AN IMPACT EVALUATION OF THE SINDH STUNTING PREVENTION PROGRAMME

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ACRONYMS

AKU	Aga Khan University
ANC	Antenatal Care
BCC	Behaviour Change Communication
BISP	Benazir Income Support Programme
BMI	Body Mass Index
DMU	Data Management Unit
ERC	Ethics Review Committee
Hb	Haemoglobin
HAZ	Height-for-age Z-score
IYCF	Infant and Young Child Feeding Practices
LHW	Lady Health Workers
LNS	Lipid-based Nutrient Supplement
MNP	Micronutrient Powder
MUAC	Mid-upper Arm Circumference
NBC	National Bioethics Committee
NNS	National Nutrition Survey
NPFP&PHC	National Programme for Family Planning & Primary Health Care
PLW	Pregnant and Lactating Women
PMRC	Pakistan Medical & Research Centre
PPS	Population Proportion to Size
RCT	Randomized Controlled Trial
SD	Standard Deviation
SPSS	Statistical Package for Social Sciences
TT	Tetanus Toxoid
UC	Union Council
WAZ	Weight-for-age Z-score
WFP	World Food Programme
WHO	World Health Organization
WHZ	Weight-for-height Z-score
WSB	Wheat Soya Blend

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"An Impact Evaluation of the Sindh Stunting Prevention Programme" is a joint effort by the Government of Sindh (GoS), the Aga Khan University (AKU), the United Nations World Food Programme (WFP) and in collaboration with related ministries, line departments, and technical institutions of Pakistan. The study was carried out under the overall technical supervision of the WFP in consultation with the GoS and AKU who technically reviewed and steered the process during 2014-18.

The study team was comprised of Dr. Zulfiqar A. Bhutta (Senior Technical Advisor), Dr. Sajid Soofi (Principal Investigator), Dr. Shabina Ariff (Co-Investigator), Dr. Atif Habib (Co-Investigator), Mr. Gul Nawaz Khan (Research Manager), Mr. Imran Ahmed (DMU Senior Manager), Ms. Arjumand Rizvi (Head Statistician), Mr. Asmat Ullah (Field Supervisor), Mr. Amjad Hussain (Data Coordinator) and Mr. Muhammad Sajid (Statistician).

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Finally, and most importantly, we would like to sincerely thank the United States Agency for International Development (USAID) for their generous funding support to WFP, through which AKU has been able to identify nutrition-based supplementation as an effective method to protect mothers and children from malnutrition in Pakistan.

EXECUTIVE SUMMARY

The Stunting Prevention Programme was implemented to prevent stunting among children under five years of age through nutrition-based supplementation during 2014-2017, in 29 union councils (UCs) of districts Thatta and Sujawal, Sindh Pakistan. The programme was implemented by National Programme for Family Planning & Primary Health Care (NPFP & PHC) with technical and financial support from the World Food Programme (WFP). As a third party, the Aga Khan University (AKU) evaluated the programme through robust research methodologies including a cross-sectional baseline and endline intervention comparison and a nested randomized controlled trial (RCT). The cross-sectional baseline and endline surveys were designed to assess the impact of the programme interventions on a representative sample of households in the targeted areas of the Stunting Prevention Programme.

The surveys collected information on socio-demographic characteristics, food consumption, food security, anthropometric measurements, and access to health facilities, willingness to use nutrition-based supplementation and exposure to other interventions in the study area. Spot hemoglobin (Hb) was also measured to estimate the prevalence of anemia among the target population. The baseline household survey was conducted between May and August 2014, and the endline survey was conducted between November and December 2017. This report summarizes the findings of baseline and endline cross-sectional surveys.

A comprehensive package of community-based interventions including nutrition-based supplementation and behaviour change communication (BCC) was delivered through the Lady Health Workers (LHWs). A preventative approach was used for the distribution of nutrition-based supplementation to pregnant and lactating women (PLW), children aged 6-23 months and 24-59 months.

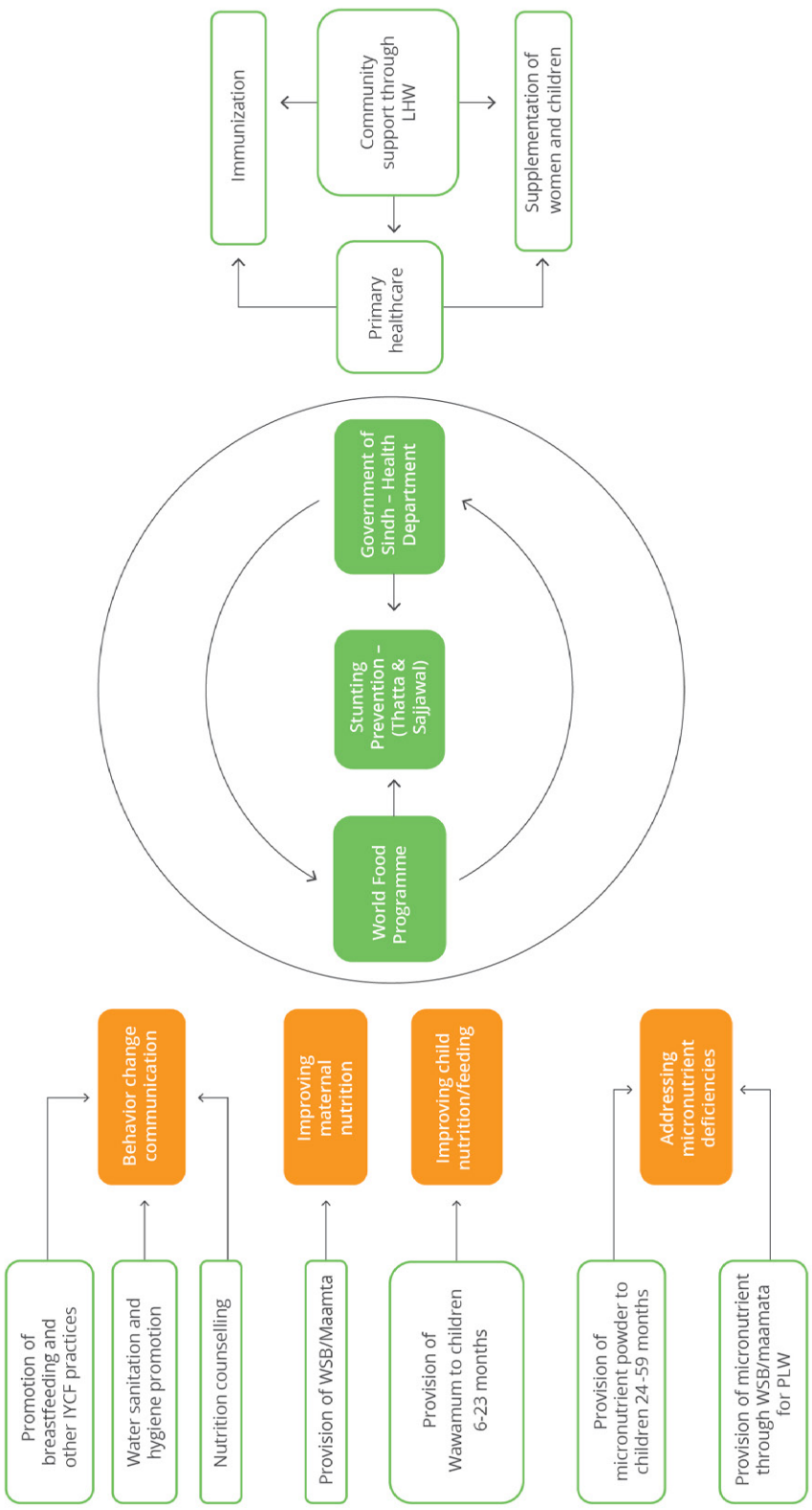


Figure 1: WFP Supported Stunting Prevention Model

INTERVENTIONS

1. **Wheat Soya Blend (WSB) and Lipid-based Nutrient Supplements (LNS)/Maamta:** WSB is a mixture of partially cooked cereals, pulses, soya and beans that are fortified with vitamins and minerals. A monthly ration of 5 kg of WSB (i.e. 165 grams/day) was provided to pregnant women during pregnancy and the first six months of the lactation period. On average, PLW were provided supplementation for a duration of nine months. However, as of January 2017, the programme intervention protocols for PLW were changed to the provision of 5kg of Maamta (a locally produced LNS) rather than the WSB. Maamta is a supplement to enrich the dietary intake of PLW. The product can be eaten directly from the package, with no dilution, mixing or cooking needed. Contrary to WSB, Maamta has shown to increase the nutrient intake for PLW, while reducing the common intra-household food sharing.

2. **Lipid-based Nutrient Supplement (LNS)/Wawamum:** LNS are called lipid-based because a significant portion of the calories are drawn from oil. They also contain a full complement of vitamins and micronutrients. A locally produced LNS (Wawamum) containing vegetable oil, skim milk powder and chickpeas was distributed for six months to children aged 6-23 months. A daily ration of 50 grams of Wawamum was provided to cover the Recommended Daily Allowance (RDA) of most micronutrients and 260 kcal of energy (about 1/4th of the daily energy requirement) for children aged 6-23 months.

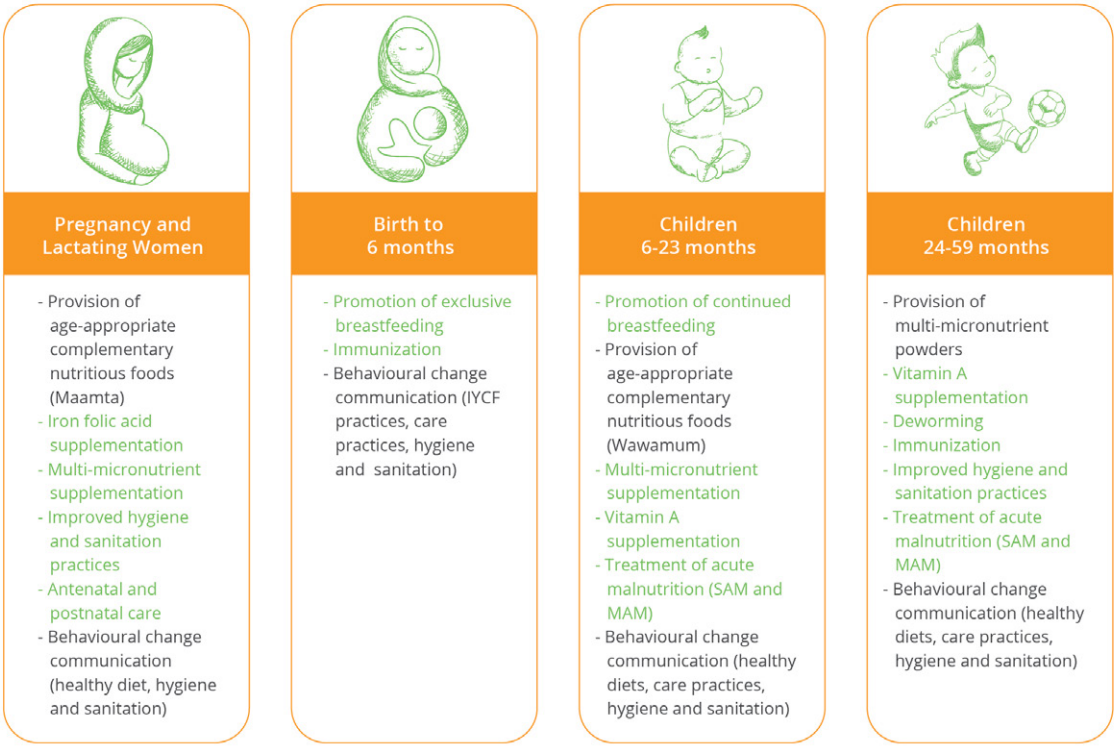
3. **Micronutrient Powders (MNPs):** MNPs are single-dose sachets containing vitamins and minerals in a powdered form that can be added to any semi-solid food. It is used to help increase micronutrient intake without adjusting the dietary habits of children. On every alternate day for six months, children aged 24-59 months received a MNP sachet containing the RDA for 15 micronutrients.

4. **Behaviour Change Communication:** Behaviour change and preventative health education messages were provided on the product's use, benefits and nutrition by LHWs using group sessions and home visits on a monthly basis. The nutrition education was based on the material developed by WFP and the Health Department, Government of Sindh.

The control group received routine public and private health services available within the area. Often, these public services consisted of the Basic Health Unit (BHU), Rural Health Centers (RHC), Taluka Hospitals, District Headquarter Hospital (DHQ) and local healers available in the community.

Figure 2: Programme Interventions

The programme was delivered through the primary healthcare system



N.B. The interventions in green are part of the primary healthcare system. The interventions in grey were supported by WFP.

STUDY POPULATION

A two-stage cluster sampling technique was used to select households for interviews. In the first stage, a total of 29 clusters (UCs) were selected from the geographic areas. In the second stage, a Population Proportion to Size (PPS) sampling method was used to select households to be interviewed from each of the selected areas per UC. All households with PLW and children 0-59 months of age were eligible for the baseline and endline surveys.

SAMPLE SIZE

The sample size was calculated for comparing two cross-sectional surveys, while assuming the baseline prevalence of stunting to be 49% in Sindh with a 10% reduction in the prevalence of stunting during the three-year implementation of the Stunting Prevention Programme. For estimating impact of the interventions (α=0.05, power=0.80), each group had 3200 participants. To account for dropouts and data errors, the sample size was increased by 15% giving a new total of 7360 study participants (3680 participants per group).

Information was collected from 4,350 households at baseline and 4,283 households at endline. From the households selected at baseline, the study participants were 1829

pregnant women, 1948 lactating women and 2195 children under five. From the households selected at endline, the study participants were 1884 pregnant women, 2164 of lactating women and 2923 children under five.

RESULTS

Nutritional Status of Children Under Five

A significant reduction of 10.3% (45% at baseline; 40.3% at endline; p = 0.003) in the prevalence of stunting among the children under five years of age was observed in intervention areas, but only a marginal 2.3% reduction (52% at baseline; 50.8% at endline; p = 0.46) was noted in the control areas. There was also a significant reduction of 8.3% in the prevalence of underweight in the intervention areas (35.1% at baseline; 32.2% at endline; p = 0.05) and a 2.8% reduction in the control areas (44.5% at baseline; 43.3% at endline; p = 0.44). A 6.8% reduction in the prevalence of wasting was observed in children under five receiving the intervention; however, the reduction was not statistically significant (p = 0.38). Similar findings for wasting (18.7% at baseline; 17.3% at endline; p = 0.25) were observed in children under five from the control areas.

Anemia Status of Children Under Five

Reductions in the prevalence of anemia in children under five was significant in both intervention and control areas (p<0.001) through the Stunting Prevention Programme. There was a significant decrease of 13.3% in anemia prevalence (87.5% at baseline; 74.8% at endline, p<0.001) in the intervention areas. Similarly, a 11% reduction in the prevalence of anemia was observed in children under five (86.5% at baseline; 77.0% at endline; p<0.001) in the control areas. No gender disparity in the occurrence of anemia was observed at baseline and endline.

Nutritional Status of PLW

The prevalence of normal nutritional status among PLW improved by 3.8% (56.6% at baseline; 58.5% at endline; p = 0.20) in the intervention areas, but not significantly. However, there was a significant decline observed in the nutritional status of PLW in control areas (57.2% at baseline; 54.1% at endline; p = 0.04).

Anemia Status of PLW

Overall, there was a reduction in the prevalence of moderate and severe anemia in the intervention and control areas. There was a significant reduction in the prevalence of severe anemia (9.5% at baseline to 4.8% at endline, p<0.001) and moderate anemia (69.9% at

baseline to 58.6% at endline, p<0.001) among PLW in the intervention areas. Additionally, a significant decrease in severe (8.6% at baseline; 6.5% at endline; p = 0.012) and moderate anemia (77.0% at baseline; 67.3% at endline; p<0.001) among PLW was observed in control areas.

Household Consumption Pattern

The household consumption pattern was assessed through a household 24-hour recall of specified food groups at baseline and endline. Consumption of cereals and tubers was common among all households, both in the intervention (99.2% at baseline; 99.5% at endline) and control areas (99.9% at baseline; 99.4% at endline). Moreover, a 45.3% increase was observed in the consumption of vegetables (58.1% at baseline; 84.4% at endline; p<0.001), meat products (50.8% at baseline; 62.6% at endline; p<0.001) and dairy products (97.7% at baseline; 99.8% at endline; p<0.001) among households who received BCC messages on nutrition and health in the intervention areas.

Conclusion

In conclusion, the findings of the baseline and endline surveys demonstrate the plausibility of achieving nutrition gains and preventing stunting in children under five in the short term with nutrition-based supplementation delivered through the primary healthcare system.

With three years of programme implementation, the nutritional status – stunting and underweight – improved significantly for children under five years. A 10% reduction was identified in the prevalence of stunting in children under five years of age in the intervention areas. Moreover, a significant 8% decrease was observed in the prevalence of underweight in the intervention areas. Our findings show a significant reduction in the prevalence of anemia in children under five and PLW receiving the intervention.

Overall, the study findings demonstrate the positive impact of nutrition-based supplementation on nutritional status of PLW, maternal anemia, nutritional status of children and child anemia. This shows that nutrition-based supplementation is an effective method to protect mothers and children from malnutrition caused by food insecurity and lack of timely access to quality, adequate age-appropriate nutritious foods in vulnerable countries such as Pakistan. This provides solutions in the short term while longer term measures to combat malnutrition holistically are put in place.

1.

INTRODUCTION

1. INTRODUCTION

Childhood stunting is defined as height or length that is two or more standard deviations below the WHO child growth standards [1]. It is a result of many factors, some of which are poor nutritional intake, frequent infections and poor psychosocial stimulation [2]. Stunting is impaired growth and development experienced by a fetus in the womb and continuing until the child is two years of age – the 1,000 days' window of opportunity [2-4]. Impaired growth and development have multiple adverse consequences on children; consequences include lower cognitive development, lower IQ scores, increased risk of death from infectious diseases and reduced schooling attainment, low productivity and increased risk of non-communicable diseases, which ultimately affects adult income levels [5-14]. Hence, stunting not only has health consequences, but also greatly impacts human capital and economic growth at the individual, household and national level [5]. Research has shown that stunted children are 33% less likely to escape poverty in adulthood [15]. With a combined impact of these consequences, stunting prevalence can contribute to GDP losses of 4-11% in Africa and Asia.

In Pakistan, micronutrient deficiencies are widespread across all age groups, particularly among PLW and children under five. According to the National Nutrition Survey, 10.5% of women are undernourished (BMI<18.5 kg/m^2), 51% of women are anaemic, 44% of the children under five years are stunted; 31% are underweight; 15% are wasted; 46% are vitamin A deficient; 44% are iron deficient; 62% are

anaemic and 40% are deficient in zinc [16]. As the bearers of the future generation, these women give birth to the future of the country – the future workforce and human capital. However, by failing to tackle the widespread micronutrient deficiencies and malnutrition among PLW and children, the present and future of Pakistan can be put on a dangerous downward trajectory. Based on recent research, the country is already experiencing economic consequences of stunting in the form of 177, 000 child deaths annually, low educational attainment, reduced labour productivity and a high burden on the health system [17]. This amounts to the country losing 3% of its GDP annually, equal to about USD 7.6 billion due to malnutrition.

Across the country, Sindh has one of the highest rate of acute and chronic malnutrition, with 17.5% of children being wasted, 47.3% being stunted and 39.8% being underweight [18]. Further intensifying the situation is the widespread food insecurity in Sindh - more than 70% of households are unable to afford an adequate nutritious diet [19]. According a provincial survey conducted in Sindh, 15.4% of children were wasted, 48.0% were stunted and 42.0% were underweight [20]. Within the province, Thatta and Sujawal are two districts where more than 50% of children under five are stunted and underweight, while 20% of children are wasted - a major public health concern. The situation is further exacerbated by the frequent occurrence of natural disasters (floods and droughts), which have increased the vulnerabilities of the communities, depleted their savings, destroyed their source of earning and negatively impacted their nutritional status.

In order to address stunting through the first 1000 days' window, both the global and regional experts have sought to reduce stunting through investment in proven nutrition interventions such as antenatal micronutrient supplementation for pregnant and lactating women (PLW), counselling mothers on infant and young child feeding (IYCF) practices, provision of nutrition-based supplementation (balanced energy-protein supplementation) to PLW, intermittent presumptive treatment of malaria in endemic areas for pregnant women, vitamin A supplementation for children under five and prophylactic zinc supplementation for children and public provision of nutrition-based supplementation for children [21].

Balanced energy-protein supplements refer to as nutrition-based supplements contain less than 25% protein as their total energy content. These supplements are intended for pregnant women who are undernourished or at risk of becoming undernourished, and promote gestational weight gain and improve birth outcomes. Globally, maternal supplementation with balanced energy-protein supplements have shown a 34% reduction in the risk of small-for-gestational-age babies and stillbirths [22,23]. Moreover, research has demonstrated a

32% reduction in the risk of low birthweight [24]. In terms of children provided with nutrition-based supplements, regardless of nutrition counselling, were shown to improve weight gain and height gain among children under two years of age. Another study found that the provision of nutrition-based supplements reduced stunting for children under two years of age by 67% in food insecure populations [25].

There is considerable evidence on the effectiveness of nutrition-based interventions in preventing and managing stunting in developing countries [26-32]. However, these studies do not account for the local environmental factors and widespread nutrient deficiencies in Pakistan. These studies are often conducted in controlled environments, where the results cannot be generalized to programs operating under field conditions. Hence, the Government of Pakistan and WFP commissioned a Stunting Prevention Programme, consisting of a preventative nutrition-based approach using the primary healthcare system and an operational research study of nutrition-based interventions to determine the impact, advantages and optimal length of supplementation for children (6–59 months), and PLW.

The Stunting Prevention Programme consisted of a preventative nutrition-based approach to prevent stunting in children under five years of age, with a priority on children under two years of age, in districts of Thatta and Sujawal, Sindh. To ensure the prevention of stunting in children, the programme focused on the 1,000 days' window of opportunity, where specialized nutritious food (WSB/Maamta for PLW; Wawamum/LNS for children 6-23 months; MNPs for children 24-59 months) and key nutrition, health and hygiene messages were provided to PLW and children aged 6-59 months. The programme was integrated in the primary healthcare system, through the LHW Programme, where LHWs provided the interventions to the targeted PLW and children aged 6-59 months.

The Programme was implemented during 2014-2017, in 29 union councils (UCs) of districts Thatta and Sujawal, Sindh Pakistan. The Programme was evaluated through robust research methodologies including a cross-sectional baseline and endline intervention comparison and a nested randomized controlled trial (RCT). The cross-sectional baseline and endline surveys were designed to assess the impact of the programme interventions on a representative sample of households in the targeted areas of the Stunting Prevention Programme.

The baseline household survey was conducted between May and August 2014, and the endline survey was conducted between November and December 2017 by Aga Khan University (AKU) in collaboration with the Department of Health, Government of Sindh and with technical and financial support from the World Food Programme (WFP). The surveys

collected information on socio-demographic characteristics, food consumption, food security, anthropometric measurements, and access to health facilities, willingness to use food supplements in the near future and exposure to other interventions in the study area. Spot haemoglobin (Hb) was also measured to estimate the prevalence of anaemia among the target population. This report summarizes the findings of baseline and endline cross-sectional surveys.

1.1 OBJECTIVES OF CROSS-SECTIONAL SURVEYS

The objectives of the cross-sectional surveys were to assess the prevalence and impact of nutrition-based supplementation on;

a. Nutritional status of pregnant and lactating mothers and children under five years of age.
b. Morbidity in pregnant women, lactating mothers and children under five years of age.
c. Stunting, wasting and underweight in children under five year of age.
d. Household food consumption patterns.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2.

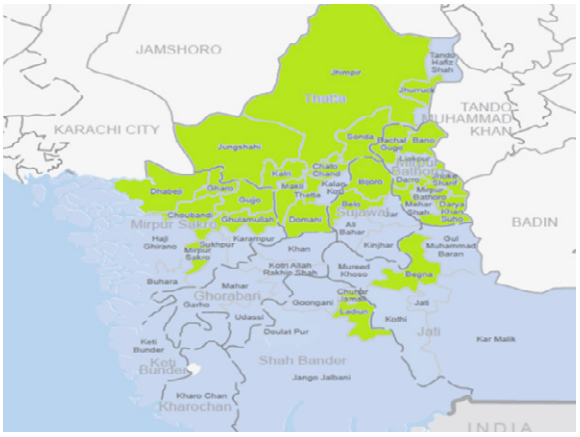
METHODS

2. METHODS

2.1 STUDY SETTING

The cross-sectional household surveys were conducted in 29 UCs of Thatta and Sujawal districts, Province Sindh, Pakistan. These districts are located in the southern part of province Sindh, Pakistan. Thatta and Sujawal have a population of approximately 1.5 million and an area of 17,355 square kilometres, which occupies 12.3% of the total geographical area of Sindh.

Figure 3: Map of Thatta and Sujawal Districts, Stunting Prevention Programme



*Green highlighted are stunting project areas

2.2 TARGET POPULATION

The target population for the cross-sectional surveys was pregnant and lactating women and children 0-59 months of age.

2.3 STUDY DESIGN

A cross-sectional survey design was conducted on a sub-set of the stunting prevention programme population to assess the impact of nutrition-based supplementation provided to women during pregnancy and the first six months of lactation, children 6-23 months and children 24-59 months.

Pregnant women received a monthly ration of 5 kg (i.e. 165 grams/day) of wheat soya blend (WSB) during pregnancy and during the first 6 months of lactation period. WSB is a mixture of partially cooked cereals, pulses, soya and beans that are fortified with vitamins and minerals. On average, PLW were provided supplementation for a duration of nine months. However, as of January 2017, the programme intervention protocols for PLW were changed to the provision of 5kg of Maamta (a locally produced LNS) rather than the WSB. Maamta is a supplement to enrich the dietary intake of PLW. The product can be eaten directly from the package, with no dilution, mixing or cooking needed. Contrary to WSB, Maamta has shown to increase the nutrient intake for PLW, while reducing the common intra-household food sharing.

Children 6-23 months received a daily ration of 50 grams/day of lipid-based nutrient supplement (LNS), a locally produced version called Wawamum, to cover the recommended daily allowance (RDA) of most micronutrients and 260 kcal of energy (about 1/4th of the daily energy requirements). On average, these children were provided supplementation for a duration of six months. LNS are called lipid-based because a significant portion of the calories are drawn from oil, containing vegetable oil, skim milk powder and chickpeas.

Children aged 24-59 months received a sachet of micronutrient powder (MNP) containing the RDA for 15 micronutrients every alternate day for six months. MNPs are single-dose sachets containing vitamins and minerals in a powdered form that can be added to any semi-solid food. It is used to help increase micronutrient intake without adjusting the dietary habits of children.

A blanket approach was used for the distribution of nutrition-based supplementation to PLW, children 6-23 months and children 24-59 months delivered through the LHW programme. The control group received routine public and private health services available within the area. Often, these public health services consisted of the Basic Health Unit (BHU), Rural Health Center (RHC), Taluka Hospital, District Headquarter Hospital (DHQ) and local healers available in the community.

2.4 SAMPLE SIZE

The sample size was calculated for comparing two cross-sectional surveys, while assuming the baseline prevalence of stunting to be 49% in Sindh with a 10% reduction in the prevalence of stunting during the three- year implementation of the Stunting Prevention Programme. For estimating impact of the interventions (α=0.05, power=0.80), each group had 3200 participants. To account for dropouts and data errors, the sample size was increased by 15% giving a new total of 7360 study participants (3680 participants per group).

Information was collected from 4,350 households at baseline and 4,283 households at endline. From the households selected at baseline, the study participants were 1829 pregnant women, 1948 lactating women and 2195 children under five. From the households selected at endline, the study participants were 1884 pregnant women, 2164 of lactating women and 2923 children under five.

2.5 SAMPLING STRATEGY

A two-stage cluster sampling technique was used to select households for interviews. In the first stage, a total of 29 clusters (UCs) were selected from the geographic areas. In the second stage, a Population Proportion to Size (PPS) sampling method was used to select households to be interviewed from each of the selected areas per UC. All households with PLW and children 0-59 months of age were eligible for the baseline and endline surveys. Eligible participants were selected randomly from a complete household listing created using the LHW family register for the intervention areas and social mapping approach for control areas. For the study control areas, a social mapping approach was used, where data collection teams met with health facility officials and community members (elders, mothers, community based birth attendants, midwives, and social workers) to identify eligible households with PLW and children for interviews.

2.6 NUTRITIONAL STATUS AND ANAEMIA ASSESSMENT

To assess the nutritional status of children, their height, weight and MUAC were measured through SECA anthropometry kits (height boards, weighing scales, MUAC tapes). The anthropometric measures together with the age and gender of the infants at six months were used to calculate the weight-for-age (underweight), length/height-for-age(stunting) and weight-for-height (wasting) z-scores. Prevalence of malnutrition in its different forms (underweight, wasting and stunting) was calculated using the z-score cut-off point of ≤ 2 from the WHO 2006 growth standards. Furthermore, anaemia was defined as haemoglobin levels <11gm/dl. HemoCue meters (Mod. Hb 201+ & Hb 301+) were used to estimate haemoglobin blood concentration in children and women. All equipment for anthropometric and anaemia assessment was provided by WFP.

2.7 HOUSEHOLD QUESTIONNAIRE

A combined household survey questionnaire was developed in consultation with WFP, the government and all other relevant stakeholders. The questionnaire was pre-tested in the field and changes were incorporated accordingly before actual data collection. The printed questionnaires used by data collectors were available in both English and Sindhi.

The household questionnaire was used at baseline and endline for all study participants (PLW and children under five) to collect data on household socio-demographic information, exposure to other interventions, access to healthcare services, willingness to use food supplements, and household food consumption. The questionnaire also had three individual sections; one for PLW, one for children 6-23 months and one for children 24-59 months. The section of the questionnaires for PLW collected basic information on her gestational age, reproductive history, antenatal care, morbidity and care seeking practices, exposure to interventions, anthropometry and haemoglobin levels. The section for children 6-23 months and children 24-59 months collected information on their length/height, weight, MUAC, haemoglobin levels, morbidities, care seeking practices and exposure to interventions.

2.7.1 MATERNAL AND CHILD MORBIDITY

Morbidity was assessed retrospectively for the previous two weeks, by asking PLW or the child's mother whether they had been ill in the past two weeks. Symptoms were also investigated; although for programmatic interest and simplicity, we chose to only ask about diarrhoea, cough, fever, rapid breath or respiratory tract infections for children and care seeking patterns during illness.

2.7.2 MULTI-MICRONUTRIENT SUPPLEMENTATION AND TETANUS TOXOID (TT) VACCINATION FOR PREGNANT AND LACTATING WOMEN

The proportion of women who received the multi-micronutrient supplementation and tetanus toxoid (TT) vaccination was estimated through participant recall by data collectors. Women reported whether they had received micronutrient supplementation, iron and folic acid or TT vaccine during their last pregnancy. If the women responded yes; then follow-up information related to the duration of supplementation and number of doses was obtained through questions.

2.7.3 VITAMIN A SUPPLEMENTATION AND VACCINATION COVERAGE IN CHILDREN UNDER FIVE

The proportion of children who received vitamin A in the last six months was estimated through maternal recall or immunization cards by data collectors. Mothers of selected children reported whether their child had received a vitamin A capsule during the last six months. In order to help with recall, a sample of the vitamin A capsule was shown to the mother during the interview. Information on immunization coverage was collected in two ways: from immunization cards or maternal recall. If the immunization card was available, the interviewer copied the immunization dates directly onto the questionnaire. When there was no immunization card, or if a vaccine had not been recorded on the card as being administered, the mother was asked to recall the specific vaccines given to her child and to show the BCG scar.

2.7.4 HOUSEHOLD FOOD CONSUMPTION

The survey also collected anthropometric data on women and children; measures of household food consumption; and information on household dietary diversity. Household food consumption was assessed using a comprehensive list of food items from the four food groups through participant recall.

2.8 FIELD TEAM TRAINING SESSIONS

The data collection teams received a 6-day hands-on training on data collection techniques, anthropometric measurements, haemoglobin testing, ethical issues and data collection tools. The first training was provided during the last week of April 2014, prior to the baseline data collection. A three-day refresher training for endline data collection was provided during the first week of November 2017. As part of the training, measurements for weight, height and MUAC were taken on six children. The measurements were taken twice, once by the team leader and once by the enumerators. The accuracy (differences between the enumerator values and the team leaders' values) and precision (differences between the two measurements taken by each enumerator) were subsequently calculated. A one-day field testing session was carried out before the actual field work. A survey manual was provided to each team leader, which included instructions, methodology and sampling

strategy. All questionnaires were pre-tested in the field and changes were incorporated accordingly before actual data collection. The printed questionnaires used by data collectors were available in both English and Sindhi.

2.9 FIELD TEAM COMPOSITION

Enumerators and team leaders were hired locally from Thatta and Sujawal districts for the study. A total of 16 enumerators, 4 team leaders, 2 desk editors and 2 supervisors were hired and participated in the training sessions. For data collection, enumerators worked in teams of four - 2 enumerators were responsible for anthropometric measurements and Hb testing, while the other 2 were responsible for completing the questionnaires. The enumerators' roles were exclusive and teams were requested not to exchange roles during data collection. The team leader was responsible for the supervision of daily field activities and questionnaire review.

2.10 FIELD MONITORING & SUPERVISION

Each team leader was responsible for checking data quality, ensuring correction of mistakes, retaking measurements if needed and assessing team work. Morning meetings were conducted by the team leader every day. Once the field work was completed, data collection teams returned to the office for reviewing questionnaires before submitting them to the concerned supervisor. The field supervisor and desk editor were responsible for reviewing the completed questionnaires for errors and inconsistencies. In case any errors and inconsistencies were identified, the questionnaires were returned to the data collectors for correction from the field.

2.11 STEERING COMMITTEE FOR STUNTING PREVENTION PROGRAMME

A Steering Committee was established to provide a coordination platform for the relevant Government Departments, Vertical Programmes, Development Partners and UN agencies to supervise, monitor and review the implementation of the Stunting Prevention Programme in Sindh.

Figure 4: Steering Committee for Stunting Prevention Programme

Overall Objectives:

1. To supervise the planning, implementation, monitoring and evaluation of the Stunting Prevention Programme
2. To review the ongoing research component being managed by AKU
3. To establish and strengthen linkages, collaboration and communication among key stakeholders and academia
4. To provide technical input based on the latest scientific best practices (articles in indexed journals) to support implementation
5. To review and provide recommendations to the Health Department on new upcoming projects or initiatives related to stunting prevention in Sindh

Specific Responsibilities:

1. Ensure that necessary steps are taken towards implementation of the agreed recommendations
2. Monitor implementation, review monitoring reports and implement options for the improvements
3. Sharing of regular programme progress by the National Programme, Nutrition Cell and other relevant partners
4. Oversight and discussion on research being carried out for stunting prevention (including baseline, process and impact evaluation)
5. Review membership of steering committee
6. Joint monitoring of ongoing activities with special focus on behaviour change communication and immunization

CHAIR: Director General, Health Department, Government of Sindh
CO-CHAIR: Provincial Coordinator, National Programme for Family Planning and Primary Health Care.
MEMBERS: Representatives from Nutrition Cell, MNCH Programme, District Health Office, WFP, UNICEF, WHO, Merlin, AKU, PMRC and EPI Programme.

2.12 DATA ENTRY AND STATISTICAL ANALYSIS

Descriptive statistics were obtained through simple frequency tables, which provided information on socio-economic and demographic data. To assess the nutritional status of children, their height, weight and MUAC were measured through SECA anthropometry kits. The anthropometric measurements together with the age and gender of the children were used to calculate the weight-for-age, height-for-age and weight-for-height z-scores. Prevalence of malnutrition in its different forms (underweight, wasting and stunting) was calculated using the z-score cut-off point of ≤ 2 using the WHO growth standards. Furthermore, a Pearson Chi Square test was used to establish an association between various factors and growth parameters such as stunting, wasting and underweight. Anaemia was defined as haemoglobin levels <11gm/dl.

All data was double entered to achieve a satisfactory level of accuracy. Data quality was assured by performing dual and error checks simultaneously during data entry. Visual Fox Pro was used for designing of databases, data entry software and procedures for data quality assurance. Data entry screens contained range and consistency checks and steps to minimize entry of erroneous data. Special arrangements were made to enforce referential integrity of the database to ensure all data tables are related to each other without any issues. Anthropometric data was managed through the ENA SMART software for analysis, monitoring and quality assurance. For comparison, p values below 0.05 were considered statistically significant. All analysis was performed on STATA version-15.

2.13 ETHICAL CONSIDERATIONS

Written informed consents were obtained from all participants at the time of enrolment in the trial. The consent forms comprised of outlines of the objectives, measurements and process of confidentiality of the study. Participant privacy and confidentiality in electronic and printed data, publications, and reports during and following completion of the survey was ensured. The Ethics Review Committee (ERC) of Aga Khan University granted approval for the study trial. Furthermore, the National Bioethics Committee (NBC) of Pakistan approved the study for human subject research. The study was registered in ClinicalTrials.gov with registration number NCT02422953 on April 15, 2015.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3.

RESULTS

3. RESULTS

KEY FINDINGS:

- Stunting Reduction →10%
- Underweight Reduction → 8%
- Child Anemia Reduction →13%
- PLW Improvement in Nutritional Status →3%
- PLW Severe Anemia Reduction → 50%

3.1 DEMOGRAPHIC CHARACTERISTICS OF STUDY PARTICIPANTS

Through the household questionnaires, information was collected from 4,350 households at baseline and 4,283 households at endline. From the households selected at baseline, the study participants included 1,829 pregnant women, 1,948 lactating women, and 2,195 children under five, with an average of 6.6 people per household. From the households selected at endline, the study participants included 1884 pregnant women, 2164 lactating women, and 2923 children under five, with an average of 7.2 people per household. Hence, the total participants at baseline were 28,700 and 30,965 at endline. Patriarchy appeared to be the norm in the study area, since majority of the households (99%) were headed by males. The distribution of study participants across target groups (pregnant women, lactating mothers and children 6-59 months) was similar at baseline and endline as well as study groups [Table 1].

Table 1: Demographic Characteristics of Study Participants

	Intervention		Control	
	Baseline	Endline	Baseline	Endline
Households surveyed	2363	2199	1987	2084
Population	16431	16006	12269	14959
Household density	7.0	7.3	6.2	7.2
Gender ratio (M:F)	1.05	1.01	1.01	1.03
Gender of head of household				
Male	2326 (98.4)	2180	1976	2071
Female	37 (1.6)	19	11	16
Gender of all household members				
Male	8404 (51.2)	8030 (50.2)	6169 (50.3)	7592 (50.7)
Female	8027 (48.8)	7976 (49.8)	6100 (49.7)	7367 (49.3)
Number of study participants				
Pregnant women	912	947	917	937
Lactating mothers	1009	1118	939	1046
Children <6 months	314	408	272	347
Children 6-23 months	917	1102	692	1066
Children 24-59 months	2111	2034	1713	2067

3.2 SOCIOECONOMIC CHARACTERISTICS OF STUDY PARTICIPANTS

Table 2 demonstrates the socioeconomic characteristics of the household, including access to improved water, household conditions, improved toilet facilities, availability of electricity, type of main fuel, ownership of agriculture land, livestock and wealth quintiles at baseline and endline. The results indicate that majority of households (more than 80%) had access to improved water for drinking in both study areas. Housing conditions, consisting of finished floors, roofing and walls were comparatively better in the intervention areas as compared to the control areas at baseline and endline surveys.

Within the study areas, a larger number of households in the intervention areas were found to have access to electricity and improved toilet facilities. Firewood was the most common fuel used for cooking in the study areas. Majority of households had only one room designated for sleeping in intervention (71% at baseline; 68.8% at endline) and control areas (81% at baseline; 75.1% at endline). Regardless of study areas, most households had access to water and soap and had a place for handwashing at baseline and endline. Only 12.6% of households from the intervention areas and 18% from the control areas owned agricultural land, while 36% and 27.2% of households owned livestock or poultry at baseline and 27.1 and 31.7% at endline.

Table 2: Socioeconomic Characteristics of Study Participants

	Intervention		Control	
	Baseline (n=2363)	Endline (n=2199)	Baseline (n=1987)	Endline (n=2084)
Percentage of households with;	%	%	%	%
Improved water	80.6	76.8	84.5	88.3
Finished floor	39.6	40.0	14.7	19.0
Finished roofing	42.5	37.2	17.0	20.2
Finished walls	47.4	46.9	18.9	23.4
Electricity	77.9	72.2	57.1	49.7
Improved toilet facilities	48.1	18.6	16.2	5.4
Wood as fuel for cooking	83.1	84.6	98.8	93.3
Single room used for sleeping	71.3	68.8	81.5	75.1
Owned agricultural land	17.9	12.6	15.9	18.0
Owned livestock, animals or poultry	36.2	27.1	27.2	31.7
Place for handwashing is available	84.0	54.0	81.0	46.3
Water is available	81.2	88.6	73.3	83.5
Water and soap or other cleansing agent are present	58.7	61.2	55.7	43.9

3.3 MAJOR SOURCES OF HOUSEHOLD INCOME IN THE STUDY AREAS

More than half of the households in the study areas (58% at baseline; 63% at endline) relied on casual work or labour work as their main source of livelihood [Table 3]. The second source of household income was agriculture or agriculture related work; however, this was more common among the control areas (7.5% versus 21% at baseline; 7.5% versus 17.5% at endline). Employment within the government was mentioned as the third most common source of household income at baseline and endline (~10% in intervention; ~2% in control). Other sources of household income were self-owned business, livestock, fish farming, selling handicrafts, selling firewood, selling charcoal, and jobs in the private sector.

Table 3: Major Sources of Household Income in Study Areas

	Intervention		Control	
	Baseline (n=2363)	Endline (n=2199)	Baseline (n=1987)	Endline (n=2084)
	%	%	%	%
Casual / wage labour (non-agriculture)	58.0	64.2	59	62.7
Job in Government sector	9.4	8.0	2.2	2.6
Casual/ wage labour (agriculture)	7.5	7.5	21	17.5
Trade, commerce, shop	7.1	5.1	2.4	3.6
Agriculture	3.3	2.2	3.0	4.7
Fishing, fish farming	2.8	3.0	5.0	1.6
Sale of handicrafts	4.3	2.2	4.0	1.2
Collection and sale of firewood	0.5	0.3	0.9	0.6
Sale of charcoal	2.5	0.7	0.8	0.7
Petty trade (street vendor)	1.4	0.6	0.4	0.6
Job in private sector	2.8	1.9	1.0	1.2
Other jobs	0.4	2.5	0.1	1.6
Livestock, sale of livestock / animal products	0.3	1.7	0.5	1.3

3.4 ACCESS TO HEALTH FACILITIES AND HEALTH SEEKING BEHAVIOURS AMONG STUDY PARTICIPANTS

Table 4 presents data on access to health facilities and community health seeking behaviours in the study area. The results revealed that distance to the nearest health facility was not a barrier for the intervention areas as majority of participants were required to travel less than 6 km to access a health facility. In the control areas, however, distance was observed as a major barrier since most participants needed to travel more than 6 km to access a facility. Irrespective of the distance to a health facility, the care seeking behaviours were similar (more than 95%) in both study areas at baseline and endline.

Other barriers identified in seeking care were lack of basic services provided at the health facility (intervention: 59.7% at baseline to 34.2% at endline; control: 9.5% at baseline to 45.5% at endline), cost of transportation (intervention: 2.6% at baseline to 36.7% at endline; control: 47.6% at baseline to 23.8% at endline), and cost of treatment (intervention: 10.4% at baseline to 49.4% at endline; control: 40.5% at baseline to 45.5% at endline). Spouse or family approval to seek care was a barrier for a limited number of participants in the intervention (15.6% at baseline; 5.1% at endline) and control (4.8% at baseline; 0.0% at endline).

In the intervention areas, majority of women (96% at baseline; 99% at endline) were aware of the presence of LHWs and received LHW visits for vaccinations (74% at baseline; 70% at endline) and provision of nutritional supplements (35% at baseline; 31% at endline).

Table 4: Access to Health Facilities and Health Seeking Behaviours among Study Participants

	Intervention		Control	
	Baseline (n=2363)	Endline (n=2199)	Baseline (n=1987)	Endline (n=2084)
Distance to nearest health facility	%	%	%	%
< 1 Km	19.6	3.9	0.4	0.2
1 - 2.5 Km	33.1	42.5	9.9	15.5
2.6 - 6.0 Km	35.9	33.6	35.2	22.7
> 6.0 Km	11.4	19.9	54.5	61.2
Don't Know		0.1		0.3
Usually seeking care for illness from health facility	96.1	96.4	97.8	95.2
Main barriers in accessing health services				
Health facility is very far	9.1	30.4	35.7	15.8
Absence of basic facilities at health facility	59.7	34.2	9.5	45.5
Can't afford transportation cost	2.6	36.7	47.6	23.8
Can't afford medical cost	10.4	49.4	40.5	45.5
No permission from husband/family members	15.6	5.1	4.8	0.0
No 24 hours service	2.6	0.0	0	0.0
Presence of LHW in area	96.2	99.4	0.1	0.8
Purpose of LHW's last visit				
Information on mother and child health	7.0	4.5	0	0.0
Contraceptive supplies	4.1	1.0	0	0.0
Referred to health facility	0.2	0.0	0	0.0
Treatment of side effects	0.1	0.2	0	0.0
Vaccination	74.2	70.0	0	0.5
Treatment for mother and child	0.7	0.8	0	0.0
Nutritional supplements	35.1	30.9	0	0.0
Others	0.1	0.0	0	0.0

3.5 EXPOSURE TO OTHER AVAILABLE INTERVENTIONS IN THE STUDY AREAS

As part of the questionnaire, information was collected on a household's exposure to other available interventions in the study areas [Table 5]. The questionnaire revealed that about 20% of households received cash transfers from Benazir Income Support Programme (BISP) at baseline in the past three months. At endline, only 1% of households in intervention areas and 2.3% of households in control areas received cash transfers from BISP in the past three months. More than half of the PLW and children received Maamta and Wawamum, whilst only 31% of children received MNP in the intervention areas at endline. There was significant improvement in the percentage of PLW receiving BCC messages from LHWs in the past three months in the intervention areas (0.8% at baseline; 37.1% at endline, $p<0.001$). All PLW reported receiving BCC messages from LHWs at baseline in the intervention areas, while only one PLW in the control areas mentioned receiving BCC messages from polio vaccinators during past three months.

Table 5: Exposure to Other Available Interventions in the Study Areas

	Intervention				Control			
	Baseline	Endline	% difference	P-value	Baseline	Endline	% difference	P-value
Wawamum for children	36.3	43.7	20.4	<0.001	0.0	0.3	-	0.010
RUTF for children	7.7	0.8	-89.6	<0.001	0.3	0.0	-100.0	0.1
MNPs for children	18.7	31.2	66.8	<0.001	0.1	0.1	0.0	0.962
WSB/Maamta for women	30.9	35.0	13.3	0.003	0.6	0.1	-83.3	0.0
Wheat flour (Atta)	2.8	0.6	-78.6	<0.001	0.4	0.0	-100.0	0.028
Cash money	17.4	1.0	-94.3	<0.001	22.2	2.3	-89.6	<0.001
Cash voucher	3.9	0.0		<0.001	7.2	0.1	-98.6	<0.001
Food voucher	0.4	0.1	-75.0	0.046	0.1	0.0	-100.0	0.147
Medicines, health assistance	1.9	0.2	-89.5	<0.001	0.2	0.1	-50.0	0.381
Support for education fees, uniforms, books	2.2	0.0		<0.001	0.3	0.1	-66.7	0.138
Nutritional education	0.8	37.1	>100	<0.001	0.0	0.0	-	0.329

3.6 STUDY PARTICIPANTS' KNOWLEDGE ON MICRONUTRIENTS

Questions were asked to determine the participants' level of knowledge on micronutrients at baseline and establish if there were improvements in their knowledge through the BCC messages at the time of the endline survey [Table 6]. The endline survey results revealed that knowledge of micronutrients improved more in the intervention areas than in the control areas. There were significant improvements in knowledge of vitamins (62% at baseline; 78% at endline, p<0.001), vitamin A (28% at baseline; 41% at endline, p<0.001), anaemia (65% at baseline; 81% at endline, p<0.001) and iodized salt (42% at baseline; 61% at endline, p<0.001) in the intervention areas. A similar trend was observed in knowledge of micronutrients in control areas.

Table 6: Study Participants' Knowledge on Micronutrients

	Intervention				Control			
	Baseline	Endline	% difference	P-value	Baseline	Endline	% difference	P-value
Knowledge on vitamins	36.3	43.7	20.4	<0.001	0.0	0.3	-	0.010
Knowledge on vitamin A	7.7	0.8	-89.6	<0.001	0.3	0.0	-100.0	0.1
Knowledge on anaemia	18.7	31.2	66.8	<0.001	0.1	0.1	0.0	0.962
Knowledge on iodized salt	30.9	35.0	13.3	0.003	0.6	0.1	-83.3	0.0
Use of iodized salt for cooking	2.8	0.6	-78.6	<0.001	0.4	0.0	-100.0	0.028

3.7 PREGNANCY STATUS AND ANTENATAL CARE

Table 7 describes the pregnancy status and antenatal care (ANC) women in the study received during their current or last pregnancy. At baseline and endline, almost 45% of women were pregnant in the study areas. There was a slight significant increase in the percentage of women who received ANC in the intervention areas over the course of the study (82% in baseline; 83% in endline; $p = 0.05$). A larger significant increase of 5.8% was observed among women receiving ANC in the control areas at endline as compared to baseline ($p<0.001$). The percentage of women who received ANC from skilled provider increased significantly from 81.8% at baseline to 84.1% at endline ($p = 0.04$) in the intervention areas and from 66.2% at baseline to 73.9% at endline ($p<0.001$) in the control areas.

The two recommended tetanus toxoid (TT) vaccinations for pregnant women were received by 41.1% of women during their last pregnancy in intervention areas at baseline and 43% at endline – a 4.6% increase in TT vaccinations at endline ($p = 0.19$). However, in the control areas, 16% of women at baseline and 19.6% of women at endline in control areas received two doses of the TT vaccination, which resulted in a 22.4% significant increase in vaccination rate ($p<0.001$). More than half of the women from the intervention areas received an iron syrup or iron tablets, while a quarter of women from the control areas received an iron syrup or iron tablets throughout the study.

Table 7: Pregnancy Status and Antenatal Care

	Intervention				Control			
	Baseline	Endline	% difference	P-value	Baseline	Endline	% difference	P-value
Current pregnancy	39.2	42.3	7.9	0.001	46.4	44.0	-5.2	0.182
Received ANC	82.3	83.3	1.3	0.050	66.4	70.3	5.8	<0.001
ANC provided by skilled health worker	81.8	84.1	2.8	0.042	66.2	73.9	11.6	<0.001
4+ ANC visits	20.5	22.0	7.0	0.232	6.8	14.4	112.7	<0.001
2+ TT injections	41.1	43.0	4.6	0.194	16.0	19.6	22.4	0.003
Received iron tablets or iron syrup supplementatiom	55.6	54.4	-2.2	0.441	28.5	44.3	55.4	<0.001

3.8 PREVALENCE OF UNDERWEIGHT AND ANAEMIA IN PLW

Irrespective of the study area, three out of every five women were found to be of normal bodyweight (BMI 18.5-24.9kg/m^2) – normal nutritional status – at baseline [Table 8]. Furthermore, more than a quarter of women were found to be underweight (BMI<18.5kg/m^2) at baseline. At endline, a larger proportion of women who received WSB/Maamta were found to have a normal BMI (56.6% at baseline; 58.5% at endline; p = 0.20), normal nutritional status, in the intervention areas. In the control areas, a 3% decline was observed in the proportion of women with a normal BMI over the course of the study (57.2% at baseline; 54% at endline; p = 0.04).

The prevalence of moderate and severe anaemia in women at baseline was similar among the intervention and control areas. However, after the provision of WSB/Maamta as part of the intervention, there was a significant reduction in the prevalence of moderate anaemia (69.9% at baseline; 58.6% at endline; p<0.001) and severe anaemia (9.5% at baseline; 4.8% at endline; p <0.001) among PLW. A significant reduction was also observed in moderate anaemia (77.0% at baseline; 67.3% at endline; p<0.001) and severe anaemia (8.6% at baseline; 6.5% at endline; p<0.01) in the control areas. This significant reduction in anaemia may have been due to the consumption of eggs, fish, and meat in the control areas at the time of the endline survey. These food products are often more consumed during the winter seasons.

Table 8: Prevalence of Underweight and Anaemia in PLW

	Intervention				Control			
	Baseline (%)	Endline (%)	% difference	P-value	Baseline (%)	Endline (%)	% difference	P-value
Anaemia Status								
Severe (Hb<7 g/dL)	9.5	4.8	-49.5	<0.001	8.6	6.5	-24.4	0.012
Moderate (Hb 7-11.99 g/dL)	69.9	58.6	-16.2	<0.001	77.0	67.3	-12.6	<0.001
Normal (Hb>12 g/dL)	20.7	36.6	+76.8	<0.001	14.4	26.2	+81.9	<0.001
BMI								
Underweight (<18.5 kg/m^2)	30.0	29.6	-1.3	0.761	37.4	39.1	+4.5	0.289
Normal (18.5-24.9 kg/m^2)	56.6	58.5	+3.4	0.200	57.2	54.1	-5.4	0.044
Overweight/ obese (>25.0 kg/m^2)	13.4	11.9	-11.2	0.138	5.3	6.9	30.2	0.042

3.9 COVERAGE OF IMMUNIZATION IN CHILDREN UNDER FIVE OF AGE

Baseline and endline surveys collected information on immunization coverage for all children under five years of age enrolled in the study [Table 9]. In terms of the BCG vaccine, about 85% of children in intervention areas at baseline and endline received the vaccine; while in the control areas 58.9% at baseline and 65.9% at endline received the BCG vaccine. Coverage of polio vaccines was relatively high in both areas at baseline and endline surveys. Immunization of PENTA-1 vaccine increased from baseline to endline in the intervention areas (77.5% at baseline; 79% at endline; $p<0.001$) as well as in control areas (48% at baseline;54% at endline; $p <0.001$). Coverage of measles vaccine remained low at endline in both areas compared to baseline survey. There were significant improvements observed in coverage of vitamin A supplementation in both study areas, from 59% to 62% ($p<0.001$) in the intervention areas and from 35% to 44% ($p<0.001$) in the control areas.

Table 9: Coverage of Immunization in Children under Five Years of Age

Type of childhood vaccinations	Intervention				Control			
	Baseline	Endline	% difference	P-value	Baseline	Endline	% difference	P-value
At birth								
BCG	85.4	85.5	0.1	0.921	58.9	65.9	11.8	<0.001
OPV0	91.0	94.2	3.5	<0.001	74.9	93.5	24.9	<0.001
At 6 weeks								
OPV1	76.1	77.7	2.2	0.010	45.6	52.2	14.6	<0.001
PENTA1	77.5	79.0	1.9	0.018	48.1	53.8	11.8	<0.001
PCV1	64.8	71.4	10.1	<0.001	35.3	45.0	27.4	<0.001
At 10 weeks								
OPV2	69.6	69.7	0.1	0.917	37.5	41.9	11.9	<0.001
PENTA2	70.7	70.6	-0.1	0.928	39.3	43.1	9.6	<0.001
PCV2	52.2	60.8	16.6	<0.001	27.6	36.0	30.5	<0.001
At 14 weeks								
OPV3	40.5	48.6	20.0	<0.001	16.1	25.0	54.9	<0.001
PENTA3	41.4	49.3	19.1	<0.001	17.1	25.6	49.9	<0.001
PCV3	13.4	34.6	157.5	<0.001	2.5	17.4	603.2	<0.001
At 9 months								
Measles	80.9	77.9	-3.7	<0.001	59.0	52.8	-10.4	<0.001
Vitamin A (6-59 months of age)	59.3	62.0	4.6	<0.001	34.8	43.9	26.3	<0.001

3.10 PREVALENCE OF CHILD MORBIDITIES IN THE STUDY PARTICIPANTS

Mothers of children under the age of five years were asked whether these children had any diarrhoea, fever, cough, rapid or fast breathing issues in the two weeks preceding the survey [Table 10]. The prevalence of diarrhoea decreased significantly by 46.6% in the intervention areas (33.5% at baseline; 17.9% at endline; p<0.001) and by 26.1% in the control areas (20.7% at baseline; 15.3% endline; p<0.001).

More than 40% of children in intervention and control areas had a fever during the last two weeks at baseline, however at endline the prevalence of fever among children was seen to decrease significantly by more than 30% in the intervention areas and by 20% in the control areas. The prevalence of acute respiratory infections (ARI) symptoms varied in the intervention and control areas at baseline and endline. Children in intervention areas experienced a larger decrease in coughing and irregular breathing as compared to children in control areas at endline.

Table 10: Prevalence of Child Morbidities in the Study Participants

Type of childhood vaccinations	Intervention				Control			
	Baseline	Endline	% difference	P-value	Baseline	Endline	% difference	P-value
Child had diarrhoea in the last 2 weeks	33.5	17.9	-46.6	<0.001	20.7	15.3	-26.1	<0.001
Fever at any time in the last 2 weeks	47.5	32.0	-32.6	<0.001	41.5	33.4	-19.5	<0.001
Cough at any time in the last 2 weeks	24.5	23.2	-5.3	0.324	10.4	26.0	150.0	<0.001
Breathe faster than usual with short rapid breaths	20	17.3	-13.5	0.026	13.5	17.2	27.4	0.002
Fast or difficult breathing	23.4	16.7	-28.6	<0.001	16.4	15.4	-6.1	0.410

3.11 PREVALENCE OF UNDERWEIGHT IN CHILDREN UNDER FIVE YEARS OF AGE

Table 11 describes the prevalence of underweight in children under five years of age at baseline and endline. Among children under five who were provided LNS/Wawamum and MNPs, there was an overall 8.3% reduction observed in the prevalence of underweight in the intervention areas (35.1% at baseline;32.2% at endline; p = 0.50). There was a 2.8% decrease seen in underweight children in the control areas (44.5% at baseline;43.3% at endline; p = 0.44), however the change was not statistically significant.

Boys were found to be comparatively more underweight than girls in both study areas at baseline and endline. At endline, the prevalence of underweight was found to increase as the child's age increased, with a 39.2% increase in underweight among children aged 0-5 months (p 0.034), a 29.7% increase in children aged 6-11 months (p = 0.060), and a 17.6% increase in children aged 12-23 months (p = 0.049) in the intervention areas. However, once the children reached 24 months in the intervention areas, there was a steady decline observed in the prevalence of underweight until they reached 59 months of age. Similar trends were observed in control areas.

Children from the poorest households were more likely to be underweight than children from the richest households at baseline. A considerable reduction of 24.4% was observed in the prevalence of underweight among children from poorest households receiving LNS/ Wawamum and MNPs in the intervention area (41.6% at baseline; 31.4% at endline; p = 0.02). Reductions in the prevalence of underweight in the intervention areas were seen across all wealth quintiles, except the middle wealth quintile. Rather an increase of 13.5% in the prevalence of underweight was identified (33.8% at baseline; 38.4% at endline; p = 0.178). In contrast, there was a 4.3% increase in the prevalence of underweight in the poorest households (44.5% at baseline; 46.4% at endline; p = 0.52) in the control areas.

Table 11: Prevalence of Underweight in Children under Five Years of Age

	Intervention				Control			
	Baseline	Endline	% difference	P-value	Baseline	Endline	% difference	P-value
Overall underweight	35.1	32.2	-8.3	0.050	44.5	43.3	-2.8	0.445
Gender								
Boys	36.7	33.5	-8.7	0.129	44.3	43.8	-1.2	0.821
Girls	33.4	30.9	-7.6	0.225	44.8	42.7	-4.6	0.383
Age Group								
0-5 months	18.3	25.5	+39.2	0.034	24.6	32.1	+30.2	0.049
6-11 months	22.4	29.0	+29.7	0.060	37.5	40.9	+9.1	0.406
12-23 months	35.0	41.2	+17.6	0.049	45.6	50.3	+10.5	0.183
24-35 months	45.5	29.7	-34.6	<0.001	57.7	47.7	-17.4	0.002
36-47 months	45.8	33.7	-26.3	0.003	52.0	43.9	-15.6	0.071
48-59 months	37.7	30.7	-18.6	0.156	37.4	38.1	+1.9	0.890
Wealth Quintiles								
Lowest	41.6	31.4	-24.4	0.023	44.5	46.4	+4.3	0.520
Second	42.0	33.2	-20.9	0.025	47.2	43.5	-7.8	0.259
Middle	33.8	38.4	+13.5	0.178	46.3	45.0	-2.7	0.726
Fourth	37.5	35.0	-6.7	0.415	43.1	40.7	-5.6	0.56
Highest	29.0	25.1	-13.4	0.132	27.8	35.7	+28.5	0.178

3.12 PREVALENCE OF STUNTING IN CHILDREN UNDER FIVE YEARS OF AGE

Table 12 describes the prevalence of stunting in children under five years of age at baseline and endline. There was a statistically significant 10.3% reduction in the prevalence of stunting in children under five years of age (45% at baseline; 40.3% at endline, p = 0.003) who received Wawamum and MNP at the end of the study period. There was no significant difference in the prevalence of stunting in control areas at endline (52% at baseline; 50.8 % at endline, p = 0.46). Irrespective of study areas, boys were found to be more stunted than girls at both baseline and endline. A similar trend was reported in the PDHS 2012-13 and MICS Sindh 2014.

The stunting rates were found to gradually increase across age groups in the intervention areas, with a 28.3% increase in stunting among children 0-5 months and a 14.3% increase in children 6-11 months. However, once the children reached 12 months of age a steady decline in the prevalence of stunting was observed till 47 months of age. In the control areas, similar trends in the prevalence of stunting were identified at baseline and endline.

Overall, children from the poorest households receiving LNS/Wawamum and MNPs were found to have experienced a large reduction of 14.7% (51.7 at baseline; 44.1% at endline; p = 0.102) in stunting as compared to middle income households (42.5% at baseline; 43.2% at endline; p = 0.847), but not significantly. Furthermore, when compared to the poorest households in the control areas, the prevalence of stunting in children under five was found have increased by 8.6% (49.7% at baseline; 53.9% at endline; p = 0.154) at endline.

Table 12: Prevalence of Stunting in Children under Five Years of Age

	Intervention				Control			
	Baseline	Endline	% difference	P-value	Baseline	Endline	% difference	P-value
Overall Stunting	45.0	40.3	-10.3	0.003	52.0	50.8	-2.3	0.462
Stunting by Gender								
Boys	48.2	41.1	-14.6	0.001	54.9	53.0	-3.4	0.413
Girls	41.6	39.6	-4.9	0.347	49.0	48.3	-1.5	0.753
Age Group								
0-5 months	15.1	19.3	+28.3	0.17	26.5	29.6	+11.5	0.42
6-11 months	25.5	29.2	+14.3	0.31	48.5	43.9	-9.6	0.268
12-23 months	48.7	46.3	-4.9	0.456	61.1	57.6	-5.6	0.337
24-35 months	62.1	49.9	-19.6	<0.001	57.7	60.4	+4.7	0.405
36-47 months	59.7	51.8	-13.2	0.059	66.7	59.9	-10.2	0.119
48-59 months	41.9	42.0	+0.2	0.985	45.0	43.8	-2.8	0.808
Wealth Quintiles								
Lowest	51.7	44.1	-14.7	0.102	49.7	53.9	+8.6	0.154
Second	49.5	46.3	-6.6	0.419	52.8	49.7	-6.0	0.334
Middle	42.5	43.2	+1.6	0.847	56.2	51.8	-7.8	0.22
Fourth	45.6	41.4	-9.2	0.188	52.3	51.4	-1.7	0.833
Highest	42.0	32.2	-23.4	<0.001	44.4	43.1	-3.1	0.822

3.13 PREVALENCE OF WASTING IN CHILDREN UNDER FIVE YEARS OF AGE

Table 13 describes the prevalence of wasting in children under five years of age at baseline and endline. At baseline, 13.9% of children in the intervention and 18.7% in the control areas were wasted, whereas this prevalence decreased to 13% in intervention and 17.3% in control areas at endline, respectively. Overall, a similar reduction in wasting was found in the intervention (6.8% decrease; p = 0.382) and control groups (7.7% decrease; p = 0.251). No significant reduction in wasting was observed in both study areas. Similar to underweight and stunting, the prevalence of wasting was higher among boys than girls at baseline and endline; however, when provided LNS/Wawamum and MNPs a larger reduction of 8.6% (p = 0.400) in the prevalence of wasting was observed in boys as compared to girls (3.6% decrease; p = 0.754) in the intervention areas.

The wasting rates were found to gradually increase across age groups in the intervention areas, with a 90.1% increase in wasting among children 0-5 months, a 7.1% increase in children 6-11 months and a 48.7% increase in children 12-23 months. However, once the children reached 24 months of age a steady decline in the prevalence of wasting was observed till 59 months of age. In the control areas, similar trends in the prevalence of wasting were identified at baseline and endline.

Overall, children from the poorest households receiving LNS/Wawamum and MNPs were found to have experienced a large reduction of 33.4% (17.5% at baseline; 11.7% at endline; p = 0.072) in wasting as compared to a 1.2% reduction in middle income households (13.6% at baseline; 13.5% at endline; p = 0.949), but not significantly. Furthermore, when compared to the poorest households in the control areas, the prevalence of stunting in children under five was found have decreased by 12.8% (21.7% at baseline; 18.9% at endline; p = 0.25) at endline. The prevalence of wasting across wealth quintiles in the control areas was found to be similar to the intervention areas.

Table 13: Prevalence of Wasting in Children under Five Years of Age

	Intervention				Control			
	Baseline	Endline	% difference	P-value	Baseline	Endline	% difference	P-value
Overall Wasting	13.9	13.0	-6.8	0.382	18.7	17.3	-7.7	0.251
Gender								
Boys	15.3	14.0	-8.6	0.400	18.5	18.5	+0.1	0.996
Girls	12.4	11.9	-3.6	0.754	19.0	15.9	-16.2	0.087
Age Group								
0-5 months	10.1	19.3	+90.1	0.002	12.6	23.3	+85.2	0.001
6-11 months	15.6	16.7	+7.1	0.709	18.2	20.9	+15.2	0.408
12-23 months	12.8	19.0	+48.7	0.008	19.1	27.6	+44.0	0.006
24-35 months	16.7	7.1	-57.4	<0.001	24.9	10.6	-57.3	<0.001
36-47 months	12.5	4.0	-67.7	<0.001	17.7	8.8	-50.0	0.003
48-59 months	13.8	8.1	-41.6	0.074	11.0	7.8	-29.3	0.278
Wealth Quintiles								
Lowest	17.5	11.7	-33.4	0.072	21.7	18.9	-12.8	0.25
Second	18.4	15.1	-17.7	0.28	20.1	18.9	-5.8	0.653
Middle	13.6	13.5	-1.2	0.949	18.3	16.2	-11.8	0.427
Fourth	13.8	15.1	+9.4	0.564	15.0	19.7	+31.6	0.135
Highest	10.9	10.1	-7.5	0.647	5.6	9.0	+61.3	0.313

Figure 5: Prevalence of Underweight, Stunting and Wasting by Program Area

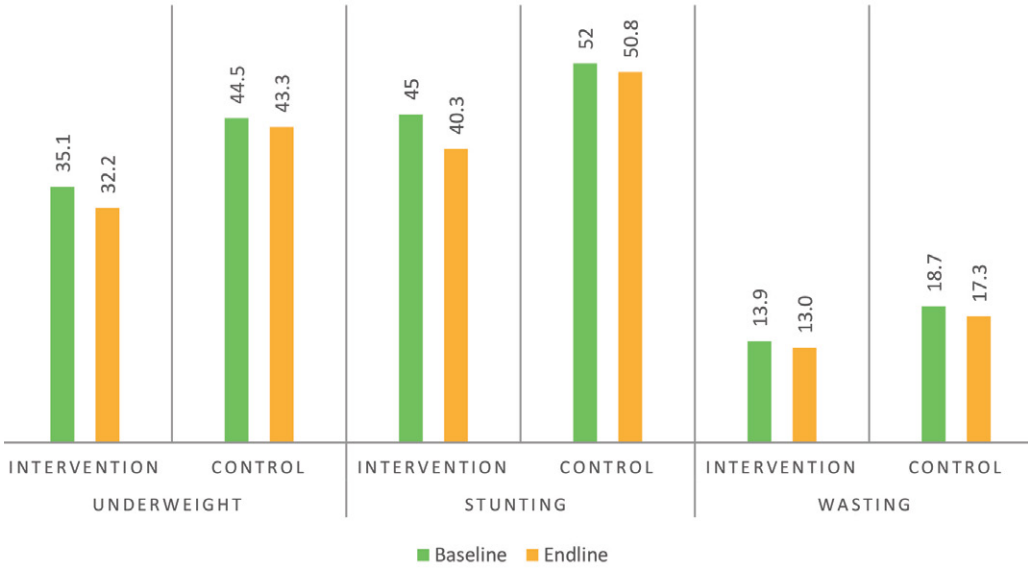
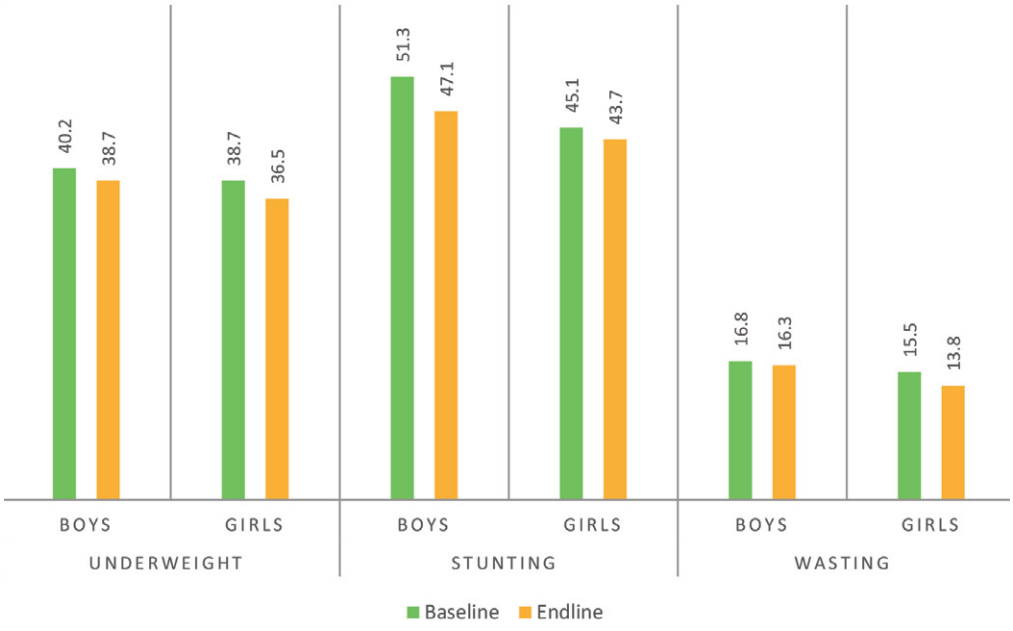


Figure 6: Prevalence of Underweight, Stunting and Wasting by Gender



3.14 PREVALENCE OF ANAEMIA IN CHILDREN UNDER FIVE YEARS

At endline, a 13.3% significant reduction in anaemia was observed in the intervention areas (87.1% at baseline; 75.5% at endline; p <0.001), and 11% decrease in the control areas (86.5% at baseline; 77% at endline; p <0.001) [Table 14]. No gender differences were found in the prevalence of anaemia nor in the reduction of anaemia at endline across study areas.

The prevalence of anaemia among children under five was found to gradually decrease across age groups in the intervention areas, with approximately a 20% decline in anaemia among children 0-5 months, a 10% decline in children 6-11 months, a 4% decline in children 12-23 months, a 7% decline in children 24-35 months, a 10% decline in children 36-47 months and a 20% decline in children 48-59 months. Similar trends in the prevalence of anaemia were identified among children in the control areas.

Children from the poorest households receiving LNS/Wawamum and MNPs were found to have experienced a reduction of 10.5% (84.0% at baseline; 75.2% at endline; p = 0.02) in anaemia as compared to a 12.3% reduction in the poorest households in control areas (87.4% at baseline; 76.6% at endline; p <0.001). Moreover, regardless of household wealth status, a significant reduction in the prevalence of anaemia was observed in the intervention areas. The prevalence of anaemia across wealth quintiles in the control areas was found to be similar to the intervention areas.

Table 14: Prevalence of Anaemia in Children under Five Years

Anaemia levels	Intervention				Control			
	Baseline	Endline	% difference	P-value	Baseline	Endline	% difference	P-value
Anaemic	87.1	75.5	-13.3	<0.001	86.5	77.0	-11.0	<0.001
Severe (<7 g/dL)	7.4	5.2	-28.8	0.005	5.4	5.2	-2.6	0.850
Moderate (7-11.99 g/dL)	79.7	70.3	-11.8	<0.001	81.2	71.8	-11.5	<0.001
Normal (>12 g/dL)	12.9	24.5	+89.2	<0.001	13.5	23.0	+70.4	<0.001
Anaemia by Gender								
Boys	87.5	74.8	-14.6	<0.001	86.1	77.3	-10.2	<0.001
Girls	86.6	76.3	-11.9	<0.001	87.0	76.7	-11.8	<0.001
Age groups								
0-5 months	76.8	56.2	-26.8	<0.001	72.6	58.5	-19.5	<0.001
6-11 months	87.7	78.8	-10.1	0.003	86.3	76.8	-11.0	0.003
12-23 months	91.1	87.6	-3.8	0.081	91.2	86.9	-4.7	0.056
24-35 months	89.7	83.1	-7.4	0.003	91.6	84.6	-7.6	0.001
36-47 months	86.1	72.7	-15.6	<0.001	86.9	78.0	-10.2	0.010
48-59 months	84.4	66.1	-21.7	<0.001	84.1	67.6	-19.6	<0.001
Wealth Quintiles								
Lowest	84.0	75.2	-10.5	0.020	87.4	76.6	-12.3	<0.001
Second	88.6	68.4	-22.8	<0.001	86.5	76.2	-11.9	<0.001
Middle	91.3	79.0	-13.4	<0.001	86.9	81.2	-6.6	0.029
Fourth	87.1	77.2	-11.3	<0.001	86.9	73.0	-16.1	<0.001
Highest	84.7	75.8	-10.6	<0.001	77.8	77.6	-0.3	0.969

*Anaemia (<11 g/dL)

3.15 WILLINGNESS OF MOTHERS TO USE NUTRITION-BASED SUPPLEMENTATION FOR PLW AND CHILDREN UNDER FIVE

A total of 98% of women expressed willingness to use nutrition-based supplements in intervention areas and control areas [Table 15]. There was a significant increase in the willingness of women in the control areas to use nutrition-based supplements (98% at baseline; 99.9% at endline; $p<0.001$), which may indicate that women within the communities perceive LNS/Wawamum, MNPs and WSB/Maamta as an effective method to keep their children healthy. In terms of the women's preference for supplement delivery, 84% of women at baseline and 76.3% at endline in intervention areas preferred delivery of supplements through LHWs directly to their homes and through the LHW Health House.

Table 15: Willingness of Mothers to Use Nutrition-Based Supplementation for PLW and Children under Five

	Intervention				Control			
	Baseline	Endline	% difference	P-value	Baseline	Endline	% difference	P-value
Willingness to use supplements	98.4	98.6	0.2	0.44	98	99.9	1.9	<0.001
Preferred place to pick up supplements								
LHW health house	10.8	17.0	57.4	<0.001	0.4	1.9	375.0	<0.001
Health facility	1.2	1.5	25.0	0.247	7.3	2.0	-72.6	<0.001
Village head/ councillor	2.6	4.9	88.5	<0.001	44.7	6.5	-85.5	<0.001
LHW should deliver at our home	84.7	76.3	-9.9	<0.001	46.8	88.4	88.9	<0.001
Others	0.0	0.0	-	-	0.3	0.7	133.3	<0.001
Don't know	0.8	0.3	-62.5	0.041	0.7	0.4	-42.9	0.218

3.16 HOUSEHOLD FOOD CONSUMPTION PATTERNS

Table 16 shows the percentage of households that consumed food from each of the specified food groups in the last 24 hours prior to baseline and endline survey. Almost all households, both in the intervention and control areas, had consumed cereals and tubers in the last 24 hours prior to the baseline and endline surveys. Moreover, a 45.3% increase was observed in the consumption of vegetables among households who received BCC messages on nutrition and health in the intervention areas (58.1% at baseline; 84.4% at endline; $p<0.001$). Consumption of meat products (50.8 at baseline; 62.6% at endline; $p<0.001$) and dairy products (97.7% at baseline; 99.8% at endline; $p<0.001$) increased significantly among the intervention areas – households which received BCC messages.

Table 16: Household Food Consumption Patterns

	Intervention				Control			
	Baseline	Endline	% difference	P-value	Baseline	Endline	% difference	P-value
Cereals and Tubers (bread, wheat, rice, maize, potato, sweet potato, etc.)	99.2	99.5	0.3	0.267	99.9	99.4	-0.5	0.006
Pulses and nuts (beans, lentils, peas, peanut, etc.)	48.2	38.9	-19.3	<0.001	40	40.4	1.0	0.818
Vegetables	58.1	84.4	45.3	<0.001	45.9	87	89.5	<0.001
Fruits	49.4	48.9	-1.0	0.823	48.2	48.1	-0.2	0.956
Meat, Fish and Eggs (all types)	50.8	62.6	23.2	<0.001	45	57.4	27.6	<0.001
Dairy and dairy products (milk, yogurt, cheese, other milk products)	97.7	99.8	2.1	<0.001	97.9	99.4	1.5	<0.001
Sugar, honey	97.7	99.7	2.0	<0.001	97.9	99.7	1.8	0.030
Oil, fats	97.3	99.7	2.5	<0.001	98	99.6	1.6	<0.001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4.

CONCLUSION

4. CONCLUSION

This report presents the findings of the cross-sectional baseline and endline surveys conducted in Thatta and Sujawal districts, Sindh, during August 2014 and December 2017. The study was designed to assess the impact of the programme interventions on a representative sample of households in the targeted areas of the Stunting Prevention Programme. The programme interventions consisted of the provision of WSB/Maamta to PLW, provision of LNS/Wawamum to children 6-23 months and provision of MNP to children 24-59 months. The study participants were a sub-set population from the Stunting Prevention Programme (PLW, children 6-23 months and children 24-59 months). The control group received standard care as per the recommendation of the Government of Sindh.

Moreover, the surveys collected information on socio-demographic characteristics, food consumption, food security, anthropometric measurements, and access to health facilities, willingness to use food supplements in the near future and exposure to other interventions in the study area. Through this information, the study also assessed the impact of the interventions on the nutritional status of PLW (BMI) and children under five (underweight, stunting and wasting), presence of morbidities, and household consumption patterns. Spot haemoglobin (Hb) was measured to estimate the prevalence of anaemia among PLW and children under five.

The findings of the study revealed that the provision of WSB/Maamta to PLW and LNS/

Wawamum and MNPs to children under five were effective in reducing the prevalence of stunting and underweight among children under five. An overall 10% reduction in the prevalence of stunting was observed in children provided the nutrition-based supplementation, which can be attributable to the Stunting Prevention Programme. An equally impressive reduction of 8.2% was found in the prevalence of underweight in children under five who were provided LNS/Wawamum and MNP the intervention areas.

Moreover, the provision of WSB/Maamta to PLW improved the nutritional status, which resulted in a larger proportion of PLW with a normal BMI, but not significantly. When compared to the control areas, the proportion of PLW with a normal BMI was found to have decreased significantly by 3% over the course of the study. There was a significant reduction in the prevalence of moderate anaemia and severe anaemia among PLW provided WSB/ Maamta. A 13.3% significant reduction in anaemia was observed in the intervention areas, where LNS/Wawamum and MNPs were provided to children under five.

In terms of household food consumption patterns, there were improvements in consumption of vegetables among households who received BCC messages on nutrition and health in the intervention areas. Consumption of meat products and dairy products also increased significantly among households which received BCC messages.

In conclusion, the study shows that is possible to achieve reduction in stunting and achieve nutrition gains in children under five and PLW through a model that provides nutrition-based supplements delivered through primary healthcare.

05. REFERENCES

1. WHO. The WHO Growth Standards. 2018. Available from: https://www.who.int/childgrowth/en/
2. WHO. Nutrition: Stunting in A Nutshell. 2018. Available from: http://www.who.int/nutrition/healthygrowthproj_stunted_videos/en/
3. Dewey KG, Begum K. Long-term consequences of stunting in early life. Matern Child Nutr 2011;7(Suppl 3):5-18.
4. Victora CG, de Onis M, Hallal PC, Blossner M, Shrimpton R. Worldwide timing of growth faltering: revisiting implications for interventions. Pediatrics 2010;125: e473-80.
5. Victora, C.G., M. de Onis, P.C. Hallal, M. Blössner, and R. Shrimpton. 2010. "Worldwide Timing of Growth Faltering: Revisiting Implications for Interventions." Pediatrics 125: e473–e80.
6. Benjamin TC. , Kirk AD., Stephen CA et al. Impact of early and concurrent stunting on cognition. Maternal and Child Nutrition; 2011;7;397-409.
7. Evan D. Peet, Dana C. McCoy, Goodarz Danaei, Majid Ezzati, Wafaie Fawzi, Marjo-Riitta Jarvelin et al. Early Childhood Development and Schooling Attainment: Longitudinal Evidence from British, Finnish and Philippine Birth Cohorts. PLoS One. 2015; 10(9): e0137219.
8. Adair LS, Fall CH, Osmond C, Stein AD, Martorell R, Ramirez-Zea M, Sachdev HS, Dahly DL, Bas I, Norris SA, et al. Associations of linear growth and relative weight gain during early life with adult health and human capital in countries of low and middle income: findings from five birth cohort studies. Lancet 2013; 382:525-34.
9. Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P, de Onis M, Ezzati M, Grantham-McGregor S, Katz J, Martorell R, et al. Maternal and child undernutrition and overweight in low-income and middle income countries. Lancet 2013; 382:427-51.
10. Olofin I, McDonald CM, Ezzati M, Flaxman S, Black RE, Fawzi WW, Caulfield LE, Danaei G; Nutrition Impact Model Study. Associations of suboptimal growth with all-cause and cause-specific mortality in children under five years: a pooled analysis of ten prospective studies. PLoS One 2013;8: e64636.
11. Prentice AM, Ward KA, Goldberg GR, Jarjou LM, Moore SE, Fulford AJ, Prentice A. Critical windows for nutritional interventions against stunting. Am J Clin Nutr 2013; 97:911-8.
12. Leroy JL, Ruel M, Habicht JP, Frongillo EA. Linear growth deficit continues to accumulate beyond the first 1000 days in low- and middle income countries: global evidence from 51 national surveys. J Nutr 2014; 144:1460-6.

13. Lundeen EA, Stein AD, Adair LS, Behrman JR, Bhargava SK, Dearden KA, Gigante D, Norris SA, Richter LM, Fall CH, et al. Height-for-age z scores increase despite increasing height deficits among children in 5 developing countries. Am J Clin Nutr 2014; 100:821-5.
14. The International Bank for Reconstruction and Development [Internet]. Washington (DC): World Bank [updated 2006]. Repositioning nutrition as central to development a strategy for large-scale action. Available from: http://siteresources.worldbank.org/NUTRITION/ Resources/281846-1131636806329/NutritionStrategyOverview.pdf.
15. Tim Evans, WB. Adapted from World Bank,2016. Investing in nutrition: the foundation for development – an investment framework to reach the global nutrition targets. Washington, D.C.: World Bank Group. http://documents.worldbank.org/curated/en/2016/04/26231191/investing-nutrition-foundationdevelopment-investment-framework-reach-global-nutrition-targets.
16. National Nutrition Survey 2011; Planning Commission, Planning & Development Division, Government of Pakistan. Islamabad: UNICEF Pakistan; 2011.
17. Government of Pakistan and WFP. The Economic Consequences of Undernutrition in Pakistan. Planning Commission, Planning & Development Division, Government of Pakistan. Islamabad: WFP Pakistan; 2017.
18. National Institute of Population Studies (NIPS), ICF International. Pakistan Demographic and Health Survey 2012–13. NIPS and ICF International. 2013. http://www.nips.org.pk/abstract_files/PDHS%20Final%20Report%20as%20of%20Jan%2022-2014.pdf.
19. Ministry of Planning, Development and Reform and WFP. (2016). Minimum Cost of the Diet – Pakistan. Islamabad, Pakistan.
20. Sindh Bureau of Statistics and UNICEF. 2015. Sindh Multiple Indicator Cluster Survey 2014, Final Report. Karachi, Pakistan: Sindh Bureau of Statistics and UNICEF.
21. Shekar M, Kakietek J, Eberwein JD, Walters D. 2017. An Investment Framework for Nutrition: Reaching the Global Targets for Stunting, Anaemia, Breastfeeding, and Wasting. Washington, DC: International Bank for Reconstruction and Development / The World Bank.
22. Ota, E., H. Hori, R. Mori, R. Tobe Gai, and D. Farrar. 2015. "Antenatal Dietary Education and Supplementation to Increase Energy and Protein Intake (Review)." The Cochrane Library.
23. Bhutta ZA, Das JK, Rizvi A, Gaffey MF, Walker N, Horton S et al. Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? Lancet 2013; 382:9890.

24. Imdad A, Yakoob MY, Bhutta ZA. Impact of maternal education about complementary feeding and provision of complementary foods on child growth in developing countries. BMC Public Health 2011, 11(Suppl 3): S25.

25. Lassi ZS, Das JK, Zahid G, Imdad A, Bhutta ZA. Impact of education and provision of complementary feeding on growth and morbidity in children less than 2 years of age in developing countries: a systematic review. BMC Public Health 2013, 13(Suppl 3): S13.

26. Lazzerini M, Rubert L, Pani P. Specially formulated foods for treating children with moderate acute malnutrition in low- and middle-income countries. Cochrane Database of Syst Rev. 2013;21(6):CD009584.

27. Salam RA, MacPhail C, Das J, Bhutta ZA. Effectiveness of Micronutrient Powders (MNP) in women and children. BMC Public Health. 2013;13Suppl 3: S22.

28. De Pee S, Bloem MW. Current and potential role of specially formulated foods and food supplements for preventing malnutrition among 6-23 month old children and for treating moderate malnutrition among 6-59 month old children. Food and Nutrition Bulletin, 30:3.

29. Bhutta ZA, Ahmed T, Black RE, Cousens S, Dewey K, Giugliani E, et al. What works? Interventions for maternal and child undernutrition and survival. Lancet. 2008; 371:417–40.

30. Olney D, Leroy, JL, Bliznashka L, and Ruel, M. (2018). PROCOMIDA, a Food-Assisted Maternal and Child Health and Nutrition Program, Reduces Child Stunting in Guatemala: A Cluster-Randomized Controlled Intervention Trial. J Nutr 2018; 148:1493–1505.

31. Donegan S, Maluccio JA, Myers CK, Menon P, Ruel MT, Habicht J-P. Two food-assisted maternal and child health nutrition programs helped mitigate the impact of economic hardship on child stunting in Haiti. J Nutr 2010; 140:1139–45.

32. Leroy, JL, Olney D, and Ruel, M. (2018). Tubaramure, a Food-Assisted Integrated Health and Nutrition Program, Reduces Child Stunting in Burundi: A Cluster-Randomized Controlled Intervention Trial. Journal of Nutrition, 148:445-452.

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