary caregivers of children under five year old of commune. Results: child malnutrition prevalence of children under five year old in 3 forms reduced, underweight reduced by 1.9%, stunting reduced by 8.6% (21.0% vs 12.4%, $p<0.001$), and wasting reduced by 2.4% (5.6% vs 3.2%, $p=0.019$). Proportion of children being weighed and their growth being monitored regularly increased 35.6% ($p<0.001$), early initiation of breastfeeding (within 60 minutes after delivery) increased 9.8% ($p<0.001$), children being given oil in weaning foods increased 44.1% ($p<0.001$), mothers giving proper solid foods increased 7.8% ($p<0.001$), children being breastfed more during diarrhea increased 14.4% ($p<0.001$), children being dewormed every 6 months increased 49.9% ($p<0.001$). The nutrition collaborators network has been built. Conclusions: the project has been found to have effect to improve nutritional status of children under 5 as well as nutritional knowledge and practices of mothers, nutrition collaborators and preschool teachers. The experiences from the project should be expand to other communities.

IAEA-CN-217--44P

Community Based Nutrition Rehabilitation in Tanzania: Challenges and lessons learned

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Malnutrition among children under the age of five continues to be a significant public health problem in Tanzania. Despite numerous nutritional interventions that have been implemented, the country still experiences high rates of malnutrition. According to Tanzania Demographic and Health Survey of 2010 the prevalence of underweight was estimated to be 16%, wasting 5% and stunting 42 %. Factors contributing to causes of malnutrition include immediate, underlying and basic causes. All these factors are interlinked and operate synergistically and not independently.

Approaches for managing malnourished children in Tanzania evolved from facility based Nutrition Rehabilitation Units (NURU) in the late 1960s to Community Based Nutrition Rehabilitation (CBNR) in late 1980s. In the latter approach, malnourished children are rehabilitated in the same environment (village, home) that precipitated the condition, using resources and infrastructures available in the community. Mothers are taught about child feeding using family foods to make good food mixtures and of the importance of feeding frequency for the young child. Limitations for this approach include inadequate advocacy to leaders from districts down to the community level, few trained health providers and community health workers on knowledge and skills on community based nutrition rehabilitation, inadequate equipment and supplies for identification and categorization of malnutrition, low awareness of parents, care givers and community leaders on home rehabilitation of malnourished children. Nonetheless, Community Based Nutrition Rehabilitation approach has the potential to address malnutrition in children given political will and resources.

Key words: malnutrition, causes of malnutrition, Community Based Nutrition Rehabilitation

IAEA-CN-217--46P

Reliability of the Anthropometric Indicators of Acute Malnutrition in Pastoralist Populations: Secondary Analysis of a Recent Survey in Bahr-EI-Ghazal, Chad

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A cross-sectional survey conducted by ACF among the Gorane pastoralist population of the north Bahr-EI-Ghazal region, Chad, in April 2013, confirmed the existence of a massive difference in the diagnosis of acute malnutrition according to Mid Upper Arm Circumference (MUAC) and Weight-for-Height Z-score (WHZ), with WHZ returning much larger estimates of acute malnutrition than MUAC. While both indicators are recommended proxies to identify 6 to 59 months old children suffering from non-oedematous acute malnutrition, a previously formulated hypothesis is that WHZ overestimates the diagnosis of acute malnutrition among pastoralist children because of their assumed slender morphology. An alternative hypothesis is that MUAC underestimates acute malnutrition in the older, male, and non-stunted children. We aimed at testing these hypotheses, as well as evaluating if MUAC could be considered as a suitable stand-alone criterion in this context.

Besides anthropometric measurements (including sitting height), statements of the caretaker regarding child's morbidity, loss of weight and lack of food intake has been collected. We first assessed the association between risk factors such as age, sex, stunting and proportion of legs in total body size, and MUAC- or WHZ-based diagnoses. We then described the cases of moderate or severe acute malnutrition diagnosed by WHZ but not by MUAC in terms of slender morphology (high height-for-age and/or long legs compared to the trunk) and vulnerability (anthropometric deficits and caretaker's anamnesis). Finally, we defined alternative indicators of acute malnutrition by combining subjective statements of the caretaker and anthropometric deficits (underweight without stunting). We assessed if MUAC diagnosis was, more than WHZ, associated with these indicators, first through sensitivity and specificity calculations, then through logistic regression. Analyses were further stratified by legs proportion.

Having a high proportion of legs in the body size was associated with WHZ-based diagnosis, while gender (being a girl), young age and stunting were associated with MUAC-based diagnosis. However, cases of moderate or severe acute malnutrition according to WHZ displayed large rates of vulnerability-associated characteristics, while not systematically presenting slender shape profiles. Further analysis showed a strong association between WHZ-based diagnosis and alternative indicators of acute malnutrition, which remained stable across categories of legs proportion, thereby contradicting the hypothesis of a bias due to slender shape in WHZ-based diagnosis. On another hand, no association could be found between MUAC and alternative indicators of acute malnutrition, thereby confirming the low sensitivity of MUAC towards these indicators.

These results indicate that WHZ-only diagnosis can hardly be considered as misdiagnosis, while, in contrast, MUAC is probably missing "at risk" children in need for treatment. Further medical investigation of cases diagnosed only by WHZ should be conducted. In the meanwhile, the common assumption that MUAC is sufficient to estimate the prevalence of acute malnutrition in nomadic populations should be questioned, and strategies for the detection, referral and admission of WHZ-only cases should be defined.

IAEA-CN-217--47P

Household Food Security amongst Children with Moderate Malnutrition in South Africa

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Despite emphasis on Infant and Young Child Feeding and efforts towards breastfeeding promotion in South Africa, rates of malnutrition remain a concern. Children older than 12 months, presenting with moderate malnutrition can still provide health care workers with a golden opportunity to reverse malnutrition and improve nutritional status, growth, health and development. However, the presence of hunger and food insecurity as underlying cause of moderate malnutrition may be the tip of this iceberg, hampering intervention. Targeted supplementary feeding in moderately malnourished children may only result in short term improvements if the underlying problem is not recognized and addressed. It is important to determine the prevalence of food insecurity in children with moderate malnutrition in order to develop appropriate interventions for long term solutions.

The aim of this study was therefore to assess food security in children between 12 and 60 months, presenting with moderate malnutrition. Two hundred and twenty six children from three provinces, admitted to a targeted supplementary feeding programme, between September 2012 and August 2013 were included in the study. Ethical approval was obtained from the Research Ethics Committee, NNMU and parents or legal guardians provided written informed consent before participation.

Data were collected with a structured questionnaire, under supervision of a registered dietician and included demographic information, a Food Security Questionnaire based on the Household Hunger Scale, a history of breastfeeding practices, as well as adequacy of food intake and meal frequency. Data were analyzed using PASW (Predictive Analytics SoftWare) by SPSS (Version 21).

The mean age of the children was 29.3 months (± 13.5 SD) with an equal gender distribution. Eight questions, indicated in Figure 1, were asked to caregivers to reflect household food security.

The mean number of members per household was 5.7 (± 2.2) ranging between two and thirteen. For 46.8% of the children, food intake was described as inadequate or most inadequate; and 5.2% of children were fed 1-2 meals per day, 35.8% three meals per day and 59% four or more meals per day. Breastfeeding rates of 86.9% were reported with 24.7% of children currently being breastfed; and the mean duration of breastfeeding being 15.4 months (± 11.3 SD).

Food insecurity, as indicated by adequate food availability in the house, differed significantly between the three provinces ($p=0.002$), with caregivers in the Free State (Botshabelo) indicating the highest lack of adequate food, followed by the Southern Cape and the Northern Cape province.

This study shows high rates of food insecurity and inadequate food intake amongst children with moderate malnutrition, even in the presence of high rates of breastfeeding for extended periods of time. Food insecurity is therefore an important underlying factor to be considered and addressed, possibly by blanket food distribution to enhance the effectiveness of targeted supplementary feeding programmes in the treatment of moderate malnutrition. Current programmes in South Africa only allow for targeted supplementary feeding and serious consideration should be given to implement alternative interventions in food insecure environments.

IAEA-CN-217--48P

Alarming Default Rates in South African Children with Moderate Malnutrition on Targeted Supplementary Feeding Programmes

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In 2008, 4.7% South African children under five years suffered from moderate wasting and 23.9% from moderate stunting. Intervention strategies in the public health care system allow for targeted supplementation of children with moderate malnutrition and/or growth failure for three to six months or less if catch-up growth is established. Earlier research among HIV-infected adults on antiretroviral therapy showed that only about 50% of adults could be retained in a nutrition supplementation programme. The aim of this research was to determine default rates of children with moderate malnutrition on a targeted supplementary feeding programme, using Ready-to-use Supplementary Food (RUSF) as home treatment and to explore possible associations between socio-demographic and nutritional factors and defaulting.

Between September 2012 and August 2013, a prospective controlled trial was performed in three provinces of South Africa. Children between 12 and 60 months, classified as moderately malnourished, were purposefully selected by dietitians for inclusion in the study, after informed consent was obtained from the legal guardian. Ethical approval was obtained from the Research Ethics Committee, NNMU.

In this study defaulting refers to failure to return to the programme after admission, or more than two consecutive absences. Participants had to attend five follow-up sessions, during which children were weighed, measured and data collected in a structured questionnaire. At each visit participants received RUSF as treatment for moderate malnutrition. Parents received a stipend to encourage return.

Data were analyzed using PASW (Predictive Analytics SoftWare) by SPSS (Version 21). Frequencies and percentages were used to describe categorical data. Comparisons of means were performed using t-tests. Chi-square tests and two-tailed Pearson correlations were used to describe and test associations and correlations between variables. A p-level ≤ 0.05 was considered statistically significant.

The mean age of the sample of 226 children was 29.3 months ($\pm 13.5SD$) which consisted of 50.2% males. Both parents were alive in >90% of children. With five visits possible, the mean number of clinic visits was 3.7. There was no correlation between time traveled to the clinic or age of the child and number of follow-up visits; and no association between age, gender or perceived food security of the child and defaulting.

Of five possible visits, 51.3% attended all follow-up visits, with 30.5% attending only once or twice. Alarming default rates were found in this targeted supplementary feeding programme for children. It was expected that parents would be more diligent bringing younger children to the clinic, especially in cases of shorter traveling distances to the clinic. However, no association was found between age, gender or traveling distance and defaulting. Furthermore no association was found between breastfeeding, meal frequency or food security and default rates.

Targeted food supplementation programmes only succeed if default rates are low and supplements are consumed. As defaulting was significantly associated with the site, research into the attitudes of parents and health professionals and content of nutrition information provided, should receive priority.

IAEA-CN-217--50P

Moderate Acute Malnutrition Treatment among children 6-23 months and 24-59 months aged

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The prevalence of acute malnutrition in Mali has slightly decreased between 2012 and 2013 in southern areas from 8.9 to 8.6 percent. The youngest children 6-23 months are seriously affected as 12.6% according the SMART nutrition survey in 2013. The aim of this study was to show how seasonality impacts relapse rates among youngest moderately malnourished children aged 6-23 month compare to 24-59 months.

The World Food Programme in Mali set up Targeted Supplementary Feeding Programme (TSFP) in 1032 community health facilities to address the burden of MAM. This TSFP includes treatment of MAM with 92g of Plumpy'SupTM per days during 60 days. The entry criteria according to national protocol was Mid Upper Arm Circumference less than 125mm (MUAC<125mm) and Weight for Height Z-Score less than -2 (WHZ<-2). The exit criteria is according the same parameter MUAC>=125 mm or WHZ >=-1.5 during two consecutives visits. In addition, the programme is accompanied with community based activities such as active screening and culinary demonstration for women groups and sensitization.

As a result, after 10 months of implementation, 41604 children 6-23 months aged have been admitted for MAM treatment. This represents 82% of total estimated caseload in this group (50666). During the same period, only 14% (14473) of total estimated caseload (101333) in children 24-59 months aged group have been admitted and treated.

Although 74% (41604) of total admission (56077 children 6-59 months) was 6-23 months aged, the programme performance indicators show that children 24-59 respond better to the treatment compared to 6-23 months: Average recovery rate 88% vs 87%; death rate 0.55% vs 1.07% none response 0.21% vs 0.50%. Only, the defaulter rate was higher in 24-59, 10.21% vs 7.5%. Nevertheless, compared two Sphere performance norms and threshold, the programme is fully satisfactory in all categories.

The seasonal analysis shows that the highest admission in MAM programme was registered between April and September in all categories. 79% of the total caseload has been admitted during this period which corresponds to lean season considering the bad agricultural campaign registered in previous years. Furthermore, 74% of 936 reentries (relapse) have been observed in this period. It's important to notice that 86% of registered relapse was children 6-23 months aged. The death rate in the pic of lean season (July-September) among 6-23 month reach 4% which higher than the acceptable threshold fixed by sphere under 3%, confirming the criticality of nutritional situation of children in this category.

According these results, the moderate acute malnutrition is crucial among 6-23 month and that the duration of treatment need to be sustained by continuing preventive programme among 6-23 months to ensure that relapse is controlled during the lean season and reduce mortality burden. This will guarantee the best growth for children in an important part of their lives: the 1000 days and reduce subsequent burden of stunting.

IAEA-CN-217--51P

Defining Malnutrition in Community Nutrition Surveys: Which is the Right Indicator?

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Background

In India, community nutrition surveys of children use weight-for-height Z scores (WHZ) and the World Health Organisation (WHO) International Growth Standards to classify malnutrition and to admit children to the nutrition rehabilitation program. Weight-for-height, an age independent indicator, does not provide information about the prevalence of stunting (height) and underweight which are age-dependent.

Children who participated in a rural-community based intervention trial, in Maharashtra, India, of the effect of vitamin B-12 supplementation on growth and body composition were measured at before and after 18 months. The B-12 intervention was discontinued and recruitment stopped when a state-wide government nutrition programme for undernourished children was rolled out.

Methods

One hundred and eleven children (6–60 months; 54 boys) attending village Anganwadi centres were enrolled. According to baseline WHZ: 54 were severely wasted (WHZ<-3sd, severe acute malnutrition, SAM), 32 moderately wasted (WHZ>=-3 and <-2sd, moderate acute malnutrition, MAM) and 25 were normal (WHZ>=-2sd). Measures included socio-demographics, anthropometry, bioimpedance, and total body water using deuterium dilution. These measures were repeated at 18 months (N=107; loss to follow up, 1 MAM, 3 normal). The SAM and MAM children were enrolled in the Government's 30 days-nutrition rehabilitation program during the follow up period. The children received three times every day, at 8am, 4pm and 6pm, fresh, locally prepared food items providing 900 kcal and 20 g protein. This is in addition to two meals provided in Anganwadi (at 10am and 12noon) and food consumed at home, and daily multi-micronutrients and calcium supplements.

Results

No children had any chronic illness, or oedema, and all were free-living. At enrolment, using age based indicators of weight and height all children were underweight (WAZ <-2sd), and in addition 59 (55%) were either stunted and/ or wasted (HAZ and WHZ <-2sd) (Figure1).

At 18 months five children were still classified as SAM, 17 improved to MAM and 20 to normal category. Head circumference-for-age Z scores did not change: (mean) baseline, -2.79 ±1.3 and 18 months, -2.31 ±1.1. Rate of weight gain (g/kg/d) over 18 months was higher in SAM than in MAM or normal children: Median (25th, 75th centile) 0.78 (0.60, 1.26) SAM; 0.52 (0.40, 0.65) MAM and 0.62 (0.40, 0.68) normal group, (p<0.001, Mann Whitney test).

After 18 months, 51 children were severely stunted, 94 severely underweight and 55 were still in MAM group. Using WHZ, 52 children were normal, but three out of four (n=39) were still stunted and/or underweight (HAZ or WAZ <-2sd).

Conclusions

The sole use of weight-for-height as an indicator in community nutrition surveys underestimates the burden of stunting and underweight. The village rehabilitation resulted in slow and poor recovery in children who had composite anthropometric failures. Current protocols of screening for and the community-based management of undernutrition in India need improvement.

IAEA-CN-217--52P

Absorbed zinc and exchangeable zinc pool size are significantly greater in Pakistani infants receiving traditional complementary foods with zinc fortified micronutrient powder

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Adequacy of zinc intake from breast milk alone becomes marginal in relation to infant requirements by around six months of age. Simple and cost effective strategies are needed at population level to ensure adequate intakes of zinc in infants and toddlers in populations at risk of zinc deficiency. We determined the amount of absorbed zinc (AZ) from a micronutrient powder (MNP) without and with 10 mg of zinc (MNP, MNP+Zn, respectively) added to local complementary foods used in Pakistan, and the impact on the exchangeable zinc pool (EZP) size. As a nested study within a large prospective cluster randomized trial, 6 month old infants were randomized to receive MNP or MNP+Zn. Stable isotope methodology was applied after ~ 3 and 9 months of use to measure AZ from MNP-fortified test meals of rice-lentils (khitchri) and EZP. Nineteen infants per group completed the first metabolic studies; 14 and 17 infants in MNP and MNP+Zn groups, completed the follow-up studies. Mean (\pm SD) AZs were 0.1 ± 0.1 and 1.2 ± 0.5 mg at the first point for the MNP and MNP+Zn groups, respectively ($p < 0.001$); results were nearly identical at the follow-up measurement. EZP did not differ between groups at the first measurement but was less in the MNP group (3.7 ± 0.6 mg/kg) than in the MNP+Zn group (4.5 ± 1.0 mg/kg) at the second measurement ($P = 0.01$).

These data confirm that the MNP+Zn in khitchri were well absorbed, and after a year of home fortification, zinc status assessed by EZP was significantly better for the MNP+Zn group. Additional field studies may be necessary to ascertain the adequacy of this dose for infants at high risk of deficiency.

IAEA-CN-217--53P

NUTRITIONAL STATE OF THE CHILDREN FROM 6 TO 24 MONTHS SEEN IN PAEDIATRIC CONSULTATION AT THE GENERAL HOSPITAL OF NATIONAL REFERENCE OF N'DJAMENA (CHAD)

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SUMMARY:

Objectives: Infantile malnutrition is a problem of public health major in the Development Countries. In Chad, it constitutes a real problem of public health in particular in the children of less than 24 months. The present study aims at evaluating the nutritional statute of the children from 6 to 24 months seen in pediatric consultation at the general hospital of reference of Djamenà to Chad.

We proposed to make a descriptive cross-sectional study allowing to make the photography of the situation at a given time.

Methods: A descriptive exploratory study proceeded for two months and concerned 400 old children from 6 to 24 months, seen in pediatric consultation at the general hospital of national reference.

Results: The nutritional statute of the children in hospital medium with the HGRN of Djamenà is not alarming with a prevalence of 41,5% from emaciation, 33,3% of delay of growth and 52% of underweight according to NHCS. The fever was the most frequent sign having pushed the mother to consult, that is to say 40% of the children consulted for the fever, 25% for the acute respiratory infections, 24% for the diarrhoea. Our study found 56,8% of the mothers living in polygamies. 36% of the questioned women had a primary level but 37% were still illiterate. approximately 38% of the mothers of the children of 12 à 17 month were illiterate and depended on their husband. 29,5% of the mothers were multipares and 6% were large multipares. 46% pauci avoid and 18,5% first calf cow. The level of knowledge of the mothers remains acceptable on the food diversification of the children because more the share began it between 6 and 24 months, are 65,5% had a liquid feeding, 89% had a semi-fluid feeding and 86% had a solid feeding between 6 and 24 months. The enriched pulp was the food more used by approximately 75% of the mothers. We noted 26,3% children separated before 24 months whose more share are those from 18 to 24 months. The reason for weaning according to mothers' remains the refusal of tété of the child during the disease (82,25% children).

Conclusion: These data suggest the reinforcement with the methods of prevention which only will bring a long-term solution to the problem of malnutrition.

Key words: Children - nutritional State – food, Diversification – Djamenà (Chad)

IAEA-CN-217--54P

Acceptability study on locally developed Ready – to – Use Supplementary Food (RUSF) in Vietnam

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Background:

Despite much progress, the prevalence of stunting and acute malnutrition remains too high in Vietnam. Since 2010, the National Institute of Nutrition, UNICEF-Vietnam and the Institut de Recherche pour le Développement have been working on the development of locally produced ready-to-use foods (RUFs) for severe and moderate acute malnutrition (SAM/MAM). In contrast to clear evidence of the effectiveness of RUFs for SAM in Africa, data are limited with respect to the acceptability and effectiveness of RUFs in South-East Asia. A report from Cambodia showed poor acceptability of peanut-based RUFs. The present study examined the acceptability of a locally produced supplementary RUF in Vietnamese preschool children and their caregivers.

Methods:

The local produced RUSF was formulated in accordance to the recent WHO guidelines on specifications for RUSF. The study was conducted in two kindergartens in Bac Giang province, Vietnam. Preschool children (n=61) aged 3-5 years and having WHZ between -3 and -1.0 z-score (mean -1.53 Z-score) and/or a MUAC less than 125 mm, were included in the study. Selected children were given daily one sachet of local RUSF (92g) as snack meal rations for 5 days/week for two consecutive weeks. Weight and height was measured at baseline and endline. In addition, eaten quantity, eating patterns and hedonic evaluation of children and their caregivers were collected.

Results:

Most children (75.4%) consumed >75% of the offered RUSF with 85.8% (95% CI: 80.5, 91.1) of the offered RUSF consumed. Sex and age of children affected the amount of RUSF eaten. Almost all children and their caregivers scored the product high on organoleptic properties. Children gained on average 2 g/kg body weight per day over the study period. The majority of caregivers reported a willingness to buy the RUSF for their children.

Conclusion:

The locally produced RUSF had a positive impact on weight gain, and was very well-accepted by Vietnamese preschool children and caregivers.

Keywords:

Ready - to Use Supplementary Food (RUSF); child malnutrition; acceptability; Vietnam.

IAEA-CN-217--55P

Effectiveness of a locally produced RUTF for the treatment of Acute Malnutrition in Vietnam.

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Background and Objectives

After an assessment of peanut-based RUTF in Cambodia found low acceptability rates, the National Institute of Nutrition Vietnam, UNICEF and the Institut de Recherche pour le Développement started in 2009 to work on a locally produced RUTF, adapted to local taste and preference for the treatment of severe acute malnutrition (SAM). In 2010, the newly developed product was found to be highly acceptable, but impact on weight gain needed to be proven. Therefore, this study was conducted to assess the effectiveness of the local RUTF on weight gain and recovery rate using the RUTF in a home based treatment of acute malnutrition.

Methods and Design

The study was a randomized intervention trial in 150 children, aged 6-59 months, with SAM or moderate acute malnutrition (MAM) to test the effectiveness of the local RUTF (bar) against a standard RUTF (peanut-based paste). The study was done as a community-based intervention trial in Kon Tum province (Central Highlands region), Vietnam, where an Integrated Management of Acute Malnutrition programs (IMAM) program was just being introduced.

Results

Children consumed 92% and 70% of the offered local RUTF and standard RUTF respectively, underlining the problems with a peanut-based RUTF in SE Asia. Nutritional status of the children was significantly improved after the 8 weeks intervention. Mean weight gain with the standard RUTF and the local RUTF was 2.97 (\pm 1.57) g/kg/d and 2.52 (\pm 1.23) g/kg/d respectively. Also, both RUTFs improved significantly height and HAZ-scores, with a mean height gain of 22.4 (\pm 18.7) mm and 32.3 (\pm 36.3) mm for respectively standard and local RUTF. The recovery rate from acute malnutrition with RUTFs as home treatment was 70.8%, and not different between the 2 interventions.

Conclusions

The local RUTF was as effective as the standard RUTF on the treatment of acute malnutrition, whereas acceptability was higher. The local RUTF can be successfully used in the IMAM programs. The study supports the current efforts in Viet Nam to include IMAM and therapeutic foods into the National Targeted Programme and National Health Insurance scheme.

Future

Currently the partners are working on the development of a RUSF specifically developed for moderate acute malnutrition, with an effectiveness study of the product alone or in combination with WASH just finishing.

Keywords: children, malnutrition, RUTF, IMAM

IAEA-CN-217--58P

Effect of provision of daily zinc and iron with several micronutrients on growth and morbidity among young children in Pakistan: a cluster-randomised trial

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Background

Powders containing iron and other micronutrients are recommended as a strategy to prevent nutritional anaemia and other micronutrient deficiencies in children. We assessed the effects of provision of two micronutrient powder formulations, with or without zinc, to children in Pakistan.

Methods

We did a cluster randomised trial in urban and rural sites in Sindh, Pakistan. A baseline survey identified 256 clusters, which were randomly assigned (within urban and rural strata, by computer-generated random numbers) to one of three groups: non-supplemented control (group A), micronutrient powder without zinc (group B), or micronutrient powder with 10 mg zinc (group C). Children in the clusters aged 6 months were eligible for inclusion in the study. Powders were to be given daily between 6 and 18 months of age; follow-up was to age 2 years. Micronutrient powder sachets for groups B and C were identical except for colour; investigators and field and supervisory staff were masked to composition of the micronutrient powders until trial completion. Parents knew whether their child was receiving supplementation, but did not know whether the powder contained zinc. Primary outcomes were growth, episodes of diarrhoea, acute lower respiratory tract infection, fever, and incidence of admission to hospital. This trial is registered with ClinicalTrials.gov, number NCT00705445.

Results

The trial was done between Nov 1, 2008, and Dec 31, 2011. 947 children were enrolled in group A clusters, 910 in group B clusters, and 889 in group C clusters. Micronutrient powder administration was associated with lower risk of iron-deficiency anaemia at 18 months compared with the control group (odds ratio [OR] for micronutrient powder without zinc=0.20, 95% CI 0.11–0.36; OR for micronutrient powder with zinc=0.25, 95% CI 0.14–0.44). Compared with the control group, children in the group receiving micronutrient powder without zinc gained an extra 0.31 cm (95% CI 0.03–0.59) between 6 and 18 months of age and children receiving micronutrient powder with zinc an extra 0.56 cm (0.29–0.84). We recorded strong evidence of an increased proportion of days with diarrhea ($p=0.001$) and increased incidence of bloody diarrhoea ($p=0.003$) between 6 and 18 months in the two micronutrient powder groups, and reported chest indrawing ($p=0.03$). Incidence of febrile episodes or admission to hospital for diarrhoea, respiratory problems, or febrile episodes did not differ between the three groups.

Interpretation

Use of micronutrient powders reduces iron-deficiency anaemia in young children. However, the excess burden of diarrhoea and respiratory morbidities associated with micronutrient powder use and the very small effect on growth recorded suggest that a careful assessment of risks and benefits must be done in populations with malnourished children and high diarrhoea burdens.

IAEA-CN-217--60P

The challenges of underweight and overweight in South African children: Are we winning or losing the battle? A systematic review

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Background: Underweight and overweight are associated with negative health consequences in children and adolescents. In South Africa, the burden of economic and social disparity coexists with undernutrition and overnutrition in children. In line with the health promotion strategies, periodical tracking of underweight and overweight in children as well as promotion of government feeding scheme policies are recommended to improve children nutritional status. The purpose of this study was to review available literature regarding the prevalence's of underweight and overweight and evaluate government policies in addressing undernutrition and overnutrition in South African children.

Methods: The electronic search included PubMed, Science Direct, Google Scholar and library catalogue journal for prospective longitudinal or cross-sectional studies published on malnutrition, undernutrition, overnutrition, underweight and overweight in South African children within the age ranges of 0 to 14 between 1990 and 2013.

Results: Fourteen cross-sectional and two longitudinal studies met the criteria for inclusion in this review. Data synthesis revealed the small number of prospective studies highlights the dearth of research in tracking undernutrition and overnutrition in South African children. Overall, a higher percentage of the studies (ten) were reported in the rural areas compared to two studies in urban areas. The remaining four studies were a mixed of rural and urban. In this review, a high percentage of underweight (0.7-66%) was reported among children in rural areas compared to a similarly higher proportion of overweight (3.1-32.4%) in urban areas. Similarly, all studies reported a higher rate of underweight in boys than girls who were significantly more likely to have higher body fat. The data indicated that both underweight and overweight affected the adolescent's performances in many forms including physical activity and fitness, academic performance and self-esteem. Numerous recommendations were made in the reviewed studies as well as the reports, but unfortunately effective strategic programs in eradicating both underweight and overweight are minimal.

Conclusion: It is evident from the reviewed studies that underweight and overweight challenges are still huge in South African children. The most highly affected by underweight are rural children while children in urban areas in transition were faced with overweight. There are little efficient and effective strategic programs in addressing underweight and overweight in children. Based on these findings, the study recommends the introduction of efficient and effective four hour per week intensive physical activity in the school syllabi and government need to revisit its school-feeding scheme for optimal benefits. It was apparent from the reviewed studies that more robust longitudinal studies covering all provinces of South Africa are needed to elucidate the available literature.

Keywords: Undernutrition, overnutrition, growth, development, functional capacity, rural, urban, South African children

IAEA-CN-217--61P

Duration of episodes of untreated Acute Malnutrition in children 6 – 59 months as observed during monthly growth monitoring sessions in South of Bangladesh

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Background: Planning for management of severe and moderate acute malnutrition programs requires estimation of the caseload of children in need of care. Since incidence of acute malnutrition is not readily available, estimate of caseload is often derived from survey prevalence and the estimated duration of untreated episodes of acute malnutrition. However, information on the duration of acute malnutrition is limited. Sufficient guidance has not been given to planners on how to translate wasting prevalence rates into the probable caseload of a program based on Mid Upper Arm Circumference for admission.

Objective: To report the duration of acute malnutrition in children 6 – 59 months as observed during community growth monitoring in the south of Bangladesh.

Methodology: The study design was retrospective cohort using administrative data from Terre des hommes' monthly Growth Monitoring Program in Patharghata Union of Barguna District in absence of any community management. Monitoring data were available between November 2011 and December 2012 for 3340 children and on average, 1766 children were measured each month. Of these children only 585 had observations for every time point. During analysis two models were run, one which imputed missing observations based on status before and after the missing observation and one utilizing complete records.

Case definition: Based on the World Health Organization's threshold for weight-for-height z-scores and MUAC, the duration of acute malnutrition began when children were identified with acute malnutrition. The duration of acute malnutrition ended when children were not identified as suffering with acute malnutrition at any monthly visit. Episodes of acute malnutrition observed during the first and last periods of growth monitoring were excluded from the estimation of duration.

Results: The prevalence of global acute malnutrition varied over the year, with a peak in June/July (29.7% & 29.0%) and a low in December/January (15.6% & 15.1%). The overall prevalence rate during the period was 22.4% for global acute malnutrition (GAM) and 3.9% for severe acute malnutrition (SAM). During the period 438 new episodes of severe and 1502 new episodes of moderate acute malnutrition (MAM) were identified for a total of 1600 new episodes.

Of the 921 cases of MAM which were completely contained within the period, only 4.7% continued to degrade into a severe episode (SAM) within the next 1 to 6 months. For the cases of MAM which did not degrade into SAM, the duration of MAM for majority of children (65%) was only one month. In total, 80.5% of children recovered within 2 months and 92.9% within 4 months.

Discussion: Because only one year of data was available, periods of acute malnutrition greater than one year in duration were not included in this analysis which may have shortened the duration observed. In absence of any feeding programme, counseling to the child's caregiver was provided and this may have shortened the duration observed. The observed duration of episode of acute malnutrition would assist a great deal in estimation of caseload and manage resources accordingly.

IAEA-CN-217--62P

The Minimum reporting package – Using standardised indicators to analyse the performance of Supplementary Feeding Programmes in 7 countries

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Background

The 2008 HPN Network Paper 'Measuring the effectiveness of Supplementary Feeding Programmes in emergencies' highlighted the inconsistencies, inadequacies and bias associated with reporting of Supplementary Feeding Programmes (SFP) and outlined the lack of existing tools to support all reporting needs for Community Management of Acute Malnutrition (CMAM) programmes. The 'Minimum Reporting Package' (MRP) was developed in response to this paper, and has evolved to a concise and comprehensive management tool which uses standardised indicators to improve the reporting and monitoring of the treatment components of community based management of acute malnutrition (CMAM). The aim of the tool is to provide a contextualised overview of the CMAM programmes to improve programme management decisions, improve accountability and assist urgently needed learning in the effectiveness of this programme approach.

Methods

Data is collected regularly by a group of MRP partners and feeds into a central database. Analysis is on-going and leading to a larger analysis planned for the end of 2013/early 2014. The aims of these analyses are:

- To describe the characteristics of CMAM programmes
- To describe and assess the effect of CMAM programmes on rehabilitating malnourished individuals
- To compare programme performance and outcomes according to contextual factors, differences in protocols or approaches.

A preliminary analysis was run on Supplementary Feeding Programme (SFP) data collected between January 2012 and July 2013. The length of programme data differs but is generally above 3 months in order to be able to analyse programme results (a full contextual analysis will be conducted in early 2014 to be presented).

Results

SFP data was available from 4 NGOs, supporting 10 programmes in 7 countries (Burkina Faso, Chad, Ethiopia, Ivory Coast, India, Kenya, Somalia). After data cleaning, a total of 23,584 admissions and 15,496 were included. The majority of admissions were new admissions, (only four programmes reported relapses or re-admissions). MUAC was the most common admission criteria (81.3% of admissions). Performance indicators showed overall recovery rates of 86.9%, death rates of 0.1%, defaulter rates of 10.8%, transfer rates of 0.9%, and non-response rates of 1.3%. 6/10 programmes reported recovery rates above 90%.

Results

SFPs are implemented widely and overall obtain good results but with wide variation depending on where and how they are implemented. The presentation of descriptive data in the standardised MRP format allows easy, robust, real time analysis of programme data; easy comparison of different programmes, protocols and organisations; and easy access to information on programme background and characteristics. It identifies and provides contextualised data (which will be included as the analysis is updated) to assist in programme management decisions. This allows programme managers to identify programme characteristics (stage of programmes, success of programmes, potential problems in coverage, impact of stock-outs, programmes with patient backlogs), identify the impact of specific events that may be affecting the quality and outcomes of the programmes, and identify sites in need of supervisory support, therefore enhancing the management of CMAM programmes.

IAEA-CN-217--63P

Online Database Allows for Quick and Easy Monitoring and Reporting of Supplementary Feeding Program Performance: An Analysis of World Vision CMAM Programs (2006-2013)

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Background: Despite the widespread implementation of interventions to address moderate acute malnutrition (MAM), lack of robust monitoring systems have hindered evaluation of the effectiveness of approaches to prevent and treat MAM.

Since 2006, World Vision (WV) has provided supplementary feeding to 280,518 children 6-59 months of age (U5) and 105,949 pregnant and lactating women (PLW) as part of Community Based Management of Acute Malnutrition (CMAM) programming.

The Excel-based system initially used for monitoring individual site programs faced numerous challenges. It was time consuming, prone to human error, lost data as a result of staff turnover and hence use of data to inform program performance was limited. In 2010, World Vision International (WVI)'s Nutrition Centre of Expertise (NCOE) established an online database to overcome these limitations. The aim of the database was to improve monitoring and reporting of WV's CMAM programs. As of December 2013, the database has been rolled out in 14 countries Burundi, Chad, DRC, Ethiopia, Kenya, Mali, Mauritania, Niger, Sudan, Pakistan, South Sudan, Somalia, Zimbabwe and Zambia.

Methods: The database includes data on admissions (mid-upper arm circumference, weight for height, oedema, referral) and discharge outcomes (recovered, died, defaulted, non-recovered, referral) for Supplementary Feeding Programs (SFPs) for children U5 as well as PLWs. A quantitative analysis of the data sets available was conducted to identify issues with data quality and draw findings from the data itself. Variations in program performance as compared to Sphere standards were determined by country and aggregated over the 14 countries. In addition, time trend analyses were conducted to determine significant different and seasonality effects.

Results: Most data was related to program admissions from 2010 to July 2013, though some retrospective program data was available from 2006 to 2009. The countries with the largest number of admissions were Niger (65,092 children), Ethiopia (57,195 children) and Pakistan (42,299 children). On average, the SFP programs met or exceeded the recommended Sphere Standards for children U5: 92.2% recovered, 0.1% died and 5.6% defaulted. Some individual programs in particular years, did not meet the Sphere standard of < 15% of discharges defaulted. Common reasons for high defaulting were stock pipeline ruptures, and lack of follow-up with absentees. The online database has allowed program managers to compare performance indicators across all sites to identify low performing locations and take the necessary action to improve performance.

Conclusions: This analysis of the WVI CMAM database highlights the value of an online database system with harmonized reporting categories for monitoring supplementary feeding programs across national and regional levels, as well as individual country sites. In addition to its application to SFPs, World Vision intends to apply a similar monitoring system for other interventions used in the management of MAM such as cash transfers to contribute to the global evidence base on interventions to address MAM.

IAEA-CN-217--64P

Successful Decreases of Malnutrition among Children in Islamic Republic of Iran in the Past Two Decades

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During the last twenty years, MOH of I.R.Iran with collaboration of relevant sectors has provided successful remarkable services and interventions for improving the health and nutrition among children. Six national surveys conducted during 1991–2011 showed a remarkable decrease in prevalence of malnutrition.

In 1991, national prevalence of underweight was determined using the percentile method in urban and rural areas. Data of this survey showed that 15% of boys and 23% of girls in rural area were under 3rd percentile of weight for age (table-1). In 1995, anthropometric indices (wasting, underweight, and stunting) were calculated nationally for children using the z-score method (table-2, 3, and 4). After this study, multidisciplinary intervention for reducing malnutrition among children was designed. This intervention was performed from 1996 to 1999 in 3 villages of 3 provinces as a model in rural areas and a range of appropriate nutritional and social intervention strategies were designed to combat malnutrition (Promotion of breastfeeding, growth monitoring, and complementary feeding, home gardening, promoting consumption of dairy products and fruits, environmental health, and animal husbandry).

In 1999, using the same method of 1995, these indices were determined and the appropriate results of this intervention made the ground for its national implementation. Using the data also showed us that more than 30 % of malnutrition especially in rural areas are due to poverty so, we designed two other programs in rural areas to detect the poor families that have children under five or pregnant mother and give them a regular food basket. In these programs, through cooperation of two semi-governmental organizations, under 5 years old children with improper growth status based on NCHS growth charts, and pregnant mothers of the poor families, were recognized for receiving free food baskets. Expansion of the efforts in this field and also cooperation of all of governmental and non-governmental organizations, made a condition that in the national survey of 2004, malnutrition of the under 5 years old children has considerably decreased and caused Iran's top ranking in the region (table 2, 3, and 4). Moreover, since 2004, some comprehensive information like the curve of height for age and head circumference, and also the guideline of complementary feeding were added to the traditional growth chart of the primary health care (PHC). The results of Iran Multiple-Indicator Demographic and Health Survey (IrMIDHS) in 2010 showed the considerable decrease of children's malnutrition (table-5). In addition to the mentioned national programs, some other programs like flour fortification and provincial interventions such as providing a warm meal per day at rural kindergartens are currently being done. Meanwhile, for controlling the prevalence of severe malnutrition in some provinces, the packages of RUTF is being tested for effectiveness.

In 2011, the World Bank has announced that Iran has done the most successful activities in combating the poverty and malnutrition and has the best situation in respect of lowering the malnutrition levels of children among the Middle East and North Africa states.

IAEA-CN-217--65P

Prevalence of Malnutrition in Iranian Children with Physical Disability

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Background and Objective: Malnutrition can potentially prone a disabled child to further morbidities thus imposing further suffering to the affected child and his/her family. There for, periodically assess the nutritional status of children with disabilities to perform the appropriate nutritional care needs of this vulnerable group. This is the first report on the prevalence of malnutrition and nutritional status of physically disabled children from Iran. Present study investigates prevalence of malnutrition and nutritional status in Iranian children with physical disabled.

Materials and Methods: A total of 290 physically disabled children aged 6- 12 years old, of both sexes, and from all specialized schools in Tehran (Iran's capital), Meshed and Rasht (two major cities in North and East of Iran) were enrolled in a descriptive cross sectional study. Weight and height were measured and body mass index (BMI) was calculated for all subjects. In those disabled children whose heights could not be measured directly, height was estimated using Arm Length (AL) and Tibia Length (TL). Percent of low weight, thinness and short stature was determined in disabled children using CDC standards and Z- score. Dietary assessment was performed using 24hr and food-frequency questionnaires.

Results: The result based on Z score of weight showed that 49.5% and 40.1% of disabled girls and boys were underweight respectively. Only 11.2% of disabled girls' weights were between 3 and 95 percentiles and none of them were above percentile 95. However 2% of disabled boys' weights were above 95 percentile. Comparison with anthropometric data from other studies showed that low weight was more prevalent in disabled than in non- disabled children ($p<0.001$). Moreover, both disabled boys and girls had significantly shorter statures than their non disabled counterparts. In disabled children, while the mean energy intake was more than 90% of the amount required, mean calcium and iron intakes were 75.8% and 58.7% of the corresponding required amounts. Despite absence of significant difference in energy and fat intake, the intakes of protein, calcium and riboflavin were significantly lower in girls than in boys.

The high prevalence of underweight in children with disability in accordance with the standard CDC particularly in Tehranian girls is thought.

Conclusions: Malnutrition (low weight and stunting) is quite prevalent among Iranian children with motor disabilities. It seems that poor food composition is a more important contributing factor than total low calorie intake. These data warrants further studies. Further prevention programs are necessary to induct.

IAEA-CN-217--68P

Birth Weight, Nutritional Status and Body Composition among Malaysian Children Aged 7 to 10 Years

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Studies have indicated that lower birth weight is associated with lower body mass index, but the use of birth weight in predicting later nutritional status and adiposity remains inconsistent. Hence, this paper aimed to examine the relationship between birth weight and nutritional status with body composition among Malaysian children. This study is part of the Nutritional Survey of Malaysian Children, which is part of the four-country South East Asian Nutrition Surveys (SEANUTS). Subjects comprising 398 boys and 389 girls from the main ethnic groups, namely Malays, Chinese, Indians, Sabah and Sarawak natives, were recruited using a stratified random sampling. Anthropometric measurements comprised body weight, height, waist circumference (WC) and body fat (BF). Body mass index (BMI), fat mass index (FMI) and fat-free mass index (FFMI) adjusted with height were included, and birth weight was obtained by parental report. Nutritional status such as weight-for-age (WAZ), height-for-age (HAZ) and BMI-for-age (BAZ) were determined using the WHO growth reference for 5–19 years. Physical activity level was assessed using the Physical Activity Questionnaire for Children. Mean birth weight, height, weight, and BF were 3.1±0.5kg, 128.0±8.1cm, 28.4±8.9kg, and 27.9±9.1% respectively. Boys (20.4±4.2kg) had higher FFM ($p<0.05$) as compared to girls (19.4±4.9kg). Overall, the prevalence of stunting, underweight and thinness were 6.7%, 9.8% and 6.4%, respectively; while the prevalence of overweight and obesity were higher at 11.9% and 15.6%, respectively. Significant differences between the sexes ($p<0.05$) were found in HAZ (boys: -0.43 ± 0.99 ; girls: -0.42 ± 1.17) and BAZ (boys: 0.26 ± 1.76 ; girls: 0.09 ± 1.48). Children born low birth weight (<2.5 kg) had lower nutritional status (WAZ: 0.59 ± 1.62 ; HAZ: -0.83 ± 0.96) as compared to those with normal birth weight (WAZ: -0.05 ± 1.62 ; HAZ: -0.40 ± 1.09) and high birth weight (>4.0 kg) (WAZ: 0.51 ± 1.35 ; HAZ: -0.07 ± 0.67) at $p<0.05$. Besides, there were significant differences in weight, height, BAZ, FFM and FFMI between birth weight groups. Birth weight has weak correlation ($p<0.01$) with FFM ($r=0.22$), WAZ ($r=0.21$), HAZ ($r=0.20$), BAZ ($r=0.18$) and WC ($r=0.14$). After adjusting for covariates, we found that higher birth weight was associated with significant higher values in all anthropometric measurements ($p<0.01$), especially WC ($\beta=2.82$, $p<0.001$). Multiple regression analysis also indicated that birth weight positively predicted later nutritional status; 1kg increase in birth weight predicted 0.70, 0.46, and 0.58 unit increases in WAZ, HAZ, and BAZ, respectively. In conclusion, this study suggests that nutritional status and adiposity are influenced by birth weight. Birth weight is not only an indicator of the nutritional status during infancy, but also a risk factor that affect child growth and development.

IAEA-CN-217--70P

Nutritional Status and Influence of Breast Milk Consumption among Toddlers below Two Years Old In Malaysia: A Nationwide Cross Sectional Study

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Infant feeding practices was found to impact on a child's nutritional status. This paper aims to determine the nutritional status and influence of breast milk intake among toddlers less than two years in Malaysia. This study is part of the Nutrition Survey of Malaysian Children, which is part of the four-country South East Asian Nutrition Surveys (SEANUTS). A total of 190 subjects were recruited through stratified random sampling of nurseries, comprising 90 boys (47.4%) and 100 (52.6%) girls, with mean ages of 1.3 ± 0.4 years and 1.3 ± 0.5 years, respectively for boys and girls. Subjects were 66.3% Malays, 14.2% Chinese, 5.8% Indians and 13.7% Sabah and Sarawak natives. Anthropometric measurements comprised weight and height; body composition was assessed with bioelectrical impedance technique. WHO Child Growth Standard 2006 was used to determine z-scores for length-for-age (LAZ), weight-for-age (WAZ) and BMI-for-age (BAZ). Among the subjects, underweight (10%) was found to be more prevalent than overweight/obese (6.3%) for WAZ. The prevalence of stunting (22.1%) was found to be higher among boys (30.0%) than girls (15.0%) for LAZ. A similar trend was found to be more prevalent among boys (10.0%) than girls (2.0%) for thinness (5.8%), with BAZ between -3SD and -2SD. Independent t-test revealed significant differences in LAZ ($p<0.05$) for children who breastfed for 6 months or more and children who breastfed for less than 6 months, however no significant differences in birth weight, fat mass (FM) and lean mass (LM) were found between the two groups. Pearson's correlation ($p<0.05$) showed that only height ($r=0.22$), but not with parental income, BMI, FM and LM, had significant correlation with breastfeeding duration. Linear regression analysis confirmed that only age ($p<0.05$) and total number of siblings ($p<0.01$) contributed to breastfeeding duration. In conclusion, dual burden of malnutrition was found to coexist in our young children. Breast milk duration had positive influences on a child's height, which implies that breast milk is essential in ensuring a proper growth and development of a child. Therefore, breastfeeding should always be promoted among mothers in order to improve nutritional status of a child.

IAEA-CN-217--73P

A comparative study on Nutritional status of Preschool children in Kekirawa Divisional Secretariat area and Gampaha Divisional Secretariat area in Sri Lanka.

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Nutritional status is one of the most important indicators of the overall well being of population. According to Ayurveda Wellbeing of Physical, Mental & Spiritual status is known as health. This refers the definition of health defined by World Health Organization (WHO). Underweight, Stunting, Wasting and Overweight are important status of nutrition declared by the WHO. Height for age $\leq -2SD$ from the mean, Weight for height $\leq -2SD$ from the mean and Weight for age $\leq -2SD$ were defined as Stunting, Wasting and Underweight respectively. Results of a Survey carried out in 2007 in Sri Lanka were highlighted that, 21.1% are underweight, 14.7% were wasting and 17.3% were stunting among the under five year children. Under nutrition has been identified as a major problem among the preschool children in Sri Lanka. With this background, a preliminary survey was designed to identify the nutritional status of selected areas. Collecting Anthropometric measurements such as height & weight and evaluating the nutritional status of Preschool children were the objectives of the study. The study was carried out in the Kekirawa divisional secretariat division of the Anuradhapura district and Gampaha divisional secretariat division of the Gampaha district. Five preschools in Kekirawa division and two preschools in Gampaha division were randomly selected and 100 preschool children from each division were subjected to the survey.

Under the permission of Preschool teachers, mothers of the Preschool children's were instructed to meet Ayurveda Medical Officer in scheduled date with their children to take anthropometric measurements. Then heights and weight of children were measured using Stadiometer and scale with digital display. Recorded data were processed using WHO Anthro software - 2011. Age distribution of the sample was identified as 36-47 months and 48-60 months. Results of Prevalence of nutritional status revealed that 32.4% wasting, 24.5% stunting and 42.3% underweight among the served preschool children in Kekirawa divisional secretariat division and 14.4% wasting, 3.1% stunting and 8.2% underweight among the served preschool children in Gampaha divisional secretariat division. According to the survey prevalence of undernutrition was assessed as severely wasted, wasted, severely stunted, stunted and severely under weight, under weight.

In Kekirawa Divisional Secretariat area, Male wasting status was 4% $\leq -3SD$, 26% $\leq -2SD$, Stunting status was 8% $\leq -3SD$, 26% $\leq -2SD$ and Underweight status was 10% $\leq -3SD$, 30% $\leq -2SD$. Female wasting status is containing 0% $\leq -3SD$, 29.2% $\leq -2SD$, Stunting status is 2.1% $\leq -3SD$, 16.7% $\leq -2SD$ and Underweight status is 8.3% $\leq -3SD$, 31.3% $\leq -2SD$.

In Gampaha Divisional Secretariat area, Male wasting status was 0% $\leq -3SD$, 11.1% $\leq -2SD$, Stunting status was 0% $\leq -3SD$, 4.4% $\leq -2SD$ and Underweight status was 0% $\leq -3SD$, 4.4% $\leq -2SD$. Female wasting status is containing 1.9% $\leq -3SD$, 15.4% $\leq -2SD$, Stunting status is 0% $\leq -3SD$, 1.9% $\leq -2SD$ and Underweight status is 0% $\leq -3SD$, 11.5% $\leq -2SD$.

IAEA-CN-217--75P

Psychosocial components in prevention of MAM

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Recent research and intervention have shown that early childhood is a critical time for integrating health, nutrition and child stimulation. This presentation will highlight the importance of psychosocial component and in particular maternal mental health in the prevention of MAM. Examples from the field will be proposed for sharing difficulties and lessons learnt.

IAEA-CN-217--76P

Factors Associated with the Diagnosis of Acute Malnutrition by Anthropometric Indicators in Nutrition Surveys

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Two anthropometric indicators, low Mid Upper Arm Circumference (MUAC) and low Weight-for-Height Z-score (WHZ), are widely accepted proxies to identify 6 to 59 months old children suffering from non-oedematous acute malnutrition. However, they only partly identify the same children, which raises crucial issues at a time when MUAC is increasingly used as a stand-alone criterion in nutritional programmes. Misdiagnoses or differing pathophysiologies could in fact explain such diagnosis discrepancies. In particular, MUAC in the reference population is lower for girls than for boys, and increases with age. MUAC may also vary with the level of growth retardation. We thus aimed at testing the association between these factors and the diagnosis of severe or moderate acute malnutrition by MUAC, as well as their contribution to the diagnosis discrepancy, in a wide range of contexts.

We used a series of more than 600 anthropometric surveys conducted by ACF-IN, from January 2001, in 25 countries. All surveys had a similar cluster sampling scheme. The association between sex, age, stunting (independent variables) and indicators of acute malnutrition (dependent variable) was investigated through multivariate logistic regressions. The clustering by surveys and countries was accounted for in multilevel modelling with random effects.

Among the children included in the analysis, approximately 4.8% presented with either a MUAC<115mm or a WHZ<-3. Only 22.8% were identified as SAM cases by both indicators. This proportion was highly variable across countries, from 6.6% in Kenya to 50.0% in Mali. Being a female was significantly associated with low MUAC, whereas it appeared to be a protective factor for low WHZ. Young age and severe stunting were associated with both WHZ and MUAC diagnoses, although these associations were much stronger for MUAC (young age: OR=7.86 [7.46; 8.29] vs. 2.15 [2.07; 2.24]; severe stunting: OR=4.83 [4.59; 5.07] vs. 2.14 [2.03; 2.25]). Among the low WHZ cases, being a female, being younger than 2 years and being severely stunted were all factors independently associated with being also diagnosed as by MUAC: 81% of the low WHZ cases combining these 3 characteristics were also identified by MUAC. Among the low MUAC cases, being a female was a strong protective factor of being also diagnosed by WHZ. No other significant associations were reported.

This study brings quantitative evidence about the dramatic extent of the discrepancy between MUAC and WHZ diagnoses of acute malnutrition, its variability across contexts, and some of its major determinants. Further medical and physiological investigation of the cases diagnosed by anthropometric criteria would be necessary to understand how far the differences in diagnoses correspond to distinct levels of severity and nutritional needs.

IAEA-CN-217--77P

Results and lessons learned from UMANG program: a large scale community-managed supplementary feeding program in India

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India's National Family Health Survey (2005-2006) revealed that 48% children under 5 years old were stunted while 43% were underweight. Child malnutrition is the outcome of high levels of exposure to infections, inappropriate infant and young child feeding and caring practices. It has its origins almost entirely during the first two to three years of life. Child malnutrition is responsible for 22% of India's burden of disease. According to the Lancet journal in 2013, undernutrition during pregnancy, affecting fetal growth, and the first two years of life is a major determinant of both stunting of linear growth and subsequent obesity and non-communicable diseases in adulthood.

World Vision India (WVI) is a humanitarian organization working in India since 1951 and currently serving 163 districts in 25 states. The strategic directive of WVI for 2011-2014 focuses on reducing infant mortality and eliminating hunger in communities. In March 2011, a special task force Integrated Programming - Child Health (IPCH) with the key mandates to target families of malnourished children residing in program areas towards delivering fullness of life; support Government, communities and other partners in scaling up proven multisectoral interventions; leverage multi-sectoral coalitions to combat malnutrition; advocate change in system and sustainability; and set up organizational support. A generic logframe with the intervention packages was adopted by Area Development Programs (ADPs) in 96 locations, making it the biggest nutrition program ever been implemented by WVI. After doing the nutritional assessment, 83255 children were identified to be in moderate and severe malnutrition condition.

Considering that even mild to moderate malnutrition greatly increases the risk of children dying from common childhood diseases, WVI decided to set up an emergency response as an ethical and critical decision to save the lives of these children. A community managed supplementary feeding program called "UMANG" (Urgent Management & Action for Nutrition Growth) was developed and implemented across 84 ADPs. Through this program a malnourished child gets an additional feeding (one full meal and healthy snack), apart from what is provided at home and through the Government run Anganwadi Centre (an Indian policy to provide free mid-day meal to the children, but recent review shows varying degree of quality and attendance). UMANG menu meets one third of the daily requirement of children using locally available low cost nutritious food provided for a period of 90 days. Through UMANG mothers were educated and trained on healthy cooking, feeding and caring practices.

Within the period of October 2012 to May 2013, as many as 24,154 children were enrolled in UMANG, and 44% have graduated to normal nutritional status at the end of 90 days program. Review of the program revealed that UMANG has increased the knowledge of mothers on malnutrition, contributed to the formation of common interest groups and enhanced the co-ordination of the frontline workers in addressing malnutrition. The presentation will highlight lessons learned from the 90-day implementation of this large scale community-managed supplementary feeding program.

IAEA-CN-217--78P

The Effectiveness of Community Health Workers Approach in Preventing Moderate Malnutrition among Infants and Young Children in Bethlehem villages in Palestine

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Background and aims:

Infant and young child feeding practices are critically important for preventing and managing moderate malnutrition.

The Palestinian Central Bureau of Statistics report 2011 revealed that malnutrition among children under-five in Palestine is on rise. Between the years 2000 and 2010, prevalence of malnutrition rose by 41.3% on the national level. Currently, 11 out of 100 children under-five suffer malnutrition.

An assessment on maternal child health and nutrition conducted by World Vision in the same year in Bethlehem governorate in Palestine ,showed that malnutrition among children are mostly attributed to poor knowledge and practices among caregivers especially mothers in regards to breastfeeding, complementary feeding, feeding during illness and supplementation.

The objective of this intervention is to assess the effectiveness of home targeted and timely visits by trained community health workers (CHWs) for increased knowledge and improved practices among caregivers regarding IYCF as a preventive approach to moderate malnutrition.

Method: An intervention study was carried out by World Vision in eleven villages surrounding Bethlehem. Mothers (n=360) of infants born during the year 2011, 2012 were identified by 17 trained CHWs. The CHWs targeted the mothers with key messages and support for positive infant and young child feeding practices during organized home-visits throughout 14 months. Baseline and end-line data were collected through household interviews.

Results and discussion: Infant and young child feeding practices were significantly improved after the intervention; exclusive breastfeeding until 6 months increased from 44.7% to 65.7% (P <0.001), duration of breastfeeding above one year increased from 66.8% to 82.5% (P <0.001),timely introduction of the complementary meals increased from 71.5% to 87%,offering the minimum meal diversity increased from 28.5% to78.9% (P <0.001), meal frequency increased from 4.2%-75.9% (P <0.001), giving the appropriate feeding during illness increased from 40.7% to 76% (P <0.001), giving regular VIT A supplements increased from 44.6% to 75.6% (P <0.001) and giving regular iron supplementation increased from 38.8% to 76.7% (P <0.001).

Conclusion: Home based interventions by trained community health workers proved to be an effective approach for the control and prevention of malnutrition, this approach has positively influenced different practices related to infant and young child feeding in Bethlehem villages .

Due to context similarities in most Palestinian localities scale up plans for this intervention in recommended to be used in other areas as a tool to prevent and control moderate malnutrition.

IAEA-CN-217--80P

Evaluation of Coverage and Barriers to Access to MAM Treatment in West Pokot County, Kenya

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Despite an increased number of nutrition treatment coverage assessments conducted, they often focus on Severe Acute Malnutrition (SAM) treatment. In a recent experience in Kenya, Action Against Hunger| ACF International (ACF) conducted a coverage assessment to evaluate access to SAM and Moderate Acute Malnutrition (MAM) treatment. ACF supports the Ministry of Health (MoH) in delivering SAM and MAM treatment at health facility level through an Integrated Management of Acute Malnutrition (IMAM) programme in West Pokot county since 2011.

In order to evaluate the coverage of Outpatient Therapeutic Programme (OTP) and Supplementary Feeding Programme (SFP) components, the Simplified Lot Quality Assurance Sampling Evaluation of Access and Coverage (SLEAC) methodology was used. The goals of the coverage assessment were i) to estimate coverage for OTP and SFP; ii) to identify barriers to access to SAM and MAM treatment; iii) to evaluate whether any differences exist between barriers to access to SAM versus to MAM treatment as SFP coverage and uptake of MAM services were never assessed before; and iv) to build local capacities in assessing coverage and to provide recommendations for the MoH-led IMAM programme. With the support of the Coverage Monitoring Network (CMN), ACF led the SLEAC assessment as part of an on-the-job training exercise for MoH and partners in July 2013, covering all of West Pokot county.

SLEAC is a rapid and low-resource survey method that uses a three-tier classification approach to evaluate and classify coverage, i.e., low coverage: < 20%; moderate: 20% -50%; and high coverage: ≤ 50%. In a first sampling stage, villages in each of the four sub-counties were randomly selected using systematic sampling. In a second sampling stage, in order to also assess MAM coverage, a house-to-house approach was applied to identify all or near all acutely malnourished children using Mid Upper Arm Circumference (MUAC) tape and identification of bilateral pitting oedema.

Results showed that none of the four sub-counties achieved high coverage classification. The coverage for OTP was moderate in North and South Pokot, whilst low in West and Central Pokot. The overall county coverage classification was moderate. SFP coverage classification was found to be low across all four sub-counties and county wide as well. The assessment also identified that barriers to access to SAM and MAM treatment were often similar, e.g., the main barrier to access for both services was lack of programme awareness in Central and West Pokot.

Some key recommendations towards increasing coverage included to improve stakeholder awareness via advocacy, engaging with the use of mass media, increasing outreach activities, and to minimize rejection by revising screening methods and systems in place. These were applicable to both OTP and SFP components of IMAM. Coverage evaluations for MAM treatment are less commonly conducted than those for SAM treatment as it is more challenging to identify cases of MAM physically. Nonetheless, in order to document program effectiveness, it will be important to further explore methods that can evaluate coverage of MAM programming.

IAEA-CN-217--81P

Conduct of breastfeeding among young Tunisian Mothers

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Introduction: Breastfeeding is a natural phenomenon that reflects reality and occupies an important space in the life of all human beings. It is the reference for infant feeding since it is the food better tailored to his needs as its capabilities. The decision to make this practice is the responsibility of each parent. However, it is found that although mothers in particular young age properly begin the practice of breastfeeding, they end, for various reasons by early introduction of other foods or even stop breastfeeding few weeks after the delivery.

Objectives: We aim from this study to examine the behavior of young mothers in breastfeeding, determine the impact of attitudes of mothers on the nutritional status of infants and encourage policymakers health to establish a line of action to initiate future and young mothers to breastfeed.

Methods: This is a prospective study of 50 young mothers coming to consult or to vaccinate their children aged 2 to 23 months at the center of maternal and child of El Zouhour.

Results: The analysis of our results showed that 76 % of surveyed mothers have a high level of education, half primiparous and 64 % are housewives.

Concerning the practice of breastfeeding, we found that 42% of surveyed mothers have weaned their children and only 26% of them believe breastfeeding or breast-feed their infants exclusively for the first six months.

Moreover , we noted That among children suffering from obesity 2nd degree be 16% of the total population , 87.5% of them were not (or are not) exclusively breastfed for the first six month of life . However , this relationship is not statistically significant.

Conclusion: The evolution of knowledge of young mothers has not influenced their practices in breastfeeding. This requires the establishment of a line of action to promote breastfeeding based on the evaluation of implemented national programs in recent years, the update of their content and the improvement of training of personnel of health in breastfeeding which will further develop the quality of information and guidance provided to new and expectant mothers.

IAEA-CN-217--82P

Anthropometric Indicators in Children Referred to a Tertiary-level Public Health Care Institution from Buenos Aires, Argentina

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Introduction: Stunting is a multifactorial phenomenon with a high prevalence in developing countries. *Helicobacter pylori*, a bacterium that colonizes the gastric mucosa, has been related to growth impairment due to micronutrient malabsorption. However this hypothesis remains controversial. **Objective:** The aim of our work was to determine anthropometric indicators in children referred to a Tertiary-level Public Health Care Institution from Buenos Aires, Argentina, for upper gastrointestinal symptoms evaluation. **Methods:** 525 children (4-16 y) assisting to the Gastroenterology Unit of the Hospital de Niños "Sor María Ludovica", La Plata, Argentina, were diagnosed for *H. pylori* infection by the ¹³C-Urea Breath Test. Weight and height were measured for calculation of anthropometric indicators height for age (HAZ), weight for age (WAZ) and Body Mass Index for age (BMI) using the Anthro Plus 2007 software of the World Health Organization. Statistical analysis was performed by Student's t Test, Mann-Whitney Test and lineal regression. **Results:** Prevalence of *H. pylori* infection was 25.1% (95% CI, 21.5-29.5), with a mean age of the children similar in both groups, 10.1y (95% CI, 9.8-10.3y). Mean HAZ and WAZ were -0.40 (95% CI, -0.57-[-0.22]) and -0.31 (95% CI, -0.51-[-0.11]) in the positive group, and -0.18 (95% CI, -0.28-[-0.09]) and -0.10 (95% CI, -0.21-0.01) in the negative group. HAZ was significantly lower in the positive group (p=0.04), while no significant differences were found for WAZ (p=0.07) and BMI for age (p=0.20) between both groups. However, after adjusting for confounding factors these differences were no longer significant. Stunting was found in 4.5% (95% CI, 2.1-9.6) and 3.3% (95% CI, 1.9-5.6) of the *H. pylori* positive and negative children respectively, while underweight was observed in 5.3% (95% CI, 2.6-10.5) and 6.7% (95% CI, 4.6-9.6) of the above mentioned groups. **Conclusions:** Prevalence of stunting and underweight were low in the studied population. Although the evaluated anthropometric indicators tended to be lower for the *H. pylori* positive children, the differences were not statistically significant.

IAEA-CN-217--83P

Nutritional Status of Children under five years and it's determinants in Vakarai, Sri Lanka

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Vakarai area was heavily affected during the conflicts. After cessation of the war it's decided to identify the nutritional problems to support with appropriate interventions. Study aimed to determine the nutrition status of children under five years of age and it's determinants to make the recommendations.

Cross sectional study done in 389 children identified using cluster sampling. Interviewer administered questionnaire to and anthropometric measurements were taken. WHO standards were used.

Prevalence of wasting was 24.7% (CI;20.4-28.9%), of which 20.5% (CI;16.5-24.5%) moderate and 4.2% (CI;2.2-6.2%) severe wasting. Prevalence of stunting and underweight 16.2% (CI;12.5-19.8%) and 33.4% (CI;28.7-38.1%) respectively. National estimates of moderate and severe wasting was 11.7% and 1.9% respectively.

Low birth weight in the sample was 28.8% higher than national estimates (28.8%;18.1%). Immediate causes indicated 63.1% and 4.4% of children had respiratory tract infections and diarrhoea.

10.9% of children in the age group up to 6 months were given any items other than breast milk within first 3 days of life. Among those in the age group 6 – 23 months, water was the commonest item given (97.3%) and 77.4 % was given rice, bread and rice flour preparations. As age increased more of the children were given a variety of food items. 32.4% children aged 6-23 months has received a minimum acceptable diet, which was lower among girls compared to boys. Among the breastfed children the percentage having minimum meal frequency was higher (30.1%) than the non-breastfed children (14.3%).

96% had a Child Health Development Record and 95.8% had age appropriate immunization. 35.5% children were given de worming tablets within the previous 6 months with the percentage received a vitamin A was 69.8%.

Rice and other cereals and coconut have been consumed almost on all days during the preceding week. Meat and pulses consumption was less frequent and 51.2% of the households' food stocks or money available for purchase was only for a week's supply.

54.1% of mothers of the study sample wash their hands using soaps in five critical times (After using toilet, before eating, before feeding the child, after cleaning child's stool and before cooking).

Actions aimed at further reduction of severe and moderate wasting needs to be considered with the focus on starting a therapeutic feeding, feeding for moderate wasting children, improving feeding during illnesses, encouragement for exclusive breastfeeding, community rehabilitation programme to prevent malnutrition, improving dietary practices, reduction of morbidity and improvement of practices related to personal hygiene. Practices related to cleanliness related to cooking and feeding the children, needs improvement. Improving food consumption of children under 2 years needs special attention to reduce the prevalence of stunting to acceptable levels. Income generation activities should be linked either directly or indirectly with promoting appropriate food consumption patterns.

IAEA-CN-217--84P

Integration of Nutrition and Economic Development in Sri Lanka: The Graduation Model

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WV Lanka's Graduation Model integrates economic development and nutrition-specific interventions in order to sustainably reduce childhood growth failure.

The Graduation Model identifies families where they are on the economic and nutrition scale to tailor interventions enabling graduation from one living standard segment to the next, as well as enabling improved nutrition. Families with malnourished children are identified and supported with appropriate nutrition interventions, in addition to the tailored economic interventions, which first focus on nutrition rehabilitation through positive deviant Hearth approach and then increasing diet diversity through food security and livelihoods. WV Lanka is implementing an integrated approach to address malnutrition.

The components of the Graduation Model focused on families:

1. Participatory Living Standard Ranking (PLSR) to identify the living standards of the families.

PLSR leads to a segmentation of all households into six segments depending on the living standards. They are: Destitute (DT), Poorest of the poor (PoP), Poor (P), Vulnerable non-poor (VNP), Suitable livelihood & Micro Entrepreneur (SL & ME) and Small and Medium Entrepreneur & above (SME & Above).

2. Nutrition assessment/growth monitoring to identify nutritional status of children and their families.

3. Family Development Plan prepared for all households and all members of the family – incorporating the Sustainable Livelihood.

4. The Positive Deviance/Hearth approach is used to identify existing practices which promote good nutrition and these practices later on were shared to caregivers of malnourished children through experiential learning. The Positive Deviance/Hearth sessions are used to promote the caring, feeding, hygienic and health seeking practices among caregivers.

Low income families with malnourished children are supported to establish home gardens. Interventions include a combination of home gardens, business training, pre-microfinance (savings clubs), skills/technical/asset transfer and microfinance, depending on the PLSR ranking. Economic development activities include skills transfer, savings clubs and small business development. Progress along the Graduation Pathway is measured by improvements in both economic well-being and child nutritional status.

The Graduation Model optimizes development resources through its integrated pathway to economic self-sufficiency and improved nutrition. Families are empowered to improve their living conditions and children's nutritional status. Future plans include expansion of the Model to new project areas and incorporation of early childhood education and agriculture interventions.

World Vision Lanka has achieved significant achievements by integration of economic development and nutrition through the graduation pathway model. 24% of Poorest of the Poor (PoP) families who were identified at the baseline survey were reduced to 19.2% within a two years which is a 4.8% progress. The number of Poor (P) families reduced from 31% to 27.6%; Vulnerable non-poor families reduced from 23% to 19.5% and Small and Medium entrepreneur families increased from 14% to 17%.

After two years of implementation in one project area, significant reductions were noted in the prevalence of anaemia (71% to 33%) and underweight (32% to 26%) among children 6-59 months. Changes were seen in wasting (17% to 16%) or stunting (26% to 24%).

IAEA-CN-217--85P

The Determination of National Growth Charts to Prevent and Manage Malnutrition in Iranian Children: Necessity and Importance

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Objectives: Standard height and weight charts are the most important evaluation tools for the assessment of growth and development of children which could be further used to develop preventive interventions both in individual and epidemiologic assessments in the community. Children of different populations differ a lot in size and shape, resulting from differences in their genetic pattern, their needs and interaction of these two. Regarding the existence of different standards, it seems that a national standard can provide a more accurate functional individual and social evaluation tool and many problems will be solved in case of availability of an Iranian standard for comparison of children's height, weight, and their growth follow-ups. One of these problems is the abnormal results regarding malnourishment, overweight, or obesity in Iranian children. Considerable rate of childhood malnutrition in Iran and other countries necessitates the implementation of interventional programs including development of local growth charts to prevent and manage malnutrition in the community.

This study was undertaken with the aim of reviewing different current growth curves, their advantages and disadvantages, and performing a review of the studies conducted in Iran and other countries on determination of weight and height standards.

Methods: In order to collect materials for this review, a detailed search of Scientific Information Database (SID), Iran Medex, MEDLINE, Pub Med, and Web of Science was carried out for the time period 2005-2011 using the keywords: national standard, height, weight, children, and growth chart. Initially, we reviewed international standards of weight and height.

Results: The results of performed studies in European and Asian countries showed that the height and weight curves of these children were different from WHO and NCHS growth standards. The finding of growth trend study of Iranian children showed that the mean height and weight of girls and boys were increased. In spite of these increases, the median height and weight of Iranian girls and boys under 15 years was under 20th percentile of the United States National Center for the Health Statistics.

Conclusions: Considering the epidemiological changes and existing genetic differences and different children's weight and height growth patterns, it seems that the global standard for the children's growth, including the WHO standards, are not applicable to all the populations.

The result of a study about growth trend of Iranian children and teenagers showed that the mean height and weight of girls and boys have increased. In spite of these increases, the median height and weight of Iranian girls and boys aged less than 15 years was under 20th percentile of the US National Center for the Health Statistics. This shows the necessity of cultural education along with the economic development in order to eliminate the gaps in growth and development of infants and children. Hence, it is suggested that, as one of the major decision-makers, the Iranian Ministry of Health and Medical Education with the cooperation of educational and research centers makes an effort for determination of locally height and weight standards.

IAEA-CN-217--86P

Body Composition, Muscular Strength and Bone Status among Undernourished Children in Malaysia

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Despite significant advances in social and economic development, undernutrition remains a devastating public health problem that affects millions of children across the globe, particularly in developing nations. It is important to understand how changes in nutritional status affect physical health and function, so that undernutrition-related alterations can be identified and interpreted correctly. This paper aimed to determine the impact of undernutrition in children through the assessment of three nutrition-related indicators: body composition, muscular strength and bone status. This study is part of the Nutrition Survey of Malaysian Children, which is part of the four-country South East Asian Nutrition Surveys (SEANUTS). A total of 208 school children (102 boys, 106 girls) in the age range of 7 to 10 years were included in this analysis, of which 104 were underweight ($WAZ < -2SD$) and 104 were normal-weight group ($-2SD \leq WAZ \leq +2SD$), individually-matched for sex, age, and ethnicity. Anthropometric measurements included weight and height; and body composition was measured by bioelectrical impedance analysis. Muscular strength of both hands was assessed independently by hand-held dynamometer. Bone status was evaluated using a radial quantitative ultrasound system at one-third distal radius of the non-dominant hand. Anthropometric measurements and bone status were not significantly different between the sexes. Boys had significantly higher muscular strength and lean mass ($p < 0.05$), but lower fat mass when compared to the girls ($p < 0.01$). In both sexes, the undernourished group presented significantly lower anthropometric and body composition measurements and muscular strength than their normal-weight counterparts ($p < 0.001$). However, no significant differences were observed for bone status between the two weight groups in boys ($p = 0.09$) and girls ($p = 0.98$). These findings imply that undernutrition can have profound negative impact on body composition as well as muscular strength of children, but does not appear to influence bone status. Nevertheless, improving the overall nutritional status and health function should be the ultimate goal when tackling the undernutrition issues in this vulnerable population.

IAEA-CN-217--87P

Microbiota is immature in moderate and severe acute malnutrition

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Globally 19 million under-five children suffer from severe acute malnutrition (SAM) while 51.5 million children have moderate acute malnutrition (MAM). These two conditions, together known as acute malnutrition, are responsible for 14.6% of all under-five deaths. Case fatality rate can be reduced with treatment of SAM, which however, is not readily available everywhere. Even with effective treatment, recovery can be slow and relapse not uncommon. Lack of nutrients is one of the causes of acute malnutrition but other factors including infections, inter- and intra-generational factors are also believed to play important roles in the etiology. The gut microbiota is another factor; however its relationship with nutritional interventions and therapeutic response is poorly understood. We studied the gut microbiota of children suffering from severe and moderate acute malnutrition in Bangladesh. Children with SAM were studied during the acute phase, nutritional rehabilitation and follow up in icddr,b Hospital, Dhaka. During the nutritional rehabilitation phase, the children were randomized to either RUTF or a combination of local diets (khichuri and halwa). Children with MAM were randomly selected from a birth cohort in a slum settlement and so were healthy controls. Gut microbiota were identified using 16S rRNA datasets generated from monthly fecal samples obtained from the healthy control children. 'Relative microbiota maturity index' and 'microbiota-for-age Z-score' were computed from a model developed from the age-discriminatory bacterial species identified in the healthy and acutely malnourished children. The index and the Z-score compare maturation of an acutely malnourished child's fecal microbiota relative to healthy children of similar chronological age. Our results indicate that SAM is associated with relative immaturity of the gut microbiota. Moreover, treatment with either RUTF or the local diets is associated with incomplete recovery of the gut microbiota. Similarly, MAM is also associated with immaturity of the gut microbiota, the degree of immaturity correlating with the severity of malnutrition. The immaturity of the gut microbiota in acute malnutrition may have an important role in metabolic and immunologic perturbations that result in suboptimal response to therapeutic measures.

IAEA-CN-217--89P

Role of Mothers' Education on Children's Nutritional Status in Bangladesh

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Background: Malnutrition continues to be a major public health problem in Bangladesh. Roughly half of all children under five years in this country show evidence of chronic malnutrition. Reasons behind this range from household distribution of foods, dietary practices, distribution of land, access to education and health facilities and infrastructure development. So, as a part of building up a regular alert system, a surveillance program named Food Security Nutritional Surveillance Project (FSNSP) was setup in 2009. This study is tasked to determine the effect of mother's education on child nutritional status.

Methodology: FSNSP has been implementing a nationally representative surveillance over three major seasons in Bangladesh: post-aman harvest period (January-April); monsoon (May-August); and post-aman harvest season (September-December). The project is tasked to track key food security, nutrition and health indicators through these three seasons of the year and to build national capacity to sustain the system in the future. FSNSP also aims to provide timely information about the health, agriculture, economic, and social sectors with regard to food security and nutrition. It targets food insecure areas through seven vulnerable agro-ecological zones. The ultimate sampling unit is all households with an adolescent girl/woman from 10 to 49 years of age or a child less than five years of age. In each season, 9024 households are interviewed.

Results: Almost 30% of the study children were found stunted whereas 40% were underweight and 11% were wasted of which 10.6% were moderately acute malnourished (MAM). Prevalence of under nutrition in the form of stunting, underweight and wasting varies significantly across maternal educational status. Rates of under nutrition were significantly lower among children of higher educated mothers (stunting: 17.2%, underweight: 26.3% and wasting: 10%) compared to children of illiterate mothers (stunting: 37.5%, underweight: 46% and wasting: 13.6%). In addition, children of educated mothers were less likely to become moderately stunted (OR=0.41, p-value<0.01), underweight (OR=0.46, p-value<0.01) and wasted (OR=0.71, p-value<0.10) compared to children born to illiterate mothers in unadjusted models. These findings persisted even after adjusted for some important socio-economic, demographic and health related characteristics. Moreover, proportion of getting knowledge from proper source about child feeding increases significantly with the increase of maternal education (from 17% for illiterate to 36% for educated mothers).

Conclusion: Results from the study showed that maternal education is the key to reduce under nutrition in Bangladesh. It can be inferred that female education is essential to break the cycle of malnutrition.

IAEA-CN-217--91P

Efficacy of community-based follow-up, with or without food supplementation and psychosocial stimulation in the management of young moderately wasted Bangladeshi children

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Objective: To assess the effect of community-based follow up, with or without food-supplementation and/or psychosocial stimulation, as an alternative to current hospital-based follow-up of children with moderate-acute-malnutrition (WHZ <-2 to -3) (MAM).

Design/methods: The study was conducted at the icddr,b Dhaka Hospital and in four urban primary health care centers of Dhaka, Bangladesh during 2005-2007. The efficacy of five different randomly assigned interventions was compared with respect to the rate of completion of follow-up, growth and morbidity in 227 MAM children aged 6-24 months who were initially treated at icddr,b for diarrhea and/or other morbidities. The interventions were:

- 1) Fortnightly follow-up care (FFC) at the icddr,b's outpatient-unit, including growth monitoring, health education, and micro-nutrient supplementation (H-C, n=49).
- 2) FFC at community follow-up unit (CNFU) [established in the existing urban primary health-care centers close to the residence of the child] but received the same regimen as H-C (C-C, n=53).
- 3) As per C-C plus cereal-based supplementary food (SF) (C-SF, n=49). The SF packets were distributed on recruitment and at every visit in CNFU [1 packet/day for 6-11 and 2 packets/day for 12-24 month old children. Each packet contained 20g toasted rice-powder, 10g toasted lentil-powder, 5g molasses, and 3g soy bean oil, to provide a total of ~ 150kcal with 11% energy from protein].
- 4) As per C-C plus psychosocial stimulation (PS) (C-PS, n=43). PS consisted of child-stimulation and parental-counseling conducted by trained health workers.
- 5) As per C-C plus both SF+PS (C-SF+PS, n=33).

Results: A total of 227 children (48.5% female), with a mean±SD age of 12.6±3.8 months, and WHZ of -2.53±0.28 enrolled. Baseline characteristics did not differ by treatment group. The rate of spontaneous attendance at scheduled follow-up visits gradually decreased in all groups. Follow-up attendance and gain in weight and length were greater in groups C-SF, C-SF+PS, and C-PS than C-C, and these indicators were observed least in H-C. Children in the H-C group more often suffered from diarrhea (25% vs. 4-9%) and fever (28% vs. 8-11%) than other groups (p<0.05). Children who attended at least five of the total six scheduled follow-up visits gained more in weight (median: 0.86 vs. 0.62 kg, p=0.002), length (median: 2.4 vs. 2.0 cm, p=0.009) than those who attended fewer.

Conclusions: Community-based service delivery, especially including supplementary food with or without psychosocial stimulation, permits better rehabilitation of children with MAM compared to current hospital outpatients-based care. By scaling the community-based follow-up including food supplementation with or without psychosocial stimulation, it will be possible to rehabilitate a greater number of MAM children in a better way.

IAEA-CN-217--92P

Prevalence of malnutrition and relationship between dietary intake and sociodemographic characteristics with anthropometric indicators among Malaysian children below five years old

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Malnutrition, a condition marked by deficiencies of energy, protein, fats, vitamins and minerals, can pose a great risk to the health of a child. This paper aims to determine the nutritional status and the relationship between sociodemographic characteristics, nutrient and energy intake with anthropometric indicators among children below five years old. This study is part of the Nutrition Survey of Malaysian Children, which is part of the four-country South East Asian Nutrition Surveys (SEANUTS). This nationwide cross sectional study recruited a total of 880 (48.2% boys, 51.8% girls) children aged between 0.5 months to 5 years through stratified random sampling. Anthropometric measurements comprised weight and height, and body mass index (BMI) was calculated. Dietary intake was assessed by food frequency questionnaires developed and validated for Malaysian children. WHO Child Growth Standards 2006 was used to determine z-scores for height-for-age (HAZ), weight-for-age (WAZ), weight-for-height (WHZ) and BMI-for-age (BAZ). Overall, 7.5% of the children were underweight, 13.3% stunted, 3.2% wasted and 2.6% thin with the highest prevalence in children aged below one year. The prevalence of underweight (8.6% vs 6.3%), stunted (16.8% vs 9.7%) and wasting (4.0% vs 2.3%) was found to be higher among boys; while thinness was higher among girls (3.5% vs 1.6%). WHZ ($R^2=0.296$), HAZ ($R^2=0.291$) and BAZ ($R^2=0.265$) were found to have positive and significant relationships with intake of energy, calcium and vitamin C. Statistically significant linear dependence of the mean of WAZ on all nutrient variables was found ($R^2=0.448$). Other factors influencing anthropometric outcomes were sex, locality of residence, household income and ethnicity. In conclusion, malnutrition is still a health concern among children under five in Malaysia. Stunting and underweight is the predominant nutritional problem among children below one year old. Problems of malnutrition need to be targeted early as proper nutrition in the first thousand days of life is crucial in determining a child's future health and well-being.

IAEA-CN-217--94P

Factors Influencing Child Undernutrition in Bangladesh: A comparative study of FSNSP and DHS data

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Background: Including Bangladesh, undernutrition remains a major problem throughout the world. Evidence from Food Security Nutritional Surveillance Project (FSNSP) and Bangladesh Demographic and Health Survey (BDHS) conducted both in 2011 reveal that nutritional vulnerability in the form of stunting (FSNSP: 40% vs. BDHS: 41%), underweight (FSNSP: 34% vs. BDHS: 36%) and wasting (FSNSP: 12% vs. BDHS: 16%) still exists highly in Bangladesh. This study aims at exploring the factors associated with child undernutrition in Bangladesh.

Methodology: Two nationally representative, FSNSP conducted in 2012 and BDHS conducted in 2011, data sets were used to conduct this study. Using standard cut-offs, anthropometric criterion were applied to define child nutritional status followed by household food insecurity access scale for measuring household food security in both data sets. Bivariate and multivariate analyses were carried out to meet the study objectives. Studies were restricted among alive under five children born during last delivery of their mother. Cases having missing values for all anthropometric measurements were excluded from this study.

Results: Compared to nourish mothers and food secured households, rates of stunting, underweight and wasting-both for severe and moderate- were found significantly higher among children of undernourished mothers and food insecure households. Significant lower rates of undernutrition were found among children born to educated mothers compared to that of illiterate mothers. Both FSNSP and BDHS data evidenced that children of undernourished mothers (BMI<18.5 kg/m²) were at higher risk of being moderately wasted (FSNSP: OR=1.86, p<0.01 vs. BDHS: OR=1.77, p<0.01), stunted (FSNSP: OR=1.55, p<0.01 vs. BDHS: OR=1.66, p<0.01) and underweight (FSNSP: OR=1.69, p<0.01 vs. BDHS: OR=1.98, p<0.01) compared to that of nourished mothers (BMI≥18.5 kg/m²) in unadjusted models. Likewise, children of food insecure households had significantly higher likelihood of becoming moderately wasted (FSNSP: OR=1.55, p<0.01 vs. BDHS: OR=1.22, p<0.05), stunted (FSNSP: OR=1.65, p<0.01 vs. BDHS: OR=1.41, p<0.01) and underweight (FSNSP: OR=1.66, p<0.01 vs. BDHS: OR=1.69, p<0.01) compared to children of food secured households for both data sets in unadjusted models. These findings persisted even after adjusted for some important maternal, child and household characteristics for both data sets, except for food insecurity on moderate wasting in BDHS data. Findings from both data sets reveal that food insecurity has significant impact on both maternal and child undernutrition and maternal education, antenatal care and toilet facility have significant association with child nutrition.

Conclusion: Study results focus the need of necessary interventions addressing the highlighted problems, particularly to give emphasis on maternal nutrition, education and food security of households. To protect child from undernutrition, it is must to protect mother from undernutrition to break the cycle of undernutrition and reduction of food insecurity at sufficient level is obvious to protect maternal and child undernutrition.

IAEA-CN-217--96P

The pattern of moderate acute malnutrition in a rural area of Sri Lanka: Integrated approach is needed to address the problem

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Introduction

Sri Lanka has a well-established preventive health care system. Irrespective of well-established preventive health care system, malnutrition of children is yet a public health challenge in Sri Lanka.

Aims

To assess the current nutritional status and associated factors with the malnutrition in Nawagaththegama area, Sri Lanka.

Methods

A descriptive cross-sectional study was conducted among a representative sample of children under 5 years (total population = 1434). Twenty five clusters were selected by probability proportionate to the size of the under five children in 19 Gramasewa Niladari Divisions (the smallest administrative division in the area). Height and weight of children under 5 years were measured according to the WHO protocol, and an interviewer administered questionnaires was used to ascertain socio demographic characteristics, feeding practices, common morbidities of children and health service utilization pattern. WHO Standards were used to assess the nutritional status. Hemoglobin levels were assessed in a subsample.

Results

The questionnaire was completed by 493 children. Weight, height, hemoglobin was measured among 442, 419, 120 children respectively. Out of weight measured children, 24.7% (confidence interval (CI) = 19.4 – 30.8) had weight for age <-2SD and 4.8% (CI = 2.5 - 8.8) had weight for age < -3SD. Out of height measured children, 16.5% (CI = 13.1 – 20.5) had height for age < -2SD and 4.1% (CI = 2.2 - 7.4) had height for age < -3SD. Global acute malnutrition (GAM) was 18.5% (CI= 2.3% -26.9%) and Moderate Acute malnutrition is 15.6% where as Severe Acute Malnutrition is (SAM) was 2.9% (CI = 1.3% - 5.9%) . Lowest percentage having the weight for age <-2SD and weight for height/length was reported from the age group of 1 – 6 months (11.8 % (CI = 4.6 - 27.1))and 12.9% (CI = (3.4% - 38.1%)). Over 99% of children were continue to have the breast milk at the completed 6 months while 4.2 % gives the formula milk and 8.8% have initiated the solid/semi-solid food during the first 6 months. Highest weight for age percentage of <-2SD reported from the children age 49 - 60 months (33.3% (CI = 21- 48.5)). Highest percentage of MAM was reported in the age group of 49-60 months. About 10% of children had presumed pneumonia with in the 2 weeks prior to the survey. A wide disparity was noticed in underweight proportions over the geographical localities. Majority of the children had haemoglobin levels less than 11.0 g/dl (n = 78, 65.0%).

Conclusions and recommendations

Weight for age percentage of <-2SD is higher than the national average while weight for height percentage of <-2SD is lesser than the National average. Multiple factors such as high levels of respiratory tract infections, poverty, lack awareness etc. may contribute to the low nutritional status of children. Integrated approach is needed to address the malnutrition in this area. A short term targeted interventions should be designed for the MAM child

IAEA-CN-217--97P

Nutritional Intervention Package To Insure 1000 Safe Days From Conception To The First Two Years Of Life And Implication On Human Capital

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Egypt is not one of the countries doing well in nutrition during the critical window of development that starts during a mother's pregnancy and goes through her child's second birthday. The critical 1000-day window from pregnancy to a child's second birthday is crucial to developing a child's cognitive capacity and physical growth. Many of these babies are born with low birth weight which is an indicator of malnourished mother, malnourished children are therefore less likely to develop to their full potential. Recent WHO data Low Birth Weight Deaths in Egypt 13.6%. Furthermore, 30-39 % of Egyptian children under age 5 are stunted due to chronic malnutrition.

Preventing under nutrition, means more than just providing food to the hungry. It is a long-term investment in our future, with generational payoff. Save The Children has highlighted six low-cost nutrition interventions for this period: iron, folate, breastfeeding, complementary feeding, vitamin A, zinc and hygiene. High protein diet is unaffordable by the poor; solutions are to be discussed with low cost high protein nutritional intervention. The at most objective is strategic preventive and intervention measures to reduce maternal hunger and children malnutrition to achieve the Millennium development Goal 2015 specially child stunting.

The study will be conducted on pregnant, lactating women visiting the out-patient clinic of tertiary maternal hospital (Giza/Egypt) and their of springs till two years of life. Approval was obtained from the Ethical Review Committee. An Integrated Nutrition intervention Project (INP) will be implemented to them, daily prenatal food supplementation to women with a body mass index ≤ 18.5 kg/m², providing 25 % of the daily energy requirement.

Advanced nutritious food product will be used in infant 8m- 2years. Starting from September 2013 collecting data of deliveries and prevalence of LBW as well as incidence of neonatal mortality, to design requirements and extend of problem. The program will take care of newborns with low birth weights (≤ 2500 grams). Questionnaire, follow up of Lactating women and breast fed children (home visits), with regular nutrition education sessions as well as nutritional intervention with nutritionally balanced high protein products with vitamin A requirement and essential fatty acids. The first six months of the project is for collecting data and visualizing the extent of the problem we collected 5 months preliminary data most important results are: Average total deliveries was 616/month, 63.5% normal vaginal, 35% CS, 2% mothers with high blood pressure, 5% prenatal deaths, average 39 neonate/m were admitted to neonatal unit, 30% of them less than 2500 gm, 64% above that, 11% of deaths were among LBW, while 2.4% deaths in >2500 gm, average 4% of cases with LBW were transferred to other hospital for ventilation. In conclusion this preliminary results showed high incidence of low birth weight with high mortality compared to mortality in >2500 gm, low birth weight is most probably due to inadequate growth in mother womb, due to mother malnutrition, which is under investigation, emphasizing the need for INP.

IAEA-CN-217--99P

Benefits of Dairy Nutrients- Optimization of Formulations: The State of the Art in Moderate Acute Malnutrition

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Milk-derived ingredients provide important nutrients: high quality protein, minerals, B-vitamins, lactose, and bioactive factors for the treatment of moderate acute malnutrition (MAM). Milk proteins are high quality proteins due to their excellent digestibility, content of essential amino acids and branched chain amino acids, needed for growth. Lactose, a major component of human milk and dairy ingredients, can enhance palatability, provide energy and has been shown to enhance mineral absorption in infants. It may have beneficial effects on growth and enhance beneficial intestinal bacteria. Milk minerals can have effects on bone growth. These nutrients are available in variable proportions in milk and whey ingredients, allowing both nutritionists and food scientists to optimize (for cost effectiveness) formulations designed to treat and prevent MAM. Major options available to researchers are outlined.

The use of RUTF in severe acute malnutrition (SAM) is now an established international standard of care. Studies have shown benefits in recovery rates when using RUTFs contain 25% milk when compared to 10% or no milk. In contrast to SAM, programs for the management of MAM had remained relatively unchanged over 30 years, with grain blends often provided. Recently, the addition of animal source foods has been recommended for promotion of growth in children with MAM, and testing of various formulations underway are highlighted.

We review studies published since 2008 and assess the state of the science testing interventions that contain dairy ingredients for MAM. Clinical trials using new RUSF and CSB++ containing milk powder have demonstrated high recovery rates and benefits on growth. The identification of the optimal level of components of milk for treatment or prevention of MAM needs to be defined. Two studies currently testing levels of milk powders in supplements for MAM are in progress and will provide answers. One study is examining LNS with and without milk, the second study is examining the effect of different amounts of protein (0, 20 and 40%) provided by milk powder. Research questions include: 1) determination of the optimal dose and mixture of protein for supplements intended for children with MAM; 2) the significance of a new method for measuring protein quality, Digestible Indispensable Amino Acid Score (DIAAS) to provide more cost-effective treatments. Additional pilot research on milk minerals and lactose, and data gaps are presented. Mechanistic research, the development of new biomarkers for growth and studies on functional outcomes are encouraged.

To date, comparisons between studies remain a challenge. Most studies are effectiveness studies which compare product treatments for MAM. Protocols, primary endpoints and inclusion criteria vary between studies while calories or other nutrients provided often vary between and within a study. "Best practices" for trials including inclusion/exclusion criteria, primary endpoints tested, and adherence to reporting research outcomes in accordance with CONSORT 2010 are presented for consideration by the international community.

IAEA-CN-217--100P

Quantitative assessment of breastfeeding practices and determination of the quantity of maternal milk consumed by infants aged up to 6 months using isotope dilution technique

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Aims: 1- Determination of the quantity of maternal milk consumed using isotope dilution technique. 2-Determination of zinc content of maternal milk and blood. **Methods:** This study was carried out in Hôpital d'Enfant in Rabat on 32 women of whom 12 were paired to small birth weight infants. The method used is based on the administration of deuterium and the collection of samples of saliva from the mother and the baby during the following 14 days. The FTIR is used to determine the amount of milk consumed by the baby and the maternal body composition. The zinc status in the maternal blood and milk is analysed using the ICP-SM. **Results:** The use, for the first time in Morocco, of isotopic techniques based on deuterium enrichment of saliva reveals a regression of exclusive breastfeeding in the country. In fact, the prevalence of babies exclusively breastfed is 33,3% for the first month, 26,7% at 3 months and only 12,5% at 6 months. As for the maternal milk intake, the amount of milk consumed during the 1st and 3rd months of life by the babies exclusively breastfed (respectively $690,3 \pm 163,1$ g/d and $891,8 \pm 206,8$ g/d) is significantly high compared to babies not exclusively breastfed (respectively $466,2 \pm 189,1$ g/d and $442,0 \pm 117,5$ g/d). The amount of milk consumed by the babies exclusively breastfed covers their energy requirements for the first 6 months. However, the body composition shows that babies born to mothers with percentage of body fat > 27% present a superior daily milk intake compared to babies born to mothers with percentage of body fat < 27%. The zinc content of maternal milk decreases between the first and sixth month of life. It is slightly lower in the milk of women paired to low birth weight babies. As for zinc content of maternal blood, results show low levels in the two study groups. **Discussion:** This study, the first one to be conducted in North of Africa, gives a better idea about the amount of milk consumed by babies less than 6 months. The rate of exclusive breastfeeding in Morocco remains low, despite advice on the benefits of breastfeeding, clearly showing a resistance to change of behaviour of these mothers.

Key words: isotopic technique, exclusive breastfeeding, body composition, zinc, maternal milk

This study was supported by IAEA

IAEA-CN-217--101P

Effective Nutrition Intervention to Treat Children Under 5 Years Old Suffering MAM in Public Primary Health Care Services in El Salvador

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Background: In El Salvador Moderate Acute Malnutrition (MAM) affects less than 1% of children under 5 years old. The importance of MAM has been neglected as a public health issue. Although moderate wasting is not a condition of medical urgency, it can easily deteriorate. If some of these undernourished children with moderate wasting do not receive adequate support, they may progress towards severe acute malnutrition (SAM), defined by the presence of severe wasting and/or bilateral pitting oedema, which is a life-threatening condition. Since 2010, a complementary feeding program for children from 6 to 59 months old was implemented at the primary health clinics for the management of moderate malnutrition. Program was implemented in 100 municipalities identified with the greatest levels of poverty at national level and it consists of a corn-soy fortified flour to be prepared at home as a poudrige given to children during the routine health controls. During the first months of program implementation, an acceptability test was conducted and it was determined that more than 85% of children had good acceptance of the product. The treatment consists of 45 grams per day of complementary food. Mothers were instructed on how to prepare the product and every month they would have to bring their children to the clinic to receive complementary food and control weight gain. If mothers did not attend the control, a health promotion worker would go visit the mother at their home and bring the complementary food to the child.

Objective: Assess the results on nutritional status of children under 5 years old with MAM treated with complementary food during health controls at primary health facilities in El Salvador during January to October 2013.

Methods: Transversal study. Inclusion criteria was children 6 to 59 months old attending health controls coming from prioritize municipalities, diagnose with MAM by a health professional without other disease or infections that would complies their nutritional status, children who received at least two subsequent controls after being diagnose. Data was collected from the child clinic.

Results: 60 cases were identified, 35 boys, 31 lived in rural areas, mean age 20,6 months (min 6, max 52), 44 had MAM and 16 SAM, mean weight at diagnose 8,0 kilos (5 min, 11 max) and height 77,7 cm (62 min, 92 max). Children received prescription of 50,75 g per day of corn-soy flour, mean 3 subsequent health controls, average treatment duration 5,2 months. At the end of the treatment average weight 9,5 kilos (6,3 min, 12,7 max), height 80,7 cms (65 min, 102 max), 46 recovered from MAM, effectiveness of 76.7% . The other 14 children who did not recovered were classified with MAM and none of them with SAM.

Conclusions: Complementary feeding is effective to treat MAM when children are follow up by health professionals and mothers receive adequate counseling.

IAEA-CN-217--102P

Effects Of Two Micronutrient-Fortified Food Aid Products Containing Different Levels Of Dairy Protein On Anthropometric Variables In Rural Pre-School Children In Guinea-Bissau

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Food insecurity in Guinea-Bissau is widespread and micronutrient deficiencies are anticipated among vulnerable groups. The objective: to test the efficacy of two Micronutrient-Rich Ready to Use Supplementary Foods (MNR-RUSF) in preschool children aged 3-5 years over 3 months. 9 preschools were randomly assigned to one of two intervention arms (92 gram MNR-RUSF sachets containing 500 kcal/sachet and either 15% or 33% of dairy protein, provided 5 days per week) or to a control (C) group that received no MNR-RUSF. Weight, height and mid upper arm circumference (MUAC) were measured at baseline and endline. Malnutrition at baseline was high, with 5.6% <2 z scores for weight and 7.1% <2 z scores for height. Both intervention arms showed a significant increase in weight vs. controls (Δ Weight 15% group = 0.77+0.75 kg, 33% group = 0.76+0.78 kg, C = 0.42+0.1.8 kg, $p<0.05$) but not in height (Δ Height 15% group = 3.1+2.0 cm, 33% group = 2.8+2.1 cm, C = 2.8+3.8 cm, $p=0.34$). Changes in weight and height were not significantly different between the 15% and 33% groups ($p= 0.99$ and $p=0.38$, respectively). There was a significant increase in MUAC in both the intervention arms vs. control, with the 33% intervention arm demonstrating a significantly greater increase than the 15% intervention arm (Δ MUAC 15% group = -0.03 ± 0.68 cm, 33% group = 0.14 ± 0.78 cm, C = -0.31 ± 0.67 cm, $p<0.001$). This study is the first to focus on anthropometry in preschool-aged children in Guinea-Bissau and indicates that while both standard and high-dairy containing MNR-RUSF products improve weight in preschool populations with a high prevalence of malnutrition, those containing high levels of dairy protein have additional benefits for improving MUAC.

IAEA-CN-217--103P

Nutritional status of children under the age five in Morocco

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Introduction: In Morocco we live nutritional, demographic and epidemiological transition. These transitions affect the nutritional status of the population, especially that of children under five years of age. They also play a guiding role in the development of strategies to be implemented to improve the situation.

Aim: To describe the evolution of the nutritional status of children under five years in Morocco over the past ten years. **Methods:** Two national surveys were conducted in 2004 and 2011. One of the objectives of these surveys is to assess the nutritional status of children aged less than five years compared to WHO standards.

Results: The surveys that included 5737 children under 5 years in 2004 and 7271 in 2011 showed according to WHO standards, at the national level, a prevalence of underweight of 3.1 % (weight / age <- 2SD) in 2011, compared to 10.7 % in 2004. At the national level in 2011, 14.9 % of children under 5 suffer from stunting (height / age <-2 SD), this proportion was 23.7 % in 2004, acute malnutrition affects 2.3 % of children under five in 2011 against 12.7% in 2004, the proportion of children who are overweight and obese is 12. 5% (BMI for age > 2 SD) 2.6 % of which are obese (BMI for age > 3 SD), whereas the proportion of children with overweight and obesity was 10.4 % in 2004.

Discussion/conclusions: These studies show that acute malnutrition almost disappeared in Morocco, however prevalence of stunting remains high, overweight and obesity among children less than five years increased in the country.

Key words: Acute malnutrition, Stunting, obesity, children under five.

IAEA-CN-217--104P

Impact study of the consumption of oil and flour fortified in vitamins and minerals on the nutritional status of children aged less than five years in Morocco

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Introduction: Micronutrient deficiencies represent a major public health problem in Morocco. The ministry of health and his partners developed a national program to fight against these deficiencies. Fortification of foods consumed on large scale is one of the strategies of this program (e.g. oil fortified in vitamin A and D3 and flour fortified in elementary iron and folic acid). After achieving a feasibility study on food fortification (2001) and introducing the fortified oil on market (2002) and the fortified flour (2006), the ministry of health and his partners undertook impact studies (sentinel surveillance system) in 2006, 2007 and 2008.

Méthodology: The impact studies (sentinel surveillance system) (2006- 2007 -2008) were carried out in all the regions of Morocco. The collection of data concerning the fortified food from population (childbearing women and children under the age of five) included: a- knowledges, b- attitudes, c- practices, d- Hb analysis, e- estimation of serum ferritine (with CRP), f- estimation of serum folic acid, g- estimation of serum retinol, h- estimation of serum vitamin D3. We will only present the results of children aged less than five years in this abstract.

Results: In 2006, the fortified oil covers almost 100% of households, while fortified flour covers 17%. In 2007, fortified flour covers 21% of households while in 2008, it covers 37%. Before the introduction of oil fortified in vitamin A; the prevalence of vitamin A deficiency (Retinol <200µg/l) in children was 41% (n=1453). In 2008 it dropped to 22.7%. Before the introduction of flour fortified in elementary iron and folic acid; the prevalence of anemia (Hb<11g/dl) was 31.5% (n=1354) in 2000. In 2007 anemia was 37.7% (n=1197), Iron deficiency (Ferritin < 12 µg/l) was 15.7%, Folic acid deficiency (< 3ng/ml) was 31.3%. In 2008 anemia was 28.9% (n= 1183), Iron deficiency was 13.8%, Folic acid deficiency was 30.6%. The fortification of flour did not have an effect on the iron deficiency.

Conclusion: The fortification of oil with vitamin A and D3 is a success story in Morocco, we expect to accomplish one of the objectives of the national strategy of Nutrition 2011-2019 by eliminating the vitamin A deficiency in Morocco. On the other hand the fortification of flour with elementary iron did not give the anticipated results (industrial flour can cover only 50% of households atmost). The elementary iron should be replaced by the iron EDTA and/or ferrous fumarate and a minimum of 50% of households should be attained by the industrial flour cover. A solution should also be provided to the situation of the artisanal mills that cover the resting 50% of the households.

Key words: Fortification – Vitamins A and D3 – elementary iron – folic acid - oil – flour – children under five – impact study

This study was supported by GAIN

IAEA-CN-217--105P

A case study comparing Positive Deviance/Hearth vs. the traditional health/nutrition education (Mother Care Groups) approach to prevent MAM and rehabilitate underweight children in Soroti, Uganda

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BACKGROUND: Globally, 52 million children under 5 are moderately/severely wasted. To date, Supplementary Feeding Program (SFP) has been most commonly used to address moderate acute malnutrition (MAM) (low weight-for-height) where food rations are distributed. However, recently, high levels of wasting are being found even in areas with food security. Thus, rather than creating a dependence on food aid, different approaches need to be explored to address the global burden of MAM.

World Vision (WV) has been implementing Positive Deviance/Hearth (PDH) since 1999 and has now expanded to more than 40 countries. WV believes PDH is an effective sustainable rehabilitation program for underweight children (low weight-for-age). However, since 2012, WV began using PDH to also rehabilitate MAM children, especially in areas with food security and no treatment for children with acute malnutrition.

PDH is a behaviour change program that aims to rehabilitate children in the context of their own homes, to sustain the rehabilitation and prevent future malnutrition using existing resources, local solutions, and a food-based approach.

Internationally, to date, there are mixed results in the effectiveness of PDH and the traditional health and nutrition education program called, "Mother Care Groups" (MCG), in successfully improving the behaviours of caregivers and rehabilitating underweight children. As PDH was being implemented in Soroti, Uganda, it was assessed and compared to MCG.

METHODS: A comparative case study – quasi-experimental design was used to compare the effectiveness of the two programs in improving the knowledge, behaviour and confidence levels of primary caregivers of malnourished children aged 6-36 months of age in child feeding, hygiene, caring, and health-seeking practices in Soroti, Uganda. If change was seen, the improvement in the nutritional status of malnourished children was also assessed. 64 caregivers with underweight children were included in the PDH group and 64 primary caregivers in the MCG. A pre- and post-intervention questionnaire was conducted prior to being admitted into the programs and 3 months after.

RESULTS: There were no differences in the baseline characteristics between the two groups. At follow-up, significant improvements were seen in levels of knowledge for both groups. Significant behaviour change was seen in all six key targeted messages for the PDH and in a greater number of behaviours in the MCG.

Figure 1. Change in levels of underweight pre- and post-intervention within PDH and MCG

In 3 months, both PDH and MCG saw a significant decrease in the levels of underweight, PDH (18.7% reduction, $Z=-3.479$, $p=0.001$) and MCG (5.8% reduction, $Z=-4.900$, $p<0.001$) (Figure 1).

CONCLUSION: Both PDH and MCG were effective in improving the knowledge and changing behaviours of caregivers, but the PDH program was more effective in rehabilitating underweight children and further data should be collected to assess the effectiveness in rehabilitating MAM children. The two programs should be implemented together, PDH to rehabilitate and MCG to prevent future MAM.

IAEA-CN-217--106P

Using Behaviour Change and Food-based Approach, Positive Deviance/Hearth (PDH), to Rehabilitate Malnourished U5 Children in Inteta, Mozambique

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Background: Globally, 52 million children under 5 are wasted. In Africa, due to historic high food insecurity, Supplementary Feeding Program (SFP) has been most commonly used to address moderate acute malnutrition (MAM) where food rations are distributed to families with MAM children. However, recently, there has been an increase in food security, with consistently high rates of wasting. Thus, there is a need to explore sustainable approaches to address MAM.

World Vision (WV) is using PDH as a behaviour change approach to rehabilitate, sustain and prevent malnutrition in both MAM (low weight-for-height) and underweight children in the context of their own homes. Based on a process of discovery of existing resources, including locally available and affordable nutrient dense foods, local knowledge and practices that allow children to be healthy even from low-income households, the findings are developed into 6 key messages that can teach mothers local solutions to rehabilitate and prevent child malnutrition.

WV has been implementing PDH since 1999 and has now expanded to more than 40 countries. PDH has shown to be an effective sustainable rehabilitation program that requires minimal financial resources in comparison Community-based Management of Acute Malnutrition (CMAM).

Mozambique has wasting levels of 5.9% and no real treatment for acute malnutrition at the health centre-level. WVMozambique has been using PDH to rehabilitate malnourished children U5.

METHOD: 8-10 underweight or acutely malnourished children and their primary caregivers were admitted into a PDH session for 12-consecutive days. A key message was shared each day, along with sub-messages throughout the 2-3 hour session. A Hearth meal was cooked by the primary caregivers and fed to the child everyday. After the 12-days, there was 2-weeks of home-visits conducted by the community volunteers to help caregivers overcome any barriers at home. Weights of the children were collected at Days 1, 12, 30, 3 months, 6 months, and 1 year. However, MUAC data was only collected at baseline.

RESULTS: There was a significant difference in the median weight-for-age z-score (WAZ) on Day 1 (-2.03SD) vs. Day 30 (-1.05SD)($Z=-7.62$, $p<0.0001$). There was also a significant difference in the median WAZ on Day 30 (-1.05SD) vs. Year 1-follow-up (-0.22SD)($Z=-5.125$, $p<0.0001$). Moreover, there was a significant difference in the percentage of healthy (0% vs. 80.1%), mild (48.8% vs. 13.1%), moderate (35.7% vs. 3.6%), and severe (15.5% vs. 1.2%) underweight nutritional status children on Day 1 vs. Year 1-follow-up, respectively ($p=0.028$) (Figure 1.0).

CONCLUSION: PDH was an effective behaviour change program to rehabilitate underweight children and to sustain the rehabilitation of malnourished children in Inteta, even after the 12-Day Hearth sessions and 2 week home visits. Further studies are recommended to explore the use of the PDH program and its effect on reducing MAM rates in food secure areas.

IAEA-CN-217--108P

Description of children identified as suffering from MAM in Bangladesh: Varying results based on case definitions

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Background: There is a wide discrepancy between the proportion of children classified as acutely malnourished when MUAC criteria are used compared to weight for height. This has greatly complicated setting targets for the coverage of SAM and MAM programs in Bangladesh. This difference is much larger for children identified with MAM than for those with SAM, largely because identification as MAM can overlap both with SAM and with children not identified as acutely malnourished.

Objective: To review existing data sets in order to determine the relationship between MUAC and other anthropometric measures, helping to provide a better understanding of the implications of different admission criteria to therapeutic and supplementary feeding programs.

Methodology: This study uses data collected through national nutritional surveillance projects over multiple seasons in Bangladesh. For the years 1990 to 2006, sub-samples of data from the Nutritional Surveillance Project were pulled from areas of the country that remained constant over a set period. Data from 2010 to 2012 was pulled from the Food Security and Nutrition Surveillance Project.

Case definition: Cases of moderate acute malnutrition were identified using MUAC- for-age z-scores ($-3 > z\text{-score} > -2$), MUAC cut-offs ($115\text{mm} > \text{MUAC} > 125\text{mm}$), and weight-for-height z-scores ($-3 > z\text{-score} > -2$).

Results: In all years more than 50% of all children identified as moderately malnourished were classified as such by only one measure (1990 selected sub-districts: 52%, 2012 national sample: 69%) In 1990 a higher proportion of children were categorized as moderately malnourished based on MUAC-for-age z-scores than by weight for height z-scores, but since 2000 the opposite has been true. This change is closely tied to the increasing height of children sampled, due to the declining rates of stunting in the country. After controlling for age and weight-for-height z-scores, an increase in height of one cm was associated with an increase in MUAC slightly less than 1mm. For children of less than two years of age, this relationship was even larger.

Discussion: Due to the large differences in which children are identified as moderately malnourished depending on the measure used, treatment protocols can be expected to differ greatly. Further research into these differences may allow programs to run at a reduced cost which still serving those most in need.

Funding: Support for this review was provided through the Millennium Development Goals Fund in Bangladesh and facilitated by WFP. The Food Security and Nutrition Surveillance Project is funded by the European Union. The Nutritional Surveillance Project was funded by multiple partners during its 17 years of operation, notably including the United States Agency for International Development and The Embassy of the Kingdom of the Netherlands/Bangladesh

IAEA-CN-217--111P

Breast Feeding, Sex and Body Composition as Correlates of Stunting Among Kenyan Children at 6 and 15 Months of Age

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Introduction and objective:

Stunting is prevalent in young children in low-income countries, and has detrimental effects on psychomotor development and later working capacity. The objective of this study was to assess the association of body composition (fat-free mass and fat mass), breastfeeding and sex with stunting in Kenyan children aged 6 and 15 months

Subjects and Method:

As part of a nutrition trial conducted in Western Kenya, 449 six months old infants were recruited if MUAC \geq 11.5cm. At six and 15 months of age, weight, recumbent length, skinfolds and mid-upper arm circumference (MUAC) were measured. Deuterium oxide dilution method was used to determine body fat and fat-free-mass. A predose saliva sample was taken prior to a dose to the infant of 0.5 g deuterium oxide per kg of body weight. Postdose saliva samples were taken after 2 and 3 hours, respectively. Deuterium enrichment was measured using Fourier Transformed Infrared Spectrophotometer. Linear regression was used to assess the association of sex, breastfeeding, fat-free mass index (FFMI), fat mass index (FMI) and body mass index (BMI) as correlates of stunting

Results:

At 6 months, males had FMI being 14.03 kg/m² (95%CI 13.80; 14.26) compared to females at 13.67(95% CI 13.40; 13.94). At 15 months males had an FMI of 14.74(95% CI 14.48; 14.99) while females had 14.41(95% CI 14.18; 14.64). At age 6 and 15 months, females had a lower -0.45 (95% CI -2.37; 1.46) kg/m² and -0.36 (95% CI -0.59;-0.13) kg/m² FFMI compared to girls, respectively. Stunting was not associated with body composition at neither 6 nor 15 months. Those who stopped breastfeeding before 15 months (11.1%) had a 0.01(95% CI 0.002; 0.02) kg/m² lower FFMI when they reached 15 months.

Conclusion:

Longer duration of breastfeeding was associated with higher FFMI in early infancy in resource poor settings. Stunting was associated with lower FMI at the age of 6 months but not at 15 months. Wasting was associated with a deficit in both FFMI and FMI at both 6 and 15 months of age.

Keywords: Stunting, linear growth, fat free mass, fat mass, body composition, Kenya.

IAEA-CN-217--112P

Willingness-to-Pay for Lipid-Based Nutrient Supplements in Burkina Faso

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Supplementing young children's diets with small-quantity lipid-based nutrient supplements (SQ-LNS) is a promising strategy to prevent growth restriction and improve development. It is uncertain how best to scale up the distribution of SQ-LNS and both private and public approaches are being considered. This paper reports on the willingness-to-pay (WTP) by households in rural Burkina Faso for SQ-LNS designed to prevent childhood undernutrition.

In a recent randomized controlled nutrition efficacy trial in the Dandé Health District in rural Burkina Faso, 20 g of SQ-LNS per day along with selected healthcare services have been shown to increase the linear growth and weight gain of children who received the supplement daily from 9-18 months of age. Given the frequency and duration of prescribed consumption of SQ-LNS (one sachet per day, per child) and inter-household differences in poverty, a hybrid distribution system that reaches target consumers through both public channels and retail markets may be recommended; the viability of the latter will hinge on demand. Therefore, policy makers will need to consider household-level demand for SQ-LNS and the factors that influence demand to guide decisions regarding the cost burden borne by recipients versus public sector programs.

Using a contingent valuation approach, we solicited, at baseline and six months later, the hypothetical WTP for a daily dose of 20 g of SQ-LNS and a traditional substitute, herbal teas, from a subsample (N = 319) of households participating in the efficacy trial. WTP for SQ-LNS is positive for almost all households, but WTP for SQ-LNS is, on average, lower than WTP for herbal teas. At baseline, average WTP for a day's supply of SQ-LNS is \$0.22 (4th quarter 2011 USD), while average WTP for herbal teas is \$0.28. Approximately six months later, average WTP for LNS and for herbal teas, respectively, are \$0.21 and \$0.25.

These results suggest that while households do value SQ-LNS, nutritionally inferior herbal teas are more highly valued, hence educational/promotional campaigns may be necessary to stimulate demand for SQ-LNS. Results of multivariate regression analyses suggest that households exposed to information regarding SQ-LNS, and less-poor households, are willing to pay more for it; no first-born or child-gender biases were associated with WTP for SQ-LNS. Households in the intervention group that more steeply discounted the future had lower WTP for SQ-LNS. Production and distribution costs will need to be set alongside these demand estimates to assess the viability of SQ-LNS retail markets.

IAEA-CN-217--113P

Control of growth promotion (cgp) and screening for malnutrition in central region and Lomé-commune, January to June 2013 Togo

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Background

Control of Growth Promotion (CGP) is an activity that can detect early if the child has a developmental problem and investigate the cause and take appropriate decisions to overcome the consequences. In Togo, the goal in 2013 is to weigh at least 80 % of children 0-5 years during the sessions of CGP. What are the levels achieved this goal after the first semester and the problems of malnutrition detected?

Method

We conducted a descriptive cross-sectional study data collected in the quarterly reports in two regions of Togo, Lomé - Commune in the South and Central Region in the North. The study involved data from the first semester of 2013 in all districts of the two regions. Database monitoring activities at national level CGP was used. Data from the two regions were separated and analyzed using Excel. Comparison tests of proportions were made using Epi Info7.

Results

Detection rate of nutritional status by the CGP in the first half of 2013 was 29% of the total target of 155,423 children under 5 years in the two regions. This rate was higher for the Central region (33 %) than for Lomé-Commune (26 %). No district has reached half of the goals. Their rates vary from 17.9 % and 18 % respectively for District No. 2 and District No. 4 of Lomé-Commune to 39.7% for the District of Tchaoudjo. The malnutrition rate was 8.8 %. This rate is higher in the Central region (10.9 %) than in Lomé-Commune (6.8 %) with a RR = 1.59, 95% CI = [1.50 to 1.69]. Severe malnutrition was 1.4 %. It is predominant in Lomé-commune (1.7 %) than in the Central region (1.1%) with a RR = 1.55, 95% CI = [1.32 to 1.82].

Conclusion

All districts in the two regions are below the target detection rate in the first half. The CGP has detected cases of moderate and severe malnutrition. To compare that rates with the survey data, the screening tools must be standard and adequate.

Keywords : Screening, malnutrition, Togo

IAEA-CN-217--114P

Long-term Effects of Acute Malnutrition on Growth and Body Composition

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Acute malnutrition (AM) is an important cause of child mortality worldwide and is therefore the main focus of current treatment programmes. However, given emerging evidence of early nutritional exposures affecting long term adult health, it is vital that future AM treatment strategies also start looking beyond the short term alone and consider opportunities to improve long-term outcomes in survivors. To do this, an improved evidence base on the long term implications of AM is vital. Our aim in this study was thus to explore growth, body composition and early markers of chronic disease 7 years after an episode of malnutrition.

Methods

We present preliminary data from a study following up 463 ex-malnourished children and comparing them to both siblings and community controls. These are the known survivors of an original cohort of 1024 children admitted to Nutrition ward, Blantyre, Malawi from July 2006 - March 2007 for treatment of SAM. Current round of follow-up is 7 years after the original episode of malnutrition. We present preliminary analysis of study progress to date. Paired t-tests were used to analyse anthropometric data entered so far.

Results

Our cohort of 463 AM survivors now have a median age of 8yrs7months. 138/455 (30.3%) are HIV positive. So far, 91/107 (85%) of searches have been successful. Preliminary analysis of 90 case children shows ongoing mortality: 9/90(10%) have died in the last six years. Seven of these deaths were HIV positive and two died of a further episode of malnutrition at least two years after their first admission for SAM. Analysis of available anthropometric data shows that the ex-AM children are significantly more stunted than their community controls: HAZ -2.13(95% CI -2.48 to -1.78) vs -1.56(95% CI -2.04 to -1.07) p= 0.01). Their BMI and WAZ are similar to those of both sets of controls. Waist circumference, waist-hip ratio and sitting height ratio are also similar to controls. Numbers per group so far are however small (n=24 for comparison with sib controls; 22 for comparison with community controls). The hand-grip strength of the ex-malnourished children is weaker than that of community controls, but not significantly so: 11.3 kg grip (95%CI 9.3 to 13.4) vs 12.9kg (95% CI 11.1 to 14.6),p=0.087.

Conclusions

Even early on in data collection, differences between ex-malnourished children and sibling/community controls are emerging. We hypothesise that further differences will become apparent as recruitment continues and study power increases. Though the great majority of children in our study had SAM rather than MAM, we believe these results are important to advocate for proactive case finding in MAM: earlier detection and treatment could prevent the adverse long-term health sequelae which we are seeing following SAM. To test this hypothesis, more data on long term effects of both types of AM is needed.

IAEA-CN-217--115P

Adaptation of the Positive Deviance Hearth Approach in Urban Slums, Phnom Penh, for the Prevention and Treatment of Moderate Malnutrition.

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Objective: To sustainably rehabilitate malnourished children living in poor urban communities, and prevent future child malnutrition.

Methods: Survey data shows an increase in young child malnutrition in urban areas. During the last decade there has been a huge influx of poor rural migrant families to Phnom Penh. Migrant parents work long hours in factories or construction sites, while their young children are cared for by grandmothers or older relatives. Housing conditions are basic with limited sanitation facilities. Following a situational analysis in the target communities, an adapted Positive Deviance approach was implemented. At the beginning of the program 1,127 children aged 0-36 months were weighed; 29% or 328 children were mild and moderately underweight. The following steps were conducted: community mobilization around the issue of child malnutrition, positive deviance inquiry, training of community volunteers, implementation of positive deviance hearth sessions, follow up home visits and ongoing community growth monitoring. Innovations introduced to the project were: mobilization and training of local food vendors to promote, prepare and sell safe, nutritious and affordable locally available complementary foods. The food vendor's menus were also promoted during the Hearth sessions. In addition mobile phone messages were sent to the caregivers to reinforce key infant and young child care and feeding practices. The length of hearth sessions were adapted to the urban context with five days, then five day practice of new behaviors at home, followed by five additional days of Hearth sessions, to share experiences and challenges for practicing the new behaviors.

Despite their low income all the caregivers were able to contribute food for the preparation of complementary food, such as meat, vegetables and rice. Caregiver also actively participated in cooking nutritious foods and discussions about the importance of food variety, amounts and frequency of feeding; good hygiene and responsive feeding practices.

Results: Since the program commenced in mid 2013, 38 malnourished children and caregivers have completed Hearth sessions and 30 out of 38 (79%) of mild and moderate malnourished children gain weighed after the 15 days program. Twenty out of the 30 children gained from 200 up to 1000 grams, whereas 10 children gained 100g. The food vendors have adapted new behaviors for preparation of safe and nutritious foods, and the caregivers have demonstrated that despite multiple challenges they are committed to attend regular Hearth sessions and practice new practices.

Conclusion: The preliminary results from the adapted PD Hearth approach show that this approach has the potential to successfully address child malnutrition in urban slum areas. The positive results have also boosted the confidence and motivation of the community. The next step is to continue close follow up of the children who have graduated from the session, re-admit the children who still need to gain weight and continue to involve the community in monitoring all the children under five years old.

IAEA-CN-217--116P

The Nutrition Club Approach: Community Mobilization to Prevent Child Malnutrition

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Objective: To establish a scalable and sustainable, community led approach to prevent and manage child malnutrition, and increase vulnerable families' access to food security.

Methods: The establishment of the nutrition club is a participatory community mobilization process involving local leaders including the Women's Union, Farmers Union and Youth Union, local health workers and caregivers of young children. The first step in the process is the formation of district and commune management boards and community development boards. This is followed by a training needs assessment and capacity strengthening of local partners. Nutrition club facilitators are selected by the community and are widely respected and committed to community service. Monthly nutrition club meetings are attended by pregnant women and caregivers of children under five years old. Activities during the nutrition club meeting includes: care and nutrition during pregnancy and the post partum period, complementary feeding, child care practices, development of home gardens and hygiene and sanitation; using interactive facilitation methods such as games, skills practice, role plays and competitions. Follow up home visits are conducted to reinforce positive practices and support vulnerable families. Caregivers who attend the nutrition club have access to community led interest groups such as: chicken raising, livelihoods, agriculture and micro- credit schemes. Nutrition club members pay a small monthly fee that covers cost of refreshments and utilities. Monitoring and supervision is conducted by a team of government district and health center staff.

Sustainability of the approach is promoted by mobilizing and utilizing existing resources. An agreement is made between the community development board and World Vision that support for running costs will gradually be reduced and discontinued after four years. The alignment of the nutrition club approach with government policy and priorities also helps to ensure sustainability. During scale up of the approach to new districts site visits to established nutrition clubs provide a valuable learning experience. Advocacy activities are conducted regularly at national government level.

Results: Over a six year period the nutrition club approach has been scaled up to cover 29 of the most remote and vulnerable districts in Vietnam. A total of 521 Nutrition Clubs cover 41% of the target coverage area villages, reaching approximately 17,029 children per month. Caregivers report improved complementary feeding practices and have access to home gardens, chicken raising, livelihoods and micro credit interest groups. Caregivers also report increased support for infant and young child feeding from their household members and perceive the regular growth monitoring as important.

The government health staff report increased uptake of maternal and child health services. More than a thousand nutrition club facilitators have been trained and 521 village development boards have increased capacity. Commune and district health staff have increased capacity for facilitating and monitoring nutrition interventions. The oldest established nutrition clubs demonstrate that the approach can be sustained using local resources. In addition The National Institute of Nutrition has committed to scale up the approach to non-World Vision Vietnam areas.

IAEA-CN-217--117P

Body Composition Explains Greater Variance in Weight-for-Length Z-scores than Mid-Upper Arm Circumference during Infancy - A Secondary Data Analysis

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Background: Traditionally, weight-for-length/height z-score (WLZ) was used to assess wasting (a mortality risk factor) in children 0-59 months. A recent consultation reached a majority position that mid-upper arm circumference (MUAC) is a better mortality predictor than WLZ in children 6-59 months. In addition, MUAC collected at the ages of 6-14 weeks has shown to identify infants more likely to die before reaching one year.

To understand which body compartment is most affected by undernutrition, associations between anthropometric indicators and body composition data have been studied in children aged 6-59 months. To our knowledge, no such study has been done in children aged 0-6 months. We aimed to study these associations.

Methods: Weight, length, MUAC, and lean and fat mass (LM and FM, respectively) obtained by air-displacement plethysmography of infants aged 0-6 months were obtained from an Ethiopian birth cohort study. The data, originally used to construct body composition reference data, measured infants at birth, 1.5, 2.5, 3.5, 4.5, and 6 months of age. A complete set of measurements available for 2506 out of a total of 2777 child measurements (563/598, 403/436, 414/444, 413/446, 368/415, and 345/441 in each age, respectively) was used for this analysis.

Weight and length data were transformed to sex-and age-specific weight-for-length z-score (WLZ) values using the 2006 WHO growth standards. To remove the confounding positive association between LM or FM and length, we calculated sex- and age-specific standardised residuals values obtained from regressing LM or FM on length, separately by sex and age of measurement.

The associations between MUAC, WLZ, length, and body composition residuals were assessed using correlation analysis. We used regression analysis to assess the independent contribution of body composition residuals to MUAC and WLZ. All analyses were done separately by age.

Results: MUAC was strongly and positively correlated with length at all ages (correlation values range 0.42 to 0.61) compared to WLZ which correlated negatively with length only between birth and 2.5 months (range -12 to -15). Both MUAC and WLZ were strongly and positively correlated with LM and FM standardised residuals with correlation values being systematically greater for WLZ (range 0.53 – 0.82 and 0.54 – 0.77, for LM and FM respectively) than for MUAC (range 0.28 – 0.42 and 0.45 – 0.63, respectively).

Together LM and FM standardised residuals (controlled for sex) explained over 93% of WLZ variance at all ages (see table 1). In contrast, LM and FM residuals explained between 37 – 52% MUAC variance.

Conclusions: LM and FM values have stronger associations with WLZ and together they explain almost all the variance of this anthropometric indicator compared to MUAC in children aged 0-6 months. Given these findings, it is unlikely that any greater capacity of MUAC to predict mortality among infants can be explained by the overall variability in body composition.

IAEA-CN-217--118P

Breastfeeding assessment tools

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Breastfeeding plays a major role in reducing the global burden of child mortality and under-nutrition. Whilst many programmes aim to support breastfeeding and prevent feeding problems occurring, interventions are also needed once they have developed. In this situation, accurate assessment of a problem is critical to inform prognosis and enables tailored, appropriate treatment. The presentation will present a review, which aims to identify breastfeeding assessment tools/checklists for use in assessing malnourished infants in poor resource settings.

The literature review identified 24 breastfeeding assessment tools, and 41 validation studies. Evidence underpinning most of the tools was mainly low quality, and conducted in high-income countries and hospital settings. The presentation will describe the main findings of the literature review and propose recommendations for improving existing tools in order to appropriately assess malnourished infants and enable early, appropriate intervention and treatment of malnutrition.

IAEA-CN-217--122P

Body composition and hydration factors in infants and young children using multicompartiment models

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Background. Until recently deuterium (2H2O) analysis has been performed almost exclusively by isotope ratio mass spectrometry (IRMS). The IAEA has promoted the FTIR methodology to measure deuterium (2H2O) enrichment, but there is limited information in infants and small children, which have different hydration status than adults. Due to the limited information available, the optimum deuterium dose amount to be administered to children in these studies has also been controversial. The aim of this investigation were to measure body composition and determine the hydration factors in infants and young children using multi-compartment models generating algorithms for prediction of body composition. **Subjects and Methods.** Seventy-eight male and female infants and young children (ages 3-24 months), from the urban and agricultural zones of Hermosillo, Sonora, Mexico participated. We measured weight, length and circumferences to evaluate nutritional status using the WHO Growth Reference 2006. We also measured total body water (TBW) by deuterium oxide dilution, bone mineral content (BMC) through a DXA scan and body density was estimated through published algorithms. Bioimpedance analysis (BIA) was also measured to explore the prediction of body composition using this technique. **Results.** In general, children from the urban area had better nutritional indicators than children from the agricultural area. Eleven (16.1%) children had some type of malnutrition (any nutritional index below -2 Z cutoff point) and 2 were overweight. Optimal amount of deuterium for dosing in this age range was 0.53 to 0.83 mg/kg body weight, which has implications for future studies of body composition in infants and young children. DXA overestimated body fat percentage compared to other 2, 3 and 4 compartment models ($p < 0.0001$). Hydration of fat-free mass was not different between children with normal nutritional indexes and those with some type of malnutrition ($p > 0.05$). Resistance or impedance indexes (Height^2/R or Z) were not important predictors of FFM or TBW (increase in $R^2 = 0.004$). Prediction of FFM was then performed by using only anthropometric variables, sex and age. The final model was: $\text{FFM (kg)} = 0.6462 (\text{Body weight in kg}) + 0.0672 (\text{Age in months}) + 0.2702 (\text{Sex; } 0 \text{ for females and } 1 \text{ for males}) + 0.4263$ ($R^2 = 0.98$, $\text{SEE} = 0.19$, $n = 21$) based on the 4C model by Lohman (1993). Final FFM prediction model was accurate, precise and showed no significant bias. **Conclusions.** Children from the urban area had a better nutritional status than the children from the agricultural zone. Hydration of FFM in malnourished children does not appear to be different to the hydration of FFM in healthy children; however, sample size needs to be increased. In this age group, BIA with current methodology applied to adults was not appropriate for predicting body composition.

IAEA-CN-217--123P

Effects Of Two Micronutrient-Fortified Food Aid Products Containing Different Levels Of Dairy Protein On Nutrition Status In Rural Infants and Young Children In Guinea-Bissau

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Food insecurity in Guinea-Bissau is widespread and micronutrient deficiencies are anticipated among vulnerable groups. The objective: to test the efficacy of two Micronutrient-Rich Ready to Use Supplementary Foods (MNR-RUSF) in rural village children aged 6 to 24 months. This study was funded by the United States Department of Agriculture as part of a larger pilot project testing different supplements in pregnant and lactating women and infants and children aged 6-59 months. 411 children were randomly assigned to one of two intervention arms (46g MNR-RUSF sachets containing 250 kcal/sachet and either 15% or 33% of dairy protein, collected 5 days per week from a supplement distribution center in the village) or to a control (C) group that received no MNR-RUSF. Weight, height and mid upper arm circumference (MUAC), hemoglobin, and retinol-binding protein were measured at baseline and end-line. Randomization to the 33% supplement group was associated with significantly increased visits to the distribution center to collect supplement, as well as higher ratings for product taste and overall acceptability. The 15% supplement improved hemoglobin levels relative to controls ($+0.81\pm 1.43$ vs. 0.07 ± 1.47 , $P<0.05$) and the combined 15% and 33% supplements improved hemoglobin levels relative to controls ($+0.76\pm 1.44$ vs. 0.07 ± 1.47 , $P<0.05$). There was no difference in changes in RBP between control and supplement groups, but both 15% and 33% groups had significantly reduced rates of reported malaria, diarrhea and other illnesses compared to control infants ($P<0.001$). The supplements did not improve weight or length gains in the population of infants as whole, but did result in significantly greater gain in weight-for-age z score among the infants who had a z-score >-2.0 at baseline. This study is the first to examine the effects of supplements containing different amounts of dairy protein in infants and young children in Guinea-Bissau and indicates that, while substitution of provided supplement for home food may have reduced the potential impact of the supplements on weight and height, the nutritional quality of the supplements was high relative to traditional food sources, with the result that both standard and high-dairy containing MNR-RUSF products improved hemoglobin and rates of reported diseases. Furthermore, the supplements containing a higher level of dairy protein had a very high rate of acceptability, leading to increased supplement usage, which, over time, may translate to additional health and cognitive benefits for this vulnerable group prior to entering school.

This work was part of a pilot project funded by the United States Department of Agriculture Foreign Agriculture Service (USDA/FAS) McGovern-Dole International Food for Education and Child Nutrition under Agreement FFE-657-2012/043-00.

IAEA-CN-217--124P

Locally Available Dietary Menus Promote Weight Gain among Acutely Malnourished Children Undergoing a Community-Based Nutrition Rehabilitation Program in Uganda

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Background

A significant proportion of Uganda's children still suffer from acute malnutrition, despite decades of government, donor and agency investment in basic health services. The demand for the WHO recommended Ready to Use Therapeutic Foods (RUTF) for community based nutrition rehabilitation programs (CMAM) and costs involved have been overwhelming, thus prompting the need for alternative, sustainable, local solutions.

Methods

The Management Sciences for Health STRIDES for Family Health Project (MSH-STRIDES), funded by USAID, implemented a community-based nutritional rehabilitation intervention using the principles of Positive Deviance. The approach identified solutions (practices) already being used by community members with well-nourished children despite not having access to special resources (positive deviants). Community volunteers encouraged children to be assessed for nutrition during special growth monitoring sessions. Children found malnourished were enrolled into a nutrition rehabilitation program also known as a hearth cycle, in a volunteer's home. Project staff and trained volunteers followed-up with malnourished children in their homes and invited the caregivers to bring them to participate in hearth cycles over 26 days. Caregivers were taught to recognize malnutrition and to treat it with supervised supplemental feedings of menu-mixtures of locally prepared, nutrient-dense foods. Weight gain was used as an outcome measure. Children were linked to health centers within the locality for curative services. MSH-STRIDES provided training to staff in the facilities and equipped them to serve as referral points for the children identified from the community.

Results

Hearth cycles were conducted in 230 villages from 34 sub-counties in 11 out of 15 project districts. A total of 1336 health workers and 283 caregivers were trained and involved in the implementation of the community model. Overall, 2525 children with moderate and severe acute malnutrition were enrolled. Their mean age was 15 ± 1.8 months with a male to female ratio of 1:1.2. Of those enrolled, 76% (1918/2525) completed the hearth cycles. Mean weight gain was calculated as 600 ± 1.01 g among malnourished children. Cure rate for a completed hearth cycle was estimated as 80%. There was an inverse correlation between the weight for height index at the start of the rehabilitation and weight gain ($r = 0.401$, $p < 0.05$). Severely malnourished children were more likely to present with severe wasting, eodema, infections and complications, compared to their moderately malnourished counterparts ($p < 0.05$). Children who needed referral had access to a total of 84 health units/centers scattered within the project area.

Conclusion

Locally available foods were used to provide an affordable, potentially efficacious nutrition rehabilitation menu for children in the selected rural communities. Further study will be required to evaluate the intervention using more precise methods such as determining weight change in terms of actual body composition. The results contribute to the knowledge gap regarding local solutions to nutrition rehabilitation challenges at community level.

IAEA-CN-217--128P

Improving infant and young child feeding practices through nutrition education with local resources

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Poor nutritional status in early infancy is associated with growth faltering and increased risk for morbidity. Main causes for undernutrition are a diet poor in quality and quantity, feeding practices, and hygiene. Programmes emphasize on affordable ways for improving diets for low-income families. Little is known about the period needed for behaviour changes.

Longitudinal studies were conducted in Malawi and Cambodia looking at infant and young child feeding as well as growth of children below two years. At baseline 6-9 months old children and their caregivers participating in a nutrition education (NE) program of FAO were invited. The recruited children were matched by age (days) and sex with children living in an area without NE (control). Baseline data was collected prior the NE carried out by trained volunteers twice a month based on locally adopted teaching materials. The children and their caregivers were visited every three months for a total period of 12 months.

At baseline the mean age of the children in Malawi was 227 days, all breastfed (n=149). In Cambodia the mean age was 230 days and 90% of them were still breastfed (n=96). The mean HAZ was -1.53 in Malawi and -0.87 in Cambodia. Minimum acceptable diet (MAD) was received by 42% and 34% of the children in the intervention areas of Malawi and Cambodia respectively. After three months MAD was achieved by 88% in Malawi and 45% in Cambodia. The rates in the control area in Malawi increased as well from 22% at baseline to 52% three months later. A similar change could be observed in Cambodia with 28% of the children receiving MAD at baseline and 38% three months later. Hygiene behaviour was one focus of the NE in both countries. In Malawi soap usage before feeding the child increased to 32% ($p < 0.001$), and before food preparation to 33% (both $p < 0.001$). Also washing before eating the food increased to 22%. In the control area no significant changes in terms of soap usage could be observed.

In Cambodia the prevalence of good hygiene was already at 90%. No further changes could be observed. Regarding an improved porridge, the intervention in Cambodia led to 19% of the caregivers stating to have prepared a special meal for their child during the previous day at baseline and 44% after three months. In the control area this change was smaller with 3% at baseline and 20% three months later.

Behaviour change messages can be quickly adopted if they are locally appropriate and affordable.

The research was conducted within the IMCF Project of FAO and JLU Giessen, Germany which is funded by the German Federal Ministry of Food, Agriculture and Consumer Protection.

IAEA-CN-217--132P

Efficacy study of the consumption of milk fortified in vitamins and minerals on the nutritional and cognitive status of children in rural regions of Morocco

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The micronutrients deficiencies cause considerable economic losses. In Morocco, iron deficiency alone leads to a shortfall of about two billion dirhams a year. Iodine deficiency costs Morocco 1.48% of GDP in terms of lost productivity, support for mentally retarded children, school dropouts and infant mortality. In line with the National program for fight against micronutrients deficiencies and the National Nutrition Strategy 2011 – 2019, an efficacy study was conducted jointly by the UMNRA, the Ministry of Health, the Ministry of National Education and the "Foundation CL for Child Nutrition"

It is a longitudinal, randomized, double-blinded efficacy study conducted for 9 months (2012) on school children (7 – 9y), without preliminary deworming, living in rural areas at high altitude. The population consisted of 380 children. One group of the children (FG) received daily 200ml of UHT fortified whole milk (Vitamin A, vitamin D3, iron and iodine)(30% RDA), the other control group(NFG) received daily 200ml of non fortified whole milk . Anthropometric, socio-economic, food consumption and morbidity data were collected. Biological tests included retinol, vitamin D, hemoglobin, ferritine and urinary iodine. Children also received a cognitive test (Raven test) at T0, T4 and T9months.

Results showed 18% reduction of stunting in the fortified group. The results of serum analyses proved the efficacy of the fortification. In fact, after 9 months of intervention we noted : a- elimination of vitamin A deficiency (dropped from 50% to 4%), b- reduction of vitamin D deficiency (from 60% to 25.5%), d- reduction of iodine deficiency (from 74.7% to 29.4%). It was also observed that the non fortified whole milk contributed in the decrease of these deficiencies, but there was no impact on the iron status (ferritine). Cognitive tests showed no significant difference between the two groups.

Conclusion: This study showed the efficacy of the consumption of fortified milk on the vitamins and minerals status of children. A study of longer duration should be conducted to determine the improvement of the cognitive capacities. The results of this investigation will be useful to the National Nutrition Strategy, 2011-2019 especially as they pertain to the food fortification component.

This study was performed with the support of "La Fondation Centrale Laitière de Nutrition pour l'Enfant"

IAEA-CN-217--137P

Does Abolishing User Fees in Primary Healthcare Centers Contribute to Reduce Moderate Acute Malnutrition in Children?

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Introduction. About 17 % of children under 5 years of age are wasted in Burkina Faso. Children with moderate acute malnutrition [MAM] are rarely detected and treated. Primary healthcare personnel are trained to manage malnutrition in children but access to health centers is limited. Fees represent an important barrier for households.

Objective. To evaluate the association between the abolition of user fees in primary healthcare centers and the prevalence of MAM in children under 5 years of age.

Context. The study area includes two comparable health districts in Burkina Faso. In the intervention district, user fees were removed for children under 5 years of age in July 2011. Consultations at health centers and treatments administered by health personnel have since been free-of-charge. In the control district, user fees remained.

Methods. The study is observational and relies upon a longitudinal design (repeated cross-sectional measures inside a cohort). The eligible population resides in a 15 kilometer-radius around the cities of Kaya and Zorgho. Three thousands households were randomly selected with an equal proportion from rural and urban areas. Once a year, a survey was administered to every household during the peak of malaria transmission (July 2011, August 2012 & 2013). Biological tests (malaria, anaemia) were administered to every child under 5 years of age and middle-upper arm circumferences were measured. The z-scores based on the WHO 2006 were estimated by using WHO's software Igrowup (macro for Stata®). Registries from the 10 primary healthcare centers in the study area were collected and their consultation data from January 2005 to November 2012 were encoded. Time series analyses were performed.

Results. The monthly number of visits by children under 5 years of age to primary healthcare centers has been increasing in both districts since 2005 but in the intervention district the removal of user fees in 2011 significantly accelerated this tendency. In the intervention district, the crude prevalence of MAM – defined as a middle-upper arm circumference between -3 and -2 z-scores – was at baseline (in 2011) 6.4% in the urban area and 8.8% in the rural area, and dropped the following year to 5.9% and 7.1% (respectively). In the control district, prevalence in 2011 was lower than in the intervention district – 3.3% in the urban area and 5.1% in the rural area – but rose the following year to 3.8% and 5.5% (respectively). In the intervention district, 77% of children with MAM in 2011 were no longer malnourished in 2012, compared to 72% in the control district.

Conclusion. Abolishing user fees in primary healthcare centers increases the number of visits by children under 5 years of age. This may contribute to improve the probability for a child with MAM to be treated, as well as to reducing the prevalence of MAM in the child population.

IAEA-CN-217--138P

Body Composition and Catch-up in Height after Treatment of Malnourished Children

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Background and Objectives: The use of enriched diets to promote rapid catch-up-growth and the delay in catch-up in length/height relative to catch-up in weight may be associated with excess adiposity and poor lean tissue deposition. We aimed to assess lean mass (LM) during treatment of Jamaican malnourished children and to investigate if stunted malnourished children remained stunted as adults.

Methods: All participants were managed in hospital and in accordance with WHO guidelines. Diagnosis (marasmus, kwashiorkor, marasmic-kwashiorkor) was based on the Welcome Classification. LM was estimated from total body water (TBW) in 44 children (group 1), aged 3 to 32 months, during the stabilization period, mid catch-up growth and on achieving at least 90% of reference weight-for-length using deuterium dilution technique. Length-for-age (LAZ) and height-for-age (HAZ) Z-scores were determined in another group of 168 malnourished children (group 2) on admission, aged 3 to 33 months, and when they attained adulthood. LAZ was calculated using recent WHO child growth standards.

Results: Data are mean \pm SD. The participants included moderately and severely malnourished children based on weight-for-length Z-score (WLZ). In group 1, after initial stabilization intake increased to 685 ± 101 kJ/kg/d and 3.7 ± 0.6 g protein/kg/d resulting in rapid weight gain (16.5 ± 5.1 g/kg/d) and catch-up in weight over 20 ± 10 d. Consequently, WLZ at admission (non-oedematous: -3.0 ± 0.2 ; oedematous: -2.1 ± 0.2) improved to -0.48 ± 0.2 . At recovery in weight, LM was consistent with reported values in normal children (71% to 92 % of body weight and 11 to 15 kg/m²) but the children remained stunted (LAZ: -3.3 ± 3.2). Insecurity of TBW measurement and estimating LM in the acute malnourished state and during rapid growth limits the ability to capture changes in lean and fat during rehabilitation.

Similar to group 1, WLZ in group 2 was -3.2 ± 1.3 on admission; -0.6 ± 1 at recovery in weight and the children remained stunted (HAZ: -3.8 ± 2.1). On admission, 16% percent was moderately stunted (LAZ between -3 and -2) and 73% was severely stunted (LAZ > -3). Repeated measures analysis showed that LAZ is positively associated with adult HAZ ($p = 0.00$) controlling for age, sex and diagnosis. Whereas, most of the children were severely stunted on admission, by adulthood none were severely stunted but 34% had HAZ less than -1 and 6.5% remained moderately stunted.

Conclusions: The results suggest that normal body composition is achieved with rapid catch-up in weight. However, reference body composition has not been clearly established. Majority of the stunted Jamaican children caught-up in height by adulthood. The factors contributing to persistent stunting in some children are not clear, but the results indicate the importance of periodic monitoring to ensure that adequate intake is maintained after recovery in weight.

funded by IAEA Grant: contract No 15268/RO

IAEA-CN-217--141P

Contribution of stable isotope to better understand breastfed infant nutritional status in burkina Faso: longitudinal study with body composition measurement at one year

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Background and objectives: Exclusive breastfeeding for six months, followed by the introduction of appropriate complementary foods and continued breastfeeding, as recommended by the World Health Organization, are cornerstones in infant nutrition. In Burkina Faso, only limited information is available on the quantities of human milk consumed and the time of introduction of other foods into infants' diets and the effect of feeding practice on the infant's growth. In this work we analyzed infant's nutritional status according to their feeding practice.

Methods: We used the deuterium oxide (DO) dose-to-the mother technique to measure the human milk intake (HM) as well as the non-milk water intake (non-HM) by the babies at 3, 6, 9 and 12 mo. We also evaluated the infant body composition at 12 mo by giving a dose of DO to the babies in order to determine the fat-free mass (FFM) and the fat mass (FM). Saliva samples were collected from the babies and their mother and the DO enrichment in saliva was analyzed by FTIR. At each period, the anthropometric measurements were done to assess the infant nutritional status at 3, 6, 9 and 12 mo according to the WHO standards.

Results: The HM was maximum at 3mo with a mean of 968.1 ml (95%CI=847.2 ml-1089.1 ml), decreased at 6 mo to 918.4 ml (95%CI=815.9 ml-1020.8 ml) that didn't change until 12 mo. The non-HM that was 54.6 ml (95%CI= -12.6ml-121.7ml) increased significantly (p=0.001) to 175.2 ml (95%CI=100.2ml-250.4ml) at 6 mo. Exclusive breastfeeding was 32% at 3 mo and reduced to 16% at 6mo. Breastfeeding was predominant after 6 mo and the contribution of HM in infant feeding was 80% at 9 mo and 69% at 12 mo.

The anthropometric measurement showed that wasting was 1.5% at 3 mo but increase significantly (p=0.04) to 8.7% at 6 mo. The DO dose to mother confirmed that all of the malnourished infants were not exclusive breastfed. At 9 mo the WHZ<-2 was reduced to 6.8%, but 4.5% of the children were severe malnourished and 12 mo, wasting was 15% with 5% of SAM. That confirmed the complementary feeding practice used by the mothers couldn't cover well the needs of those infants after 6 mo.

The body composition measurement showed that the FFM (7.5kg [95%CI=7.1kg-7.7kg]) as well as the FM (1.8kg [95%CI=1.4kg-2.2kg]) of healthy infants were significantly (p=0.01 and p=0.009) greater than the FFM (5.7kg [95%CI=5.4kg-6.0kg]) and the FM (0.7kg [95%CI=0.4kg-1.0kg]) of the malnourished children.

Conclusion: The DO dilution technique helped us to validate infant's feeding practice and their nutritional status in limited resource setting.

IAEA-CN-217--143P

Percent body fat and BMI in indigenous and mestizo children from South, Centre and North Mexico derived from bioimpedance analysis (BIA) and deuterium oxide dilution

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Background. Body mass index (BMI) is an international standard to evaluate nutritional status but has the inability to distinguish fat mass from fat free mass, especially with regards to ethnicity. Mexico is the eight country in ethnic diversity in the world. The changes in fat mass and fat free mass offers the possibility to evaluate the effects of intervention programs in shorter periods. Objective. The purpose of the present study was to investigate the relationship between body composition and anthropometric characteristics of indigenous and mestizo Mexican children. Subject and Methods. A total of 1618 male and female indigenous (n=498) and mestizo (n=1120) children 7-9 years, were selected by stratified multiple stage cluster sampling. Indigenous groups and States were: Tarahumaras (Chihuahua), Mayos (Sonora), Nahuas (Puebla), Otomies (Hidalgo), Tzotziles (Chiapas) and Mayas (Yucatan Peninsula). Mestizos from the same regions were included. Fat free mass and fat mass were obtained from a previously reported BIA cross validated equation using deuterium oxide dilution from 339 children from the same population, groups and regions. Results. The indigenous groups had 18.5 + 5.9 % fat compared to 23.5 + 8.4 in the mestizos (p<0.0001). Nahuas had the lowest % fat (p<0.0001) with 16.5 + 5.7, compared to Mayos, Tarahumaras and Mayas that had 18.6 + 6.2, 19.0 + 6.3 and 18.0 + 6.5 respectively. Mestizos from the Centre, North, and South had the highest levels of % body fat (p<0.001) with 25.4 + 7.7, 21.9 + 8.2, and 20.5 + 7.8, respectively. In indigenous children (n= 498) the 5th percentile (95% CI) corresponded to 9 (8,10) % body fat, while for Mestizos (n=1120), the 5th percentile was 10 (9,11). Using this percentile, only one third of the children approximately of both groups would be classified as thin by WHO and IOTF classifications. Conclusion. Indigenous children had lower body fat than mestizos, however, the relationship of BMI to % body fat was similar between both groups but indigenous children had a less body fat than mestizos at the same BMI.

IAEA-CN-217--144P

Management of moderate malnutrition by the “the positive deviance” and “grand-mother” approaches in Benin

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The malnutrition of young children is becoming more and more worrying and is today a major public health problem in developing countries in general and in Benin particularly. The positive deviance and grand-mother approach are two endogenous solutions jointly used to combat moderate malnutrition in rural communities in Benin in the framework of the Community Nutrition Program (PNC) implemented by the NGO PLAN-BENIN. The results of PNC's interventions in 16 villages in the commune of "Ouinhi" show that, on 1494 children screened, 999 children (66.9 %) have good nutritional status; 492 Children (33%) are moderately underweighted and 03 children (0.2%) are severely underweighted. These results showing the nutritional situation of these communities are returned in general assembly. After this, exchanges are carried out with the community about the peremptory measures opening of "Homes of Learning and Nutritional Rehabilitation" (FARN) for the moderate malnourished children. The severe cases and those with complications are referred to the Health Center of Recovery and Nutritional Education. The FARN is organized for a period of 12 days (six days per week), in the houses of one of the community members or in public square. It admits to a maximum of 15 malnourished children who are registered on a sheet. The FARN organized at the location of moderately malnourished children have been already carried out in three villages (Ahicon, Gbokpago and Zaloko) just after the restitution of screening results and FARN preparation meetings. On 52 moderates malnourished children having participated to the FARN in these 3 villages, 41children (78.8%) have a satisfactory weight gain $\geq 400g$, whereas 09 children are below ($< 400g$) of weight gain required. Note that the weight of the children is taken the first day of opening of the FARN and the last day of the end of the FARN. In the objective to follow the children admitted to the FARN, home visits are organized every 7th days and on two weeks at the end of the FARN in order to identify cases of relapse to transfer into another FARN. During FARN meetings, the choice of local foods to prepare returns for mothers of malnourished children who are helped by the mothers-models. The later live in the same community, but have developed good practices and positive behaviors in terms of infant care and feeding. The practices of balanced diet, care, hygiene to keep the nutrients of food are put into practice in a group to be subsequently repeated at home on an individual basis with the support of grand-mothers. The later were previously trained by the NGO's workers. The importance of the role of grand-mothers and their positive experiences for the well-being of women and children in the village and at household level is incontestable today and used as contribution.

IAEA-CN-217--146P

The Minimum Cost of a Nutritious Diet Study: Building an evidence-base for the prevention of undernutrition in Afghanistan

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Background

In Afghanistan, mortality rates are amongst the highest in the world. Mean life expectancy is 62 years, U5MR is 97 deaths per 1,000 live births, and the MMR is 327 deaths per 100,000 live births while 33% of the population is food insecure.

Undernutrition is alarmingly high in children under-five with global acute malnutrition rates of 8.7%, stunting 60.5% and underweight 37.7% , , and 72% are iodine and iron deficient.

As part of their prevention efforts, WFP and the MOPH carried out a Cost of Diet study (CoD) in Afghanistan in late-2012.

Cost of Diet Study

The CoD assesses a household's food and nutrition security based on economic constraints in accessing their nutrient requirements, especially for the most vulnerable, such as children U2 years.

Objectives

1. How important is access to nutritious food to overcome undernutrition in different areas of Afghanistan?
2. Is a nutritious diet available and affordable to the local populations?

Methodology

The CoD tool used linear optimization to generate following output from market surveys and secondary household data:

- A diet and the corresponding food baskets meet all nutritional requirements of a typical family, including a child U2 years, and its costs. Any other diet would be more expensive and/or would not meet their nutritional requirements.

The tool calculated minimum cost of nutritious diet (MCNUT) in four livelihood zones (LHZ) of Afghanistan.

Results

The MCNUT is the baseline nutritious diet. When compared to household income, it shows the number of households who cannot afford to meet their nutrient needs. The MCNUT calculates cheapest combination of food items and quantities to ensure all energy and nutrient requirements are met. It is theoretical and sometimes unrealistic.

The Locally Adapted, Cost Optimised Diet (LACON), obtained using questionnaires and focus group discussions, provides a more realistic diet based on dietary preferences.

Findings showed that approximately 50% of the populations in three LHZs were unable to afford the MCNUT, and 80% of households in the fourth.

When adding local preferences, LACON findings showed that costs for typical families in three LHZs increased by at least 20% and by 38% in the fourth LHZ.

However, significant reductions in the cost of a nutritious diet were observed when micronutrient powders, fortified wheat flour or voucher transfers were modeled and added to the household's diets.

Conclusion

The Afghanistan CoD study provided valuable evaluations on household affordability and cost-effectiveness, modeling fortified wheat flour, micronutrient powders, and voucher transfer interventions. The study provides an important benchmark for nutrition policy discussions; it clearly illustrated the high cost of accessing a nutritious diet for children under two, and for the rest of the household. Although economic access to nutritious food is not the sole determinant of undernutrition, it is an important prerequisite. Measuring this dimension is a necessary first step to inform policy decision making in Afghanistan and prevent undernutrition.

IAEA-CN-217--151P**Normalisation of body composition parameters for nutritional assessment**Prof. PRESTON, Thomas ¹¹ *SUERC, University of Glasgow, United Kingdom***Corresponding Author:** tom.preston@glasgow.ac.uk

Normalisation of body composition parameters to an index of body size facilitates comparison of a subject's measurements with those of a population. There is an obvious focus on indexes of obesity, but first it is informative to consider Fat Free Mass (FFM) in the context of common anthropometric measures of body size namely, height and weight. The contention is that FFM is a more physiological measure of body size than body mass. Many studies have shown that FFM relates to height^p. Although there is debate over the appropriate exponent especially in early life, it appears to lie between 2 and 3. If 2, then FFM Index (FFMI; kg/m²) and Fat Mass Index (FMI; kg/m²) can be summed to give BMI. If 3 were used as exponent, then FFMI (kg/m³) plus FMI (kg/m³) gives the Ponderal Index (PI; weight/height³). In 2013, Burton argued that that a cubic exponent is appropriate for normalisation as it is a dimensionless quotient. In 2012, Wang and co-workers repeated earlier observations showing a strong linear relationship between FFM and height³. The importance of the latter study comes from the fact that a 4 compartment body composition model was used, which is recognised as the most accurate means of describing FFM.

Once the basis of a FFMI has been defined it can be used to compare measurements with those of a population, either directly, as a ratio to a norm or as a Z-score. FFMI charts could be developed for use in child growth. Other related indexes can be determined for use in specific circumstances such as: body cell mass index (growth and wasting); skeletal muscle mass index (SMMI) or appendicular SMMI (growth and sarcopenia); bone mineral mass index (osteoporosis); extracellular fluid index (hydration). Finally, it is logical that the same system is used to define an adiposity index, so Fat Mass Index (FMI; kg/height³) can be used as it is consistent with FFMI (kg/height³) and PI. It should also be noted that the index FM/FFM, describes an individual's adiposity in relation to their measured body size, independent of height. Field measures such as skinfold thickness (SFT) and mid-upper arm circumference (MUAC; probably corrected for triceps SFT) can be expressed in proportion to indexes by considering their dimensions. MUAC/height best relates to FFMI (kg/height³), whereas SFT/height relates to FMI (kg/height³).

Body composition charts based upon PI will be demonstrated, similar to those based on BMI as described by Hattori in 1997. These could be developed as a graphical tool to illustrate cross-sectional and longitudinal measurements in the context of a population. In conclusion, a common framework of body composition indexes can be developed once the means to normalise FFM has been optimised. If the consensus is to apply a height exponent other than 3, this approach is equally relevant.

The author gratefully acknowledges the support of the Nutrition and Health-Related Environmental Studies section of the IAEA.

IAEA-CN-217--156P

Body composition and physical activity assessment by euthopic and obese adolescents

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The increase of prevalence of overweight and obesity in adolescents has called the attention of researchers and professionals in the health area, because the consequences of the comorbidities associated with weight gains. Inactivity is one of the risk factors for adolescents. In the literature, precise methods to assess physical activity are not found. The aim of this research is to assess the body composition and the level of physical activity by euthopic and obese adolescents classified by the growth curve of the World Health Organization, 2006 in Brazil (WHO, 2006). Methods: 29 adolescents were selected aged between 11 and 15 years from state schools of Ribeirão Preto- SP- Brazil. Nineteen are euthopic and 10 are obese. Weight, height, waist and hip circumference and electric bioimpedance were measured it. To assess physical activity it was used accelerometer (activPAL®, Glasgow, UK) for 7 days and IPAQ questionnaire. It was also evaluated eating habits by the food behavior questionnaire. Results: BMI mean for obese was 29.40 kg/m² and 21.27 kg/m² for the euthopic. The obese adolescents classified by BMI showed higher mean fat mass by electric bioimpedance when compared to euthopic adolescents, 38.6% versus 26%, respectively. The relation waist/hip circumference was higher in the obese group than in the euthopic (0.85 for obese and 0.71 for euthopic). Reading to high cardio vascular risk above 0.8. The level of physical inactivity by IPAQ was 89.5% for the euthopic and 80% for the obese. The inactivity classification was determined by those individuals who did less than 300 minutes of physical activity per week. The results of the accelerometer did not show statistical difference in the activities performed by the obese and euthopic. These activities are the time spend sitting, walking and standing. 63% of the euthopic and 60% of the obese have the habit of watching television while eating. Conclusion: Adolescents have the same profile for physical activity and eating habits apart from the anthropometric rate. They spend a lot of time sitting and lying down in both groups without gender difference which is related to the increase of fat mass and cardio vascular risk specially in obese adolescents.

IAEA-CN-217--157P

Carer and Healthcare Worker Perspectives on Community Management of Acute Malnutrition in Infants Aged Under 6 Months: a Formative Study from Malawi

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Background and aim: Over the last decade, community based treatments have revolutionized the treatment of acute malnutrition in childhood. Of an estimated 38 million children aged <5 years with MAM (Moderate Acute Malnutrition) worldwide, 4.7 million are infants aged <6 months; of 20 million with SAM (Severe Acute Malnutrition), 3.8 million are infants <6m. Recent WHO guidelines on SAM for the first time given international guidance on infants aged <6m – but they are based on very weak evidence. What to do for infant MAM remains unknown and poorly described. In this study, we aimed to explore what carers and healthcare-worker perspectives thought about the new WHO proposals for community-based care for infant SAM. Since community-based care for infants is also highly relevant to infant MAM, this study has much wider relevance and implications.

Methods: This was a formative, qualitative study based on 12 interviews and 20 focus group discussions in two rural and three urban centres of Southern Malawi. In total, 143 people were interviewed. Participants included mothers, fathers, grandparents and healthcare workers. Purposive sampling were applied. Data were analysed using Excel. Thematic analysis deduced 6 major themes and 29 codes.

Results: Infant malnutrition was a sensitive topic raising emotional and instinctive responses, involving family relationships and taboos. Six themes emerging from the data were: understanding of causes and symptoms of infant malnutrition; perception of management of infant malnutrition in hospitals; Perception of management of infant malnutrition in the community; caregiving resources (mother and household); caregiving resources (community level); perceived priorities for management of infant malnutrition. Participants instinctively preferred inpatient-based treatments for infant malnutrition. However, this was based on a superficial risk-benefit judgment and high expectations from inpatient-care and food and medicine availability. All these elements can be easily delivered in community setting. Participants also recognized the value of community-based care including support from healthcare workers, family and community members. They preferred individually tailored rather than group treatments.

Conclusion and Recommendation: Recognizing the importance of stakeholder involvement is vital to any new policy: we hope that our findings will therefore help inform and shape future policy and future research studies on acute malnutrition in infants.

For new services to develop successfully and reach as many affected individuals and populations as possible, close engagement with families and communities is essential. Infant treatment services must not only support the mother-infant dyad but consider wider family and social contexts underlying malnutrition. Community-based care providers should work closely with hospital teams to ensure synergy and avoid being perceived as a 2nd-best service.

Acknowledgments and funding: We are grateful to all participants who took part in the study, Blantyre District Health office and Queen's Hospital who hosted the study, and the Academy of Medical Sciences/Wellcome Trust/British Health Foundation/Arthritis Research UK "Starter Grant" (held by MK) funding this work.

IAEA-CN-217--158P

Prevention of Moderate Acute Malnutrition (MAM) Positive Deviance Hearth (PDH) Approach in Burundi

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Background and Objectives: PDH approach utilizes local resources and solutions to rehabilitate and prevent future malnutrition in children under five. Although PDH focuses on addressing underweight, PDH includes children with MAM and may have potential to address and prevent MAM where community-based management of acute malnutrition (CMAM), specifically targeted supplementary feeding component, may not be appropriate. The objectives are: 1) to assess the effectiveness of PDH to reduce moderate and severe underweight in participant children as well as prevent malnutrition in younger siblings of participant children; and 2) to assess PDH's effectiveness for treatment and prevention of MAM in ten villages in Burundi. **Methods:** Starting September to November 2012, PDH was implemented by trained community volunteers in the ten villages. A "positive deviant" inquiry identified local practices that positively impact child nutritional status. These practices were transferred to families of malnourished children through experiential learning during 12 days of "Hearth" sessions. Two weeks of home visits followed Hearth. Mid-upper arm circumference of participant children (n=70) were measured on the first day of Hearth, with appropriate referral for cases of severe acute malnutrition. Weights of children were assessed at Day 1 (n=94), 12 (n=94), 30 (n=74) and one year after the start of Hearth (n=92). Weight gain of children at Day 12 and 30 were compared with standard weight gains for PDH (200-250 grams for Day 12 and 400 grams for Day 30). Younger siblings were also weighed at the one year follow-up (n=73).

Results: Mean weight-for-age z-scores (WAZ) of the children improved from -3.1 ± 0.2 to -1.1 ± 0.1 ($p < 0.001$), showing sustained catch-up growth at home. Almost all children achieved the standard weight gain on Day 12 and Day 30 (92.6% (87/94) and 98.6% (73/74), respectively). Within one year, severe and moderate underweight decreased from 77% to 21% in participant children ($p = 0.001$). Moreover, all younger siblings were of normal weight-for-age status at one year follow-up. Of children identified with MAM on the first day of Hearth (n=21), two thirds (n=14) had normal WAZ by one year follow-up; all but one child achieved improved WAZ at one year.

Conclusion: PDH is effective in reducing underweight in participant children under five as well as preventing malnutrition in younger siblings. Due to limited monitoring data, it is unclear whether all children identified with MAM at baseline were treated. However, it is convincing that two thirds of the children were treated as they are normal for weight-for-age status by one year. All but one child with MAM at baseline has improved WAZ by one year, showing improved nutritional status and catch-up growth. Further analysis is required for assessing the adequacy of PDH in rehabilitating children with MAM, but the improved nutritional status of both participant children and their younger siblings indicates potential of using PDH for MAM prevention.

IAEA-CN-217--159P

Integrated Blanket Supplementary Feeding Program Reduces Levels of Stunting in Yenangyaung, Myanmar

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BACKGROUND: Yenanchaung Township is the top ranked amongst the six poorest townships in the 25 townships comprising of Magway Division. There is food insecurity, poor transportation, high unemployment and migration rates widespread illiteracy, poor hygiene, and lack of health facilities. Along with food insecurity, high rates of malnutrition are found. In 2010, 39.5 percent of children under five years of age were found to be stunted, 18.1 percent wasted and 28.3 percent underweight.

World Food Program (WFP) and World Vision Myanmar (WV) have been collaborating in response to the food insecurity situation in Yenangyaung since 2005 through food assistance interventions. However, in 2011, WV target villages started focusing on implementation of food activities apart from just food assistance; a more sustainable approach.

Thus, the project is now focusing on maintaining the food security status of the targeted communities by strengthening the capacity in agriculture technique, alternative livelihood skills, and health/nutrition education.

METHODS: This project is focused on food provision for all pregnant and lactating mothers and under 3 children according to the set criteria by WFP as well as nutrition education in the respective villages. Township health offices, village leaders and trained volunteers were used to carry out the activities of the project, including: health/nutrition education, food distribution, cooking demonstrations, integration of immunization and vitamin A supplementation, pre-/post-natal care, growth monitoring, counseling and referrals. The weight and MUAC of the children (n=381) were taken every month, and height was measured every 3 months. Follow-up was conducted January 2012 to December 2012. Children were discharged from the program when they reached 3 years of age, regardless of the nutritional status. Thus, the data collected during the project was used to assess the impact of the program.

RESULTS: No significant changes were seen in the underweight and wasting levels. However, significant improvements in the median height-for-age z-score (HAZ) were found in levels of stunting on Day-1 (-2.37SD, n=381) vs. 6-month follow-up (-1.99SD, n=314)(Z=-7.683, p<0.0001). Unfortunately, there were significant increases in the levels of stunting on Day-1 (-2.37SD, n=381) vs. 1-Year follow-up (-2.70SD, n=242)(Z=-2.21, p=0.027).

CONCLUSION: An integrated blanket supplementary feeding program could possibly reduce levels of stunting in just 6-months, but continued monitoring is required of the children even if the children are discharged from the program to ensure their rehabilitation is sustained at home. The increase in levels of stunting at 1-Year follow-up may have been due to the fact that many of the rehabilitated children were discharged and not followed up for the study. Thus, further research is needed to assess the effects of integrated blanket supplementary feeding programs on reducing levels of stunting.

IAEA-CN-217--160P

Agrobiodiversity a future solution of acute malnutrition in Africa; Study in the causation of acute malnutrition among Sudanese children and infants'

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Introduction : Food security and livelihood assessments tend to focus on the household food security component of the underlying causes of acute malnutrition, which considered as a negative impacts of food insecurity and livelihood-related coping strategies . Household food security directly impact the types and quantity of food an individual consumes within the household. It includes feeding practices for infants and young children e.g. breastfeeding and complementary feeding; Nutrition causal analysis NCA Isotopes and nuclear techniques can measures more accurate parameters about nutritional situation and needed food items for sustainable long term solution .

In the studies for the evaluation of body composition of children with SAM and human milk intakes using isotopic techniques (FTIR) supported by IAEA it was opserveved that 23% of SAM patients coming back to hospital after discharged and infants with less human milk intakes coming from low income families .

Methods ; A nutrition survey was carried out among SAM and participated women in human milk intake families in Khartoum state . Nutrition casual analysis was conducted , livelihood assessment using PRA and HHEA were carried out along with measuring body composition of small number of children from those families .

Results : Livelihood evaluation should that 56% of the families categorized as low income with lower economic approaches and house hold food insecurity was also detected . The nutritional profile of the study population expressed a prevalence of acute malnutrition among infants and children (15.7%). Regression analysis showed that the body fat and fat free mass were influenced by the consumption of an imbalanced diet . The causes of malnutrition are complex, a leading cause was found to be a general simplification of diets with a decline in diversity and nutritional quality. It was appeared that Diet, biodiversity can be considered as a solution of hidden hunger among selected communities have a monotonous diet with very low consumption of needed diverse foods . Besides the negative effect on their body composition, this last result points to the risk of developing infectious diseases . The same deficient diets used during recovery from moderate acute malnutrition in young children .

Recommendations :

Small farming system using agriobiodivesity approaches can improved livelihood of poor communities . assisting smallholder farmers to grow food in a sustainable way- organic farming, and helping poor communities to improve their livelihood approaches , consume safe, diverse and nutritious foods, while controlling diseases and protecting the environment in sustainable manners .

To investigate the links between nutrition and agriculture a systemic approach needs to be applied with the food chain integrating next to environmental issues, such as soil, water and health hazards, also intersect oral communication, knowledge production and education . The planed study will mainly focus on the production side of the value chain and how a greater diversity in the farming system, which could positively contribute production related to nutritional outcomes. Isotopic techniques will used to measure body composition of under five as outcome measures .